ENVIRONMENTAL STATEMENT – VOLUME 3 – APPENDIX 8.4

Terrestrial Invertebrate Survey Report

Drax Bioenergy with Carbon Capture and Storage

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations, 2009 – Regulation (5(2)(a))

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AUTHOR: C. Horley

APPROVER: P. Peterson

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TABLE OF CONTENTS

FIGURES

TABLES

EXECUTIVE SUMMARY

WSP was appointed by Drax Power Limited to undertake a terrestrial invertebrate survey of land included in the Order Limits for the Drax Bioenergy with Carbon Capture Use and Storage (BECCS) Project, near Drax, Selby.

A habitat potential assessment and subsequent targeted survey of terrestrial invertebrates was completed in August 2021; this included a range of survey techniques (pan traps, sweep netting, beating, grubbing and moth trapping) to gather samples in the field. Samples were subsequently sorted and identified to enable a preliminary evaluation of the importance of the Site for invertebrates.

The results of the targeted survey provide an indication of the relative species diversity within the targeted groups of invertebrates. Approximately 190 specimens were collected or incidentally recorded during the survey and 78 invertebrate taxa identified to species level. Of the target groups, Lepidoptera was the dominant order recorded. The majority of the species recorded are without a recognised status, being widely distributed and common, and exhibiting little habitat fidelity. Only one species was recorded with a recognised conservation status. A further five species (all moths) were recorded that were listed as Section 41 Priority Species vis the provisions of the Natural Environment and Rural Communities (NERC) Act (2006).

1. INTRODUCTION

1.1. PROJECT BACKGROUND

1.1.1. WSP UK Ltd. (hereafter referred to as 'WSP') was commissioned by Drax Power Limited to undertake a Terrestrial Invertebrate Survey (TIS) of an area in the north of the Drax Power Station Site, located near Drax, Selby (centred on National Grid Reference SE 66162 28068.

1.1.2. The Proposed Scheme would involve the installation of post-combustion carbon capture technology to capture carbon dioxide from up to two existing 660 megawatt electrical ('MWe') biomass power generating units at the Drax Power Station (Unit 1 and Unit 2). The installation of this technology constitutes an extension to the biomass Units 1 and 2, and is referred to as post-combustion carbon capture as the carbon dioxide is captured from the flue gas produced during the combustion of biomass in Units 1 and 2. The Proposed Scheme is designed to remove approximately 95% of the carbon dioxide from the flue gas from these two Units.

1.1.3. A full description of the Proposed Scheme is set out in **Section 2.2** of **Chapter 2** (Site and Project Description) of the ES (document reference 6.1.2). The Proposed Scheme is shown on **Figure 1**.

1.2. ECOLOGICAL BACKGROUND

1.2.1. A Preliminary Ecological Appraisal (PEA) of the Site was undertaken in April 2021 (document reference 6.3.8.1). Records of notable invertebrate species were identified within 2 km of the Site during the desk study. An extended Phase 1 habitat survey of the Site was also undertaken as part of the PEA. This identified habitats with suitability for these invertebrate species and others. One location in particular was identified as containing a diverse mosaic of brownfield and successional habitats, namely the area known as 'the old wood yard'. The approximate extents of this area are shown on **Figure 2**. The old wood yard was considered to provide optimal habitat for a range of terrestrial invertebrates.

1.3. AIMS AND OBJECTIVES

1.3.1. This habitat assessment is designed to gain an understanding of the invertebrate assemblage the Site supports, including the presence of any species of conservation concern.

1.3.2. The main aims of this assessment are listed below.

a. Evaluate habitats present on Site for their potential to support important assemblages of invertebrates.

b. Undertake a survey for invertebrates using a variety of survey techniques during a single survey event.

c. List the invertebrate species collected / observed during the course of the survey, including an appraisal of any species of nature conservation value (Species of

Principal Importance, nationally scarce or rare species (following International Union for Conservation of Nature - IUCN and Red Data Book - RDB criteria)).

d. Outline the legislative and / or policy protection afforded to any species of nature conservation value potentially associated with the Site.

e. Assess the invertebrate assemblage(s) of the Site using the Pantheon tool.

1.3.3. The methods and results of this survey are included within this report.

2. METHODS

2.1. STUDY AREA

2.1.1. The desk study and field survey were undertaken within the following study areas:

a. Desk Study Area – a zone extending to 2 km from the Site boundary.

b. Field Survey Area – this comprised primarily the old wood yard, with some consideration given to immediately adjoining areas.

2.2. DESK STUDY

2.2.1. A desk-based review of existing biological information pertaining to the invertebrate interest of the Site was undertaken across the Desk Study Area. This included a review of historic invertebrate records within 2 km, supplied by the North and East Yorkshire Ecological Data Centre (NEYEDC).

2.3. FIELD SURVEY

INVERTEBRATE HABITAT POTENTIAL ASSESSMENT

2.3.1. The Field Survey Area was assessed for its potential to support important invertebrate assemblages on the 11 and 12 August 2021. To enable a baseline characterisation of the Site for invertebrates, an Invertebrate Habitat Potential (IHP) assessment was undertaken. This included observations of features that might limit invertebrate interest, as well as those which might be of particular value for invertebrates.

2.3.2. In particular, emphasis was placed on the following features (where present):

a. Woodland edge and scrub, especially where this had a diverse vegetation structure and species composition;

b. Species-rich grassland, especially that in association with scrub, with a high proportion of plants providing nectar and pollen, and with a varied vegetation structure;

c. Early successional habitat (e.g., cliff faces, quarried areas, eroded banks, periodically disturbed bare or sparsely vegetated ground), especially free-draining ground where there is a high proportion of exposed bare earth; and

d. Marshy areas and marginal vegetation (e.g., around the edges of standing water, ponds and ditches).

2.3.3. **Tables 2.1 and 2.2** below show details of the IHP assessment protocol. In short, there are eleven habitat elements that a survey should score to. "*These comprise the main habitats / meso-habitats, and resources and influencing factors that contribute to providing potential value for invertebrate assemblages. Therefore, sites or parcels (within sites) with a greater variety of Habitat Elements have the capacity to support a more diverse invertebrate fauna. It is, however, not appropriate to add value to a site or parcel that has multiple Habitat Elements where they are of poor quality. A grading*

system is therefore applied (Table 2.2) to enable an assessment of the quality of the Habitat Element, from Negligible (Grade E) to Major (Grade B) and in a few cases, Exceptional (Grade A). Habitat Elements with better grades are considered likely to be able to support more specialised, unique, and often rare invertebrate assemblages. For example, a veteran tree in an intensively managed field parcel which qualifies as Grade A (decaying wood), may have a higher potential than an adjoining parcel, where all 11 Habitat Elements are present but are Graded C or D." (Dobson & Fairclough, 2021).

