Appendix E1: Ecological Assessment

Land south and east of Adastral Park, Ipswich, Suffolk,

On Behalf of:

Carlyle Land Ltd and Commercial Estates Group

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www.ses-eco.co.uk

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1.0 Introduction and Aims

1.1 Southern Ecological Solutions Ltd. (SES) was commissioned by Commercial Estates Group (CEG) and Carlyle Land Ltd to undertake a Phase 1 Habitat Survey following JNCC guidelines (2010) at the proposed development site at Land to the south and east of Adastral Park, Ipswich in Suffolk (the Site). Follow-up species specific Phase 2 ecological surveys were then undertaken.

1.2 The land south and east of Adastral Park is subject to an outline application for up to 2,000 dwellings, an employment area of c0.6ha (use Class B1), primary local centre (comprising use Classes A1, A2, A3, A4, A5, B1, C3, D1 and D2), secondary centre (comprising possible use Classes A1, A3 and A5), a school, green infrastructure (including Suitable Alternative Natural Green Space (SANGS), outdoor play areas, sports ground and allotments/community orchards), public footpaths and cycleways, vehicle accesses and associated infrastructure. The whole site covers approximately 113.3ha of land with approximately 25.1ha for use as suitable alternative greenspace.

1.3 Following an initial Phase 1 Habitat Assessment the following species specific surveys were recommended:

- Bats – roosting (including emergence) and activity surveys;
- Great crested newt presence/likely absence survey;
- Otter and Water vole;
- Wintering and breeding bird surveys;
- Botanical survey;
- Badger survey;
- Invertebrate survey;
- Reptiles presence/likely absence survey;
- Small and medium-sized notable mammal surveys.

1.4 The aims of these surveys were to:

- Determine the value of habitats on Site;
- Determine the usage and value of the Site by protected and notable species;
- Assess the value of the Site and potential direct and indirect impacts the proposed development may have on these species/habitats;
- Outline a mitigation strategy where necessary.

1.5 This report summarises the results of the Extended Phase 1 Survey and Phase 2 Surveys and Assessments. All features, including statutory and non-statutory sites, habitats and protected and notable features are then evaluated using the evidence from the desk study, field surveys and relevant literature. The development details are set out and the impacts on receptors assessed without mitigation. Mitigation options are outlined and the residual impacts assessed.

1.6 The Extended Phase 1 Habitat Survey indicated the requirement for a shadow Habitats Regulations Assessment (sHRA) screening report because of the potential impacts on internationally designated sites, designated under the Conservation of Habitats and Species Regulations (2010) and located within 10km of the Site. This assessment is presented in Baker Consultants (2017).

1.7 The proposed outline mitigation also seeks to minimise impacts on biodiversity and provide net gains where possible, in accordance with relevant wildlife legislation and planning policy such as Chapter 11 of the National Planning Policy Framework (NPPF): Conserving and Enhancing the Natural

Environment (DCLG, 2012), and policies SP1, SP2, SP12, SP14, SP15, SP20, DM27 and SSP1 of the Local Plan formed from the Suffolk Coastal District Local Plan: Core Strategy & Development Management Policies (Suffolk Coastal District Council, 2013), the Site Allocations and Area Specific Development Policy Document (Suffolk Coastal District Council, 2017a), Felixstowe Peninsula Area Action Plan Development Plan Document (Suffolk Coastal District Council, 2017b) and the Suffolk Coastal Local Plan: remaining 'Saved Policies' (Suffolk Coastal District Council, 2017c).

1.8 All surveys were undertaken following best practice guidance. Other than those listed in section 2, all surveys were undertaken or supervised by suitably qualified ecologist Lucy Addison BSc (Hons) MSc Graduate Member of the Chartered Institute of Ecology and Environmental Management (CIEEM, Grad CIEEM) and overseen by suitably qualified ecologist Sean Crossland BSc BCA Full Member of CIEEM (MCIEEM).

1.9 The Site is located to the east of Ipswich, between Waldringfield, Martlesham and Martlesham Heath. The Site is a varied area of land consisting of habitats of generally low ecological value such as arable farmland, offices, warehouses and a sand and gravel quarry as well as areas of relatively higher ecological value, such as woodland, lakes and semi-natural grasslands. The wider landscape surrounding the Site is made up of a mixture of industrial, residential, arable farmland, caravan parks, mixed woodlands a golf course and lakes. The Site is mainly bound by roads, to the west of the Site is the A12 dual carriageway, to the south is Ipswich Road, Newbourne Road bounds the Site in the east and the Adastral Park industrial area marks the north boundary. A plan of the Site showing the boundary and the proposed development area within it is provided in Appendix 1.

2.0 Methods

Desk Study

2.1 Previous survey reports (The Landscape Partnership, 2012 and Environ UK, 2009) were reviewed and informed the assessment. A summary of the results has been included within this report.

2.2 Data searches were requested from the Suffolk Biological Information Service (SBIS) in April 2016 which included records of all protected and notable species within 2km of the Site's boundaries, non-statutory designated sites within 2km of the Site's boundaries and designated sites within 10kms of the Site's boundaries, including those listed on Schedules within the Conservation of Habitats and Species Regulations (2010); Schedules within the Wildlife and Countryside Act (WCA, 1981) (5km); National Parks and Access to the Countryside Act, (1949) Section 21, non-statutory designated sites (2km), those listed as priority species on Schedule 41 (S41) of the Natural Environment and Rural Communities Act (NERC, 2006), previously Biodiversity Action Plan (BAP) species / habitats; those listed on other wildlife legislation for example Badgers (detailed within Chapter 3, Results), and other species of conservation concern (e.g. Nationally Scarce invertebrates). Relevant legislation is detailed in Appendix 2.

2.3 An Ordnance Survey map of the area using the government's Magic Maps website (www.magic.gov.uk) and aerial photographs on Google Earth (Google Inc., 2011) were examined to determine the possible habitats present on, and adjacent to the Site, and their context in the surrounding landscape, searching in particular for waterbodies, watercourses and other landscape

features that may be of ecological significance to protected species, notably mobile species such as bats and birds.

Field surveys

2.4 The following is a summary of the methods employed during field surveys; full details of each survey method are provided in Appendix 3.

Habitats

2.5 A Phase 1 Habitat Survey using JNCC (2010) guidelines was undertaken over the course of 2016. The Phase 1 Habitat map can be found in Appendix 4.

2.6 The Phase 2 botanical survey was undertaken 5th (Sean Crossland BSc BCA MCIEEM and Stephen Parr) and 13th (Sean Crossland BSc BCA MCIEEM and Lucy Addison BSc (Hons) MSc GradCIEEM) July 2016, aims were to:

- Produce a summary description of habitat diversity, management and condition.
- Record a comprehensive plant species list for the areas of semi-natural grassland, with an indication of relative abundance using the 'DAFOR' scale for each species.
- Identify the presence or likely absence of protected, rare and notable species.
- Survey for rare and notable plants.

2.7 Botanical nomenclature followed *New Flora of the British Isles* by Stace (2010).

Bats

2.8 All surveys were undertaken in accordance with Bat Conservation Trust (BCT) Guidelines (Collins, 2016).

Activity Surveys

2.9 Bat activity surveys were undertaken over two transects once a month between May and October 2016. Only one transect was completed in May because of the commencement date of the project and access issues. In addition, the working parts of the quarry were not included within the transect due to health and safety issues. This did not significantly constrain the assessment of bat activity on the site overall given the amount of data collected throughout the season. See Appendix 3 for personnel on each survey and Appendix 5 for a plan showing the transect locations.

Automated Surveys

2.10 Static bat detectors, both SM2+ (Wildlife Acoustics Ltd.) and Anabat units, were used to record bat activity over at least five consecutive nights once per month between June - October 2016 at various locations within the Site. No surveys were undertaken during April and May due to the commencement date of the project and access issues, this is not considered to affect the results given the amount of data gathered and static detectors were deployed for longer than the recommended 5 nights in several of the months to compensate. See Appendix 5 for a plan showing the automated detector locations.

Tree Scoping Surveys and Aerial Inspection

2.11 A tree inspection survey was undertaken following best practice guidance (Collins, 2016), by Steve Parr, Darren Denmead and Lucy Addison on 1st, 5th and 6th July. The trees inspected were those identified as likely to be removed as a result of or at the edge of the proposed development (i.e. the interior of the broad-leaved woodland was not assessed).

2.12 Trees with moderate or high potential for roosting bats were subject to an aerial inspection by a trained and qualified tree climbing and aerial rescue team (NPTC level 2 certification): Adam Dayman BSc (Hons) FdSc and Christopher Horley BSc (Hons) who is also a suitably qualified ecologist. Best practice guidance for use of endoscopes in trees with potential roosts (Northern Ireland Environment, Bat Conservation Trust, Natural Resources Wales and Scottish Natural Heritage, 2015) was followed. Trees were assessed as to their potential to support roosting bats based on the features inspected, following best practice guidance (Collins, 2016).

Building Surveys

2.13 The buildings on Site were subject to a rigorous external inspection on 24th August 2016 by Sean Crossland BSc BCA MCIEEM, looking for potential suitability and access points for bats. Where any potential access points were observed, these were inspected for evidence of use by bats such as lack of cobwebs, staining, droppings, scratch marks etc. Buildings were categorized for their potential suitability for bats based on the evidence observed.

2.14 Following external inspection, buildings on Site that had low, moderate or high suitability for bats were subject to further survey, including internal inspection where possible by Lucy Addison BSc (Hons) MSc GradCIEEM and Ella Barnett BSc (Hons) ACIEEM on 3rd November 2016 and 4th January 2017. Internal inspection utilized the use of an endoscope, ladder, binoculars and a high-powered torch.

Hibernation Surveys

2.15 Hibernation surveys were undertaken on those trees / buildings with hibernation potential, through internal inspections as well as static detector recordings where appropriate. These surveys were undertaken throughout November 2016 – February 2017 by Lucy Addison BSc (Hons) MSc GradCIEEM and Ella Barnett BSc (Hons) ACIEEM on 3rd November 2016, 4th January 2017 and 14th February 2017.

Emergence Surveys

2.16 Emergence surveys were undertaken on the trees identified to have residual moderate or high bat roosting potential following aerial inspections and buildings identified as having high, moderate or low potential following external inspections. These surveys were undertaken throughout August and September 2016 by several field ecologists. See Appendix 3 for full methodology and a full list of surveyors.

Great Crested Newt

2.17 All ponds within 500m of the Site were identified from available mapping. For the purposes of this assessment only those waterbodies on Site and within the Adastral Park industrial area were assessed for great crested newt (GCN) *Triturus cristatus* presence, except for Pond 5 due to its complete unsuitability for GCN (extremely high turbidity and fast flowing water pumped in regularly). Habitat Suitability Indexes (HSIs) (Oldham *et al.*, 2000) for GCN were calculated for all ponds surveyed. A single visit to collect eDNA samples from the ponds on Site (shown in Appendix 6) was undertaken by licensed GCN surveyors Lucy Addison MSc BSc (Hons) GradCIEEM and Sean Crossland BSc BCA MCIEEM on 27th June 2016 following best practice guidance (Biggs *et al*., 2014).

2.18 Samples were collected by courier and returned to ADAS for analysis on 5th July 2016, with the results of the analysis returned to SES on 15th July 2016.

Otter and Water Vole

2.19 The water bodies on Site were surveyed for water vole *Arvicola amphibius* and otter *Lutra lutra* on the 27th June 2016 and 28th October 2016 via a walkover of all accessible banks looking for field signs of these two species, i.e. footprints, mammal runs, latrines/spraints as well as potential burrows / holts. Survey methodology followed Strachan & Moorhouse (2011), Jeffries (2003) and Strachan and Jeffries (1993).

Birds

Breeding Birds

2.20 The breeding bird survey (BBS) followed the standard Common Bird Census (CBC) methodology (Gilbert *et al*., 1998) but was modified from ten to three survey visits through the spring and early summer to ensure that both resident breeding birds and migrant breeding birds (which tend to start breeding later in the season) were recorded. Surveys were undertaken by Stephen Parr BSc (Hons) MCIEEM and Darren Denmead BSc (Hons) Grad CIEEM on the 6th and 27th May and 1st June 2016 in suitable weather conditions and during the morning after the dawn period when bird singing intensity tends to be high but stable (Bibby et al. 2000).

Wintering Birds

2.21 A wintering bird survey (WBS) was undertaken following generic wintering bird monitoring methods derived from Gilbert *et al.* (1998), visiting the Site a total of three times through the wintering period, between November 2016 and March 2017. Dr Matthew Denny MCIEEM made the first survey visit on 16th November 2016, in suitable weather conditions (see Table 15). Dr Denny and Darren Denmead BSc (Hons) Grad CIEEM have undertaken two further surveys on 26th January 2017 and 24th February 2017. Survey visit times have been coordinated with local tides, to ensure that a variety of tidal conditions are covered, as this is likely to be the most important daily variable to effect wintering bird use of the site (e.g. duck, geese and waders from the nearby Deben Estuary are most likely to use the site during high tide, when the intertidal feeding grounds are inaccessible). As the Site does not support wintering bird habitats of potentially high significance (e.g. no large areas of semi-natural or wetland habitats), three visits are believed sufficient to determine the usage by wintering birds at this site.

2.22 A scoping exercise identified the grassland of the BT long-range test site (an area of short grass where BT test their equipment) to be the most likely area used by Brent geese *Branta bernicla* and potentially other waterfowl. To monitor the use of this grassland, two passive infrared trail cameras (Little Acorn Lt5210A) were installed along the southern field boundary near the east and west ends respectively. These were left *in situ* to remotely record use of the grassland by birds, with the aim of recording any diurnal and/or nocturnal waterfowl activity.

2.23 The survey effort also included a scoping visit of the nearby European Designated Sites in order to establish wintering birds utilising the local designated sites and assess any correlations between these and the proposed development site, which are discussed further within the sHRA.

Badgers

2.24 A survey for badger *Meles meles* was undertaken in October and November 2016, and January and February 2017 by Lucy Addison BSc (Hons) MSc Grad CIEEM, Ella Barnett BSc (Hons) ACIEEM, Mark Poynter BSc (Hons) and Katie Mann across the site, searching for evidence using standard guidelines for classifying badger setts (Harris *et al.*, 1989) and categorising entrance holes (Natural England, 2009). In addition, a team of qualified IRATA personnel (Level 1) Mark Poynter BSc (Hons) and Stuart Pankhurst MSc BSc DiplC MCIEEM assessed [redacted] using rope access techniques, to assess the slopes for potential badger setts and/or badger field signs. Trail cameras (Bushnell Trophy Cam) were also installed outside potential badger entrance holes to determine current use.

Invertebrates

2.25 The broad sampling protocol followed the protocols relevant to the Invertebrate Species-habitat Information Service (ISIS) of Natural England as described by Drake et al. (2007) and consistent with the proposals of English Nature (2005) albeit without surveys in the very earliest part of the season April and May. Sampling was mainly undertaken at seven main sampling stations of the likely highest quality habitat and with coverage of the main habitat types. These main sampling stations were sampled on: 6th June, 4th July, 26th July, 12th August and 27th September 2016, with sampling on each visit comprised of 40-minutes of sampling, divided as hand searching and sweep netting. Additionally, on 14th June 2016 a more widespread survey was undertaken, sampling an additional 12 minor sampling stations for 10-minutes, mainly by sweep and spot netting with the main focus being the flies and bees and wasps; this survey was intended to provide a rapid assessment of a wide part of the site. Appendix 7 provides the locations and photographs of sampling sites.

Reptiles

2.26 A seven-visit presence and likely absence survey was undertaken during 'suitable' days for reptile activity by Christopher Horley BSc (Hons), Katie Mann, Russell Mansfield MSc BSc (Hons) and Rachel Geller BSc (Hons) between August and September 2016. This survey methodology followed best practice guidance (Froglife, 1999; Gent & Gibson, 2003). See Appendix 8 for a plan showing the location of reptile refugia, of which approximately 300 were deployed.

Small and Medium-sized Mammals

2.27 Records, observations and / or field signs of small and medium-sized mammal species, especially those species listed as priority species under S41 of NERC (2006), including hedgehog *Erinaceus europaeus*, harvest mouse *Micromys minutus* and brown hare *Lepus europaeus*, were collected during survey visits for other protected species.

3.0 Results

Statutory and Non-Statutory Designated Sites

European Designated Sites

3.1 There are 3 sites of European importance within 10km of the Proposed Development: Deben Estuary Special Protection Area (SPA) and Ramsar, Sandlings SPA and Stour and Orwell Estuaries SPA and Ramsar, see Table 1a.

Table 1a: European Designated Sites within 10km of the site, listed in order of distance from site.

Name and Site Designation	Distance	Direction from Site	Designated features
Deben Estuary SPA and Ramsar Site	1.5km	NE	The SPA is designated for wintering avocet and Brent goose. The Ramsar site is designated for internationally important levels of dark-bellied Brent goose.
Sandlings SPA	4.9km	W	The SPA is designated for Nightjar and Woodlark.
Stour and Orwell Estuaries SPA and Ramsar Site	6km	SW	The SPA is designated for golden plover. And Migratory species: Dark-bellied Brent goose, shelduck, ringed plover, grey plover, dunlin, black-tailed godwit, redshank and turnstone. The Ramsar is designated for its wintering assemblage and species/populations occurring at levels of international importance.

Sites of Special Scientific Interest and Local Nature Reserves

3.2 There are 14 Sites of Special Scientific Interest (SSSI) within 5km of the boundaries of the site. There is one SSSI within the Site's boundaries, however this is designated for its geological, rather than biological interest, and as such is not discussed further within this report. A further three SSSIs are also designated for their geological rather than biological interest and again are not discussed further within this report.

3.3 Of the remaining ten SSSIs Ipswich Heaths SSSI is the closest at approximately 800m from Site. The SSSI comprises Martlesham Heath and Purdis Heath and is designated as a remnant of a former extensive tract of heathland. The site contains areas of heather heath and acid grassland, of which Martlesham Heath contains the last colony of the silver studded blue butterfly in East Anglia.

3.4 In addition, there are three Local Nature Reserves (LNRs) within 5km of the Site. The closest of which is Mill Stream LNR which is situated 3.7km west of Site, designated for its pond, wet carr and woodland habitat, with known water vole presence.

3.5 A summary table of the UK statutory sites is given below in Table 1b.

Table 1b: SSSIs and LNRs within 5km of the site, listed in order of distance from site with SSSIs listed first followed by LNRs.

Name and Site Designation	Distance	Direction from Site	Designated features
Waldringfield Pit SSSI	0	N/A	Waldringfield Pit is a geological SSSI important for a sequence of Middle Pleistocene deposits.
Ipswich Heaths SSSI	0.8	W	Martlesham and Purdis Heaths are the best remnants of a formerly extensive tract of heathland, containing substantial areas of heather *Calluna vulgaris* heath and acid grassland, together with stands of bracken *Pteridium aquilinum* and gorse *Ulex europaeus* scrub. These communities grade into one another to form a mosaic of habitats of particular value for butterflies. Martlesham Heath is notable for supporting the largest colony of the silver-studded blue butterfly in East Anglia, as well as a number of other species.
Newbourn Springs SSSI	0.9	S	Active management has led to the maintenance of a rich and varied flora and the subsequent diversity of habitats attracts good populations of breeding and migratory birds, including nightingales, goldcrests, warblers and woodpeckers. Butterflies including the green hairstreak and white letter hairstreak are regular visitors.
Deben Estuary SSSI	1.5	NE	Deben Estuary is important for its populations of overwintering waders and wildfowl and also for its extensive and diverse saltmarsh communities. Several estuarine plants and invertebrates with a nationally restricted distribution are also present.
Sinks Valley, Kesgrave SSSI	2	NW	Site is designated for diversity of habitats located in an uninterrupted sequence, consisting of open water, fringing swamp, spring-fed fen and wet grassland, wet alder woodland, dry acid grassland, heathland and oak woodland.
Ferry Cliff, Sutton SSSI	3.6	NE	Geological SSSI.
Ramsholt Cliff SSSI	3.7	SE	Geological SSSI.
Rockhall Wood Pit SSSI	3.8	E	Geological SSSI.
Nacton Meadows SSSI	4.2	SW	Nacton Meadows are of special interest for their areas of fen-meadow, of a type that is very scarce in Suffolk, being mainly found in the western parts of Britain. In Suffolk, there is a total area of approximately 55 ha of this vegetation type remaining in only five other sites that are of a similar quality to Nacton Meadows. In addition, this site supports a relatively species-rich version of the vegetation community type compared to the other sites in the County.

Name and Site Designation	Distance	Direction from Site	Designated features
Riverside House Meadow Hasketon SSSI	4.8	N	Riverside House Meadow is a floristically rich unimproved meadow. The number of such traditionally managed herb-rich meadows has been greatly reduced in recent decades and remain under threat from changes in agricultural practice. The site supports a typically high number of grasses and herbs. Dominating species include meadow foxtail *Alopecurus pratensis*, crested dog's tail *Cynosurus cristatus* and Yorkshire Fog *Holcus lanatus*.
Sutton and Hollesley Heaths SSSI	4.9	W	Sutton and Hollesley Heaths form one of the largest remaining fragments of the once extensive Sandlings heaths of the Suffolk coast. They consist of characteristic dry acidic grass and heather-dominated heathland with much scrub, bracken and self-sown pine and birch. The site has a subsidiary ornithological interest and forms a regular winter roost for Hen Harrier. Long-eared Owls breed together with a variety of other heathland species.
Bixley Heath SSSI	5	W	Bixley Heath is important for its heathland which occurs here in association with a scarce swamp vegetation. The presence of these two habitat types within a single site is a particularly rare feature in the Suffolk Sandlings
Sandlings Forest SSSI	5.2	NE	This site is notified for its coniferous woodland which supports internationally important populations of woodlark *Lullula arborea* and nightjar *Caprimulgus europaeus.*
Crag Pit, Sutton SSSI	5.3	E	Site contains a well-established colony of the nationally rare annual plant, Small Alison *Alyssum alyssoides* – first recorded in 1967 and only occurs in one other locality in Britain. The site also contains 2 nationally uncommon species.
Mill Stream LNR	3.7	W	Designated due to area of wet carr, ponds and woodland with confirmed presence of water voles.
Sandlings LNR	4.3	N	Designated due to habitats including acid grassland, scrub, and wildflower meadow. 22 species of butterfly including the white-letter hairstreak have been recorded, along with 70 species of bird.
Bixley Heath LNR	5	W	Mixed aged heather and acid grassland, woodland, scrub, sedge and reed beds and scarce swamp vegetation.

Non-statutory Designated Sites

3.6 There are 14 County Wildlife Sites (CWS) within 2km of the site's boundaries. The closest of which is adjacent the north-west corner of the site, and is designated for its rabbit grazed acid grassland habitat which supports common lizard *Zootoca vivipara.*

Table 1c. Non-statutory Designated Sites within 2km of Site.

Site Name	Distance and Direction from Site	Description
Martlesham Soakaway Acid Grassland	Adjacent north-west corner	High quality acid grassland maintained by rabbit grazing. Site supports common lizards.
Martlesham Heath Wood	180m west	Woodland with amenity and wildlife value. Including Birch woodland (<40yrs old), oak and scot's pine with bracken understorey. Gorse thickets and heathland remnants.

Old Rotary Camping Ground	240m north	An area of tall herb dominated by bracken encroaching on heavily rabbit grazed acid grassland and a wetter meadow area. The whole is bounded by a thorn hedge with a few oak and dead elm, and beyond this lies a pine/birch woodland with areas of heather. Each habitat is of botanical interest.
Brightwell Grazing Meadows	500m south	Herb rich, cattle grazed meadows of considerable botanical interest adjoin both sides of the River Mill.
The Mill River	700m south	The watercourse flows through a diverse landscape ranging from alder carr, flower-rich grazing meadows, improved pasture and poplar plantation. Springs feed the Mill River from both sides and the river is unusual in Suffolk in having a natural flow unimpeded by weirs and dams. A number of areas which border the Mill River have also been identified as County Wildlife Sites. The Mill River has good water quality and therefore supports a wide variety of aquatic wildlife.
Martlesham Common	1km north-west	Remnant of the Suffolk Sandlings heathlands. Patches of diverse acid grassland flora interspersed with large areas of Bracken and Gorse. Important for its population of silver-studded blue butterflies.
Valley Farm Meadow	1km south-west	A small area of wet grassland, situated adjacent to the River Mill between the A12 embankment and Valley Farm (now derelict). The site supports a good diversity of wet meadow species. Of particular interest is a thriving population of southern marsh orchid.
Martlesham Plantation Acid Grassland	1.1km north	Small area of acid grassland, remnant of the once extensive Martlesham Heath.
Lumber Wood	1.2km north-east	Ancient Woodland of mature sycamore, some of which is coppiced, and sweet chestnut.
Kyson Meadows, Sluice Wood & Martlesham Creek Reed	1.3km north	Cattle grazed unimproved pastures and reedbeds used by breeding, migrating and wintering water birds as well as a large number of toads. The plant community is also of conservation value. The area is used as a late Autumn roost for up to 1000 swallows and sand martins. Sluice wood is an important breeding habitat for amphibians and shows a long woodland history.
Bloomfields Farm Meadow	1.5km north	Wide diversity of wetland plants, meadow also supports large colonies of heath spotted orchid and southern marsh orchids.
Osier Bed and Martlesham Plantation	1.7km north-west	Two meadows and former osier bed adjacent Butlers Brook. Some noteworthy plants, e.g. Twayblade, Southern Marsh Orchid, Opposite-leaved Golden Saxifrage. Springs on site form boggy flushes. Meadows still support a diverse plan community.
Kesgrave Wood / Sinks Valley	1.9km north-west	Kesgrave Wood (covered by a Tree Preservation Order) is an early 19th century plantation which has subsequently been considerably augmented by natural regeneration. The central part appears to have been set out as a park and a number of parkland trees of considerable age can be identified. A number of very old pollard oaks fringe the road on the southern edge of the wood. Noctule bats have been recorded on this site. The woodland supports a comprehensive range of birds. The valley supports areas of acid grassland, heathland, alder woodland and scrub, which together with Kesgrave Wood, form an important mosaic of semi- natural habitat along the valley.
Newbourne Springs Meadows	2km south	A series of unimproved meadows are situated adjacent to the east bank of Newbourne Springs. Some of the meadows are managed by one annual cut. As a consequence they support a herb-rich community characteristic of wet meadows. The

		reed-fringed dykes and stream support good numbers of reed and sedge warblers.

Phase 1 Habitats

3.7 There are nineteen different habitat types found within the site and on the boundaries. The site is a varied area of land consisting of habitats of generally low ecological value such as arable land, offices, warehouses and a working sand and gravel quarry as well as areas of relatively higher ecological value, such as woodland, water bodies, semi-natural grasslands and scrub. The phase 1 habitat map can be found in Appendix 4. A list of each habitat type is provided below.

- Standing Water
- Semi-natural Broadleaved Woodland
- Mixed Plantation Woodland
- Coniferous Plantation Woodland
- Dense Scrub
- Scattered Scrub
- Scattered Trees
- Semi-improved Grassland
- Bracken
- Arable
- Amenity Grassland
- Bare Ground
- Buildings
- Caravan Park
- Quarry
- Spoil Heap
- Earth Bank
- Dry Ditch
- Short Perennial / Ephemeral

Standing Water

3.8 The ponds on and around site are highly variable in physical nature. The 3 quarry ponds (Ponds 3, 4 and 5) are heavily silted due to their use in the quarry works. There is no emergent or marginal vegetation present at any of them.

3.9 The large fishing lake (Pond 2) has mixed ecological value due to the presence of mature trees and scrub around the margins providing biodiversity value, but with large populations of big fish (stocked for anglers as part of a private fishing lake) which are generally a negative biodiversity feature for native species due to heavy predation on amphibians, native fish, invertebrates etc. as well as disruption to the physical environment (e.g. increased turbidity, reduced substrate stability).

Semi-natural Broadleaved Woodland

3.10 This habitat covers approximately 4ha and is positioned in the north of the site. It consists of mainly an English oak *Quercus robur* and sweet chestnut *Castanea sativa* canopy, with a generally sparse understorey, although bramble *Rubus agg*. and bracken *Pteridium aquilinum* are locally dominant.

Mixed Plantation Woodland

3.11 Mixed plantation woodland borders the southern boundary, providing a tree screen for the quarry. Species are generally semi-mature, consisting of silver birch *Betula pendula*, scots pine *Pinus sylvestris*, hawthorn *Crataegus monogyna*, elder *Sambucus nigra* and English oak. There is little undergrowth in most areas but with dense bramble scrub in others.

Coniferous Plantation Woodland

3.12 Coniferous plantation woodland borders the southern boundary, providing a tree screen for the quarry and consists mostly of scots pine.

Dense Scrub

3.13 Dense scrub is present around the site in various extents, species predominantly include gorse *Ulex europaeus* and bramble.

Scattered Scrub

3.14 Scattered scrub is present throughout some of the grasslands and again consists of gorse but predominantly bramble.

Scattered Trees

3.15 A number of trees are scattered around the Site, particularly around the Site's boundaries and fishing lake boundaries. A cluster of trees is present on the northern edge of the lake, which are mostly semi-mature and consist of English oak, silver birch and crack willow *Salix fragilis*. Species around the outside of the lake consist of a mature weeping willow *Salix x chrysocoma* as well as crack willow and field maple *Acer campestre*. A line of young English oak are present along the long-range test site (the thin strip of semi-improved grassland running south-east to north-west, south of the broad-leaved woodland). Around the Site's eastern boundary, linking with the woodland are a number of semi-mature / early mature English oak, scots pine and holly *Ilex aquifolium*.

Semi-improved Grassland

3.16 These areas consist of a grass-dominated sward, with broad-leaved herbaceous species including a number of rare and / or notable plant species. These areas are classified as semi-improved grassland with patches of both acid and chalk characteristics. No clear NVC community type could be determined due to the highly variable nature of the grasslands, many of which are recently colonised grasslands following quarry or arable farming works. Several of the grasslands are species-rich and could be considered diverse e.g. the grassland field with the fishing lake, the small grassland field south of this and the large grassland to the south of the quarry which also encompasses an area of ephemeral / short perennial habitat which can be classed as BAP habitat 'Open Mosaic Habitat on Previously Developed Land' (see ephemeral / short perennial paragraph below). Other areas are much less diverse, including the long-range test-site. Typical species within the sward include yarrow *Achillea millefolium*, common bent *Agrostis capillaris*, sedges are present in damper areas including pendulous *Carex pendula* and spiked *C. spicata*, cock's foot *Dactylis glomerate* etc. (see Appendix 9).

Bracken

3.17 Large patches of bracken are present along the north boundary abutting the Adastral Park industrial area as well as around the mechanic's workshop, south of the lake.

Arable

3.18 Large arable fields are present in the east and west of the Site. The fields have narrow to no field margins.

Amenity Grassland

3.19 Amenity grassland is present off-site in neighbouring gardens, caravan parks and in the industrial areas.

Bare Ground

3.20 Hard-standing paths and roads are present around the Site as bare earth, dirt tracks or hardcore roads. In addition, there are patches of bare earth present around the site, i.e. along newly created bunds and spoil piles.

Buildings

3.21 Several buildings are present around the Site, there are two working buildings within the quarry in the form of a pre-fab office and a large workshop. Along the long-range test strip is a brick built three storey testing tower with a central staircase and single rooms on each floor, with a small pre-fab office semi-attached. There are two pillboxes within the arable field in the west of the site and a number of industrial units along the access point through the Adastral BT Business Park.

Caravan Park

3.22 Several off-site caravan parks are present to the east of the site, with typical amenity grassland, hard-standing and caravans.

Quarry

3.23 Large areas of sand and gravel quarry are present in the middle of the Site, including working areas with heavy machinery and vehicles in constant use (during daytime hours), as well as areas which have fallen out of use.

Spoil Heap

3.24 A small area of rubble and litter is present at the entrance to the arable field in the west of the Site.

Earth Bank

3.25 An earth bund is present marking out the boundaries of the quarried areas on Site. In some places this remains bare earth whereas in other more established bunds, this has become vegetated.

Dry Ditch

3.26 A dry ditch is present along the western boundary of the large grassland field with the lake. The ditch marks the boundary between the grassland field and public footpath.

Short Perennial / Ephemeral

3.27 There are two short perennial / ephemeral fields on Site. One of which is presumed to be an arable field which has been left fallow and has since been colonised by common weeds, grasses and herbaceous species indicative of disturbed, nutrient enriched soils e.g. common nettle *Urtica dioica*, nodding thistle *Carduus nutans,* common fiddleneck *Amsinckia micrantha*, common mallow *Malva sylvestris* etc. Two non-native species are also present: Canadian fleabane *Conyza Canadensis* and green alkanet *Pentaglottis sempervirens*.

3.28 The second field is a former quarry area which has since been filled and left to re-colonise. With the presence of bare ground and ephemeral species this field could be considered BAP habitat 'Open Mosaic Habitat on Previously Developed Land'. Many poppy *Papaver* species are present here, including common *P. rhoeas*, opium *P. somniferum* and Californian *Eschscholzia californica*.

Phase 2 Survey Results

Habitats

3.29 Notable habitats and those of principal importance (section 41 of the NERC Act) are discussed:

Lowland Mixed Deciduous Woodland

3.30 This habitat covers approximately 4ha of the site (the woodland in the north of the site) and although it is not considered particularly diverse and generally a poor representation of this habitat type, it is considered a BAP / NERC Act habitat of principle importance. The woodland on site is of value to a number of protected species including European protected species such as bats. In addition, its age and degree of ecological connectivity through the landscape adds further value to this priority habitat.

Plantation Woodland

3.31 The plantation woodlands along the southern boundary of the Site are not classed as a UK BAP / NERC Act habitat of principle importance but are considered a habitat of local importance to biodiversity, providing a tree screen from the quarry to the road.

Semi-improved Grasslands

3.32 The main grassland areas within the Site are highlighted in Appendix 9. These areas consist of a grass-dominated sward, with broad-leaved herbaceous species including a number of rare and / or notable plant species. These areas are classified as **semi-improved grassland** with patches of both acid and chalk characteristics, although overall showing slightly more calcareous properties than acidic. The Ellenberg values for each grassland area are shown in Table 2. The values indicate the

general overall characteristics of the grasslands, and are not an indication of individual species characteristics. The grassland habitats on site generally indicate: sun-loving species (typical of open grassland habitat), loosely associated with drier sites (expected on restored former sand and gravel quarry), and loosely associated with nutrient-rich/low stress level sites, as well as associated more towards calcareous than acidic grassland. Areas 1, 3 and 4 also show relatively high species-diversity (see Appendix 9).

3.33 An area circa 1.63ha in the south-east of the site likely meets the classification of UK BAP habitat **Open Mosaic Habitat on Previously Developed Land** due to the presence of bare ground and ephemeral species**.**

Table 2: Ellenberg Values for grasslands on site, refer to Appendix 9 for locations.

Ellenberg Value	Scale	Ellenberg Score				
		Area 1	Area 2	Area 3	Area 4	Area 5
L - Light	1: deep shade 9: full sun	7.2	7.2	7	7.2	7.2
F - moisture	1: extreme dryness 12: submerged species	5.1	4.9	5	4.9	4.8
R - soil reaction	1: extreme acidity 9: calcareous	6.5	6.7	6.5	6.7	6.7
N - Nitrogen	1: high stress tolerance/extremely infertile sites 9: low stress levels/extreme nutrient rich situations	5.3	5.8	5.8	5.4	5.6

3.34 Notable plant species at the time of survey included: common cudweed *Filago vulgaris* listed as 'Near Threatened' on the IUCN Red List; Species of Conservation Concern, Nationally Scarce and Vulnerable smooth cat's ear *Hypochaeris glabra*, which is locally frequent at dry sites in Suffolk (Suffolk Biodiversity Information Service); field pepperwort *Lepidium campestre* 'Near Threatened' in England; corn mint *Mentha arvensis* listed as in decline and 'Near Threatened' in England; the Nationally Scarce plant dittander *Lepidium latifolium*; hound's tongue *Cynoglossum officinale* also listed as 'Near Threatened' in Great Britain; and annual beard-grass *Polypogon monspeliensis*, listed as 'Nationally Scarce' and Rare in Suffolk. These species are mostly present in low numbers in Areas 1, 3 and 4 with the exception of Area 5 which had low numbers of dittander. No clear community type could be determined.

Mixed Grass and Scrub

3.35 An extensive area of scrub adjacent to mixed rough-grassland near the sites' middle is utilized by breeding birds of conservation concern including common linnet *Carduelis cannabina*, dunnock *Prunella modularis* and nightingale *Lascinia megarhynchos*. This area appears to have been unmanaged for some time, with establishing gorse, bramble scrub and interspersed nettle patches.

Ponds and Open Standing Water

3.36 The ponds on and around Site (see Appendix 6) are highly variable in their ecological value. Pond 17 shows valuable ecological features such as marginal vegetation, as opposed to ponds 1, 3, 4, 5 and 18 which show virtually no ecological features, such as no emergent plants or submerged aquatic species. Pond 2 is a large lake with mixed ecological value due to the presence of mature trees and scrub being a positive biodiversity feature, as well as large populations of big fish which are generally a negative biodiversity feature.

Rare and Invasive Plant Species

3.37 Species identified within the Site as protected, rare, or otherwise notable, and non-native invasive species, are indicated as such in the plant species list provided in Appendix 9. Protected, rare or otherwise notable species include: common cudweed, smooth cat's ear, field pepperwort, corn mint, dittander, hound's tongue and annual beard-grass.

3.38 Japanese knotweed *Fallopia japonica*, a highly invasive non-native invasive species listed on Schedule 9 of the WCA Act 1981 (as amended), is present on site in several locations as identified on Appendix 9.

Bats

Desk Study

3.39 Records from the SBIS showed likely roosting records for brown long-eared bats *Plecotus auritus* on Site, as well as a rescued Natterer's bat *Myotis nattereri*. There are two records of bats hibernating on Site in 2013, one for Natterer's bat and another for brown long-eared. On further investigation, it can be concluded that both records are for the same occasion and one species rather than two (as observed in a previous report, The Landscape Partnership, 2013, and Natural England letter to the quarry, 2013), which at some stage the species has been mis-recorded. It is not known which entry is correct. The location of the hibernating bats was within a double skinned brick wall with plant (Hopper) on top, within the working quarry area, which provided a 'cave' like habitat the bats were utilizing. The bats were discovered when the plant was being replaced, however the structure has since become unsuitable for roosting bats.

3.40 In addition, known maternity roosts are present 450m south of Site for Natterer's bats and common pipistrelle *Pipistrellus pipistrellus* (SBIS, 2016).

3.41 Other bat species records include Western barbastelle *Barbastella barbastellus*, serotine *Eptesicus serotinus*, soprano pipistrelle *Pipistrellus pygmaeus* and pipistrelle species all within 1.2km of the site (see Table 3 below).

3.42 The habitat on site has the potential to support any of these species in a roosting, commuting and foraging capacity as well as other species that are not shown in previous records.

Table 3: Bat records held by data suppliers, with most recent date recorded, total number of records and their regional and national conservation status.

Species	Closest Distance from Centre of Study Area	Total No. of Records	Date of Most Recent Record	Conservation Status
Western barbastelle *Barbastella barbastellus*	1.1km south east	1	2013	UK BAP Suffolk BAP
Serotine *Eptesicus serotinus*	Adjacent site (Ipswich Rd)	5	2014	-
Natterer's *Myotis nattereri*	On site (bat rescue)	4	2013	-
Soprano pipistrelle *Pipistrellus pygmaeus*	0.02km south	12	2014	UK BAP Suffolk BAP
Common pipistrelle	0.02km south	23	2014	-

Pipistrellus pipistrellus				
Pipistrelle sp. *Pipistrellus sp.*	0.03km east	1	2011	-
Brown long-eared *Plecotus auritus*	On site (hibernation site)	5	2013	UK BAP Suffolk BAP

3.43 The barbastelle record is the most notable, as this species is considered nationally rare. Concentrations are found in the south, central England and Wales (BCT, 2010). The barbastelle bat is protected under Annex II of the Habitats Regulations (2010) and is a UK and Suffolk BAP species. It is a species associated with mature broad-leaved woodland with a well-developed understory, as well as more open areas provided they are dark (BCT, 2010). Suitable habitat for this species exists on the Site, for example around the large lake, woodland and woodland boundaries as well as the grasslands on site which are not lit.

3.44 All other species recorded in the desk study were recorded from within 1.1km of the Site and within the last four years. The habitat on the Site has potential to support any of these species (shown in table 3) in a foraging, commuting or roosting capacity.

Activity and Static Surveys

3.45 A total of ten species were recorded during the activity surveys, five more than recorded in 2008 (Environ UK, 2009), with pipistrelles being the most common species observed. In addition, the rare barbastelle was recorded in the broad-leaved woodland in the north of the Site, along the east and southern boundaries and through the middle of the Site, through the grassland field with the fishing lake. In addition, there have been multiple records/observations of *Myotis* species, big bats (i.e. Leisler's *Nyctalus leisleri*, noctule *N. noctula* and serotine) and brown long-eared (a UK and Suffolk BAP species). Survey results showed a seasonal trend with July and September showing the highest numbers of passes, and July also showing the highest species diversity. Common and soprano pipistrelles were the most frequently recorded species (the latter being a UK and Suffolk BAP species), with relatively high numbers of *Myotis* species also observed, particularly in June. Noctules were also recorded in relatively high numbers. The east transect had almost twice as many bat passes as the west transect overall. See Table 4 for results.

Table 4: Activity Survey Summary.

Species	May		June		July		August		September		October		Total East / West		Total
	East	West	East	West	East	West	East	West	East	West	East	West	East	West	
Common pipistrelle	18	n/a	1	8	25	13	15	13	36	8	5	-	100	42	**142**
Soprano pipistrelle	3		2	11	21	12	8	6	10	12	-	17	44	58	**102**
Pipistrelle sp.	-		-	-	-	-	3	-	-	-	-	-	3	0	**3**
Noctule	2		-	-	4	7	-	3	7	4	-	-	13	14	**27**
Leislers	1		-	-	-	-	-	-	-	-	-	-	1	0	**1**
***Nyctalus* sp**	-		-	-	3	-	-	-	-	-	-	-	3	0	**3**
Serotine	4		-	-	10	-	-	-	-	-	-	-	14	0	**14**
Big bat	-		-	2	-	1	1	-	-	-	-	-	1	3	**4**
***Myotis* sp.**	1		27	1	1	2	-	-	-	-	1	1	30	4	**34**
Daubenton's bat	-		-	3	-	-	-	-	-	-	-	-	0	3	**3**
Brown long-eared	-		-	-	-	-	-	-	-	-	2	-	2	0	**2**
Barbastelle	-		3	-	-	-	-	-	-	-	-	-	3	0	**3**
Unidentified sp.*	-		6	--	-	3	-	-	-	-	1	-	7	3	**10**
Total No. of Passes	**29**		**39**	**25**	**64**	**38**	**27**	**22**	**53**	**24**	**9**	**18**	**221**	**127**	**348**
Total no. of Species	**6**		**7**		**8**		**5**		**3**		**5**				

* Recordings too faint or of poor quality to identify to genus or species

Table 5: Bat species and number of passes recorded by each static detector each month.

Bat Species	June				July				August				September			October				Total
Static Detector I.D.	**2**	**3**	**4**	**5**	**2**	**3**	**Sm23**	**4**	**1**	**3**	**5**	**7**	**1**	**2**	**3**	**1**	**3**	**4**	**A**	
Common pipistrelle	29	151	1493	49	209	88	506	37	13	63	29	10	22	1	264	56	1	-	2	**3023**
Soprano pipistrelle	-	104	28	15	1349	11	35	11	28	16	5	7	17	-	241	-	14	-	14	**1895**
Pipistrelle sp.	-	15	3	3	12	-	11	-	-	-	-	-	2	-	4	-	-	-	-	**50**
Nathusius'	-	-	-	-	-	-	-	-	-	-	-	-	3	-	1	-	-	-	-	**4**
Possible Nathusius'	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	**2**
Noctule	202	892	13	83	309	576	31	3	14	13	10	5	14	-	120	3	-	-	2	**2290**
Leisler's	6	3	-	-	15	33	6	-	2	5	5	-	1	-	1	-	-	-	-	**77**
***Nyctalus* sp.**	5	4	-	-	68	52	7	1	1	11	3	-	2	-	2	-	-	-	-	**156**
Serotine	-	-	-	-	27	18	-	-	2		2	-	36	-	3	-	-	-	-	**88**
Big Bat	-	-	-	-	8	7	-	-	1	1	-	-		-	1	-	-	-	-	**18**
***Myotis* sp.**	1	16	17	9	62	1	-	-	-	-	-	1	52	-	1	1	-	-	-	**161**
Brown long-eared	-	-	-	-	5	-	-	-	-	-	-	-	15	-	1	-	-	-	-	**21**
Barbastelle	-	-	2	1	2	-	-	-	-	-	-	-	3	-	1	-	-	-	1	**10**
Possible barbastelle	-	-	-	-	-	1	-	-	-	-	-	-	4	-	2	-	-	-	-	**7**
Total	**243**	**1185**	**1556**	**160**	**2066**	**787**	**596**	**52**	**61**	**109**	**54**	**23**	**171**	**1**	**644**	60	15	0	19	**7802**
Monthly Total	**3144**				**3501**				**247**				**816**			**94**				

3.46 The static surveys recorded nine species, with Daubenton's bat *Myotis daubentonii* being the only species not identified on the static surveys but identified on the activity survey. This is likely due to the difficulty in determining the *Myotis* species, and so is likely included within the *Myotis* recordings. The static surveys recorded a high number of bat passes, particularly in June and July, although the statics were out for almost 3 times as long as recommended in July (14 nights compared to recommended no. of 5). The highest numbers of passes were recorded by common and soprano pipistrelles, as well as noctule bats (see Table 5). See Appendix 5 for static detector locations.

