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Site: Site 49 – Worsborough Treatment Works

Survey: Preliminary Ecological Appraisal Report

Client: Yorkshire Water

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1 Summary

1.1.1 This PEA report has been produced to inform the development of ground-mounted solar photovoltaic (PV) panels at Yorkshire Water's Worsbrough Treatment Works. Table 1 below highlights the constraints identified and the actions required.

Table 1 - Summary

Factor	Constraint Risk			Recommended Action
	Presence on site		Potential presence on site	
Sites of Nature Conservation Interest	**On site**	**Within 2km**		
Statutory sites	NO	YES	-	Site lies immediately adjacent to Worsbrough Country Park Local Nature Reserve (LNR); Avoid siting the development in close proximity to the LNR. Strict pollution prevention controls.
Non-statutory sites	NO	YES	-	Barrow Colliery Local Wildlife Site (LWS) lies immediately to the west of the site. Avoid siting the development in close proximity to the LWS. Strict pollution prevention controls.
Botany				
Biodiversity Action Plan (BAP) Habitat	YES		-	Approximately 4.5ha of the site likely qualifies under the BAP Open Mosaic Habitat on Previously Developed Land (OMHPDL). Pollution prevention methods should be in place and works should be located a minimum of 3m from all waterbodies highlighted within the report, as well as both the River Dove and Blacker Dike which both run through the survey area/site.
Invasive non-native species (INNS)	YES		-	Himalayan balsam was recorded in the north-east section of the site and along Blacker Dike. This will require specialist treatment and removal if areas are impacted by the solar panel installation.
Faunal species				
Badger	UNKNOWN		YES	Badger survey required if excavation/piling within 30m of dense scrub or the wooded embankment in the north of the site. If the development has not occurred within 12 months of the date of this report a pre-construction badger survey should be considered
Bats	LIKELY		YES	Bat scoping survey of trees required if any lopping/topping/ felling of trees is planned.
Birds	YES		YES	Any vegetation removal should take place outside the breeding bird season (or after a check by a suitably qualified ecologist). Breeding bird surveys may be required (April-June) depending on the location of the panels.
Great crested newts	UNLIKELY		YES	The eDNA surveys of P4 and P5 were returned as negative. Insufficient standing water was present at location P3 at the time of the eDNA surveys to take a viable sample and therefore the presence of great crested newts (and other amphibians), although considered unlikely cannot be ruled out completely. Precaution mitigation recommended.
Otter	UNKNOWN		YES	If the detailed design of the development indicates that the earth banks, woodland and dense scrub along the banks of the River Dove to the east (where the River is less disturbed) will be impacted, an otter survey for the presence of holts would be required.

Reptiles	YES	YES	Recommended that works take place during active period for reptiles, therefore avoiding winter and periods of excessive wet weather in order to avoid killing/injury of reptiles and to minimise the impact to habitats. Two-stage vegetation clearance (outside breeding bird season) and removal of all arisings.
Water vole	UNKNOWN	YES	Water vole survey to be carried out by a suitably qualified ecologist should the river or dike be directly impacted by the proposed works.
White-clawed crayfish	NO	NO	No action required.
Migratory and coarse fish	UNKNOWN	YES (River Dove)	See general below.
Invertebrates	YES	-	Recommended that works take place during active period for reptiles, therefore avoiding winter and periods of excessive wet weather to minimise the impact to habitats and therefore invertebrate communities. Impacted habitats to be reinstated/replicated post-installation. Pollution prevention measures.
BAP species	UNKNOWN	YES	Due to the habitats present on site, both hedgehogs and brown hare are likely to be present within the survey area, see general below.
General			
General actions which cover multiple botanical and faunal factors	• Ideally site the panels within the species-poor, semi-improved grassland field (avoiding the woodland, open mosaic habitats and water bodies). • If tree/woodland/hedgerow removal is required these habitats should be replaced on a 2:1 basis with specimens of the same species on site or on a suitable receptor site. • Protect retained trees in line with BS:5387 (2012) guidelines. • Site panels at least 3-4m from the site boundaries and 5m from watercourses where possible. • Security fencing (if required) should ideally allow a 20-30cm gap around the base to allow the passage of mammals. • If vegetation removal or soil stripping is required the area should ideally be sown with a wildflower mix. • Excavations left open overnight should have a means of escape for trapped fauna. • Avoid night working and using security lighting during construction phase if possible. If lighting is required mitigation should be implemented to reduce the impacts to faunal species. • Avoid long-term security lighting where possible, reduce light spill onto boundaries if lighting is required. • Pollution prevention methods should be in place during the development to avoid polluting the waterbodies within and surrounding the site. The Environment Agency's Pollution Prevention Guidelines should be consulted. • Minimal management of the grassland surrounding the panels is recommended to allow a tussocky grassland with a litter-layer not less than 70mm deep. Bare ground and short grass should be avoided.	
Biodiversity net gain	• Planting climbers up the security fencing would provide additional habitat for foraging bats and nesting birds • Scrub management along Blacker Dike and within the retained grasslands and open mosaic habitats would help improve the structure and allow grassland species to develop, which in turn would provide a biodiversity net gain. • Provision of bird and bat boxes on the buildings and trees.	

1.1.2 In conclusion, siting panels in the species poor, semi-improved field to the west of the site, and in conjunction with a suitable CEMP and BEMP to mitigate for the development being within close proximity of the adjacent LNR and LWS, the development of this site for solar panels could be undertaken with minimal impacts to habitats and faunal species and has the potential to provide a biodiversity net gain.

2 Introduction

2.1 Background to Development

2.1.1 Yorkshire Water are considering the use of solar photovoltaic (PV) panels at sites across Yorkshire. It is proposed that the land at these sites is leased to external companies and therefore preliminary surveys are proposed to understand the potential risks prior to bidding.

2.1.2 Worsbrough Treatment Works (TW) is being considered as a potential location for the PV panels and it is the focus of this ecology report. The area of land under consideration at Worsbrough TW (hereby referred to as 'the site'), which does not include the current TW, is located at Ordnance Survey grid reference SE 3635 0340, as illustrated on Figure 1.

2.1.3 The proposal (hereby referred to as 'the development') involves construction of a 0.6ha 505kW solar PV installation within the 7ha site. Further details on the development, including construction and operational running and maintenance, are un-known at this stage.

2.2 Objectives

2.2.1 The purpose of this report is to identify any ecological constraints to the installation and running of solar PV panels at Worsbrough TW. The assessment therefore sought to classify habitats within the site, establish the presence or likely absence of species protected by European/UK legislation and policy, establish the value of the species/habitats identified, assess the potential impacts, and likely further surveys or mitigation required.

2.3 Agreed Brief

2.3.1 BL Ecology was commissioned to undertake a preliminary ecological appraisal of the site. The agreed brief was to:

- Undertake a desk study to ascertain protected species and nature conservation sites known within 2km of the site;
- Complete a Phase 1 habitat survey of the areas likely to be affected by works;
- Assess the habitat suitability for protected and BAP species; and
- Submit a report with associated mapping, outlining the likely mitigation for the site including the need for additional surveys.

3 Methodologies

3.1 General

3.1.1 A survey area was defined which is shown on Figure 1 (hereafter named 'the site'). The walkover was undertaken on 20th May 2020 by Emma Mackenzie (ACIEEM), who has been an ecologist for 13 years and holds Natural England survey licences for great crested newts and bats.

3.1.2 This chapter describes the methodologies involved for each stage of the assessment. Standard stages undertaken for this type of assessment include a desk study, a Phase 1 Habitat Survey, and an assessment of habitats available for the presence of protected faunal species. This methodology follows the CIEEM 'Guidelines for Preliminary Ecological Appraisal' (December 2017).

3.2 Desk Study

3.2.1 A standard 'study area' was defined which encompassed an area up to 2km from the site. The following sources were used in order to provide data:

- Protected sites and notable/protected faunal records from Yorkshire Water's data agreement with relevant local record centres;
- Multi-Agency Geographic Information for the Countryside (MAGIC) (www.magic.gov.uk) – to ascertain whether there are any statutory sites designated for nature conservation any recently granted (since 2009) European Protected Species (EPS) licences within 2km of the site; and
- Aerial photos – in order to aid preliminary ecological and overall assessment of the site.

3.3 Phase 1 Habitat Survey

3.3.1 A walkover survey was undertaken in accordance with Phase 1 Habitat Survey Guidelines (JNCC, 2010). This methodology provides a standard technique for classifying and mapping habitats. The approach is based upon differentiating between various vegetation and other topographical and substrate features such as watercourses. Each habitat type is described in terms of size, condition, and characteristic plant species present. Phase 1 Habitat maps are produced to illustrate the results and target notes are used to provide further information on habitat features of particular or potential interest.

3.3.2 All animal and plant names are referred to in the text under their common names and scientific names. All nomenclature for vascular plants follows Stace (1997). Floral diversity and broad NVC of plant communities has been recorded wherever possible.

3.3.3 Any plant species listed on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) that may be present, particularly Japanese knotweed (*Fallopia japonica*), giant hogweed (*Heracleum mantegazzianum*) and Himalayan balsam *(Impatiens glandulifera*), have been recorded and mapped.

3.5 Faunal Surveys

Badger Presence/Absence Survey

3.5.1 Badgers can be found on a variety of habitat types. They generally prefer to create setts in undisturbed areas and within typography that is sloped. Preferred habitats for foraging include woodlands and grassland (Woods, 1995). The site was searched for any signs of badger presence. Signs searched for included entrance holes (setts), dung pits, hair, footprints, badger footpaths, scratching posts, and snuffle holes. Due to the size of the survey area and access restrictions a presence/absence badger survey was undertaken for most but not all of the site; depending on the location of the development, some areas may require further survey.

Bat Survey

3.5.2 Bats use a variety of roosts depending on the species, time of year, weather conditions and purpose (maternity, hibernation, day, transitional etc). As part of the general assessment, broad types of features with the potential to support roosting bats were recorded. Suitable bat roosting features noted on trees included loose bark, woodpecker holes, rot holes, mature ivy, dead wood, and stress splits and cracks. No buildings were present within the site boundary.

3.5.3 Habitats were also assessed for their suitability for foraging and commuting bats; the most suitable habitats are generally managed less intensively, have sheltered areas, contain water, and linear features (such as hedgerows/rivers) for commuting

Breeding Bird Habitat Assessment

3.5.4 Nesting sites for birds depends on the species involved and can be created within structures (buildings, bridges, cliffs etc.), trees, shrubs, within ground vegetation and on bare ground, providing that suitable foraging habitat is adjacent. Habitats within the site were assessed for their suitability for breeding birds.

Great Crested Newt Habitat Assessment

3.5.5 Great crested newts require standing water on the site or on adjacent land. Any ponds within 250m of the site were considered. One waterbody on site and four within immediate proximity to the site were identified, all of which were assessed via the calculation of a Habitat Suitability Index (HSI) in line with the procedure set out by Oldham *et al*. (2000). The HSI is a quantitative assessment of the capacity of a water body to support great crested newts. Ten key suitability indices (SI) are used, and it is assumed that population size is determined by habitat suitability. The indices include criteria such as pond location, size, desiccation rate, water quality, shade, number of waterfowl and fish, number of other ponds within 1km, the quality of the surrounding terrestrial habitat, and the level of macrophyte cover in the pond.

3.5.6 The SI scores are expressed as a value between 0 and 1. They are used to calculate the HSI of the water body as a geometric mean, using the equation: HSI = (SI1 * SI2 * SI3 * SI4 * SI5 * SI6 * SI7 * SI8 * SI9 * SI10)/10. The final HSI is expressed as a single number between 0 and 1, representing a completely unsuitable habitat or a completely suitable habitat for great crested newts respectively.

3.5.7 Due to the suitability of two waterbodies to support great crested newts, water samples of P4 and P5 (the closest waterbodies within Barrow Colliery LWS immediately to the west) were collected for eDNA analysis on the 24th June 2020 by Jacob Birkenhead and Ellie Hind, using kits provided by SureScreen Scientifics. Samples were taken following the technical advice note WC1067, as approved by Natural England. Samples were then

returned to SureScreen Scientifics for analysis. Insufficient water was present in P3 to take a viable sample at the time of the survey.

3.5.8 Great crested newts require different habitats at different times of the year; the site was searched for terrestrial habitat most suitable for newts including scrub, unimproved grassland, woodland and gardens (Oldham *et al.,* 2000). Full details of great crested newt ecology can be found in Appendix 2.