Table 2.1 – Summary of Eleven Habitat Elements assessed by IHP Survey

Habitat Element	No.	Comments
Decaying Wood	HE1	In all its forms; from decaying wood on/in large trees to woodland floor debris
Rotational Management	HE2	Planned or serendipitous; and whether for nature conservation of other purposes
Nectar Resources	HE3	As a proxy for nectar- and pollen resources, as assessment of pollen resources is impracticable on a walk-through survey
Wet Substrates	HE4	Including marginal, marshy, muddy and seasonally inundated habitats, as well as flushes
Open Water Habitats	HE5	The Open Water element of rivers, lakes, ponds, streams, ditches etc.
Structural Patchwork	HE6	Habitat Mosaics, including, but by no means restricted to open mosaic habitats on previously developed land.
Still Air (S)	HE7	Suntraps and still-air microclimates in open situations. The term 'still air' is used in preference to 'wind breaks' as many rigid wind breaks are likely to produce turbulent air in their lee
Still Air (H)	HE8	Humid still-air microclimates in sheltered and shaded situations
Connectivity	HE9	Landscape-scale connectivity between the site and external habitats
Ecoclines	HE10	A graded transition between two or more broad habitats

Habitat Element	No.	Comments
Bare Earth	HE11	Un-shaded bare or sparsely-vegetated well-drained substrate, regardless of soil type

Table 2.2 – Grading System applied to Habitat Elements

Grade	Description
Negligible / Absent (E)	Habitat element is absent or of insignificant (barely perceptible) quantity.
Minor (D)	Habitat element is present but is of insufficient quality to qualify as Moderate or above. For example, it may be of extremely limited extent, or very sparsely dispersed. Likely to support common and widespread, generalist species.
Moderate (C)	A clear example of the habitat element is present, but which does not qualify as Major. Likely to be of sufficient quality to support a characteristic invertebrate fauna.
Major (B)	Good quality examples of each habitat element which do not meet the criteria for Exceptional. Likely to be a predominant factor in supporting characteristic and specialised invertebrate assemblages. Considerations might include the extent, maturity and historic- and current connectivity of the element.
Exceptional (A)	Very high-quality examples of the habitat element, including but not restricted to those of potential regional significance. This may be for reasons of intrinsic quality, rarity, vulnerability, or the perceived importance of its position in the wider landscape.

TARGETED SURVEY FOR TERRESTRIAL INVERTEBRATES

2.3.5. Terrestrial habitats with potential to support important invertebrate assemblages (identified during the IHP assessment) were subject to more detailed survey. The main habitats targeted included: areas of disturbed ground, ruderal herbs, scattered and dense scrub, bare ground, lower-lying seasonally wet depressions with wetland vegetation and pockets of drier grassland.

2.3.6. The survey was designed therefore to target the collection of key indicator groups associated with such habitat. This approach relates to the guidance set out in Drake et al. (2007); which lists many of the target taxa of field layer and arboreal assemblages and their value in assessment. Coleoptera (beetles) and Hemiptera

(true bugs) are two orders that are strongly represented in such assemblages; therefore, these were targeted by the surveys. Certain families (and suborders) of the order Diptera - flies (e.g., Syrphidae - hoverflies) and other Brachycera (a diverse suborder of flies which includes, amongst others: robberflies, bee-flies and snipeflies) were also targeted. In suitable habitats such as scrub edge and field layer assemblages, sampling methods also enabled the collection of aculeate Hymenoptera (bees, ants and wasps) and Orthoptera (grasshoppers and crickets). Incidental observations of other invertebrate taxa, including butterflies and moths (Lepidoptera) were also recorded.

2.3.7. A range of different sampling methods were employed, including pan traps, sweep-netting, beating, grubbing, moth trapping and spot sweeping. These methods are described in detail in **Table 2.3** below.

Table 2.3 – Entomological Methods used During the Survey

Method	Description
Pan Traps	A cluster of 6 x pan traps were set out in flower-rich patches of the Field Survey Area during sunny conditions over the dates of 11th and 12th August 2021. The pan traps comprised yellow plastic trays into which a small amount of water was poured (along with a few drops of detergent to break the surface tension). These traps mimic large yellow flowers and attract flying insects of many groups, which then become trapped in the fluid, for later collection (to allow for species identification). The traps were operational for the duration of the two-day survey visit and were collected in at the end of day two (12th August).
Sweep Netting	Sweep netting was conducted during the survey visit across the Field Survey Area. This method involves walking at a steady pace through the vegetation and passing an entomologist's sweep net back and forth through vegetation in a figure of eight motion. Sweep netting was accompanied by 'spot-sweeping' where individual invertebrates were targeted (if spotted, i.e. those that could be detached from vegetation and collected via a single sweep).
Beating	Beating was conducted during the survey visit across the Field Survey Area, targeting scrub/scrub edge habitat within the survey area, where accessible. Beating is a useful technique for extracting beetles and bugs from overhanging branches of trees and shrubs. This method involves placing a beating tray beneath a branch before delivering several sharp blows to the branch, sending any dislodged invertebrates into the beating tray for inspection.

Method	Description
Grubbing	Grubbing is the name generally applied to the extraction of invertebrates by hand from a variety of media such as dead wood or fungi and under bark; from moist cracked ground in seasonally inundated habitats; from tipped debris; or from dense aggregations of leaf matter and detritus (e.g., base of grass tussocks and leafy / woody deposits). If appropriate, to assist in the detection of small beetles, material was sieved or placed in a bucket of water to capture invertebrates struggling to the surface.
Moth Trapping	Two actinic portable heath moth traps were run overnight on the 11th August and were inspected the following day. This method uses an artificial light source (in this case an actinic blub) to attract moths during the night. The moths then fall into the box-shaped trap unharmed, and then settle within the cardboard egg-boxes provided inside. This method is predominantly used for trapping moths but will also often catch beetles and other insects attracted to light sources.
Incidental observations	Throughout the survey incidental observations of invertebrates on the wing were made, specifically for butterflies and moths (those mainly of the day-flying variety).