3.47 Areas of relatively high activity on Site included the large fishing lake, the south boundary of the site, the east boundary and boundary with the woodland in the north, as well as the broad-leaved woodland itself in the north of the Site. Noctules (a UK and Suffolk BAP species) were recorded in high numbers around the large fishing lake, the woodland in the north and the two open fields of ephemeral short perennial habitat in the south of the site. The rare barbastelle was recorded in relatively low numbers commuting / foraging along the east boundary (following the public footpath), the boundary with the industrial site, the woodland in the north of the site, the southern boundary, the grassland / scrub matrix field in the south of the site and the edge of the ephemeral short perennial habitat in the south of the Site.

Tree Scoping Survey

3.48 All trees due to be removed as a result of or on the edge of the proposed development were inspected from ground level; 42 trees were identified as having the potential to support roosting bats and thus were subject to further survey (see Table 6).

3.49 Following ground inspection, aerial scoping of the trees was carried out on those with moderate or high potential for roosting bats (approximately 18 trees) as per best practice guidance (Collins, 2016). A summary and maps of the ground and aerial inspections has been provided in Appendix 10. Aerial inspections found 5 trees of moderate potential and two of high potential to be subject to emergence surveys. The remaining trees were either classified as having low (nine trees) or no (two trees) potential for roosting bats and thus were not subject to further survey.

Tree Emergence / Re-entry Survey

3.50 Emergence/re-entry surveys were carried out on the trees identified in the tree scoping survey as having moderate or high potential to support roosting bats following the aerial inspection where applicable (see Appendix 10). Between two and three surveys were undertaken on each tree depending on the roosting potential the tree held, as per BCT Guidance (Collins, 2016). See Table 6 for details.

Table 6: Summary of Tree Survey Results

Tree ID	Species	Pre-inspection rating	Post-inspection rating	Roost confirmed
1	Weeping willow	Low	N/A	N/A
2	Oak	Low	N/A	N/A
3	Oak	Low	N/A	N/A
4	Oak	Low	N/A	N/A
5	Oak	Low	N/A	N/A
6	Oak	Moderate	Low	N/A

Tree ID	Species	Pre-inspection rating	Post-inspection rating	Roost confirmed
7	Oak	Low	N/A	N/A
8	Oak	Moderate	None	N/A
9	Oak	Low	N/A	N/A
10	Oak	Moderate	Moderate	Likely Absent
11	Oak	Moderate	Low	N/A
12	Oak	Moderate	Low	N/A
13	Oak	High	None	N/A
14	Oak	Moderate	Moderate	Likely Absent
15	Scots pine	Low	N/A	N/A
16	Oak	Low	N/A	N/A
17	Scots pine	Low	N/A	N/A
18	Oak	Moderate	N/A	N/A
19	Oak	Moderate	Low	N/A
20	Oak	High	Moderate	Likely Absent
21	Oak	Moderate	Low	N/A
22	Oak	High	Moderate	Likely Absent
23	Oak	Moderate	Moderate	Likely Absent
24	Oak	High	High	Likely Absent
25	Oak	Low	N/A	N/A
26	Sycamore	Moderate	Low	N/A
27	Oak	Low	N/A	N/A
28	Oak	Low	N/A	N/A
29	Oak	Low	N/A	N/A
30	Oak	Low	N/A	N/A
31	Oak	Moderate	Off-site	N/A
32	Oak	Moderate	Low	N/A
33	Oak	Moderate	Low	N/A
34	Sycamore	Moderate	Low	N/A
Group H	Oak	Low	N/A	N/A
35	Oak	Low	N/A	N/A
36	Oak	Low	N/A	N/A
37	Oak	Low	N/A	N/A
38	Oak	Low	N/A	N/A
39	Oak	Low	N/A	N/A
40	Oak	Low	N/A	N/A
41	Oak	Moderate	High	Pipistrelle Roost Present + Possible barbastelle

3.51 Approximately six common pipistrelles were observed emerging from Tree 41, a veteran oak just off-site, on Ipswich Road, which sits opposite the proposed new development (see Appendix 10 for location). In addition, a barbastelle was also seen potentially emerging from the same tree on one occasion of the three survey visits (15th August 2016). Tree 41 was surveyed three times in total (one dusk and two dawn surveys) and bats were seen emerging or re-entering on two of the three surveys. Pipistrelle emergences were observed on 15th August 2016 and 1st September 2016. No

bats were seen to emerge or re-enter any of the features on the additional trees with moderate or high potential.

Building Inspections

3.52 All buildings on site and within the Adastral Park BT Business Park were externally inspected on 24th August 2016 and 4th January 2017 for their potential to support roosting bats. Four of the buildings on site were identified to have potential for roosting bats and thus were subject to internal inspections and / or emergence surveys (see Table 7 for summary and Appendix 10 for a map of the buildings and building ID).

Table 7: Summary of buildings on site

Building No	Description	Features	Potential	Roost Present	Roost category
1	Reception building brick construction with a flat roof	None	Negligible	N/A	N/A
2	2 storey glass building	None	Negligible	N/A	N/A
3	Breeze bloc construction 2 storey building with a flat roof. Plus, pebble dash single storey storage container	None	Negligible	N/A	N/A
4	Small breeze bloc shed	None	Negligible	N/A	N/A
5	Collection of small brick storage units with flat roofs in good condition	None	Negligible	N/A	N/A
6	2 storey brick office building, roof has machine cut tiles	Gaps in fascia, brickwork and slipped tiles	High	Common Pipistrelle * 1	Occasional day roost
7	Brick and corrugated metal multi-storey offices, flat roof in very good condition	None	Negligible	N/A	N/A
8	Corrugated metal flat roofed multi-storey buildings in good condition	None	Negligible	N/A	N/A
9	Glass multi-storey offices in good condition	None	Negligible	N/A	N/A
10	Glass multi-storey offices in good condition	None	Negligible	N/A	N/A
11	Corrugated metal multi-storey building in good condition	None	Negligible	N/A	N/A
12	Corrugated metal flat roofed multi-storey buildings in good condition	None	Negligible	N/A	N/A
13	Several brick and corrugated metal gas storage buildings/offices	None	Negligible	N/A	N/A
14	Large brick and corrugated metal storage shed in good condition	None	Negligible	N/A	N/A
15	Two -- offices, flat roofed	None	Negligible	N/A	N/A
16	Series of brick buildings with flat roofs, singe storey offices	None	Negligible	N/A	N/A
17	Series of flat roofed shipping containers served as electrical power units for satellites	None	Negligible	N/A	N/A
18	Flat roofed --- multi-storey office	None	Negligible	N/A	N/A
19	Series of temporary shipping units and one brick building with a flat roof	None	Negligible	N/A	N/A

20	Two corrugated large sheds (sports hall)	None	Negligible	N/A	N/A
21	Small corrugated storage shed	None	Negligible	N/A	N/A
22	multi-storey office in corrugated metal roof. High disturbance with air con fans in raised vents on roof	None	Negligible	N/A	N/A
23	Large office / storage complex with pebble dash and corrugated metal exterior	None	Negligible	N/A	N/A
24	Small wooden shed and larger flat roofed --- office adjacent a tennis court	None	Negligible	N/A	N/A
25	Three small wooden storage sheds with bitumen roofing felt	None	Negligible	N/A	N/A
26	Small pre-fab buildings with flat roofs	None	Negligible	N/A	N/A
27	Large BT complex - multi-storey glass offices with flat roofs	None	Negligible	N/A	N/A
28	Four brick buildings with corrugated metal or pebble dash exteriors, 2 with flat roofs	None	Negligible	N/A	N/A
29	Two prefab buildings with flat roofs used for storage	None	Negligible	N/A	N/A
30	Three --- oval shaped offices in good condition	None	Negligible	N/A	N/A
31	Multi-storey glass offices with flat roofs	None	Negligible	N/A	N/A
32	Two flat roofed concrete storage units in good condition	None	Negligible	N/A	N/A
33	Multi-storey glass / ---- buildings with flat roofs	None	Negligible	N/A	N/A
34	Open storage area with corrugated roof - High pollution	None	Negligible	N/A	N/A
35	Brick and tiled roof --- station in good condition	None	Negligible	N/A	N/A
B	Series of flat roofed storage / offices - viewed from road side	None	Negligible	N/A	N/A
C	Series of corrugated roofed breeze black and corrugated asbestos --- and workshops	None	Negligible	N/A	N/A
D	Asbestos corrugated breeze block shed with no roof void	None	Negligible	N/A	N/A
E	Brick BT tower 2 storeys with flat roof. Gap at the top of the roof on the north side and 2 x holes 1 storey up on north and west sides	Holes at roof and into brickwork	High	Common and soprano pipistrelles * 2	Day roost and transitional roost
F	Pre-fab tower -- structure in good condition	None	Negligible	N/A	N/A
G	Metal container used as a ready-mix station	None	Negligible	N/A	N/A
H	Small breeze block built generator building with corrugated asbestos roof. Access points into building.	Access points – i.e. gaps in pointing and fascia's	Negligible	Feeding perch	Feeding perch
I	Large workshop brick built with	Gaps between	Negligible	Feeding perch	Feeding perch

	corrugated asbestos cladding and roof. Access points into building.	cladding and brickwork			
J	Pre-fab office buildings with concrete boards. Gaps into building but insect mesh preventing access.	None	Negligible	N/A	N/A

3.53 Internal inspections in 2008 discovered approximately 30 droppings from brown-long eared bats, however emergence surveys showed no signs of roosting bats and the building was assessed as a transitional roost (Environ UK, 2009). Although a plan of the location of the building was not available, the evidence suggests the building is within the Adastral Park business area and thus outside of the proposed development. As such, it is not discussed further.

3.54 The internal inspections were undertaken on 3rd November 2016 (Buildings 6 and E) and 4th January 2017 (Buildings H, I and pillboxes), results of which can be found below:

Building 6

3.55 Building 6 is located in the BT business Park on the edge of the application boundary and is though unlikely to be impacted by the development. Building 6 was unable to be internally inspected due to the presence of asbestos. However, the detailed external inspection showed a number of slipped and missing tiles, gaps between the brickwork and soffits, gaps between the barge boards and soffits and some staining on the north facing aspect (see Appendix 10 for location). The building has been assessed as having high potential for roosting bats.

Building E

3.56 Building E is located within the long-range test site in the east of the site. The building is used for testing and as such is only sporadically disturbed by human presence. The building is three story's high with access to the roof via an external staircase and walkways. The building has two holes cut into the brickwork on the first floor which are used for cabling. One of which (north aspect) leads straight through to the interior, the other (west facing) is partially blocked by expandable foam. The holes are roughly tennis ball sized and reminiscent of a woodpecker hole.

3.57 The interior inspection of Building E revealed several pipistrelle droppings in the room on the first floor, as well as some on the brickwork on the stairwell between the first and second floor. In addition, a pipistrelle bat was found likely preparing for hibernation, although not yet in hibernation (3rd November 2016), within a gap in the brickwork in the stairwell between the first and second (top) floor. As such it is possible that the building contains a transitional or hibernation roost (see section 3.66) and is also assessed as having high potential for roosting bats.

Building H

3.58 Building H is the generator building within the working quarry, which currently houses an old generator and a raised concrete platform where another was held. The building consists of a brick built storage shed with an elevated additional roof along half of the building. The exterior is clad in corrugated asbestos sheets, as is the pitched roof. There are multiple access points, for example through gaps above the large double barn doors, gaps between the cladding and the brickwork,

missing pointing and in the wooden fascia. However, there are no features inside the building suitable for roosting bats.

3.59 There was no evidence of roosting bats within Building H, however feeding remains (butterfly wings) were present, indicating a potential feeding perch, likely for brown long-eared bats which have been recorded on site. The building is assessed as having negligible roosting potential.

Building I

3.60 Building I is the large workshop within the working quarry which is currently used for spray painting vehicles, a kitchen, offices and working stations / machinery for the quarried materials. The building is brick built with corrugated asbestos cladding and roof. The cladding is variable, some with gaps between the cladding and the brickwork, some with a 2nd layer providing some insulation for the building, some with padded insulation and others with Ivy covering the gaps. A single potential bat dropping was present in one of the gaps at the east facing side of the building, likely indicating a foraging bat searching out new potential roost sites. There are five large up-and-over garage doors where large machines / vehicles have access to the workshop.

3.61 There was no evidence of roosting bats in the interior of the workshop building, however feeding remains (butterfly wings) were present in two locations within the workshop, indicating a potential feeding perch, likely for brown long-eared bats which have been recorded on site. Likely access points include above the garage doors and through a missing cladding panel in the Spray workshop. Nonetheless, the building is assessed as having negligible bat roosting potential due to the high levels of disturbance within the building, and the lack of roosting opportunities.

Pillboxes

3.62 There are two pillboxes on site, both of which contain negligible bat roosting potential due to their openness, light and airy nature as well as lack of crevices and cracks for bats. With the exception of the most northerly pill box which contains a double skinned wall. No evidence was observed in either pill box and it is considered they have negligible potential for summer roosting. Hibernation roosting opportunities are limited.

Building Emergence / Re-entry Surveys

3.63 Three Emergence and/or Re-entry Surveys were undertaken on Building 6 and Building E. A potential common pipistrelle emergence was seen on Building 6, although this was only observed on one of the three surveys undertaken and as such is believed to potentially be an occasional day roost for common pipistrelle bats.

3.64 Building E on the long-range test strip had common and soprano pipistrelles emerging from the building during the summer / autumn surveys. A peak of 2 pipistrelles were observed on any one evening, with a total count of 4. In combination with the internal inspections, Building E is confirmed as a summer roost for pipistrelle bats and is subject to further survey for hibernating.

Hibernation Surveys

3.65 A record of hibernating brown long-eared or Natterer's bat was present within the quarry area on site. After investigation with Brett Aggregates staff present at the time the record referred to a hibernating site that is no longer present, within a double skin wall within the working plant on site. As machinery has changed, the double skin wall has become filled over time and could no longer be used by bats due to a lack of access. As such, this area is considered unsuitable for hibernating bats and they are considered likely absent from this previous roosting space.

3.66 Building E was initially assessed on the 3rd November 2016 when a single pipistrelle bat was observed in a crack in the brickwork, likely preparing for hibernation. Follow up surveys on the 4th January 2017 and 14th February 2017 revealed no hibernating bats within this building. The building is therefore assessed as being a summer day roost, transitional roost and is also considered to have past and future hibernating potential, due to features enabling hibernating.

3.67 Tree 41 was inspected for its potential to support hibernating as well as the summer roosting bats. The tree was climbed and inspected with an endoscope into all available crevices. No evidence of hibernating bats was found; however, this is not considered conclusive due to the complexity of the crevices meaning a full inspection was not possible. Static detectors were then deployed on the tree as further survey from 23rd January 2017 – 26th January 2017 with no bat calls heard and no roosts found. It is thus, considered unlikely that Tree 41 is used for hibernating, due to its unlikely stable temperatures (situated on a roadside rather than within a woodland which would help stabilise the micro-climate) required by hibernating bats (BCT, 2015).

3.68 The two pillboxes on site were inspected in November 2016, January and February 2017 for their potential to support hibernating bats. No evidence of bats or bats themselves were found in either building on either survey visit and the buildings are considered to currently provide sub-optimal hibernating habitat.

Great Crested Newt

Desk Study

3.69 Records from the SBIS results show one record of GCN, a local BAP species (SBIS, 2017), approximately 0.9km to the north-west of the site, recorded in 2004. Previous surveys on the site have not detected GCN presence (Environ UK, 2009).

3.70 Previous surveys did however detect common toad *Bufo bufo* (a local BAP species) within two of the quarry ponds and Pond 17 (see Appendix 6 for location) within the Adastral Park business area, smooth / palmate newts *Lissotriton vulgaris / L. helveticus* in two of the ponds within the Adastral Park business area and common frog *Rana temporaria* in Pond 17 (see Appendix 6 for location). From descriptions of the quarry ponds, it is considered likely these ponds have substantially declined since the 2008 survey (Environ UK, 2009). It is likely the toads have dispersed from Kyson Meadows, Sluice Wood & Martlesham Creek Reed CWS 1.3km north of site, where a large population is known, to find hibernating habitat. Although the 2008 surveys found common toads within two of the ponds on the Application Site (both quarry ponds) and one within the Adastral Park business complex (Environ UK, 2009), it is considered unlikely they are still using the ponds on the Application Site due to their diminished wildlife value since 2008 rendering them unsuitable for amphibians.

Habitat Suitability Index (HSI)

3.71 There is a total of seven waterbodies on Site or within the Adastral Park industrial area, which vary from large established lakes to moderate sized reservoirs. The results of the HSI for these ponds indicate that the ponds vary from 'Excellent' to 'Poor' for GCN on the GCN Habitat Suitability Index (see Table 8 below). Ponds on Site include: Pond 2, Pond 3, Pond 4 and Pond 5. With those off-site within the Adastral Park BT complex include: Pond 1, Pond 17 and Pond 18.

3.72 Survey to ponds outside of the Site and the Adastral Park BT complex, within 500m of the sites' boundaries (see Appendix 6 for map) was not undertaken, thus no HSI assessments for off-site ponds were undertaken in 2016. Nonetheless Pond 8, approximately 60m from site could be observed from the site's boundaries and was assessed as having low/no suitability for GCN, with no emergent vegetation, high turbidity, steep banks and extensive wildfowl use. In addition, Pond 9, approximately 150m from site was assessed as having little connectivity to Site, although the pond was not be accessed to assess its suitability for GCN.

Table 8: Adastral Park Waterbodies HSI Assessment

Pond Number/ SI Number - Pond Score	**1**	**2**	**3**	**4**	**5**	**17**	**18**
1 – Location	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2 – Pond Area	0.91	-	-	0.8	-	1.0	0.6
3 – Drying Out	0.9	0.9	0.9	0.9	0.9	0.9	0.9
4 – Water Quality	0.67	0.67	0.33	0.33	0.33	0.67	0.67
5 – Shade	1.0	1.0	1.0	1.0	1.0	1.0	1.0
6 – Water Fowl	0.67	0.67	0.67	0.67	0.67	0.67	0.67
7 – Fish	0.01	0.67	0.67	0.67	0.67	0.67	0.01
8 – Nearby Ponds	1.0	1.0	1.0	1.0	1.0	1.0	1.0
9 – Terrestrial Habitat	0.67	0.67	0.67	0.67	0.67	0.67	0.33
10 – Macrophytes	0.3	0.3	0.6	0.3	0.3	0.7	0.5
H.S.I ($X^{1/10}$)	**0.49**	**0.72**	**0.72**	**0.68**	**0.67**	**0.81**	**0.46**
Pond Suitability	**Poor**	**Good**	**Good**	**Average**	**Average**	**Excellent**	**Poor**
Distance from Site	**Adjacent boundary**	**On Site**	**On Site**	**On Site**	**On Site**	**15m**	**215m**

Presence/Likely Absence Survey

3.73 Survey results for 2016 eDNA presence / absence survey are provided in Table 9 below. The eDNA survey showed negative results for GCN in all the ponds surveyed.

Table 9: eDNA Survey Results

Pond ID	Grid Ref	Distance and Direction from Site	ADAS Kit ID No.	Result (P = Present, A = Absent
1	TM 25383 44710	Adjacent north boundary	2016-1209	A
2	TM 25587 44711	On-site	2016-1224	A
3	TM 25760 44986	On-site	2016-1223	A
4	TM 25849 44965	On-site	2016-1218	A
5	TM 25946 44908	On-site	2016-1226	n/a
17	TM 24898 44801	15m north	2016-1213	A
18	TM 25022 44974	215m north	2016-1225	A

3.74 Pond 5 was not surveyed for GCN due to health and safety concerns regarding access around the pond (dense scrub, quick sand and steep / no banks) as well as its complete unsuitability for this species and for eDNA survey, because of heavy amounts of silt, and no in pond vegetation.

3.75 GCN are considered likely absent from Site. As such the Site is assessed as being of no importance to GCN and as such, they are not discussed further within this report.

Other Amphibians

3.76 Two common toads were observed during the late September survey visit (26th September 2016) utilising the reptile refuges. The toads were present utilising refuges near to Spratt's Plantation (The broad-leaved woodland at the north of the Site) and along the eastern boundary.

Otter and Water Vole

Desk Study

3.77 There are seven records of otter, a local BAP species for Suffolk, in the surrounding landscape. The closest of which is approximately 200m east of Site although the grid reference is only accurate to 100m^2. The other records are to the south-east of the Site.

Field Survey

3.78 The field survey covered the waterbodies within the proposed development Site as well as those within the Adastral Park industrial area, with particular focus on the fishing lake where fishermen have reported seeing otter.

3.79 There were no field signs (latrines, footprints, burrows, feeding stations, runways in the vegetation etc.) for water vole, a local BAP species for Suffolk, on Site. As such it is considered that water vole are not using the proposed development site.

3.80 In addition, there were no spraints, footprints, holts, mammal runs into the water etc. for otter, also a local BAP species. Nonetheless, local knowledge and the desk study both indicate that otter can use the Site, however the lack of field signs and/or holts suggests occasional use by foraging otter only. It is likely that the otter are using the upper reaches of the Deben Estuary (approximately 2km from Site), the Mill River (approximately 700m from Site) and / or the River Fynn (approximately 1.6km from Site) as their main foraging grounds, utilising a series of ponds and ditches which lead towards the Site. Five of the records are from Mill River, present in the south-west of the Site, near to Brightwell. The river sits approximately 700m from Newbourne Road and 1.4km from the fishing lake on Site. As such otter are not considered to use the fishing lake or other water bodies on Site as a main foraging resource, but may occasionally frequent the fishing lake for adhoc foraging.

Birds

Desk Study

3.81 Bird records supplied by SBIS include a range of common species, many associated with farmland, marshland and wetland habitats, considered likely to be in association with the nearby European Designated Sites (Deben Estuary and Stour and Orwell Estuaries). SBIS database holds records for a total of 94 species within 2km of the Site boundary, of which 29 species were listed on Schedule 1 of WCA 1981 (as amended). Of these 29 Schedule 1 listed bird species, a number could utilize habitats on Site such as fieldfare *Turdus pilaris*, redwing *Turdus iliacus*, wood sandpiper *Tringa glareola*, green sandpiper *Tringa ochropus* and barn owl *Tyto alba.* It should be noted that the Schedule 1 legislation protects against disturbance to breeding birds, and that many of the 29 species listed in the desk study results do not breed in the region and/or in habitat types found on the Site, even if they have potential to occur as non-breeding birds. As such, Schedule 1 species listed with potential to breed or utilize the Site are hobby *Falco subbuteo,* kingfisher *Alcedo atthis*, Cetti's warbler *Cettia cetti,* little ringed plover *Charadrius dubius,* peregrine *Falco peregrinus,* barn owl*,* and avocet *Recurvirostra avosetta*.

3.82 A web-based search was undertaken for relevant information and reports pertaining to birds in the local area, including the statutory designated sites (more information presented in the sHRA, Baker Consultants, 2017).

3.83 Local priority habitats which hold the potential to support significant bird populations include ancient woodlands, unimproved grasslands, heathland, and freshwater habitats. Some of these are statutory designated sites for which more details are outlined within the separate HRA.

Breeding Birds

3.84 A total of 43 species were recorded during the breeding bird surveys. This included a total of 34 breeding species and nine non-breeding species, the latter were either foraging or roosting on the Site and included gulls, waders and raptors. Details of which can be seen below in Table10.

3.85 Territories were recorded generally across the Site, although there was a higher concentration in the grassland and scrub habitats. Additionally, birds such as skylark *Alauda arvensis* utilized areas of arable land within the south west in addition to the grasslands across the Site. A map of territories of noteworthy observation can be seen in Appendix 11.

3.86 A single cuckoo *Cuculus canorus* was recorded on the second visit (27/05/2016) amongst the scrub around the quarry ponds. Cuckoo was probably breeding on Site.

3.87 Four singing nightingales were recorded on the first visit (06/05/2016) amongst areas of scrub. Neither species were recorded on the other visit dates. The early morning visit in May allowed singing nightingales to be detected in suitable scrub breeding habitat. This species arrives in April and sings mostly at night and dusk/dawn until late May, when territories are mostly established and breeding underway. Nightingales are difficult to observe, and most records in the UK are of singing birds. BirdTrack reporting rates (http://app.bto.org/bt-dailyresults/results/s347-20-12.html) demonstrate how nightingale singing rates decline dramatically during the second half of May, to a rate approximately one-third of that at the start of May. This is likely to explain why the species was not recorded on the two later survey visits, and these birds were likely still present and breeding.

3.88 The presence of up to three pairs of shelduck *Tadorna ferruginea*, recorded within the scrub surrounding the waterbodies associated with the quarry, was also notable. Shelduck was listed as part of the notable breeding wetland bird assemblage of the original SPA Citation (1996) for the nearby Deben Estuary, although were not included in the 1999 and 2015 JNCC notification reviews.

3.89 The open scrape and grassland habitats had the potential to support waders such as lapwing and little ringed plover, however no wading species were recorded within this habitat. The open water habitats were equally species-poor. The only habitats that supported significant species were the scrub habitats that supported linnet, nightingale and cuckoo as well as the open grasslands that supported breeding skylark and foraging linnet.

Table 10: Birds recorded from the Site during the breeding bird survey, including immediately adjacent areas, with numbers of confirmed/probable and possible breeding territories, and their national and regional conservation and legal status.

Species	Sch 1	BoCC Status	UKBAP	Suffolk BAP	Breeding Status & Territories
Cuckoo *Cuculus canorus*		Red	✓	✓	Possible 1 - territory
Herring gull *Larus argentatus*		Red	✓	✓	Non-breeding roosting on Site
Linnet *Carduelis cannabina*		Red	✓	✓	Probable - 4 territories
Nightingale *Luscinia megarhynchos*		Red			Possible - 4 singing males
Skylark *Alauda arvensis*		Red	✓	✓	Probable - 5 territories
Starling *Sturnus vulgaris*		Red	✓	✓	Non-breeding foraging on Site
Black-headed gull *Chroicocephalus ridibundus*		Amber			Non-breeding roosting on Site
Dunnock *Prunella modularis*		Amber	✓	✓	Probable - 2 territories
Green sandpiper *Tringa ochropus*	✓	Amber			Non-breeding passage migrant
Kestrel *Falco tinnunculus*		Amber			Probable - 1 pair
Lesser black-backed gull *Larus fuscus*		Amber			Non-breeding roosting on Site
Mallard *Anas platyrhynchos*		Amber			Probable - 1 pair
Oystercatcher *Haematopus ostralegus*		Amber			Non-breeding 1 flying over
Shelduck *Tadorna tadorna*		Amber			Probable - 3 pairs
Stock dove *Columba oenas*		Amber			Probable - 2 territories
Blackbird *Turdus merula*		Green			Probable
Blackcap *Sylvia atricapilla*		Green			Probable

Species	Sch 1	BoCC Status	UKBAP	Suffolk BAP	Breeding Status & Territories
Blue tit *Cyanistes caeruleus*		Green			Probable
Buzzard *Buteo buteo*		Green			Non-breeding - 1 flying over
Carrion crow *Corvus corone*		Green			Probable
Chaffinch *Fringilla coelebs*		Green			Probable
Chiffchaff *Phylloscopus collybita*		Green			Probable
Goldfinch *Carduelis carduelis*		Green			Possible
Great spotted woodpecker *Dendrocopos major*		Green			Possible
Great tit *Parus major*		Green			Probable
Green woodpecker *Picus viridis*		Green			Possible
Greenfinch *Carduelis chloris*		Green			Possible
Hobby *Falco subbuteo*	✓	Green			Non-breeding - Foraging on Site
Jackdaw *Corvus monedula*		Green			Possible
Jay *Garrulus glandarius*		Green			Probable
Long-tailed tit *Aegithalos caudatus*		Green			Probable
Magpie *Pica pica*		Green			Probable
Pied wagtail *Motacilla alba*		Green			Probable
Robin *Erithacus rubecula*		Green			Confirmed
Rook *Corvus frugilegus*		Green			Non-breeding foraging on Site
Sand martin *Riparia riparia*		Green			Confirmed - 35 apparently occupied holes
Sparrow hawk *Accipiter nisus*		Green			Possible
Swallow *Hirundo rustica*		Green			Non-breeding foraging on Site
Whitethroat *Sylvia communis*		Green			Probable
Woodpigeon *Columba palumbus*		Green			Probable
Wren *Troglodytes troglodytes*		Green			Probable
Canada goose *Branta canadensis*		NA			Possible
Pheasant *Phasianus colchicus*		NA			Probable
Red-legged partridge *Alectoris rufa*		NA			Probable - 1 pair

Red rows are BOCC red-list, Amber rows are BoCC amber-list, Green rows are BoCC green-list, NA rows are non-native species. BoCC = Birds of Conservation Concern as defined and listed in Eaton et al. 2015

3.90 There were 10 notable species recorded on the Site on account of them being listed as Birds of Conservation Concern (BoCC) (Eaton et al. 2015) as shown in Table 11: four on the BoCC red-list and five on the amber-list. Hobby, a green-listed bird, was also considered notable due to its listing as a Schedule 1 species. Furthermore, six further species are considered notable on account of being listed as UK and Suffolk BAP species.

3.91 A sand martin *Riparia riparia* bank located within an area of disused sand quarry adjacent to the large central fishing lake. This bank had approximately 35 occupied breeding holes. During the winter surveys, this nesting bank was found to have been removed during the course of routine quarrying operations. It was noted that the quarrying of the area to the west has created large temporary areas of sand cliff suitable for nesting sand martins.

Table 11: Summary of notable bird species recorded on Site including immediately adjacent areas, with numbers of confirmed/probable and possible breeding territories.

Species	Sch 1	BoCC Status	UKBAP	Suffolk BAP	Breeding Status & Territories
Cuckoo *Cuculus canorus*		Red		✓	Possible - 1 territory
Linnet *Carduelis cannabina*		Red		✓	Probable - 4 territories
Nightingale *Luscinia megarhynchos*		Red			Possible - 4 singing males
Skylark *Alauda arvensis*		Red		✓	Probable - 5 territories
Dunnock *Prunella modularis*		Amber		✓	Probable - 2 territories
Kestrel *Falco tinnunculus*		Amber			Probable - 1 pair
Mallard *Anas platyrhynchos*		Amber			Probable - 1 pair
Shelduck *Tadorna tadorna*		Amber			Probable - 3 pairs
Stock dove *Columba oenas*		Amber			Probable - 2 territories
Hobby *Falco subbuteo*	✓	Green			Non-breeding - Foraging on Site

Red rows are BOCC red-list, Amber rows are BOCC amber-list, Green rows are BOCC green-list, NA rows are non-native species

Table 12: Summary data on conservation status of breeding bird community.

BoCC Status	Total		UKBAP		Suffolk BAP		Schedule 1	
	Breeding	Non-breeding	Breeding	Non-breeding	Breeding	Non-breeding	Breeding	Non-breeding
Red	4	2		1	3	2		
Amber	5	4			1			
Green	22	3						1
NA	3							
Total	**34**	**9**		**1**	**4**	**2**		**1**

3.92 Survey dates and weather conditions for each survey visit are outlined in Table 13.

Table 13: Survey conditions for the three site visits.

Visit Number	Date & Time	Survey conditions
1	06/05/2016 08:00 –12:00	V. Good: 17°C, no precipitation, no winds, cloud 1/8, good visibility.
2	27/05/2016 07:00 – 11:30	V. Good: 15°C, no precipitation, low winds, cloud 2/8, good visibility.
3	01/06/2016 0730 – 12:00	Good: 15°C, slight precipitation, low winds, 4/8, good visibility.

Constraints

3.93 There were no significant constraints to the assessment.

Wintering Birds

3.94 An assemblage of 39 bird species have been recorded during the wintering surveys, including automated camera surveys (see Table 14). Thirty-five were considered to be using the Site whilst the other four were simply flying over. Some records were from the northern woodland, central lake area and grassland to the north or boundary shelter belts which will be retained intact and are classified as being outside the development footprint. Seventeen are notable species on account of being on the list of BoCC, of which nine are red-listed and eight amber-listed (see Table 14), of which

dunnock, reed bunting, lapwing, linnet, song thrush and skylark are also UK and Suffolk BAP species. None of the species recorded are considered uncommon or rare at any geographical scale, with their amber-listed and BAP species status due to widespread declines across their large UK geographic range. They are still widespread in the region, and the reasons for their declines are not considered to be driven by development impacts.

3.95 The most notable species from the survey were the presence of seven teal on the settling ponds, a foraging woodcock on the grassland strip and the following (with maximum peak count quoted) on the stubble and abandoned former arable/grassland fields and associated scrub within the proposed development area of the Application Site: 36 skylark; 18 fieldfare; 17 meadow pipit; 16 song thrush, 11 dunnock and 25 linnet. These species are known to be distributed across almost the whole County (Balmer et al. 2013) away from urban areas, where there is suitable arable and grassland farmland, scrub and other foraging habitat.

Table 14: Birds recorded from the Site during the wintering bird survey, including immediately adjacent areas, noting whether recorded flying over the Site only, and the number of individuals within the proposed development footprint.

Common name	Latin name	On Site	Over Site	Within development footprint	Outside development footprint
Black-headed gull	*Chroicocephalus ridibundus*	√		22	
Blackbird	*Turdus merula*	√		4	16
Blue tit	*Cyanistes caeruleus*	√			6
Carrion crow	*Corvus corone*	√		6	
Common gull	*Larus canus*	√		4	
Coal tit	*Pariparus ater*	√			2
Cormorant	*Phalacrocorax carbo*		√		
Chaffinch	*Fringilla coelebs*	√		1	
Dunnock	*Prunella modularis*	√		11	1
Fieldfare	*Turdus pilaris*	√		18	
Goldcrest	*Regulus regulus*	√			1
Goldfinch	*Carduelis carduelis*	√		20	2
Great spotted woodpecker	*Dendrocopos major*	√			1
Great tit	*Parus major*	√			8
Green woodpecker	*Picus viridis*	√			1
Greylag goose*	*Anser anser*		√		
Herring gull	*Larus argentatus*	√		2	
Jackdaw	*Corvus monedula*		√		
Kestrel	*Falco tinuniculus*	√		1	
Lapwing	*Vanellus vanellus*	√		2	
Linnet	*Carduelis cannabina*	√		25	
Long-tailed tit	*Aegithalos caudatus*	√			7
Magpie	*Pica pica*	√		16	
Mallard	*Anas platyrhynchos*	√		4	
Meadow pipit	*Anthus pratensis*	√		17	
Mistle thrush	*Turdus viscivorus*	√		2	
Moorhen	*Gallinula chloropus*	√		1	
Pheasant	*Phasianus colchicus*	√		1	
Red-legged partridge	*Alectoris rufa*	√		9	
Redwing	*Turdus iliacus*	√		1	22
Reed bunting	*Emberiza schoeniclus*	√		1	
Robin	*Erithacus rubecula*	√		3	4
Song thrush	*Turdus philomelos*	√		16	
Sparrowhawk	*Accipiter nisus*		√		
Skylark	*Alauda arvensis*	√		36	
Teal	*Anas crecca*	√		7	
Wood pigeon	*Columba palumbus*	√		28	42
Woodcock	*Scolopax rusticola*	√		1+	
Wren	*Troglodytes troglodytes*	√		11	3

Highlighted rows are UK BAP species

Red text are BoCC red-listed species
Amber text are BoCC amber-listed species

3.96 Survey dates and weather conditions for each survey visit are outlined in Table 15.

Table 15: Survey conditions for the three wintering bird survey visits.

Visit Number	Date & Time	Survey conditions
1	17/11/2016 09:00 –15:00	Good: 8.5°C, no precipitation until heavy rain at 14:30, SW wind BS force 3, cloud 8/8 at start and end, 5/8 12:00-14:00, good visibility.
2	26/01/2017 08:15 – 12:30	Good, but cold: -1°C, no precipitation, SE wind BS force 3, cloud 8/8, moderate to good visibility.
3	24/02/17 12:00-17:00	Good: 6°C, no precipitation, NW wind BS force 1, cloud 3/8 throughout, good visibility.

Constraints

3.97 The survey methodology is considered appropriate to recording the range of species potentially wintering on the Site. The weather conditions during the visit were appropriate for observing and recording wintering birds, albeit with deteriorating conditions for the final 20 minutes of the first survey, but this was not considered to significantly limit the survey results as this time was spent returning to the car largely across areas already surveyed earlier in the day.

Badgers

3.98 There are two records of Badger on Site, one [redacted] and the other [redacted]. An additional 4 records are present within 2km of the Site.

3.99 The location and classification of all potential setts, as well as field signs of badgers, i.e. mammal runs, footprints, hairs, latrines etc., recorded during surveys is provided in Appendix 12 as a confidential document. The majority of evidence of badgers is focused [redacted], as well as foraging signs in the west arable field, and along the eastern corridor.

3.100 There are a number of potential outlier / subsidiary setts on Site. Two entrance holes were observed along the [redacted] (Sett A), with multiple mammal tracks, badger prints and spoil piles outside the entrance holes indicating current use. A trail camera indicated one of these two holes was in current use, evidenced by a single male badger entering the hole on several occasions over the period the camera was out (10th – 30th January 2017). The second hole is believed to be utilized by rabbits. A mammal track is present running east into dense scrub, where access was initially prohibited during the early January visit, due to health and safety. Further survey of the bank was undertaken by a qualified IRATA climbing team in the middle of January, who were also able to clear paths through the vegetation to allow access to the banks and assess any additional holes in close detail. A total of 11 holes were found, although the majority of which (8) were disused and had collapsed due to the sandy nature of the substrate. A number of rabbit burrows were also present in this area. Another 3 trail cameras were installed outside entrance holes which looked as though they could be in current use (i.e. clear entrance holes, footprints and pathways). Camera footage from the monitoring period (10th – 30th January 2017) revealed that a single badger was utilizing one of these entrance holes and on one occasion a second badger was observed entering the sett. This sett (Sett B) is classified as an outlier sett, although may have been a larger sett (likely subsidiary) in the past.

3.101 A further likely subsidiary sett is located on the [redacted] (Sett C) in the center of the Site. This sett consists of 4 entrance holes showing signs of current use in the form of a single dung pit, badger prints, hairs and fresh spoil. A further two holes are located in the vicinity, however one of these is a collapsed 'D shape' hole and the second is indicative of rabbits in its size and dimensions. A trail camera was used to monitor this sett in order to determine the level of use. Footage identified two badgers occupying the sett during this period. The number of holes along with camera footage and field signs indicate that this sett can be classified as a likely subsidiary sett.

3.102 A four-entrance hole sett (Sett E) is located in the [redacted] Site, within an area of [redacted] along the [redacted]. The sett is situated under [redacted] and a number of mammal runs are present within this area of habitat. A single latrine was identified near to the sett entrances. Monitoring of the sett using trail cameras identified two badgers entering and exiting one of the four entrances on one occasion during the monitoring period. Due to the low level of field signs, and the level of use indicated during monitoring, it can be considered that the sett is not in continuous use, it can be classified as an outlier sett that is in current use.

3.103 A further 4 potential entrance holes are present on Site; [redacted]. All of the holes were single entrance holes, it is considered that these are likely to be outlier setts. These potential setts show no signs of current use by badgers and field signs of rabbits were present in their vicinity.

Invertebrates

Desk Study

3.104 Records for 78 species of invertebrate of conservation concern were returned by the data search, comprising: 45 widespread species afforded the status of Species of Principal Importance; two Species of Principal Importance also classified as Red Data Book or Nationally Scarce; four butterflies listed as Species of Principal Importance and also included on the Red List for butterflies; nine other species listed as Red Data Book species; and 18 other Nationally Scarce species.

3.105 The habitat characteristics of the species on the data search are summarised in Table 16. Many of the records are from Martlesham Heath, an area of heathland west of the village conurbation, with species such as the silver-studded blue butterfly *Plebejus argus*. A number of bee and wasp records are also from the BT complex of Adastral Park itself. A wide variety of habitats (Broad Assemblage Types) support rare and scarce invertebrates locally, with woodland and grassland the principal habitats, with the more specialist species (Specific Assemblage Types) mainly on open and disturbed grassland. The 'heartwood decay' species is the stag beetle *Lucanus cervus* (Coleoptera: Lucanidae).

Table 16: ISIS summary of data search records (some species do not have Assemblage Types Associations).

Assemblage code	Assemblage name	Number of species
Broad Assemblage Type		
A1	Arboreal canopy	15
F1	Unshaded early successional mosaic	13
F2	Grassland & scrub matrix	9
A2	Wood decay	2
W3	Permanent wet mire	2
Specific Assemblage Type		
F111	Bare sand & chalk	5

A213	Fungal fruiting bodies	1
F112	Open short sward	2
W314	Reedfen and pools	1
A211	Heartwood decay	1

Field Survey

Habitats and Associations

3.106 The Site comprises a large sand quarry Site, with on-going extraction and extensive areas of former workings at different seral stages from bare sand through to established grassland. There is also a block of older woodland, albeit close canopy and with limited dead wood habitat, and a large fishing lake of low potential value for invertebrates due to fish and steep sides without extensive marginal habitat.

3.107 Across the Site the open grassland areas there is a variety of habitat conditions, including extensive areas of open vegetation with bare substrates and sparse swards and also more established grassland. There are also areas of sloping ground, most notably along a large earth bank to the north of the Site and small banks and bunds elsewhere; however, within many of the vegetation blocks the topography is relatively flat and uniform, with post-extraction 'flattening' of the ground rather than leaving mounds and heaps extensively across the Site.

3.108 Seven sampling stations were surveyed five times and an additional 12 subject to a rapid survey on a single date. A total of 258 species were recorded. The main sampling stations variously covered areas of open habitat, including ephemeral and grassland vegetation of various types; the minor sampling stations likewise mainly covered open vegetation but also included the parcel of deciduous woodland (Table 17).

Table 17: Descriptions of sampling stations.

Sampling station number	Habitat description
Main sampling stations	
1	Ephemeral vegetation on area probably left unmanaged for < 5 years, with a sparse herb cover and extensive bare substrate largely without grasses; an abundance of blossom. Flat without variation in topography or other physical variation
2	Semi-improved grass sward on a gently-sloping south-facing field. Unmanaged but with variation ins ward conditions from rabbit grazing and peripheral areas in association with scrub
3	A high earth bank with steep sides and a flat top. Sparsely vegetated with a grass dominated sward. Local variation in bank profiles created by water scour, exposing a coarse sandy substrate beneath a finer topsoil. Little blossom adjacent to the bank
4	As for station 4 but with an area of blossom-rich ephemeral vegetation at the foot of the south face
5	Area of tall ruderal and ephemeral vegetation on area probably left unmanaged for < 5 years, with a sparse herb cover and extensive bare substrate largely without grasses; an abundance of blossom. Varied topography with mounds of spoil
6	Area of grassland, unmanaged and generally a tall sward with little bare substrate visible. Grass-dominated and few herbs
7	Area of short sward, semi-improved grassland in association with disturbed areas created by occasional vehicle movements and with varied topography including low banks and spoil mounds
Minor sampling stations	
A	Semi-improved grassland and ephemeral vegetation with some low banks and spoil mounds
B	Semi-improved grassland and ephemeral vegetation with some low banks and spoil mounds
C	Semi-improved grassland and ephemeral vegetation with some low banks and spoil mounds

Sampling station number	Habitat description
D	Semi-improved grass sward on a gently-sloping south-facing field
E	Broad leaved woodland, generally closed canopy and with little dead wood other than relatively narrow (<20cm diameter) timbers on the ground and as aerial dead wood
F	Semi-improved grassland with tall herbs associated with a high earth bank with steep sides and a flat top
G	Semi-improved grassland with tall herbs associated with a high earth bank with steep sides and a flat top
H	Disturbed trackway with bare substrate and semi-improved grass verges with an open sward structure
I	Disturbed trackway with bare substrate and semi-improved grass verges with an open sward structure
J	Ephemeral vegetation and short sward grassland in areas of disturbance with low banks and mounds
K	Ephemeral vegetation and short sward grassland in areas of disturbance with low banks and mounds
L	Ephemeral vegetation and short sward grassland in areas of disturbance with low banks and mounds

3.109 The ecological profile of the species across the Site is presented in Table 18. Of particular note is the 'Favourable' condition of the Broad Assemblage Type (BAT) of 'unshaded early successional mosaic' with a score of 208 (relative to a threshold of 160, albeit with a substantial survey effort). The two BATs associated with grassland (F1 and F2) comprise 87% of species assigned to BATs, with the other species being woodland associated or mainly vagrant wetland hoverflies such as the *Eristalis* and *Helophilus* species (Diptera: Syrphidae), but also a limited number of more sedentary species associated with humid habitats, such as the spider *Oedothorax gibbosus* (Araneae: Linyphiidae).