Otter Habitat Assessment

3.5.9 Otters require freshwater habitat in the form of standing or running water. The water must contain prey species, such as fish, crustaceans or amphibians. Suitable riparian habitat is required that can support resting sites and natal dens, the latter of which are created within secure, undisturbed sites such as within exposed tree roots adjacent to the water, or within disused rabbit entrances. Habitats within the site were assessed for their suitability for otters and full details of otter ecology can be found in Appendix 3.

Reptile Habitat Assessment

3.5.10 The habitat requirements of this group depend on the species involved. The most likely species to be encountered in the UK are common lizard (*Zootoca vivipara*), grass snake (*Natrix natrix*), slow worm (*Anguis fragilis*) and adder (*Vipera berus*). Reptiles require a heterogeneous habitat with different vegetation types and structures, including bare ground patches for basking. Habitats within the site were assessed for their suitability for reptiles, and full details of reptile ecology can be found in Appendix 4.

Water Vole Habitat Assessment

3.5.11 This species requires freshwater habitat that has a relatively stable water level. Undisturbed riparian habitat is required that has an abundance of vegetation species such as grasses and rushes that provide both cover from predators and act as a food source (Strachan, 2011). Habitats within the site were assessed for their suitability for water voles, and full details of water vole ecology can be found in Appendix 5.

White-Clawed Crayfish Habitat Assessment

3.5.12 This species of crayfish requires calcareous streams with an abundance of suitable refuges, such as a rocky substrate, tree roots and leaf litter (Holdich, 2003). Habitats within the site were assessed for their suitability for crayfish.

3.6 Impact Assessment

3.6.1 A preliminary impact assessment of the proposed development was undertaken following the ‘Guidelines for Ecological Impact Assessment in the UK and Ireland (Second Edition, 2016)’ by the Chartered Institute for Ecology and Environmental Management. Further details of the assessment methodology are provided in Appendix 6.

3.7 Limitations

3.7.1 The data collected and presented within this report is considered valid for a period of two years, after which update surveys are likely to be required to re-assess the conditions.

4 Results and Impacts

4.1 Desk Study

4.1.1 Table 2 below provides the results of the faunal data search, which are mapped onto Figure 1.

Table 2: Faunal Data Search Results

Faunal Group/Species	Records on Site	Records within 500m	Records within 2km
Amphibians	None	None	None
Badgers	None	None	None
Bats	None	None	Twenty-one records consisting of brown long-eared (*Plecotus auritus*), common pipistrelle (*Pipistrellus pipistrellus*), Leisler's bat (*Nyctalus leisleri*), myotis, noctule (*Nyctalus noctula*) and soprano pipistrelle (*Pipistrellus pygmaeus*)
Birds	One record of the BoCC[1] amber listed species green sandpiper (*Tringa ochropus*)	Twenty-eight records including green sandpiper, and the Schedule 1[2] species kingfisher (*Alcedo atthis*), redwing (*Turdus iliacus*) and barn owl (*Tyto alba*)	One hundred and five records consisting of the Schedule 1 species, kingfisher, redwing, barn owl (*Tyto alba*), fieldfare (*Turdus pilaris*), merlin (*Falco columbarius*), goshawk (*Accipter gentilis*), quail (*Coturnix coturnix*), red kite (*Milvus milvus*), peregrine falcon (*Falco peregrinus*), pintail (*Anas acuta*), goldeneye (*Bucephala clangula*) and little ringed plover (*Charadrius dubius*); and the BoCC red listed common scoter (*Melanitta nigra*).
Floral invasive non-native species	One record of Himalayan balsam (*Impatiens glandulifera*)	Twenty-three records consisting of Himalayan balsam Japanese knotweed (*Fallopia japonica*), rhododendron (*Rhododendron ponticum*), floating pennywort (*Hydrocotyle ranunculoides*), Canadian goldenrod (*Solidago canadensis*) and Holm oak (*Quercus ilex*)	One hundred records consisting of records consisting of Himalayan balsam, Japanese knotweed, rhododendron, floating pennywort, Canadian goldenrod, Holm oak, Nuttall's waterweed (*Elodea nuttallii*), New Zealand Pigmyweed (*Crassula helmsii*), Japanese rose (*Rosa rugosa*), Russian vine (*Fallopia baldschuanica*) and Turkey oak (*Quercus cerris*)

[1] Birds of Conservation Concern – The population status of birds in the UK, Channel Islands and the Isle of Man, reviewed every five years and placed into one of three lists, red, amber or green according to their level of conservation concern.

[2] Bird species with additional protection under the Wildlife & Countryside Act 1981 (as amended), during the breeding season, as do their nests, eggs and dependent young.

Otters	None	None	One record of Eurasian otter (*Lutra lutra*)
Reptiles	One record of grass snake (*Natrix natrix*)	Twelve records consisting of grass snake, adder (*Vipera berus*) and common lizard (*Lacerta vivipara*)	Thirteen records of grass snake and adder.
Water Vole	None	None	None
Invertebrates	None	None	None
UK BAP Species	None	None	None

4.1.2 Table 3 below provides a list of all protected nature conservation sites within 2km of the site and the potential impact from the installation and running of solar PV panels. It should be noted that the impacts are not fully known at this stage

Table 3: Nature Conservation Sites within 2km

Receptor	Details	Impact	Legislation (if relevant)
Statutory Nature Conservation Sites			
There is one Statutory Nature Conservation Sites within 2km of the site			
Worsbrough Country Park Local Nature Reserve (LNR)	Boarders the site to the west. An urban fringe LNR with habitats including an ancient semi-natural woodland, reservoir, willow carr, managed grassland and meadow, and reedbed. It also supports a number of waterfowl species.	This could result in the disturbance of the breeding bird populations, and direct connectivity between the sites for other local populations of protected species such as bats, otters, amphibians and reptiles. Potential impact on the hydrology of the site and the habitats which are linked.	WCA 1981[3]
Non-Statutory Nature Conservation Sites			
There are six Non-Statutory Nature Conservation Sites within 2km of the site			
Barrow Colliery Site Local Wildlife Site (LWS)	Borders the western boundary of the site. Designated due to grassland, running water, open water, hedgerow, young plantation, and lowland heathland habitats. Also noted for orchids (*Dactylorhiza sp.*), breeding invertebrates and breeding birds.	Potential killing/injury of birds/invertebrates both directly and indirectly due to potential increases in dust, light, and noise pollution. Potential impact on birds that can move between sites.	Barnsley Local Plan
Wombwell Wood LWS	0.19km south-east of the site, designated due to woodland, scrub, standing water, running water. Also noted for Woodruff (*Galium odoratum*), breeding birds and rock exposures.	No direct impact to the LWS. The sites are connected through field boundaries - possible impact on organisms that can move between sites.	Barnsley Local Plan
Worsbrough Reservoir	0.92km west of the site, designated due to standing water, running water, fen woodland, swamp, scrub, and grassland habitats. Also noted for breeding birds, wintering birds, passage birds, bats, invertebrates, and Touch-me-knot Balsam (*Impatiens noli-tangere*).	No direct impacts anticipated due to the distance from the site, however the sites are connected through the River Dove (connective habitat for species such as otter and migratory fish) and Worsbrough Reservoir also makes up part of the Worsbrough Country Park LNR.	Barnsley Local Plan

[3] Wildlife and Countryside Act 1981 (as amended)

Short Wood and Hay Green LWS	1.07km south-west of the site, designated due to woodland, acid grassland, neutral grassland, standing water and running water habitats. Also noted for Dyer's greenweed (*Genista tinctoria*), Pink purslane (*Monitia sibirica*), Yellow rattle (*Rhinanthus minor*) and Viper's-bugloss (*Echium vulgare*).	The sites are connected by field boundaries, but at over 1km between them there is no anticipated impact.	Barnsley Local Plan
Swaithe Flood Meadows LWS	1.19km north-east of the site, designated due to inundation, open water and cultivated land habitats. Also noted for breeding birds.	No anticipated impact due to the distance from the site and lack of connectivity, the sites are separated by a railway line.	Barnsley Local Plan
Kendal Green Scrub LWS	1.86km west of the site, designated due to grassland and scrub habitats. Also noted for Bee orchid (*Ophrys apifera*).	No anticipated impact due to the distance from the site and lack of connectivity, the sites are separated by the A61.	Barnsley Local Plan

4.1.1 This site does not lie within an SSSI Impact Risk Zone (IRZ).

4.2 Phase 1 Habitat Survey

4.2.1 Habitats found during the Phase 1 Habitat Survey are shown on Figure 2. All are common habitats found across the UK, with no rare flora or communities recorded during the survey. Although not considered rare, the mosaic of grassland (with no standard NVC community) tall ruderals, ephemerals, scrub and bare ground (to the east of the current TW and north and south of the river within what appears to be areas of the old works) was target noted, and may qualify under the UKBAP Priority Habitat Open Mosaic Habitat. As such, if the development is sited in these areas, further survey may be required.

4.2.2 Table 4 below details the habitats found on the site and consideration of the faunal groups/species that could be present. An indication of the potential impacts has been provided; however, this is only outline at this stage and should be reassessed once the plans for the site have been formulated.

4.2.3 The site is approximately 7ha in size and predominantly comprises three main areas; the areas of unmanaged land to the east and west of the current treatment works to the north of the River Dove, the unmanaged land south of the River, and the species-poor semi-improved field alongside Powder Mill Lane.

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Table 4: Survey Results and Potential Impacts

Receptor	Details	Potential Impact	Legislation (if relevant)
Habitats			
Semi-natural broad-leaved woodland	Approximately 0.1ha of broadleaved woodland was present along the river in the north-west of the site containing trees of varying age including sycamore (*Acer pseudoplatanus*), hawthorn (*Crataegus monogyna*) and willows (*Salix sps.*).	Loss of up to approximately 0.1ha of semi-natural broad-leaved woodland. Root compaction and damage leading to the death of trees may occur if appropriate mitigation is not undertaken during the construction period. ***Moderate adverse impact and contravention of the objectives of the Local Plan***	Barnsley Local Biodiversity Action Plan (LBAP)
Scattered broad-leaved trees	Trees of various ages were scattered throughout the site including self-set saplings to mature trees. Species included willows, silver birch (*Betula pendula*), elder (*Sambucus nigra*), hawthorn, sycamore, ash (*Fraxinus excelsior*) and lines of grey (*Populus x canescens*) and Lombardy poplar (*Populus nigra L. var italica*).	Potential loss of trees Root compaction leading to the death of trees may occur if appropriate mitigation is not undertaken. ***- slight adverse impact.***	N/A
Hedgerows	310m present. An unmanaged hawthorn hedgerow ran along the southern boundary to the east of Blacker Dike. The hedgerow was sited along a dry ditch and the understorey predominantly common nettle (see Figure 3, photograph 1). A managed, predominately hawthorn hedgerow with scattered bramble and elder ran along the southern boundary of the site along the edge of the species-poor, semi-improved field. An outgrown hawthorn hedgerow with occasional willow ran along the western boundary of the site along Powder Mill Lane. It was sited along a bank, with an understorey dominated by bramble and nettles.	Loss of up to 310m of hedgerow. Root compaction leading to the death of tree and hedgerow species if appropriate mitigation is not undertaken - ***slight adverse impact.***	N/A
Dense and scattered scrub	Approx. 1.2ha present. Large areas of dense and scattered scrub within and around woodland, along watercourses, within grassland habitats, along site boundaries and overgrowing perimeter fence lines and disused areas	Impact to 0.6ha subject to location of Solar PV panels and operational maintenance strategy, as well as loss of species diversity which also functions as part of a larger habitat mosaic (see Open Mosaic Habitat on previously developed hand (OMHPDL)) - ***Slight adverse impact / potential moderate***	Alone, this habitat is common throughout the UK; however, may qualify as part of the UKBAP Priority Habitat Open Mosaic