SAMPLE SORTING AND IDENTIFICATION

2.3.9. Whilst some species could be identified in the field, the majority of specimens were stored in 70% methanol solution for later identification, using a stereoscopic microscope and with the aid of identification literature.

2.4. DATES OF SURVEY, WEATHER AND PERSONNEL

2.4.1. Field survey work was undertaken by a suitably qualified senior ecologist (BSc, MSc) who is a member of the Royal Entomological Society (Mem.RES) and has experience undertaking invertebrate surveys and assessment across the UK.

2.4.2. The field survey took place on the 11 and 12 August 2021. The weather was dry and predominantly bright with sunny spells, but with periods of moderate cloud cover, and a light breeze. The maximum temperature was 21°C. The survey commenced at approximately 09.30 and ended at 17.30 each day.

2.5. EVALUATION

2.5.1. The following results and discussion sections place a value on the rare and notable invertebrates found within the Field Survey Area. Further information on status

definitions and criteria of invertebrate groups can be found in Section 4.2 of this report.

Pantheon Assemblage Analysis

2.5.2. The list of species derived from the targeted terrestrial invertebrate surveys were analysed using the "Pantheon" database tool developed by Natural England and the Centre for Ecology and Hydrology. For each species recognised by Pantheon, various attributes relating to associated habitats and resources, assemblage types and habitat fidelity scores are placed against them. Reports can then be generated including those that provide:

- **a.** Information on each individual species entered into the database;
- **b.** A list of species belonging to different feeding guilds (e.g., xylophagous, saprophagous, nectivorous);
- **c.** A list of species with different associations (e.g., to certain groups of plant, fungi or animal);
- **d.** A summary of the number of species within the sample that have a particular score or fidelity and, if relevant an overall score that provides insight into the quality of the Field Survey Area that the sample has come from; and,
- **e.** Summary tables that assess where species live and what assemblages they are associated with.

2.5.3. In the context of this assessment, the output that Pantheon provides relating to locations species occupy and what assemblages they are associated with is useful in evaluating the relative importance of the Field Survey Area for its invertebrates. This considers the habitats and resources used by an invertebrate species at various hierarchical levels, from broad biotopes (e.g., tree associated, wetland, coastal) at the highest level, down to specific habitats (e.g., tall sward and scrub, decaying wood, arboreal, marshland) at a mid-level, and resources (e.g. sapwood and bark decay, heart-rot and fungal fruiting bodies all associated with the decaying wood habitat) at the finest level. The assessment also considers the "ISIS" (Invertebrate Species-habitat Information System) assemblage types that had previously been developed by Natural England. The original Specific Assemblage Types (SATs) are therefore carried forward in their original form, although 'Habitats' have replaced the ISIS Broad Assemblage Types (BATs).

2.5.4. SATs include only habitat specific species, which are normally faithful to a single habitat or resource. Such species are often closely associated with locations of higher conservation value. Analysis of SATs is helpful to inform the determination of the nature conservation value of a location for invertebrates. Locations with high-scoring SATs are considered to have good quality invertebrate assemblages.

2.5.5. The original role of ISIS was to guide Natural England on assessing the conservation value of SSSIs for their invertebrate assemblages (especially for the purposes of Common Standards Monitoring). This was done by identifying whether an assemblage associated with a location was in a "favourable condition" (i.e., where it

was considered to be of sufficient condition to meet the threshold criteria for an assemblage of SSSI-level value). However, whilst the condition assessment function is still retained within Pantheon, it is not the sole use. Accordingly, the analysis may be used in other situations (e.g., by nature reserve managers or those assessing the effects of a development) to help understand which assemblages (SATs) at a Site are likely to be important.

2.5.6. A useful measure of the quality of a location for its invertebrate assemblage is to count and assign scores that are more heavily weighted towards the rarer species. The Species Quality Index (SQI) is a numerical scoring system contained within Pantheon that does exactly this. Each species recorded from a sample is given a Species Quality Score (SQS) based on their conservation status. The SQI is the sum of all SQSs divided by the number of species in that sample. This score is multiplied by 100 to give a three-figure value without decimal places (e.g.,100 rather than 1.00). This SQI score is preferred to the SQS since it eliminates to a greater extent the effect of recorder effort. Notwithstanding this, locations where little effort has been made to record the common species could result in overly amplified SQI scores. There is presently no published guidance on what SQI score might be classed as 'good' or 'average', as this might vary between habitats and regions (e.g., Northern vs. Southern England). However, as a general rule of thumb, based on the experience of the author, a habitat with an SQI score exceeding 125 is likely to be of some value and merit further consideration.

2.6. LIMITATIONS AND CONSTRAINTS

2.6.1. Local record centre species data provides positive records of species recorded; however, the species records within a given area are dependent on the recording effort of individuals and are often biased towards certain well-recorded groups e.g. butterflies and moths, dragonflies and damselflies etc. and the paucity of recording of less easily recognised species cannot be proof of a lack or absence of such species.

2.6.2. Every effort was made to record habitat features of potential conservation value for invertebrates at a suitable resolution to inform a robust study. However, the recognition of key habitat features with potential to support important invertebrate species or species assemblages is based on knowledge and experience. It cannot be guaranteed that habitats considered to have high conservation potential would be confirmed as such if surveyed in detail, or conversely, some habitat features supporting uncommon species or species assemblages may have been overlooked during the survey.

2.6.3. A single survey visit was conducted in August that comprised mostly active methods of sampling (e.g., not including longer-term passive sampling methods such as use of pitfall traps). Whilst survey at this time is within the optimal season for invertebrates, additional survey would sometimes be appropriate, to include surveys that capture invertebrates active in spring/early summer or early autumn. Notwithstanding this, the information derived from a single visit, undertaken within the optimal season is considered likely to be reasonably informative in terms of making a judgement as to

whether the Site is likely to be important for invertebrates. For example, if few invertebrates are recorded and these are common and widespread species, then it can be inferred that additional survey would only reveal a similar picture, whereas the converse would likely be true if a reasonable number of species with a conservation status were identified. In general, it is considered that the greater the survey effort, the more likely it will be for notable or rare invertebrates to be found, as many species tend to be cryptic or are only infrequently active, and within short periods of time throughout the year.