3.110 The more specialist species – those with a Specific Assemblage Type Association (SAT) – are again mainly associated with open habitats, with two species on either scrub or mature heathland vegetation and two on dead wood:

- The species of 'open short sward' comprise a diverse assemblage of species seemingly associated with the warm microclimate as with the brown argus *Aricia agestis* (Lepidoptera: Lycaenidae) or possibly the physical conditions of the soil, as with the click beetle *Agrypnus murinus* (Coleoptera: Elateridae) whose larvae feed on plant roots.
- The species associated with 'bare sand and chalk' again associated with the physical conditions of the soil, for burrowing as with the burrowing wasp *Mellinus arvensis* (Hymeoptera: Spehecidae) or the sparse ruderal vegetation, as with the seed-eating ground beetle *Harpalus anxius* (Coleoptera: Carabidae).
- The single species of 'scrub edge' was the robberfly *Dioctria baumhaueri* (Diptera: Asilidae), with a soil-dwelling larva and adults as sit-and-wait predators on foliage.
- The species of 'mature heath and dry scrub mosaic' is the spider *Dictyna latens* (Araneae: Dictynidae), restricted to well established low vegetation where it creates a web.
- The species of 'bark and sapwood decay' comprise a beetle *Malachius bipustulatus* (Coleoptera: Malachidae), whose larvae are predatory under bark but found widely on flowers, and the bee *Hylaeus cornutus* (Hymenoptea: Colletidae) which nests in dead wood and plant stems while foraging widely into flower-rich open areas.

Table 18: Number of species in the Broad and Specific Assemblage Types recorded from the field surveys.

Assemblage code	Assemblage Name	Number of Species	Favourable
Broad Assemblage Type			
F1	Unshaded early successional mosaic	76	Favourable
F2	Grassland & scrub matrix	79	
A1	Arboreal canopy	10	
W3	Permanent wet mire	11	
A2	Wood decay	4	

Assemblage code	Assemblage Name	Number of Species	Favourable
F3	Shaded field & ground layer	2	
Specific Assemblage Type			
F112	Open short sward	19	
F111	Bare sand & chalk	8	
F212	Scrub edge	1	
F222	Mature heath and dry scrub mosaic	1	
A212	Bark & sapwood decay	2	

Species of Conservation Concern

3.111 Fourteen species of conservation concern were recorded (Table #), comprising:

- Four widespread Species of Principal Importance;
- One Species of Principal Importance with Red Data Book status;
- Three additional Red Data Book species; and
- Five Nationally Scarce species.

3.112 The species of conservation concern are all associated with grassland types other than the bee *Hylaeus cornutus* (Hymenoptera: Colletidae), associated with dead plant stems for nesting, and the buff ermine *Spilosoma luteum* (Lepidoptera: Erebidae) which feeds on various scrub species as a caterpillar. Four of the grassland species have Specific Assemblage Type Associations: two on 'open short sward' and two on 'bare sand and chalk'. The species of conservation concern were recorded widely across the Site (Table 19; Appendix 13).

Table 19: Species of conservation concern.

Higher group / Species	Status	Sampling station		Ecology	BAT / SAT code
		Main	Minor		
Bee *Hylaeus cornutus* (Hymenoptera: Colletidae)	Nationally Scarce-A	2		Nests in dead plant stems and dead wood, forages in grassland on a range of herbs	A2 / A212
Bee *Nomada fulvicornis* (Hymenoptera: Apidae)	RDB 3 (Rare)	2 and 7		A cleptoparasite of other ground-nesting bees. Forages on a range of shrubs and herb flowers	F1 / -
Wasp *Philanthus triangulum* (Hymenoptera: Crabronidae)	RDB2 (Vulnerable)		H & I	Ground nesting wasp, predatory on honey bees and foraging on a range of blossom	F1 / -
Wasp *Cerceris quinquefasciata* (Hymenoptera: Crabronidae)	RDB3 (Rare) Species of Principal Importance	3, 4 and 5		Ground nesting bees, hunting weevils in grassland and foraging on blossom	F1 / F111
Wasp *Sphecodes reticulatus* (Hymenoptera: Halictidae)	Nationally Scarce -A	3		Cleptoparasite of ground-nesting bees	F1 / -
Wasp: large velvet ant *Mutilla europaea* (Hymenoptera: Mutillidae)	Nationally Scarce -B	7		Parasitoid of ground-nesting bees, feeding on a range of herb blossom	F1 / -
Wasp *Nysson dimidiatus* (Hymenoptera: Crabronidae)	Nationally Scarce -B	2		Cleptoparasite of ground-nesting bees, foraging on blossom	F1 / -

Higher group / Species	Status	Sampling station		Ecology	BAT /
Wasp: Small Velvet Ant *Smicromyrme rufipes* (Hymenoptera: Mutillidae)	Nationally Scarce -B	7		Parasitoid of ground-nesting bees, feeding on a range of herb blossom	F1 / -
Fly: Golden-tailed Robberfly *Eutolmus rufibarbis* (Diptera: Asilidae)	RDB 3 (Rare)	3		Predatory fly with soil-dwelling larva associated with sandy substrate	F1 / F111
Butterfly: Small Heath *Coenonympha pamphilus* (Lepidoptera: Satyridae)	Species of Principal Importance Suffolk BAP Species	2, 3, 4, and 6		Butterfly with larva on fine-leaved grasses in open swards	F1 / F112
Butterfly: Wall *Lasiommata megera* (Lepidoptera: Satyridae)	Species of Principal Importance Suffolk BAP Species	2		Butterfly with larva on fine-leaved grasses in open swards	F1 / F112
Moth: Ghost *Hepialis humuli* (Lepidoptera: Hepialidae)	Species of Principal Importance Suffolk BAP Species	6		Moth with soil-dwelling larva, feeding on grass roots	- / -
Moth: Buff Ermine *Spilosoma luteum* (Lepidoptera: Erebidae)	Species of Principal Importance Suffolk BAP Species		E	Moth with larva on various shrubs	- / -
Moth: Cinnabar *Tyria jacobaeae* (Lepidoptera: Erebidae)	Species of Principal Importance Suffolk BAP Species	2, 3, 4, and 6		Specific to ragwort *Jacobaea vulgaris*, in various grassland situations	- / -

Reptiles

3.113 The data search showed all of the four most common reptile species have been recorded within 2km of the proposed development site, with common lizard being previously recorded on Site (Environ UK, 2009). The four common reptile species (common lizard, grass snake *Natrix natrix*, slow worm *Anguis fragilis* and adder *Vipera berus*) are all local BAP species for Suffolk (SBIS, 2017).

3.114 Table 20 below highlights weather conditions for each survey visit as well as reptiles recorded; indicative locations of reptile refugia can be found in Appendix 8.

Table 20: Weather Conditions and Reptile Species Recorded.

Survey visit	Date	Prevailing weather	Temp °C	Species
1	23.08.16	5% Cloud Cover, Beaufort 1	17°C	No reptiles.
2	25.08.16	10% Cloud Cover, Beaufort 1	17°C	1 female common lizard.
3	30.08.16	15% Cloud Cover, Beaufort 0	16°C	No reptiles.
4	06.09.16	80% Cloud Cover, Beaufort 0	17°C	1 male common lizard.

Survey visit	Date	Prevailing weather	Temp °C	Species
5	19.09.16	70% Cloud Cover, Beaufort 1	16°C	1 adult common lizard.
6	26.09.16	80% Cloud Cover, Beaufort 0	15°C	3 male common lizards.
7	30.09.16	65% cloud cover, Beaufort 1	17°C	4 male and 1 juvenile common lizards.
Peak Count of Adults				4 Common Lizards

3.115 Common lizards were recorded in small numbers during the seven surveys, indicating a small population of common lizards on Site, consistent with the 2007/2008 reptile survey (Environ UK, 2009). Common lizards were recorded in the small grassland field south of the fishing lake as well as in the small grassland margin south of the arable field in the west of the Site (See Appendix 14). In addition, a single adult grass snake was observed within the broadleaved woodland in the north of the Site, during the Phase 1 Habitat Survey on the 14th April 2016. All other species are considered likely absent from Site.

Small and Medium-sized Mammals

Desk Study

3.116 Records of UK BAP/NERC Act priority species identified within 2km of the study area included European hedgehog, brown hare and harvest mouse, all of which are local BAP species for Suffolk:

- A high number of hedgehog records (107+) within the wider landscape the closest of which is 80m from Site;
- Four records of brown hare the closest at approximately 200m from Site;
- Five records of harvest mice, the closest at approximately 1km from Site.

Habitat Assessment

European Hedgehog

3.117 The scrubby areas on Site, are considered to provide suitable foraging habitat for the European hedgehog based on the guidance provided by Harris & Yalden (2008). Although no evidence or sightings of hedgehog was observed while on Site during the 2016 / 2017 surveys, a single hedgehog was observed during a bat survey in August 2008 (Environ UK, 2009).

Brown Hare

3.118 No evidence or sightings of brown hare were present throughout the phase 2 surveys which included dusk and dawn site visits. As such brown hare is not considered further within this report.

Harvest Mouse

3.119 Due to the sub-optimal quality of the habitats combined with the lack of nest evidence obtained during field surveys, it is considered unlikely that harvest mice are present within the Site. Hence this species is not considered further.

4.0 Evaluation

Valuing ecological features and resources

4.1 The CIEEM Guidelines (2016) recognise that ecological evaluation is a 'complex and subjective process' but provides key considerations to apply when 'applying professional judgment to assign values to ecological features and resources'.

4.2 In this chapter, all ecological resources or features are assigned to a value relating to their geographic frame of reference, using the following scale:

- International;
- National (England);
- Regional (East Anglia);
- County (Suffolk);
- District (Suffolk Coastal);
- Local (Woodbridge etc.); and
- Site (Land south and east of Adastral Park).

4.3 In order to identify the geographical scale at which a feature is important, the CIEEM guidance recommends that legal protection be considered separately from ecological importance, and suggest that it is better to use professional judgement when making such assessments. In terms of impact assessment, it is stated in the CIEEM guidance to consider all features which might be impacted upon significantly, again working within a geographical scale.

Statutory and Non-Statutory Designated Sites

European Protected Sites

4.4 The three European designated sites within 10km of the Site (Deben Estuary Special Protection Area (SPA) and Ramsar, Sandlings SPA and Stour and Orwell Estuaries SPA and Ramsar) are assessed as being of **International** importance.

UK Statutory Designated Sites

4.5 The ten biological SSSIs within 5km of the Site (Ipswich Heaths; Newbourn Springs; Deben Estuary; Sinks Valley, Kesgrave; Nacton Meadows; Riverside House Meadow, Hasketon; Sutton and Hollesley Heaths; Bixley Heath; Sandlings Forest; and Crag Pit, Sutton) are assessed as being of **National** importance.

4.6 The three LNRs within 5km of the Site (Mill Stream; Sandlings; and Bixley Heath) are assessed as being of **County** importance.

Non-statutory Designated Sites

4.7 There are fourteen non-statutory designated sites within 2km of the Site's boundary. The closest of which is adjacent the Site's north-west corner. There are a number of site's designated for their acid grassland or woodland habitats. Many of which have birds and / or plants as one of their notable

features. The CWS are in general high quality examples of habitats in the local landscape and are assessed as being of **County** importance.

Habitats

Woodland

4.8 The broad-leaved woodland in the north of the Site can be classified as Lowland Mixed Deciduous Woodland, valuable to protected species as well as being a valuable habitat in its own right. Lowland Mixed Deciduous Woodland is categorised as a habitat of principal importance under Section 41 of the NERC Act (2006) and is a UK BAP Priority Habitat. Given the young age, lack of structural / species diversity and extent of the habitat type. The broadleaved woodland is assessed as being of **Local/District** importance.

4.9 The plantation woodlands along the southern boundary of the Site are not classed as a UK BAP habitat but are considered a habitat of **Local** importance.

Semi-Improved Grasslands

4.10 It is likely that quarry works have influenced the variation in grassland areas within the Site and this is indicated by the differences between the species recorded on Site and Ellenberg values. For example, species such as common fleabane *Pulicaria dysenterica* and annual beard-grass indicate damp or wet ground, in direct contrast to biting stonecrop *Sedum acre* and hare's foot clover *Trifolium arvense* which indicate dry / sandy sites, in line with the Ellenberg values for the Site as a whole, which indicate a slightly drier site. Or heather *Calluna vulgaris* which is an acidic grassland indicator, as opposed to the Ellenberg values which indicate slightly calcareous soils.

4.11 The grasslands on Site hold a number of rare and notable plant species, although some of which (smooth cat's-ear and dittander) have a stronghold in Suffolk and are thus not considered rare for the locality. The remaining five notable plants (common cudweed, field pepperwort, corn mint, annual beard-grass and hound's tongue) are all important on a National scale, however these species are only present in low numbers in areas 1, 3 and 4 (see Appendix 9). The grasslands on Site are variable and transient in nature given the high levels of disturbance from the working quarry. These grassland habitats are considered important at a **District** level.

4.12 The small ephemeral / short perennial field (included in Area 4) in the south-east of the Site may be considered a BAP habitat 'Open Mosaic Habitat on Previously Developed Land'. This area is considered a poor representation of this habitat type due to the presence of several non-native species. This field is considered to be of **District** importance.

Ponds and Open Standing Water

4.13 The quarry ponds on the Application Site have virtually no ecological value due to the high magnitude of disturbance present here, as well as the lack of natural features and heavy siltation and are considered of no ecological importance. They also do not qualify as a BAP / NERC Act habitat of principle importance 'Ponds'.

4.14 The fishing lake on the Application Site is a BAP / NERC Act habitat of principle importance 'Ponds' and has more ecological value due to the presence of natural habitats around the margins of the lake, as well as vegetation within the lake. Nonetheless the fishing lake on Site is not considered a high-quality example of this habitat type, largely due to the presence of abundant fish and human disturbance. The lake is considered to be of **Local/Site** importance.

Other Habitats

4.15 The fourteen other habitat types found within the Application Site boundaries are shown on the Phase 1 Habitat Map and full descriptions of each can be found in chapter 3 – results.

4.16 All the other habitats on site (dense scrub, scattered scrub, scattered trees, bracken, arable, amenity grassland, bare ground, buildings, caravan park, quarry, spoil heap, earth banks and dry ditch) are considered important on a **Local/Site** scale.

Plants

4.17 Species identified within the Application Site as protected, rare, or otherwise notable species include: Common Cudweed, Smooth Cat's Ear, Field Pepperwort, Corn Mint, Dittander, Hound's Tongue and Annual Beard-grass. Smooth Cat's-ear and Dittander both have a stronghold in Suffolk and are thus not considered rare for the locality. The notable plants and plant composition on the Application Site (see Appendix 9) are considered to be of **Local / District** importance.

Bats

4.18 The Site had an assemblage of at least ten species, it is possible that other *Myotis* species also occur. Nathusius' pipistrelle *Pipistrellus nathusii* was recorded seven times, and this is a species which is considered rare in the UK. Noctule was relatively common on Site and the habitats on the Site were considered to be ideal for this species. Barbastelle bats (a nationally rare species and Suffolk BAP species) were recorded on Site eleven times, as well as a possible barbastelle roost being located just off-site along Ipswich Road in T41 which also contains a likely day roost for approximately six common pipistrelle bats. A common and soprano pipistrelle day roost and transitional roosting site was located in Building E on the long-range test site. And another potential pipistrelle day roost was present within one of the industrial buildings in the north-west corner of Site (Building 6). Feeding perches were also found within two of the buildings within the quarry (Buildings H and I).

Foraging and Commuting

4.19 The broadleaved woodland, southern and eastern boundaries and the central lake area displayed relatively high foraging and commuting activity and species diversity. These habitats can be considered to be of up to **County** importance for the foraging and commuting bat assemblage utilizing these areas.

4.20 The remaining habitats, such as the quarry, arable field are considered to be of **Site** importance only.

Roosting

4.21 The pipistrelle day roosts / transitional roosts on Site/adjacent Site (Building E on the long-range test site, Building 6 in the northern quadrant of the BT industrial area, Tree 41 and feeding perches within the quarry buildings) are considered to be of **Local / District** importance.

4.22 The potential barbastelle roost (Tree 41) is considered to be of **County** importance.

Amphibians

4.23 Previous surveys (Environ UK, 2008) and recent surveys (by SES in 2016) found Great Crested Newts are considered likely absent from the Application Site.

4.24 A small population of common toads (peak count of 2) were observed whilst undertaking the reptile surveys, near to the broad-leaved woodland in the north of the Application Site and along the eastern boundary. It is likely the toads have dispersed from Kyson Meadows, Sluice Wood & Martlesham Creek Reed CWS 1.3km north of Site, where a large population is known, to find hibernating habitat.

4.25 Although the 2008 surveys found common toads within two of the ponds on Site and one within Adastral Park business complex (Environ UK, 2009), it is considered unlikely they are still using the ponds on Site due to their diminished wildlife value since 2008. The Site is assessed as being of **Site** importance for common toads for hibernating only.

Otter and Water Vole

4.26 It is considered that water voles are likely absent from the Application Site and that Otters are only using the fishing lake, which provides a limited, occasional foraging opportunity. As such the fishing lake is considered to be of **Site** importance for otters.

Birds

Breeding birds

4.27 The breeding bird community was not rich in species given the size of the site (113.3ha) with between 25-49 breeding species. Fuller (1980) does not provide for an assessment of District or Parish level, only for Local value between 49-25, or County between 69-50. Therefore, it is assumed that an assemblage comprising between 49-25 equates to District importance, and fewer than 25 species is of Site/Local value as defined by IEEM (2006). The breeding bird community is hence regarded as being of **District** importance based on the criteria of Fuller (1980).

4.28 The bird community richness is a function of the size of the site and also the diversity, type and quality of habitats. The open habitats did not support breeding waders such as lapwing *Vanellus vanellus* or little ringed plover and were of no significant value. The open water habitats were equally species-poor. The only habitats that supported significant species were the scrub habitats that supported linnet, nightingale and cuckoo as well as the open grasslands that supported breeding skylark and foraging linnet. We can therefore divide and categorise the breeding bird diversity of the different habitats/sections of the Site to help inform spatially explicit impact assessments. The scrub

habitats with breeding shelduck and nightingale are assessed as being of **District** importance, whilst the remainder of the Site is of **Local** importance.

4.29 When evaluating the notable species recorded separately, we have compared the size of breeding populations on the Site with recent County estimates. Mason (2011) states that singing nightingales were recorded from 40 sites in Suffolk in 2011, with peak sites supporting between 3 and 27 pairs. The 1999 national nightingale survey recorded 878 singing males in Suffolk (Wilson et al. 2002). Whilst national breeding population trends have declined since then (Balmer et al. 2013), this has been particularly outside its core range of Kent, Suffolk and Sussex. From this we estimate a County total of approximately 500 territories. The four territories recorded on the Site therefore comprise under 1% of the County population, but constitute a population of **District** importance.

4.30 Mason (2011) describes cuckoo as a declining summer visitor in Suffolk. However, in 2010 cuckoos were recorded from 27% of 51 breeding bird survey squares in the County, demonstrating that they remain widespread, but other reports indicate that they occur in low density. In this context, a single record from this site is evaluated as being of high **Local** importance.

4.31 Mason (2011) describes shelduck as a locally common resident, and lists five Suffolk sites supporting over three pairs during the breeding season, including at least 55 pairs at three key sites. It is likely there are many sites with small numbers of breeding shelduck which are overlooked. In this context, it is unlikely that three pairs can be considered to be of County value, but are considered to be of **Local** importance.

4.32 Mason (2011) states that skylark is a common resident in Suffolk, and high counts from 2010 include 40 at Great Waldringfield Airfield and similar populations at a number of other sites. The species is known to be distributed across almost the whole County (Balmer et al. 2013) away from urban areas, where there is suitable arable farmland and other nesting habitat. In this context, the five territories on this Site are of **Local** importance only.

Table 21: Site value based on breeding bird community size (adapted from Fuller 1980).

Number of breeding bird species	Site Value
<25	Local
25-49	District
50-69	County
70-84	Regional
>85	National

Wintering Birds

4.33 An assemblage of 39 bird species were recorded using the Site during the wintering surveys, including automated camera surveys. All these species are common and widespread both locally and nationally, despite there being a relatively large number of red and amber-listed species and UK and Suffolk BAP species present. Given this, the wintering bird assemblage on the Application Site is considered to be of **Local** importance.

4.34 In addition, notable species on Site are assessed as **Local** importance, and include:

- Skylark;
- Fieldfare;
- Meadow pipit

- Linnet;
- Song thrush;
- Dunnock;
- Teal; and
- Woodcock.

Badgers

4.35 The potential badger setts recorded on Site had a low number of entrances and generally a moderate level of activity (small spoil heaps, few well-worn paths leading to entrances etc.) by a low number of individuals, which indicated that there was no main sett within the Site and that these were more likely to be subsidiary and outlier setts, consistent with the 2007 badger survey (Environ UK, 2009). At present, there is one likely subsidiary sett present [redacted] (Sett C), two likely outliers in current use [redacted] (Setts A and B) and a third outlier [redacted] (Sett E). All other entrances on Site are considered likely outliers but did not show signs of current use. The Site has abundant sett building habitat, however it is considered any sett habitat on Site is generally transient due to the high levels of disturbance on site and regular landscape changes from the quarry works.

4.36 In addition, the Site is utilized by low numbers of badgers foraging and dispersing within discrete areas of the Site, consistent with the 2007 badger survey (Environ UK, 2009), to include the disused areas of quarry, arable field margins and eastern / southern boundaries. The frequency of latrines along the eastern boundary likely represents the single badger groups territory boundary in this area.

4.37 It is considered that the outlier / subsidiary setts on Site are utilized by a minimum of two and maximum of four badgers with no breeding setts on Site. The field signs on Site indicate use by a single badger social group, who are currently utilising the likely subsidiary sett near [redacted] (Sett C) and the outlier setts by [redacted] (Setts A and B) and [redacted] (Sett E). The main sett is likely to be present [redacted]. The Site is therefore evaluated as being of **Site** importance for its Badger population.

Invertebrate Survey

4.38 In preparing an assessment of the Site the key factors considered are:

- Site size and extent of habitat. The Site itself is large, but with substantial parts of the Site comprising parcels of bare substrate either recently dug over and physically graded or being actively worked and of negligible value to invertebrates.
- Quality of habitat features as judged visually. The various habitat areas include features of substantial value to invertebrates, such as sparsely vegetated grass and herb-rich swards. However, compared to some examples of former aggregate works the individual parcels are relatively uniform and with little physical or vegetation variety, largely lacking spoil mounds, steep slopes or small-scale variation in vegetation characteristics.
- The overall invertebrate assemblage includes a suite of specialist species associated with open grassland habitats, as identified by the 'open short sward' and 'bare sand and chalk' Specific Assemblage Types.
- Numbers of rare and scarce species. The Site supports a moderately rich assemblage of rare and scarce species associated with open grassland habitats, and additional recording would

probably record additional species: four Red Data Book species and five Nationally Scarce species. However, at least one of the four Red Data Book species is more widespread than at the time of its conservation review (*Philanthus triangulum*; BWARS, 1997a) and two species are also widespread in south-east England although of restricted occurrence within that range (*Cerceris quinquefasciata* and *Nomada fulvicornis;* BWARS, 1997b, 2012); the fourth Red Data Book species is widespread in south-east England but strongly associated with the main heathland regions including Suffolk Sandlings and Breck heaths (*Eutolmus rufibarbis*; Stubbs and Drake, 2001). The wasp *Cerceris quinquefasciata* is the only Species of Principal Importance recorded that is rare or scarce, the others are widespread moths and butterflies afforded the status due to recent population declines while remaining widespread (Butterfly Conservation, 2007).

4.39 Against the Colin Plant criteria (2006) the presence of (likely) viable populations of Red Data Book species would probably justify an evaluation of national; however, as considered above, these species are of moderately widespread occurrence in south-east England and East Anglia and likely to co-occur with other Red Data Book species on 'several' other sites nationally. The numbers of Nationally Scarce species falls below the threshold of ten for a site of Regional importance. When considered more subjectively against semi-natural heathland sites nationally the Site is not considered to be of similar quality to those recognised as being of national importance, as in Breckland and the south of England (such as Surrey and Dorset); likewise, there are substantially fewer rare and scarce species when compared to nationally important former aggregate and brownfield sites. At the East Anglian regional scale the Site is likewise not of as high a quality as heathland sites with likely similar assemblages, such as sites in the Norfolk and Suffolk Breckland heaths, heathlands of North Norfolk and Suffolk Sandlings, or several brownfield sites in the Thames Gateway.

4.40 On balance, therefore, based on the relatively widespread occurrence of the Red Data Book species recorded, the relatively low numbers of Nationally Scarce species and the lower quality of the Site compared to other sites in East Anglia, the discrete patches of open grassland areas and peripheral scrub areas of Site are assessed as being of **County** importance.

Reptiles

4.41 The seven-visit presence and likely absence survey during suitable weather conditions uncovered low numbers of common lizards on Site, consistent with the 2007/2008 reptile survey (Environ UK, 2009). A small population of grass snakes is also present on Site, observed during the Phase 1 Habitat Survey. Other reptile species are considered likely absent from the proposed development.

4.42 The Site is assessed as being of **Local** importance for common reptile species.

Small and Medium-sized Mammals

4.43 There were no records of small or medium-sized mammals on the Site and no field signs observed. The habitats were assessed as having potential to support European hedgehog, consistent with previous surveys (Environ UK, 2009). European hedgehog as a feature within the Site is assessed as being of **Site** importance.

Summary of Evaluation Features

Table 22: Summary Evaluation of Site Features

No.	Feature	Summary Description	Value
1	SPA/Ramsar	Deben Estuary SPA and Ramsar Sandlings SPA Stour and Orwell Estuaries SPA and Ramsar	International
2	SSSI/LNR	A total of 11 biological SSSI's (Ipswich Heaths; Newbourn Springs; Deben Estuary; Sinks Valley, Kesgrave; Nacton Meadows; Riverside House Meadow, Hasketon; Sutton and Hollesley Heaths; Bixley Heath; Sandlings Forest; and Crag Pit, Sutton) A total of 3 LNRs (Mill Stream, Sandlings and Bixley Heath)	National County
3	CWS	A total of fourteen CWS (Martlesham Soakaway Acid Grassland; Martlesham Heath Wood; Old Rotary Camping Ground; Brightwell Grazing Meadows; The Mill River; Martlesham Common; Valley Farm Meadow; Martlesham Plantation Acid Grassland; Lumber Wood; Kyson Meadows, Sluice Wood and Martlesham Creek Reed; Bloomfields Farm Meadow; Osier Bed and Martlesham Plantation; Kesgrave Woods/Sinks Valley; and Newbourne Springs Meadows)	County
4	UK BAP Priority Habitats	Broadleaved woodland Open Mosaic Habitat on Previously Developed Land Open Water (Fishing Lake)	Local / District District Site / Local
5	Other habitats	Semi-improved grassland Plantation woodland (mixed and coniferous), Scrub, Open Water (Quarry ponds), Other	District Site / Local
6	Rare and Notable Plants	Seven species of rare and / or notable plants	Local / District
7	Bats - Roosting	Possible barbastelle roost (Tree 41) Three roosting sites for pipistrelles (including potential past/future hibernation roosts / current transitional roost) and two buildings with feeding perches	County Local / District
	Bats - Foraging	The bat assemblage utilising the broadleaved woodland, southern and eastern boundaries and central lake area The bat assemblage utilising the remaining habitats e.g. quarry and arable fields	County Site
8	Amphibians	Terrestrial habitat along northern/eastern boundary for common toad	Site
9	Otter	Limited foraging at fishing lake	Site
10	Birds	Breeding shelduck, nightingale and linnet (scrub habitats) Other breeding species (including skylark, linnet and cuckoo) Wintering assemblage (including eight notable species)	District Local Local
11	Badger	Foraging and commuting habitats present, as well as subsidiary/outlier setts on site and sett building habitat for one social group.	Site
12	Invertebrates	Four widespread Species of Principal Importance; one Species of Principal Importance with Red Data Book status; three additional Red Data Book species; and five Nationally Scarce species using discrete patches of open grassland and scrub habitats	County
13	Reptiles	Common reptile species (Common lizard and Grass snake) present in low numbers	Local

No.	Feature	Summary Description	Value
14	Small and Medium-sized Mammals	Suitable habitats for European hedgehog	Site

5.0 Impacts without Mitigation

Characterising and quantifying effects and assessing their significance

5.1 The CIEEM Guidelines (CIEEM, 2016) state that ecological effects should be characterised in terms of ecosystem structure and function and reference should be made to: positive or negative effects; extent; magnitude; duration; reversibility; timing and frequency; and cumulative effects where appropriate. The guidelines provide a list of 'key aspects of ecosystems to consider when predicting effects'. Whilst a full Ecological Impact Assessment (EcIA) will be undertaken for this proposal, for clarity this report also quantifies the effects in a comparable way.

5.2 Following the characterisation of effects, an assessment of the ecological significance of an effect is made. The CIEEM Guidelines promote an approach in which a positive or negative effect is determined to be significant or not, in ecological terms. This is in relation to the integrity of the defined site or ecosystem(s) and/or the conservation status of habitats or species within a given geographical area. This in turn relates to the level at which it has been valued. The decision about whether an effect is significant or not, is independent of the value of the ecological feature; the importance of any feature that would be significantly affected is then used to determine the implications, in terms of legislation, policy and/or development control (CIEEM, 2016).

5.3 The Guidelines also state that: 'Significant effects on features of ecological importance should be mitigated (or compensated for) in accordance with guidance derived from policies applied at the scale relevant to the value of the feature or resource' and that: 'Any significant effects remaining after mitigation (the residual effects), together with an assessment of the likelihood of success in the mitigation, are the factors to be considered against legislation, policy and development control in determining the application' (CIEEM, 2016).

5.4 Impacts have been assessed using the Mitigation Hierarchy, which forms the Key Principles of EcIA:

- Avoidance – seeking options to avoid harm to ecological features
- Mitigation – seeking options to avoid or minimise adverse effects
- Compensation – offsetting adverse effects through appropriate compensatory measures
- Enhancements – Seek to provide net benefits for biodiversity

5.5 Avoidance was undertaken during the design stage, to avoid areas of relatively high ecological value, as informed by the phase 1 and phase 2 assessments set out in this report. As such, the impacts have been assessed based on the Illustrative Framework Masterplan (Reference no. 08, Revision G).

Development Footprint

5.6 The Proposed Development would comprise up to 2000 residential dwellings with community facilities, associated highways, landscaping, open space and SANG. The developable area within the

Site, including formal greenspace, covers approximately 88.2ha of the site, with a residual 25.1ha for use as biodiversity areas and/or informal green space provision (see Appendix 1).

European Designated Sites

5.7 The sHRA (Baker Consultants Ltd, 2017) has assessed the potential impacts of the Proposed Development upon European sites located within 10km of the Proposed Development. The Proposed Development does not give rise to any direct loss of land within any of European sites and therefore the assessment concentrated on the likelihood of any indirect effects.

5.8 The sHRA considered that the only impact pathway that could result in likely significant effects (before taking into account any mitigation) was the potential for increased recreation pressure resulting in disturbance to citation bird species, likely to result in a **moderate negative impact without** mitigation.

UK Statutory Designated Sites

5.9 Without mitigation, there is risk of a **minor negative impact** on nearby SSSIs and LNRs from disturbance during the construction phase, i.e. to breeding and migratory birds in Newbourn Springs SSSI and Sandlings LNR. This is a significant impact at the National and County level (respectively) in accordance with CIEEM guidelines (CIEEM, 2016). Confidence in this assessment is high based on a comprehensive review of impacts.

Non-Statutory Designated Sites

5.10 Construction impacts to the adjacent Martlesham Soakaway Acid Grassland CWS includes physical (e.g. trampling) and chemical (e.g. spills) damage from construction workers / traffic without mitigation as the area is not currently fenced off. Furthermore, this CWS holds a population of common lizards which are considered further in the reptile section. In addition, impacts on all sites could include pollution (dust and chemical) and increased recreational pressure. Overall the impacts are assessed as having a **moderate negative** impact at the County level.

5.11 There are no predicted impacts on any of the remaining thirteen CWSs due to the distance from Site (>180m from Site). Thus impacts are assessed as **negligible**.

Habitats

5.12 Construction impacts will lead to the loss of a range of habitats and the losses are estimated in Table 23 below. Impacts are assessed as minor when the percentage loss is between 10% and 20%, moderate when between 21% and 60% and major when 61% or greater for those habitats that provide nature conservation interest:

Table 23: Approximate habitat losses from development footprint

Habitat	Habitat Area (ha)*	Area under Development Footprint (ha)*	%	Significance of negative impact
BAP Habitats				
Semi-natural Broadleaved Woodland	4.01	0	0	None
Open Mosaic Habitat on	1.63	1.63	100	Major / District

Habitat	Habitat Area (ha)*	Area under Development Footprint (ha)*	%	Significance of negative impact
BAP Habitats				
Previously Developed Land				
Open standing water (to include Fishing Lake only)	1.8	0	0	None
Other Habitats				
Dense Scrub	4.66	3	64	Major / Site
Scattered Trees	0.65	0.15	23	Moderate / Site
Mixed Plantation Woodland	0.7	0	0	None
Coniferous Plantation Woodland	0.67	0	0	None
Quarry Ponds	1.8	1.8	100	Major / Site
Semi-improved Neutral Grassland	28.05	23.21	83	Major / District
Buildings	0.4	0.4	100	Major / Site
Short perennial / ephemeral	6.15	6.15	100	Major / Site
Arable	18.2	18.2	100	Major / Site

* Measurements from satellite images and mapping software have been used to provide the above estimates.

5.13 The impacts considered significant are the loss of 1.63ha of Open Habitat Mosaic on Previously Developed Land and 23.21ha of semi-improved neutral grassland. The loss of these two habitats on Site without mitigation is considered to be **major negative**.

5.14 Although the majority of the other habitat losses on Site are total, these losses are not considered significant due to their ubiquity in the surrounding landscape, loss of small amounts and / or lack of quality of the habitat on Site.

5.15 Retained habitats (woodlands and fishing lake) on Site also have the potential to be negatively impacted by the proposed development during the construction phase, for example through dust and pollution events, and the operational phase through lighting/increased human activity. These impacts are considered **moderate negative**.

Rare and Notable Plants

5.16 The following species are considered and confidence in all the assessments is high:

- Smooth cat's-ear and dittander areas will likely be lost as part of the proposed development – these species are mostly lost under the development footprint although some remain in open space and thus may not be altogether lost. This impact is assessed as a **minor negative** impact at the Local level.
- Common cudweed, field pepperwort, corn mint, annual beard-grass and hound's tongue areas will likely be lost as part of the proposed development – these species are mostly lost

under the development footprint although some remain in open space and thus may not be altogether lost. This impact is assessed as a **minor negative** impact at the District level.

5.17 Retained, translocated and re-established plants could be damaged through trampling and picking during the operational phase. Assessed as **minor negative** at the Local / District level.

Invasive Species

5.18 The Japanese knotweed present on Site is likely to be spread to other areas and potentially into ecologically valuable habitats, without mitigation. This would constitute an offence under the Wildlife and Countryside Act, 1981, as amended.

Bats

5.19 There is potential for the possible barbastelle day roost to be impacted upon through increased lighting during the construction phase (due to remain unlit during the operational stage). The timing of the temporary disturbance would have varying effects on this species, with hibernation and breeding times considered to have a **major negative** effect and **minor negative** effect outside of these times. Without mitigation and a Natural England European Protected Species (EPS) License the temporary loss of this roost may constitute an offence under the Conservation of Habitats and Species Regulations 2010 or the Wildlife and Countryside Act 1981. As such, an up to **major negative** impact on the potential roosting barbastelle is considered likely at the County level without suitable mitigation depending on the time of year of disturbance.

5.20 There are three pipistrelle bat day roosts on Site, one within the building on the long-range test site (Building E) which is also a transitional roost and could also provide future hibernating habitat, one within the tree to the to the south of the Site (Tree 41), along Ipswich Road and another within the building in the north quadrant of the Site (Building 6). In addition, there are two feeding perches within the quarry buildings (Buildings H and I). All except for the tree (Tree 41) are due to be lost through demolition of the buildings. The loss of the 3 day roosts on Site is considered to have a **moderate negative** impact at a Local / District scale, as the roosts hold low numbers of a relatively common bat species.

5.21 The loss of the two feeding perches will cause a **minor negative** effect on a Site scale due to the common and widespread species likely to be utilising these (Brown Long-eared) and the ubiquity in the surrounding landscape.

5.22 Destruction of these roosts without mitigation and a Natural England European Protected Species License (EPSL) would potentially kill / injure a bat during the demolition process and constitute an offence under the Conservation of Habitats and Species Regulations (2010) causing a **major negative** impact at a Local / District scale.

5.23 There is potential for bats to be utilizing Tree 41 and / or the building within the long-range test site (Building E) for hibernating. The loss of these potential hibernating roosts would be considered a **moderate negative** effect on hibernating bats at a Local / District level if the species found are common e.g. pipistrelles and County if the species sound are rare e.g. barbastelle due to the rarity of hibernating sites.

5.24 A foraging/commuting link between the woodland to the north of the Site, and that to the south is present on the proposed development site via the southern site boundary, the eastern boundary and also through the middle of the site, via the fishing lake and grasslands. The proposed development will alter this corridor through lessening the amount of habitat available and could potentially light up a currently dark corridor reducing suitability for the rarer species using it (Stone, 2013). The proposals will not however, altogether sever this foraging/commuting link (see current Illustrative Framework Masterplan, Reference no. 08, Revision G). As such, potential foraging habitat loss and fragmentation of commuting links (through reduction of habitat and increased lighting) is considered to convey a **moderate negative** effect at a County level of importance without mitigation.

5.25 Loss of the remaining habitats (arable fields, quarry, quarry ponds etc.) would result in a **minor negative** impact on the foraging and commuting assemblage at the Site level.

5.26 It is considered that lighting within the development will affect bats during the construction and operational phases, assessed as **major negative** at the County level.

Otter

5.27 The proposed development will retain the otter foraging resource but access here is likely to be restricted due to the loss of the quarry ponds which may have aided dispersal, and the large blocks of housing which will fragment the landscape. It is likely that otter will cease using the fishing lake once construction around the fishing lake and grass and scrub field to the south has started and during the operational phase. The loss of this potential feeding resource is considered **minor negative** at a Site level.

Amphibians

5.28 The proposed development will not impact on any breeding habitat for common toads. Without mitigation there is potential for any vegetation clearance along the north/east boundary of the site or within the woodland may result in killing/injury of hibernating common toads, assessed as a **moderate negative** impact at the Site level.

Birds

Breeding Birds

5.29 The proposed development footprint is currently within and adjacent to the breeding territories of several red-list/BAP and amber-listed species (e.g. nightingale, shelduck and linnet), and the loss of the scrub habitats without mitigation is considered to be **minor negative** at the District level, and significant for those species through disturbance and habitat loss. Other losses especially on extensive grasslands with skylark are also assessed as **minor negative** at the Local level. Other losses are assessed as Negligible.

Wintering Birds

5.30 The Proposed Development is currently within and adjacent to habitat for a number of wintering birds including the red and amber-listed and BAP species (skylark, linnet, meadow pipit, dunnock, fieldfare and song thrush), particularly across the grassland and arable farmland habitats and

associated scrub and ruderal vegetation. The loss of habitat and associated disturbance for these species (grassland and arable) without mitigation is considered to potentially result in a **minor negative** impact on these wintering species in the Local context.

5.31 As the wintering bird assemblage is considered to be of value in a Local context only, and as some of the key areas such as the main waterbody, the scrub/grassland northwest of this, and woodland are being retained, the impact on birds using the woodland, waterbodies and grassland is considered to be **negligible**.

5.32 Disturbance impacts during the operational phase of development to notable wintering bird species are considered to potentially result in a **minor negative** impact over the long term for notable species mentioned above at the Local level.

Badgers

5.33 The three outlier setts in current use (Setts A, B and E) will be damaged or destroyed by the development. The current subsidiary sett [redacted] will be retained within the retained habitat [redacted] (Sett C). The majority of the disused holes will also be lost to development. This represents a **moderate negative** impact at the Site level.

5.34 In addition, there would be a loss of approximately 25% of foraging / sett building / dispersal habitat for example the [redacted]. This represents a **minor negative** impact at the Site level.

5.35 During construction and operational phases, there is a risk of killing or injuring badgers through earthworks and road traffic accidents. This represents a **major negative** impact at the Site level.

5.36 There is also potential for the development on Site to fragment the landscape for badgers (including connectivity from the main sett potentially [redacted]), in particular from lighting and road traffic. This represents a **major negative** impact at the Site level.

5.37 Impacts are overall assessed as being **major negative** at the Site level.

Invertebrates

5.38 The sparsely vegetated areas of open grassland support the main invertebrate interest on the Site, in terms of the overall numbers of species, most specialists and species of conservation concern. The impacts of the scheme will be detrimental to invertebrates, from both direct losses of habitat within development footprints and also from the cessation of the periodic disturbance associated with aggregate operations, resulting in ranker grass swards and scrub and loss of open sward grassland. The combined effects are assessed as **major negative** at the **County** level. This is therefore considered significant.

Reptiles

5.39 A small population of common lizards were recorded on Site along with a small population of grass snakes. In addition, the neighbouring Martlesham Soakaway Acid Grassland CWS also contains a population of common lizards. All other species of reptiles are considered to be absent from Site.

The reptiles are mostly located within the mixed grass and scrub field, south of the fishing lake. The field will be partially lost to development through levelling, despite the area being retained as open space. In addition, reptiles are located within the grassland field margin in the west of the Site (near to the Martlesham Soakaway Acid Grassland CWS) and the broad-leaved woodland in the north of the Site. This habitat loss will likely result in a **moderate negative** effect at the Local level. During the construction phase there is a risk of killing and / or injuring reptile species which would constitute an offence under the WCA (1981) as amended.

5.40 In addition, operational impacts may include increased mortality and disturbance from residents and their pets. Habitats if not managed may also decline in their suitability through scrub encroachment and woodland regeneration. The retained / created habitats may also become isolated from other suitable habitats by roads and unsuitable habitats. Impacts of disturbance, isolation and decline in habitat suitability over time are assessed as **moderate negative** at a Local level.

Small and Medium-sized Mammals

5.41 The loss of habitats suitable for European hedgehog from construction impacts are assessed as **moderate negative** effects at a Site level of importance. There is also a risk of killing / injury of hedgehogs during vegetation clearance, impacts are assessed as **major negative** at a Site level of importance.

5.42 Operational impacts for hedgehogs are considered **major negative** at a Site level of importance through increased predation by dogs, increases in road traffic accidents and recreational disturbance. Although gardens will provide ideal foraging habitats for hedgehog, if access is restricted hedgehogs are likely to become isolated through fragmentation.

Summary

Table 24: Summary of Impacts without Mitigation Arising from the Development of the Site.

No.	Receptor	Predicted Impact	Level/Predicted Adverse Effect	Confidence in Prediction
1	European Sites	Increased recreation pressure	International / Moderate negative	High
2	SSSI / LNR	Disturbance to citation birds during construction	Up to National / Minor negative	High
3	CWS	Adjacent Martlesham Heath Acid Grassland CWS could be impacted through pollution, physical / chemical damage and increased recreational pressure	County / Moderate negative	High
4	UK BAP Priority Habitats	Loss of 1.63ha of Open Mosaic Habitat on Previously Developed Land Pollution (dust, chemical etc), increased lighting/activity on retained habitats	District / Major negative Up to District / Moderate negative	High
5	Other habitats	Loss of 23.21ha of semi-improved neutral grassland Loss of other habitat Pollution (dust, chemical etc) on retained habitats and increased lighting/activity on retained habitats	District / Major negative Site / Major negative Up to Local / Moderate Negative	High

No.	Receptor	Predicted Impact	Level/Predicted Adverse Effect	Confidence in Prediction
6a	Rare and Notable Plants	Loss or damage (i.e. through trampling/picking) of Smooth Cat's-Ear and Dittander	Local / Minor negative	High
6b	Rare and Notable Plants	Loss or damage (i.e. through trampling/picking) of Common Cudweed, Field Pepperwort, Corn Mint, Annual Beard-Grass and Hound's Tongue	District / Minor negative	High
7a	Bats - Roosting	Temporary loss of Possible barbastelle roost Loss of three roosting sites for pipistrelles (including potential future hibernation roosts) and two buildings with feeding perches Construction and operational disturbance (i.e. light) Killing / injury during demolition)	County / Major negative Up to District / Moderate negative Up to County / Major negative	High
7b	Bats – Foraging / Commuting	Loss / disturbance (including light pollution) to the bat assemblage utilising the broadleaved woodland, southern and eastern boundaries and central lake area Loss / disturbance to the bat assemblage utilising the remaining habitats e.g. quarry and arable fields Permanent disturbance during operational stage	Up to County / Moderate negative Site / Minor negative Local / District / County Major negative	High
8	Otter	Fragmentation to potential feeding resource	Site / Minor negative	High
9	Amphibians	Killing / injury hibernating common toads during vegetation clearance	Site / Moderate negative	High
10	Birds	Breeding nightingale and linnet (scrub habitats) Other breeding species (skylark, cuckoo and linnet) Wintering assemblage (Skylark, linnet, dunnock, meadow pipit, fieldfare and song thrush)	District / Minor negative Local / Minor negative Local / Minor negative	High
11	Badger	Loss of and disturbance to outlier setts and sett building habitat. Loss and/or fragmentation of foraging and commuting habitat for one social group including increases in road traffic accidents.	Site / Major negative	High
12	Invertebrates	Loss of sparsely vegetated open grassland to development footprints and cessation of disturbance resulting in succession to ranker grass sward and scrub	County / Major negative	High
13	Reptiles	Loss of foraging, dispersal and shelter habitat. Risk of killing / injury through construction phase Disturbance from new residents / pets	Local / Moderate negative	High
14	Small and Medium-Sized Mammals	Construction and operational impacts on European hedgehogs including killing / injury, fragmentation and habitat loss	Local / Up to Major negative	High

6.0 Mitigation, Enhancement and Residual Impacts

6.1 Mitigation for biodiversity loss will be primarily provided through a network of 25.1ha of SANGS (approximately 22% of the Application Site) that will be created, retained and/or enhanced around the Site (see Table 25 below), to include heathland creation, wildflower meadow creation, areas of sparsely vegetated ground, enhanced management of the scrub and woodland habitats for wildlife and marginal planting around the retained fishing lake to enhance the lake for wildlife. See Appendix 15 for mitigation plan. The SANGS and associated habitats will be created in step with development impacts to ensure impacts are appropriately mitigated as they arise.

