

# VPI-Immingham Energy Park 'A'

Appendix 10G: Terrestrial Invertebrate Survey

VPI Immingham

[DRAFT]

Project Number: 60547702

July 2018

## Quality information

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## Revision History

Revision	Revision date	Details	Authorized	Name	Position
01	27.07.18	Draft	For issue	L King	Regional Director

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## 1 Introduction

1.1.1 This Appendix of the Environmental Statement (ES) presents the results of a terrestrial invertebrate survey undertaken for the Proposed Development. The terms of reference used in this report are consistent with those defined within the main chapters of the ES (Volume 1).

### Survey Scope

1.1.2 A total of three daytime visits were undertaken to meet the minimum requirements for assessing the invertebrate fauna of a site in terms of conservation evaluation (Drake et al. 2007).

1.1.3 The aims of the survey were:

- To sample areas of high entomological value using several sampling methods;
- To identify collected specimens to species level where possible;
- To identify any significant species either in terms of local or national rarity;
- To identify any significant groups of species associated with specific habitats or plants;
- To identify the most likely areas of the Survey Area to have a diverse invertebrate fauna; and
- To identify the areas with the most potential for invertebrates.

1.1.4 The Survey Area included all accessible habitats within the red line boundary of the Proposed Development, as well as the brownfield land on the plot to the east (between the Proposed Development and Rosper Road) (Figure 10G.1). This Survey Area was established because at the time the terrestrial invertebrate surveys commenced, the red line boundary for the Proposed Development had not been defined, however it is considered to provide a representative sample area for the habitats present.

1.1.5 The evaluation section presents an overall evaluation of the survey area, as well as a more focussed evaluation on the habitats and species recorded within the Proposed Development area only, as defined in Chapter 2 of the ES.

### Relevant Legislation

1.1.6 Whilst a large number of the UK invertebrate species are widespread and common, there are many threatened and/or vulnerable species that are covered by policy and legislation; these include domestic wildlife legislation, local and national biodiversity policies, and relevant international statutes. Most of these measures aim to protect vulnerable species, but some invasive species are also covered by legislation.

1.1.7 The relevant policies are as follows:

- UK invertebrate species protected by international statutes;
- Invertebrate species listed on Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) for England and Wales;
- Invertebrate species listed under Section 41 of the Natural Environment and Rural Communities Act 2006;
- Invertebrate species endangered by trade and listed under the EU CITES Regulations; and,
- Invertebrate species listed on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended).

- 1.1.8 Full details of these policies, and how they relate to UK invertebrate species is available at:  
<https://www.buglife.org.uk/sites/default/files/Policy>

## 2 Survey Methods

### Desk Study

2.1.1 A desk study was undertaken as part of the scope of works for the Phase 1 Habitat survey and is reported in detail in the Preliminary Ecological Appraisal (PEA) (Appendix 10A in ES Volume 3). Terrestrial invertebrate records were obtained from the local ecological records centre (Greater Lincolnshire Nature Partnership) for a search radius of 1 km from the Proposed Development boundary, referred to as the study area in this report.

### Terrestrial Invertebrate Survey

2.1.2 A terrestrial invertebrate survey was undertaken following best practice guidelines as detailed in NERR005 Drake et al (2007) comprising a number of passive trapping, active trapping and direct observational survey techniques.

2.1.3 Three entomological sampling methods were used; sweep netting, yellow water traps, and direct observation/spot checking. The sampling techniques chosen were in line with recommended sample techniques provided in the NERR005 "Surveying Terrestrial and Aquatic Invertebrates for Conservation Evaluation" (Drake et al 2007).

2.1.4 The Survey Area was visited on three dates; May 10<sup>th</sup>, June 4<sup>th</sup> and July 10<sup>th</sup> 2018. These dates were selected as they covered the activity period of most spring and summer diurnal invertebrates. Each visit lasted 5-6 hours and the weather conditions encountered are shown in Table 2.1 below.

**Table 2.1: Survey Dates and Weather Conditions**

Visit No.	Date	Temperature °C	Cloud (0/8)	Wind	Rain
1	10/05/2018	14	5	2	0
2	04/06/2018	14	8	1	Drizzle showers
3	10/07/2018	19	6	1	0

### Sweep netting

2.1.5 Sweep netting was chosen as a technique as it can collect insects from a wide range of insect Orders. A 14" wide white sweep net with a fixed handle was used to collect insects from vegetation up to a height of three metres.

2.1.6 Due to the small size of the Survey Area, three ten minute sweep samples across the Survey Area were undertaken with all of the habitat ecotones swept ensuring that survey effort was distributed evenly across the area and less promising areas were surveyed with equal effort as apparently good areas.

2.1.7 Each sample consisted of sweeping for 10 minutes, using back-and-forth sweeps while walking at a moderate pace, and keeping the net as low as practical in the vegetation for the whole length of the sweep. Captured invertebrates were removed frequently from the net, with large specimens that were easily identifiable (e.g. some Syrphidae, Hymenoptera and Coleoptera) noted and released and smaller specimens removed with a pooter and preserved in 70% isopropyl alcohol for later identification.

## Yellow water traps

- 2.1.8 Yellow water traps target those orders of insects that visit flowers such as the Hymenoptera (Bees and wasps), some families of Coleoptera (beetles), and Diptera (true flies).
- 2.1.9 Ten pairs of identical shallow yellow trays were located throughout the Survey Area and filled with slightly soapy water to half their depth (approximately 0.8l). They were set up upon arrival on Survey Area at 08:30 am to allow time for insects to be attracted to them. The traps were left in the field for approximately 6 hours, whereupon the contents of the traps were carefully sieved and the specimens preserved in 70% isopropyl alcohol for later identification.
- 2.1.10 They were located in sheltered, sunny areas across the survey area and were located within ecotones where two or more habitat types (e.g. bare ground and short sward grassland) meet and grade into one another.

