

MONA OFFSHORE WIND PROJECT

Environmental Statement

Volume 7, Annex 3.5: Terrestrial invertebrate survey technical report

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Image of an offshore wind farm

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MONA OFFSHORE WIND PROJECT

Contents

1	TERRESTRIAL INVERTEBRATE SURVEY TECHNICAL REPORT	1
1.1	Introduction	1
1.2	Study area	1
1.3	Survey area	1
1.4	Relevant Legislation	3
1.5	Consultation	3
1.6	Methodology	4
1.6.1	Overview	4
1.6.2	Desk study	4
1.6.3	Site-specific surveys	4
1.6.4	Data analysis	5
1.6.5	Limitations	6
1.7	Results	7
1.7.1	Desk study	7
1.7.2	Site-specific surveys	8
1.8	Summary	19
1.9	References	20

Tables

Table 1.1:	Summary of key desktop sources.	4
Table 1.2:	Notable terrestrial invertebrate species within terrestrial invertebrate study area.	7
Table 1.3:	Sites subject to terrestrial invertebrate surveys	9
Table 1.4:	Survey conditions during terrestrial invertebrate surveys	9
Table 1.5:	Sites scoped out from further terrestrial invertebrate surveys	10
Table 1.6:	Invertebrate assemblages derived from Pantheon	13
Table 1.7:	Species of conservation concern recorded during field surveys.	14

Figures

Figure 1.1:	Terrestrial invertebrate study and survey area	2
Figure 1.2:	Protected and notable terrestrial invertebrate species (sheet 1)	16
Figure 1.3:	Protected and notable terrestrial invertebrate species (sheet 2)	17
Figure 1.4:	Protected and notable terrestrial invertebrate species (sheet 3)	18

Appendices

Appendix A:	Survey data	21
Appendix B:	Invertebrate conservation criteria	36

MONA OFFSHORE WIND PROJECT

Glossary

Term	Meaning
Expert Working Group (EWG)	Expert working groups set up with relevant stakeholders as part of the Evidence Plan process.
Pantheon	An analytical tool developed by Natural England and the Centre for Ecology & Hydrology to assist with the analysis of invertebrate species samples.
Site fidelity	The tendency of animals returning to familiar breeding, feeding or recently visited areas.
Specific Assemblage Type (SAT)	Assemblages of invertebrates relating to favoured habitats and characterised by ecological restricted species.
Species of Principal Importance	Species recognised in Welsh policy and afforded due regard in the planning system by the Environment (Wales) Act 2016, Section 7. Public bodies have a legal duty to conserve such species through their work.
Species Quality Index (SQI)	A measure of the number of rare species in a sample, divided by the total number of species in a sample.
Species Quality Score (SQS)	A score assigned to an invertebrate species based on its conservation status. The scores are used to create the Species Quality Index.

Acronyms

Acronym	Description
CR	Critically Endangered
DD	Data Deficient
Defra	Department for the Environment, Food & Rural Affairs
EN	Endangered
EWG	Expert Working Group
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
MAGIC	Multi Agency Geographic Information for the Countryside
MLWS	Mean Low Water Springs
Nb	Nationally Scarce (pre-IUCN 2001)
NR	Nationally Rare
NS	Nationally Scarce
NT	Near Threatened
RDB	Red Data Book
SAT	Specific Assemblage Type
SPI	Species of Principal Importance
SQI	Species Quality Index
SQS	Species Quality Score