European Statutory Designated Sites

6.2 SPAs and SACs are afforded protection under European law, as such, all direct/indirect effects should be sufficiently considered in accordance with regulation 61 of the Conservation of Habitats and Species Regulations (2010).

6.3 The sHRA addresses the potential impacts on European Designated Sites within 10km of the Site (Baker Consultants, 2017). 25.1ha of SANG will be provided on the Site and proposed financial contribution to fund off-site mitigation measures through the emerging Recreation Access Mitigation Strategy (RAMS) will provide sufficient mitigation for any potential increases in recreational pressure.

6.4 The SANGS will include the creation of new habitats around the retained central fishing lake and will include the creation of heathland, woodlands and grasslands. The SANGS is designed to be high quality greenspace that will attract people who wish to walk in the countryside. The SANGS will include areas for dogs to be let off the lead and circular walks of various lengths suitable for dog walking. The central lake area will be remodelled to provide an attractive location for more intensive use (picnicking, access to the water's edge, informal play areas) that is close to the local centre.

6.5 In addition, it is also proposed that off-site mitigation of potential recreational impacts will be funded through the emerging RAMS which will ensure that any residual recreational impacts from people traveling to the surrounding European sites will be effectively mitigated. The residual effect will therefore be **neutral** and **no likely significant effects alone or in combination** with other projects is predicted.

UK Statutory Designated Sites (SSSI / LNR)

6.6 SSSIs and LNRs are afforded protection under the Wildlife and Countryside Act 1981 and the National Parks and Access to the Countryside Act 1949, Section 21 (respectively). As such, all direct/indirect effects of the proposals should be sufficiently considered.

6.7 A minor negative disturbance impact is predicted on Newbourn Springs SSSI and Sandlings LNR for the breeding and migratory birds utilising scrub habitats, most notably nightingale. Creation and enhancement of retained habitats on Site, in step with development, will provide habitats of higher quality for nightingales and thus mitigate any effects. The residual effect will therefore be **neutral.**

6.8 It is considered there will be no disturbance or recreational impacts on other the surrounding SSSIs and LNRs during either the construction or operational phases due to the distance of the sites from the proposals, and access arrangements at the sites concerned, therefore no mitigation has been offered and these effects are considered neutral.

Non-statutory Designated Sites

6.9 County Wildlife Sites are afforded protection under UK planning policy (NPPF) but are not protected by legislation.

6.10 The potential for the neighbouring CWS (Martlesham Soakaway Acid Grassland) to be adversely affected can be mitigated by erecting security fencing around the boundaries of the CWS abutting the Development Site to ensure site workers / construction traffic do(es) not transverse this inconspicuous boundary.

6.11 To mitigate for the impacts from pollution (e.g. dust and chemical spillage) a Construction Environmental Management Plan (CEMP) will be produced and adhered to on Site, to reduce the risk of pollution events on the surrounding CWS. This is likely to include requirement of chemicals to be stored away from this boundary to ensure there is no spillage onto the CWS.

6.12 To mitigate impacts upon the reptile population within the Martlesham Soakaway Acid Grassland CWS, reptile exclusion fencing will be erected around the construction zone in this area to exclude individuals from the construction zone and connectivity measures (habitat enhancements) will be undertaken to reduce fragmentation. See reptile section for more detail.

6.13 Public access is not permitted on the CWS at present, however there are no physical barriers to people accessing the CWS for recreation. To prevent impacts from damage (i.e. trampling, picking and / or fouling from dogs / cats), a fence will be erected around the designated site with signage for no public access. An interpretation board may also be pertinent in preventing trespassing.

6.14 Given the recommended mitigation measures and CEMP, the residual effect is assessed as **neutral.**

Habitats

6.15 The development will lead to the loss of habitat including a significant negative effect on the Open Mosaic Habitat on Previously Developed Land and semi-improved grasslands without mitigation.

6.16 Mitigation will be provided through a network of 25.1ha of SANGS (approximately 22% of the Application Site) that will be created, retained and/or enhanced around the Application Site. To include: heathland creation, wildflower meadow creation, areas of sparsely vegetated ground, enhanced management of the scrub and woodland habitats for wildlife and marginal planting around the retained fishing lake to enhance the lake for wildlife. See Table 25 for a summary of mitigation on Site for habitats and Appendix 15 for a plan of all mitigation on Site.

6.17 The loss of the BAP habitat Open Mosaic Habitat on Previously Developed Land will be total. However, the development has a significant opportunity to improve the retained habitats on Site (woodland and fishing lake) and re-create heathland which is of higher ecological priority. In addition, areas of sparsely vegetated early successional grassland will be created and maintained throughout the network of SANGS which will compensate for the loss of the BAP habitat.

6.18 The loss of part of the semi-improved grassland will be directly mitigated for through creation of wildflower meadow and neutral/acid grassland creation through the network of SANGS.

6.19 The proposed development will also enhance the retained woodland on Site through enhanced management in perpetuity. Enhancements could take place through planting native trees and increasing the diversity of the understorey, to be guided by the ecological management plan.

6.20 A low-level lighting scheme will be implemented within these retained and enhanced habitats to maintain the biodiversity value on Site (see bat section for more detail).

6.21 To mitigate for increased human activity, a low disturbance zone around part of the fishing lake, new wildflower meadow and heathland will be created through native thorny species planting and path creation drawing activity away from sensitive areas. Interpretation boards around the SANGS areas will inform new residents of the importance of the habitats helping to prevent damage during the operational phase.

6.22 The creation of habitats and enhancements to retained habitats will be guided by an Ecological Mitigation and Management Plan (EMMP) see Table 25 for treatments.

6.23 The development has the potential to negatively impact the retained habitats through pollution events, for example dust, noise, chemical and light pollution. Mitigation will include storage of chemicals away from retained habitats and sensitive lighting (see bat section for detail) and be guided by the production of a CEMP with compliance ensuring the retained habitats are protected during the construction phase and EMMP for the operational phase.

Table 25: SANGS summary, refer to Appendix 15 for locations.

Green space area	Description	Treatment
North green space	Broad-leaved woodland (area 1)	To be enhanced through sensitive ongoing management; Ad hoc removal of Sycamore which can otherwise become invasive; Low level lighting scheme; Planting native trees; and Increasing the diversity of the understorey including opening up of rides and walkways to encourage shade tolerant wildflower species to establish.
Central green space	Fishing lake, retained scrub and some retained grassland as well as heathland creation and marginal vegetation around the lake (areas 3, 4 and 6)	Creation and sensitive ongoing management of heathland; Creation of wildflower meadow; Creation of neutral/acid grassland; Creation of areas of sparsely vegetated early successional grassland; Provision of low disturbance zone; Low level lighting scheme; A marginal wetland habitat will be incorporated around the margins of the lake; Re-enforced scrub and tree planting around north margins of lake for badgers and nightingales; and Scrub to be managed on rotation to encourage structural diversity. Bare ground, grassland and scrub sensitively managed for reptiles, invertebrates etc.
The Valley	Grass and scrub field south of the fishing lake (area 7)	Creation of neutral/acid grassland; Creation of areas of sparsely vegetated early successional grassland; Low level lighting scheme; Bare ground, grassland and scrub sensitively managed for reptiles, invertebrates etc.
South and East buffer	Semi-improved grassland buffer along the east boundary (area 2 and	Provision of increased species and structural diversity through: sowing of a wildflower mix and managing in a low intensity manner to provide gradation in structure; Low level lighting scheme;

Green space area	Description	Treatment
	9) and plantation woodland along the south boundary (area 8)	Creation of wildflower meadow; Native species planting to reinforce the boundary habitats for small mammals to utilise. Management to maintain connectivity through and around the development site.
West green space	Currently arable / quarry where a green corridor will be created (area 5)	Planting of a native species-rich hedgerow along the new footpath; Low level lighting scheme; and Enhancement of pillboxes for bats.

6.24 Given the mitigation measures and the recommended management plans there would be an overall increase in habitat quality, despite a loss in extent, with enhancements to associated notable species such as bats, birds and reptiles. The residual effect will therefore be **neutral.**

Rare and Notable Plants

6.25 Seven rare and/or notable plants are present on Site; smooth cat's-ear, dittander, common cudweed, field pepperwort, corn mint, annual beard-grass and hound's tongue which are located within the open grassland habitats on Site, as shown within Appendix 9. The largest field on Site which contains four of the seven notable or rare species on Site (common cudweed, smooth cat's-ear, field pepperwort and corn mint), is due to be retained and enhanced for biodiversity through creation of heathland. In addition, one of the fields containing dittander is partially due for retention. As such, it is only hound's tongue and annual beard-grass whose current extent will be completely lost. Nonetheless, it is considered that habitat can be recreated for all seven rare and notable species on Site with appropriate mitigation and management.

6.26 Mitigation during the construction phase will include the retention and enhancement of grassland and bare ground habitats within/around the heathland area and other greenspace areas in step with development impacts. Many of the species require slightly acidic, sandy or gravelly substrates, which can be re-created within the open areas of the Site. Hound's tongue requires a slightly more calcareous soil on gravelly substrates which could be recreated elsewhere on site, for example in the small grassland field to the south of the fishing lake. Dittander, a Nationally Scarce plant, would also need gravelly or bare substrate. The management of discrete areas within the SANGS network will aim to replicate these habitats. Interpretation boards around the SANGS areas will inform the new residents of the importance of these species and prevent picking / trampling damage during the operational phase.

6.27 To ensure the species of concern are able to re-establish on Site, prior to construction, individual plants of these species should be identified by a suitably qualified ecologist and as many of the plants as possible be translocated to a suitable area which is to be unaffected by construction of the proposed development, for example, the created heathland habitat or greenlinks forming part of the SANGS network on Site. Targeted management of these areas will provide optimal habitat for these species allowing them to persist on Site post-development.

6.28 The residual effect is assessed as **neutral**.

Invasive Species

6.29 The Japanese Knotweed on site will be eradicated by a specialist invasive species contractor, following an appropriate method statement, prior to works commencing (including vegetation

clearance in affected areas). Methods of control / eradication include; disposal in a licenced landfill, sprayed with approved herbicides by a specialist invasive species contractor or the rhizomes buried to a depth of at least 5m and covered with a root barrier membrane.

Bats

6.30 Bats and their roosts are protected under UK (WCA, 1981) and European (Conservation of Habitats and Species, 2010) law, making it illegal to damage, destroy or disturb any bats or roosts without having taken the necessary precautions.

6.31 Temporary loss of the possible barbastelle roost through increased lighting during the construction phase (the road will remain unlit during the operation phase) would result in a significant negative affect for this species at a County level and would also cause an offence under the Wildlife and Countryside Act 1981, and Conservation of Habitats and Species Regulation 2010. As such, the roost is protected from lighting impacts through the CEMP. If this is not possible it is recommended a Natural England license is applied for. The license stipulations are likely to include timing to avoid significant times of the year. Compensatory roosts nearby may also be necessary. With this mitigation in place the roost will be protected and the residual effect is assessed as **neutral**.

6.32 There are three pipistrelle roosts on Site and two feeding perches. The loss of which would result in a significant negative effect at a Local / District level and would also cause an offence under the Wildlife and Countryside Act 1981, and Conservation of Habitats and Species Regulations 2010. As such, it is recommended a Natural England license is applied for, for any roosts that will be destroyed, damaged or disturbed as part of the proposals. This would include the demolition of the building(s) as well as any significant lighting increases on / around Tree 41. The license stipulations are likely to include exclusion of bats to ensure they are not harmed and timing to avoid important times of the year (breeding/hibernation). Compensatory roosts nearby will also be necessary. Compensatory roosts could include integrated bat boxes / bricks within new buildings, access tiles for bats into lofts (providing breathable roofing membranes are not used) or traditional bat boxes which can be externally fixed onto retained trees or new buildings where disturbance and artificial lighting levels are low. The residual effect is assessed as **neutral**.

6.33 There is potential for Building E to be utilized by hibernating bats prior to demolition. Loss of potential hibernating sites will also require a Natural England EPS licence. Licence stipulations are likely to be the same as the above. Compensatory roosts suitable for hibernating bats will be provided. The pill boxes on the Application Site could form ideal hibernating opportunities for bats with enhancement works such as installing bat boxes and other roosting features and blocking entrances to reduce the risk of vandalism. The residual effect is assessed as **minor positive**.

6.34 Several species have been found to use the Site for foraging and commuting purposes, predominantly utilising the south and east boundaries, broad-leaved woodland in the north and grassland and scrub habitat across the middle of the Site, as well as the fishing lake. These habitats are largely being retained, enhanced and / or created into habitat of higher ecological priority (i.e. the new heathland) within the network of SANGS, as set out in the habitats section. Without mitigation, there is high likelihood that light pollution will negatively affect the bat assemblage utilising these retained habitats that are foraging and commuting corridors for bats. As such a sensitive lighting scheme, as described in detail below and within the Lighting Appraisal (Brookbanks, 2017), will be implemented across the Site during operation and construction, with particular

sensitivity to the aforementioned important commuting and foraging corridors. The residual effect is assessed as **neutral**.

6.35 There is a risk that the extent and variety of different habitats on Site will be lost to the proposed development. To maintain the species richness utilizing the Site, mitigation should include provision of a variety of high quality habitats for bats, with management set out in an ecological mitigation and management plan. The residual effect is assessed as **neutral**.

6.36 It is also recommended that the retained habitat and newly created garden habitats are enhanced for wildlife in general, with plant species of benefit to bats incorporated throughout the landscaping scheme, to ensure bats can continue foraging post-development. The residual effect is assessed as **minor positive**.

6.37 Whilst the woodland around the Site (broad-leaved in the north, mixed and coniferous in the south) are being retained, they will also be buffered from the development through green space and native species planting (see Appendix 4 for location) with no/low level lighting along these boundaries to ensure the dark corridor which is currently on Site can persist post-development. The residual effect is assessed as **neutral**.

6.38 In general, it is recommended that Site lighting is kept to a minimum during both the construction and operational phases, especially in areas of potential foraging/commuting corridors such as woodland edges, the fishing lake, east and south boundaries, and along retained habitat through the middle of site (heathland and the valley). Where lighting is necessary, then there are a number of ways to minimise the effect of lighting on bats, to allow dark corridors to persist in line with paragraph 125, Chapter 11 of the NPPF. The following mitigation strategies are based on the Bat Conservation Trust Landscape and Urban design for Bats and Biodiversity (Gunnell *et al.*, 2012) and other referenced sources:

- In general, light sources should emit minimal ultra-violet light (Langevelde *et al.*, 2011) and avoid the white and blue wavelengths of the light spectrum, to avoid attracting insects and thus potentially reducing numbers in adjacent areas, which bats may use for foraging.
- Limiting the height of lighting columns to eight meters and increasing the spacing of lighting columns (Fure, 2006) will reduce spill of light into unwanted areas such as the aforementioned habitats, as well as the tree (Tree 41) with bat roosting potential, buildings with bat roosts (Buildings 6 and E) and pillboxes with future hibernating potential after enhancements (see Appendix 10).
- The spread of light will be kept near to or below the horizontal plane, by using as steep a downward angle as possible and eliminating bare bulbs and upward pointing light fixtures.
- Light spill will be reduced using directional luminaires, shields, baffles and/or louvres. Flat, cut-off lanterns are best.
- Additionally, lights will be located away from reflective surfaces where the reflection of light will spill onto potential foraging/commuting corridors.
- Lighting that is required for security or access will use a lamp of no greater than 2000 lumens and be PIR sensor activated, to ensure that the lights are only on when required and turned off when not in use (Jones, 2000; Hundt, 2012).

6.39 With these lighting implementations, it is considered that any adverse effects from lighting upon potential bat populations would be minimized, if the dark corridor links between the woodland and

potential Barbastelle roost in the south remains connected with the woodland in the north via the southern and eastern boundaries as well as the grassland field with the fishing lake present. In addition, the trees with roosts will remain dark and thus connected to foraging habitats. The residual effect from lighting is assessed as **neutral**.

6.40 There is an opportunity to provide additional roosting opportunities over and above the current provision existing on Site. As such, provision will be made for bat boxes (in addition to those compensatory of any EPS Licence) being installed on/within the proposed buildings or mature trees around Site, away from artificial light and regular disturbance. There are numerous bat box designs but the Schwegler universal bat box 1FF provides excellent summer roosting conditions and the Schwegler 2F is a good multi-purpose bat box for crevice inhabiting species including pipistrelles which have been recorded roosting and foraging on Site. As barbastelle do not generally roost in buildings (BCT, 2015), compensatory roosts may be supplied in a location that will remain dark in the form of: translocation of potentially suitable features from a tree which will not be retained; creation of suitable features in a nearby retained tree (e.g. replicated limb fracture); or provision of an appropriate bat box for barbastelles (e.g. the Kent Bat Box). The residual effect on roosting is assessed as **minor positive.**

6.41 In addition, there is an opportunity to enhance the retained habitats on Site for foraging bats post development. For example, the understorey of the northern woodland is of poor ecological quality and there is ample scope for enhancement, i.e. through planting of native species and of benefit to bats and/or thinning to create more structural diversity; enhancing it for bats and for biodiversity in general, in line with the NPPF (DCLG, 2012). This will be guided via the EMMP. Species of known benefit to bats (see Appendix 10) should also be included within the landscaping scheme providing additional foraging resources. The resulting residual effect upon foraging/commuting bats is considered **neutral** if the above listed mitigation and enhancements are undertaken.

6.42 The resulting residual effect upon foraging/commuting bats is considered **neutral** if the above listed mitigation and enhancements are undertaken with a **minor positive** residual effect predicted upon roosting bats.

Otter

6.43 Development impacts on otter are likely to include the reduction in use of the fishing lake as part of their foraging range. However, the impact is not considered significant given the very low level use of the Site. Through provision of mitigation for other species, which includes; reduced speed levels, green corridors and low lighting zones, the proposed development will result in a **neutral** effect on the local otter population.

Birds – Breeding and Wintering

6.44 To comply with the WCA 1981 and avoid nest destruction, clearance works affecting nesting habitat (scrub/trees/buildings/grassland) will be scheduled so that they do not occur during the bird breeding season (i.e. outside the period March-August inclusive). If this is not possible, an alternative strategy is to undertake a nesting bird survey in advance of clearance work to ensure that active birds' nests are not damaged or destroyed by the works and that Schedule 1 nesting birds are not intentionally or recklessly disturbed.

6.45 The following mitigation measures will be implemented during the construction phase to reduce impacts upon the bird assemblage utilising the Site:

- Habitat creation/enhancement will be provided in step with habitat loss impacts.
- Areas of created heathland in accordance with the Mitigation Map (see Appendix 15) will create areas of suitable foraging habitats for species such as linnet and nightingale. This will provide abundant invertebrate prey and overwinter seed resources for birds, if managed appropriately. An area of this habitat will be treated as a low impact zone in order to minimise disturbance to species utilising the habitat.
- Specialised areas surrounding the large central fishing lake should be managed as low impact zones in order to avoid disturbance from residential pressure. Management here will include reinforcing the scrub and thorny native species around the edge of this zone, to naturally deter access to these areas. This is turn will allow for the creation of nesting and foraging opportunities within the reinforcing scrub features.
- A marginal wetland habitat will be created around the margins of the lake to mitigate for the loss of habitat around the three waterbodies within the quarry, used by cuckoo and linnets in the breeding season and teal in the winter as well as providing optimal foraging habitat for nightingale.
- Plant a range of nectar-rich plants within the formal landscaped areas, to encourage invertebrate and plant food for birds. This can be designed in combination with the requirements for bats (see bat section).
- A native wildflower seed mix of local provenance should be sown within discrete patches in the network of SANGS for example the edges of heathland and green links, with management to include cutting on long rotation to allow the sward to grow long, whilst providing suitable grassland foraging habitat for different bird species with a range of grass sward heights at any one time. This will allow connectivity around the Site in a circular route for a range of foraging bird species.

6.46 The implementation of the following mitigation measures are recommended during the operational phase and guided by the EMMP:

- Implement appropriate grass cutting management of the urban greenspace to maintain short sward heights for thrushes and starlings across the more heavily used amenity areas, and less frequent cutting (1- times a year, depending on ecological aims) of sown wildflower meadow areas.
- Install bird-nesting features or boxes into the developed realm to provide nesting opportunities for birds adapted to nesting in urban areas, such as swift *Apus apus*, house martin *Delichon urbicum*, house sparrow *Passer domesticus* and starling *Sturnus vulgaris*, to provide enhancement.
- Management of ponds to enhance invertebrate populations: and important prey source for many birds. A pond-dipping platform could also be provided at the central lake with information boards to foster wildlife interest amongst the new residents.
- Distribute and otherwise make available to new residents, information explaining the wildlife value of the site and how they can help nurture this resource by not deviating from designated paths, not using scrambling or mountain bikes on the designated wildlife areas, and controlling pets and reducing their potential dog-fouling pollution, predation and disturbance impacts.
- Provide dog-fouling bins.

- Provide appropriate wildlife signage to inform the residents of the ecological value of the managed habitats within the site.

6.47 A full assessment of the key birds of principal importance of the Site has been undertaken in order to assess the impacts upon these particular species post development and the sites breeding and wintering bird assemblages as a whole. Taking into account the proposed mitigation, it is considered that impacts upon scrub habitats and the corresponding effect on linnet and nightingale will result in a **neutral effect.** This is due to the retention, enhancement and management of grassland scrub habitats throughout the Site creating further nesting and foraging habitats within the site as compensation for habitats to be lost.

6.48 Impacts upon birds in association with the waterbodies such as mallard and wintering teal are also considered to result in a **neutral effect.** Although the quarry ponds are due to be lost to development it is considered that the management and enhancement of the large central fishing pond with the inclusion of low impact zones will offer suitable habitat for principal species. As the waterbodies within the Site offered minimal ecological benefits and were considered species poor, the management plan has the potential to increase net species biodiversity.

6.49 Loss of arable land and grassland habitats will result in the potential loss of five skylark territories and overwintering resource for significant skylark, linnet, fieldfare, meadow pipit and song thrush. This loss of habitat holding up to five territories is considered to result in a **minor negative effect** upon the local skylark assemblage and other key wintering species' populations. However, considering the optimal surrounding habitat within the wider landscape it is believed that this negative impact will not impinge on the status of these species outside the Application Site itself, as the abundant suitable farmland breeding and wintering habitat surrounding the Application Site will not be impacted, and the breeding skylark and wintering farmland species populations in the wider landscape is unlikely to be significantly affected by the loss of this resource. Therefore, the negative impact will be at the **Site level** only.

6.50 A maximum of three breeding pairs of shelduck were recorded utilising the Site, it is considered that the development will result in the loss of these three pairs. Nearby breeding sites at Orfordness, North Warren and Landguard support much larger populations (Mason 2011). Within the local estuaries, Holzer et al (1989) reported total breeding populations (no. pairs) in 1988 of 126 on the Deben, 114 on the Orwell, 17 on the Stour and 202 on the Alde/Ore. Slightly further afield, but within the District, the Blyth Estuary supported 72 pairs, giving a total of at least 531 pairs breeding within the District. As the UK shelduck population has increased slightly by 2% over the period 1995-2010 (Balmer et al. 2013), and these estuaries have all been protected as SPAs over this period, it is likely that these breeding shelduck populations have not changed significantly since 1988. The three pairs using the Application Site is approximately 0.6% of the District total, less than the 1% trigger for District importance; therefore it is of Local importance.

6.51 The loss of three pairs is considered to be a **minor negative effect** upon the local shelduck population. As the current shelduck habitat is ephemeral, being created as a result of the on-going quarrying activities, it is likely that a do nothing option would result in the longer term loss of the habitat and shelduck population. It also indicates that this breeding site has only been occupied recently, since extraction industry activities have created suitable habitat (Linton & Fox 1991). Shelduck were not recorded on the later June survey visit. Given this, it is suspected that the three pairs may not all have bred on the Application Site, and also that there was no successful breeding.

This indicates that the Application Site population is recent and reproductively unsuccessful, probably forming a 'sink' (Pullman, 1988) subpopulation (of the nearby larger and reproductively successful source breeding populations) of fluctuating size according to the principles of the 'buffer effect' (Krebs, 1973). Given this, the impact is considered only to be effective in the shorter term at a Local level as it is unlikely to have any significant role in the long-term functioning of the wider population (Runge et al. 2006).

6.52 The key areas of breeding bird habitat to be lost are grassland and scrub, however the promotion and creation of and management of heathland/acid grassland, scrub, woodland, waterbodies and species rich grassland has the potential to create/recreate habitats that will ensure this loss will be minimal and fully mitigated in the longer term. Therefore, assessing the entire breeding bird assemblage of the Application Site, while taking into account the proposed mitigation plans, it is considered that there will be an overall **neutral effect** on the breeding and wintering bird assemblage.

Badgers

6.53 Badgers are legally protected under The Protection of Badgers Act (1992) and as such, are of material consideration when applying the principals of the NPPF (DCLG, 2012).

6.54 There are three outlier setts in current use (Setts A, B and E) and a number of disused outliers on Site which are likely to be permanently lost under the proposed development. The setts in current use will require closure under a Natural England license to ensure badgers are not harmed during the destruction of the sett and to comply with the Protection of Badgers Act (1992). As there are no main setts on Site, there will be no requirement for a compensatory sett to be created as part of the license. It is considered that the permanent closure of the setts on Site will not have a significant negative effect on the local badger's conservation status given that no main setts are being affected and that outlier setts naturally fall in and out of use. Alternative sett building habitats will be provided in step with development (within the low disturbance zone) and the residual effect is assessed as **neutral**.

6.55 Once the quarry is not in use, there are areas of the Site which could become more frequently used by badgers, including for sett building, for example: retained woodlands, some grassland fields and bunds around the Site which surround the quarries. As such it is recommended an update badger survey is undertaken prior to construction starting on Site to establish the current baseline and inform the Natural England licenses and detailed strategy for the EMMP and CEMP.

6.56 Any active badger setts on Site will have a 20-30m exclusion zone in place around the extent of the sett. No excavation work should be undertaken within this buffer zone to avoid disturbing, injury or killing of badgers within their sett or damage to the sett itself. If the proposed works do fall within this buffer zone then advice should be sought from the project ecologist. It is likely a license from Natural England will need to be obtained to temporarily or permanently close the sett which can be done between July-November (inclusive). This will ensure that no badgers are disturbed or harmed during the construction works. During the operational phase, the subsidiary sett retained [redacted] will be included within the low disturbance zone, with access from new residents discouraged by thorny species planting, path diversion and signage.

6.57 Precautionary measures will be put in place to ensure that in the event of a badger coming on to Site during construction the risk of injuring and killing is minimised:

- Covering any trenches at night or leaving a plank of wood leant against the side to ensure they can escape if they were to accidentally fall in.
- Chemicals should be appropriately sealed and stored.

6.58 Approximately 25% of foraging habitat on Site is likely to be lost with the proposed development. However, the proposed development will include creation of a network of SANGS including new heathland habitat within the large grassland field with the fishing lake, the creation of the heathland and wildflower grassland areas. This will provide additional and enhanced foraging for badgers. In addition, more formal areas such as the formal recreation area, residential gardens, orchard/allotments and other open space will also provide foraging habitat for badgers.

6.59 Fragmentation effects from the proposed development will be mitigated through the provision of the network of SANGS allowing badgers to move through the landscape post development, especially north – south connectivity from [redacted] to their likely main sett [redacted]. These green corridors will be subject to a sensitive lighting strategy and speed limits on site should be restricted, particularly around these sensitive areas.

6.60 Thus, residual impacts upon the local badger social group from the proposed development of the Site are considered to be **neutral**.

Invertebrates

6.61 The Site is an active sand quarry, with the habitat of principal value to invertebrates being the early stages, particularly open grassland with bare substrates. In the medium and longer terms the habitats will likely become less suitable and decline in value as grassland becomes ranker and scrub invades. Although many of the individual species of conservation concern were recorded from restricted areas they are likely to have dynamic distributions, tracking areas of habitat according to their suitability, colonizing areas as they become suitable and with local losses as vegetation becomes over mature for that species. It is not thought that individual areas of the Site should be 'protected' for invertebrates rather masterplanning should aim to allow for appropriate areas of habitat to be created / retained with the likely long-phasing schedule for the scheme allowing sufficient time for colonization of created / retained habitat.

6.62 It is recommended that habitat creation should aim to create grassland habitat with substantial structural and physical variety, to provide a range of conditions locally; relevant design features include mounds and slopes within grassland areas rather than uniformly flat conditions.

6.63 In addition to on-going management such as mowing, incidental disturbance should be 'designed-in' to allow for users such as walkers and cyclists to create the gradients of disturbance and early seral conditions required by many species. These features can be included throughout the SANGS areas for the benefit of the invertebrate assemblage utilizing the Site. An EMMP will be produced to address invertebrate needs. The resulting residual effect is assessed as **minor positive**.

6.64 Invertebrate species likely to utilize such habitat areas – mosaics of grassland swards and peripheral scrub – include all of the species of conservation concern recorded, with the more specialist

conditions to be created being 'open short sward' and 'bare sand and chalk' and a range of other conditions relevant to the species of grassland, scrub and woodland edge conditions. More generally the habitat conditions will be relevant to a wider group of species present locally or present on the site and not recorded, including many of the widespread moths with the status of Species of Principal Importance and listed on the Suffolk BAP. Of the scarcer species recorded locally, the habitat conditions will be relevant to heathland specialists such as the silver-studded blue butterfly and potentially contribute to the conservation of this species at the landscape scale, by increasing total area of habitat available locally and contributing to landscape connectivity.

6.65 The above strategy is consistent with the outline habitat management relevant to former aggregate sites proposed by Buglife (undated) and the broader principles for grassland and scrub invertebrates (Fry and Lonsdale, 1991; Kirby, 2001). The resulting residual effect is assessed as **minor positive**.

Reptiles

6.66 There are four common reptile species found throughout Britain; common lizard, slow-worm, grass snake, and adder. They are primarily legally protected under the WCA 1981 (as amended).

6.67 Common lizards and grass snakes were observed utilising the grass field south of the fishing lake, the western field boundary and the woodland. They are also known to be present in the neighbouring CWS (Martlesham Soakaway Acid Grassland).

6.68 To mitigate for the loss of reptile habitat, the grassland field south of the fishing lake will be retained and enhanced. The creation of heathland on Site, with appropriate long-term management, will provide enhanced habitat for reptile's post-development. Valuable features such as log piles and reptile hibernacula will be installed within reptile areas to increase the number and quality of foraging / sheltering and hibernating habitats available to the reptile population on Site post-development. This mitigation is likely to result in a residual **neutral** to **minor positive** effect on the reptile population on the Application Site with the retained and created habitats managed for reptiles in the long term.

6.69 In addition, wildlife friendly planting, throughout the landscaping scheme (i.e. within the green space / network of SANGS as well as within the green spaces in the residential areas) will ensure connectivity across the site is maintained and enhancements are provided. This mitigation is likely to result in a residual **neutral** to **minor positive** effect on the reptile population on Site.

6.70 Due to the planned residential development, an increase in disturbance (for example by dog walkers) or predation (for example by domestic cats) is predicted, although predation from cats is not considered significant as reptiles are only known to contribute a small proportion of their diet (Woods *et al*, 2003). Such impacts are difficult to quantify and mitigate, however with the provision of a low disturbance area of the heathland, as well as thorny scrub within the open areas of the grassland, hibernacula and new log piles providing additional shelter from predation and excessive disturbance within the SANGS areas, it is predicted this impact can be mitigated. In addition, with the recommended appropriate sensitive management of the heathland, as set out in an ecological mitigation and management plan, the conservation status of reptiles on Site will be secured in the long term.

6.71 To mitigate for death/injury impacts during construction, reptile exclusion fencing will be erected around the two grassland fields with reptiles present, as well as around the south boundary of the woodland and boundaries with the neighboring CWS to prevent reptiles from entering these construction areas once construction starts. These areas will be trapped out for reptiles, with any caught reptiles moved into a receptor site (retained habitat along the western boundary of the central green space, adjacent the BT complex). The receptor site will be enhanced with features such as log piles and hibernacula providing additional foraging/sheltering resources.

6.72 ARG UK guidance requires a minimum of 60 suitable days (HGBI, 1998) for the low population class size present. However, it is considered that if capture effort is increased over and above the recommended guidance and methods such as habitat manipulation are employed, after 30 days the capture could be concluded, following 7 consecutive 'clear' trapping visits or at the judgement of the site ecologist. Natural England's *Standing Advice Species Sheet: Reptiles* recommends that capture and translocation should be undertaken during spring and early autumn, avoiding periods of inactivity and the hotter months of July and August. Effort should also be restricted to periods of appropriate weather. This will ensure no reptiles are injured or killed as a result of the construction. In addition, as toads are known to be present on the Application Site, any trapped toads will also be translocated to the reptile receptor area.

6.73 The translocated population of reptiles will not be temporarily fragmented during the construction period due to sufficient habitat being retained on the Application Site (grassland south of the lake, central lake area and boundary habitats) and new habitats created in step with development impacts. Production of an EMMP will ensure the long-term management of these habitats for reptiles. This mitigation is likely to result in a residual **neutral** to **minor positive** effect on the reptile population on Site.

6.74 Overall, the resulting impact on reptiles is considered to be **minor positive**.

Small and Medium-sized Mammals

6.75 Retention of habitats of value to hedgehogs on the Site (i.e. scrub, woodland boundaries) will partially mitigate for the loss of hedgehog habitat on the Application Site. Additional and enhanced habitat will be created throughout the Application Site, for example the network of SANGS and green links, log piles, enhanced management of scrub etc. will mitigate for loss of foraging habitat.

6.76 The production of a CEMP will detail precautionary methods that include; (i) appropriate timing of vegetation clearance outside the hibernation period (October – March) when hedgehogs are more vulnerable; or (ii) where this is not feasible, a fingertip search and/or staged habitat removal on localised patches of habitat undertaken under a method statement.

6.77 Dispersal and foraging habitat for the hedgehog is thought not to be significantly reduced with the retention of boundary habitats. However, given the findings of recent studies (Wembridge, 2011) highlighting the decline of hedgehogs throughout the UK in recent years, the provision of access points into residential gardens would be an important enhancement for this species providing additional foraging resources. To facilitate the movement of hedgehogs through the Site, ad hoc 13cm x 13cm holes will be provided within fencing/walls to permit movement of hedgehogs. This size gap is too small for most pets and can be undertaken by raising a fence panel per garden;

installing hedgehog friendly fencing; removing a brick at the bottom of a wall or cutting a hole in fencing/walls.

6.78 Mitigation against recreational disturbance will be provided through creation / enhancement of new foraging / dispersal and shelter habitat, to include a 'low / no disturbance' area. In addition, enhancement of boundary features will be provided through wildlife friendly planting, throughout the landscaping scheme (i.e. within the green space / network of SANGS as well as within the green spaces in the residential areas) will ensure connectivity across the Site is maintained and enhancements are provided where possible.

6.79 A reduced speed limit on the road systems on the Site will reduce the likelihood of mortality of hedgehogs from road traffic accidents.

6.80 The sensitive lighting scheme and retention of 'dark corridors' across the Site, recommended for other protected species, will also benefit hedgehogs.

6.81 This mitigation (and enhancements) is likely to result in a residual **moderate positive** effect.

Summary

Table 26: Summary of Residual Impacts Arising from the Development of the Site on Features that are Significantly Impacted by the Proposed Development.

No.	Receptor	Summary Mitigation Measures for Significant Impacts	Residual Impact
1	SAC/SPA	Provision of 25.1 Ha of SANGS Financial contribution to off-site mitigation through RAMS	Neutral
2	SSSI/LNR	Creation and enhancement of retained habitats on Site to provide habitats of higher quality for birds (notaly nightingale) from Newbourn Springs SSSI in step with the development No impacts on any of the other SSSIs are anticipated in terms of disturbance and therefore no mitigation necessary No impacts on any of the SSSI are anticipated during the construction phase with regard to pollution and therefore no mitigation is required	Neutral
3	CWS	Fencing and safe chemical storage to prevent physical damage to adjacent CWS (Martlesham Soakaway Acid Grassland). CEMP to prevent pollution effects on the 14 CWS in the locality Damage to adjacent Martlesham Soakaway Acid Grassland CWS i.e. through recreation, trampling, picking and dog/cat fouling prevented through fencing and interpretation boards. No recreational impacts anticipated on remaining 13 CWSs	Neutral
4	Habitats	Habitat creation and enhancement An ecological management plan will ensure the long-term perpetuity of these habitats	Neutral
5a	Rare and Notable Plants	Recreate habitat for rare / notable plants within retained / enhanced habitat Translocate individuals An ecological management plan will ensure the long-term perpetuity of these species	Neutral
5b	Invasive Species	Eradicate Japanese knotweed from Site under method statement by specialist contractor	Neutral

No.	Receptor	Summary Mitigation Measures for Significant Impacts	Residual Impact
6a	Bats – Roosting	Natural England EPSL obtained and compensatory roosts created Sensitive lighting scheme to be implemented Installation of bat boxes throughout scheme	Minor positive
6b	Bats – Activity	Creation of new habitats, enhancements of retained habitats, Bat friendly planting scheme and an ecological management plan implemented to ensure the long-term perpetuity of the bat assemblage Sensitive lighting scheme employed throughout Site	Neutral
7	Otter	Reduced speed levels, lighting levels and retained green corridors in and around Site	Neutral
8	Amphibians	Sensitive habitat clearance along northern / eastern boundaries	Neutral
8	Birds	Management plan to recreate heathland, enhance woodland and scrub, and sensitively manage grassland Creation of new and replacement habitat and nesting opportunities/features including sand martin bank Creation, maintenance and inform new residents of low impact, disturbance-free zones	Minor negative (Site): Breeding Skylark Minor negative (Site): Wintering skylark, linnet, fieldfare, meadow pipit, dunnock and song thrush Minor negative (Local): Breeding shelduck Neutral: all other species and breeding and wintering assemblages
9	Badgers	Natural England licence obtained to close active setts Foraging habitats retained and enhanced around boundaries, woodland and new heathland Fragmentation minimised through reduced speed levels, low lighting levels and retained green corridors	Neutral
10	Invertebrates	Phasing of development to ensure creation of new areas before complete loss of habitats of value to invertebrates Management plan to create open grassland habitats with extensive structural and physical variety, with on-going management to maintain early seral habitat conditions	Minor positive
11	Reptiles	Translocation of individuals from reptile areas to receptor site Enhancement of SANGS areas for reptiles Landscaping scheme of benefit to reptiles throughout scheme Ecological management plan for newly created habitats and receptor site	Minor positive
12	Small and Medium-sized Mammals	Sensitive lighting scheme and reduced speed levels across Site Connectivity through newly created gardens through cut-outs in fences etc. Ecological management plan for newly created habitats to ensure sensitive vegetation removal to avoid hedgehog hibernating period	Moderate positive

7.0 Conclusion

7.1 The Land south and east of Adastral Park, Ipswich has been assessed for its biodiversity value in general as well as its potential to support a number of ecological receptors, through an Extended Phase 1 Habitat survey undertaken by SES in 2016, through various Phase 2 ecological surveys and assessments by SES over 2016 to 2017 as discussed within this report as well as a sHRA (Baker Consultants, 2017) and previous survey work (Environ UK, 2009 and The Landscape Partnership, 2012).

7.2 Through implementing the above mitigation recommendations, it is considered that all significant adverse impacts from the proposed development upon specific habitats, designated sites and protected species would be mitigated and positive outcomes for biodiversity, in accordance with:

- Relevant wildlife legislation;
- Chapter 11 of the National Planning Policy Framework (DCLG, 2012);
- Policies SP1, SP2, SP12, SP14, SP15, SP20, DM27 and SSP1 of the Local Plan (Suffolk Coastal District Council, 2013a).

7.3 Table 26 (above) summarises the mitigation for each receptor and the residual impacts as a result of this mitigation. Appendix 15 provides a visual representation of the mitigation for the Site as a whole.

7.4 An Ecological Mitigation and Management Plan will be produced to guide the proposed development and to maximise the biodiversity potential of this Site. The production of this document is usually facilitated through a pre-commencement condition, which is considered suitable in this instance.

8.0 References

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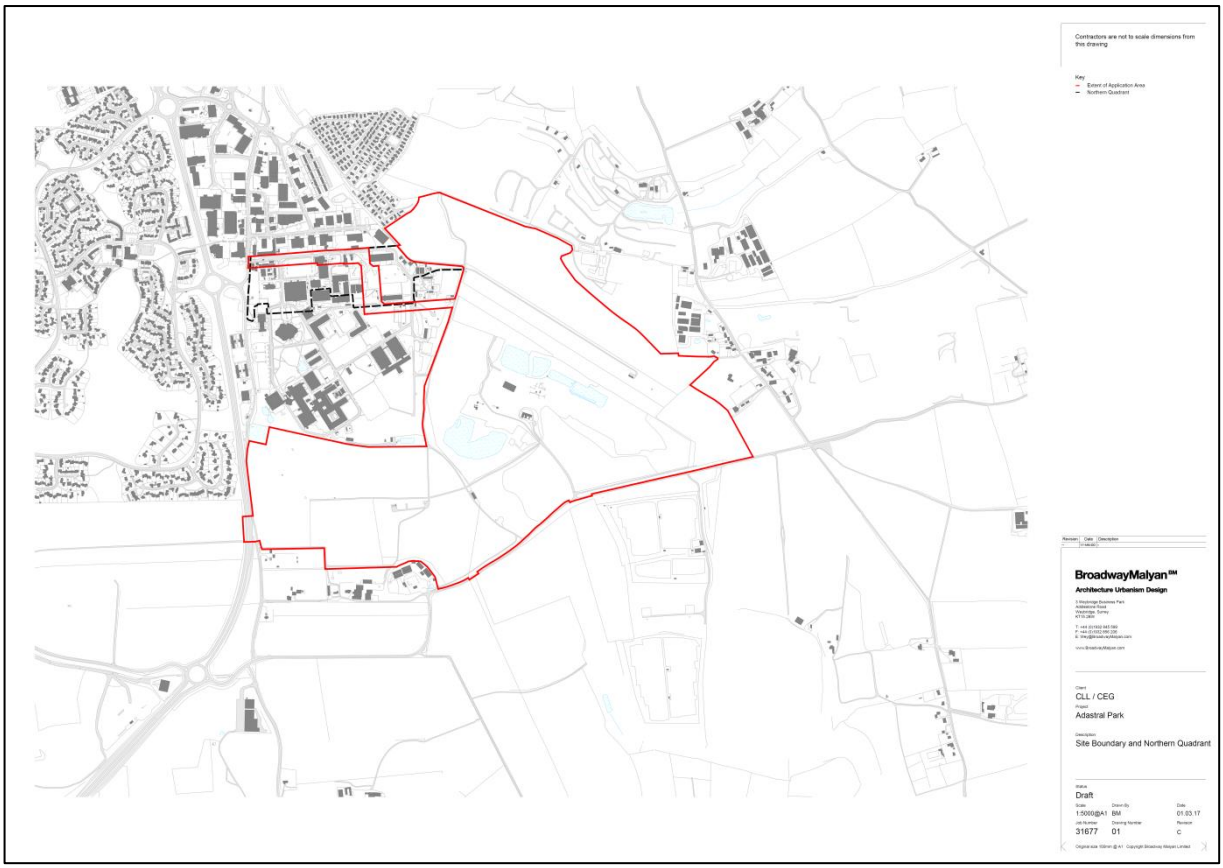
Appendix 1: Proposed Site Plan

Site boundary



Proposed Development

Appendix 2: Legislation

This document has not been prepared by a legal or planning professional and should be read as an interpretation of relevant statutes and planning policy guidance only. The information presented within this document has been reported in good faith and are the genuine opinion of SES on such matters. SES does not accept any liability resulting from outcomes relating to the use of this information or its interpretation within this document.

Conservation of Habitats and Species Regulations 2010 and the Wildlife and Countryside Act (WCA) 1981

The two principal sources of wildlife legislation are the Conservation of Habitats and Species Regulations 2010 (CHSR) that deals principally with internationally important sites and species, and the Wildlife and Countryside Act (WCA) 1981 that deals principally with nationally important sites and species.

Species listed under Schedule 2 of the CHSR 2010 are the European Protected Species (EPS). Together with provisions in the WCA 1981, the EPS are protected by the following criminal offences. It is an offence to:

- Deliberately capture, injure or kill any wild animal of an EPS;
- Deliberately disturb wild animals of any EPS, in particular any disturbance which is likely to impair their ability:
  - to survive, to breed or reproduce, to rear or nurture their young; or
  - in the case of animals of a hibernating or migratory species, to hibernate or migrate; or
  - to affect significantly the local distribution of the species to which they belong;
- Intentionally or recklessly:
  - Disturb any EPS whilst it is occupying a structure or place which it uses for shelter or protection; or
  - Obstruct access to any structure or place which any EPS uses for shelter or protection
- Damage or destroy any structure or place which any wild animal of an EPS uses for shelter or protection;
- Deliberately take or destroy the eggs of an EPS;
- Possess or transport any part of a EPS;
- Sell, offer or expose for sale, or possess or transport for the purpose of sale, any live or dead EPS, or any part of, or anything derived from an EPS;

Japanese Knotweed *Fallopia japonica,* along with a number of other introduced and invasive species, is listed under Schedule 9 of the WCA 1981 making it an offence to plant or otherwise cause Japanese Knotweed to grow / spread into the wild. Japanese knotweed is also classed as controlled waste under the Environment Protection Act (1990).