2.6.4. The survey approach has been designed with reference to guidance set out in Drake et al. (2007). It should be noted that the confidence in the ISIS / Pantheon analysis of SATs is reduced where survey work does not follow the precise ISIS sampling protocols. Since the objectives of the present survey were to identify a broad range of invertebrates across target groups in predicted key areas of habitat, the methods employed do vary slightly from the ISIS protocol. In such instances Webb et al. (2018) advises that caution is applied when using the SAT assessments, and that confidence in a favourable condition should be considered as 'Medium' for semi-ISIS compliant samples. In the present context, the analysis is considered to be broadly indicative; and may therefore give further steer to help understand which assemblages within the Field Survey Area are likely to be important.

3. RESULTS

3.1. DESK STUDY

3.1.1. The desk study resulted in six records of confirmed protected and notable terrestrial invertebrates provided by NEYEDC for the Desk Study Area. These are summarised in **Table 3.1**.

3.1.2. The table details species with a recognised conservation status (including Species of Principal Importance (SPI); Endangered (RDB1), Vulnerable (RDB2), Rare (RDB3), Near Threatened, or Nationally Scarce species.

Table 3.1 – Desk Study Results

Taxon (group)	No. of species records	No. of SPI species[1]	Species with a recognised conservation status	Year of record
Coleoptera (Beetles)	4	4	Oxystoma cerdo [Nb] Microplontus campestris [Nb] Horsetail weevil *Grypus equiseti* [Nb] Curculio rubidus [Nb]	2011 2011 2011 2011
Lepidoptera (Butterflies)	1	1	Small heath Coenonympha pamphilus [NT; SPI]	2015
Trichoptera (Caddis Flies)	1	1	Ceraclea senilis [N]	2014

3.2. INVERTEBRATE HABITAT POTENTIAL ASSESSMENT

3.2.1. The Field Survey Area comprised the old wood yard, which was historically primarily used for storing biomass fuel to be used at the Drax Power Station. Some stored materials remained at the time of survey. Materials stored here included old bales of straw and hay, wood chippings and the dispersed remains of pulverised flue ash (PFA) from coal combustion processes in the power station's past. The habitats in the wider area include arable and woodland parcels to the north and west, to the

[1] These records relate to species with a recognised conservation status (including Species of Principal Importance; Endangered, Rare, Vulnerable or Nationally Scarce species.

south exists the rest of the existing Drax Power Station, with farmland to the north and east.

3.2.2. The survey area is relatively flat, with the only sloping ground provided by the mounds of biomass materials present. Vegetation does exist across the survey area, much of which is that associated with disturbed ground habitats, but there are also areas of scrub (sparse and dense), and areas of lower growing plants and pockets of bare ground. The survey area is seasonally wet, and has scrape-like depressions that would hold water during parts of the year, forming temporary shallow pools. Some water was evident during the survey visit in August 2021 (although most of the area was dry).

3.2.3. The drier areas of short perennial vegetation included low lying plants such as black medic *Medicago lupulina*, selfheal *Prunella vulgaris*, and spurge *Euphorbia* sp., and tall ruderal vegetation with species such as ragwort *Jacobaea vulgaris*, bristly oxtongue *Helminthotheca echioides*, sow-thistle *Sonchus* sp., sorrel *Rumex acetosa* and teasel *Dipsacus fullonum*. Other areas of the waste ground were developing a grassland flora with species such as false-oat grass *Arrhenatherum elatius*, red clover *Trifolium pratense* and thistles *Cirsium* sp. The mounds of old biomass materials and piles of woody debris look to have been there for some time, on the basis of the vegetation growing from them. Species here included swathes of common nettle *Urtica dioica*, thistles and the invasive plant Himalayan balsam *Impatiens glandulifera*.

3.2.4. The Field Survey Area is bound by a bank with the outer perimeter marked by a security fence. There were trees and shrubs following this perimeter, with species present including beech *Fagus sylvatica*, ash *Fraxinus excelsior*, willow *Salix* sp. and non-native buddleia *Buddleja davidii*. There was some level of scrub regeneration taking place across the Field Survey Area, with many scattered immature trees present. Species noted included alder *Alnus glutinosa*, birch *Betula* sp., and beech. The alder leaf beetle *Agelastica alni* was numerous and observed in both adult and larval stages on many of the immature alder trees across the Field Survey Area.

3.2.5. The ephemeral wetter areas also had vegetation present with various species of rush *Juncus* sp., reedmace *Typha* sp., and reed *Phragmites* sp. present. It is likely that the survey area becomes rather waterlogged during the winter months of the year, based on the topography and discussions with Drax personnel who were present to escort WSP ecological surveyors.

3.2.6. Table 3.2 shows the results of the IHP assessment at Drax. The results show gradings of three D's, four C's and four B's. This represents a fairly good quality site in terms of its potential to support a diverse invertebrate assemblage, based on the professional judgement of the WSP invertebrate ecologist.

Table 3.2 – Drax Invertebrate Habitat Potential Assessment Results

Habitat Element	HE1	HE2	HE3	HE4	HE5	HE6	HE7	HE8	HE9	HE10	HE11
IHP Grading	D	D	B	C	D	B	B	C	C	C	B

3.3. INVERTEBRATE SPECIES ASSEMBLAGE

3.3.1. The results of the targeted terrestrial invertebrate survey provide an indication of the relative species diversity within the targeted groups of invertebrates. Over 190 specimens were collected or recorded during the course of the survey, allowing 78 species to be identified from the Field Survey Area. Figure 2 shows the location of the areas sampled for invertebrates, including symbols showing which of the sampling methods were used in which locations.

3.3.2. Of the target groups, Lepidoptera was the dominant order recorded with 33 species; followed by Coleoptera which was represented by 13 species; Diptera with 10 species; Hymenoptera with nine species; Hemiptera with five species; Orthoptera with four species; Odonata with two species; and Dermaptera and Araneae with one species each.

3.3.3. Only one species was recorded with a recognised conservation status, this is the alder leaf beetle, which was previously believed to be extinct in the UK. There have been, however, an increasing number of recent records and the true status of this leaf beetle is currently unknown. It has a RDB K (insufficiently known) status (Naturespot.org.uk, 2021). In addition, a further five species of moth were recorded that are identified as Section 41 Priority Species via the provisions of the NERC Act (2006). These species were; Cinnabar moth *Tyria jacobaeae*, Dusky Thorn *Ennomos fuscantaria*, Shaded Broad-bar *Scotopteryx chenopodiata*, The Crescent *Helotropha leucostigma* and The Rustic *Hoplodrina blanda*.