MONA OFFSHORE WIND PROJECT

Acronym	Description
VU	Vulnerable

Units

Unit	Description
°C	Degrees Celsius
km	Kilometres
km ²	Square kilometres

1 TERRESTRIAL INVERTEBRATE SURVEY TECHNICAL REPORT

1.1 Introduction

- 1.1.1.1 This document forms Volume 7, Annex 3.5: Terrestrial invertebrate survey technical report of the Environmental Statement for the Mona Offshore Wind Project.
- 1.1.1.2 The purpose of this technical report is to present the results of the terrestrial invertebrate desk and field surveys undertaken in August 2023 to inform Volume 3, Chapter 3: Onshore ecology of the Environmental Statement.
- 1.1.1.3 The desk study and field surveys were designed to determine the presence or likely absence of protected or notable terrestrial invertebrate species.
- 1.1.1.4 Two separate areas have been defined for the purposes of this technical report. These include the 'study area', which describes the geographical extent subject to desk based research, and the 'survey area', which describes the area of land subject to Site-specific surveys. The extent of the study area was selected to ensure all available data was collected for the Mona Onshore Development Area and the surroundings that may support this species group and may reasonably be affected by the Mona Offshore Wind Project. The extent of the study area and the survey area were discussed and agreed with the onshore ecology EWG.

1.2 Study area

- 1.2.1.1 The study area comprises the Mona Onshore Development Area, landward of Mean Low Water Springs (MLWS) and a 1 km buffer ('the terrestrial invertebrate study area'). The location and geographic extent of the terrestrial invertebrate study area is presented in Figure 1.1 of this technical report.

1.3 Survey area

- 1.3.1.1 Following the commencement of terrestrial invertebrate surveys, the Mona Onshore Development Area has been refined and now occupies a smaller geographical area. As such, the area of land subject to terrestrial invertebrate surveys ('the terrestrial invertebrate survey area') extends beyond the current iteration of the Mona Onshore Development Area. The results from surveys undertaken beyond the Mona Onshore Development Area (i.e. surveys undertaken based on an earlier design iterations) have been included in this technical report because they provide further context regarding the ecological sensitivity of the wider area and to inform Volume 3, Chapter 3: Onshore ecology of the Environmental Statement (where relevant). All the ecological data collected as part of the Environmental Statement for the Mona Offshore Wind Project has been made publicly available through the relevant data records centre.
- 1.3.1.2 Adopting a survey area that is greater in extent than the Mona Onshore Development Area is in accordance with the precautionary approach. It ensures that the Environmental Statement is accurately informed with data from within the Mona Onshore Development Area (i.e. that may be subject to direct impacts) and data from outside the Mona Onshore Development Area (i.e. that may be subject to indirect impacts).
- 1.3.1.3 The location and geographic extent of the terrestrial invertebrate survey area is presented in Figure 1.1 of this technical report.