All wild birds are protected from intentional killing, injuring or taking under the WCA (1981). Certain species of wild bird listed on Schedule 1 of the WCA 1981 are further protected from intentional or reckless disturbance at their nest sites whilst building a nest or in, on or near a nest containing eggs or young. A further offence is the intentional taking or destroying of an egg of any wild bird.

In addition to this statutory protection British birds are also classified according to their conservation status, including their position on the Red and Amber lists of *Birds of Conservation Concern in the UK 3* (Eaton *et al*, 2015) and whether they have been identified as Priority Species under the England Biodiversity Strategy.

Red list species are those that are Globally Threatened according to IUCN criteria, those with populations or ranges that have declined rapidly in recent years and those that have declined historically and not shown a substantial recent recovery.

Amber list species are those with an unfavourable conservation status, those whose population or range has declined moderately in recent years; those whose population has declined historically but made a substantial recent recovery; rare breeders; and those with internationally important or localised populations.

Green list species are all regularly occurring species that do not qualify under any of the Red or Amber criteria. The Green list also includes those species listed as recovering from Historical Decline in the last review that have continued to recover and do not qualify under any of the other criteria.

The Protection of Badgers Act 1992

Badgers have historically been given legal protection since 1973 however the Protection of Badgers Act 1992 consolidated and strengthened previous legislation. It is a criminal offence to:

- Wilfully kill, injure, or take any Badger.
- Possess or cruelly ill-treat a badger.
- Possess any dead badger or part of one.
- Possess or control a living, healthy Badger.
- Intentionally or recklessly damage, destroy or obstruct access to a sett, or disturb a Badger whilst it is occupying a sett.

The Hedgerows Regulations 1997

Under the Hedgerows Regulations 1997, hedgerows growing in, or adjacent to, any common land, protected land, or land used for agriculture, forestry or the breeding or keeping of horses, ponies or donkeys are protected from removal if; the hedgerow has a continuous length of, or exceeding, 20 metres; or it has a continuous length of less than 20 metres and, at each end, meets (whether by intersection or junction) another hedgerow. In addition, certain hedgerows receive additional protection from removal as “Important Hedgerows”.

England Priority Species and Priority Habitats

The UK Government’s commitment to the conservation and enhancement of biological diversity was outlined in the United Kingdom Biodiversity Action Plan (UK BAP). It listed habitats and species that were of conservation concern and set national priorities and targets for the protection and enhancement of these resources. The UK BAP has been superseded by the Natural Environment and Rural Communities Act (NERC Act, 2006), however the UK BAP is still referred to for priority habitats and species.

The UK Post-2010 Biodiversity Framework succeeded the UKBAP and the subsequent adoption of the Ecosystems Approach. This was as a result of a change in strategic thinking following the publication of the Convention on Biological Diversity’s Strategic Plan for Biodiversity 2011-2020’, and its 20 ‘Aichi Biodiversity Targets’ in 2010, as well as the launch of the new EU Biodiversity Strategy (EUBS) in May 2011. The UK Post-2010 Biodiversity Framework demonstrates how the work of the four countries in the UK should contribute to achieving the Aichi Biodiversity Targets, and identifies the activities required to complement the country biodiversity strategies in achieving these targets.

Appendix 3: Survey Methods

Bats

Bat Activity Survey

A suite of transect and static detector surveys were undertaken in 2016 to conform to methodology stated in the *Bat Surveys: Good Practice Guidelines* (Collins, 2016). In relation to these guidelines the site was assessed *a-priori* as of moderate quality for bat activity. Therefore, the following programme of survey work was undertaken:

- Bat activity surveys along two walked transects once a month between May and October. Transects were not completed in April, and only one transect was completed in May, due to the commencement date of the project and access issues. Each transect was routed to cover the site as evenly as possible; the working parts of the quarry were not included within transects due to health and safety issues however the boundary areas of the quarry were able to be surveyed. Transects were supplemented with spot counts at 12 designated sampling points for c. five minutes (see Appendix 5 for transect routes walked on each survey). Each transect was walked simultaneously by paired surveyors. Transect start points and route direction (clockwise/anti-clockwise) were varied systematically between survey visits to ensure coverage of different areas of the site at different times in relation to sunset, to ensure there was no systematic spatio-temporal bias in the results. During the September visit both a dusk and dawn activity survey was undertaken. Em3 recorders and a combination of Batbox duet detectors and edirol recorders were use to record bat calls for activity surveys.
- Automated survey locations were sampled (using constant-monitoring data-logging detectors – Anabats and SM2s) between June and October. The surveys used up to four detectors for a varying numbers of nights, with a maximum number of 54 nights monitoring in July and monitoring from four different locations in June, July, August, and October. (see Appendix 5).

Personnel varied between each activity survey, and weather conditions for activity/automated surveys can be found in the tables below.

Personnel on activity surveys

Survey date	East transect surveyors	West transect surveyors
25/05/2016	Lucy Addison & Sean Crossland	-
29/06/2016	Chris Horley & Russell Mansfield	Lucy Addison & Darren Bonner
11/07/2016	Mark Poynter & Russell Mansfield	Rachel Geller & Lucy Addison
03/08/2016	Ella Barnett & Russell Mansfield	Darren Bonner & Rachel Geller
12/09/2016	Kirk Hardes & Ben Nelumbu	Josh Samuels & Rachel Geller
13/09/2016	Kirk Hardes & Ben Nelumbu	Josh Samuels & Rachel Geller
17/10/2016	Ella Barnett & Josh Samuels	Lucy Addison & Kirk Hardes

Weather conditions during each activity survey

Date	Type	Weather Conditions	Temperature (°C)
25/05/2016	Dusk	Cloud cover 100%, Beaufort 0-1	11
29/06/2016	Dusk	Cloud cover 100%, Beaufort 2	18
11/07/2016	Dusk	Cloud cover 70%, Beaufort 1	18
03/08/2016	Dusk	Cloud cover 50%, Beaufort 2	20
12/09/2016	Dusk	Cloud cover 50%, Beaufort 0	20
13/09/2016	Dawn	Cloud cover 5%, Beaufort 0	19
17/10/2016	Dusk	Cloud cover 5%, Beaufort 1	15

Automated survey summary

Month	Dates	Detector #	No of nights recorded	Avg no. of hours per evening	Total Hours Accrued (approximate)	Average Temperature (°C)
June	14/06/2016 – 20/06/2016	Anabat 2	6	8.25	50.4	13.5
	14/06/2016 – 20/06/2016	Anabat 3	6	8.25	50.4	13.5
	14/06/2016 – 20/06/2016	Anabat 4	6	8.25	50.4	13.5
	14/06/2016 – 20/06/2016	Anabat 5	6	8.25	50.4	13.5
July	11/07/2016 – 25/07/2016	Anabat 2	14	8.6	120.4	15
	11/07/2016 – 25/07/2016	Anabat 3	14	8.6	120.4	15
	11/07/2016 – 20/07/2016	SM2 3	9	8.6	77.4	15
	13/07/2016 – 20/07/2016	SM2 4	7	8.6	60.2	15
August	03/08/2016 – 08/08/2016	Anabat 1	5	9.75	48.75	17.5
	03/08/2016 – 08/08/2016	Anabat 3	5	9.75	48.75	17.5
	03/08/2016 – 08/08/2016	Anabat 5	5	9.75	48.75	17.5
	03/08/2016 – 08/08/2016	Anabat 7	5	9.75	48.75	17.5
September	12/09/2016 – 19/09/2016	Anabat 1	7	12.25	85.75	19.5
	08/09/2016 – 14/09/2016	SM2 2	6	12.25	73.5	19.5
	12/09/2016 – 19/09/2016	Anabat 3	7	12.25	85.75	19.5
October	17/10/2016 – 24/10/2016	Anabat 7	7	14.5	101.5	12.5
	17/10/2016 – 24/10/2016	SM2 1	7	14.5	101.5	12.5
	17/10/2016 – 24/10/2016	SM2 3	7	14.5	101.5	12.5
	17/10/2016 – 24/10/2016	SM2 4	7	14.5	101.5	12.5

Bat call analysis

All bat calls recorded on Anabats or SM2 detectors were downloaded with all recordings made in zero crossing format except for October SM2 recordings which were made in full spectrum. WAV files from SM2s were analysed using the automated identification programme SonoChiro (Biotope, 2015). This analyses each individual call event and can record up to 15 seconds in a single sound file. Thus some files contain calls lasting a fraction of a second, whilst others may record for multiple seconds (for example, where a foraging bat flies repeatedly in a tight space close to the detector). The length of the sound file has not been discriminated in this analysis. Each sound file may record multiple individuals of each species, but this is difficult to distinguish, thus only species and not number of individuals have been assigned to each sound file. SonoChiro assigns a confidence value to each putative identification to facilitate creation of a subset of data for manual checks of call identification.

Manual checks were performed on SM2 WAV files using Batsound 4.2 (Pettersson Elektronik AB, 2013), and on Anabat Zero Crossing (ZC) files using AnalookW (Chris Corben, 2011), using Zero Crossings Analysis. SM2 WAV files were scrubbed using Kaleidoscope (Wildlife Acoustics 2015) detection software, removing files classified as background noise. 10% of files automatically detected as background noise (Kaleidoscope) or as a pipistrelle species (Sonochiro) were manually checked using Batsound to confirm accuracy. Manual species identification was undertaken using differing combinations of the following call characteristics and parameters: peak frequency energy; maximum and minimum frequency; call duration; call slope; overall visual pattern assessed by eye. Calls were compared to an in-house bat call library and the book *British Bat Calls* (Russ, 2012) was used extensively to guide identification.

Myotis species are particularly difficult to identify from calls and many of these were assigned to *Myotis* genus only or tentatively identified to species by both SonoChiro and in manual checks. Some pipistrelle calls are also difficult to assigned to common or soprano, and have been assigned to *Pipistrellus* genus only.

Bat Roost Scoping Survey

Tree scoping surveys were undertaken on the 1st, 5th and 6th July by suitably qualified ecologists Steve Parr, Darren Denmead and Lucy Addison following best practice guidance (Collins, 2016). The trees assessed from the ground were those identified as likely to be removed as a result of or at the edge of the proposed development (i.e. the interior of the broad-leaved woodland was not physically assessed). The survey involved using binoculars to look for potential roosting features such as woodpecker holes, splits and cracks in branches and loose bark.

Trees that were believed to have potential to support roosting bats were subject to an aerial inspection by a trained and qualified tree climbing and aerial rescue team (NPTC level 2 certification): Adam Dayman BSc (Hons) FdSc and Christopher Horley BSc (Hons) who is also a suitably qualified ecologist. Best practice guidance for use of endoscopes in trees with potential roosts (Northern Ireland Environment, Bat Conservation Trust, Natural Resources Wales and Scottish Natural Heritage, 2015) was followed. Trees were assessed as to their potential to support roosting bats based on the features inspected, following best practice guidance (Collins, 2016).

All accessible potential roosting features were surveyed in this way, with detailed observations being made on the presence of bats (live and/or dead) or evidence of occupation by bats; including bat droppings, scratch marks at potential access points, urine staining as well as characteristic staining and/or smoothing of the tree bark made by the fur of bats. Notes were made on the nature of the features and the potential for the features and tree to support roosting bats.

These aerial inspections guided the level of emergence survey effort as per the below.

Building Surveys

The buildings on site were subject to a rigorous external inspection on 24th August 2016 by Sean Crossland BSc BCA MCIEEM, looking for potential suitability and access points for bats. Where any potential access points were observed, these were inspected from the ground for evidence of use by bats such as lack of cobwebs, staining, droppings, scratch marks etc. Buildings were categorized for their potential suitability for bats based on the evidence observed.

Following external inspection, buildings on site that had low, moderate or high suitability for bats were subject to further survey, including internal inspection where possible by Lucy Addison BSc (Hons) MSc GradCIEEM and Ella Barnett BSc (Hons) ACIEEM on 3rd November 2016 and 4th January 2017. Internal inspection utilized the use of an endoscope, ladder, binoculars and a high-powered torch.

Bat Emergence/Re-entry Surveys

Following external inspections, trees and buildings were categorised into one of three potential risk categories; low, moderate and high. These categories are defined as follows:

- **Low:** A structure with one or more potential roost sites that could be used by individual bats opportunistically. However, these potential roost sites do not provide enough space, shelter, protection, appropriate conditions and/or suitable surrounding habitat to be used on a regular basis or by larger numbers of bats (i.e. unlikely to be suitable for maternity or hibernation. In addition; a tree of sufficient size and age to contain PRFs but with none seen from the ground or features seen with only very limited roosting potential.
- **Medium:** A structure or tree with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions, and surrounding habitat but unlikely to support a roost of high conservation status (with respect to roost type only)

- **High**: A structure or tree with one or more potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection, conditions, and surrounding habitat.

Emergence/re-entry surveys were carried out on the trees/buildings following standard guidelines recommended in Bat Surveys: Good Practice Guidelines (Collins, 2016).

Recordings were made of bat calls to assist in the identification of any bats seen emerging and/or entering the trees. Any bats emerging from or re-entering the trees were identified from calls, counted, with roost access points and flight direction noted where possible. In addition to this, general bat activity at the point of surveys was also recorded.

Surveys were undertaken throughout August and September 2016 by a number of field ecologists. The table below delineates dates surveyed and surveyors, in addition to weather conditions.

Personnel and conditions on emergence/re-entry surveys

Survey date	Survey type	Surveyors	Weather conditions	Temperature °C
03/08/2016	Dusk	Kate Mann, Michelle Tyrrell, Sven Wair	Cloud cover 80%, Beaufort 2-3	19
15/08/2016	Dusk	Lucy Addison, Rachel Geller, Josh Samuels, George Hosegood, Kirk Hardes, Sven Wair	Cloud cover 10%, Beaufort 0	17
16/08/2016	Dawn	Kirk Hardes, Rachel Geller, Sven Wair	Cloud cover 10%, Beaufort 0	12
31/08/2016	Dusk	Josh Samuels, Chris Kelly	Cloud cover <5%, Beaufort 1-2	16
01/09/2016	Dawn	Chris Kelly, Josh Samuels	Cloud cover 30%, Beaufort 1	14
05/09/2016	Dusk	Rachel Geller, Josh Samuels, Chris Kelly, Nathan Jenkinson	Cloud cover 100%, Beaufort 0	18
06/09/2016	Dawn	Chris Kelly, Rachel Geller, Josh Samuels, Kirk Hardes, Nathan Jenkinson	Cloud cover 90%, Beaufort 0	18
22/09/2016	Dusk	Josh Samuels, Nathan Jenkinson	Cloud cover 70%, Beaufort 1	15
23/09/2016	Dawn	Mark Poynter, Nathan Jenkinson	Cloud cover 0%, Beaufort 1	9

Emergence surveys took place 15 minutes before sunset and ended 1.5-2 hours after sunset. Re-entry surveys took place 1.5-2 hours before sunrise and ended 15 minutes after sunrise.

Equipment used included Batbox Duet frequency division detectors with Edirol digital recorders and EM3+ detectors. Recorded calls were analysed using Batsound 4.2.

Great Crested Newt Presence/Likely Absence Survey

Scope of Survey Effort

The survey followed published guidance (English Nature, 2001) with the study area being established as ponds 500m from the boundary of the site, unless there were significant barriers for great crested newt dispersal between these ponds and the site, or where access to private land was not forthcoming.

Survey Techniques

The survey techniques used are outlined below and their use (due to suitability) within each water body is shown within Appendix 6.

eDNA

To detect the presence/likely absence of great crested newt (GCN) in ponds within a predetermined distance of the site, a single eDNA survey visit of each of the ponds was undertaken by licensed GCN surveyors Lucy Addison MSc BSc (Hons) Grad CIEEM and Sean Crossland BSc BCA MCIEEM on 27th June 2016, following best practice guidance as described by Biggs *et al*. (2014). The equipment required for the eDNA survey, the analysis of water samples, the results and a summary of the appropriate survey, storage and sample return methods were supplied by ADAS (2015).

With the eDNA detection method, it is thought that a negative result will be a strong indication of true absence of GCN, and any individual GCN that is in the pond has a higher likelihood of being detected, even in conditions that are not conducive to traditional sampling (e.g. murky waters). This was tested in the research carried out by Biggs *et al.* (2014). Thomsen *et al*. (2012) demonstrated that GCN DNA in water degrades within 20 days, so a positive result shows that the species has been present recently.

The collection, storage and return of eDNA samples followed the following method (adapted from ADAS, 2015):

Sample Collection

Twenty samples of 30 mL of pond water were collected from around the pond (in the areas already identified as suitable for sampling) using the sampling ladle (fill the ladle). Each of the 20 samples was emptied into the Whirl-Pak bag, filling the Whirl-Pak bag to just under half full. During the pond sampling, a pair of plastic gloves supplied as part of the eDNA sample kit were worn to prevent cross-contamination.

Before each ladle sample was taken, the pond the water column was gently mixed using the ladle to stir the water from the surface to close to the pond bottom, **without** disturbing the mud in the bottom. DNA 'sinks' and so will often be present in larger amounts close to the pond bottom. The collection of sediment within the samples was avoided as this may cause inhibition of the PCR analysis, which could lead to an inconclusive result.

Sample Preservation

Once 20 samples had been collected, the samples were mixed by shaking the Whirl-Pak bag for 10 seconds. This mixed any DNA across the whole water sample. Once the samples were mixed, the second pair of gloves supplied with the eDNA kit were put on to keep the subsequent stages as uncontaminated as possible.

Each conical tube was labelled with the date, the sampler's name, and the pond name along with the sample ID number. Using the clear plastic pipette provided, 15 mL of water was taken from the Whirl-Pak bag, and transferred into one of the six conical tubes containing 35 mL of preserving fluid (i.e. fill tube to the 50 mL mark). The tube was then sealed and shaken vigorously for 10 seconds to mix the sample and preservative thoroughly. This process was repeated for each of the 6 conical tubes in the eDNA kit. Any liquid that had leaked from a tube was wiped away prior to returning the kit to the sample box.

The remaining water from the Whirl-Pak bag was emptied back into the pond.

Returning the Kit

Samples were returned to ADAS at ambient temperature in the original packaging for analysis on 5th July 2016. Storage of samples was necessary prior to their return, and so samples were refrigerated (2-4°C). Samples can be stored in this way for up to 1 month prior to analysis. Results of the analysis were returned to SES on 15th July 2016.

Refugia searches

This method involves experienced surveyors hand searching suitable terrestrial refugia within areas surrounding the water body (refugia includes habitat such as brash piles, rocks).

Pond Habitat Suitability Index (HSI)

The HSI for the great crested newt was developed by Oldham *et al* (2000). An HSI is a numerical index, between 0 and 1. 0 indicates unsuitable habitat, 1 represents optimal habitat. The HSI for the great crested newt incorporates 10 suitability indices, all of which are factors thought to affect great crested newts. The HSI system proposed by Oldham *et al.* is fairly easy to use. However, one suitability index (SI9, terrestrial) involves a more lengthy measurement and calculation than the other factors. During this study a simpler evaluation of terrestrial habitat quality based on a four-point scale was used; this variation was first used by Lee Brady (2008) in Kent.

Habitat Suitability Index Data Collection and Calculation

The HSI is calculated as a geometric mean of the 10 suitability indices (SI) as indicated below:

$$HSI = (SI_1 \times SI_2 \times SI_3 \times SI_4 \times SI_5 \times SI_6 \times SI_7 \times SI_8 \times SI_9 \times SI_{10})^{1/10}$$

The factors used within the scale that are thought to affect great crested newts are:

(i) Geographic locality
(ii) Pond area
(iii) Permanence
(iv) Water quality
(v) Shade
(vi) Waterfowl presence
(vii) Fish presence
(viii) Pond count within 1km^2 of survey pond
(ix) Terrestrial habitat quality
(x) Macrophyte cover

The data regarding each factor is collected in the field at each pond and also by using maps, this is then converted into SI scores on a scale of 0.1 -1.0. The results can then be used to calculate the HSI.

Habitat Suitability Index Applications and Limitations

The HSI for great crested newts is a measure of habitat suitability. It is not a substitute for newt surveys. In general, ponds with high HSI scores are more likely to support great crested newts than those with low scores. However, the system is not sufficiently precise to allow the conclusion that any particular pond with a high score will support newts, or that any pond with a low score will not do so. There is also a positive correlation between HSI scores and the numbers of great crested newts observed in ponds. So, in general, high HSI scores are likely to be associated with greater numbers of great crested newts. The relationship however is not sufficiently strong to allow predictions to be made about the numbers of newts in any particular pond. HSI scoring of ponds can be useful when:

- Evaluating the general suitability of a pond or group of ponds to support great crested newts.

- Comparing ponds across different areas of a site or within the landscape.
- Evaluating the suitability of ponds to be used as receptor sites for great crested newts.
- Planning restorative or enhancement works to ponds.

Categorising Habitat Suitability Index Scores

Lee Brady developed a system of using HSI scores to define ponds suitability for great crested newts on a categorical scale during a study undertaken in south-east England in which 248 ponds were surveyed for great crested newts using standard methods and also subjected to an HSI. The results of this study show that as the HSI score increases, the proportion of ponds occupied also increases, as summarised in the table below:

HSI Range, Associated Pond Suitability and Predicted Presence of Great Crested Newts.

HSI Ranges	Pond Suitability	Predicted Presence of Great Crested Newts
<0.5	Poor	0.03
0.5- 0.59	Below average	0.20
0.6-0.69	Average	0.55
0.7-.0.79	Good	0.79
>0.8	Excellent	0.93

Birds

Breeding Birds

Breeding bird surveys were undertaken by Stephen Parr BSc (Hons) MCIEEM and Darren Denmead BSc (Hons) Grad CIEEM on the 6th and 27th May and 1st June 2016. The survey area included the whole of the area within the application site boundary and adjacent areas that could be surveyed from within the Site, generally covering a buffer perimeter of 10-20m. Thus adjacent field boundaries and other potential bird nesting habitats where birds using the site during the breeding season may nest, and vice versa were generally also included. A transect was walked slowly pausing to record birds heard and observed, covering all areas of the Site within 25m, and route directions were varied between survey visits. Birds flying over and not using the site or surrounding area were recorded separately. All bird locations and behaviour was mapped onto photocopied OS maps (1:5000 scale) using the standard CBC notation.

All survey visits were undertaken during the morning after the dawn period when bird singing intensity tends to be high but stable (Bibby et al. 2000). Survey times and weather conditions can be found in the table below.

Dates and weather conditions of breeding bird survey visits

Visit Number	Date & Time	Survey conditions
1	06/05/2016 08:00 –12:00	V. Good: 17°C, no precipitation, no winds, cloud 1/8, good visibility.
2	27/05/2016 07:00 – 11:30	V. Good: 15°C, no precipitation, low winds, cloud 2/8, good visibility.
3	01/06/2016 07:30 – 12:00	Good: 15°C, slight precipitation, low winds, 4/8, good visibility.

Analysis of mapped bird registrations

Field maps were analysed to determine probable breeding bird registrations relating to different territories and to judge which birds are using the area for breeding or for other activities such as foraging. A probable or definite territory is defined as a cluster of registrations of singing or displaying individuals from more than one visit, or one or more registrations of the following breeding behaviour: disturbance displaying, interspecific aggressive interaction, repetitively alarming, carrying food, nest material or faecal sacs, or if active nests or young were found.

If a singing bird is recorded on just one visit or sight observations of birds are recorded in the same area on more than one visit and are not likely to be associated with any other recorded territories, these are assigned as possible territories. For birds that do not sing, such as many waterfowl, birds present at a location in suitable breeding territory on at least two visits are assigned to probable territories. Presence of such species in suitable breeding habitat on a single visit is assigned to possible territories unless the possibility of nesting is considered negligible by the observer.

This process is open to subjectivity in interpretation except where active nests are located. Therefore, these territories are classed as putative and their mapped locations indicate the 'centre' of a territory and not necessarily the nesting location. The maps were analysed to determine the number of probable and possible territories or pairs of each species present.

Wintering Birds

The wintering bird survey method is a derivation of standard breeding bird survey methodology (Gilbert *et al*. 1998) visiting the site three times through the wintering period, between November 2016 and March 2017. During the surveys a transect was walked slowly pausing to record birds heard and observed, covering all areas of the site within 25m, and route directions were varied between survey visits. Birds flying over and not using the site or surrounding area were recorded separately. All bird locations and behaviour was mapped onto photocopied OS maps (1:5000 scale). Dr Matthew Denny MCIEEM made the first survey visit on 16th November 2016, in suitable weather conditions. Dr Denny and Darren Denmead undertook a second survey on 26th January and a final visit on the 24th February 2017. Survey visit times have been coordinated with local tides, to ensure that a variety of tidal conditions are covered, as this is likely to be the most important daily variable to effect wintering bird use of the site (e.g. duck, geese and waders from the nearby Deben Estuary are most likely to use the site during high tide, when the intertidal feeding grounds are inaccessible). As the site does not support wintering bird habitats of potentially high significance (e.g. no large areas of semi-natural or wetland habitats), three visits are believed sufficient to determine the usage by wintering birds at this site.

A scoping exercise identified the grassland of the BT testing area to be the most likely area used by brent geese and potentially other waterfowl. To monitor the use of this grassland, two passive infrared trail cameras (Little Acorn Lt5210A) were installed along the southern field boundary near the east and west ends respectively. These were left in situ to remotely record use of the grassland by birds, with the particular aim of recording any diurnal and/or nocturnal waterfowl activity.

The survey effort also included a scoping visit of the nearby European Designated Sites in order to establish wintering birds utilising the local designated sites and assess any correlations between these and the proposed development site, which are discussed further within the Habitat Regulation Assessment (HRA).

Assessment Methodology for both Breeding and Wintering Birds

The assessment methodology for this report follows the "Guidelines for Ecological Impact Assessment" developed by the Institute of Ecology and Environmental Management (IEEM 2006).

Valuing ecological features and resources

The IEEM Guidelines recognise that ecological evaluation is a 'complex and subjective process' but provides key considerations to apply when 'applying professional judgement to assign values to ecological features and resources'.

In this chapter, all ecological resources or features are assigned to a value relating to their geographic frame of reference, using the following scale:

- International
- UK
- National (England)
- Regional (Southeast)
- County (Surrey)
- District (Waverley)
- Local or parish including the immediate zone of influence of the site.

Focusing on assessments of biodiversity value, there are various characteristics that can be used to identify ecological resources or features that are likely to be important in terms of biodiversity. The following factors have been considered when assessing the conservation value of the breeding bird resource:

- Species diversity
- The presence of species or populations of general nature conservation importance
- The presence of locally, regionally or nationally rare species.

The methods by which these factors have been assessed are detailed below.

Species diversity

The number of species present is a simple and effective measure of diversity that can be used to describe conservation value separately for breeding, passage and wintering bird assemblages. Fuller (1980) provided the following criteria for breeding birds where the number of species found breeding in an area can be given a value as shown below:

Criteria used to define importance of breeding bird assemblages

National	Regional	County	Local
85+	84-70	69-50	49-25

The application of this approach to assemblages of County importance or lower requires some care as there is no provision for assessment at the District or Parish scale. It is assumed that an assemblage comprising between 49-25 equates to District importance, and fewer than 25 species is only of importance at the Parish/Local level.

Since the publication of this method, further declines have occurred in many bird populations, and for this reason it is probably legitimate to recalibrate the categories slightly downwards.

Species of conservation importance

Criteria for the assessment of species of conservation importance are draw from the following:

- Birds of Conservation Concern (BoCC) listings (Eaton *et al.*, 2015). The red list currently contains 52 species in need of urgent conservation action. Breeding and non-breeding species are included. Criteria for inclusion in the red list are species whose UK populations declined by more than 50% during 1984-09 or during 1969-2009, or whose UK population has experienced a historical (1800-1995) decline, or globally threatened species regularly occurring in the UK. The amber list contains 126 species. The criteria for inclusion for species

in the amber list are those whose UK populations declined by 25-49% during 1984-09 or during 1969-2009, or whose UK population is restricted or small, or are present in internationally important numbers in the UK, or Species of European Conservation Concern.

- Wildlife and Countryside Act (1981) and the Birds Directive (1979). Species listed under Section 1 of the 1981 Act are specially protected by law and species listed on Annex 1 to the 1979 Directive on the Conservation of Wild Birds (79/409/EEC) are recognised for their international conservation importance.
- Biodiversity Action Plan Species. The Convention on Biological Diversity, one of several major initiatives stemming from the 'Earth Summit' in Rio de Janeiro, Brazil in 1992, led to the UK Government setting out a broad strategy for the conservation and enhancement of wildlife species and habitats through the UK Biodiversity Action Plan (BAP) (The Biodiversity Partnership 2005 & 2006). Twenty six bird species were identified as species of principal importance for the purpose of conserving biodiversity and requiring urgent conservation action within the UK BAP. A review of the UK BAP in August 2007 has identified a further 32 bird species or subspecies of principle conservation importance giving a total of 58. The statutory basis for the habitats and species listed in BAPs is provided by Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 which places a duty on the Secretary of State to take steps and promote the taking of steps by others, to further the conservation of the habitats and species on the list.
- Natural Environment and Rural Communities Act 2006. The BAP lists form the basis of the list of species and habitats considered to be of principal importance for the purpose of conserving biodiversity that has been drawn up as directed by Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006. This places a duty on the Secretary of State to take steps, and to promote the taking of steps by others, to further the conservation of the habitats and species on the list.
- Both the National Planning Policy Framework (2012) (NPPF) and the Circular 06/05 Biodiversity and Geological Conservation - Statutory Obligations and Their Impact Within the Planning System (2005) present guiding principles that those species identified as being of principal importance for the purpose of conserving English biodiversity should be protected from the adverse effects of development through the planning system. The conservation of these species should be promoted through the incorporation of beneficial biodiversity designs within developments.
- Populations of conservation importance. The generally accepted criterion is that the presence on a site of a bird species' population of over 1% of the total geographical resource is significant at the international or national scale. A similar approach has been taken in this report to assess the importance of populations at the Regional, County, District or Local scale. At the National and Regional scale evaluations have been judged using population estimates published in Baker *et al.* (2006) and information in Gibbons *et al.* (1993).

Rare species

The generally accepted criterion is that species with fewer than 1000 pairs breeding in the UK are described as Nationally Rare. There is no formal definition for a rare non-breeding bird species or breeding birds in a regional or local context. However, if such species are present they are likely to fall within the criterion for populations of conservation importance as outlined above.

Characterising and quantifying effects and assessing their significance

The CIEEM Guidelines state that ecological effects should be characterised in terms of ecosystem structure and function and reference should be made to: positive or negative effects; extent; magnitude; duration; reversibility; timing and frequency; and cumulative effects. The guidelines provide a list of 'key aspects of ecosystems to consider when predicting effects'. Whilst this proposal does not require a formal Ecological Impact Assessment (EcIA), this report quantifies the effects in a comparable way.

Following the characterisation of effects, an assessment of the ecological significance of an effect is made. Prior to the publication of the current Guidelines in 2016, ecological significance was defined using a matrix in which ecological value and magnitude of effect were combined to determine different grades of significance; usually high, medium or low. The guidance now advises that assigning levels of significance in this way obstructs a clear understanding of the EcIA process and can result in an assessment that lacks rigour (IEEM, 2005). The Guidelines promote a more transparent approach in which a beneficial or adverse effect is determined to be significant or not, in ecological terms, in relation to the integrity of the defined site or ecosystem(s) and/or the conservation status of habitats or species within a given geographical area, which relates to the level at which it has been valued. The decision about whether an effect is significant or not, is independent of the value of the ecological feature; the value of any feature that will be significantly affected is then used to determine the implications, in terms of legislation, policy and/or development control. (IEEM, 2005).

The Guidelines also state that: 'Significant effects on features of ecological importance should be mitigated (or compensated for) in accordance with guidance derived from policies applied at the scale relevant to the value of the feature or resource' and that: 'Any significant effects remaining after mitigation (the residual effects), together with an assessment of the likelihood of success in the mitigation, are the factors to be considered against legislation, policy and development control in determining the application' (IEEM, February 2016).

Badger

Presence/Likely Absence Survey

Badger surveys can be undertaken anytime, but ideally outside of the summer months when vegetation is dense. They are best undertaken when vegetation is low in February and April; which also coincides with a peak in territorial activity. A second peak in activity occurs in October but vegetation can potentially hinder the location of setts in dense vegetation.

The survey consisted of a review of aerial photographs and a detailed systematic walkover survey, with particular attention being paid to areas where vegetation and/or topography offered suitable sett sites. The badger signs looked for were:

- Setts,
- Prints,
- Badger runs,
- Hairs,
- Latrines,
- Scratching posts, and
- Snuffle marks.

The walkover survey was undertaken on the in October and November 2016, and January 2017, when the weather conditions were dry and with good visibility. Surveys were undertaken by Lucy Addison BSc (Hons) MSc Grad CIEEM, Ella Barnett BSc (Hons) ACIEEM, Mark Poynter BSc (Hons) and Katie Mann. In addition, a team of qualified IRATA personnel (Level 1) Mark Poynter BSc (Hons) and Stuart Pankhurst MSc BSc DipIC MCIEEM assessed the [redacted] using rope access techniques, to assess the slopes for potential badger setts and/or badger field signs.

All accessible holes were examined to determine if they were or ever had been badger setts. The number of entrances and levels of use were recorded and the sett was classified according to the criteria used in the National Badger surveys (Harris *et al*. 1989). The classification criteria are given below:

- **Main setts** – a large well established, often extensive and in continuous use. There is only one main sett per social group of badgers. This is where the cubs are most likely to be born.

- **Annexe setts** – occur in close association with the main sett and are linked to the main sett by clear well-used paths. If a second litter of cubs are born, they will be reared here.
- **Subsidiary setts** – these often have 3-5 holes and are normally over 50m from a main sett and are not linked by clear paths. These setts are not continually active.
- **Outlying setts** – these usually have 1-3 holes, have small spoil heaps and are sporadically used. Foxes and rabbits may move in.

An assessment of the activity of each sett was undertaken; the following categories were assigned to the entrance holes to make this assessment:

- **Well-used**: Entrances clear of debris and vegetation and are obviously well used.
- **Partially-used**: Entrances are not in regular use and have debris such as leaves or twigs across the entrances. These holes could come into regular use with minimal clearance.
- **Disused**: Entrances have not been used for some time, are partially or completely blocked. There may be a depression in the ground where the hole used to be.

Natural England define a badger sett as the system of tunnels and chambers, in which badgers live, and their entrances and immediate surrounds or to other structures used by badgers for shelter and refuge. More specifically the 1992 Act says that these structures and places must show signs indicating current use by a badger. 'Signs indicating current use' are those such as fresh spoil heaps and clear entrances.

Assessment of Territory Size and Population Density

Badger territories are likely shaped by the dispersion of food resources (Kruuk & Parish, 1982) as it is known that badgers often feed in patches, where food resources are more easily obtained. We know that badgers may live within a territory that contains a significant earthworm biomass, but there is no correlation between earth worm biomass (most important badger food resource in England) and badger group size as the earth worms may not be accessible. For instance they may be present in high numbers within arable fields, where it is difficult to extract them. Certain habitats constitute high quality foraging habitat, especially deciduous woodland, the base of hedgerows and close grazed pasture as earth worm biomass is high and extracting them is relatively easy (Hoffer, 1988). Thus if a small proportion of earth worm rich habitat is present in a territory, large quantities of other habitat types are also included.

Invertebrate Survey

Field Sampling

Sampling was mainly undertaken at discrete sampling stations, seven in total. The sampling stations were decided upon following a preliminary walkover and with reference to the phase 1 habitat survey; these stations were located in areas considered to be of highest likely value and to ensure a good representation of the highest value habitats on the site. These stations were sampled on: 06 June, 4 July, 26 July, 12 August and 27 September 2016, with sampling on each visit 40-minutes of sampling was undertaken, divided as hand searching and sweep netting. Sampling covered all of the taxa considered necessary for a robust assessment of such habitats (following Drake et al., 2007), including the major families of beetles and flies, bees and wasps and plant bugs. Additionally, on 14 June 2016 a more widespread survey was undertaken, sampling an additional 12 stations for 10-minutes, mainly by sweep and spot netting with the main focus being the flies and bees and wasps; this survey was intended to provide a rapid assessment of a wide part of the site. The fieldwork was mainly undertaken by Dr Graham Hopkins MCIEEM FRES but with assistance from Dr Jit Thacker (6 June 2016). Identifications of specimens was undertaken by Drs Hopkins and Thacker. Appendix 7 provides the locations and photographs of sampling sites.

ISIS Analysis

Species lists were analysed using the Invertebrate Species-habitat Information System (hereafter 'ISIS') Natural England (Drake *et al.,* 2007). This package provides standardised descriptions for a species habitat requirements:

- Broad Assemblage Type describing the broad association of a species, and;
- Specific Assemblage Type for species with greater specialisation, which are only found in a specific sub-set or type of a Broad Assemblage Type (although the majority of species are generalists and do not have a Specific Assemblage Type).

Species of conservation concern are defined as: protected species, those satisfying rare or scarce criteria (Red Data Book or Nationally Scarce), and/or those listed as Species of Principal Importance as described in the table below.

Summary of conservation statuses for invertebrates (see Drake et al., 2007 for full definitions).

Conservation Status	Definition
Red Data Book species	Species occurring in fewer than 16 10-km squares of the National Grid, divided as: Endangered (Red Data Book 1), for species known from a single population or in continuous recent decline and now known from five or fewer 10-km squares; Vulnerable (Red Data Book 2), likely to become Endangered (Red Data Book 1) if causal factors continue; Rare (Red Data Book 3), species at risk but not qualifying as Vulnerable.
Nationally Scarce	For simplicity the term Nationally Scarce is used even where the formal classification of a species is Nationally Notable. Both Nationally Scarce and Nationally Notable status apply to species known or likely to be present within 16 to 100 10-km squares of the National Grid; for a number of species this is further refined as –A or –B according to range: –A is assigned to species thought to occur in 30 or fewer 10-km squares of the National Grid; and –B for species thought to occur in 31 to 100 10-km squares of the National Grid
Species of Principal Importance	Those species listed on Section 41 of the National Environment and Rural Communities Act, 2006. Included on the list are a number of species afforded the status due to recent population declines while nevertheless remaining widespread (Butterfly Conservation, 2007)

Evaluation

For invertebrates, the frame of reference is as described above with the evaluation following the criteria proposed by Colin Plant Associates (2006). Also available is the output from ISIS, which provides scores for broad and specific assemblage types with thresholds for determining 'favourable' status that is broadly equivalent to assemblages of Site of Special Scientific Interest (SSSI) quality or national value.

The criteria used to define significance of invertebrate habitats.

Significance	Description	Minimum qualifying criteria
National	UK important site	Achieving SSSI invertebrate criteria or containing RDB2 (Vulnerable) or containing viable populations of RDB 3 (Rare) species or containing viable populations of any species protected under UK legislation or containing habitats that are threatened or rare nationally
Regional	Site with populations of invertebrates or invertebrate habitats considered scarce or rare or threatened in south-east England	Habitat that is scarce or threatened in the region or which has, or is reasonably expected to have, the presence of an assemblage of invertebrates including at least ten Nationally Notable species or at least ten species listed as Regionally Notable for the English Nature region in question in the Recorder database or elsewhere or a combination of these categories amounting to ten species in total
County	Site with populations of invertebrates or invertebrate habitats considered scarce or rare or threatened in the county in question	Habitat that is scarce or threatened in the county and/or which contains or is reasonably expected to contain an assemblage of invertebrates that includes viable populations of at least five Nationally Notable species or viable populations of at least five species regarded as Regionally Scarce by the county records centres and/or field club
District	Site with populations of invertebrates or invertebrate habitats considered scarce or rare or threatened in the administrative District	A rather vague definition of habitats falling below county significance level, but which may be of greater significance than merely Local. They include sites for which Nationally Notable species in the range from 1 to 4 examples are reasonably expected but not yet necessarily recorded
Local	Site with populations of invertebrates or invertebrate habitats considered scarce or rare or threatened in the affected and neighbouring Parishes	Habitats or species unique or of some other significance within the local area
Low Significance	_	Although almost no area is completely without significance these are the areas with nothing more than expected 'background' populations of common species and the occasional Nationally Local species

Reptiles

To detect presence or likely absence, a seven visit survey is recommended (Froglife, 1999). Seven survey visits were undertaken during 'suitable' days for reptile activity by Christopher Horley BSc (Hons), Katie Mann, Russell Mansfield MSc BSc (Hons) and Rachel Geller BSc (Hons) between August and September 2016. A 'suitable' survey day is determined by the weather, with temperature being the pre-eminent factor.

Refugia were laid in suitable habitat using the surveyor's professional judgement. This assessment allowed an assessment of the carrying capacity of these habitats. As density dependence often plays a role in population size (Massot *et al.*, 1992), this information will guide the mitigation and compensation measures.

Refugia were laid at a density of 10 per hectare in suitable habitat, as per best practice guidance (Froglife, 1999). Reptile refugia (0.5m x 0.5m felt squares and corrugated tin) were used to observe reptiles basking or taking refuge, these were laid in transects and left for seven days to settle before the survey commenced. Appendix 8 shows the indicative refugia positions. If presence was detected a categorical population assessment would be carried out with the largest count within the first seven visits indicating the category (Low, Good, Exceptional) of the recorded reptile species. This survey methodology is recognised as best practice by Froglife (1999) and the Herpetofauna Worker's Manual (Gent & Gibson, 2003).

As described above, following guidelines set out by Froglife (1999) it is possible to make an assessment of the population size using the maximum number of adult animals seen per survey visit. This method is based on refuges being placed at a density of up to 10/ha. The table below details the assessment categories:

Froglife Population Class Assessment for Reptiles.

Species	Low Population	Good Population	Exceptional Population
Common Lizard	<5	5-20	>20
Slow-Worms	<5	5-20	>20
Grass Snake	<5	5-10	>10
Adder	<5	5-10	>10

Ambient air temperature is an essential factor for reptile surveys after suitable habitat has been located. Reptile surveys conducted between 10 and 17 degrees centigrade have the most chance of success. The key months for reptile surveys are April, May and September with April and May being advantageous because it is reptile mating season, which means they will be more obvious and less wary of observers. Also the temperatures are generally lower during these months and as such it will take longer for the reptiles to warm up so they must spend more time basking. During the warmer summer months animals will have to spend less time basking due to the increase in ambient temperature, thus reptile survey visits will be conducted earlier in the day during the hotter summer months. However the temperature on the day of the visit will ultimately determine what time the survey takes place.

Small and Medium-sized Mammals

The Phase 1 survey undertaken in 2016 identified habitats on site which may have the potential to support small mammals listed as UK BAP priority species and as species of principle importance under section 41 of the Natural Environment and Rural Communities (NERC) act 2006. As such a survey for BAP mammals was undertaken on the subsequent Phase 2 surveys by or supervised by suitably qualified ecologist Lucy Addison BSc (Hons) GradCIEEM.

The presence/likely absence of these species (European hedgehog, brown hare and harvest mice) has been determined using incidental surveying during numerous site visits following Cresswell *et al*. (2012) survey methodology, including early morning and evening ecological surveys such as bats, reptiles and breeding birds.

European Hedgehog

Records of hedgehogs within the vicinity of the study area were analysed in addition to spotlight surveys at night using a powerful lamp and scanning the ground either side as the observer walks along habitats used by hedgehogs (e.g. woodland edges and short grass). Occasional pauses to listen for rustling are useful. Cold and/or wet nights are less productive than warm nights. In addition survey for potential nesting sites (i.e. brushwood piles, sprawling brambles as well as underground in burrows, tree stumps or natural cavities) and materials (medium sized deciduous leaves i.e. oak leaves) are vital features, with an absence of sheltering supportive structures suggesting an absence of hedgehogs.