3.3.4. A complete list of terrestrial invertebrates recorded during the survey work is displayed in **Table 3.3** below.

Table 3.2 – Overall Invertebrate Species List Recorded from Drax Power Station (August 2021)

Type	Order	Family	Common name	Scientific name	Count	Season	Year	Date	Method	Life stage
Spider	Araneae	Araneidae	Garden spider	Araneus diadematus	3	Summer (August)	2021	11.08.21	Sweep/beat	Adult
Beetle	Coleoptera	Chrysomelidae	Alder leaf beetle	Agelastica alni	50+	Summer (August)	2021	11.08.21	Day time observation	Larvae & Adults
Beetle	Coleoptera	Scarabaeidae	Brown chafer	Serica brunnea	1	Summer (August)	2021	11.08.21	Light trapping	Adult
Beetle	Coleoptera	Silphidae	Banded sexton beetle	Nicrophorus investigator	1	Summer (August)	2021	11.08.21	Pan trap	Adult
Beetle	Coleoptera	Silphidae	Common burying beetle	Nicrophorus vespillo	1	Summer (August)	2021	11.08.21	Pan trap	Adult
Beetle	Coleoptera	Chrysomelidae	Flea beetle	Sphaeroderma testaceum	3	Summer (August)	2021	11.08.21	Pan trap	Adult
Beetle	Coleoptera	Coccinellidae	14-spot ladybird	Propylea quatuordecimpunctata	4	Summer (August)	2021	11.08.21	Sweep/beat	Adult
Beetle	Coleoptera	Coccinellidae	22-spot ladybird	Psyllobora vigintiduopunctata	2	Summer (August)	2021	11.08.21	Sweep/beat	Adult
Beetle	Coleoptera	Coccinellidae	16-spot ladybird	Tytthaspis sedecimpunctata	3	Summer (August)	2021	11.08.21	Sweep/beat	Adult
Beetle	Coleoptera	Coccinellidae	Harlequin ladybird	Harmonia axyridis	2	Summer (August)	2021	11.08.21	Sweep/beat	Adult
Beetle	Coleoptera	Coccinellidae	7-spot ladybird	Coccinella septempunctata	8	Summer (August)	2021	11.08.21	Sweep/beat	Adult
Beetle	Coleoptera	Cantharidae	Common red soldier beetle	Rhagonycha fulva	1	Summer (August)	2021	11.08.21	Sweep/beat	Adult
Beetle	Coleoptera	Carabidae	Common sun beetle	Amara aenea	1	Summer (August)	2021	11.08.21	Sweep/beat	Adult
Beetle	Coleoptera	Carabidae	Black clock beetle	Pterostichus madidus	1	Summer (August)	2021	12.08.21	Sweep/beat	Adult
Earwig	Dermaptera	Forficulidae	Common earwig	Forficula auricularia	2	Summer (August)	2021	11.08.21	Sweep/beat	Adult

Type	Order	Family	Common name	Scientific name	Count	Season	Year	Date	Method	Life stage
Soldierfly	Diptera	Stratiomyidae	Flecked general	Stratiomys singularior	4	Summer (August)	2021	11.08.21	Pan trap	Adult
Hoverfly	Diptera	Syrphidae	Stripe-winged dronefly	Eristalis horticola	4	Summer (August)	2021	11.08.21	Pan trap	Adult
Hoverfly	Diptera	Syrphidae	Marmalade hoverfly	Episyrphus balteatus	1	Summer (August)	2021	11.08.21	Pan trap	Adult
Hoverfly	Diptera	Syrphidae	Tiger hoverfly	Helophilus pendulus	7	Summer (August)	2021	11.08.21	Pan trap	Adult
Hoverfly	Diptera	Syrphidae	Broad-handed hoverfly	Platycheirus granditarsus	1	Summer (August)	2021	11.08.21	Pan trap	Adult
Hoverfly	Diptera	Syrphidae	Small spotty-eyed dronefly	Eristalinus sepulchralis	18	Summer (August)	2021	11.08.21	Pan trap	Adult
Hoverfly	Diptera	Syrphidae	Long hoverfly	Sphaerophoria scripta	5	Summer (August)	2021	11.08.21	Pan trap	Adult
Flesh fly	Diptera	Sarcophagidae	Flesh fly	Sarcophaga carnaria	2	Summer (August)	2021	11.08.21	Pan trap	Adult
Snail-killing Fly	Diptera	Sciomyzidae	Sieve-winged snailkiller	Coremacera marginata	3	Summer (August)	2021	11.08.21	Sweep/beat	Adult
Cranefly	Diptera	Tipulidae	Marsh crane fly	Tipula oleracea	8	Summer (August)	2021	12.08.21	Sweep/beat	Adult
Bug	Hemiptera	Cicadellidae	Leaf hopper	Evacanthus interruptus	2	Summer (August)	2021	11.08.21	Pan trap	Adult
Mirid Bug	Hemiptera	Miridae	Red-spotted plant bug	Deraeocoris ruber	4	Summer (August)	2021	11.08.21	Sweep/beat	Adult
Shield Bug	Hemiptera	Pentatomidae	Hairy shieldbug	Dolycoris baccarum	5	Summer (August)	2021	11.08.21	Sweep/beat	Adult
Shield Bug	Hemiptera	Pentatomidae	Common green shieldbug	Palomena prasina	4	Summer (August)	2021	11.08.21	Sweep/beat	4th instar nymph
Shield Bug	Hemiptera	Pentatomidae	Birch shieldbug	Elasmostethus interstinctus	3	Summer (August)	2021	11.08.21	Sweep/beat	Adult