## Direct observation / spot-checking

- 2.1.11 Where nectar sources were present the sweep net was used to stalk insects visiting flowers. Large insects on the wing that could be easily identified (e.g. Lepidoptera) were recorded during the survey periods.

## Beating

- 2.1.12 Invertebrates living on the foliage and branches (saproxylic and epiphyte assemblages) of bushes and tall herbage are collected by jarring the branches with a stick so the animals fall onto a collecting tray below. This technique is largely un-favoured during optimal weather as any large or active insects escape before capture and/or identification.

## Sample Identification

- 2.1.13 Identification of the invertebrates collected was undertaken with a low powered dissecting microscope. Whilst this was adequate, some species were not identified to species level as certain small features could not be seen. In addition, identification keys for some groups only refer to males leaving the females unidentifiable. All specimens were retained and individually stored and labelled. The keys used to identify species are listed in the bibliography. The finalised species lists are shown in Appendix A.

## Sample data processing

- 2.1.14 The species list derived from sample identification was processed using the Natural England database resources ISIS (Invertebrate Species-habitat Information System) (Webb and Lott, 2006) and Pantheon (Webb et al, 2018).
- 2.1.15 The ISIS database was originally designed as an application for recognising invertebrate assemblage types in species lists collected at scales ranging from management compartment to landscape character area. The assemblage types were labelled in terms that relate to their favoured habitats in order to make them accessible to non-specialists. Two levels were recognised in the classification: broad assemblage types (BATs), a comprehensive series of assemblage types that were characterised by more widespread species; and specific assemblage types (SATs), characterised by ecologically restricted species and were generally only expressed in lists from sites with conservation value.
- 2.1.16 Pantheon is a database tool derived from ISIS and developed by Natural England and the Centre for Ecology & Hydrology to analyse invertebrate sample data. The analyses supported by

Pantheon are designed to improve understanding of the resources and structures used by invertebrates within the sample locations and aid their conservation.

## Limitations

- 2.1.17 Access into the Proposed Development area that lies within the operational area of the Total Lindsey Oil Refinery (TLOR) site was restricted in terms of installation of passive traps, and no passive traps were placed in habitats within the fenced boundary of the TLOR until access was approved for the July survey. The habitat within the TLOR fenced area was entirely contiguous with habitat outside the fenced boundary that was surveyed, and therefore it is reasonable to assume that the outcome of the terrestrial invertebrate survey outside the fenced area would be similarly applicable to habitats within the fenced area. The access restrictions into the TLOR site are therefore not considered to have limited the gathering of terrestrial invertebrate data for the purposes of impact assessment.
- 2.1.18 Due to the previous land usage and substrate conditions, the use of pitfall trapping within the Survey Area was not selected as a survey technique due to limited information regarding the contamination status of the soils, it is also likely that ground breaking activities could cause sparking from tool use and pose an explosion risk. Not using pitfall trapping as a survey technique misses many of the ground dwelling taxa that may be present on-site, particularly Carabid beetles and represents a constraint on the entomological assessment.
- 2.1.19 The weather conditions during the June visit were sub-optimal for sweep netting or direct observation of animals on the wing. In this instance beating vegetation over a tray, spot checking and water traps were utilised. The continued warm weather period into July made the Survey Area extremely dry, limiting the activity of species that may have been associated with the semi-permanent wet areas present within the survey area.
- 2.1.20 No nocturnal surveys were commissioned as part of this report. Many of the Lincolnshire BAP invertebrate species are night flying moths that would have not been observed or captured during diurnal sampling.
- 2.1.21 Identification of the invertebrates collected was undertaken with a low powered dissecting microscope. Whilst this was adequate, some species were not identified to species as certain small features could not be seen. In addition, identification keys for some groups only refer to males leaving the females unidentifiable. Appendix B provides lists of all the invertebrates that were collected during the survey.
- 2.1.22 These constraints, whilst limiting the number and range of invertebrates encountered during the survey, did not prevent a robust evaluation of the invertebrate fauna from being undertaken.

### 3 Survey Results

3.1.1 The survey identified 169 species of invertebrate (Appendix B), including representatives of the following groups: woodlice, damselflies, earwigs, bush crickets, crickets, grasshoppers, leafhoppers, bugs, beetles, ants, wasps, bees, flies, caddisflies, moths, butterflies, spiders, and snails.

#### Biodiversity Action Plan Priority Species

3.1.2 Two UK Biodiversity Action Plan (BAP) Priority Species have been found by this survey (Table 3.1). The cinnabar moth *Tyria jacobaea* and the Lackey *Malacosoma neustria*, also a moth. These two species are still widespread and common though are declining. Conservation action for these “research only” BAP species is focused on further research rather than protection of individual sites. Nevertheless, both of these BAP species have been added to Section 41 of the Natural England and Rural Communities (NERC) Act 2006 which lists species “of principal importance for the purpose of conserving biodiversity”.

3.1.3 Further information on these two species is provided in the text below.

**Table 3.1: S41 (BAP) Species Recorded**

Order	Family	Species (Scientific Name)	Species (Common Name)	Status
Lepidoptera	Erebidae	<i>Tyria jacobaea</i>	Cinnabar	S41 (Research only)
Lepidoptera	Lasiocampidae	<i>Malacosoma Neustria</i>	The Lackey	S41 (Research only)

#### Key Species

3.1.4 Amongst the 169 species recorded by these surveys, 10 (5.91%) have NERC S41 (as detailed in Table 3.1), RDB, Nationally Scarce, Threatened or Near Threatened conservation status (Table 3.2); for the purposes of this report, these species will be referred to as “Key Species”. Table 3.2 is ordered by conservation status category with the rarest/most threatened species listed first.

3.1.5 For an explanation of the conservation status categories of invertebrates, see Appendix A. This total of 10 Key Species includes the two S41 species (Cinnabar moth and The Lackey).