	of the works. The dominant species recorded was bramble (*Rubus fruticosus agg.*) with scattered elder, willow, hawthorn, dog rose (*Rosa canina*) and butterfly bush (*Buddleja davidii*), see Figure 3, photograph 2.	***adverse impact and contravention of the objectives of the UK BAP/S41 NERC Act.***	Habitat, and Barnsley LBAP
Tall ruderal vegetation	Approx. 0.45ha present. Scattered within grassland and scrub, and some large areas dominating as early colonisers of bare ground. Dominant species included nettle (*Urtica dioica*), willow herbs, hogweed (*Heracleum sphondylium*), hemlock (*Conium maculatum*), and spear thistle.	Potential impact to the majority of this habitat subject to location of Solar PV panels and operational maintenance strategy, as well as loss of species diversity which also functions as part of a larger habitat mosaic (see Open Mosaic Habitat on previously developed hand (OMHPDL)) - ***Slight adverse impact / potential moderate adverse impact and contravention of the objectives of the UK BAP/S41 NERC Act.***	Alone, this habitat is common throughout the UK; however, may qualify as part of the UKBAP Priority Habitat Open Mosaic Habitat, and Barnsley LBAP
Bare ground with ephemeral/short perennial vegetation	Relatively small areas of this habitat remain within the areas of old works north and south of the river. Areas of bare-ground (compacted dirt, sand and gravel) had become overgrown in places and to different extents with ephemeral/short perennial vegetation including mosses, common grasses such as annual meadow grass (*Poa annua*) and creeping bent (*Agrostis stolonifera*), and herb and ruderal species common of such habitats such as American willowherb (*Epilobium ciliatum*), common mouse-ear (*Cerastium fontanum*), fumitory species (*Fumaria sp.*) and shepherd's-purse (*Capsella bursa-pastoris*), see Figure 3, photograph 3.	Potential impact to the majority of this habitat subject to location of Solar PV panels and operational maintenance strategy, as well as loss of species diversity which also functions as part of a larger habitat mosaic (see Open Mosaic Habitat on previously developed hand (OMHPDL)) - ***Slight adverse impact / potential moderate adverse impact and contravention of the objectives of the UK BAP/S41 NERC Act.***	Alone, this habitat is common throughout the UK; however, may qualify as part of the UKBAP Priority Habitat Open Mosaic Habitat
Species diverse, semi-improved grassland (TN 3)	Approx. 1.6ha present. At the time of the survey these areas of grassland were grazed by deer and rabbits with varying sward heights from <10mm to stands of herbs over 500mm. Grass species were varied across the site dependent on location/conditions. Species recorded included false oat-grass (*Arrhenatherum elatius)*, soft meadow grass (*Poa pratensis*) and Yorkshire fog (*Holcus lanatus*). A diverse mix of relatively common herb and ruderal species were also recorded within the grass including creeping cinquefoil (*Potentilla reptans*), small-flowered crane's-bill (*Geranium pusillum*), ribwort plantain (*Plantago lanceolata*), creeping buttercup (*Ranunculus repens*), wintercress (*Babarea vulgaris*), hairy rock-	Impact to 0.6ha subject to location of Solar PV panels and operational maintenance strategy, as well as loss of species diversity which also functions as part of a larger habitat mosaic (see Open Mosaic Habitat on previously developed hand (OMHPDL)) - ***Slight adverse impact / potential moderate adverse impact and contravention of the objectives of the UK BAP/S41 NERC Act.*** If vegetation is retained and managed it is estimated 70-95% of the ground cover will remain, however there will be a potential reduction in species diversity and plant biomas (Gasparatos *et al*., 2017), together with changes to the soil and air microclimates (Armstrong *et al.*, 2016) beneath the panels ***– slight adverse impact.***	Alone, this habitat is common throughout the UK; however, may qualify as part of the UKBAP Priority Habitat Open Mosaic Habitat, and Barnsley LBAP

	cress (*Arabis hirsute*), red campion (*Silene dioica*), black medick (*Medicago lupulina*), lady's bedstraw (*Galium verum*), early forget-me-knot (*Myosotis ramosissima*), borage (*Borago officinalis*), teasel (*Dipsacus fullonum*), weld (*Reseda luteola*) and thistle and sow-thistles (*Sonchus sp.*). Relatively large patches of comfrey (*Symphytum s*p.) and an ever-lasting pea species (*Lathyrus* sp.) were also recorded (see Figure 3, photograph 4). This grassland does not fit with usual NVC communities, containing a mixture of more acidic, rank neutral, calcareous species and invasive/introduced species.	However, if levelling or soil stripping is required this would represent a total loss of 0.6ha of habitat – ***moderate adverse impact.***	
Semi-improved neutral grassland	Approx. 0.7ha present. The grassland within this area of the site was finer and with less tall ruderal vegetation. Festuca species dominated, with Yorkshire fog, smooth meadow grass and false-oat grass. Occasional velvet bent (*Agrostis canina*), wood barley (*Hordelymus europaeus*), sweet vernal (*Anthoxanthum odoratum*) and hard rush (*Juncus inflexus*) were also recorded. Herb species included creeping cinquefoil, yarrow (*Achillea millefolium*), ribwort plantain, borage, red clover (*Trifolium pratense*), common vetch (*Vicia sativa*), tufted vetch (*Vicia cracca*) and teasel (see Figure 3, photograph 5).	All semi-improved grasslands in Barnsley are a priority for conservation. Impact to 0.6ha subject to location of Solar PV panels and operational maintenance strategy. If vegetation is retained and managed it is estimated 70-95% of the ground cover will remain, however there will be a potential reduction in species diversity and plant biomas (Gasparatos *et al*., 2017), together with changes to the soil and air microclimates (Armstrong *et al*., 2016) beneath the panels ***– minor adverse impact.*** However, if levelling or soil stripping is required this would represent a total loss of 0.6ha of habitat – ***moderate adverse impact.***	Barnsley LBAP
Species-poor semi-improved grassland	Approx. 1.7ha present of species poor, semi-improved field to the south and west of the site. At the time of the survey the field appeared unmanaged and was not grazed. The sward height varied from <5cm in small patchy areas of bare ground, up to approx. 50cm in areas of tall grass. Species were dominated by false oat-grass, creeping (*Cirsium arvense*) thistle, hogweed (*Heracleum sphondylium*) and dock (*Rumex sp*.), see photograph 6.	All semi-improved grasslands in Barnsley are a priority for conservation. This includes those such as amenity and road verges, as they can be managed to benefit biodiversity and are therefore included in the local Biodiversity Action Plan. Impact to 0.6ha (approximately 35%) subject to location of Solar PV panels and operational maintenance strategy - ***slight adverse impact.*** If levelling or soil stripping is required this would represent a total loss of 0.6ha of habitat – ***slight adverse impact***	Barnsley LBAP
Marshy grassland	A small area of marshy grassland was recorded along the east boundary immediately adjacent to an area of 'wet' willow woodland (with areas of standing water (P3), see below).	Only a very limited area of this habitat exists, however, potential complete loss of this habitat - ***slight adverse impact.***	N/A

	Although the area appeared predominantly dry at the time of the Phase 1 survey, conditions were still very boggy. Hard rush and bulrush (*Typha latifolia*) were recorded alongside nettle, dock species, willowherb species and creeping buttercup (*Ranunculus repens*), see Figure 3 photograph 7.		
Running water	The River Dove flows from west to east through the site. Within the site the river is up to approximately 4m wide, with concrete walls and gabion baskets to the west and to the east past the bridge (see Figure 3, photograph 8). Further to the east the banks were near vertical earth banks predominantly overgrown with tall ruderals (photograph 9). The water quality looked good, relatively fast flowing and the substrate was a mixture silt and stones. Blacker Dike flows into the River Dove from the south. It varied between approximately 1m and 3m wide and appeared fast flowing in places and almost still in others. The water quality appeared poor along much of the watercourse within the site. The banks were mostly vertical and a mixture of earth and natural stone, overgrown with grasses tall ruderal and scrub and predominately shaded (see photograph 10). Immediately south of the site the dike opened up into an arable landscape (see photograph 11).	Chemical poisoning through oil spillages. Sedimentation during the construction period. Hydrological changes in the long-term by alterations in run-off may increase or decrease water levels and alter the ecological functionality of the receptor. ***– Potential moderate adverse impact and contravention of the objectives of the UK BAP/S41 NERC Act.***	UKBAP/S41 NERC 2006 Barnsley LBAP
Standing water	P1 - a fishing lake which lies immediately adjacent to the site to the east, but with the zone of influence (ZOI) of the works. P2 - a standing water tank within the current treatment works. Although outside of the site it is within the ZOI of the works. Access was from a few meters away as the tank was fenced off. The tank is plastic lined. The water quality appeared poor with a lot of algae and no obvious signs of aquatic vegetation (see Figure 3, photograph 12). P3 – the marshy area in the east of the site (see photograph 13). Conditions were very boggy under foot so the woodland was not accessed beyond the first few meters. P4 – A pond within the local wildlife site immediately to the west of the site but within the ZOI (see photograph	The water bodies should not be directly impacted. Indirect impacts due to their proximity to the development could result in increased vehicle passage during the works resulting in increased road run-off such as soil particles and chemical pollutants. Other indirect impacts could include sedimentation and hydrological changes in the long-term by alterations in run-off which may increase or decrease water levels and alter the ecological functionality of the receptor. ***– Potential moderate adverse impact and contravention of the objectives of the UK BAP/S41 NERC Act.***	UKBAP

	14). Patches of marginal and emergent bulrush and willow were recorded around the edge of the pond. Water quality appeared moderate with some invertebrate life and submerged aquatic vegetation. P5 – Split into two areas of standing water. Silt substrate with no emergent vegetation, surrounded by scrub and tall ruderal. Water depth maximum 30cm, no fish.		
Dry ditches	Approx. 140m present. A dry ditch was recorded along the hawthorn hedgerow along the southern boundary of the site. The ditch connects with Blacker Dike to the west and was predominantly overgrown with nettles.	Being situated along a hedgerow which also functions as an arable field boundary for the land to the south, it is considered unlikely this habitat will be impacted.	This habitat is common throughout the UK
Invasive non-native species (INNS)	Scattered Himalayan balsam was recorded within the section of old workings to the east of the current TW and along Blacker Dike, see Figure 2, TN2.	If works are required in these areas there is the potential for seeds to be moved (via soil movements or via wheels/equipment/boots) around this site and to other sites, spreading this invasive species further. ***–Moderate adverse impact and contravention of the Wildlife and Countryside Act 1981.***	WCA 1981[4]
Target Notes (TN*)	TN1 – Previously a small pond, now dry and completely overgrown with scrub. TN2 – Scattered areas of Himalayan balsam. TN3 – A semi-improved grassland mosaic that is species diverse and does not fit with usual NVC communities. TN4 – Areas of overgrown spoil, debris, pipes etc including a large overgrown pipe which runs the length of the species poor, semi-improved field (see photographs 15 – 17). TN5 – A dried out bed, possibly a water body or feature of old workings, see photograph 18.		
Faunal Species			
Amphibians	Potential aquatic habitat to support amphibians immediately adjacent to site was present in the waterbodies P1 – P5, although P1 and P2 were ruled out for great crested newts (see below).	Killing/injury of GCN and other BAP amphibians (such as common toad (*Bufo bufo*)) through potential loss of or direct impacts to P3; and during the construction phase through machinery movement, vegetation clearance, excavations for cables, piling works, installation of perimeter fencing (if required) or soil stripping/levelling (if required). Killing/injury of great crested newts	The Habitat Regs. 2017[5] WCA 1981

[4] Wildlife and Countryside Act 1981 (as amended)
[5] The Conservation of Habitats and Species Regulations 2017 (as amended)

	Potential terrestrial habitat is present throughout the site in particular within tall ruderal and scrub habitats and old overgrown workings and debris/spoil. The HSI results for the ponds were: P1 (the fishing lake) 0.49 (poor) P2 (settling tank) 0 (poor) P3 (wet woodland) 0.64 (average) P4 (LWS pond) 0.75 (good) P5 (LWS pond) 0.8 (excellent) The full calculations can be found in Appendix 7. The study by Oldham *et al.* (2000) found that 0.43 was the lowest score achieved where GCN presence was confirmed. eDNA samples were planned for the ponds with the highest HSI score; although the HSI for P1 was 0.49 it was not considered worth undertaking an eDNA survey as a known fishing lake (fish predate on newt eggs and larvae). It was not possible to collect a viable sample from P3 due to insufficient amounts of water at the time of the eDNA sampling. The results of the eDNA sample for P4 and P5 were negative. GCN are therefore considered unlikely to be present within the site boundary; however, although considered unlikely the presence of GCN and other amphibian species across the site cannot be ruled out completely as it has not been possible to rule them out from P3. Though the full details of the development are unknown at this stage it is possible that P3 could be impacted through the development and it is highly likely that suitable terrestrial habitats will be directly impacted.	would be a ***moderate adverse impact and contravention of wildlife legislation.*** Impacts to a maximum 0.6ha of terrestrial habitat (leaving other undisturbed available habitats); however, if the ground cover is retained intact (subject to management) it is estimated that only 5-30% of vegetation within the 0.6ha development area will be permanently lost. Furthermore, the remaining 91% of the grassland/tall ruderal field will remain undisturbed and available for use by newts; this represents a ***minor adverse impact.***	CRoW Act 2000[6]
Badger	No records of badgers (*Meles meles*) were returned for the desk study and no setts or active signs of badger were found within the surveyed area, however, some areas remain un-surveyed.	No evidence of badger was found on site however further survey of wooded and dense scrub areas would be required depending on the location of the development to ascertain the impact – ***impact unknown***.	Protection of Badgers Act 1992