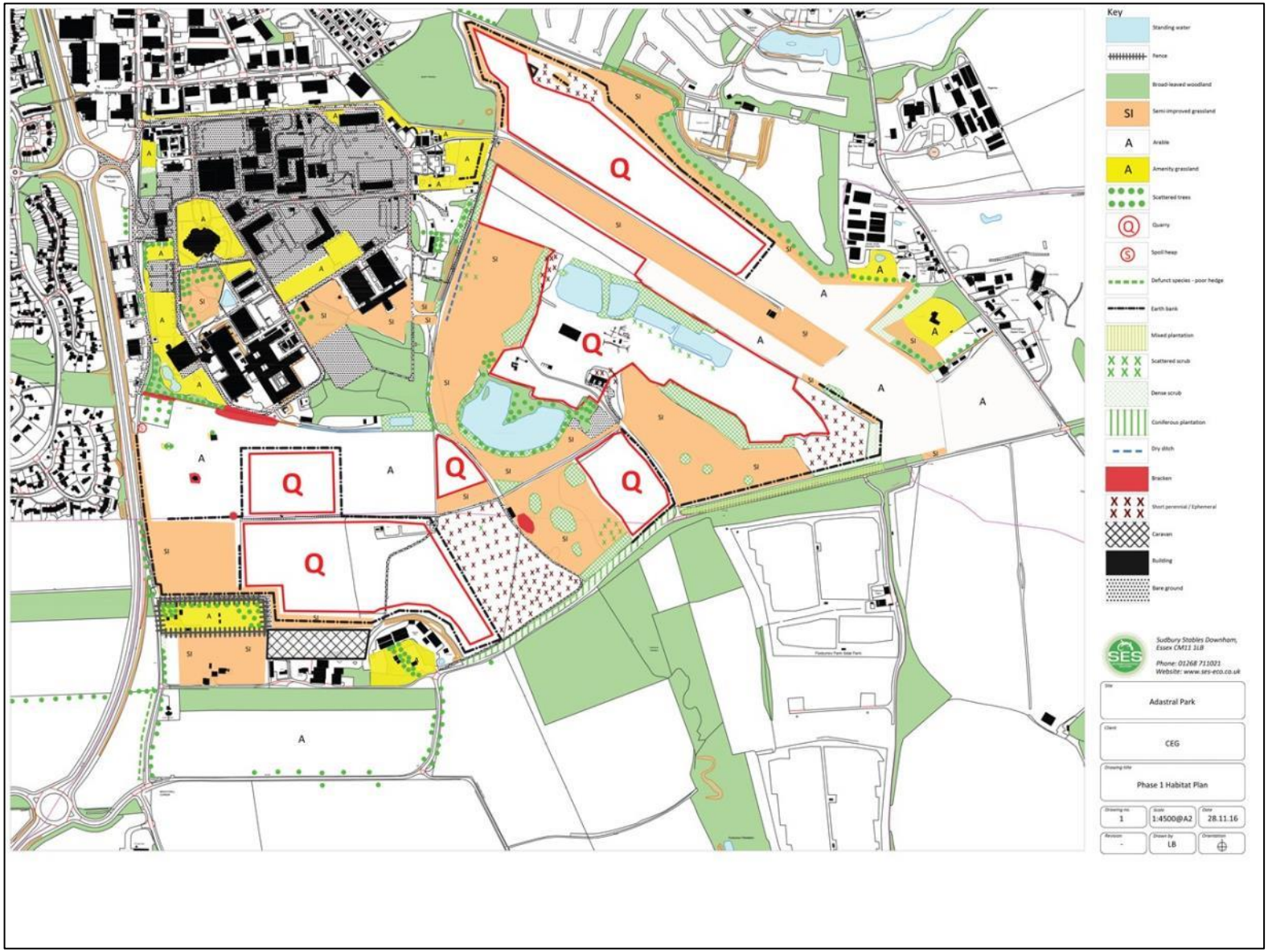
Brown Hare

Brown hares prefer open landscapes where they can evade predators more easily. Hares do not shelter in burrows. Instead they make small depressions in the ground (known as forms), usually alongside hedgerows or within long grass. Their diet consists of grasses, herbaceous plants and cereal crops. A desk top data search for brown hare was undertaken alongside spotlight searches just before dusk and just after dawn. Searches for droppings (hard, round or slightly flattened pellets, about 1cm across) are also useful. Hare surveys are best undertaken in late winter/early spring when vegetation cover is at its lowest and thus hares are at their most visible.

Harvest Mice

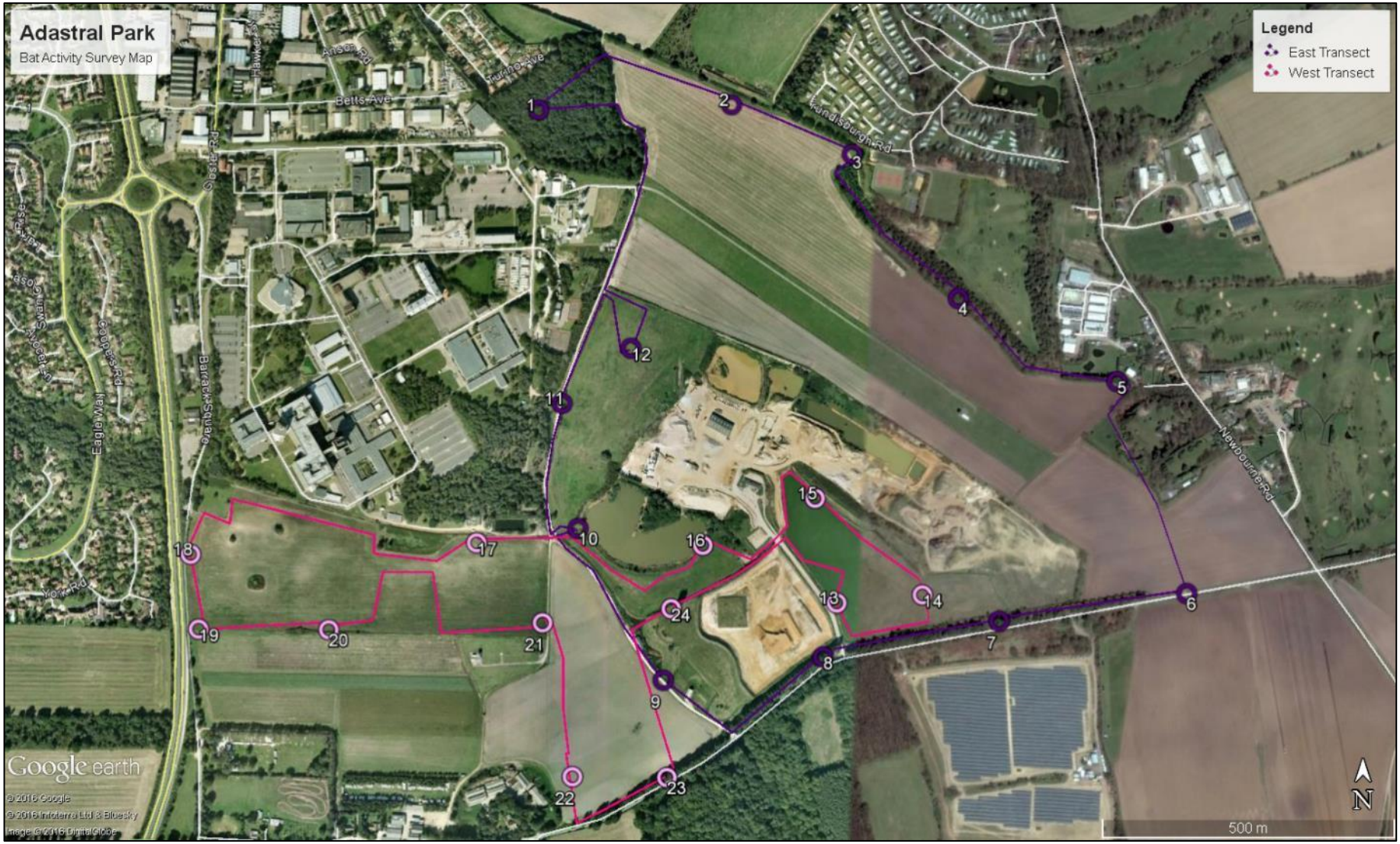
Breeding nests are the most obvious sign indicating the presence of harvest mice and they are the only British mammal to build nests of woven grass well above ground. Nests tend to be found in dense vegetation such as grasses, rushes, cereals, grassy hedgerows and brambles.

Appendix 4: Phase 1 Habitat Survey Map

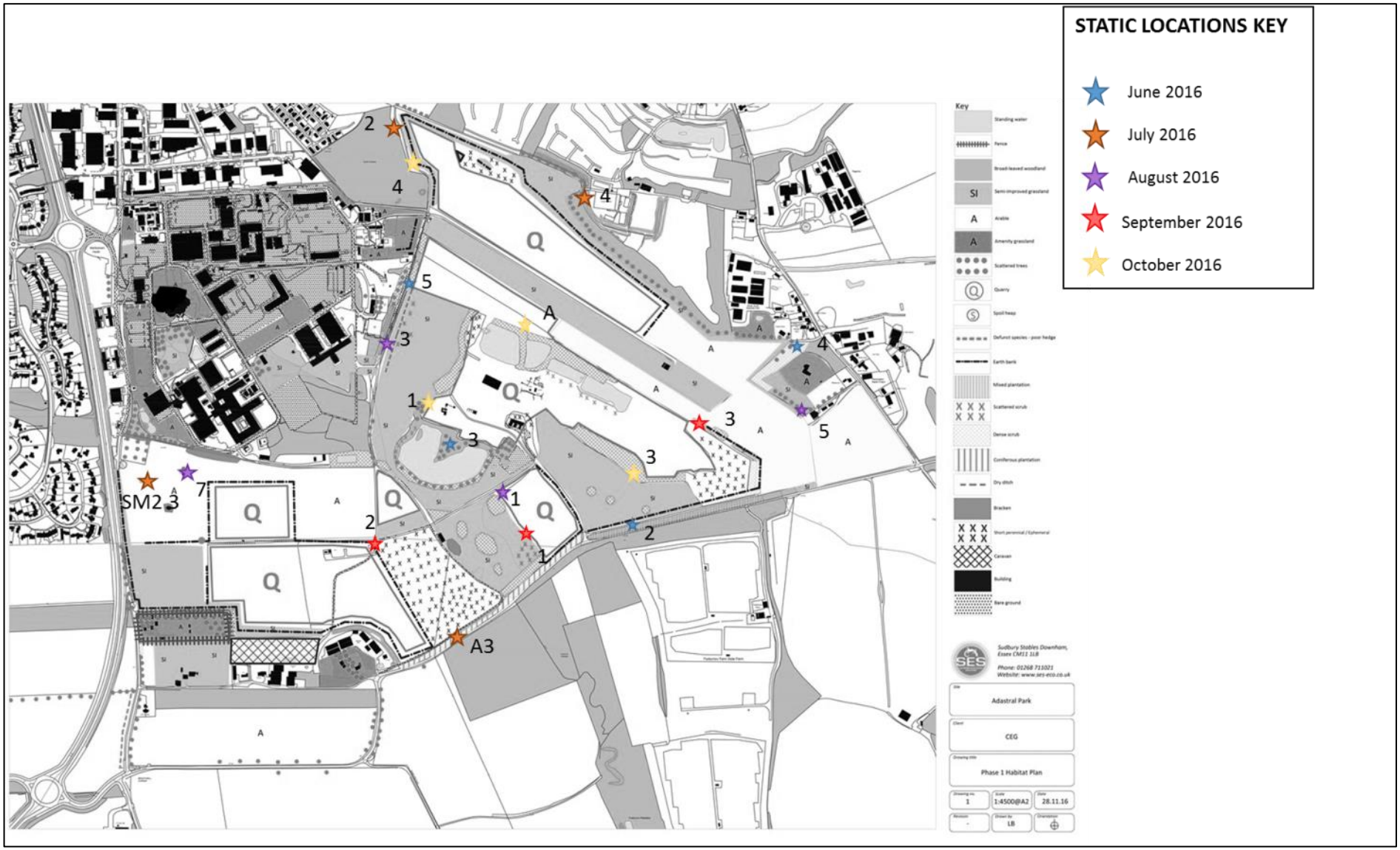


Appendix 5: Bat activity survey locations

Bat Activity Transects



Automated Detector Locations

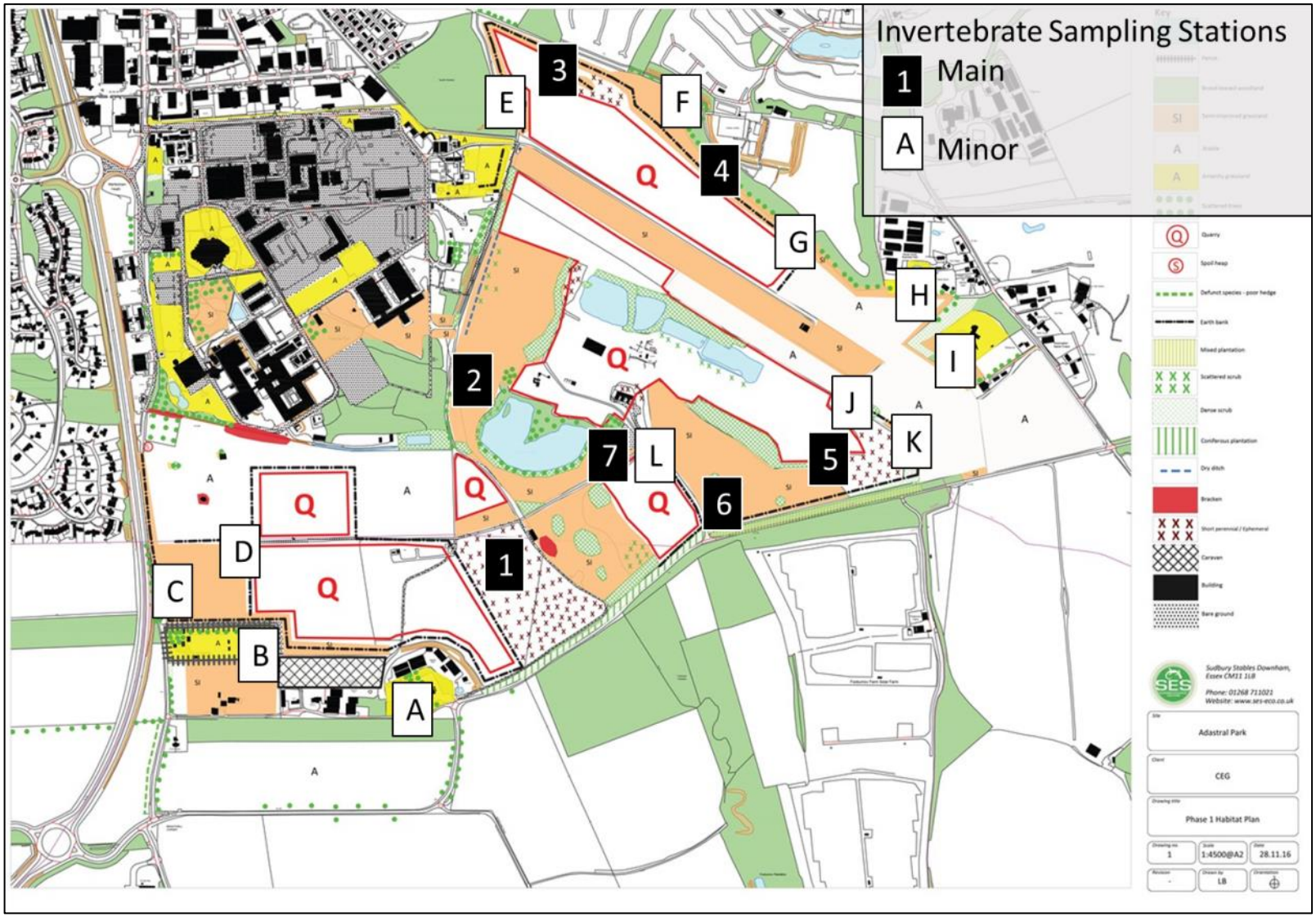


Appendix 6: Ponds surveyed for GCN

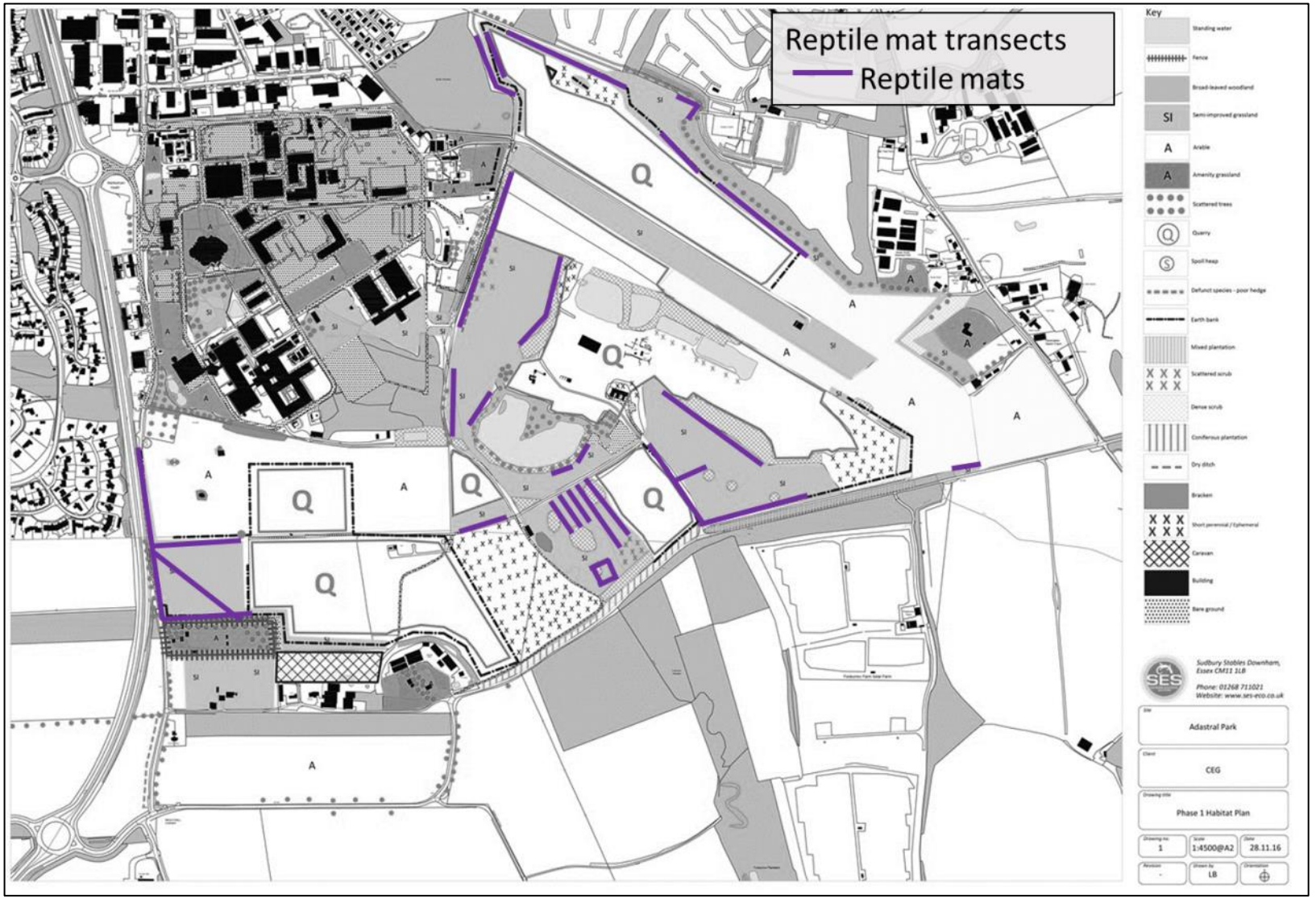
Pond Map

Ponds subject to eDNA survey

Appendix 7: Locations of invertebrate sampling sites

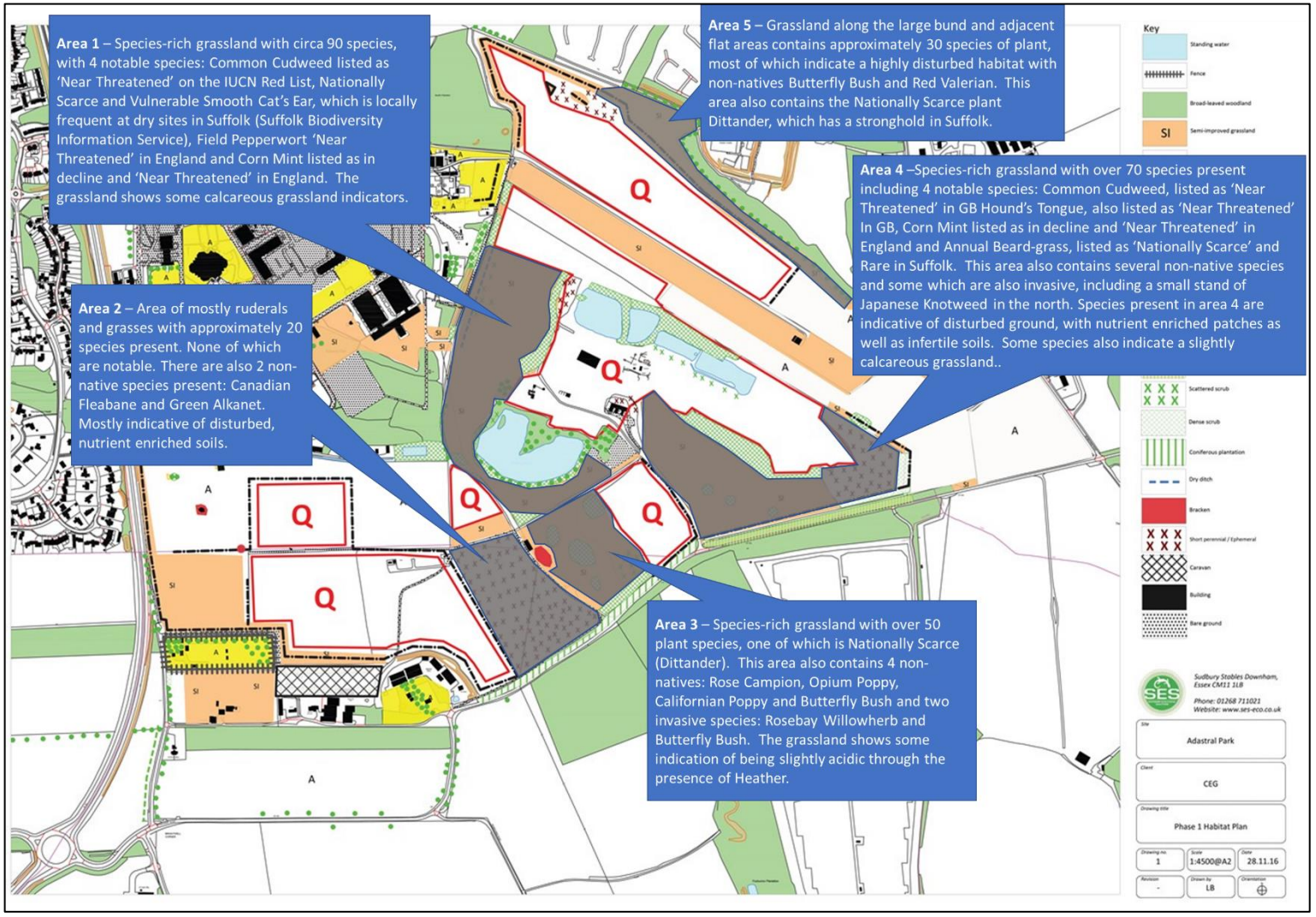


Appendix 8: Reptile refugia locations



Appendix 9: Botanical survey results

Grassland locations



Botanical survey species list

Surveys recorded only native and naturalised species within the site. Plants listed below are those identifiable at time of survey and the following lists should not be regarded as a complete.

The relative abundance of each species is indicated using the 'dafor' system where:
d = dominant, a = abundant, f = frequent, o = occasional and r = rare.
The prefix 'l' indicates 'locally' e.g. ld = locally dominant.

Presence of species protected under the Wildlife and Countryside Act 1981 (WCAct); England Red List (ERL) ('vulnerable' and above); the (draft) Surrey Rare Plant Register (SRPR) ('scarce' and above); and Non-native invasive species (NNI) are indicated in the *status* column.

Nomenclature follows New Flora of the British Isles by Clive Stace (2nd edition 1997).

Common Name	***Scientific Name***	**Area 1**	**Area 2**	**Area 3**	**Area 4**	**Area 5**	**Significance**
Yarrow	*Achillea millefolium*	O		O	O		
Common bent	*Agrostis capillaris*	A	O		O	O	
Creeping bent	*Agrostis stolonifera*	O		O	O		
Common fiddleneck	*Amsinckia micrantha*	O	O				Weed
Pyramidal orchid	*Anacamptis pyramidalis*	R			R		
Scarlet pimpernel	*Anagallis arvensis*	O		O			
Barren brome	*Anisantha sterilis*	O					
Cow parsley	*Anthriscus sylvestris*	O					
Fool's water-cress	*Apium nodiflorum*	O					
Lesser burdock	*Arctium minus agg*			O		O	
Burdock species	*Arctiumsp.*		O				
False oat-grass	*Arrhenatherum elatius*	O		A	O	O	
Mugwort	*Artemisia vulgaris*	O		O	O	O	
Black horehound	*Ballota nigra*	O					
Daisy	*Bellis perennis*	O					
Sea beet	*Beta vulgaris*	O					
Soft brome	*Bromus hordeaceus*	O	O			O	
Butterfly bush	*Buddleja davidii*	O		O		O	Invasive non-native
Heather	*Calluna vulgaris*			R			Acidic grassland indicator
Nodding thistle	*Carduus nutans*	O	O		O		
Slender	*Carduus tenuiflorus*			O	O		

Common Name	*Scientific Name*	Area 1	Area 2	Area 3	Area 4	Area 5	Significance
thistle							
Pendulous sedge	*Carex pendula*				O		
Spiked sedge	*Carex spicata*	O					
Common centaury	*Centaurium erythraea*	O			O		Chalk, limstone and heathland + typical of quarries
Red valerian	*Centranthus ruber*				O	O	Alien
Common mouse-ear	*Cerastium fontanum*	O					
Rosebay willowherb	*Chamerion angustifolium*			O	O	O	Invasive
Fat-hen	*Chenopodium album*					O	
Creeping thistle	*Cirsium arvense*	O		O	O	O	
Spear thistle	*Cirsium vulgare*				O		
Hemlock	*Conium maculatum*	R	O	O	O		
Larkspur	*Consolida ajacis*				O		Alien
Field bindweed	*Convolvulus arvensis*	O			O		
Canadian fleabane	*Conyza canadensis*		O		O		Alien
Dogwood	*Cornus sanguinea*				O		
Buttonweed	*Cotula coronopifolia*			O			Naturalised
Smooth hawk's-beard	*Crepis capillaris*					O	
Hawk's-beard sp.	*Crepis sp.*				O		
Beaked hawk's-beard	*Crepis vesicaria*		O				
Rough dog's-tail	*Cynosurus echinatus*	O			O		Established alien
Hound's Tongue	*Cynoglossum officinale*				R		IUCN Red List as Near Threatened in GB. Stated as 'declining but widespread' in the Suffolk Rare Plant Register (Suffolk Biodiversity Information Service)
Galingale	*Cyperus longus*	O					
Broom	*Cytisus scoparius*	O			O		
Cock's-foot	*Dactylis glomerata*	O		O	O	O	
Teasel	*Dipsacus fullonum*	O			O		
Viper's-bugloss	*Echium vulagre*	O					
Common couch	*Elytrigia repens*		O	O	O	O	
Broad-leaved willowherb	*Epilobium montanum*	O	O		O	O	

Common Name	*Scientific Name*	Area 1	Area 2	Area 3	Area 4	Area 5	Significance
Horsetail species	*Equisetum sp.*	O					
Common stork's-bill	*Erodium cicutarium*	O		O			
California poppy	*Eschscholzia californica*			O			Alien
Spurge species	*Euphorbia sp.*				O		
Sheep's-fescue	*Festuca ovina*				O		May indicate semi-improved / unimproved
Red fescue	*Festuca rubra agg*				A	A	
Common cudweed	*Filago vulgaris*	O			O		IUCN Red List as Near Threatened in GB. Stated as 'declining but widespread' in the Suffolk Rare Plant Register (Suffolk Biodiversity Information Service)
Fennel	*Foeniculum vulgare*	O					
Cleavers	*Galium aparine*	O					
Cut-leaved crane's-bill	*Geranium dissectum*	O		O			
Dove's-foot crane's-bill	*Geranium molle*	O		O		O	
Hogweed	*Heracleum sphondylium*			O			
Yorkshire fog	*Holcus lanatus*	A	O	O	O	O	
Wall barley	*Hordeum murinum*					O	
Perforate St. John's wort	*Hypericum perforatum*	O		O	O		
Smooth cat's-ear	*Hypochaeris glabra*	R					Nationally scarce and Vulnerable. Although locally frequent in Suffolk in dry sites in Sandlings and Breck (Suffolk Biodiversity Information Service).
Cat's ear	*Hypochaeris radicata*			O			
Yellow iris	*Iris pseudacorus*	O					
Hard rush	*Juncus inflexus*	O					
Great lettuce	*Lactuca serriola*	O			O	O	
Nipplewort	*Lapsana communis*				O		
Grass vetchling	*Lathyrus nissolia*	R					
Meadow vetchling	*Lathyrus pratensis*	O					
Field pepperwort	*Lepidium campestre*	R					Near Threatened in England. Least concern for GB
Dittander	*Lepidium latifolium*			O		O	Nationally Scarce. Suffolk has a significant proportion of the national population

Common Name	*Scientific Name*	Area 1	Area 2	Area 3	Area 4	Area 5	Significance
Oxeye daisy	*Leucanthemum vulgare*	O			O		
Perennial rye-grass	*Lolium perenne*	O					
Bird's-foot trefoil	*Lotus corniculatus*	O					Neutral and calcareous grassland
Rose campion	*Lychnis coronaria*			O			Alien
Musk mallow	*Malva moschata*	O					
Common mallow	*Malva sylvestris*	O	O	O	O	O	
Spotted medick	*Medicago arabica*	R			O		
Sand lucerne	*Medicago sativa subsp. varia*				O		
Corn Mint	*Mentha arvensis*	O			O		In decline and 'Near Threatened' in England. Least concern for GB.
Field forget-me-not	*Myosotis arvense*				O		
Evening-primrose species	*Oenothera sp.*	O			O		Invasive / Alien
Cotton thistle	*Onopordum acanthium*				O		Archaeophyte
Bee orchid	*Ophrys apifera*	R			R		Red data book listed as 'Least Concern' & on CITES convention
Common poppy	*Papaver rhoeas*				O		
Opium poppy	*Papaver somniferum*	O		O	O		Alien
Poppy species (Native)	*Papaver sp.*	O	O	O			
Wild parsnip	*Pastinaca sativa subsp. sylvestris*				O		
Green alkanet	*Pentaglottis sempervirens*	R	O				Alien can become invasive
Butterbur	*Petasites hybridus*				O		Red data book listed as 'Least Concern'
Common reed	*Phragmites australis*				O		
Bristly oxtongue	*Picris echioides*	O			O	O	
Ribwort plantain	*Plantago lanceolata*	O		O	O	O	
Poa Grass species	*Poa sp.*	O			O		
Rough meadow-grass	*Poa trivialis*	O					

Common Name	*Scientific Name*	Area 1	Area 2	Area 3	Area 4	Area 5	Significance
Annual Beard-grass	*Polypogon monspeliensis*				R		Nationally scarce and rare in Suffolk
Creeping cinquefoil	*Potentilla reptans*	O			O		
Selfheal	*Prunella vulgaris*	O		O	O		
Bracken	*Pteridium aquilinum*	R		O			
Common fleabane	*Pulicaria dysenterica*	O	O				Damp or wet open habitats
Creeping buttercup	*Ranunculus repens*	O		O			
Weld	*Reseda luteola*	O	O	O	O	O	
Bramble	*Rubus fruticosus agg.*	O			O	O	
Curled dock	*Rumex crispus*	O		O	O	O	wasteland and coastal habitats
Wood dock	*Rumex sanguineus*	O					
Elder	*Sambucus nigra*			O			
Biting stonecrop	*Sedum acre*	O					Sandy soils
Common ragwort	*Senecio jacobaea*	O	O	O	O	O	Notifiable weed subject to statutory control
Red campion	*Silene dioica*			O			
White campion	*Silene latifolia*	O		O	O	O	
Milk Thistle	*Silybum marianum*				O		
Hedge mustard	*Sisymbrium officinale*			O			
Perennial sow-thistle	*Sonchus arvensis*		O	O			
Smooth sow-thistle	*Sonchus oleraceus*	O		O	O		
Sow-thistle species	*Sonchus sp.*		O				
Hedge woundwort	*Stachys sylvatica*			O			
Lesser stitchwort	*Stellaria graminea*	O		O			
Common chickweed	*Stellaria media*		O				Red data book listed as 'Least Concern'
Greater chickweed	*Stellaria neglecta*	O					
Tansy	*Tanacetum vulgare*			O			
Dandelion	*Taraxacum officinale agg.*					O	
Salsify	*Tragopogon porrifolius*				R		Established alien
Hares-foot clover	*Trifolium arvense*	O			O		Sandy and open habitats
Hop trefoil	*Trifolium campestre*	O	O		O		
Lesser trefoil	*Trifolium dubium*	O					
Red clover	*Trifolium pratense*				O		

Common Name	*Scientific Name*	Area 1	Area 2	Area 3	Area 4	Area 5	Significance
White clover	*Trifolium repens*	O			O	O	
Scentless mayweed	*Tripleurospermum inodorum*	O	O	O	O	O	
Gorse	*Ulex europaeus*	O			O		
Common nettle	*Urtica dioica*	O		O			
Great mullein	*Verbascum thapsus*	O	O		O		
Germander speedwell	*Veronica chamaedrys*	O		O			
Common vetch	*Vicia sativa*	O		O	O		
Smooth tare	*Vicia tetrasperma*	O		O	O		
Field pansy	*Viola arvensis*	O		O	O		
Total No. of Species		**89**	**22**	**51**	**73**	**31**	

Phase 1 Habitat Species List

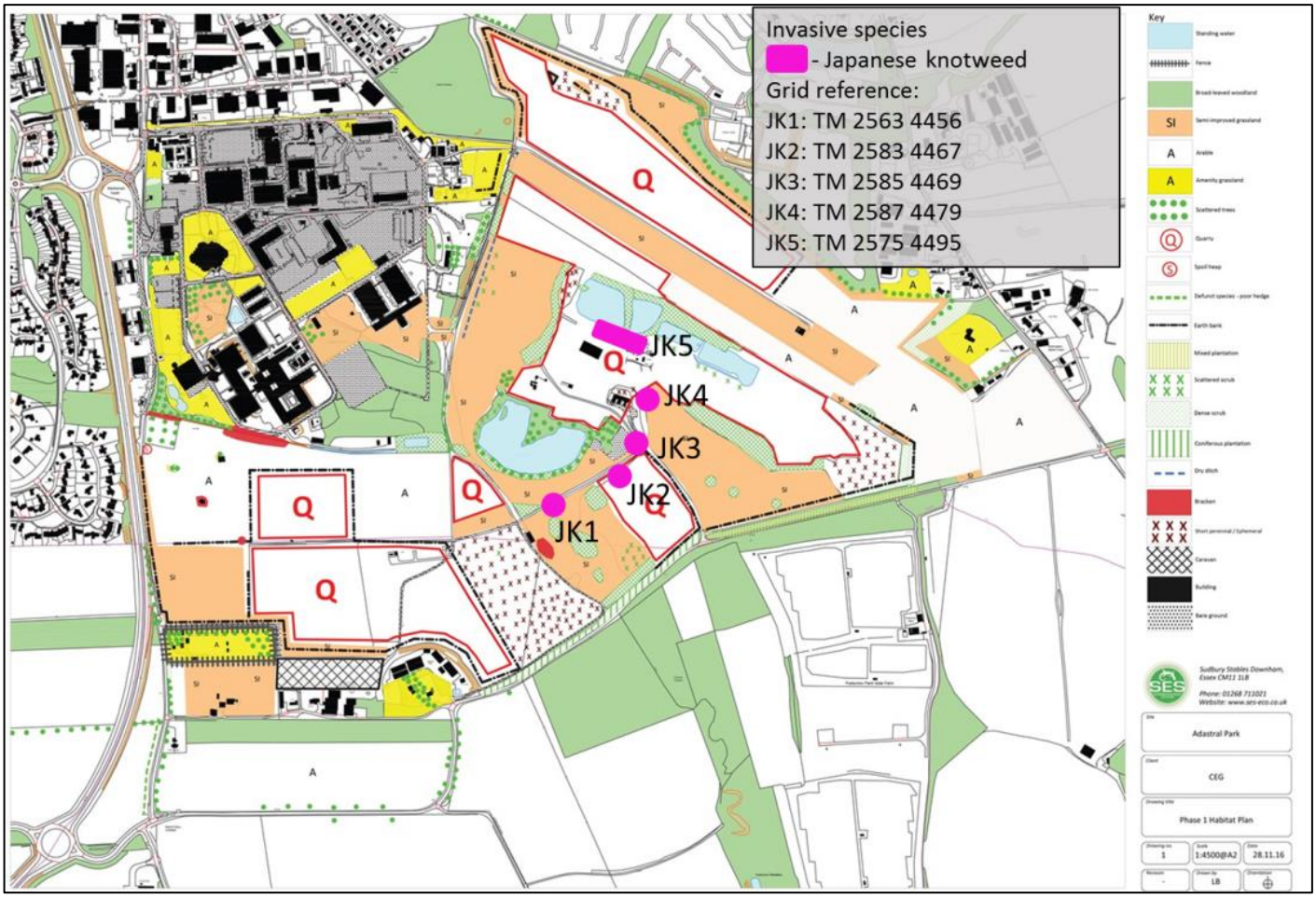
Common Name	*Scientific Name*	*Woodland*	*Scrub*	*Semi-improved Grassland*	*Arable*	*Amenity Grassland*	*Short Perennial / Ephemeral*
Ash	*Fraxinus excelsior*	*O*					
Bee Orchid	*Ophrys apifera*			*R*			
Birdsfoot trefoil	*Lotus corniculatus*			*O*			
Biting Stonecrop	*Sedum acre*						*O*
Blackthorn	*Prunus spinosa*		*O*				
Black Medick	*Medicago lupulina*			*O*			
Bluebell	*Hyacinthoides non-scripta*	*O*					
Bracken	*Pteridium aquilinum*	*O*					
Bramble	*Rubus fruticosus agg*		*A*				
Bristly oxtongue	*Helminthotheca echioides*				*O*		*O*
Broad-leaved dock	*Rumex obtusifolius*			*O*	*O*		
Broad-leaved willowherb	*Epilobium montanum*			*O*			
Broom	*Cytisus scoparius*		*O*				
Buddleja	*Buddleja davidii*		*O*				
Bugloss	*Anchusa arvensis*			*O*			
Burdock	*Arctium sp.*			*O*			
Buttercup	*Ranunculus sp.*			*O*		*O*	
California poppy	*Eschscolzia californiaca*						*O*
Carrot	*Apiaceae*			*O*			

Common Name	Scientific Name	Woodland	Scrub	Semi-improved Grassland	Arable	Amenity Grassland	Short Perennial / Ephemeral
Cat's ear	*Hypochaeris radicata*			O			
Chamomile	*Chamaemelum nobile*			O		O	
Cherry	*Prunus avium*	O					
Cleavers	*Galium aparine*		O	O			
Cocks foot	*Dactylis glomerata*			O			
Comfrey	*Symphytum sp.*			O			
Common chickenweed	*Stellaria media*			O			
Common mallow	*Malva sylvestris*			O			O
Common nettle	*Urtica dioica*	O	O				O
Common Poppy	*Papover rhoeas*						O
Common ragwort	*Senecio jacobaea*			O	O		O
Common Reed	*Phragmites.*			O			
Cow parsley	*Anthriscus sylvestris*	O	O	O			
Creeping thistle	*Cirsium arvense*			O			
Cut-leaved crane's-bill	*Geranium dissectum*			O			
Daffodil sp.	*Narcissus sp.*	O					
Dandelion	*Taraxacum agg*			O		O	
Dock	*Rumex sp*						
Dove's-foot crane's-bill	*Geranium molle*			O			
Elder	*Sambucus nigra*	O	O				
False Oat Grass	*Arrhenatherum elatius*			O			
Forget-me-not	*Myosotis sp.*			O			
Field maple	*Acer campestre*	O					
Foxglove	*Digitalis purpurea*			O			
Fumitory	*Fumaria sp.*			O			
Geranium	*Geranium sp.*			O			
Greater plantain	*Plantago major*			O		O	O
Green alkanet	*Pentaglottis sempervirens*			O			
Groundsel	*Senecio vulgaris*				O		O
Goat willow	*Salix caprea*		O				
Gorse	*Ulex europaeus*		A				
Ground-ivy	*Glechoma hederacea*			O			
Hawthorn	*Crataegus monogyma*		O				

Common Name	*Scientific Name*	*Woodland*	*Scrub*	*Semi-improved Grassland*	*Arable*	*Amenity Grassland*	*Short Perennial / Ephemeral*
Herb Robert	*Geranium robertianum*	*O*		*O*			
Hemlock	*Conium maculatum*			*O*			
Hogweed	*Heracleum sphondylium*			*O*			
Holly	*Ilex aquifolium*	*O*					
Honeysuckle	*Lonicera periclymenum*	*O*	*O*				
Hornbeam	*Carpinus betulus*	*O*					
Horsetail	*Equisetum sp.*			*O*			
Ivy	*Hedera helix*	*O*	*A*				
Japanese knotweed	*Fallopia japonica*		*O*	*O*			
Lettuce	*Lactuca sativa*			*R*			
Leyland cypress	*Cupressus x leylandi*	*O*					
Lords-and-ladies	*Arum maculatum*	*O*					
Oak	*Quercus sp*	*F*					
Opium poppy	*Papover somniferum*						*O*
Oxeye daisy	*Leucanthemum vulgare*			*O*			
Perennial rye-grass	*Lolium perenne*					*F*	
Pine	*Pinus sp.*	*O*					
Poppy sp.	*Papover sp.*			*O*			*O*
Ragwort	*Senecio jacobaea*						
Red Campion	*Silene dioica*			*O*			
Red dead-nettle	*Lamium rubra*			*O*			
Ribwort plantain	*Plantago lanceolata*			*O*	*O*	*O*	*O*
Rose	*Rosa sp*		*O*				
Sage	*Salvia officinalis*			*O*			
Scarlet Pimpernel	*Anagallis arvensis*			*O*			
Scot's pine	*Pinus sylvestris*	*O*					
Silver birch	*Betula pendula*	*O*					
Spear thistle	*Cirsium vulgare*			*O*			*O*
Speedwell	*Veronica sp*			*O*			
Spotted Medick	*Medicago arabica*			*O*			
St John's Wort	*Hypericum sp.*			*O*			
Sweet Chestnut	*Castanea sativa*	*O*					
Sycamore	*Acer psuedoplatanus*	*O*	*O*				
Thistle	*Onopordum sp.*			*O*			

Common Name	*Scientific Name*	*Woodland*	*Scrub*	*Semi-improved Grassland*	*Arable*	*Amenity Grassland*	*Short Perennial / Ephemeral*
Turkey oak	*Quercus cerris*	*O*					
Wall Barley	*Hordeum murinum*			*O*	*O*		
White campion	*Silene latifolia*			*O*			
White clover	*Trifolium repens*			*O*		*O*	
White dead-nettle	*Lamium album*			*O*			
Wild Strawberry	*Fragaria vesca*			*O*			
Willowherb	*Epilobium sp.*			*O*			
Wood spurge	*Euphorbia amygdaloides*	*O*		*O*			
Yarrow	*Achillea millefolium*			*O*		*O*	
Yorkshire-fog	*Holcus lanatus*			*O*			

Invasive species map



Appendix 10: Bat survey results

Activity survey raw data

25th May 2016. DUSK activity survey. Transect: EAST.
Weather: Beaufort: 0-1, Cloud Cover: 100%, Temperature: 11°C. **Detectors:** EM3, Edirol & BatBox.
Sunset: 20:58 / **Start time:** 20:58 / **Finish time:** 23:00.

Time	Walk no.	Stop no.	Activity
20:58	6		No Activity
21.03		5	
21:08	5		
21:14		4	1 x Common pipistrelle – heard not seen (HNS)
21:19	4		Possible Brown long-eared
21:23		3	No Activity
21:28	3		1 x Soprano pipistrelle, Leisler's bat flying along foot path, 1 x Common pipistrelle foraging (F), 1 x Noctule HNS
21:33		2	1 x Soprano pipistrelle F between caravan park & bund
21:38	2		1 x Serotine commuting (C) along foot path
21:42		1	1 x Common pipistrelle F between wood & bun, Serotine x 3 passes, 1 x Noctule F back & forth along foot path (FP)
21:49	1		1 x Common pipistrelle F along FP between woods & bund x 2 passes, 1 x Common pipistrelle between quarry & satellites
21:53		12	No Activity
21:58	12		1 x Common pipistrelle HNS, 1 x Common pipistrelle F along FP x 5 passes
22:03		11	1 x Common pipistrelle F along FP
22:08	11		2 x Common pipistrelle HNS, 1 x Soprano pipistrelle
22:13		10	1 x Common pipistrelle faint
22:18	10		No Activity
22:21		9	1 x Common pipistrelle HNS, 1 x Myotis HNS
22:26	9		No Activity
22:31		8	
22:36	8		
22:40		7	
22:45	7		
22:49		6	
23:00	Finish		

HNS: Heard not seen
F: foraging
C: Commuting

29th June 2016. DUSK activity survey. Transect: WEST.

Weather: Beaufort: 2, Cloud Cover: 100%, Temperature: 18°C. **Detectors:** Edirol & BatBox.

Sunset: 21:19 / **Start time:** 21:19 / **Finish time:** 23:31.

Time	Walk no.	Stop no.	Activity
21:17		22	No Activity
21.22	22		
21:25		21	
21:30	21		
21:35		20	1 x big bat HNS
21:40	20		1 x Soprano pipistrelle x 2 passes
21:49		19	No Activity
21:54	19		
21:59		18	
22:04	18		
22:14		17	1 x faint Soprano pipistrelle x 2 passes
22:17	17		1 x Daubenton's F over lake x 3 passes
22:24		16	1 x big bat F over lake (20 secs), 1 x Soprano pipistrelle F over lake
22:31	16		Soprano pipistrelle still F along tree line next to lake
22:36		15	No Activity
22:42	15		
22:48		14	1 x Myotis HNS
22:53	14		No Activity
22:58		13	
23:03	13		
23:08		24	1 x Common pipistrelle F (continuous) – HNS, 1 x Soprano pipistrelle F
23:14	24		1 x Common pipistrelle F (continuous) along plantation woodland, 1 x Soprano pipistrelle
23:22		23	1 x Soprano pipistrelle, 1 x Common pipistrelle HNS
23:27	23		No Activity
23:31	Finish		

HNS: Heard not seen

F: Foraging

29th June 2016. DUSK activity survey. Transect: EAST.