**Table 2.2: Key Species Recorded**

Order	Family	Species (Scientific Name)	Species (Common Name)	Status
Aranae	Thomsidae	<i>Xysticus sabulosus</i>	A crab spider	Nationally scarce (NS)
Coleoptera	Carabidae	<i>Brachinus crepitans</i>	A bombardier beetle	NS
Coleoptera	Oedermeridae	<i>Oedemera viriscens</i>	A false blister beetle	Nationally Rare (NR)
Diptera	Dolichopodidae	<i>Dolichopus migrans</i>	A dolichopid fly	NR, Vulnerable (VU)
Diptera	Dolichopodidae	<i>Dolichopus agilis</i>	A dolichopid fly	NR, VU
Hymenoptera	Nomada	<i>Nomad fulvicornis</i>	Fork-jawed nomad bee	RDB3
Hymenoptera	Pompliidae	<i>Priocnemis schioedtei</i>	A spider hunting wasp	Nationally Notable

Order	Family	Species (Scientific Name)	Species (Common Name)	Status
				(Nb)
Lepidoptera	Erebidae	<i>Tyria jacobaea</i>	Cinnabar	S41 (Research only)
Lepidoptera	Lasiocampidae	<i>Malalacosoma Neustria</i>	The Lackey	S41 (Research only)
Mollusca	Hygromiidae	<i>Cornuella virgata</i>	Vineyard snail	Data Deficient (DD)

3.1.6 For each of the Key Species recorded, a short account is provided, describing the ecology and distribution of the species in Britain, followed by details of its occurrence during the current survey. Species accounts typically make reference to “vice- counties”: a fixed set of 112 areas covering the whole of Britain which have been used by biological recorders since 1852. The Survey Area is within the vice-county of North Lincolnshire (VC 54).

***Xysticus sabulosus* (Araneae: Thomsidae) NS**

3.1.7 This species has a patchy and very scattered distribution in England, Scotland and Wales. It is a Palearctic species widespread in western and central Europe. Typically found on heathland, and although under-recorded, this species has undergone a serious decline in the UK.

3.1.8 This species was identified from sweep netting outside of the application area in July.

***Brachinus crepitans* (Coleoptera: Carabidae, Brachinae) Nationally Scarce (NS)**

3.1.9 *Brachinus crepitans* is widespread but local in southern and eastern England and into South Wales. Most recent records are coastal. It occurs in short, dry grassland, usually on chalk or limestone, and also clay brick-pits, undercliffs, sea walls and stabilised shingle on the coast.

3.1.10 This species was found through refugia searching outside of the application boundary during the June survey.

***Oedemera viriscens* (Coleoptera: Oedermeridae) NR**

3.1.11 A species of false blister beetle that is known to visit a variety of flowers such as umbels, dandelions *Taraxacum spp.* agg. and hawthorn. The larvae have been raised from rotten wood, stems of herbaceous plants and have been recorded from ragwort stems.

3.1.12 This species was recorded from sweep netting set outside of the application boundary during the July survey.

***Dolichopus migrans* (Diptera: Dolichopodidae) NR**

3.1.13 A long legged fly of the genus Dolichopodidae, recorded from Suffolk, Norfolk, Lincolnshire and Yorkshire. This species requires dry grassland on sandy soil. Little is known about the biology of this species (Falk and Crossley 2005).

3.1.14 This species was recorded from sweep netting within the application boundary in during the July survey.

***Dolichopus agilis* (Diptera: Dolichopodidae) NR, VU**

3.1.15 A long legged fly of the genus Dolichopodidae, widely distributed in England (Devon, Oxfordshire, Buckinghamshire, Norfolk, Cambridgeshire, Gloucestershire, Yorkshire), and in Wales (Carmarthenshire, Caernarvonshire). Recorded in a variety of habitats including lowland wet heath, Phragmites fen, calcareous valley fen, dry grassy heath and coastal sand dunes (Falk and Crossley 2005). This is a possible new record of the species for Lincolnshire.

3.1.16 This species was captured through sweep netting within the application boundary during the July survey.

***Nomada fulvicornis* (Hymenoptera: Aculeata, Nomada) RDB3, Rare**

3.1.17 A cleptoparasite on various *Andrena* species and has been recorded from a variety of habitats including sandy soils, coastal cliffs and landslips and, more rarely, chalk grassland. The species has flight periods that are defined by the host species and can be univoltine or bivoltine.

3.1.18 This species was recorded from sweep netting outside of the application boundary during the May survey.

***Procnemis schiodtei* (Hymenoptera, Aculeata: Pompilidae) Nationally Scarce (Nb)**

3.1.19 A spider hunting parasitoid wasp recorded from South Devon to east Kent, north to east Inverness-shire and Moray and the Channel Islands. Typically found in open situations on sandy soils but also on limestone grassland, along old hedges and earth exposures on road verges, and open areas in woodland on sandy soils.

3.1.20 This species was recorded from sweep netting outside of the application boundary during the July visit.

***Tyria jacobaeae* (Lepidoptera: Erebidae) The Cinnabar, S41**

3.1.21 JNCC Criteria 3: common and widespread, but rapidly declining moths – research needed; Declined by 83% over the last 35 years (JNCC). Resembling no other British species, except perhaps the burnets (Zygaenidae), this is a fairly common moth in much of Britain. It is generally nocturnal, but is quite often disturbed during the day from long grass, low herbage etc. At night, it comes to light. A colour form, f. *flavescens* is found occasionally, with the red markings replaced with a yellowish tint. The distinctive larvae, with their yellow and black hoops, generally feed gregariously on ragwort (*Senecio jacobaea*) and other related plants. The flight period is May through July. (Kimber 2018).

3.1.22 This species was observed regularly inside and outside of the application boundary during the June and July visits.