[6] The Countryside and Rights of Way Act 2000

	Throughout the site the overgrown banks dominated by dense scrub which were largely inaccessible (to the south) and the woodland along the Trans Pennine Trail adjacent to the site to the north provide suitable habitat for sett creation and the presence of badger setts within these areas cannot be ruled out. Potential foraging habitat likely exists in the less disturbed grassland and tall ruderal vegetation elsewhere on site.	Loss of 0.6ha foraging habitat if perimeter fencing prevents access. No signs of current badger usage were observed and therefore this is unlikely to have a significant impact on badgers – ***minor adverse impact.*** Loss of limited potential sett creation – larger woodland areas are present within the nearby landscape therefore this loss is not considered to have a significant impact to this species. Potential disturbance during the construction phase and during operation if night working is undertaken or if security lighting is implemented post-construction – ***minor adverse impact.***	
Bats	No buildings are present within the site boundary. Due to the number of trees and the inaccessible nature of some areas of the site a full bat scoping of the trees on site was not possible. When detailed plans are available, any trees likely to be impacted should be subject to a detailed scoping survey for bats. The site is likely to provide good foraging habitat for a range of bat species with unlit and undisturbed mosaic of wet habitats, woodland, scrub, tall ruderal and grassland habitats, as well as linear features such as hedgerows, lines of trees and watercourses.	Killing/injury of bats during potential felling of trees - ***moderate adverse impact and contravention of wildlife legislation.*** Loss of potential future roosts if trees require felling and loss of 0.6ha of foraging habitat – ***minor adverse impact.*** Disturbance to foraging bats during the construction phase if lighting or night working is required – ***minor adverse impact*** in the short-term. Disturbance to foraging bats during operation of the site if security lighting is required – ***minor adverse impact.***	The Habitat Regs 2017 WCA 1981 CRoW Act 2000 Barnsley LBAP
Birds	Large numbers of breeding bird records were returned including for the Schedule 1 species kingfisher, redwing and barn owl within 500m of the site. Habitats on site could support all these species. A record for green sandpiper (BoCC amber listed) was also returned for the site. Potential breeding bird habitat is present across the entire site, within the trees and scrub, on the waterbodies and for a range of ground nesting species.	Destruction/damage to nests and hence killing/injury of birds during the construction phase if undertaken during the breeding bird season (between March and September inclusive dependent on weather conditions). This would constitute a ***moderate adverse impact and contravention of wildlife legislation.*** Loss of 0.6ha habitat for foraging and breeding. Studies have shown that the structure of breeding bird communities can be altered by the installation of solar farms, with some species preferentially choosing solar farms and other actively avoiding them (DeVault *et al*. 2014). Due to the small scale of this solar farm it is considered this would be a ***minor adverse impact.*** The suitability of the land for barn owl foraging is dependent on the management of the grassland underneath/around the panels; if left intact the site will retain its suitability and additionally add new perching sites. If the vegetation is sprayed/regularly cut this will leave the area unsuitable for foraging. Given the small scale of this solar farm it is considered that the worst case would be a ***minor adverse impact*** but could be neutral with the appropriate management.	WCA 1981 Barnsley LBAP

Otter	No positive signs of otter were identified within the survey area. One record of otter was returned for the desk study from just north of the River Dove near Worsbrough Reservoir. The River Dove within the site is also highly likely to support potential prey suitable for commuting and foraging otter, and woodland and dense scrub along the banks particularly to the east where the river is less disturbed could support resting sites or holts. It is highly possible that otter could therefore be present within the site.	Potential loss of holts or resting sites and hence killing/injury of otter within certain suitable areas along and surrounding the River Dove. This would constitute a ***moderate adverse impact and contravention of wildlife legislation.*** Otter present on site during the construction works could fall into open excavations resulting in killing/injury, along with the potential for poisoning which could result from pollution events. This would constitute a ***moderate adverse impact and contravention of wildlife legislation***. Disturbance during the construction phase and during operation, including the inappropriate use of lighting and increased human presence – ***minor adverse impact.***	The Habitat Regs 2017 WCA 1981 CRoW Act 2000
Reptiles	One record of grass snake was returned for the current TW as well as anecdotal evidence from staff having seen grass snakes. The water bodies, tall ruderal, scrub and grassland habitats across the site provide suitable habitat for common species of reptile such as grass snake, slow worm (*Anguis fragilis*) and common lizard (*Lacerta vivipara*). Ephemeral and hard standing habitats and debris/spoil also provide habitats suitable for basking and hibernation.	Killing/injury of reptiles during the construction phase through machinery movement, excavations for cables, piling works, and installation of perimeter fencing (if required). This would be a ***moderate adverse impact and contravention of wildlife legislation.*** Impacts to 0.6ha of terrestrial habitat. However, if the ground cover is retained intact (subject to management) it is estimated that only 5-30% of vegetation within the 0.6ha development area will be permanently lost. Furthermore, the remaining 91% of the grassland/tall ruderal field will remain undisturbed and available for use by reptiles. This therefore is classed as a ***minor adverse impact.***	WCA 1981 Barnsley LBAP
Water vole	No records of water vole (*Arvicola amphibious*) were returned from the desk study however some limited potential aquatic habitat was considered present along sections of the River Dove and Blacker Dike. Overgrown earth banks could provide habitat for burrows and limited patches of grasses and reeds within the watercourses could provide some habitat for foraging.	Any works to, or within approximately 5m of the River Dove and Blacker Dike could result in the killing/injury of water voles through crushing, burrows collapsing under machinery or through chemical pollution. This would be a ***moderate adverse impact and contravention of wildlife legislation***. Disturbance during the construction phase and during operation, including the inappropriate use of lighting and increased human presence - ***minor adverse impact.***	WCA 1981 Barnsley LBAP
White-clawed crayfish	No records of white-clawed crayfish (*Austropotamobius pallipes*) were returned within the desk study and there are no watercourses on site considered suitable for this species.	No anticipated impact to this species.	N/A

Brown hare	Potential habitat for brown hare (*Lepus capensis*) exists in the open grassland, tall ruderal and scrub habitats on site.	Killing/injury of leverets during construction phase – ***minor adverse impact and contravention of the objectives of the UK BAP*** by reducing the population size. Permanent loss of 0.6ha of suitable habitat if perimeter fencing is required – ***minor adverse impact.***	UK BAP Barnsley LBAP
Hedgehogs	Potential habitat for hedgehogs (*Erinaceus europaeas*) exists during every stage of their life cycle, within the grassland, tall ruderal, scrub and areas of debris/spoil across the site.	Killing/injury during construction phase – ***minor adverse impact and contravention of the objectives of the UK BAP*** by reducing the population size. Permanent loss of 0.6ha of suitable habitat if perimeter fencing is required – ***minor adverse impact.***	UK BAP Barnsley LBAP
Invertebrates	The un-managed mosaic of habitats on site, including current workings, old workings, woodland, scrub, grassland, tall ruderal vegetation and waterbodies/ watercourses offers suitability for a range of terrestrial and aquatic invertebrates. Open mosaic habitats on previously developed land can support important assemblages of invertebrates and can be one of the qualifying features of this priority habitat.	Likely reduction in botanical species diversity of 0.6ha of terrestrial habitat, which has the potential to reduce the species diversity and abundance of invertebrates using the site. Total loss if soil stripping/levelling is required, however this represents approximately 9% of the grassland/tall ruderal available and therefore not considered to be a significant impact. Potential increase in light, dust and chemical pollution short-term during the construction phase, however this is likely to be minimal (assuming soil stripping/levelling is not required).	Potential UKBAP Barnsley LBAP
Migratory and coarse fish	Species from this group are likely to be present within the River Dove, located immediately to the south of the site.	Potential for ecological functionality of the river to be altered through chemical spills or pollution – ***slight adverse impact***.	A number of migratory and coarse fish are listed as Priority Species on the UK and Barnsley BAPs

5 Recommendations

5.1 General

5.1.1 The development footprint will cover 0.6ha of the 7ha site; as the location of the development within the site is not known at this stage the recommendations will set out the mitigation for a 'worst case scenario' for habitats and species and how this can be overcome and reduced by the location of the development within the site.

5.2 Statutory and non-Statutory Sites

5.2.1 One statutory nature conservation site (Worsbrough LNR) and one non-statutory site (Barrow Colliery LWS) both lie immediately adjacent to the west of the site. Both are noted for their mosaic of habitats including ancient semi-natural woodland, grassland, running water and open water, hedgerow, young plantation, and lowland heathland habitats, and for their importance for breeding invertebrates and bird species. Consideration therefore needs to be given to the ecological connectivity and hydrology of the sites and the protected species they support.

5.2.2 Local Wildlife Sites are defined in the local and structure plans under the Town and Country Planning system and are a material consideration when planning applications are being determined. The National Planning Policy Framework (NPPF) (2019) requires planning authorities to use the planning system to enhance the natural and local environment by minimising impacts on biodiversity and providing net gains in biodiversity where possible. Under the Natural Environment and Rural Communities (NERC) Act 2006, all local authorities must, in exercising its functions, have consideration for biodiversity.

5.2.3 As the details of the development are unknown at this stage, siting the development within close proximity of these sites could result in adverse direct and indirect impacts on the habitats and protected species they support including disturbance during the construction phase and post construction through increased noise, dust, the inappropriate use of lighting and night working.

5.2.4 In order to mitigate for these impacts and comply with the NERC Act it is recommended that avoidance is considered initially by siting the development away from these protected sites. The recommended location for the panels is within the species-poor, semi-improved field to the west in order to avoid the habitats on site with the highest ecological value; whilst this is adjacent to these protected sites, the field itself is approximately 1.9ha, allowing plenty of room for a buffer between the works and the protected sites.

5.2.5 The works should be undertaken in line with a construction environmental management plan (CEMP) and a long-term management plan. Strict pollution prevention methods should be in place during the development to avoid excessive dust and pollution. The Environment Agency's Pollution Prevention Guidelines should be followed (although withdrawn from their website they remain a valuable source of information and can still be accessed on the archives).

5.2.6 In addition, the recommendations within Table 5 below, particularly in relation to breeding birds and other faunal species, should be undertaken.

5.4 Habitats and Faunal Species

5.4.1 Table 5 below provides the recommendations for habitats and faunal species that will potentially be impacted by the development. Further details of these recommendations should be included within a construction environmental management plan (CEMP) and a long-term management plan. If the size of the development footprint changes the ecological assessment should be updated as the mitigation is dependent on the site and size of impacted area.

Table 5: Mitigation and Recommendations

Receptor	Mitigation
Habitats and botany	
Semi-natural broad-leaved woodland Wet woodland Scattered trees Hedgerows	Trees and hedgerows are a valuable habitat for a variety of species including birds, bats, hedgehogs and invertebrates and are an important source of carbon uptake. It is highly recommended that all areas of woodland and hedgerows are retained in their entirety on site. Should any trees/sections of woodland/hedgerow require removal they should ideally be replaced with specimens of the same age/species where possible, ideally elsewhere on site or otherwise on a suitable receptor site. Timing of tree removal should follow the requirements of faunal species, see below sections for details. Root protection zones of retained trees/hedgerows should follow BS:5387 (2012) guidelines and should be marked out on site with fencing and clear signage.
Species diverse semi-improved grassland, and tall ruderal vegetation	As part of a potential Open Mosaic Habitat (OMHPDL) these areas should be avoided if possible. If works are required in these areas, a survey may be required to assess whether the site qualifies under the UK BAP. If the development footprint is within these areas, they should be designed to impact these habitats as little as possible by aligning them in grids or a linear fashion. Should vegetation removal and soil stripping be required as part of the development the stripped area should ideally be re-sown with a wildflower grassland mix. A number of suppliers can provide specialist mix's that are designed for low maintenance biodiversity enhancement use within solar installations. A wildflower mix should be selected which takes into account the soil type and pH. Manufacturer/supplier instructions regarding sowing should be followed. Should vegetation removal not be required operational maintenance should be kept to a minimum to maintain the distribution, structure and species composition of existing habitats across the site.
Dense and scattered scrub, bare ground, ephemeral/short perennial and spoil/rubble	As part of a potential Open Mosaic Habitat (OMHPDL) these areas should be avoided if possible. If works are required in these areas, a survey may be required to assess whether the site qualifies under the UK BAP.
Species poor semi-improved grassland	Locating the development within the species poor semi-improved field to the west of the site would be preferable to locating it within those habitats of greater ecological value noted above. This would need to be in line with satisfactory mitigation for the adjacent LNR and LWS and in conjunction with a (CEMP) and a long-term environmental management plan.
Standing water and running water	Panels should be located a minimum of 5m from the River Dove, Blacker Dike and any standing water including the wet woodland in the east of the site. Pollution prevention methods should be in place during the development to avoid polluting the waterbodies within and surrounding the site. The Environment Agency's Pollution Prevention Guidelines should be followed (although withdrawn from their website they remain a valuable source of information and can still be accessed on the archives).
Invasive, non-native species (TN10 and TN13)	Strict biosecurity protocols should be put in place when working in close proximity to the invasive non-native species Himalayan balsam recorded on site.