Type	Order	Family	Common name	Scientific name	Count	Season	Year	Date	Method	Life stage
Bee	Hymenoptera	Apidae	Honeybee	Apis Mellifera	10+	Summer (August)	2021	11.08.21	Day time observation	Adult
Bumblebee	Hymenoptera	Apidae	Red -tailed bumblebee	Bombus lapidarius	4	Summer (August)	2021	11.08.21	Day time observation	Adult
Bumblebee	Hymenoptera	Apidae	Common carder bumblebee	Bombus pascuorum	2	Summer (August)	2021	11.08.21	Day time observation	Adult
Bumblebee	Hymenoptera	Apidae	Early bumblebee	Bombus pratorum	1	Summer (August)	2021	11.08.21	Day time observation	Adult
Bumblebee	Hymenoptera	Apidae	Buff-tailed bumblebee	Bombus terrestris	6+	Summer (August)	2021	11.08.21	Day time observation	Adult
Wasp	Hymenoptera	Crabronidae	Digger wasp (Ectemnius)	Ectemnius continuus	5	Summer (August)	2021	11.08.21	Pan trap	Adult
Wasp	Hymenoptera	Crabronidae	Ornate tailed digger wasp	Cerceris rybyensis	1	Summer (August)	2021	11.08.21	Pan trap	Adult
Wasp	Hymenoptera	Eurytomidae	Slender wood borer wasp	Trypoxylon attenuatum	7	Summer (August)	2021	11.08.21	Pan trap	Adult
Sawfly	Hymenoptera	Tenthredinidae	Figwort sawfly	Tenthredo scrophulariae	2	Summer (August)	2021	11.08.21	Pan trap	Adult
Moth (Macro)	Lepidoptera	Hepialidae	Orange swift	Triodia sylvina	1	Summer (August)	2021	11.08.21	Light trapping	Adult
Moth (Macro)	Lepidoptera	Erebidae	Dingy footman	Eilema griseola	3	Summer (August)	2021	11.08.21	Light trapping	Adult
Moth (Macro)	Lepidoptera	Erebidae	Straw dot	Rivula sericealis	1	Summer (August)	2021	11.08.21	Light trapping	Adult
Moth (Macro)	Lepidoptera	Erebidae	The herald	Scoliopteryx libatrix	1	Summer (August)	2021	11.08.21	Light trapping	Adult
Moth (Macro)	Lepidoptera	Erebidae	Cinnabar	Tyria jacobaeae	20+	Summer (August)	2021	11.08.21	Day time observation	Larva (Caterpillar)
Moth (Macro)	Lepidoptera	Geometridae	Willow beauty	Peribatodes rhomboidaria	1	Summer (August)	2021	11.08.21	Light trapping	Adult

Type	Order	Family	Common name	Scientific name	Count	Season	Year	Date	Method	Life stage
Moth (Macro)	Lepidoptera	Geometridae	Yellow shell	Camtogramma bilineata	1	Summer (August)	2021	11.08.21	Light trapping	Adult
Moth (Macro)	Lepidoptera	Geometridae	The Engrailed	Ectropis bistortata	1	Summer (August)	2021	11.08.21	Light trapping	Adult
Moth (Macro)	Lepidoptera	Geometridae	Shaded broad-bar	Scotopteryx chenopodiata	1	Summer (August)	2021	11.08.21	Light trapping	Adult
Moth (Macro)	Lepidoptera	Geometridae	Dusky thorn	Ennomos fuscantaria	1	Summer (August)	2021	11.08.21	Light trapping	Adult
Moth (Macro)	Lepidoptera	Geometridae	Lime-speck pug	Eupithecia centaureata	2	Summer (August)	2021	11.08.21	Light trapping	Adult
Moth (Macro)	Lepidoptera	Noctuidae	Gold spot	Plusia festucae	8	Summer (August)	2021	11.08.21	Light trapping	Adult
Moth (Macro)	Lepidoptera	Noctuidae	Silver Y	Autographa gamma	4	Summer (August)	2021	11.08.21	Light trapping	Adult
Moth (Macro)	Lepidoptera	Noctuidae	Common rustic	Mesapamea secalis	1	Summer (August)	2021	11.08.21	Light trapping	Adult
Moth (Macro)	Lepidoptera	Noctuidae	Flounced rustic	Luperina testacea	1	Summer (August)	2021	11.08.21	Light trapping	Adult
Moth (Macro)	Lepidoptera	Noctuidae	Dark arches	Apamea monoglypha	3	Summer (August)	2021	11.08.21	Light trapping	Adult
Moth (Macro)	Lepidoptera	Noctuidae	Dusky sallow	Eremobia ochroleuca	2	Summer (August)	2021	11.08.21	Light trapping	Adult
Moth (Macro)	Lepidoptera	Noctuidae	Flame shoulder	Ochropleura plecta	2	Summer (August)	2021	11.08.21	Light trapping	Adult
Moth (Macro)	Lepidoptera	Noctuidae	Large yellow underwing	Noctua pronuba	3	Summer (August)	2021	11.08.21	Light trapping	Adult
Moth (Macro)	Lepidoptera	Noctuidae	The Crescent	Celaena leucostigma	1	Summer (August)	2021	11.08.21	Light trapping	Adult
Moth (Macro)	Lepidoptera	Noctuidae	Poplar grey	Acronicta megacephala	1	Summer (August)	2021	11.08.21	Day time observation	Larva (Caterpillar)

Type	Order	Family	Common name	Scientific name	Count	Season	Year	Date	Method	Life stage
Moth (Macro)	Lepidoptera	Noctuidae	The Rustic	Hoplodrina blanda	1	Summer (August)	2021	11.08.21	Light trapping	Adult
Moth (Micro)	Lepidoptera	Crambidae	Pale straw pearl	Udea lutealis	1	Summer (August)	2021	11.08.21	Light trapping	Adult
Moth (Micro)	Lepidoptera	Tortricidae	Common yellow conch	Agapeta hamana	2	Summer (August)	2021	11.08.21	Light trapping	Adult
Moth (Micro)	Lepidoptera	Crambidae	Mother of pearl	Pleuroptya ruralis	1	Summer (August)	2021	11.08.21	Light trapping	Adult
Butterfly	Lepidoptera	Nymphalidae	Small tortoiseshell	Aglais urticae	3	Summer (August)	2021	11.08.21	Day time observation	Adult
Butterfly	Lepidoptera	Nymphalidae	Peacock	Inachis io	2	Summer (August)	2021	11.08.21	Day time observation	Adult
Butterfly	Lepidoptera	Nymphalidae	Gatekeeper	Pyronia tithonus	10+	Summer (August)	2021	11.08.21	Day time observation	Adult
Butterfly	Lepidoptera	Nymphalidae	Meadow brown	Maniola jurtina	8+	Summer (August)	2021	11.08.21	Day time observation	Adult
Butterfly	Lepidoptera	Pieridae	Green-veined white	Pieris napi	3	Summer (August)	2021	11.08.21	Day time observation	Adult
Butterfly	Lepidoptera	Pieridae	Small white	Pieris rapae	1	Summer (August)	2021	11.08.21	Day time observation	Adult
Butterfly	Lepidoptera	Lycaenidae	Small copper	Lycaena phlaeas	1	Summer (August)	2021	11.08.21	Pan trap	Adult
Butterfly	Lepidoptera	Lycaenidae	Common blue	Polyommatus icarus	1	Summer (August)	2021	11.08.21	Day time observation	Adult
Dragonfly	Odonata	Libellulidae	Common darter	Sympetrum striolatum	2	Summer (August)	2021	11.08.21	Pan trap	Adult
Damselfly	Odonata	Coenagrionidae	Blue-tailed damselfly	Ischnura elegans	4	Summer (August)	2021	11.08.21	Pan trap	Adult
Grasshopper	Orthoptera	Acrididae	Lesser marsh grasshopper	Chorthippus albomarginatus	1	Summer (August)	2021	11.08.21	Pan trap	Adult