***Malacosoma neustria* (Lepidoptera: Lasiocampidae) The Lackey, S41**

3.1.23 JNCC Criteria 3: common and widespread, but rapidly declining moths – research needed; Declined by 90% over the last 35 years (JNCC). The adults of this species are relatively dull in coloration, but the caterpillars are much more colourful, with orange, white and blue stripes on a dark brown ground colour. The larvae feed gregariously in a web of silk, on hawthorn, blackthorn (*Prunus spinosa*) and other trees and shrubs. Occurring mainly in the southern half of Britain, the flight period is July to August.

3.1.24 Aggregations of the larvae of this species were recorded on scrub species outside of the application boundary during the May survey (Plate 1).



**Plate 1: Larvae of The Lackey observed during May 2018 on blackthorn scrub**

***Cernuella virgata* (Mollusca: Hygromiidae) DD**

3.1.25 A small, air breathing pulmonate gastropod. Usually found clustered on tall vegetation or partially buried in sand or soil in dry grasslands or coastal dunes.

3.1.26 This species was recorded outside of the application boundary during the May visit.

## ISIS Results

3.1.27 ISIS covers 120 of the 169 species identified by the survey. Within the 120 species covered by ISIS, two Broad Assemblage Types (BATs) were well represented (i.e., represented by 15 species or more), seven more BATs were identified, however these fell below the Rarity scores required for favourable condition and are not discussed further. The two favourable BATs are shown in Table 3.3.

**Table 3.3: BATs Represented in the Survey Area. The ISIS scores and the number of species on which each score is based.**

BAT Code	BAT Name	No. of Species	ISIS Score	Rarity	ISIS Score 'favourable condition threshold'	Rarity Favourable condition reached?
F1	unshaded early successional mosaic	28	153		160	No

F2	grassland & scrub matrix	26	161	160	Yes
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## Pantheon Results

- 3.1.28 The list of 169 species or aggregates was entered into Pantheon from the three surveys combined. 14 taxa were not matched, so Pantheon processed a list of 155 taxa.
- 3.1.29 Pantheon covers 155 of the 169 species processed. Within the species dataset, three broad biotypes were well represented, with one broad biotype represented by a single species.
- 3.1.30 These Broad biotypes are shown in Table 3.4 below. This table includes the Broad biotopes, the number of species associated with the biotope, the percentage of the national assemblage for the biotope this represents, and the Species Quality Index (SQI).

**Table 3.4: The Broad Biotopes represented in the survey area**

Broad Biotope	No. of Species	% Representation of UK species	SQI <sup>1</sup>	No. of S41 or Key species
Open habitats	95	2	131	8
Wetland	22	<1	159	1
Tree-associated	16	<1	100	1
Coastal	1	<1	100 <sup>2</sup>	

- 3.1.31 Within these 155 species covered by Pantheon analysis, six Specific Assemblage Types (SATs) were represented. These are species that are stenotopic to a specific habitat type; and these habitats can be considered highly important to invertebrates within the Survey Area. However, only one of these SATs was represented by 15 or more species which is a minimum requirement for calculating a reliable Species Quality Index.
- 3.1.32 The SAT types represented in the survey area, including the number of stenotopic species, the Species Quality Index (SQI), and an indication of whether Favourable Condition Criteria for the habitat type has been met is shown in Table 3.5 below.

**Table 3.5: Specific Assemblage Types**

Broad Biotope	Habitat	Specific Assemblage Type (SAT)	Code	No. of Species	SQI	Favourable condition criteria met?
Open habitat		Flower rich resource	F002	22	114	Favourable
Open habitats	Short sward and bare ground	Bare sand and chalk	F111	10	290 <sup>3</sup>	Unfavourable

<sup>1</sup> A measure of the number of rare species in a sample, divided by the total number of species in the sample.

<sup>2</sup> represented by a single species

<sup>3</sup> calculated from <15 species

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Open habitats		Scrub edge	F001	7	100 <sup>3</sup>	Unfavourable
Tree-associated	Decaying wood	Bark and sapwood decay	A212	5	100 <sup>3</sup>	Unfavourable
Open habitats	Short sward and bare ground	Open short sward	F112	3	100 <sup>3</sup>	Unfavourable
Tree-associated	Decaying wood	Heartwood decay	A211	1	100 <sup>3</sup>	Unfavourable

## 4 Evaluation

### Survey Area as a Whole

- 4.1.1 A total of 169 species of invertebrate were identified from the survey area, representing a wide range of invertebrate taxonomic groups. Despite the species recorded not being well represented by ground dwelling taxa, or species that are active at night, this does provide a robust platform upon which to make an assessment of the importance of the Survey Area for invertebrate conservation.
- 4.1.2 Two Section 41 species were recorded in the Survey Area; both of these species are moths and are listed as Research Only due to documented decline. However, both of these species should be taken into account.
- 4.1.3 10 Key species were found, comprising 5.91% of the 169 species recorded across the survey dates. The figure of 5.91% is close to the mean of 5.06% for occurrence of Key Species in contemporary studies of invertebrates for conservation evaluation (Telfer 2017).
- 4.1.4 Three Rare Key Species were found, comprising 1.77% of the 169 species identified. This figure is high compared to occurrence of Key Species in contemporary studies of invertebrates for conservation evaluation. This high percentage of Rare Key Species is not consistent with the percentage of Key Species and supports the assessment as a site of high conservation importance at a County level (Site with populations of invertebrates or invertebrate habitats considered scarce or rare or threatened in the administrative District).
- 4.1.5 ISIS and Pantheon offer methods of assessing the importance of a site in the national context. The survey area supported a narrow range of invertebrate assemblages with two ISIS Broad Assemblage Types (BATs) being well represented. These two BATs yielded high Rarity scores indicating that these habitat types are important at the national level/in favourable condition. The high scoring habitats included unshaded early successional mosaic and grassland & scrub matrix, the remaining habitats fell below the below the threshold values for national importance.
- 4.1.6 Pantheon has superseded ISIS; the results generated by this database are more difficult to put into context. Although the Species Quality Index (SQI) values for the Broad Biotope of open habitats (131) is low in comparison to the ISIS Species Rarity scores, it does support ISIS in identifying the open habitats represented by unshaded early successional mosaic and grassland & scrub matrix as important and a County level.
- 4.1.7 Two Section 41 species were recorded in the Survey Area; both of these species are moths and are listed as Research Only due to documented decline. However, both of these species should be taken into account.
- 4.1.8 The Survey Area is a site of high conservation importance for invertebrates at the County level. This is strongly supported by the Key Species analysis and by the numbers of Key Species and Section 41 Research Only species. This assessment is moderately supported by both ISIS and Pantheon analysis.