	Treatment should be implemented across the site, in particularly within the vicinity of the proposed development. If further guidance on removal of these species is required, the Environment Agency have produced a guidance document on treating and managing invasive non-native species such as Himalayan balsam which can be found online (Aquatic and Riparian Plant Management: Controls for Vegetation in Watercourses, Bentley *et al.,* 2014). The methodology should be included within the CEMP.
Faunal species	
Amphibians	The results for P4 and P5 were **negative** for GCN DNA, however, as it was not possible to collect a viable sample from P3, and in order to protect amphibians (including GCN in the unlikely event they are present) any development should proceed under a precautionary approach detailed in a Method Statement within the CEMP. Measures are likely to include sensitive timings of works, hand searches and staged vegetation removal. If no works are undertaken prior to April 2022 a repeat eDNA survey should be undertaken as great crested newts are mobile animals and are known to be present within the wider area.
Bats	A bat scoping survey should be carried out on any trees likely to be impacted by the proposed development, including lopping/topping/felling. The survey can be undertaken at any time of the year, however winter is preferable as the summer canopy can obstruct views of potential roosting features. Dusk emergence and/or dawn return surveys will be required on any trees considered to hold roosting potential. The panels should be sited ideally 3-4m from the site boundaries to allow a natural verge along which bats can commute and forage (BRE, undated). Should potential linear foraging and commuting features, such as the hedgerows, lines of trees and watercourses be removed they should be replaced and/or replicated elsewhere on site either as new tree planting or native hedgerow planting. No night working to be carried out. The site should remain unlit both during the development and post development to maintain the ecological functionality for bats as potential foraging and commuting ground. If security lighting is required post-construction it should be kept to a minimum, avoid any shine onto the site boundaries (use hoods/shields), and avoid white and blue wavelengths of the light spectrum. Retention of the grassland with minimal management would retain foraging areas for bats. The planting of climbers up any boundary fencing would provide additional suitable foraging areas.
Badger	If any excavation/piling is required within 30m of areas of dense scrub or the wooded embankment immediately adjacent to the north of the site, a presence/absence survey of these areas will be required. The survey will search for active signs of badgers such as setts, prints and latrines. Badger surveys can be undertaken at any time of year however surveys undertaken in late autumn and spring, when vegetation has died back, can often reveal more signs. Any open excavations should be covered overnight, or a slope/mammal path provided to allow any badgers that fall in safe egress out. No night working to be carried out. The site should remain unlit overnight to maintain functionality of the site as a potential foraging ground for badger. Any permanent security fencing erected around the development should ideally include at least one ground level access point (300mm wide X 200mm) along each boundary to allow full access to potential foraging grounds. Alternatively, a gap 20-30cm high should be created at the base of the entire length of the security fencing to allow all small wildlife to pass through. Fencing should be set back 3.4m from the site boundary to allow passage of wildlife and a route for maintenance vehicles (BRE, undated). Should the development not take place within 12 months of the survey being carried out (20th May 2020) a pre-construction badger survey should be undertaken.
Birds	Breeding bird surveys may be required depending on the location of the solar panels. This would include four surveys spread over April-June. Any vegetation removal should be undertaken outside of the breeding bird season (i.e. undertaken between October and February). If this is not possible and vegetation has to be removed during

	the active breeding bird season then a nesting check should be carried out by a suitably qualified ecologist within 48 hours of the vegetation removal. The grassland below and around the panels should be allowed to develop into good barn owl foraging habitat, consisting of tussocky grassland with a litter-layer not less than 70mm deep. Bare ground and short grass should be avoided (The Barn Owl Trust website).
Otter	If the detailed design of the development indicates that the wet woodland or the densely vegetated areas along the banks of the River Dove will be impacted, an otter survey within these areas, including the river banks approximately 50m either side should be undertaken. No night working to be carried out. The site should remain unlit both during the development and post development so as to maintain the ecological functionality for otter as potential foraging and commuting ground.
Reptile	Installation works should ideally take place when reptiles are active and can move out of the way of machinery, therefore works should be undertaken within suitable weather conditions between March and October inclusive (dependent on weather conditions). This restricted timing will also limit the amount of habitat damage by avoiding the periods of wettest weather. Vegetation should be strimmed (outside the breeding bird season) to no lower than 100mm initially, this will safeguard reptile species while disturbing them causing them to leave the working area. Two days later the vegetation should be cut to a height of 50mm. Arisings should be collected at the end of each day and removed from the site. Vegetation cuttings provide suitable habitat for reptiles providing them with both shelter and egg laying opportunities (for grass snake only), failure to remove the cuttings at the end of each day will make the site more suitable for reptiles. A short grass sward will encourage reptiles out of the working area, and therefore a short sward height of 50mm or less should be maintained throughout the works on site. Reptile exclusion fencing is not deemed necessary because the works are temporary and habitats will be restored post-installation.
Water vole	If Blacker Dike or the River Dove are directly impacted by the proposed development a water vole survey should be carried out by a suitably qualified ecologist. One survey should be undertaken in each half of the active season, i.e. one survey in April to June and a second in July to September with the surveys at least two months apart. Any heavy plant, work vehicles, and machinery should not be present within 5m of the banks of the ditches or stream and the boundaries of the site where water courses are present (east, south and west) should remain unlit.
Hedgehogs and brown hare	Any open excavations should be covered over-night or a slope/mammal path provided to allow any mammals that fall in safe egress out. No night working should be carried out. The site should remain unlit overnight to maintain functionality of the site as a potential foraging ground for hedgehog. Any vegetation clearance required during the hibernation period should be undertaken by hand. Any security fencing should incorporate a gap between the base of the fence and the ground to allow small wildlife to pass through. The gap should be 20-30cm high. Operational maintenance of existing habitats should be kept to a minimum to maintain functionality of the site as foraging and hibernation ground for hedgehogs.
Migratory and coarse fish	Pollution prevention methods should be in place during the development to avoid polluting the River Dove, following the Environment Agency's Pollution Prevention Guidelines.
Invertebrates	Due to the plants/habitats present on site, and the importance of the adjacent LWS for invertebrates, Biodiversity Action Plan species and important invertebrate assemblages could be present on site. However, the works are temporary and the habitats will be restored post-

	installation. It is therefore not considered necessary to undertake invertebrate surveys, however mitigation will be required to minimise the impact. As per the reptile section above, it is recommended that works on this site take place during good weather conditions to ensure minimal impact to the habitats during the construction phase, i.e. avoid winter and periods of extensive wet weather. Any habitats of higher quality for invertebrates that are lost (e.g. the areas of SI containing a greater species diversity, areas of dense scrub, tall ruder) should be replaced either within the development area or elsewhere on site, for example reducing by reducing the amount of species-poor SI grassland. Areas exhibiting a mosaic of habitats including bare ground should similarly be replicated post-installation if they are directly impacted. Pollution prevent methods (Environment Agency's Pollution Prevention Guidelines) should be in place during the development to avoid polluting the waterbodies that surround site. Operational maintenance of existing habitats should be kept to a minimum to maintain structure, species composition and functionality. The inclusion of a wildflower mix would increase the invertebrate species diversity.

5.5 Optional Site Enhancements

5.5.1 The treatment/removal of Himalayan balsam (to avoid further spread) across the site and the management of areas of dense scrub, for example within the old works and the areas south of the river, would be beneficial. Controlling the extent of scrub will help maintain a mosaic of habitats as well as allowing species other than bramble to develop. Scrub management within Blacker Dike would also increase the suitability of this feature to support water voles, breeding amphibians and invertebrates.

5.5.2 The planting of a native hedgerow along the western boundary of the site (along the edge of the species poor, semi-improved field) would provide a natural buffer between the works and the adjacent wildlife sites and improve biodiversity. A variety of species could be planted to provide food throughout the year, including willows (*Salix spp.*) and blackthorn (*Prunus spinosa*) for early season nectar, hawthorn (*Crataegus monogyna*), bramble (*Rubus fruticosus agg*.) and rose (*Rosa spp.*) for summer flowers and autumn berries.

5.5.3 The provision of bat and bird boxes on the trees or buildings within the TW would provide additional roosting and nesting opportunities for bats and birds, enhancing biodiversity across the site.

6 References

6.1 Cited References

6.1.1 Armstrong, A., Ostle, N.J. & Whitaker, J. (2016). Solar park microclimate and vegetation management effects on grassland carbon cycling. Environmental Research Letters, 11: DOI: 10.1088/1748-9326-11/7/074016.

6.1.2 BRE (undated). Planning guidance for the development of large-scale ground mounted solar PV systems. https://www.bre.co.uk/filelibrary/pdf/other_pdfs/KN5524_Planning_Guidance_reduced.pdf

6.1.3 BSG Ecology (2019). Potential Ecological Impacts of Ground-Mounted Photovolatic Solar Panels: An Introduction and Literature Review. https://www.bsg-ecology.com/impacts-of-operational-solar-farms-on-biodiversity/

6.1.4 Buglife Information Sheet on 'Identifying Open Mosaic Habitats'. https://cdn.buglife.org.uk/2020/01/Identifying-open-mosaic-habitat.pdf

6.1.5 CIEEM (2013). Guidelines for Preliminary Ecological Appraisal. Chartered Institute of Ecology and Environmental Management, Winchester.

6.1.6 Collins, J. (ed.) (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn). The Bat Conservation Trust, London.

6.1.7 Department for Communities and Local Government (2018). National Planning Policy Framework. Department for Communities and Local Government, London.

6.1.8 DeVault, T.L., Seamans, T.W., Schmidt, J.A., Belant, J.L. & Blackwell, B.F. (2014). Bird use of solar photovoltaic installation sat US airports: implications for aviation safety. Landscape and Urban Planning, 122: 122-128.

6.1.9 Entwistle, A.C., Harris, S., Hutson, A.M., Racey, P.A., Walsh, A., Gibson, S.D., Hepburn, I., and Johnston, J. (2001) Habitat Management for Bats: A guide for land managers, land owners and their advisors. Joint Nature Conservation Committee, Peterborough.

6.1.10 Environment Agency. Pollution Prevention Guidelines, Works in, Near or Liable to Affect Watercourses (PPG5). http://www.environment-agency.gov.uk/commondata/acrobat/ppg05.pdf

6.1.11 Gasparatos, A., Doll, C.N.H., Esteban, M., Ahmed, A. & Olang, T.A. (2017). Renewable energy and biodiversity: implications for transitioning to a green economy. Renewable and Sustainable Energy Reviews, 70: 161-184.

6.1.12 G. Carr and M. Parker (2009). Barnsley Biodiversity Action Plan 2nd Edition. Barnsley Biodiversity Trust. http://barnsleybiodiversity.org.uk/biodiversityplan.html

6.1.13 Holdich, D. (2003). Ecology of the White-clawed Crayfish. Conserving Natura 2000 Rivers Ecology Series No.1. English Nature, Peterborough.

6.1.14 Joint Nature Conservation Committee (2003). Handbook for Phase 1 Habitat Survey – a technique for Environmental Audit (revised reprint 2007).

6.1.15 Lush, M. J, Kirby P., Shepherd, P. (2013) Open Mosaic Habitat Survey Handbook. ExeGesIS Spatial Data Management Ltd, Powys

6.1.16 MAGIC (Multi Agency Geographic Information for the Countryside) http://www.magic.gov.uk/

6.1.17 Oldham R.S., Keeble J., Swan M.J.S., and Jeffcote M. (2000). Evaluating the Suitability of Habitat for the Great Crested Newt. Herpetological Journal, Vol10, pp 143-155.

6.1.18 Stace, C.A. (1997). New Flora of the British Isles. Cambridge University Press

6.1.19 Strachan, R. (2006). Water Vole Conservation Handbook; Second Edition. English Nature, Environment Agency and Wildlife Conservation Research Unit. George Street Press Ltd.