Weather: Beaufort: 2, Cloud Cover: 100%, Temperature: 18°C. **Detectors:** Edirol & BatBox.

Sunset: 21:19 / **Start time:** 21:19 / **Finish time:** 23:31.

Time	Walk no.	Stop no.	Activity
21:19		6	No Activity
21:24	7		
21:29		7	
21:34	8		
21:38		8	
21:43	9		
21:50		9	1x myotis
21:52	10		2x myotis, 2 passes; 1x myotis, 4 passes.
22:02		10	No Activity
22:07	11		
22:11		11	1x myotis
22:16	12		No Activity
22:20		12	
22:25	1		1x myotis, 2 passes; 1x possible barbastelle; 1x soprano pipistrelle, 3 passes; 1x barbastelle, 1x common pipistrelle, 1x possible barbastelle; 1x unidentified bat sp.; 1x myotis F for 20seconds, 4 passes; 1x myotis, 2 passes; 1x brown long-eared; 1x myotis, constant F for 30seconds; 1x brown long-eared, constant F for 30seconds; 1x soprano pipistrelle, 1x unidentified bat sp., 2 passes
22:37		1	1x unidentified bat sp., 1pass, faint; 1x myotis
22:42	2		No Activity
22:45		2	1x unidentified bat sp.
22:51	3		No Activity
22:56		3	1x myotis
23:01	4		1x unidentified bat sp.; 1x myotis, 4 passes
23:05		4	1x myotis
23:10	5		No Activity
23:17		5	1x unidentified bat sp.
23:22	6		No Activity
23:29	Finish		

11th July 2016. DUSK activity survey. Transect: WEST

Weather: Beaufort: 0, Cloud Cover: 70%, Temperature: 18°C. **Detectors:** Edirol & BatBox.

Sunset: 21:12 / **Start time:** 21:04 / **Finish time:** 23:19.

Time	Walk no.	Stop no.	Activity
21:11		19	No Activity
21.16	19		
21:19		18	
21:24	18		
21:33		17	1 x Noctule HNS
21:38	17		1 x Noctule HNS
21:44		16	1 x Common pipistrelle F over lake
21:49	16		1 x Soprano pipistrelle passing overhead
21:54		15	No Activity
22:00	15		1 x Noctule HNS x 2 passes
22:05		14	1 x Noctule x 2 passes
22:10	14		No Activity
22:15		13	
22:19	13		1 x Common pipistrelle, 2 x Soprano pipistrelle
22:24		24	1 x Soprano pipistrelle x 2 faint passes, 1 x Common pipistrelle constant F, 1 x Soprano pipistrelle constant F
22:30	24		1 x Noctule HNS, 1 x Common pipistrelle
22:38		23	No Activity
22:43	23		1 x Myotis HNS
22:46		22	3 x Common pipistrelle F, 2 x Soprano pipistrelle, 1 x Myotis HNS, 1 x big bat
22:51	22		1 x Common pipistrelle x 2 passes, 1 x Soprano pipistrelle constant F
22:56		21	1 x Common pipistrelle, 1 x Noctule, unidentified sp. X 2 faint passes
23:01	21		
23:05		20	2 x Common pipistrelle F, 2 x Soprano pipistrelle F, Possible Brown long-eared
23:11	20		1 x Common pipistrelle
23:19	Finish		No Activity

HNS: Heard not seen

F: Foraging

11th July 2016. DUSK activity survey. Transect: EAST

Weather: Beaufort: 1, Cloud Cover: 70%, Temperature: 18°C. **Detectors:** EM3.

Sunset: 21:12 / **Start time:** 21:12 / **Finish time:** 23:12.

Time	Walk no.	Stop no.	Activity
21:12		1	No Activity
21.17	2		
21:21		2	
21:26	3		
21:30		3	
21:35	4		1 x Common pipistrelle, 1 x Soprano pipistrelle
21:40		4	Common pipistrelle x 4 passes, Soprano pipistrelle x 4 passes (minimum of 6 bats seen – potential roost)
21:46	5		No Activity
21:49		5	1 x Common pipistrelle C
21:54	6		4 x Common pipistrelle, 1 x Myotis
22:04		6	1 x Common pipistrelle
22:06	7		1 x Soprano pipistrelle, 1 x Nyctalus sp. x 3 passes
22:11		7	No Activity
22:16	8		
22:21		8	1 x Common pipistrelle
22:26	9		No Activity
22:30		9	1 x Noctule
22:35	10		2 x Common pipistrelle
22:40		10	4 x Soprano pipistrelle x 5 passes, 1 x Common pipistrelle x 2 passes
22:43	11		1 x Noctule, 1 x Serotine, 1 x Common pipistrelle, 1 x Soprano pipistrelle
22:50		11	No Activity
22:55	12		1 x Common pipistrelle, 1 x Soprano pipistrelle
22:57		12	1 x Common pipistrelle, 1 x Noctule
23:02	1		1 x Common pipistrelle x 3 passes, 1 x Noctule, 1 x Soprano pipistrelle x 2 passes, 1 x Serotine x 8 passes
23:12	Finish		No Activity

C: Commuting

3rd August 2016. DUSK activity survey. Transect: WEST

Weather: Beaufort: 2, Cloud Cover: 20%, Temperature: 20°C. **Detectors:** Edirol & Batbox duet.

Sunset: 20:41 / **Start time:** 20:41/ **Finish time:** 22:57.

Time	Walk no.	Stop no.	Activity
20:41	18		No Activity
20:44		18	
20:49	17		
20:56		17	
21:01	16		
21:08		16	
21:13	15		
21:21		15	
21:26	14		
21:32		14	
21:38	13		
21:42		13	
21:48	24		2 x Soprano pipistrelle, 1 x Noctule x 2 passes, 1 x Common pipistrelle
21:56		24	1 x Soprano pipistrelle F continuously
22:01	23		1 x Common pipistrelle F
22:08		23	4 x Common pipistrelle HNS, 1 x Noctule
22:13	22		1 x Soprano pipistrelle HNS, 2 x Common pipistrelle HNS x 5 passes
22:19		22	
22:24	21		1 x Soprano pipistrelle HNS
22:29		21	No Activity
22:34	20		
22:44		20	
22:49	19		
22:52		19	1 x Common pipistrelle
22:57	Finish		No Activity

HNS: Heard not seen

F: Foraging

3rd August 2016. DUSK activity survey. Transect: EAST

Weather: Beaufort: 1-2, Cloud Cover: 80%, Temperature: 19°C. **Detectors:** Edirol & Batbox duet.

Sunset: 20:41 / **Start time:** 20:41/ **Finish time:** 22:49.

Time	Walk no.	Stop no.	Activity
20:41	12		No Activity
20:51		12	
20:56	11		
21:02		11	
21:07	10		1 x big bat
21:10		10	No Activity
21:15	9		
21:19		9	1 x pipistrelle sp.
21:24	8		No Activity
21:28		8	3 x Common pipistrelle
21:33	7		1 x Soprano pipistrelle
21:40		7	1 x Soprano pipistrelle x 2 passes, 1 x Common pipistrelle x 2 passes, 1 x pipistrelle sp.
21:45	6		No Activity
22:50		6	1 x Common pipistrelle
22:55	5		2 x Common pipistrelle
22:04		5	1 x Common pipistrelle
22:09	4		No Activity
22:12		4	
22:18	3		
22:23		3	
22:28	2		
22:34		2	2 x Common pipistrelle
22:39	1		2 x Common pipistrelle, 2 x Soprano pipistrelle
22:44		1	2 x Common pipistrelle, 3 x Soprano pipistrelle
22:49	Finish		

12th September 2016. DUSK activity survey. Transect: WEST

Weather: Beaufort: 0, Cloud Cover: 40%, Temperature: 19°C. **Detectors:** Edirol & Batbox duet.

Sunset: 19:16 / **Start time:** 19:16/ **Finish time:** 21:16.

Time	Walk no.	Stop no.	Activity
19:16		20	No Activity
19:21	20		
19:24		19	
19:29	19		
19:32		18	
19:37	18		1 x Common pipistrelle F
19:46		17	No Activity
19:51	17		3 x Soprano pipistrelle, 1 x Common pipistrelle
20:00		16	1 x Soprano pipistrelle x 2 passes
20:05	16		1 x Common pipistrelle HNS, 1 x Soprano pipistrelle HNS
20:09		15	No Activity
20:14	15		
20:19		14	
20:24	14		
20:28		13	2 x Soprano pipistrelle
20:33	13		1 x Common pipistrelle HNS
20:39		24	1 x Soprano pipistrelle
20:44	24		No Activity
20:50		23	2 x Common pipistrelle
20:54	23		1 x Common pipistrelle, 2 x Soprano pipistrelle
21:02		22	1 x Noctule
21:07	22		No Activity
21:09		21	
21:13	21		
21:16	Finish		

HNS: Heard not seen

F: Foraging

12th September 2016. DUSK activity survey. Transect: EAST

Weather: Beaufort: 0, Cloud Cover: 60%, Temperature: 21°C. **Detectors:** Edirol & Batbox duet.

Sunset: 19:16 / **Start time:** 19:16/ **Finish time:** 21:36.

Time	Walk no.	Stop no.	Activity
19:16	7		No Activity
19:21		8	
19:34	8		2 x Noctule HNS, 1 x Soprano pipistrelle, 1 x Common pipistrelle F x 2 passes
19:42		9	No Activity
19:47	9		
20:09		10	2 x Common pipistrelle HNS, 1 x Soprano pipistrelle, Noctule F constant
20:17	10		1 x Common pipistrelle F
20:21		11	1 x Common pipistrelle x 2 passes HNS, 1 x Noctule
20:26	11		1 x Soprano pipistrelle HNS x 2 passes, 1 x Common pipistrelle
20:28		12	No Activity
20:33	12		1 x Common pipistrelle HNS
20:39		1	No Activity
20:41	1		3 x Common pipistrelle HNS x 2 passes
20:49		2	1 x Common pipistrelle HNS x 3 passes
20:51	2		1 x Common pipistrelle HNS
20:54		3	No Activity
20:59	3		
21:02		4	
21:07	4		1 x Common pipistrelle HNS
21:10		5	1 x Common pipistrelle F, 1 x Soprano pipistrelle F
21:13	5		2 x Common pipistrelle HNS x 3 passes, 1 x Soprano pipistrelle
21:21		6	1 x Common pipistrelle HNS x 2 passes
21:26	6		No Activity
21:29		7	
21:36	Finish		

HNS: Heard not seen

F: Foraging

13th September 2016. DAWN activity survey. Transect: WEST

Weather: Beaufort: 0, Cloud Cover: 10%, Temperature: 19°C. **Detectors:** Edirol & Batbox duet.

Sunrise: 06:28 / **Start time:** 04:28 / **Finish time:** 06:32.

Time	Walk no.	Stop no.	Activity
4:28		19	No Activity
4:33	19		
4:36		20	
4:40	20		
4:53		21	
4:58	21		
5:01		22	
5:06	22		
5:10		23	
5:15	23		
5:22		24	2 x Soprano pipistrelle
5:31	24		No Activity
5:34		13	
5:40	13		
5:42		14	
5:46	14		
5:51		15	
5:55	15		
5:59		16	Noctule F over lake
6:06	16		No Activity
6:11		17	
6:18	17		
6:23		18	
6:26	18		
6:32	Finish		

F: Foraging

13th September 2016. DAWN activity survey. Transect: EAST

Weather: Beaufort: 0, Cloud Cover: 10%, Temperature: 19°C. **Detectors:** Edirol & Batbox duet.

Sunrise: 06:28 / **Start time:** 04:39 / **Finish time:** 06:28.

Time	Walk no.	Stop no.	Activity
4:39		6	1 x Common pipistrelle HNS
4:40	6		1 x Common pipistrelle HNS
4:56		5	1 x Common pipistrelle HNS
5:57	5		1 x Common pipistrelle HNS
		4	No Activity
	4		
5:11		3	1 x Common pipistrelle HNS, 1 x Soprano pipistrelle HNS
5:13	3		No Activity
		2	
5:28	2		1 x Common pipistrelle HNS
5:29		1	2 x Common pipistrelle HNS
5:33	1		2 x Common pipistrelle HNS, 1 x Soprano pipistrelle HNS
		12	No Activity
	12		
5:55		11	1 x Soprano pipistrelle HNS
	11		No Activity
6:00		10	Noctule HNS
	10		Noctule seen not heard flying north
		9	No Activity
	9		
		8	
	8		
		7	
	7		
6:28	Finish		

HNS: Heard not seen

17 October 2016. DUSK activity survey. Transect: EAST

Weather: Beaufort: 1, Cloud Cover: 5%, Temperature: 15°C. **Detectors:** Edirol & Batbox duet.

Sunset: 17:56 / **Start time:** 17:56 / **Finish time:** 20:02.

Time	Walk no.	Stop no.	Activity
17:57	4		No Activity
18:10		3	
18:15	3		
18:17		2	
18:22	2		
18:27		1	1x unidentified bat sp.
18:33	1		1x common pipistrelle, 3 passes; 2x common pipistrelle, 1 pass
18:41		12	No Activity
18:46	12		
18:49		11	1x brown long-eared, 1 pass
18:54	11		No Activity
19:00		10	
19:05	10		
19:07		9	
19:12	9		1x brown long-eared, 1 pass; 1x myotis, 1 pass
19:17		8	No Activity
19:22	8		
19:27		7	
19:32	7		
19:35		6	
19:40	6		
19:46		5	
19:51	5		
19:57		4	
20:02	Finish		

17 October 2016. DAWN activity survey. Transect: WEST

Weather: Beaufort: 1, Cloud Cover: 5%, Temperature: 14°C. **Detectors:** Edirol & Batbox duet.

Sunset: 17:56 / **Start time:** 17:56 / **Finish time:** 20:02.

Time	Walk no.	Stop no.	Activity
17:56		24	No Activity
18:01	24		
18:06		13	
18:11	13		
18:15		14	
18:20	14		
18:26		15	
18:31	15		1x soprano pipistrelle, 2 passes; 1x soprano pipistrelle, 5 passes
18:37		16	2x soprano pipistrelle, F over lake
18:47	16		1x soprano pipistrelle, 6 passes, F over lake
18:48		17	No Activity
18:53	17		
19:01		18	
19:06	18		
19:08		19	
19:13	19		
19:21		20	
19:27	20		
19:30		21	1x soprano pipistrelle, 1 pass
19:36	21		No Activity
19:40		22	
19:47	22		1x myotis, 1 pass
19:51		23	No Activity
19:56	23		
20:00		24	
20:02	Finish		

F: Foraging

Emergence survey data – confirmed roosts

15 August 2016. DUSK emergence survey. Building/tree: 41
Weather: Beaufort: 0, Cloud Cover: 10%. Temperature: 17°C **Detectors:** Duet & Edirol.
Sunset: 20:18 / **Start time:** 20:03 / **Finish time:** 22:15.

Rec File	Time	Rec Time	Activity
1	20:34	03:20	1x common pipistrelle, HNS
	20:39	07:40	1x common pipistrelle, possible emergence
2	20:46	06:15	1x unidentified bat, faint
	20:50	10:40	1x common pipistrelle, HNS
	20:51	11:40	1x common pipistrelle, HNS
3	21:00	05:00	1x barbastelle, foraging along edge of field
	21:01	06:50	1x common pipistrelle, 2 passes, HNS
	21:02	07:30	1x common pipistrelle, 2 passes, HNS
	21:04	09:30	1x common pipistrelle, HNS
	21:05	10:00	1x faint unidentified bat call
	21:08	15:30	1x unidentified bat SNH
4	21:13	01:30	1x common pipistrelle, HNS
	21:15	05:10	1x unidentified faint bat call
	21:18	08:00	1x unidentified faint bat call
	21:19	09:45	1x common pipistrelle, HNS
	21:23	12:30	1x myotis sp foraging
	21:24	14:15	1x myotis sp., foraging.
5	21:26	00:20	1x common pipistrelle, foraging
	21:29	03:51	1x common pipistrelle, 1x common pipistrelle, 2 passes
	21:31	05:00	1x common pipistrelle, 3 passes
	21:33	06:32	1x common pipistrelle, 5 passes, HNS
	21:36	09:54	1x common pipistrelle, faint
	21:38	11:53	1x common pipistrelle, HNS
	21:39	13:05	1x common pipistrelle, distant, HNS
	21:41	15:21	1x common pipistrelle, foraging
6	21:43	01:30	1x unidentified bat, faint
	21:43	01:50	1x common pipistrelle, HNS
	21:45	03:30	1x common pipistrelle, HNS
	21:46	05:15	1x common pipistrelle, HNS, 3 passes
	21:48	07:10	1x common pipistrelle, HNS, 4 passes, foraging
	21:52	10:28	1x common pipistrelle, HNS, 11 passes, foraging
7	21:58	01:30	1x common pipistrelle, distant, HNS
	22:04	07:52	1x common pipistrelle, HNS
	22:07	10:05	1x common pipistrelle, 5 passes, HNS
Finish			22:15

HNS – Heard not seen

15 August 2016. DUSK emergence survey. Building/tree: 41
Weather: Beaufort: 0, Cloud Cover: 10%. Temperature: 17°C **Detectors:** EM3.
Sunset: 20:18 / **Start time:** 20:03 / **Finish time:** 22:15.

Rec File	Time	Rec Time	Activity
	20:28		1x common pipistrelle, emergence
	20:32		1x common pipistrelle, emergence
	20:36		1x common pipistrelle, emergence
	20:46		1x common pipistrelle, foraging, commuting west to east
	20:46		1x common pipistrelle, emergence
	20:48		1x common pipistrelle, HNS. Possible emergence
	20:50		1x common pipistrelle, HNS. Possible emergence
	20:51		1x common pipistrelle, foraging, commuting west to east
	20:52		1x barbastelle, HNS, possible emergence
	20:53		1x common pipistrelle, commuting east to west, foraging
	20:54		1x pipistrelle sp., HNS
	20:56		1x pipistrelle sp., HNS, brief
	20:57		1x barb
	20:58		1x barbastelle, 3 passes
	21:01		2x common pipistrelle, commuting west to east, foraging
	21:01		1x common pipistrelle, HNS, 3 passes
	21:07		1x myotis sp., 2 passes, HNS
	21:09		1x common pipistrelle, 2 passes, HNS
	2!:09		1x barbastelle, 2 passes
	21:09		1x myotis sp.
	21:11		1x common pipistrelle, HNS
	21:13		1x barbastelle, HNS
	21:14		1x common pipistrelle, HNS
	21:15		1x common pipistrelle, commuting west to east from direction of tree. Possible emergence
	21:17		1x common pipistrelle, commuting west to east from direction of tree. Possible emergence
	21:17		1x unidentified sp.
	21:18		1x barbastelle, HNS
	21:19		1x common pipistrelle
	21:21		1x myotis, 2 passes, HNS
	21:23		1x common pipistrelle
	21:23		1x myotis sp., 2 passes, flying west to east, foraging
	21:25		1x common pipistrelle, 2 passes, HNS
	21:26		1x myotis sp., foraging, 2 passes, flying west to east
	21:27		1x common pipistrelle
	21:29		1x common pipistrelle, 10 passes
	21:29		1x myotis sp., 2 passes
	21:32		1x myotis sp.
	21:35		1x soprano pipistrelle
	21:36		1x myotis sp., foraging west to east along road
	21:37		1x common pipistrelle, HNS
	21:38		1x common pipistrelle, HNS
	21:40		1x soprano pipistrelle, HNS

	21:42		1x common pipistrelle, 2 passes
	21:46		1x common pipistrelle, 5 passes, constant for 40 secs, then 3 passes, then constant for 1min
	21:50		1x soprano pipistrelle, foraging, social calls
	21:51		2x common pipistrelle, constant foraging along road, plus social calls
	21:58		1x common pipistrelle, HNS
	22:01		1x common pipistrelle, HNS, 3 passes
	22:06		1x soprano pipistrelle
	22:05		1x common pipistrelle, 5 passes
	22:08		1x common pipistrelle, & 1x soprano pipistrelle
	22:09		1x myotis HNS, 3 passes
	22:10		1x common pipistrelle
	22:12		1x common pipistrelle
Finish			22:15

HNS – Heard not seen

31 August 2016. DUSK emergence survey. Building/tree: B6

Weather: Beaufort: 1-2, Cloud Cover: 5%. **Detectors:** Edirol & Batbox duet.

Sunset: 19:44 / **Start time:** 19:29 / **Finish time:** 21:15.

Rec File	Time	Rec Time	Activity
1	19:29		No Activity
2	19:49		
3	20:09	09:50	1x common pipistrelle, 2 passes. Emergence.
		19:35	1x soprano pipistrelle, 1 pass.
4	20:29	00:28	1x common pipistrelle, 4 passes. Foraging regularly until 08:20
		09:07	1x common pipistrelle, 4 passes, constant foraging until 20:00
5	20:49	00:39	1x common pipistrelle, 2 passes
		01:20	1x soprano pipistrelle, 1 pass
		04:14	1x common pipistrelle 4 passes
		12:11	1x soprano pipistrelle, 1 pass
		18:18	1x common pipistrelle, 2 passes
		19:59	1x soprano pipistrelle, 1 pass
6	21:09	01:36	1x common pipistrelle, 3 passes
Finish			21:15

01 September 2016. DAWN emergence survey. Building/tree: E

Weather: Beaufort: 1, Cloud Cover: 30%. **Detectors:** Edirol & Batbox duet.

Sunrise: 06:08 / **Start time:** 04:38 / **Finish time:** 06:23.

Rec File	Time	Rec Time	Activity
7	04:38	12:11	1x soprano pipistrelle, 2 passes
		16:28	1x soprano pipistrelle, 1 pass
8	04:58	05:01	1x soprano pipistrelle, 1 pass
		19:22	1x common pipistrelle, 1 pass
9	05:19	06:50	1x noctule, 1 pass
10	05:39	03:15	1x common pipistrelle, re-entry (on other side of building)
11	06:00		No Activity
12	06:20		
Finish			06:23

01 September 2016. DAWN emergence survey. Building/tree: 41

Weather: Beaufort: 1, Cloud Cover: 30%. **Detectors:** Edirol & Batbox duet.

Sunrise: 06:08 / **Start time:** 04:38 / **Finish time:** 06:23.

Rec File	Time	Rec Time	Activity
6	04:39		
	04:44	05:36	1x soprano pipistrelle, 2 passes, HNS
	04:49	10:23	1x BLE, 1 pass, HNS
	04:53	13:46	1x myotis sp., 2 passes, HNS
	04:55	15:53	1x common pipistrelle, 2 passes, HNS
	04:59	20:06	1x common pipistrelle, 1 pass, HNS
7	05:00		
	05:01	01:10	1x soprano pipistrelle, 2 passes, HNS
	05:03	03:31	1x common pipistrelle, 3 passes, HNS
	05:11	11:28	1x common pipistrelle, 2 passes, flying east
	05:17	17:01	1x common pipistrelle, 1 pass, HNS
8	05:22	00:51	1x soprano pipistrelle, 1 pass, HNS.
	05:23	01:05	1x myotis sp. 1 pass
	05:23	01:30	1x common pipistrelle
	05:24	02:22	1x common pipistrelle, 1 pass, emerged from tree
	05:25	03:18	1x common pipistrelle, 1 pass
	05:32	10:23	1x common pipistrelle, flying east, 1 pass
	05:34	12:35	1x common pipistrelle, 1 pass
	05:38	16:18	1x common pipistrelle, 1 pass, HNS
	05:45	23:25	1x common pipistrelle, 1 pass, HNS
9	05:46		
	05:47	01:36	1x common pipistrelle, flying west behind hedgerow, 1 pass
	05:57	10:45	1x unidentified bat, SNH, 1 pass, possible re-entry. Settled in to one of the tree branches.
06:23			Finish

HNS – Heard not seen
SNH – Seen not heard

05 September 2016. DUSK emergence survey. Building/tree: E
Weather: Beaufort: 1, Cloud Cover: 70%. **Detectors:** Edirol & Batbox duet.
Sunset: 19:32 / **Start time:** 19:17 / **Finish time:** 21:02.

Rec File	Time	Rec Time	Activity
1	19:18		
2	19:40		
	19:44	03:10	1x soprano pipistrelle, 1 pass, emergence
	19:54	13:30	1x common pipistrelle, 1 pass, flying east
	19:56	14:54	1x soprano pipistrelle, 1 pass, emergence
	19:57	16:50	2x soprano pipistrelle, foraging up and down building. 1x 1 pass, 1x constant until end of recording
3	20:01	00:00	1x common pipistrelle, foraging up and down building constantly
4	20:22	00:00	1x common pipistrelle, foraging up and down building constantly
5	20:42	00:00	1x common pipistrelle, foraging up and down building constantly
21:00			Finish

22 September 2016. DUSK emergence survey. Building/tree: E
Weather: Beaufort: 1, Cloud Cover: 70%. **Detectors:** Edirol & Batbox duet.
Sunset: 18:52 / **Start time:** 18:37 / **Finish time:** 20:22.

Rec File	Time	Rec Time	Activity
1	18:37		No Activity
2	18:57		
3	19:17	00:47	1x soprano pipistrelle, 1 pass
	19:22	05:50	1x unidentified pipistrelle, emergence
		12:52	1x soprano pipistrelle, 2 passes
		17:10	1x soprano pipistrelle, 1 pass
		19:58	1x common pipistrelle, until end of rec
4	19:37	00:59	1x common pipistrelle, constant foraging until 13:42
		15:33	1x common pipistrelle, 2 passes
5	19:57	00:40	1x common pipistrelle, 1 pass
		03:52	1x common pipistrelle, 2 passes
		12:45	1x common pipistrelle, 2 passes
		15:45	1x common pipistrelle
		19:19	1x common pipistrelle, 2 passes
6	20:17	02:01	1x common pipistrelle, 1 pass
20:22			Finish

Tree scoping survey results

Bat Tree Assessment **Site:** Adastral Park **Surveyors:** Lucy Addison & Darren Denmead (Ground Inspections) and Chris Horley and Adam Dayman (Aerial Inspections)

Tree No.	1	2	3	4
Species	Weeping Willow	Oak	Oak	Oak
Location /Area	Fishing Lake	North-east of site	North-east of site	North-east of site
OS Grid Ref	TM 2569 4474	TM 26275 45012	TM 26264 45016	TM 26248 45024
Description: (M/MS/C/P)	M	M	M	MS
Age: (Y/S/M/V)	M	M	S	S
Potential Roost Features (PRF)				
Holes*	Hole in trunk and another in a split branch.	Dead Ivy creating crevices		
Splits / Cracks*			Split branches	Small crack between split
Loose Bark*			On old branch	On old branches
Photo				
Climbable	N/A	N/A	N/A	N/A
Dense Ivy	None	None	None	None
Field Signs	None	None	None	None
Roost Value (Pre-aerial inspection)	Low	Low	Low	Low
Roost Value (Post-aerial inspection)	N/A	N/A	N/A	N/A

Tree No.	5	6	7	8
Species	Oak	Oak	Oak	Oak
Location /Area	North-east of site	North-east of site	North-east of site	North-east of site
OS Grid Ref	TM 26226 45049	TM 233 45059	TM 26185 45089	TM 26160 45113
Description: (M/MS/C/P)	M	M	M	M
Age: (Y/S/M/V)	M	M	S	S/M
Potential Roost Features (PRF)				
Holes*	Holes where limbs have died back	Large Rot Hole – 30x30cm diameter, frass and damp inside, extends inwards by 10cm, could become more suitable over time. Various small holes leading into tree, most blunt, some lead into tree 2-4cm into trunk then blunt.		Hole – branch tear-out, blunt inside, 5x5cm diameter. Hole doesn't go anywhere. No evidence noted.
Splits / Cracks*	Minimal	At base of tree	Dead ivy creating crevices	
Loose Bark*	Minimal around broken branches	Around split	Dead ivy	
Photo				
Climbable	N/A	Yes	N/A	Yes
Dense Ivy	None	None	None	None
Field Signs	None	None	None	None
Roost Value (Pre-aerial inspection)	Low	Moderate	Low	Low/Moderate
Roost Value (Post-aerial inspection)	N/A	Low	N/A	None

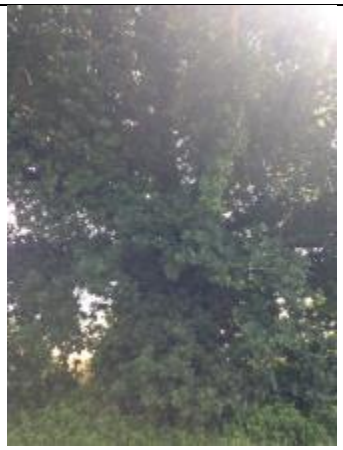
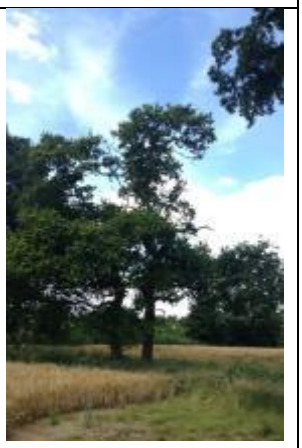
Tree No.	9	10	11	12
Species	Oak	Oak	Oak	Oak
Location /Area	North-east of site	North-east of site	North-east of site	North-east of site
OS Grid Ref	TM 26063 45181	TM 26059 45198	TM 25959 45371	TM 25956 45391
Description: (M/MS/C/P)	M	M	M	M
Age: (Y/S/M/V)	S	S	S	S
Potential Roost Features (PRF)				
Holes*		Branch socket cavity – soil and frass inside at base. Diameter 12x12cm and 20cm deep into trunk. Dry inside and rough around edges.	Hole in end of cut branch, goes in 4cm, then blunt, exposed entry hole with little hidden space inside.	2.5m up trunk – multiple small holes that are blunt and don't extend inwards.
Splits / Cracks*	Around broken branch	None	None	None
Loose Bark*	Around crack	None	Flaking/peeling bark present, depth behind is only up to 5cm max. Mostly blunt underneath.	Loose bark all around dead limb, space inside goes in 5cm. Approx. 5m up trunk.
Photo				
Climbable	N/A	Yes	Yes	Yes
Dense Ivy	Yes	None	None	None
Field Signs	None	None	None	None
Roost Value (Pre-aerial inspection)	Low	Moderate	Moderate	Moderate
Roost Value (Post-aerial inspection)	N/A	Moderate	Low	Low

Tree No.	13	14	15	16
Species	Oak	Oak	Scott's Pine	Oak
Location /Area	North of site – along PF	North of site – along PF	South along track	Woodland – north-west edge
OS Grid Ref	TM 25942 45401		TM 25616 44242	TM 25311 45428
Description: (M/MS/C/P)	MS	MS	M	MS
Age: (Y/S/M/V)	S/M	M	M	M
Potential Roost Features (PRF)				
Holes*	Hole in cut off stump near to top as well as hole in main trunk. Blunt after 5cm and rough inside.	On 'elbow' of lateral branch – 15cm deep, 5x5cm in diameter. Moist inside, frass present, rough inside.	None visible due to dense Ivy	None visible due to dense dead Ivy
Splits / Cracks*	None	From old branch	None visible due to dense Ivy	None visible due to dense dead Ivy
Loose Bark*	Minor	Minor	None visible due to dense Ivy	Minor
Photo				
Climbable	Yes	Yes	Yes – Likely spikes	Yes
Dense Ivy	None	None	Yes	Yes
Field Signs	None	None	None	None
Roost Value (Pre-aerial inspection)	High	Moderate	Low	Low
Roost Value (Post-aerial inspection)	None	Moderate	N/A	N/A

Tree No.	17	18	19
Species	Scott's Pine	Oak	Oak
Location /Area	Woodland – North-west	Woodland – West	Woodland – South
OS Grid Ref	TM 25344 45406	TM 25387 45346	TM 25433 45349
Description : (M/MS/C/P)	M	M	M
Age: (Y/S/M/V)	Dead	M	S
Potential Roost Features (PRF)			
Holes*	Minor at top	None	Large hole 6ft up main trunk - 1 x hole – 5x5cm diameter, 15cm deep, rough inside, smooth around entry hole, damp inside, southern facing.
Splits / Cracks*	On dead branch	Large split along a previously felled branch	
Loose Bark*	Around holes at top of tree	Minimal	
Photo			
Climbable	Yes	No	Yes
Dense Ivy	None	None	None
Field Signs	None	None	None
Roost Value (Pre-aerial inspection)	Low	Moderate	Moderate
Roost Value (Post-aerial inspection)	N/A	N/A	Low

Tree No.	20	21	22	23
Species	Oak	Oak	Oak	Oak
Location /Area	Woodland (south edge)	Woodland (south edge)	Woodland (east edge)	Woodland (east edge)
OS Grid Ref	TM 25453 45338	TM 25474 45343	TM 559145385	TM 55304 45483
Description: (M/MS/C/P)	M	M	M	M
Age: (Y/S/M/V)	S	S	M	S
Potential Roost Features (PRF)				
Holes*	10 ft. up main trunk – 7x5cm diameter, 20cm deep, Smooth round edges w/staining. Branch socket cavity, Pool of water inside at base, slugs and woodlouse present, frass present.	8ft up on lateral limb – 10x6cm diameter, 25cm deep, Branch socket cavity, Dry inside, wide entrance is exposed, rough inside but smooth round entry hole.	1 x hole 20ft. up where trunk forks and another 10ft up on main trunk – 15x15cm diameter – dry inside, 30cm deep. Frass at bottom of hole, Dry, exposed, rough. 2nd woodpecker hole – 5x5cm diameter, 10cm deep, rough, frass. Branch cavity 5x5cm, extends in 20cm, wet inside, frass. 3rd woodpecker hole – 5x5cm diameter, 8cm deep, hole is downward facing, wet inside, wasp nest present.	Large hole on branch 12ft. up – 10x15cm diameter, 1m deep, dry, entrance hole exposed.
Splits / Cracks*	Older branches with cracks	None	None	None
Loose Bark*	None	None	None	None
Photo				
Climbable?	Yes	Yes	Yes	Yes
Dense Ivy	None	None	None	None
Field Signs	None	None	None	None
Roost Value (Pre-aerial inspection)	High	Moderate	High	Moderate
Roost Value (Post-aerial inspection)	Moderate	Low	Moderate	Moderate

Tree No.	24	25	26	27
Species	Oak	Oak	Sycamore	Oak
Location /Area	Woodland (north edge)	Woodland (north edge)	Woodland (north edge)	Woodland (north edge)
OS Grid Ref	TM 25445 45556	TM 25426 45542	TM 25422 45532	TM 25400 45504
Description: (M/MS/C/P)	M	M	MS	M
Age: (Y/S/M/V)	S	M	M	S
Potential Roost Features (PRF)				
Holes*	1 x large cavity 5ft up main trunk, large cavity 1m up in height and whole diameter of trunk. Cavity connected by a further hole, into more chambers. A number of woodpecker holes provide further access. No evidence of roosting bats.	None visible from ground	Large open cavity 30ft up trunk – 40x50cm diameter, blunt, exposed, rough around edges, damp inside, no evidence. Open cavity at base of tree, 30x15cm diameter but no height. No evidence of roosting bats.	None
Splits / Cracks*	1 x crack 20ft up main trunk – wasps nest present, 15x8cm diameter, dry inside.	On high rotting branch	None	Broken branch 25ft up with cracks
Loose Bark*	Minor – peeling bark, cobwebs present, dry inside, too exposed.	Around crack	None	None
Photo				
Climbable	Yes	Yes	Yes	Yes
Dense Ivy	None	None	None	None
Field Signs	None	None	None	None
Roost Value (Pre-aerial inspection)	High	Low	Moderate	Low
Roost Value (Post-aerial inspection)	High	N/A	Low	N/A

Tree No.	28	29	30	31
Species	Oak	Oak	Oak	Oak
Location /Area	Track	Track	Arable field	Arable field (Off-site)
OS Grid Ref	TM 2488 4405	TM 2487 4406	TM 2488 4414	TM 2487 4414
Description: (M/MS/C/P)	M	M	M	M
Age: (Y/S/M/V)	M	M	S	S
Potential Roost Features (PRF)				
Holes*	No obvious features by dense Ivy covering much of the tree	No obvious features by dense Ivy covering much of the tree	No obvious features by dense Ivy covering much of the tree + snapped off limbs	Number of small holes 2-8m above ground level plus dead limbs with holes and peeling bark
Splits / Cracks*				
Loose Bark*				Minor on dead limbs
Photo				
Climbable	N/A	N/A	N/A	Off-site
Dense Ivy	Present	Present	Present	Present
Field Signs	None	None	None	None
Roost Value (Pre-aerial inspection)	Low	Low	Low	Moderate
Roost Value (Post-aerial inspection)	N/A	N/A	N/A	N/A

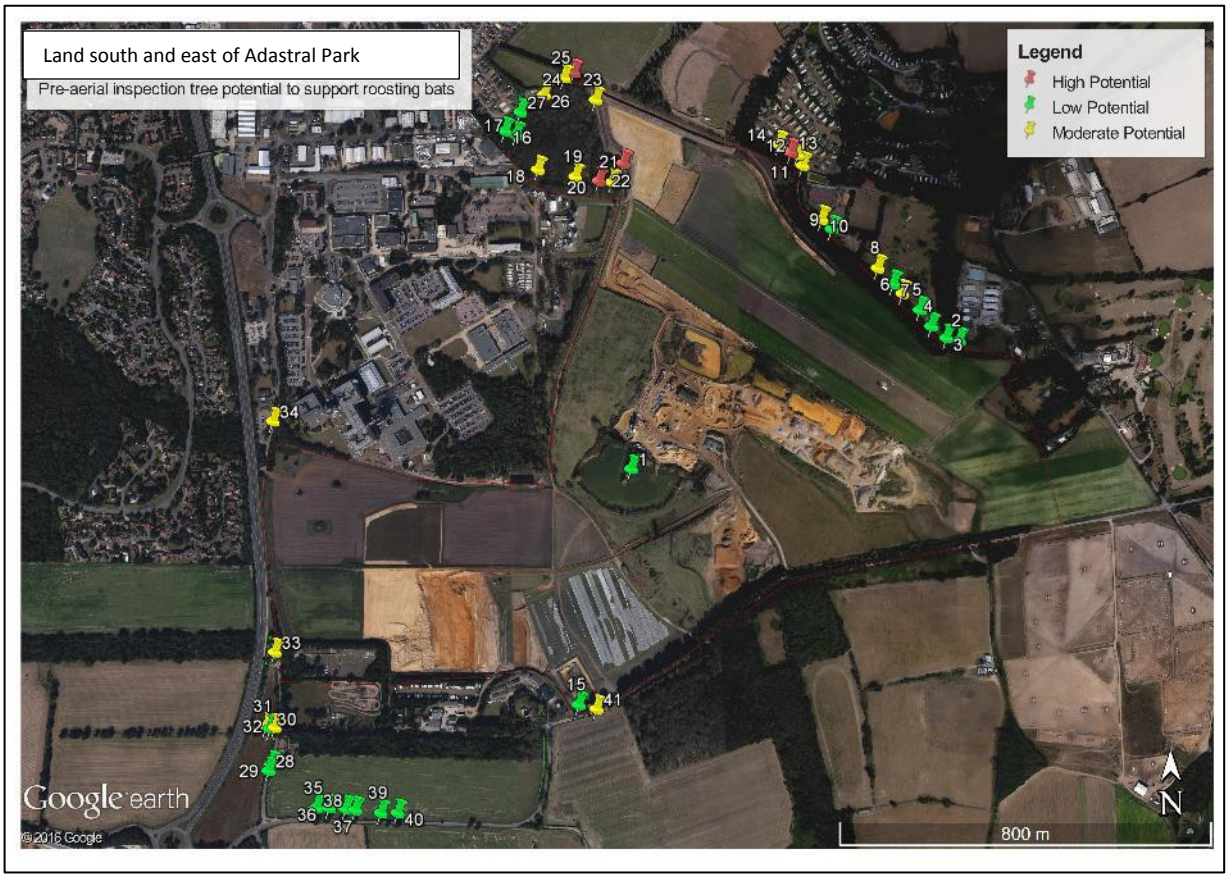
Tree No.	32	33	34
Species	Oak	Oak	Sycamore
Location /Area	Road	Road	Near BT Buildings
OS Grid Ref	TM 2489 4416	TM 2489 4430	TM 2486 4481
Description: (M/MS/C/P)	M	M	M
Age: (Y/S/M/V)	S/M	M	M
Potential Roost Features (PRF)			
Holes*	V. dense thick Ivy, obscuring tree trunk. Aerial inspection found no features present. If felled, strip Ivy then inspect again and soft fell.	No obvious features present. If felled, strip Ivy then Inspect again and soft fell.	1 x small hole – north facing 6m up trunk - Old tear out, blunt inside.
Splits / Cracks*			40cmx10cm diameter – wet inside, soil and frass in base, exposed.
Loose Bark*			
Photo			
Climbable	Yes	Yes	Yes
Dense Ivy	Present	Present	Absent
Field Signs	None	None	None
Roost Value (Pre-aerial inspection)	Moderate	Moderate	Moderate
Roost Value (Post-aerial inspection)	Low	Low	Low

Tree No.	Group H	35 – 40	41
Species	Oaks	Oaks	Oak
Location /Area	Near Café	Newbourne Road	Newbourne Road
OS Grid Ref	TM 2488 4434	TM 24967 43963 – TM 25137 43970	TM 2556 4421
Description: (M/MS/C/P)	M/MS	M	M
Age: (Y/S/M/V)	M	M	M
Potential Roost Features (PRF)			
Holes*	Number of small holes 2-8m above ground level plus dead limbs with holes and peeling bark	No obvious features but trees of an age and size where PRFs are possible	Basal cavity – exposed to 2m high on main trunk, but has good features i.e. narrow holes going further into tree on inside. Branch tearout – two holes link up 20x20cm & 15x15cm, approx. 60cm deep, dry.
Splits / Cracks*			
Loose Bark*	Minor on dead limbs		
Photo			
Climbable	Yes	N/A	Yes
Dense Ivy	Absent	None	Minor
Field Signs	None	None	None
Roost Value (Pre-aerial inspection)	Low	Low	High
Roost Value (Post-aerial inspection)	N/A	N/A	High

Survey Summary

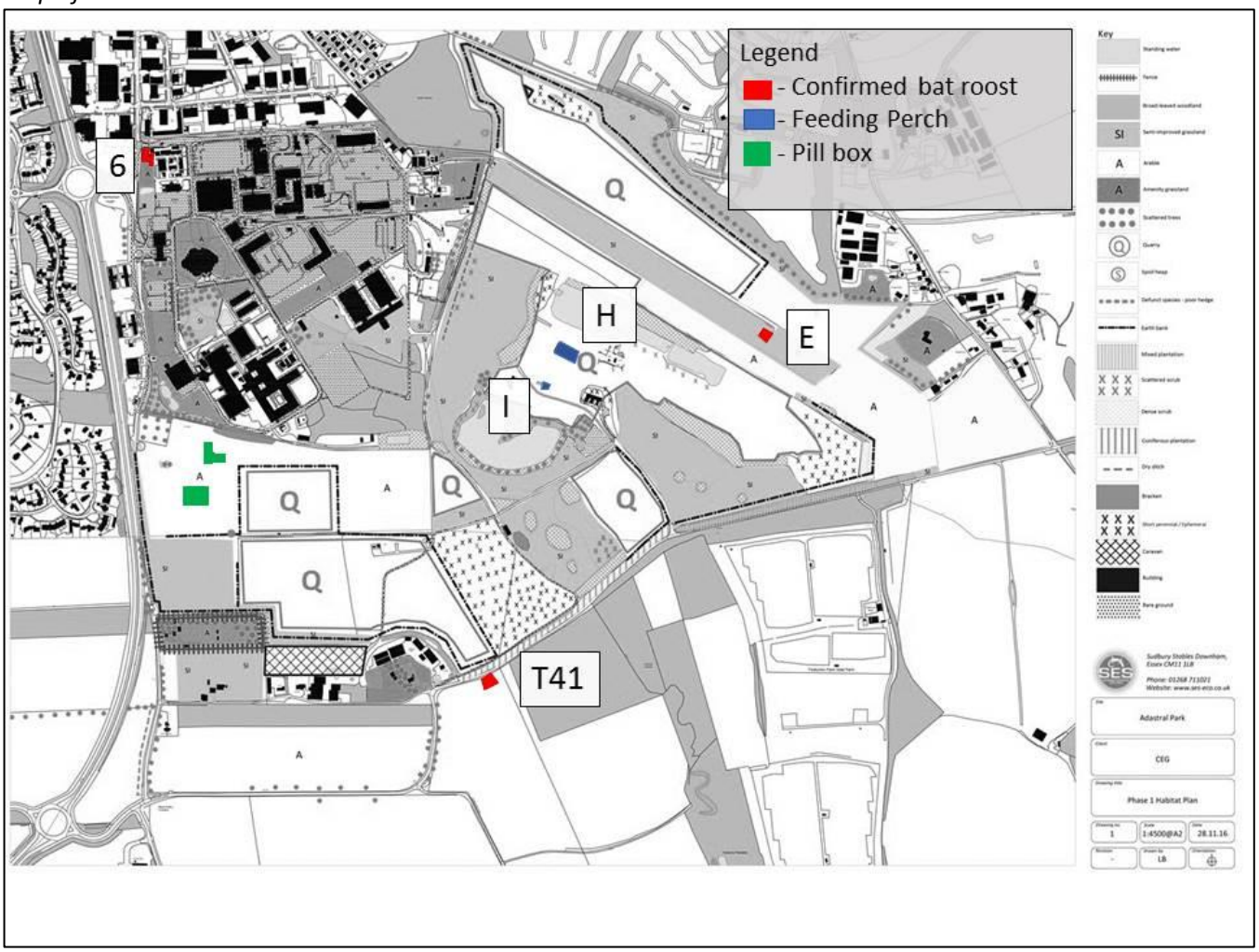
Tree ID	Species	Pre-inspection rating	Post-inspection rating	Roost confirmed
1	Weeping Willow	Low	N/A	N/A
2	Oak	Low	N/A	N/A
3	Oak	Low	N/A	N/A
4	Oak	Low	N/A	N/A
5	Oak	Low	N/A	N/A
6	Oak	Moderate	Low	N/A
7	Oak	Low	N/A	N/A
8	Oak	Moderate	None	N/A
9	Oak	Low	N/A	N/A
10	Oak	Moderate	Moderate	Likely Absent
11	Oak	Moderate	Low	N/A
12	Oak	Moderate	Low	N/A
13	Oak	High	None	N/A
14	Oak	Moderate	Moderate	Likely Absent
15	Scott's Pine	Low	N/A	N/A
16	Oak	Low	N/A	N/A
17	Scott's Pine	Low	N/A	N/A
18	Oak	Moderate	N/A	N/A
19	Oak	Moderate	Low	N/A
20	Oak	High	Moderate	Likely Absent
21	Oak	Moderate	Low	N/A
22	Oak	High	Moderate	Likely Absent
23	Oak	Moderate	Moderate	Likely Absent
24	Oak	High	High	Likely Absent
25	Oak	Low	N/A	N/A
26	Sycamore	Moderate	Low	N/A
27	Oak	Low	N/A	N/A
28	Oak	Low	N/A	N/A
29	Oak	Low	N/A	N/A
30	Oak	Low	N/A	N/A
31	Oak	Moderate	Off-site	N/A
32	Oak	Moderate	Low	N/A
33	Oak	Moderate	Low	N/A
34	Sycamore	Moderate	Low	N/A
Group H	Oaks	Low	N/A	N/A
35	Oak	Low	N/A	N/A
36	Oak	Low	N/A	N/A
37	Oak	Low	N/A	N/A
38	Oak	Low	N/A	N/A
39	Oak	Low	N/A	N/A
40	Oak	Low	N/A	N/A
41	Oak	Moderate	High	Pipistrelle Roost Present + Possible Barbastelle