### Proposed Development Area

- 4.1.9 Due to access restraints surrounding the land within the Proposed Development area boundary, this area was only accessed for invertebrate survey on one occasion during July 2018. Along with records of commonly distributed species within Lincolnshire, the survey produced records of three Key Species, one S41 species, the cinnabar moth, and two species of Dolichopid fly, *Dolichopus agilis* NR, VU and *Dolichopus migrans* NR.

- 4.1.10 The records of these three species within the Proposed Development area result in the assessment that the Proposed Development area is of importance for invertebrate conservation at the Local level i.e. possessing species unique or of some other significance within the local area.
- 4.1.11 The habitat within the Proposed Development area is of lower quality for a diverse range of invertebrate species, as despite sharing several habitat features (bare ground, flower resources and scrub) with the wider survey area, the lack of varied topography and reduced habitat heterogeneity limits the number of ecotones and habitat niches for invertebrates to exploit.

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## Appendix A: British Conservation Status Categories – Definitions

### Status Categories and Criteria Version 1 (Shirt, 1987)

#### **Conservation status categories of invertebrates**

A system of conservation statuses has been in use since the British Red Data Book for insects (Shirt, 1987), amended and supplemented by a series of JNCC Nature Conservation reviews. By this system, the rarest and most threatened species are given one of the Red Data Book (RDB) statuses. Species which do not qualify as RDB but are nonetheless uncommon are given one of the Nationally Scarce statuses. The status categories and criteria of this first version are defined here in Appendix A.

For butterflies, dragonflies, water beetles and some other groups, the most up-to-date conservation statuses are based on the International Union for Conservation of Nature (IUCN) Red List categories and criteria (IUCN, 2001). This system places less emphasis on rarity and more on factors which suggest a risk of extinction (such as severe declines in range or population)..

The species of conservation significance for a site assessment such as this (the “Key Species”) are the RDB and Nationally Scarce species under the earlier criteria and the Threatened and Near Threatened species under the later criteria.

These status categories and criteria were introduced for British insects by Shirt (1987) and received some modifications by later authors (e.g. Hyman and Parsons (1992)).

#### **Red Data Book Category EXTINCT**

Species which were formerly native to Britain but have not been recorded since 1900.

#### **Red Data Book Category 1, Endangered**

Species in danger of extinction and whose survival is unlikely if causal factors continue to operate. Endangered species either (a) occur as only a single population within one 10-km square, or (b) only occur in especially vulnerable habitats, or (c) have been declining rapidly or continuously for twenty years or more to the point where they occur in five or fewer 10-km squares, or (d) may already have become extinct.

#### **Red Data Book Category 2, Vulnerable**

Species which are likely to move into the Endangered category in the near future if causal factors continue to operate. Vulnerable species are declining throughout their range or occupy vulnerable habitats.

#### **Red Data Book Category 3, Rare**

Species which occur in small populations and although not currently either Endangered or Vulnerable are at risk. Rare species exist in 15 or fewer 10-km squares, or are more widespread than this but dependent on small areas of especially vulnerable habitat.

#### **Red Data Book Category I, Indeterminate**

Species considered to be either Endangered, Vulnerable or Rare but with insufficient information to say which. NB. Best written as ‘RDBi’ rather than ‘RDBI’ as the latter is easily confused with ‘RDB1’ (Endangered).

#### **Red Data Book Category K, Insufficiently Known**

Species suspected to merit either Endangered, Vulnerable, Rare or Indeterminate status but lacking sufficient information. Species included in this category may have only recently been discovered in Britain, or may be very poorly recorded for a variety of reasons.

#### **Nationally Scarce Category A, Na.**

Species which do not fall within Red Data Book categories but which are nonetheless uncommon in Great Britain and thought to occur in 30 or fewer (typically between 16 and 30) 10-km squares of the National Grid, or for less well-recorded groups, in seven or fewer vice-counties.

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### **Nationally Scarce Category B, Nb.**

Species which do not fall within Red Data Book categories but which are nonetheless uncommon in Great Britain and thought to occur in between 31 and 100 10-km squares of the National Grid, or for less well-recorded groups, between eight and twenty vice-counties.

### **Nationally Scarce, N.**

Species which do not fall within Red Data Book categories but which are nonetheless uncommon in Great Britain. This status category has been used where information has not been sufficient to allocate a species to either Na or Nb. These species are thought to occur in between 16 and 100 10-km squares of the National Grid.

## **Status Categories and Criteria Version 2 (IUCN, 2001)**

These later status categories and criteria are based on IUCN Red List Categories and Criteria version 3.1 (IUCN, 2001) and have been applied to British butterflies, dragonflies and a few other invertebrate groups.

### **Critically Endangered (CR)**

A taxon is Critically Endangered when the best available evidence indicates that it is facing an extremely high risk of extinction in the wild.

### **Endangered (EN)**

A taxon is Endangered when the best available evidence indicates that it is facing a very high risk of extinction in the wild.

### **Vulnerable (VU)**

A taxon is Vulnerable when the best available evidence indicates that it is facing a high risk of extinction in the wild.

N.B.: Species belonging to the above three categories may be collectively referred to as Threatened.

### **Data Deficient (DD)**

A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate.