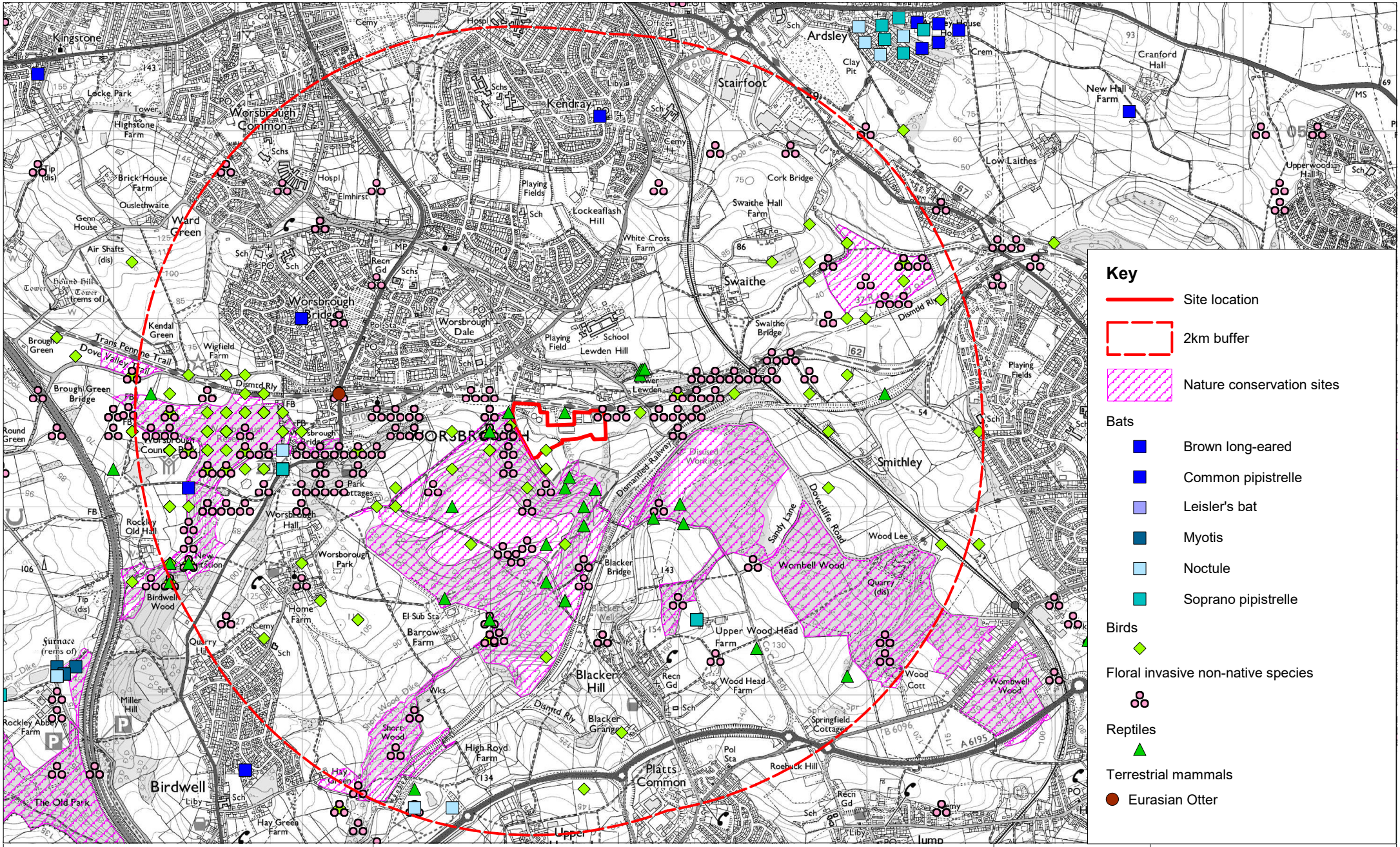
6.1.20 Woods, M. (1995). The Badger. The Mammal Society

7 Figures

7.1 Figure 1 – Site Location and Desk Study Results

7.2 Figure 2 – Phase 1 Habitat Map

7.3 Figure 3 – Photographs



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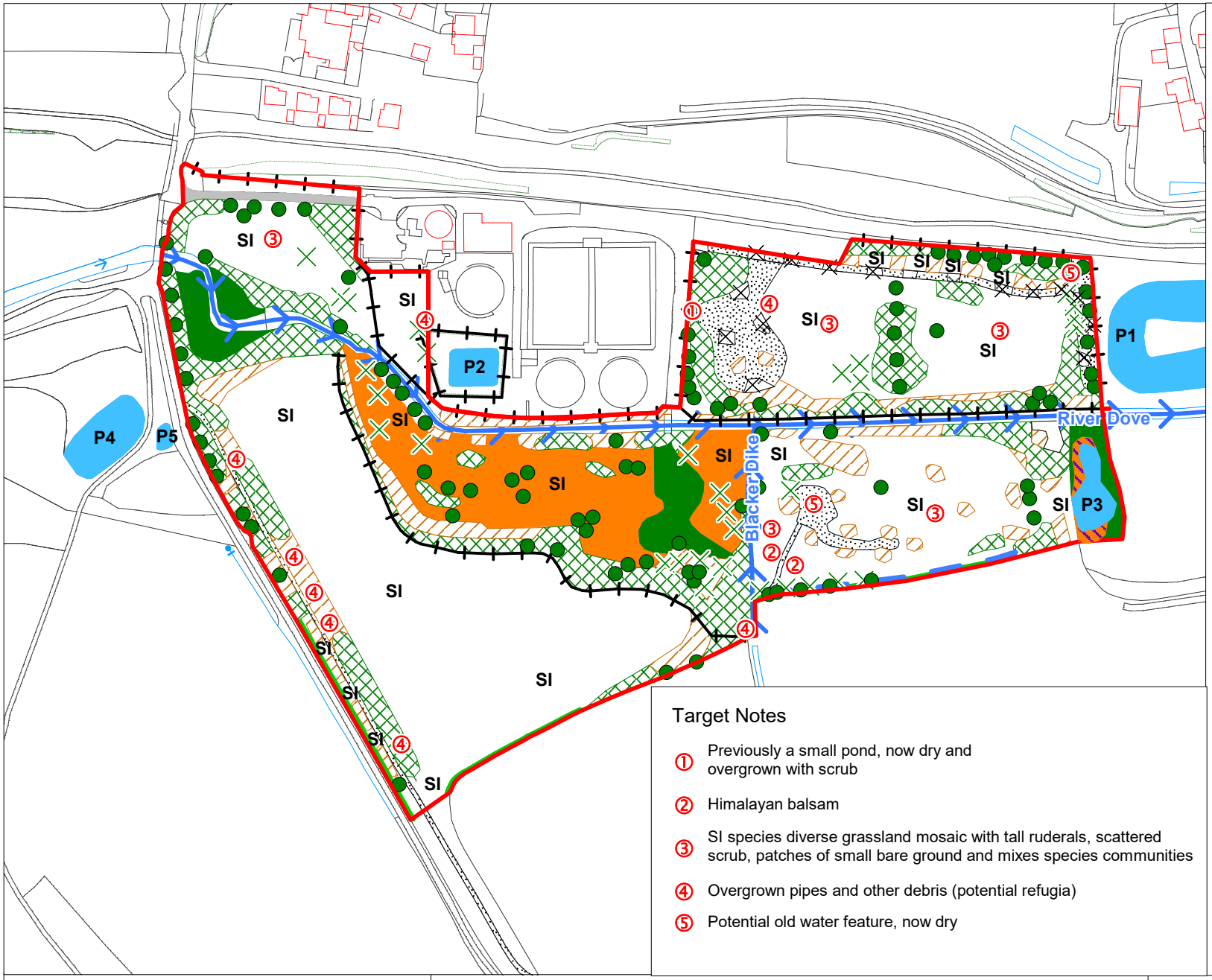
Figure 1 - Site Location and Desk Study Results

Worsbrough WwTW, Barnsley -
Preliminary Ecological Appraisal

Contains Ordnance Survey data © Crown copyright and database right [2013]
This mapping uses OS Open Data Vector Map District (1:25,000)

N

Date	03/07/2020
Map reference	084_19_49/RE01 - FIG 1 - V1
Drawn/Approved by	MG/BL
Scale	1:25'000 at A4



Target Notes

① Previously a small pond, now dry and overgrown with scrub

② Himalayan balsam

③ SI species diverse grassland mosaic with tall ruderals, scattered scrub, patches of small bare ground and mixes species communities

④ Overgrown pipes and other debris (potential refugia)

⑤ Potential old water feature, now dry

Key

- Survey area
- Fence
- Hedge
- Hard standing
- Bare ground
- Ephemeral/short perennial
- Semi-natural broad-leaved woodland
- Scattered broad-leaved trees
- Dense scrub
- Scattered scrub
- Poor semi-improved grassland
- SI — Semi-improved neutral grassland
- SI — Tall ruderal
- Marsh
- Ponds
- Running water
- Dry ditch

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Figure 2 - Phase 1 Habitat Map

Worsbrough wwtw - Preliminary Ecological Appraisal

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Ordnance Survey 0100031673

N

Date	10/09/2020
Map reference	084_19_49/RE01 - FIG 2 - V1
Drawn/Approved by	EH/BL
Scale	1:26'000 at A4

Photograph 1: Unmanaged hawthorn hedgerow running along southern site boundary



Photograph 2: Example of dense scrub in area south of the River Dove



Photograph 3: Example of bare ground with ephemeral/short perennial vegetation



Photograph 4: Example of TN3, the species diverse grassland mosaic within the old works area



Photograph 5: Example of semi-improved (SI) neutral grassland habitat



Photograph 6: Species poor SI field south-west of the River



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Photograph 7: A predominantly dry marshy area on the edge of the wet woodland



Photograph 8: The River Dove, taken from bridge looking west (concrete and gabion basket banks)



Photograph 9: The River Dove, further east with earth banks and surrounding dense vegetation



Photograph 10: Blacker Dike, predominantly overgrown within site boundary



Photograph 11: Blacker Dike within the arable land immediately south of the site boundary



Photograph 12: P2 within the current TW



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	Title	Photographs
	Reference	006_20_24
	Figure Number	3, Page 2 of 3
	Created by	Emma Mackenzie

Photograph 13: P3, feature with standing water within the wet woodland



Photograph 14: P4, within LWS and immediately adjacent to site



Photograph 15: Examples of TN4; spoil in area of old works



Photograph 16: Examples of TN4; pipes and other debris in current works becoming overgrown



Photograph 17: Examples of TN4; large overgrown pipe running the length of the species poor, SI field



Photograph 18: TN5 - A dried out bed, possibly a water body or feature of old workings



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	Reference	006_20_24
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	Created by	Emma Mackenzie

8 Appendix 1 - Bats

8.1 Biology

8.1.1 Bats make up 20% of all mammal species in the world, the order *Chiroptera* has over 1100 species with 17 species of those being native to the UK.

8.1.2 All British bats are insectivores and eat a range of prey from midges and mosquitoes to beetles and spiders. Their nocturnal feeding habits mean they are secretive and often utilise less developed areas such as woodlands, grasslands, watercourses and hedgerows. Bats can however be seen in more urban areas with the most common bats species, common pipistrelle, preferring to roost in buildings throughout the summer.

8.1.3 Bats have varying requirements for roosting throughout the year and this also varies vastly between species. Certain species are fairly restricted to trees throughout the year such as the barbastelle and noctules. General bat roosting habitats can include caves, mines, trees, buildings and churches.

8.1.4 Female bats require warmer temperatures in the summer where they can raise their young, these summer breeding sites are often used year after year and depending on species can range between 20 individuals to several hundred. Some roosts have been recorded at over 1000 individuals. Females begin to find breeding roosts in May and are normally present all summer.

8.1.5 Male bats spend most of the year segregated away from females in solitary roosts or in small numbers. In autumn after the females have had their pups in summer, male bats begin to either seek out breeding females to mate with or create mating roosts or harems. After mating bats disperse to their hibernation sites and fertilisation is delayed until the following spring.

8.1.6 In winter when insect prey is at a minimum, bats begin to seek hibernation sites where they can slow their bodies into torpor and save energy. Hibernation sites tend to support stable temperatures with high humidity, these sites are often in caves, tree hollows or deep in stone walls. Upon warming in spring bats begin their yearly cycle once again and pregnant females begin to form their maternity colonies once more.