Type	Order	Family	Common name	Scientific name	Count	Season	Year	Date	Method	Life stage
Grasshopper	Orthoptera	Acrididae	Field grasshopper	Chorthippus brunneus	1	Summer (August)	2021	11.08.21	Pan trap	Adult
Ground-hopper	Orthoptera	Tetrigidae	Slender ground-hopper	Tetrix subulata	2	Summer (August)	2021	12.08.21	Sweep/beat	Adult
Ground-hopper	Orthoptera	Tetrigidae	Common ground-hopper	Tetrix undulata	1	Summer (August)	2021	12.08.21	Sweep/beat	Adult

3.4. PANTHEON ASSEMBLAGE ANALYSIS

3.4.1. The Pantheon database has been used principally to help understand which assemblages within the Field Survey Area are likely to be important. The species list derived from the survey in August 2021 was entered into Pantheon.

3.4.2. The data output from the analysis is shown in **Table 3.4, Table 3.5 and Table 3.6** below which considers invertebrate assemblages at three different levels.

BROAD BIOTOPES

Table 3.3 – Summary of Pantheon output for broad biotopes

Broad biotope	No. of species	No. of species with conservation status recognised by Pantheon	Conservation status
Open habitats	50	3	3 [S41]
Wetland	10	1	1 [S41]
Tree-associated	10	2	1 [DD; NR], 1 [S41]

S41 = Section 41 Priority Species, DD = Data Deficient in Great Britain, NR = Nationally Rare in Great Britain

3.4.4. **Table 3.4** shows that there are three broad assemblage types which are recognised by Pantheon based on the invertebrate species recorded from the Field Survey Area. The best represented is that belonging to open habitats at 50 species, which is unsurprising given that most of the survey effort targeted this broad biotope that includes grassland and scrub habitats.

HABITATS

Table 3.4 – Summary of Pantheon Output for habitats

Broad biotope	Habitat	No. of species	No. of species with conservation status recognised by Pantheon	Conservation status
Open habitats	Tall sward and scrub	41	3	3 [S41]
Open habitats	Short sward and bare ground	5	-	-

Broad biotope	Habitat	No. of species	No. of species with conservation status recognised by Pantheon	Conservation status
Open habitats	Shaded woodland floor	1	-	-
Wetland	Acid and sedge peats	7	-	-
Wetland	Marshland	3	-	-
Tree-associated	Arboreal	8	2	1 [DD;NR], 1 [S41]
Tree-associated	Decaying wood	1	-	-

3.4.6. **Table 3.5** adds a finer level of detail to **Table 3.4**, sub-dividing broad biotopes into habitats. The most prominent habitat that features is that of 'tall sward and scrub' that lies within the broad biotope of open habitats.

SPECIFIC ASSEMBLAGE TYPES

Table 3.5 – Summary of Pantheon output for specific assemblages

Broad biotope	Habitat	SAT	No. of species
Open habitats	Tall sward and scrub	Scrub edge	3
Open habitats	Short sward and bare ground	Rich flower resource	5
Tree-associated	Decaying wood	Bark and sapwood decay Epiphyte fauna	1 1

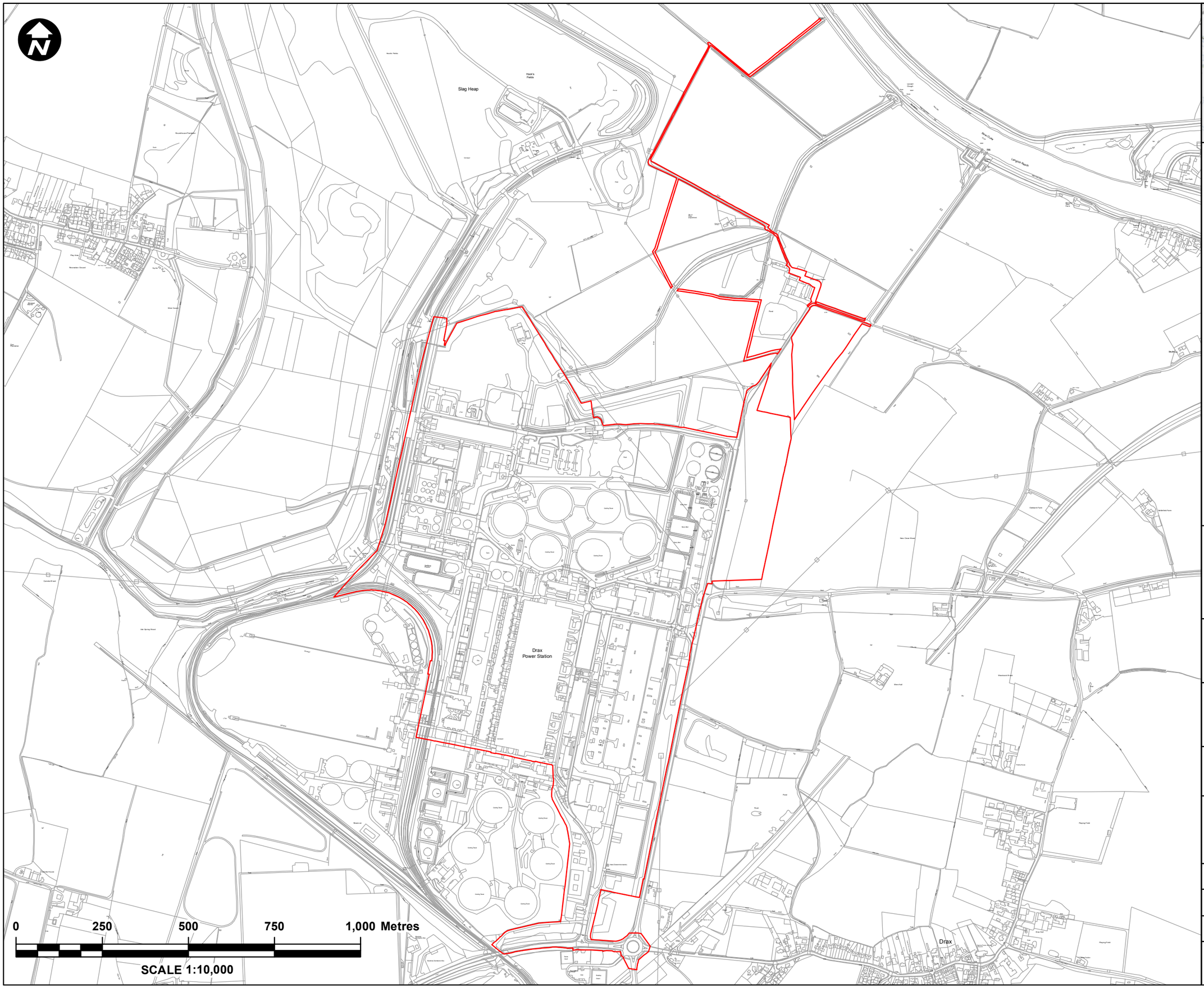
3.4.8. There are too few species on which to make a reliable assessment for Specific Assemblage Types (SATs).