The DD category effectively replaces the Indeterminate (RDBi) and Insufficiently Known (RDBK) categories of the earlier version.

### **Near Threatened (NT)**

A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.

### **Least Concern (LC)**

A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.

## Appendix B: Species List

The species of conservation significance for a site assessment such as this (the “Key Species”) are highlighted in red text in the list below

Order	Family	Species (Scientific Name)	Species (Common Name)	Status
Arachnidae	Lycosidae	<i>Alopecosa pulverulenta</i>	a wolf spider	None
Arachnidae	Lycosidae	<i>Pardosa hortensis</i>	a wolf spider	None
Arachnidae	Lycosidae	<i>Pardosa nigriceps</i>	a wolf spider	None
Arachnidae	Philodromidae	<i>Tibellus maritimus</i>	A running crab spider	None
Arachnidae	Thomisidae	<i>Xysticus erraticus</i>	A crab spider	None
Arachnidae	Thomisidae	<i>Xysticus sabulosus</i>	A crab spider	NS
Coleoptera	Alticini	<i>Altica lythri</i>	A flea beetle	None
Coleoptera	Cantharidae	<i>Rhagonycha fulva</i>	Hogweed bonking beetle	LC
Coleoptera	Carabidae	<i>Notiophilus biguttatus</i>	A ground beetle	None
Coleoptera	Carabidae (Brachninae)	<i>Brachinus crepitans</i>	A bombardier beetle	NS
Coleoptera	Carabidae (Pterostichini)	<i>Abax parallelepipedus</i>	A ground beetle	None
Coleoptera	Chrysomelidae	<i>Cassida viridis</i>	Green tortoise beetle	None
Coleoptera	Coccinellidae	<i>Coccinella septempunctata</i>	7 spot ladybird	None
Coleoptera	Coccinellidae	<i>Subcoccinella vigintiquatuor punctata</i>	24 spot ladybird	None
Coleoptera	Curculionidae	<i>Archarius salivarius</i>	Willow gall weevil	None
Coleoptera	Curculionidae	<i>Hypera rumicis</i>	A weevil	None
Coleoptera	Curculionidae	<i>Sitona lineatus</i>	Pea leaf weevil	None
Coleoptera	Elatidae	<i>Athous haemorrhoidalis</i>	Click beetle	None
Coleoptera	Malachiidae	<i>Malachius bipustulatus</i>	The malachite beetle	LC
Coleoptera	Nitidulidae	<i>Meligethes aeneus</i>	Brassica pollen beetle	None
Coleoptera	Oedermeridae	<i>Oedemera lurida</i>	False blister beetle	LC
Coleoptera	Oedermeridae	<i>Oedemera nobilis</i>	thick-legged flower beetle	LC
Coleoptera	Oedermeridae	<i>Oedemera virescens</i>	A flower beetle	NR, LC
Coleoptera	Scraptidae	<i>Anaspis pulicaria</i>	Tumbling flower beetle	LC
Coleoptera	Tenebrionidae	<i>Lagria hirta</i>	a beetle	LC
Crustacea	Isopoda	<i>Oniscus asellus</i>	Common woodlouse	None
Dermoptera	Forficulidae	<i>Forficula auricularia</i>	Earwig	None
Diptera	Asilidae	<i>Leptogaster cylindrica</i>	Striped slender robberfly	None
Diptera	Asilidae	<i>Leptogaster murina</i>	A robberfly	None
Diptera	Calliphoridae	<i>Calliphora vicina</i>	Common bluebottle	None
Diptera	Calliphoridae	<i>Calliphora vomitoria</i>	Orange-bearded bluebottle	None
Diptera	Calliphoridae	<i>Cynomya mortuorum</i>	Yellow-faced blowfly	None
Diptera	Calliphoridae	<i>Lucilla caesar</i>	Common Greenbottle	None
Diptera	Calliphoridae	<i>Pollenia angustigena</i>	Narrow-cheeked Clusterfly	None
Diptera	Calliphoridae	<i>Protocalliphora azurea</i>	Bird Blowfly	None