8.2 Protection

8.2.1 Because of the fragility of bats roosting habitats and their massive decline over the last century, bats are now a fully European protected species. The legislation makes it an offence to:

- Deliberately or intentionally capture, injure or kill a bat;
- Deliberately disturb bats in such a way as to be likely significantly to:-
    - Impair their ability to survive, breed or rear or nurture their young, or to impair their ability to hibernate or migrate; or
    - Affect significantly the local distribution or abundance of that species;
- Damage, destroy or obstruct a breeding site or resting place of bats.

8.2.2 Actions which are likely to cause one or more of the offences listed above can be licensed by Natural England.

8.2.3 In addition to this greater and lesser horseshoe, barbastelle and Bechstein's bats are included on Annex II of the Habitats Directive (Conservation (Natural Habitats etc.) Regulations 1994 (as amended 2017). This legislation requires that areas Special Areas of

Conservation (SACs) are designated in suitable areas to protect the habitat of these species.

8.3 Planning Policy

8.3.1 The NPPF states that impacts to biodiversity should be minimised and also biodiversity should be enhanced where possible. Bats are therefore considered under the NPPF; this document is therefore a material consideration when assessing planning applications.

8.4 UK BAP and Species of Principal Importance

8.4.1 Barbastelle, Bechstein's, greater and lesser horseshoe, brown long-eared, noctule and soprano pipistrelle are Priority Biodiversity Action Plan (BAP) species. These Priority species are transposed into the Natural Environment and Rural Communities Act 2006. The act means all government departments must conserve these species and promote others to conserve them and their habitats.

8.5 References

8.5.1 Collins, J. (ed.) (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn). The Bat Conservation Trust, London.

8.5.2 Entwistle, A.C., Harris, S., Hutson, A.M., Racey, P.A., Walsh, A., Gibson, S.D., Hepburn, I., and Johnston, J. (2001) *Habitat Management for Bats: A Guide for Land Managers, Land Owners and their Advisors*. JNCC, Peterborough.

8.5.3 Highways Agency (1996). *Design Manual for Roads and Bridges*, Volume 10 Environmental Design and Management: Section 4 The Good Roads Guide- Nature Conservation, Part 6 Nature Conservation Management Advice in Relation to Bats.

8.5.4 HM Government (1995). *Biodiversity: The UK Steering Group Volume 2: Action Plans.* JNCC, Peterborough.

8.5.5 Mitchell-Jones, A.J. & McLeish, A.P. (1999). *Bat Workers' Manual* (2nd Edition). Joint Nature Conservancy Committee, Peterborough

8.5.6 Office of the Deputy Prime Minister (2005). *Planning Policy Statement 9; Biodiversity and Geological Conservation*.

8.5.7 Russ, J. (1999). *The Bats of Britain and Ireland*. Alana Ecology, Shropshire.

9 Appendix 2 – Great Crested Newts

9.1 Biology

9.1.1 Great crested newts are distributed patchily throughout Great Britain, though the national population is spread across a large area. South-west England, Scotland and Wales contain only sparse populations. Woodland and Scrub habitats provide the most suitable terrestrial habitat, as well as hedgerows and rough grasslands with suitable refuges below ground. Breeding populations of great crested newts are best supported by medium sized ponds with neutral to hard water, no fish and abundant aquatic vegetation.

9.1.2 Great crested newts are the largest newt species found in Britain. Movement between terrestrial over-wintering sites and aquatic breeding sites takes place nocturnally, between February and April. Different populations migrate at various paces and dates. At the latest, some individuals arrive at breeding ponds in May. Breeding takes place between April and May and egg-laying takes place between mid-April and mid-June. Most adults will leave the breeding site by August. When migrating to over-wintering sites, great crested newts may travel up to 1km or further, though they typically range within 500m of the breeding site. Larvae most commonly emerge during late Autumn, though they may remain in the pond until the following spring.

9.1.3 Smooth newts are widespread across the British Isles and are more commonly found in the south-east, east and midlands of Britain, as well as in Ireland. Smooth newts are not usually found in northern Scotland or south-west England. A wide range of terrestrial habitats provide resources for smooth newt populations; arable land with suitable refuges is sometimes appropriate. Breeding sites are most commonly found in ponds with neutral to hard water with abundant aquatic vegetation, ideally with good exposure to sunlight.

9.1.4 Smooth newts are much smaller than great crested newts, though a prominent crest can be seen on males of both species during breeding season. Smooth newts mostly over-winter on land, moving to breeding sites during early spring. Egg laying occurs between March and June. Most adults will return to land by July, and larvae typically emerge in late autumn, although they occasionally remain in the breeding pond over winter.

9.1.5 Palmate newts are distributed patchily throughout the British Isles, being most commonly found in northern Scotland and south-west and south-east England. Palmate newts are absent from the east Midlands, East Anglia and Ireland. Ponds with soft water provide the most appropriate habitat for palmate newts, whilst all other requirements are very similar to those of the smooth newt.

9.1.6 Palmate Newts are similar in size to the smooth newt. Males have distinctive webbed feet and a thin filament at the end of the tail but no crest. Palmate newt breeding and migration cycles are very similar to those of the smooth newt.

9.2 Protection

9.2.1 Individual great crested newts are protected from any disturbance or damage by law. This protection applies within and outside designated areas. They are protected under the Conservation Regulations 1994 and the Wildlife and Countryside Act 1981. These regulations make it an offence to:

- *Intentionally or deliberately kill, or intentionally injure, a great crested newt.*
- *Deliberately disturb a great crested newt or intentionally or recklessly disturb them in a place used for shelter or protection.*
- *Damage or destroy a breeding site or resting place of a great crested newt.*

- *Intentionally or recklessly damage, destroy or obstruct access to any structure or place used for shelter or protection by a great crested newt.*
- *Possess or control any live or dead specimen or anything derived from a great crested newt unless acquired lawfully.*
- *Sell, barter, exchange, transport or offer for sale great crested newts or parts of them.*

9.3 Planning Policy

9.3.1 Any development which could kill, injure or disturb great crested newts or their habitat must include planned and licensed mitigation of any impacts. Implemented mitigation must be licensed by Natural England.

9.3.2 Smooth newts and palmate newts are protected from sale or trade under provisions of Section 9 on Schedule 5 of the Wildlife and Countryside Act. They are not subject to European protection.

9.3.3 Local Authorities are obliged to take into consideration the presence of great crested newts when considering proposed developments which may cause death, injury or disturbance of great crested newts or their habitat.

9.4 UK BAP and Species of Principal Importance

9.4.1 The UK Biodiversity Action Plan lists great crested newts as a priority species (HM Government 1994).

9.4.2 Section 41 of the Natural Environment and Rural Communities Act 2006 considers great crested newts to be a Species of Principal Importance for the Conservation of Biodiversity in England. Consequently, all government departments must consider the interests of the conservation of this species.

9.5 References

9.5.1 Arnold, H.R (1995) Atlas of amphibian and reptiles in Britain. HMSO. London.

9.5.2 Beebee, T.J.C and Griffiths, R.A (2000) Amphibians and Reptiles. Harper Collins Publishers. London

9.5.3 English Nature (2001) Great Crested Newt Mitigation Guidelines. English Nature. Peterborough.

9.5.4 English Nature (1991) Facts about Amphibians. English Nature, Peterborough.

9.5.5 Gent, A.H and Gibson, S.D eds (1998) Herpetofauna Workers Manual. Joint Nature Conservation Committee, Peterborough.

9.5.6 HGBI Advisory Notes for Amphibian and Reptile Groups (ARGS). HGBI, c/o Froglife, Halesworth. Unpublished.

9.5.7 Herpetofauna Groups of Britain and Ireland (1998) Evaluating Local Mitigation/Translocation Programmes: Maintaining Best Practice and Lawful Standards.

9.5.8 HM Government (1994 *et seq*) Biodiversity: The UK Action Plan. JNCC, Peterborough.

9.5.9 HM Government (1995) Biodiversity: The UK Steering Group Volume 2: Action Plans. JNCC, Peterborough.

9.5.10 HM Government (1998) Tranche 2 Action Plans: Volumes I and II. English Nature, Peterborough.

9.5.11 NCC (1989) Guidelines for Selection of Biological SSSIs. Nature Conservancy Council, Peterborough.

9.5.12 Oldham, R.S., Keeble, J., Swan, M.J.S., and Jeffcote, M (2000) Evaluating the Suitability of Habitat for the Great Crested Newt (Triturus cristatus). Herpetological Journal, Vol. 10, pp. 143-155.

9.5.13 Wisniewski, P.J. (1989) Newts of the British Isles. Shire Natural History, Aylesbury.

10 Appendix 3 – Otters

10.1 Biology

10.1.1 The otter (*Lutra lutra)* is a member of the mustelid family of mammals, which includes the badger, stoat and weasel. Otters are on average 1m in length, dark brown in colour and males weigh up to 9kg.

10.1.2 Otter physiology is suited to foraging in aquatic habitats; its streamlined appearance, flattened head and thick tail facilitate the hunting of fish and amphibians in rivers, lakes and streams. Otters will also occasionally feed on small mammals and water fowl. When swimming, only the eyes and nose are visible above water.

10.1.3 Otters live individually along rivers, coastline and inland water bodies, within defined home ranges. Spraints, the otter's droppings, are placed in prominent positions throughout the home range as indicators of the inhabitant's presence. Male home ranges often overlap with two or more female ranges; it is thought that the female's urine indicates her breeding condition. Otters will use holes in riverbanks, cavities in rock piles or tree roots, peat tunnels and some human-made structures for shelter.

10.1.4 Females produce one litter per year, although not every female will reproduce each year. There is no defined breeding season. Cubs are born away from the main river, and the mother will avoid leaving signs of her presence nearby. On average, two cubs are produced per litter, and they are reared for 10-12 months. Cubs learn to hunt from their mothers and subsequently disperse to establish their own territories.

10.1.5 Otters have a low reproductive rate, therefore local mortality can seriously affect expanding populations. British otter populations are considered to be vulnerable and only a few local mortalities can put smaller populations at risk of extinction, especially if there are limited corridors for immigration and emigration.

10.1.6 Otters will live in most freshwater habitats and also in many coastal and offshore island areas. Any suitable water will be used by the otter for foraging and for raising cubs, especially if secluded areas are present for use as cover. Smaller streams are beneficial for raising cubs and for the dispersal of juveniles. It is advised that all watercourses are recognised as potential habitats and wildlife corridors for otters.

10.1.7 A variety of practical conservation measures can be taken to protect and enhance otter habitat. The most important factors determining watercourse use are water quality; food supply; cover and shelter; and the presence of nearby breeding otters.

10.2 Protection

10.2.1 The otter is protected under European Law, being listed in Annexes IIa and IVa of the EC Directive (92/43), The conservation of Natural Habitats and of Wild Fauna and Flora (the Habitats Directive). This directive is applied in the UK under Statutory Instrument 490, The Conservation of Habitats and Species Regulations 2017. Additionally, the otter is listed under the 1981 Wildlife and Countryside Act in England, Wales and Scotland, and under the Wildlife (NI) Order 1985 in Northern Ireland. Together, these pieces of legislation make it an offence to:

- Deliberately capture, injure or kill an otter;
- Damage or destroy an otter's place of shelter; and
- Deliberately disturb an otter in a way in which it would:
    - Impair their ability to survive, breed, reproduce, or to rear or nuture their young; or
    - To affect significantly the local distribution or abundance of the species.

10.2.2 Legislation requires developers to manage countryside features, such as rivers and riverbanks, and habitats that allow the migration and dispersal of species. It also enables the designation and conservation of Special Areas of Conservation (SACs), which may be designated in some cases due to the presence of an otter.

10.2.3 The Otter is also protected under the Wild Mammals (Protection) Act 1996 and the Welfare of Animals Act 1972 (Northern Ireland), which makes it an offence to inflict unnecessary suffering on any wild animal.

10.3 Planning Policy

10.3.1 A licence is required from Natural England (or the equivalent statutory body) if an otter is known to be in residence on site and will be physically disturbed. Natural England must be consulted if a holt or other resting site is discovered during preliminary surveys or during construction.

10.3.2 Alternatives should be considered to avoid disturbing the holt and it is not acceptable to remove a holt during construction, as it should have been located during preliminary surveys.

10.4 UK BAP and Species of Principal Importance

10.4.1 Otter remains a Section 41 species of principal importance under NERC Act (2006). As such it is a national priority species in Biodiversity 2020. Its numbers are increasing nationally and the Otter has returned to many river catchments. It is therefore classed as Least Concern in the England Red List.