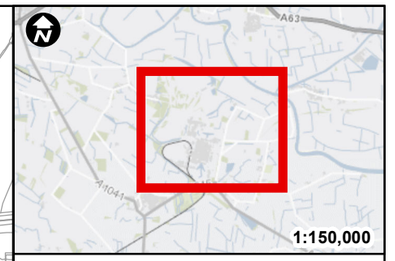
3.4.9. SATs are generally regarded as the most valuable metrics for assessing site quality. This is because SATs are made up of species with a high degree of habitat

specialisation. Such species tend to be both uncommon and representative of sites supporting habitat of quality in terms of conservation value. However, SATs often require targeted sampling of specific habitat features and are not always well represented in broadscale survey designed to gain an overall, or baseline assessment of a site's value.

3.4.10. As such, it is not appropriate to assess favourable condition of SATs identified by Pantheon at the Field Survey Area. This is because for all SATs identified, the number of species was below the threshold level (15 species). This is most likely to be due to sampling effort, with only a single survey visit in August solely contributing to the species list entered into Pantheon.

Figure 1 - Site Location





Key:

Order Limits

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 - Regulation 5(2)(a)

drax

wsp

PROJECT TITLE

DRAX BECCS DCO

DRAWING TITLE

ES - VOL 3 -CHAPTER 8 ECOLOGY - APPENDIX 8.4 TERRESTRIAL INVERTEBRATE SURVEY REPORT: ORDER LIMITS

DRAWING STATUS

FOR ISSUE

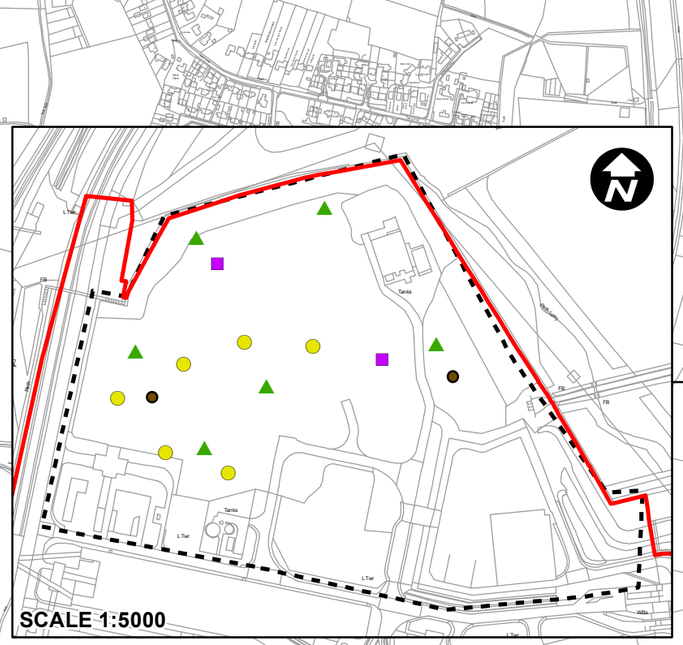
DRAWN	CHECKED	APPROVED	AUTHORISED
LH	BS	MM	NA

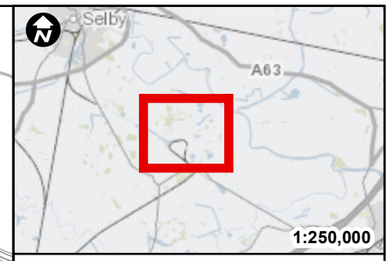
SCALE @ A3 SIZE	DATE	REVISION
1:10,000	13/05/2022	P01

DRAWING NUMBER

FIGURE 1

Figure 2 - Terrestrial Invertebrates Sampling Locations and Methods





Key:

- Order Limits
- Survey Area

Sampling Method

- Pan trap
- Moth trap
- Sweep/beat
- Grubbing

0 250 500 750 1,000 Metres

SCALE 1:10,000

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 - Regulation 5(2)(a)

PROJECT TITLE

DRAX BECCS DCO

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ES - VOL 3 -CHAPTER 8 ECOLOGY - APPENDIX 8.4 TERRESTRIAL INVERTEBRATE SURVEY REPORT: TERRESTRIAL INVERTEBRATE SURVEY

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DRAWN	CHECKED	APPROVED	AUTHORISED
LH	BS	LR	PP

SCALE @ A3 SIZE	DATE	REVISION
1:10,000	13/05/2022	P01

DRAWING NUMBER

FIGURE 2

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