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Order	Family	Species (Scientific Name)	Species (Common Name)	Status
Diptera	Calliphoridae	<i>Protophormia terraenovae</i>	Blackbottle	None
Diptera	Culexidae	<i>Culex pipiens</i>	Common house mosquito	None
Diptera	Dolichopodidae	<i>Campsicnemus curvipes</i>	A dolichopid fly	None
Diptera	Dolichopodidae	<i>Campsicnemus loripes</i>	A dolichopid fly	None
Diptera	Dolichopodidae	<i>Chrysotus cilipes</i>	A dolichopid fly	None
Diptera	Dolichopodidae	<i>Dolichopus agilis</i>	A dolichopid fly	NR, VU
Diptera	Dolichopodidae	<i>Dolichopus migrans</i>	A dolichopid fly	NR, VU
Diptera	Dolichopodidae	<i>Dolichopus plumipes</i>	A dolichopid fly	None
Diptera	Dolichopodidae	<i>Dolichopus trivialis</i>	A dolichopid fly	None
Diptera	Dolichopodidae	<i>Dolichopus unguulatus</i>	A dolichopid fly	None
Diptera	Dolichopodidae	<i>Hercostomus germanus</i>	A dolichopid fly	None
Diptera	Dolichopodidae	<i>Scellus notatus</i>	A dolichopid fly	None
Diptera	Empididae	<i>Empis livida</i>	A dance fly	None
Diptera	Empididae	<i>Empis stercorea</i>	A dance fly	None
Diptera	Empididae	<i>Empis tessellata</i>	a dance fly	None
Diptera	Limoniidae	<i>Chioneinae</i>	No further key available	None
Diptera	Limoniidae	<i>Hexatoma</i>	No further key available	None
Diptera	Mecoptera	<i>Panorpis communis</i>	Common Scorpionfly	None
Diptera	Muscidae	<i>Helina evecata</i>	A muscid fly	None
Diptera	Muscidae	<i>Hydrotaea ignava</i>	A muscid fly	None
Diptera	Muscidae	<i>Morelia aenescens</i>	A muscid fly	None
Diptera	Muscidae	<i>Musca domestica</i>	common housefly	None
Diptera	Rhagionidae	<i>Chrysopilus asiliformis</i>	Little snipefly	None
Diptera	Rhagionidae	<i>Rhagio tringarius</i>	Marsh snipefly	None
Diptera	Sarcophagidae	<i>Brachicoma devia</i>	A fleshfly	None
Diptera	Scatophagidae	<i>Norellisoma spinimanum</i>	A dung fly	None
Diptera	Stratiomyidae	<i>Chloromyia formosa</i>	The green centurion	None
Diptera	Syrphidae	<i>Chrysotoxum festivum</i>	A hoverfly	None
Diptera	Syrphidae	<i>Criorhina asilica</i>	A hoverfly	Pre 1994 - Vulnerable
Diptera	Syrphidae	<i>Episyrphus balteatus</i>	Marmalade fly	None
Diptera	Syrphidae	<i>Eristalinus aeneus</i>	A hoverfly	None
Diptera	Syrphidae	<i>Eristalinus sepulchralis</i>	A hoverfly	None
Diptera	Syrphidae	<i>Eristalis arbustorum</i>	A hoverfly	None
Diptera	Syrphidae	<i>Eristalis intricarius</i>	A hoverfly	None
Diptera	Syrphidae	<i>Eristalis nemorum</i>	A hoverfly	None
Diptera	Syrphidae	<i>Eristalis pertinax</i>	A hoverfly	None
Diptera	Syrphidae	<i>Eristalis tenax</i>	A hoverfly	None
Diptera	Syrphidae	<i>Eupeodes latifasciatus</i>	A hoverfly	None
Diptera	Syrphidae	<i>Sphaerophoria rueppellii</i>	A hoverfly	None
Diptera	Syrphidae	<i>Syrphus vitripennis</i>	A hoverfly	None
Diptera	Tachinidae	<i>Dufouria chalybeata</i>	A tachinid fly	None
Diptera	Tachinidae	<i>Exorista glossatorum</i>	A tachinid fly	None
Diptera	Tachinidae	<i>Exorista rustica</i>	A tachinid fly	None

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Order	Family	Species (Scientific Name)	Species (Common Name)	Status
Diptera	Tachinidae	<i>Gymnochaeta viridis</i>	A tachinid fly	None
Diptera	Therevidae	<i>Acrosathe annulata</i>	A stiletto fly	LC
Diptera	Therevidae	<i>Thereva nobilitata</i>	Common stiletto fly	None
Diptera	Tipulidae	<i>Tipula fascipennis</i>	A crane fly	None
Diptera	Ulidiidae	<i>Herina lugubris</i>	A picture wing fly	None
Diptera	Ulidiidae	<i>Melieria crassipennis</i>	A picture wing fly	None
Hemiptera	Cercopidae	<i>Philaenus spumarius</i>	Froghopper	None
Hemiptera	Coreidae	<i>Bathysolen nubilis</i>	A squash bug	None
Hemiptera	Miridae	<i>Apolygus spinolae</i>	A mirid bug	None
Heteroptera	Miridae	<i>Closterotomus norwegicus</i>	A mirid bug	None
Heteroptera	Miridae	<i>Leptopterna dolabrata</i>	Meadow plant bug	None
Hymenoptera	Andrenidae	<i>Andrena clarkella</i>	Clarke's mining bee	None
Hymenoptera	Andrenidae	<i>Andrena bicolor</i>	Gwynne's Mining Bee	None
Hymenoptera	Andrenidae	<i>Andrena chrysoceles</i>	Hawthorn mining bee	None
Hymenoptera	Andrenidae	<i>Andrena fulva</i>	Tawny Mining bee	None
Hymenoptera	Andrenidae	<i>Andrena haemorrhoa</i>	Early mining bee	None
Hymenoptera	Andrenidae	<i>Andrena minutula</i>	Common mini-mining bee	None
Hymenoptera	Andrenidae	<i>Andrena subopaca</i>	Impunctate Mini-mining bee	None
Hymenoptera	Apidae	<i>Apis mellifera</i>	Honeybee	None
Hymenoptera	Apidae	<i>Bombus lucorum</i>	White-tailed bumblebee	None
Hymenoptera	Apidae	<i>Bombus lapidarius</i>	Red-tailed bumblebee	None
Hymenoptera	Apidae	<i>Bombus pascuorum</i>	Common carder bee	None
Hymenoptera	Apidae	<i>Bombus terrestris</i>	Buff tailed bumblebee	None
Hymenoptera	Apidae	<i>Nomada fabriciana</i>	Fabricius' Nomad Bee	None
Hymenoptera	Apidae	<i>Nomada flava</i>	Flavus Nomad bee	None
Hymenoptera	Apidae	<i>Nomada flavoguttata</i>	Little Nomad Bee	None
Hymenoptera	Apidae	<i>Nomada goodiana</i>	Gooden's Nomad bee	None
Hymenoptera	Apidae	<i>Nomada fulvicornis</i>	Fork-Jawed Nomad Bee	RDB3
Hymenoptera	Apidae	<i>Bombus hortorum</i>	Garden bumblebee	None
Hymenoptera	Coelioxys	<i>Coelioxys elongata</i>	Dull-vented Sharp-tail bee	None
Hymenoptera	Crabronidae	<i>Crossocerus quadrimaculatus</i>	A square headed wasp	None
Hymenoptera	Crabronidae	<i>Crossocerus tarsatus</i>	A square headed wasp	None
Hymenoptera	Crabronidae	<i>Crossocerus wesmaeli</i>	A square headed wasp	None
Hymenoptera	Formcidae	<i>Mimumesa dahlbomi</i>	A spider hunting wasp	None
Hymenoptera	Formcidae	<i>Lasius flavus</i>	Yellow meadow ant	None
Hymenoptera	Formcidae	<i>Lasius niger</i>	black garden ant	None
Hymenoptera	Halictidae	<i>Myrmica scabrinodis</i>	Bronze Furrow bee	None
Hymenoptera	Halictidae	<i>Halictus tumulorum</i>	Orange-legged Furrow bee	None
Hymenoptera	Halictidae	<i>Halictus rubicundus</i>	Common furrow bee	None
Hymenoptera	Halictidae	<i>Lasiglossum calceatum</i>	Geoffroy's Blood Bee	None
Hymenoptera	Ichneumonidae	<i>Sphecodes geoffrellus</i>	A ichneumonid wasp	None
Hymenoptera	Ichneumonidae	<i>Alomya debellator</i>	A ichneumonid wasp	None
Hymenoptera	Ichneumonidae	<i>Amblyteles armatorius</i>	A ichneumonid wasp	None