10.5 References

10.5.1 Environment Agency (1999). Otters and River Habitat Management. Environment Agency, Bristol.

10.5.2 Highways Agency (1996). Design Manual for Roads and Bridges, Volume 10 Environmental Design and Management: Section 4 The Good Roads Guide- Nature Conservation, Part 4 Nature Conservation Management Advice in Relation to Otters.

10.5.3 HM Government (1995). Biodiversity: The UK Steering Group Volume 2: Action Plans. JNCC, Peterborough.

10.5.4 Office of the Deputy Prime Minister (2005). Planning Policy Statement 9; Biodiversity and Geological Conservation.

11 Appendix 4 – Reptiles

11.1 Biology

11.1.1 There are six native species of reptiles in the UK – common or viviparous lizard, sand lizard (*Lacerta agilis*), slow worm, grass snake, adder and smooth snake (*Coronella austrica*).

11.1.2 Reptiles are generally active between March and September, usually mating between April and June with the birth of young/egg hatching between June and October, dependent on species. Reptiles generally enter hibernation in October or November, depending on the weather conditions. Hibernation sites are often within crevices in soil and rock, small mammal burrows, voids between artificial structures and within piles of rubble or dead wood. The home ranges of reptiles varies between species, with the slow worm having the smallest home range of usually less than 100m^2, and the grass snake having the largest home range, often moving up to 4km from their hibernation sites.

11.1.3 The following paragraphs describe the features of each species in more detail.

Common lizard

11.1.4 The common lizard is approximately 15cm long and is usually brown in colour with clear scales present. It is found throughout the UK but is thought to be declining in numbers. This species is most likely to be found within grassland, heath and scrub. Females give birth to live young in August.

Sand lizard

11.1.5 The sand lizard can reach approximately 20cm in length and is usually brown-grey in appearance, although the male can have vivid green flanks during the mating season. This is one of the UK's rarest reptile species, being restricted to coastal sites in Surrey, Dorset, Hampshire and Merseyside, with some re-introduced populations also present in North Wales, Devon, Cornwall and West Sussex. Females lay their eggs in May/June and bury them in sand; eggs hatch between August and early October.

Slow worm

11.1.6 The slow worm is actually a lizard that has evolved without legs. They can reach up to 45cm in length and are usually grey-brown, with females and juvenile marked with a dark stripe down the back. Slow worm have a patchy distribution throughout the UK and are thought to be declining in numbers. They are most likely to be found within grassland, scrub or woodland habitats. Females give birth to live young in later summer.

Grass snake

11.1.7 Grass snake are usually between 15-100cm in length, a green, grey or brown colour, with the underneath a cream colour. The back has dark patterns which can often be mistaken for adder, however the most distinguishing feature is a yellow collar behind the head. Grass snake are most strongly associated with aquatic habitats and grassland, and are found throughout most of England and Wales but are thought to be declining in numbers. Grass snakes lay eggs in June/July amongst rotting vegetation, often within compost heaps, and the eggs hatch in late summer.

Adder

11.1.8 Adders are smaller than grass snakes, usually being between 60-80cm in length. They are grey-brown and have a distinctive dark zig-zag pattern down the back. Adder are found predominantly within heathland and grassland. They have a patchy distribution throughout

the UK but are absent from Ireland and are thought to be declining in numbers. Females give birth to live young in August and September.

Smooth snake

11.1.9 The smooth snake is the UK's rarest reptile. It is usually 60-70cm in length and is grey or brown with black markings arranged in rows down the back. This species is found only in heathlands of Dorset, Hampshire, Surrey and West Sussex. Females give birth to live young in September.

11.2 Protection

11.2.1 All six native reptile species to UK are protected under Schedule 5 Sections 9.1 and 9.5 of the Wildlife and Countryside Act 1981. This makes it an offence to:

- Intentionally kill, injure or take a reptile;
- Sell, offer for sale, possess or transport a reptile for the purpose of sale (live or dead animal, part or derivative); and
- Advertise reptiles for buying or selling.

11.2.2 Sand lizards and smooth snakes are additionally protected in UK legislation under Schedule 5 Section 9.4 of the Wildlife and Countryside Act, and within EU legislation under Schedule 2 of The Conservation of Habitats and Species Regulations 2017. Together, this legislation makes it an offence to: capture or disturb reptiles, and to

- Deliberately capture or disturb reptiles in such a way as to be likely significantly to:-
  - Impair their ability to survive, breed or rear or nurture their young, or to impair their ability to hibernate; or
  - Affect significantly the local distribution or abundance of that species;
- Deliberately take or destroy the eggs of reptiles;
- Damage, destroy or obstruct a breeding site or resting place of reptiles.

11.2.3 Actions which are likely to cause one or more of the offences listed above can be licensed by Natural England.

11.3 References

11.3.1 Gent, T. and Gibson, S. (eds.) (1998) Herpetofauna Worker's Manual. Joint Nature Conservation Committee, Peterborough.

11.3.2 Froglife (2010) Froglife website http://www.froglife.org/

11.3.3 Froglife (1999) Reptile survey: An introduction to planning, conducting and interpreting surveys for snake and lizard conservation. Froglife Advice Sheet 10.

11.3.4 Highways Agency (2005) *Nature Conservation Advice in Relation to Reptiles and Roads*. Design Manual for Roads and Bridges, Volume 10, Section 4, Part 7.

12 Appendix 5 – Water Voles

12.1 Introduction

12.1.1 This appendix provides a summary of water vole biology and the protection they receive through legislation and planning policy.

12.2 Biology

12.2.1 Water voles are the largest of the native UK voles. They are aquatic mammals nesting within burrows within the bank sides of water courses and bodies. Their burrows can consists of a network of chambers which can be present above ground and underneath the water surface. Burrows tend to be within 2m of the waters edge however burrows can be found up to 5m on the bank side.

12.2.2 The breeding season runs from March to September with females defending their territories and burrows during this period. Territories are defended by marking habitat with latrines and scent markings, burrows can however be shared outside the breeding period. It is not uncommon for litters to be of eight in size, females can have up to five litters per year.

12.2.3 Water voles can be found around canals, lakes, rivers, reed beds, wetlands and ponds, their preference is slower moving water around 3m in width and 1m deep. Cover is essential for water voles and tall and varied vegetation provides this, the shorter herbs also provide water voles with their main food source. Water voles are herbivorous and feed on leaves and stems of grasses, sedges and other short herbs. Very shaded or wooded sites are normally unsuitable.

12.2.4 Water vole numbers have declined catastrophically in the last 30 years with water voles disappearing form almost all of their former sites. The decline is through habitat degradation through agriculture and development, another large catalyst of the decline is the introduction of the American mink which are a fierce predator of the water vole.

12.3 Legal Protection

12.3.1 Water voles are fully protected under the Wildlife and Countryside Act 1981 (see Appendix 1). This makes it an offence to intentionally or recklessly:

- Kill, injure or take a water vole form the wild;
- Possess or trade in a water vole;
- Damage, destroy or obstruct access to any structure or place which water voles use for shelter or protection; and
- Disturb water voles while they are using such a place.

12.3.2 Water voles are also a Priority species in the UK Biodiversity Action Plan and a Species of Principal Importance for the Conservation of Biodiversity in England under Section 41 of the NERC Act 2006. This places a duty on all government departments to have regard for the conservation of these species.

13 Appendix 6 – Impact Assessment Criteria

13.1.1 It is important to be able to provide an objective, expert assessment/appraisal of the importance of an ecological receptor (habitats and species). To do this, BL Ecology Ltd followed the structure within the Chartered Institute for Ecology and Environmental Management's (CIEEM) Guidelines for Ecological Impact Assessment in the UK and Ireland (Second Edition, 2016). This provides for three steps in the process of assessing the significance of the impact of a development:

1) Evaluate the importance/sensitivity of the receptor (i.e. assign a conservation value to it);
2) Predict the scale of the impact (in terms of extent, magnitude, duration etc);
3) Assess the significance of the effect of those impacts relative to the conservation value of the site.

13.1.2 There is a fourth step to assess the 'residual' effects of the impacts with mitigation, which follows the same methodology as Step 3.

13.1.3 The first step in assessing the impact of a development is to assign a value to current ecological features and resources. Table 1 below provides a method for this assessment devised by BL Ecology Ltd. The categories of value are usually assigned in geographical terms, e.g. of international, national, local importance etc.

13.1.4 The value of an ecological receptor is determined by factors such as distribution, designation, rarity, population size, species assemblage, mobility, local distinctiveness and vulnerability. Whilst the legal protection or BAP status of a species or habitat must be taken into account, it cannot be automatically determined which category the receptor falls into, as that particular receptor may in in an unfavourable ecological condition, fragmented/ isolated, or a small area/population.

Table 6: Assigning Nature Conservation Value

Nature Conservation Value	Examples
International	An internationally designated site (or candidate site) such as a Special Area of Conservation (SAC), a Special Protection Area (SPA), and Ramsar Sites; Habitats listed on Annex I of the Habitats Directive; or Significant population of a faunal species listed on Annex II of the Habitats Directive or a hibernation site for the same species.
National	A nationally designated site such as a Site of Special Scientific Interest (SSSI) and National Nature Reserve; A Priority Habitat as listed on the UK Biodiversity Action Plan (UK BAP) within favourable status; or A significant population of a Priority Species listed on the UK BAP.
Regional	A third-tier (locally) designated site such as Local Wildlife Sites, Important hedgerows under The Hedgerow Regulations 1997; A Priority Habitat as listed on the District BAP and within favourable status; A significant population of a Priority Species listed on District BAP; or A regularly occurring significant population listed in a Local Red Data Book;
Local	Habitats classed as common and widespread throughout the UK; Small numbers (non-breeding) of protected species; or Significant population of common faunal species.
Negligible	Minor/no nature conservation value.

13.1.5 Potential impacts that the development may have on the ecological receptor are then considered by deliberation of the following factors:

- Extent;
- Magnitude;
- Duration;
- Reversibility;
- Timing and Frequency;
- Cumulative effects; and
- Confidence in predictions (level of uncertainty).

13.1.6 The predicted magnitude of an impact on the ecological receptor is determined using Table 2 below. Impacts can be positive or negative and consider the likelihood that a change or activity will occur as predicted, on a scale of certain, probable or unlikely, this is without mitigation.

Table 7: Predicted Magnitude of Impact (Without Mitigation)

Magnitude	Criteria
Major negative	The proposed development is likely to permanently adversely affect the integrity of the ecological receptor.
Intermediate negative	No permanent effect on the integrity of the ecological receptor however the key attributes are likely to be adversely altered.
Minor negative	Neither of the above apply, but some minor negative impact is likely.
Neutral	No observable impact in either direction.
Beneficial	Impacts which provide a net gain for the ecological receptor.

13.1.7 Consideration of the magnitude of each impact against the nature conservation value of the ecological receptor produces a matrix table to determine the overall impact that the development is likely to have on the receptor. This is shown in Table 3 below.

Table 8: Estimating the Overall Appraisal Category (in term of significance)

Magnitude of Potential Impact	Nature Conservation Value				
	International	**National**	**Regional**	**Local**	**Negligible**
Major Adverse	Very Large Adverse	Very Large Adverse	Moderate Adverse	Slight Adverse	Neutral
Intermediate Adverse	Large Adverse	Large Adverse	Moderate Adverse	Slight Adverse	Neutral
Minor Adverse	Slight Adverse	Slight Adverse	Slight Adverse	Slight Adverse	Neutral
Neutral	Neutral	Neutral	Neutral	Neutral	Neutral
Beneficial	Large Beneficial	Large Beneficial	Moderate Beneficial	Slight Beneficial	Neutral

14 Appendix 7 – HSI Results

Table 9: Results of Habitat Suitability Index Assessment

SI Factor	P1	P2	P3	P4	P5
SI 1 Location	1	1	1	1	1
SI 2 Pond area	0.8	0.65	0.65	0.985	0.8
SI 3 Permanence	0.9	0.9	0.5	0.9	1
SI 4 Water quality	0.67	0.67	0.67	0.67	0.67
SI 5 Percentage shade	1	1	0.2	1	1
SI 6 Waterfowl	0.67	0.67	0.67	0.67	0.67
SI 7 Fish presence	0	1	1	0.3	1
SI 8 Pond count	0.975	0.975	0.975	0.975	0.975
SI 9 Terrestrial habitats	0.67	1	1	1	1
SI 10 Macrophyte cover	0.45	0	0.4	0.45	0.4
Resulting HSI score	**0.49**	**0.00**	**0.64**	**0.75**	**0.8**
Suitability	**Poor**	**Poor**	**Average**	**Good**	**Excellent**