Tree scoping survey map; pre-aerial inspection

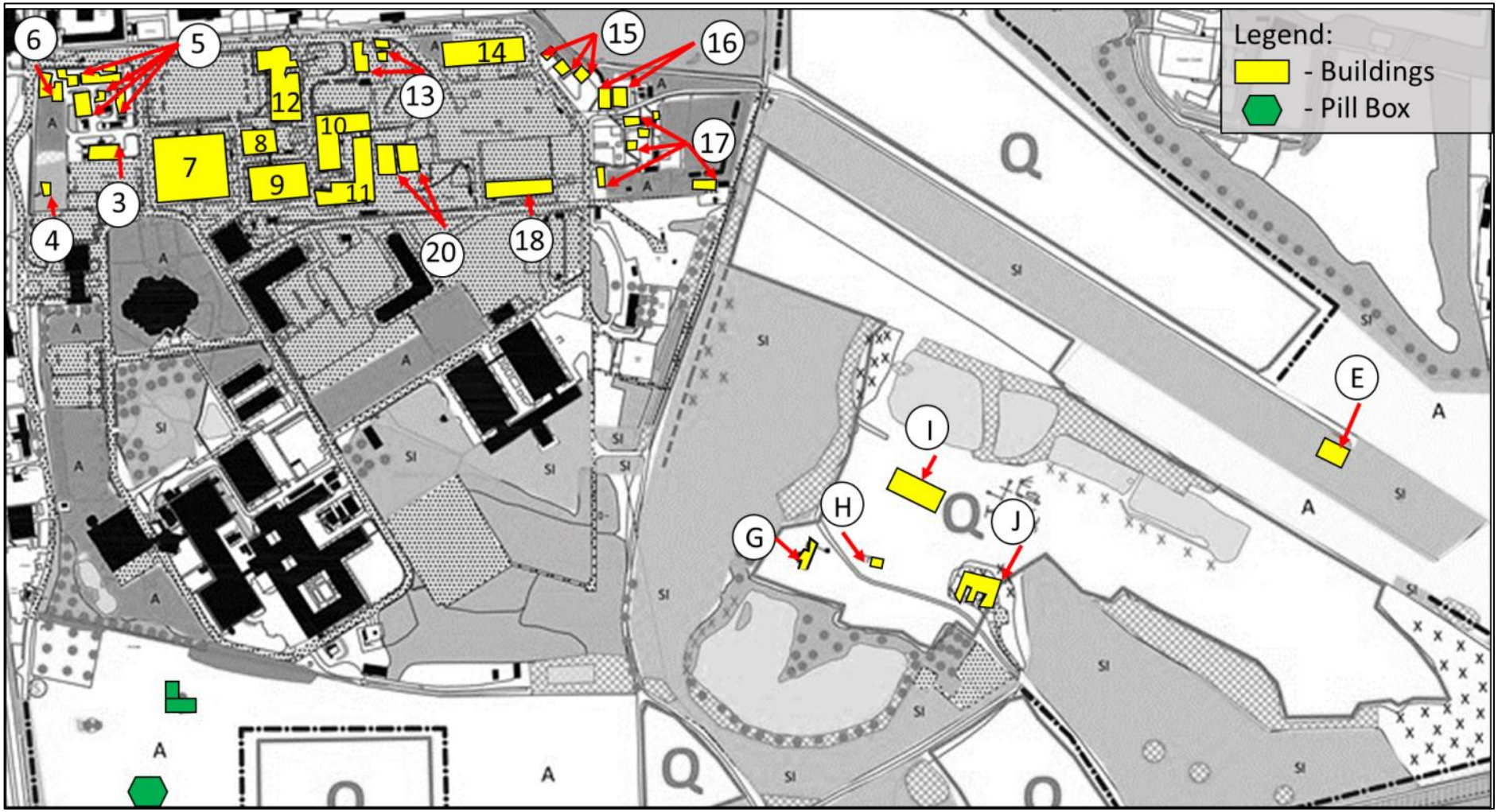


Tree scoping survey map; post-aerial inspection

Map of bat roosts

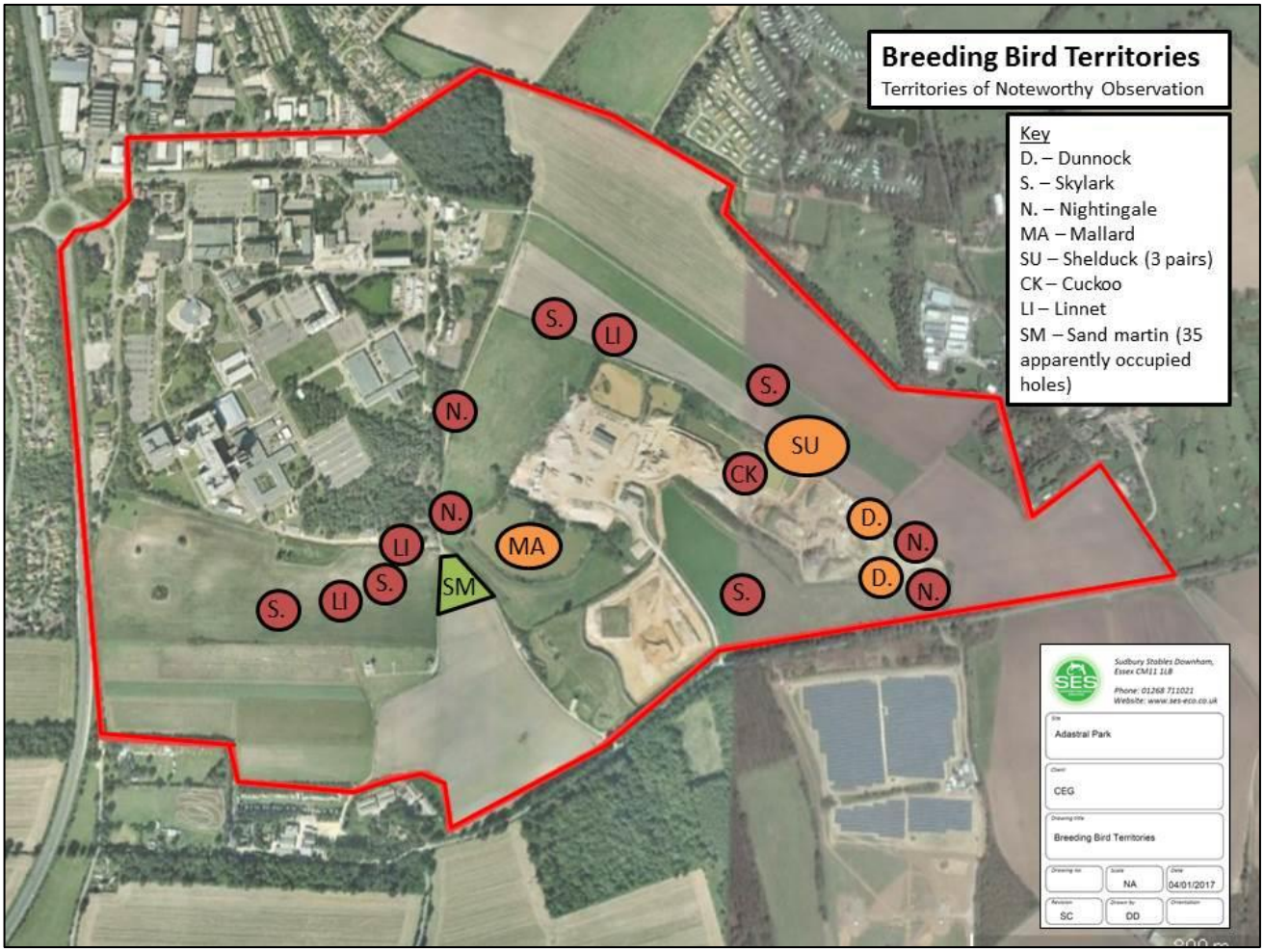


Map of buildings



Appendix 11: Bird territories

Map of breeding bird territories

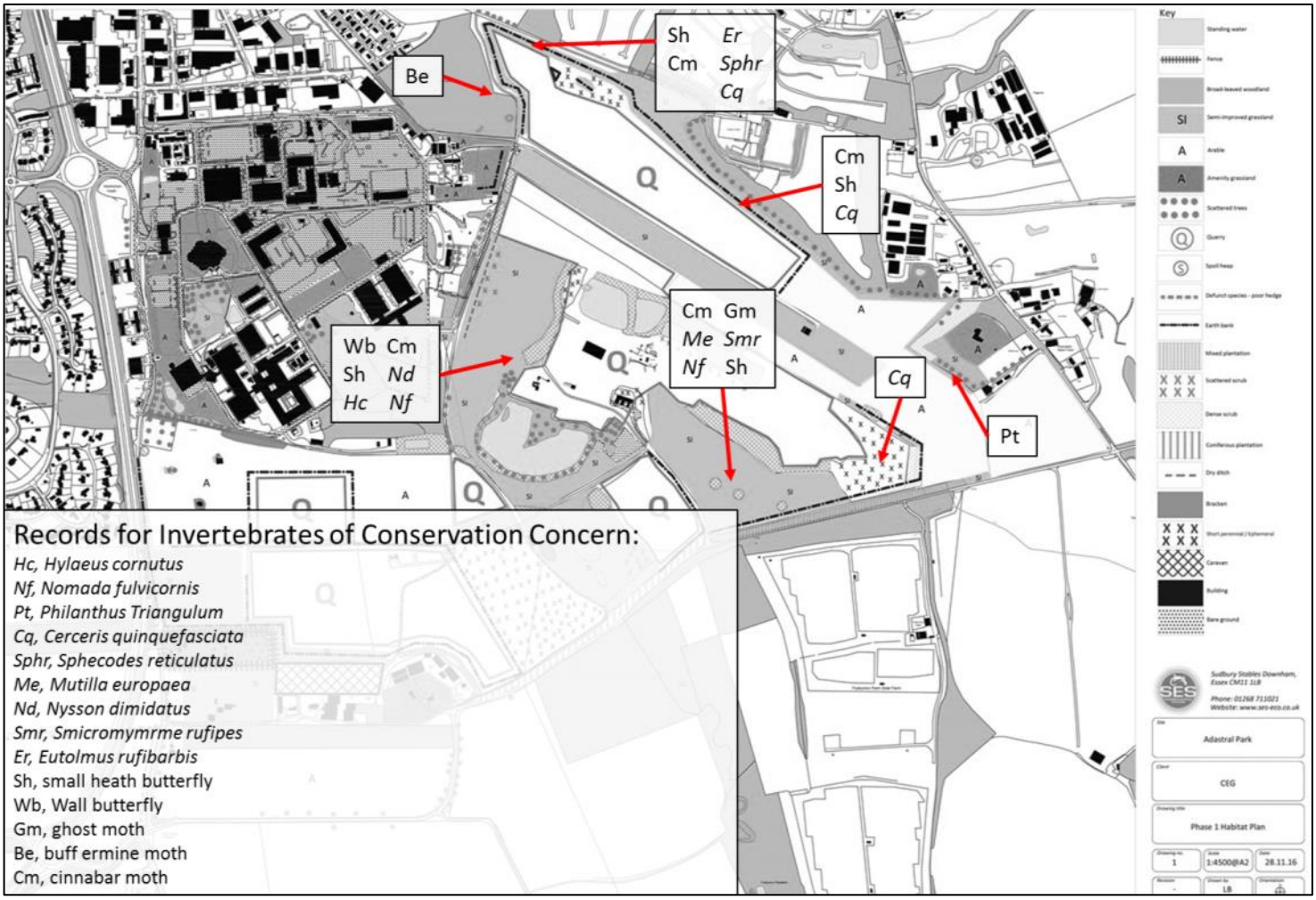


Appendix 12: Badger survey results

Confidential

Appendix 13: Invertebrate survey results

Locations for species of conservation concern



Species lists for sampling stations. For the status of species the following abbreviations are used: RDB 2, Red Data Book 2; RDB3, Red Data Book 3; NS, Nationally Scarce, with –A and –B as two categories where available; S41, Species of Principal Importance.

Higher taxon	Species	Status	Sampling stations																			
			Main							Minor												
			1	2	3	4	5	6	7	A	B	C	D	E	F	G	H	I	J	K	L
Araneae: Araneidae	*Agalenatea redii*						X														
Araneae: Araneidae	*Araniella cucurbitina*					X															
Araneae: Araneidae	*Hypsosinga pygmaea*					X															
Araneae: Araneidae	*Larinioides cornutus*				X			X													
Araneae: Araneidae	*Neoscona adianta*			X				X													
Araneae: Araneidae	*Nuctenea umbratica*				X																
Araneae: Araneidae	*Zilla diodia*		X																		
Araneae: Dictynidae	*Dictyna arundinacea*					X															
Araneae: Dictynidae	*Dictyna latens*				X	X															

Higher taxon	Species	Status	Sampling stations																			
			Main							Minor												
			1	2	3	4	5	6	7	A	B	C	D	E	F	G	H	I	J	K	L
Araneae: Gnaphosidae	*Haplodrassus signifer*								X												
Araneae: Gnaphosidae	*Micaria pulicaria*			X																	
Araneae: Linyphiidae	*Erigone atra*		X		X																
Araneae: Linyphiidae	*Lepthyphantes tenuis*		X	X	X				X												
Araneae: Linyphiidae	*Linyphia hortensis*		X						X												
Araneae: Linyphiidae	*Linyphia triangularis*								X												
Araneae: Linyphiidae	*Maso sundevalli*								X												
Araneae: Linyphiidae	*OedothoraX gibbosus*		X																		
Araneae: Lycosidae	*Pardosa monticola*							X													
Araneae: Pisauridae	*Pisaura mirabilis*		X			X															
Araneae: Salticidae	*Heliophanus cupreus*					X	X														
Araneae: Salticidae	*Heliophanus flavipes*			X					X												
Araneae: Tetragnathidae	*Metellina mengei*			X																	
Araneae: Theridiidae	*Anelosimus vittatus*			X			X	X													
Araneae: Theridiidae	*Enoplognatha ovata*		X		X			X													
Araneae: Theridiidae	*Rugathodes instabilis*								X												
Araneae: Theridiidae	*Theridion impressum*				X			X													
Araneae: Theridiidae	*Theridion mystaceum*				X																
Araneae: Theridiidae	*Theridion sisyphium*								X												
Araneae: Theridiidae	*Theridion varians*			X																	
Araneae: Thomisidae	*Philodromus cespitum*						X														
Araneae: Thomisidae	*Philodromus dispar*						X														
Araneae: Thomisidae	*Tibellus maritimus*						X														
Araneae: Thomisidae	*Tibellus oblongus*			X			X														
Araneae: Thomisidae	*Xysticus cristatus*			X				X													
Araneae: Thomisidae	*Xysticus ulmi*								X												
Coleoptera: Anthicidae	*Notoxus monoceros*					X	X														
Coleoptera: Apionidae	*Apion haematodes*				X	X															

Higher taxon	Species	Status	Sampling stations																			
			Main							Minor												
			1	2	3	4	5	6	7	A	B	C	D	E	F	G	H	I	J	K	L
Coleoptera: Apionidae	*Diplapion confluens*																X				
Coleoptera: Apionidae	*Exapion ulicis*							X													
Coleoptera: Apionidae	*Ischnopterapion virens*				X																
Coleoptera: Apionidae	*Malvapion malvae*				X																
Coleoptera: Apionidae	*Oxystoma pomonae*							X													
Coleoptera: Apionidae	*Protapion fulvipes*				X																
Coleoptera: Byturidae	*Byturus tomentosus*					X			X												
Coleoptera: Cantharidae	*Cantharis cryptica*								X												
Coleoptera: Cantharidae	*Cantharis lateralis*		X																		
Coleoptera: Cantharidae	*Cantharis rustica*			X	X										X	X					
Coleoptera: Cantharidae	*Cantharis thoracica*							X													
Coleoptera: Cantharidae	*Rhagnonycha fulva*		X																		
Coleoptera: Carabidae	*Amara aenea*			X																	
Coleoptera: Carabidae	*Amara lucida*								X												
Coleoptera: Carabidae	*Amara ovata*			X					X												
Coleoptera: Carabidae	*Amara similata*				X				X												
Coleoptera: Carabidae	*Anchomenus dorsalis*						X														
Coleoptera: Carabidae	*Bembidion lampros*			X																	
Coleoptera: Carabidae	*Bradycellus harpalinus*					X															
Coleoptera: Carabidae	*Bradycellus verbasci*					X															
Coleoptera: Carabidae	*Calathus cinctus*			X																	
Coleoptera: Carabidae	*Calathus fuscipes*			X	X			X													
Coleoptera: Carabidae	*Calathus rotundicollis*						X														
Coleoptera: Carabidae	*Curtonotus aulicus*			X																	
Coleoptera: Carabidae	*Demetrias atricapillis*							X													
Coleoptera: Carabidae	*Harpalus anxius*			X																	
Coleoptera: Carabidae	*Harpalus rufipes*			X																	
Coleoptera: Carabidae	*Harpalus tardus*			X																	

Higher taxon	Species	Status	Sampling stations																			
			Main							Minor												
			1	2	3	4	5	6	7	A	B	C	D	E	F	G	H	I	J	K	L
Coleoptera: Carabidae	*Microlestes maurus*				X	X		X													
Coleoptera: Carabidae	*Microlestes minutulus*			X		X															
Coleoptera: Carabidae	*Notiophilus biguttatus*						X		X												
Coleoptera: Carabidae	*Notiophilus palustris*		X																		
Coleoptera: Carabidae	*Pterostichus melanarius*			X				X													
Coleoptera: Carabidae	*Syntomus foveatus*						X		X												
Coleoptera: Carabidae	*Trechus quadristriatus*			X																	
Coleoptera: Chrysomelidae	*Altica lythri*				X			X													
Coleoptera: Chrysomelidae	*Altica palustris*							X													
Coleoptera: Chrysomelidae	*Aphthona euphorbiae*							X													
Coleoptera: Chrysomelidae	*Batophila aerata*						X														
Coleoptera: Chrysomelidae	*Bruchus rufimanus*			X																	
Coleoptera: Chrysomelidae	*Cassida rubiginosa*		X	X		X	X														
Coleoptera: Chrysomelidae	*Cassida vibex*							X													
Coleoptera: Chrysomelidae	*Chrysolina hyperici*							X													
Coleoptera: Chrysomelidae	*Chrysolina marginata*		X																		
Coleoptera: Chrysomelidae	*Crepidodera plutus*		X																		
Coleoptera: Chrysomelidae	*Cryptocephalus fulvus*			X					X												
Coleoptera: Chrysomelidae	*Longitarsus dorsalis*			X																	
Coleoptera: Chrysomelidae	*Longitarsus luridus*			X																	
Coleoptera: Chrysomelidae	*Neocrepidodera ferruginea*								X												
Coleoptera: Chrysomelidae	*Oulema melanopus*							X													
Coleoptera: Chrysomelidae	*Sphaeroderma rubidum*			X			X														
Coleoptera: Coccinellidae	*Exochomus quadripustulatus*								X												
Coleoptera: Coccinellidae	*Hippodamia variegata*			X			X														
Coleoptera: Coccinellidae	*Propylea quattuordecimpunctata*							X						X							
Coleoptera: Coccinellidae	*Scymnus impexus*		X					X							X						
Coleoptera: Coccinellidae	*Subcoccinella viginti-quattuorpunctata*		X			X															

Higher taxon	Species	Status	Sampling stations																			
			Main							Minor												
			1	2	3	4	5	6	7	A	B	C	D	E	F	G	H	I	J	K	L
Coleoptera: Cryptophagidae	*Cryptophagus sp.*		X																		
Coleoptera: Curculionidae	*Andrion regensteinense*				X																
Coleoptera: Curculionidae	*Archarius pyrrhocerus*					X	X	X													
Coleoptera: Curculionidae	*Ceutorhynchus pallidactylus*			X					X												
Coleoptera: Curculionidae	*Curculio nucum*								X												
Coleoptera: Curculionidae	*Hypera postica*			X				X													
Coleoptera: Curculionidae	*Larinus planus*				X																
Coleoptera: Curculionidae	*Mecinus pascuorum*								X												
Coleoptera: Curculionidae	*Mecinus pyraster*								X												
Coleoptera: Curculionidae	*Mogulones geographicus*			X					X												
Coleoptera: Curculionidae	*Otiorhynchus ligneus*				X																
Coleoptera: Curculionidae	*Otiorhynchus sulcatus*		X																		
Coleoptera: Curculionidae	*Philopedon plagiatum*						X														
Coleoptera: Curculionidae	*Phyllobius maculicornis*							X													
Coleoptera: Curculionidae	*Phyllobius roboretanus*						X														
Coleoptera: Curculionidae	*Rhinocyllus conicus*		X						X												
Coleoptera: Curculionidae	*Sitona humeralis*		X			X			X												
Coleoptera: Curculionidae	*Sitona lineatus*		X	X	X			X	X												
Coleoptera: Elateridae	*Agriotes acuminatus*							X	X												
Coleoptera: Elateridae	*Agriotes sputator*								X												
Coleoptera: Elateridae	*Agrypnus murinum*								X												
Coleoptera: Elateridae	*Athous haemorrhoidalis*							X	X												
Coleoptera: Elateridae	*Kibunea minuta*			X																	
Coleoptera: Histeridae	*Margarinotus brunneus*			X																	
Coleoptera: Leiodidae	*Choleva angustata*			X			X														
Coleoptera: Malachiidae	*Malachius bipustulatus*				X	X		X													
Coleoptera: Oedemeridae	*Oedemera lurida*		X			X		X													
Coleoptera: Scarabaeidae	*Onthophagus joannae*							X													

Higher taxon	Species	Status	Sampling stations																			
			Main							Minor												
			1	2	3	4	5	6	7	A	B	C	D	E	F	G	H	I	J	K	L
Coleoptera: Scarabaeidae	*Phyllopertha horticola*		X																		
Coleoptera: Scirtidae	*Cyphon variabilis*			X			X														
Coleoptera: Silphidae	*Silpha laevigata*			X																	
Coleoptera: Staphylinidae	*Othius laeviusculus*			X																	
Coleoptera: Staphylinidae	*Philonthus carbonarius*			X																	
Coleoptera: Staphylinidae	*Philonthus cognatus*							X													
Coleoptera: Staphylinidae	*Philonthus laminatus*				X																
Coleoptera: Staphylinidae	*Quedius schatzmayri*			X																	
Coleoptera: Staphylinidae	*Quedius semiaeneus*					X															
Coleoptera: Staphylinidae	*Quedius semiobscurus*			X																	
Coleoptera: Staphylinidae	*Tachinus rufipes*								X												
Coleoptera: Staphylinidae	*Tachyporus hypnorum*						X	X	X												
Coleoptera: Tenebrionidae	*Lagria hirta*							X													
Diptera: Asilidae	*Dioctria atricapilla*			X	X																
Diptera: Asilidae	***Dioctria baumhaueri***			X				X						X			X		X		
Diptera: Asilidae	*Dioctria rufipes*				X			X													
Diptera: Asilidae	*Dysmachus trigonus*								X												
Diptera: Asilidae	*Epitriptus cingulatus*			X	X				X												
Diptera: Asilidae	*Eutolmus rufibarbis*	RDB 3			X																
Diptera: Asilidae	*Leptogaster cylindrica*				X			X													X
Diptera: Chloropidae	*Meromyza femorata*				X																
Diptera: Chloropidae	*Oscinella frit*				X																
Diptera: Conopidae	*Conops quadrifasciatus*												X								
Diptera: Conopidae	*Myopa buccata*											X	X								
Diptera: Conopidae	*Sicus ferrugineus*					X															
Diptera: Sciomyzidae	*Coremacera marginata*			X																	
Diptera: Sciomyzidae	*Pherbellia cinerella*				X	X							X				X	X			
Diptera: Stratiomyidae	*Chorisops tibialis*			X																	

Higher taxon	Species	Status	Sampling stations																			
			Main							Minor												
			1	2	3	4	5	6	7	A	B	C	D	E	F	G	H	I	J	K	L
Diptera: Stratiomyidae	*Pachygaster atra*								X												
Diptera: Syrphidae	*Cheilosia bergenstammi*							X													
Diptera: Syrphidae	*Cheilosia pagana*			X																	
Diptera: Syrphidae	*Chrysotoxum bicinctum*			X				X					X								
Diptera: Syrphidae	*Epistrophe eligans*													X							
Diptera: Syrphidae	*Episyrphus balteatus*		X	X					X	X	X	X	X				X	X	X	X	X
Diptera: Syrphidae	*Erisatlis arbustorum*			X			X		X												
Diptera: Syrphidae	*Erisatlis intricarius*			X																	
Diptera: Syrphidae	*Erisatlis pertinax*			X	X																
Diptera: Syrphidae	*Erisatlis tenax*		X	X		X						X		X							
Diptera: Syrphidae	*Helophilus pendulus*		X	X								X									
Diptera: Syrphidae	*Helophilus trivittatus*		X	X			X					X			X	X		X			
Diptera: Syrphidae	*Melanostoma mellinum*		X	X			X	X	X			X		X	X	X	X		X		X
Diptera: Syrphidae	*Melanostoma scalare*							X													
Diptera: Syrphidae	*Meliscaeva cinctella*													X							
Diptera: Syrphidae	*Metasyrphus corollae*							X													
Diptera: Syrphidae	*Neoascia podagrica*													X							
Diptera: Syrphidae	*Pipizella viduata*			X																	
Diptera: Syrphidae	*Platycheirus clypeatus*		X	X		X															
Diptera: Syrphidae	*Sphaerophoria scripta*			X				X											X	X	
Diptera: Syrphidae	*Sphegina clunipes*													X							
Diptera: Syrphidae	*Syritta pipiens*		X		X		X	X							X			X			X
Diptera: Syrphidae	*Syrphus ribesii*			X																	
Diptera: Syrphidae	*Volucella pellucens*												X								
Diptera: Tephritidae	*Tephritis vespertina*			X																	X
Diptera: Tephritidae	*Terellia serratulae*								X												
Diptera: Tephritidae	*Urophora jaceana*							X	X												
Diptera: Therevidae	*Thereva plebeja*				X																

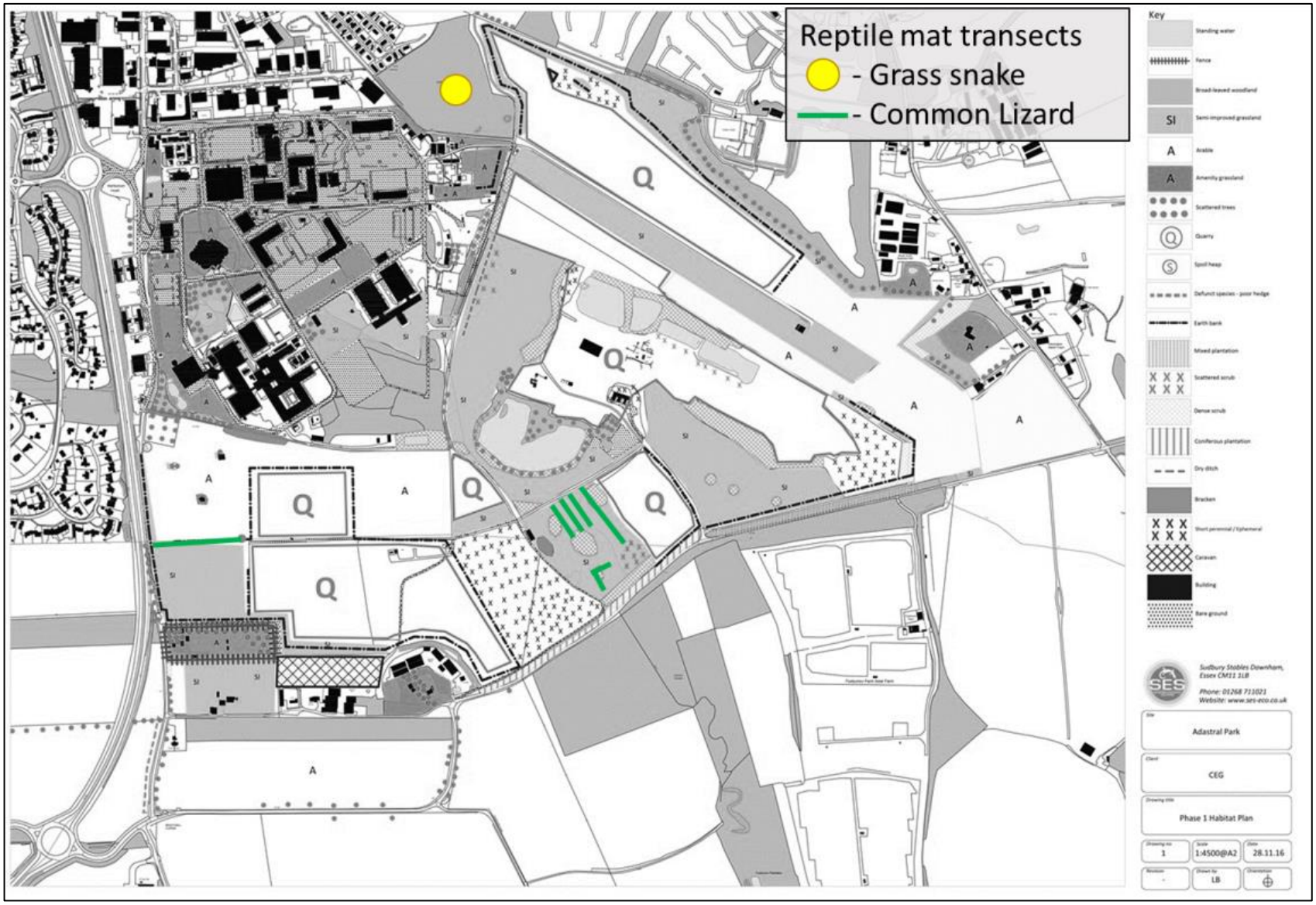
Higher taxon	Species	Status	Sampling stations																		
			Main							Minor											
			1	2	3	4	5	6	7	A	B	C	D	E	F	G	H	I	J	K	L
Heteroptera: Alydidae	*Alydus calcaratus*			X														X		X	
Heteroptera: Coreidae	*Coreus marginatus*						X		X							X					
Heteroptera: Cydnidae	*Legnotus limbosus*		X				X														
Heteroptera: Lygaeidae	*Heterogaster urticae*			X			X	X	X			X		X	X						
Heteroptera: Lygaeidae	*Trapezonotus sp.*			X																	
Heteroptera: Miridae	*Adelphocoris lineolatus*			X			X	X	X				X	X						X	X
Heteroptera: Miridae	*Lygus pratensis*							X	X												
Heteroptera: Miridae	*Notostirus elongata*			X				X	X												
Heteroptera: Miridae	*Phytocoris varipes*							X													
Heteroptera: Miridae	*Psallus sp.*								X												
Heteroptera: Miridae	*Stenodema laevigata*			X					X				X						X	X	X
Heteroptera: Nabidae	*Himacerus mirmicoides*			X				X	X												
Heteroptera: Nabidae	*Nabis ferus*								X												
Heteroptera: Pentatomidae	*Aelia acuminata*			X	X	X		X	X			X	X		X		X	X		X	X
Heteroptera: Pentatomidae	*Dolycoris baccarum*								X					X							
Heteroptera: Pentatomidae	*Palomena prasina*			X										X							
Heteroptera: Rhopalidae	*Corizus hyoscyami*																		X		
Heteroptera: Rhopalidae	*Stictopleurus punctatonervosus*																		X	X	
Heteroptera: Scutellaridae	*Odontoscelis lineola*									X											
Homoptera: Lygaeidae	*Nysius senecionis*			X				X											X		
Hymenoptera: Andrenidae	*Andrena denticulata*		X	X																	
Hymenoptera: Andrenidae	*Andrena minutula*					X						X									
Hymenoptera: Andrenidae	*Andrena thoracica*			X	X																
Hymenoptera: Andrenidae	*Panurgus banksianus*			X	X			X					X								
Hymenoptera: Apidae	*Apis mellifera*		X				X					X	X								
Hymenoptera: Apidae	*Bombus hypnorum*						X	X					X		X						
Hymenoptera: Apidae	*Bombus pascuorum*		X	X			X					X									
Hymenoptera: Apidae	*Bombus vestalis*			X																	

Higher taxon	Species	Status	Sampling stations																		
			Main							Minor											
			1	2	3	4	5	6	7	A	B	C	D	E	F	G	H	I	J	K	L
Hymenoptera: Apidae	*Nomada fulvicornis*	RDB 3		X					X												
Hymenoptera: Chrysididae	*Chrysis ignita*			X									X		X				X		
Hymenoptera: Chrysididae	*Elampus panzeri*				X														X		
Hymenoptera: Colletidae	*Colletes daviesanus*					X	X														
Hymenoptera: Colletidae	*Colletes similis*						X			X	X			X							
Hymenoptera: Colletidae	*Hylaeus annularis*													X							
Hymenoptera: Colletidae	*Hylaeus brevicornis*																	X			X
Hymenoptera: Colletidae	*Hylaeus cornutus*	NS-A		X																	
Hymenoptera: Colletidae	*Hylaeus signatus*																X				X
Hymenoptera: Eumenidae	*Anoplius nigerrimus*								X												
Hymenoptera: Formicidae	*Formica fusca*			X				X	X												
Hymenoptera: Formicidae	*Lasius niger*		X	X				X	X												
Hymenoptera: Formicidae	*Myrmica scabrinodis*			X																X	X
Hymenoptera: Halictidae	*Halictus tumulorum*				X								X								
Hymenoptera: Halictidae	*Lasioglossum calceatum*								X										X		
Hymenoptera: Halictidae	*Lasioglossum sexnotatum*								X												
Hymenoptera: Halictidae	*Sphecodes crassus*			X	X											X					
Hymenoptera: Mutillidae	*Smicromyrme rufipes*	NS-B							X												
Hymenoptera: Sphecidae	*Ammophila sabulosa*				X	X						X									
Hymenoptera: Sphecidae	*Astata boops*				X	X			X	X	X			X							
Hymenoptera: Sphecidae	*Lindenius albibarbis*		X																		X
Hymenoptera: Sphecidae	*Mellinus arvensis*			X					X												
Hymenoptera: Crabronidae	*Cerceris quinquefasciata*	RDB 3			X	X	X														
Hymenoptera: Crabronidae	*Nysson dimidiatus*	NS-B		X																	
Hymenoptera: Crabronidae	*Philanthus triangulum*	RDB 2															X	X			
Hymenoptera: Halictidae	*Sphecodes reticulatus*	NS-A			X																
Hymenoptera: Mutillidae	*Mutilla europaea*	NS-B							X												
Lepidoptera: Acrididae	*Chorthippus brunneus*						X		X		X										

Higher taxon	Species	Status	Sampling stations																			
			Main							Minor												
			1	2	3	4	5	6	7	A	B	C	D	E	F	G	H	I	J	K	L
Lepidoptera: Acrididae	*Myrmeleotettix maculatus*			X			X	X			X										
Lepidoptera: Arctiidae	*Tyria jacobaeae*	S41		X	X	X		X													
Lepidoptera: Conocephalidae	*Conocephalus dorsalis*			X																	
Lepidoptera: Erebidae	*Spilosoma luteum*	S41												X							
Lepidoptera: Hesperiidae	*Ochlodes sylvanus*			X	X	X		X													
Lepidoptera: Hesperiidae	*Thymelicus lineola*			X				X				X									
Lepidoptera: Hesperiidae	*Thymelicus sylvestris*			X				X			X									X	
Lepidoptera: Lycaenidae	*Aricia agestis*			X					X											X	
Lepidoptera: Lycaenidae	*Polyommatus icarus*			X																	
Lepidoptera: Meconematidae	*Meconema thalassinum*							X													
Lepidoptera: Moth: ghost moth	*Hepialis humuli*	S41						X													
Lepidoptera: Nymphalidae	***Inachis** io*					X	X														
Lepidoptera: Pieridae	*Pieris brassicae*						X														
Lepidoptera: Satyridae	***Aphantopus** hyperantus*			X				X													
Lepidoptera: Satyridae	*Coenonympha pamphilus*	S41		X	X	X		X													
Lepidoptera: Satyridae	*Lasiommata megera*	S41		X																	
Lepidoptera: Satyridae	*Maniola jurtina*			X	X	X		X	X			X	X							X	
Mollusca: Cochlicopidae	*Cochlicopa lubrica*							X													
Mollusca: Euconulidae	*Euconulus fulvus*								X												
Mollusca: Helicidae	*Cepaea hortensis*							X													
Mollusca: Helicidae	*Cepaea nemoralis*			X				X													
Mollusca: Hygromiidae	*Candidula intersecta*			X					X												
Mollusca: Hygromiidae	*Trichia hispida*							X													
Mollusca: Lauriidae	*Lauria cylindrica*			X																	
Mollusca: Pristilomatidae	*Vitrea pellucida*			X					X												

Appendix 14: Reptile survey results

Locations of reptiles found on site during 2016 surveys



Appendix 15: Ecological Mitigation Masterplan

Area 1 – Woodland

At present the woodland is not a particularly valuable example of this habitat type to biodiversity due to low species and structural diversity. The canopy consists of Oak and Sycamore, with a Bramble and Bracken understorey. The woodland does however provide foraging habitat for bat species, including the rare Barbastelle.

The biodiversity aims for this woodland area are to increase the species diversity through native species planting and ad hoc removal of Sycamore which can become invasive. Opening up of rides and walkways may also encourage shade tolerant woodland ground flora to establish as well as increase structural diversity.

It will be important to retain this dark habitat to ensure fragmentation does not occur, and maintain existing foraging and commuting paths for local bat populations. No lighting will be implemented within the woodland and a sensitive, low level lighting scheme will be implemented around the woodland edges where it will back onto the new residential areas, ensuring the woodland edges are not lit.

Area 2 – Green Corridors

At present the green corridors around the site form ecological connectivity for wildlife. The bunds and adjacent tree lines provide shelter from the wind for bats and the scrubby successional habitats provide habitat for birds such as the Red Listed Nightingale.

Aims for these corridors throughout the site include providing a greater species and structural diversity through: sowing of a wildflower mix into grasslands, managing in a low intensity manner to provide gradation in structure; native species structural planting; and a low level lighting scheme, which will prevent fragmentation for species using these commuting / foraging corridors between the woodlands on site and those off-site in the north and south.

Area 3 – Heathland and Wildflower Meadow

Area 3 currently consists of semi-improved grassland with a mix of species including some Near Threatened, Nationally Scarce and Nationally Vulnerable species present.

Areas of Adastral Park historically consisted of heathland and the aim for this area will be to recreate heathland on site. The newly created heathland will provide optimal habitat for notable plant species, reptiles and invertebrate species of sparsely vegetated ground, as well as retain and enhance an important foraging corridor for Nightingales. Areas of the heathland will be left as 'low disturbance' for biodiversity, by diverting paths, thorny plantings and signage. Management will be sensitive to the species that will utilise the area such as cutting on rotation with arisings removed.

Wildflower meadows, as well as patches of neutral/acid grassland and sparsely vegetated ground will also be created here for the benefit of reptiles, invertebrates and notable plants. Interpretation boards will inform the new residents of the importance of these species and prevent picking / trampling of notable plants.

Area 4 – Low Disturbance Zone

An area incorporating heathland and the northwest part of the will be designated as a 'low disturbance zone' where recreational access is restricted to allow species sensitive to disturbance, such as sand martin, nightingale, skylark, reptiles and badgers to be retained on site. Management here will include reinforcing the scrub and thorny native species around the edge of this zone, to naturally deter access to these areas.

The scrub will be cut on rotation to prevent it from superseding the heathland and retained trees will be managed by retaining any dead wood *in situ* enhancing habitat for bats and invertebrates. The heathland in this area will have no paths cut though it to further deter access to these areas. A marginal wetland habitat will be incorporated around the margins of the lake to enhance its value for biodiversity. In addition, a low level lighting scheme will be implemented.

Area 10 – Allotments / Orchard

Areas where allotments and/or orchards will be created. Orchard will be formed with an understorey of neutral / acid grassland or wildflower meadow. Low level lighting and provision of fruiting trees and shrubs.

Area 9 – Meadow Grassland

This area of the site currently consists of an arable field of low biodiversity value.

The aim for this area is to create a wildflower meadow. A native wildflower seed mix of native provenance will be sown, with management to include cutting on long rotation to allow the sward to grow long. This will allow connectivity around the site in a circular route and provide habitat for notable bird species a=such as skylark. Bare patches around the periphery will also be present for invertebrates that will require a higher level of disturbance.

Road Crossings and the Built Environment

Areas where roads will cross the SANGS areas will be carefully considered so as to avoid fragmentation. Low lighting levels and reduced speed levels would reduce risks of RTA and ensure connectivity across the greenspace network is not lost for wildlife.
Enhancements for bats will include provision of bat boxes within the masterplan and those for hedgehogs will include connectivity into gardens.

Area 8 – Southern Boundary

The southern boundary consists of plantation woodland, both broadleaved and coniferous. This boundary provides a dark corridor and foraging and commuting habitat, important for bats including the rare Barbastelle.

The aims for this area include ensuring a dark corridor persists post development, this will require buffer planting and no lighting directed on this corridor. Due to the presence of a potential Barbastelle roost, the road will remain unlit. These recommendations will also be suitable for badgers. Structural planting will also take place providing structural diversity of benefit to notable bird and invertebrate species.

Area 7 – The Valley

An area of grassland (with rare and notable species) and scrub, with suitable habitat for reptiles.

The aim for this area is to provide a continuation of existing reptile and notable plant habitat and enhancement through management and habitat creation (i.e. hibernacula and log piles). Habitats will include areas of species-rich grassland (acid/neutral) with scrub mosaic managed on a 3-5 year cutting rotation, as well area of sparsely vegetated ground for notable invertebrate species. The bare patches of soil will allow both reptiles to bask as well as invertebrates to shelter. The bare patches of soil will be suitable areas for higher levels of disturbance by walkers and cyclists, and steep banks facing south. Low light levels will be important here to allow continued connectivity from the southern boundary up to the woodland in the north particularly for bats.

Area 6 – The Lake

Area 6 contains the majority of the lake with grassland and scrub surrounding it.

This area will predominantly be recreational, however a marginal wetland habitat will be created around the margins of the lake to enhance the biodiversity value in this area. In addition a wildlife amenity seed mix will be planted to ensure the biodiversity value of this area is not lost.

Area 5 – Scheduled Ancient Monument

Area 5 contains two pill boxes that currently sit within the middle of an arable field with Bracken and scrub around them.

The proposals will enhance this area for bats to provide additional roosting opportunities. The pill boxes have the potential to be utilised by roosting bats with some minor enhancements; wooden boards for perching and roosting, as well as blocking the doorways and windows to create a darker space that is unlikely to be disturbed. In addition, planting of a native species-rich hedgerow along the new footpath will provide an enhancement for bats that can utilise the hedgerow for commuting and foraging. The hedgerow will include species beneficial to bats i.e. night scented species such as honeysuckle. This mitigation is also considered suitable for hedgehogs that may be utilising the site.