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Order	Family	Species (Scientific Name)	Species (Common Name)	Status
Hymenoptera	Ichneumonidae	<i>Apechthis compunctor</i>	An ichneuemonid wasp	None
Hymenoptera	Megachilidae	<i>Orthopelma mediator</i>	Patchwork leafcutter bee	None
Hymenoptera	Megachilidae	<i>Megachile centuncularis</i>	Leaf cutter bee	None
Hymenoptera	Pompliidae	<i>Megachile circumcincta</i>	A spider hunting wasp	None
Hymenoptera	Pompliidae	<i>Anoplius nigerrimus</i>	Leaden spider wasp	None
Hymenoptera	Pompliidae	<i>Pompilus cinereus</i>	A spider hunting wasp	None
Hymenoptera	Tenthredinidae	<i>Priocnemis schioedtei</i>	A spider hunting wasp	Nb
Hymenoptera	Tenthredopsis	<i>Ametastegia glabrata</i>	Dock sawfly	None
Hymenoptera	Vespidae	<i>Tenthredo atra</i>	A sawfly	None
Hymenoptera	Vespidae	<i>Dolichovespula sylvestris</i>	The tree wasp	None
Hymenoptera	Vespidae	<i>Vespula germanica</i>	German wasp	None
Hymenoptera	Vespidae	<i>Vespula vulgaris</i>	Common wasp	None
Lepidoptera	Choreutidae	<i>Arge pagana</i>	Large rose sawfly	None
Lepidoptera	Crambidae	<i>Anthophila fabriciana</i>	Nettle-tap	None
Lepidoptera	Crambidae	<i>Crambus lathionellus</i>	Hook-face grass-veneer	None
Lepidoptera	Erebiade	<i>Crambus perlella</i>	Satin grass-veneer	None
Lepidoptera	Erebidae	<i>Euproctis chrysorrhoea</i>	Brown-tailed moth (larvae)	None
Lepidoptera	Geometridae	<i>Tyria jacobaeae</i>	Cinnabar	S41 – LBAP
Lepidoptera	Hesperiidae	<i>Petrophora chlorosata</i>	Brown silver-line	LC
Lepidoptera	Hesperiidae	<i>Ochlodes sylvanus</i>	Large skipper	LC
Lepidoptera	Lasiocampidae	<i>Thymelicus sylvestris</i>	Small skipper	None
Lepidoptera	Lasiocampidae	<i>Euthrix potatoria</i>	Drinker (Larvae)	None
Lepidoptera	Lycaenidae	<i>Malacosoma neustria</i>	The Lackey (larvae)	S41 - LBAP
Lepidoptera	Lycaenidae	<i>Lycaena phlaeas</i>	Small copper	LC
Lepidoptera	Noctuidae	<i>Polyommatus icarus</i>	Common blue	None
Lepidoptera	Nymphalidae	<i>Autographa gamma</i>	The silver-y	LC
Lepidoptera	Nymphalidae	<i>Aphantopus hyperantus</i>	Ringlet	None
Lepidoptera	Nymphalidae	<i>Maniola jurtina</i>	Meadow brown	LC
Lepidoptera	Pieridae	<i>Pyronia tithonus</i>	Gatekeeper	LC
Lepidoptera	Pieridae	<i>Pieris brassicae</i>	Green veined white	LC
Lepidoptera	Pieridae	<i>Pieris napi</i>	Small white	LC
Lepidoptera	Pterophoridae	<i>Pieris rapae</i>	Large white	None
Lepidoptera	Tortricidae	<i>Pterophorus pentadactyla</i>	White Plume	None
Mollusca	Helicidae	<i>Tortrix viridana</i>	Green oak tortrix	None
Mollusca	Helicidae	<i>Candidula intersecta</i>	Wrinkled snail	None
Mollusca	Helicidae	<i>Cepaea nemoralis</i>	Brown-lipped snail	None
Mollusca	Helicidae	<i>Cernuella virgata</i>	Vineyard snail	DD
Mollusca	Helicidae	<i>Helix aspersa</i>	Garden snail	None
Odonata	Damsel	<i>Trichia striolata</i>	Strawberry snail	LC
Odonata	Damsel	<i>Enallagma cyathigerum</i>	Common blue damselfly	LC
Orthoptera	Acrididae	<i>Ischnura elegans</i>	Blue tailed damsel fly	None
Orthoptera	Acrididae	<i>Merioptera roeselii</i>	Roesel's bush-cricket	None
Orthoptera	Phaneropteridae	<i>Omocestus viridulus</i>	Common green grasshopper	None

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Order	Family	Species (Scientific Name)	Species (Common Name)	Status
Orthoptera	Tetrigidae	<i>Leptophyes punctatissima</i>	Speckled bush cricket	None
Trichoptera	Caddis fly	<i>Tetrix undulata</i>	Common ground-hopper	LC



## Figure 10G.1 Terrestrial Invertebrate Survey Location