MONA OFFSHORE WIND PROJECT

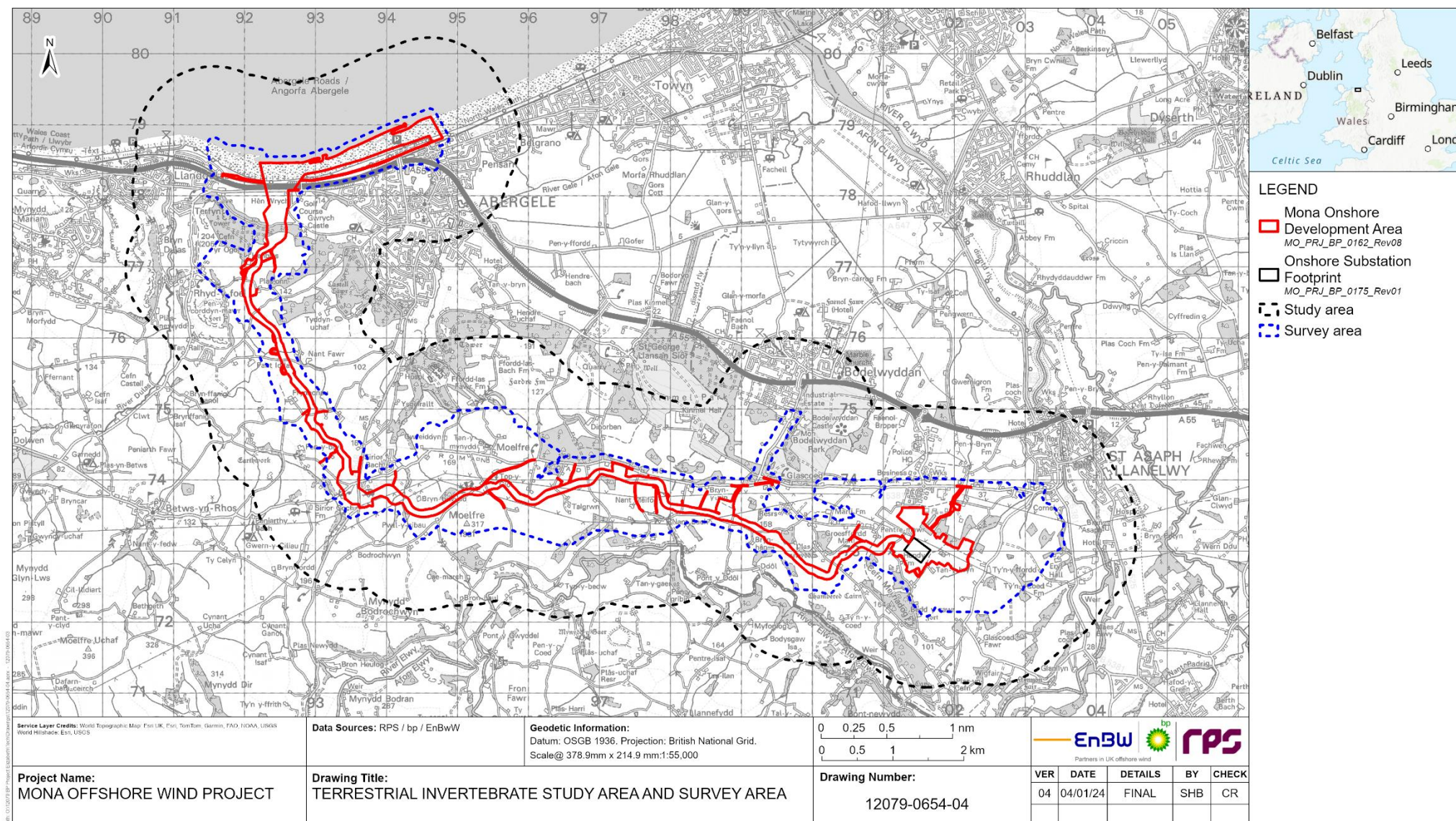


Figure 1.1: Terrestrial invertebrate study and survey area

MONA OFFSHORE WIND PROJECT

1.4 Relevant Legislation

- 1.4.1.1 Three key pieces of legislation are relevant for terrestrial invertebrates in Wales and the UK, these are: Conservation of Habitats and Species Regulations 2017 (as amended), the Wildlife and Countryside Act 1981 (as amended), and Environment (Wales) Act 2016.
- 1.4.1.2 The Conservations of Habitats and Species Regulations 2017 (as amended) protects one species of terrestrial invertebrate, the large blue *Phengaris arion*. Under schedule 2 it is an offence to:
- deliberately kill, injure, disturb or capture them
 - deliberately destroy their eggs
 - damage or destroy their breeding sites and resting places (even when invertebrates are not present)
 - possess, control or transport them (alive or dead).
- 1.4.1.3 The Wildlife and Countryside Act 1981 (as amended) fully protects 27 species of terrestrial invertebrate due to their rarity. Under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) it is an offence to:
- Intentionally kill, injure, or take the animal from the wild
 - Damage or destroy any structure used by that species for shelter and protection including obstruction of its use or disturbing the animal
 - Possess the species (dead or alive)
 - Trade or sell the species, dead, alive or any derivatives.
- 1.4.1.4 Other species of invertebrate are protected against sale only and have no specific habitat protection.
- 1.4.1.5 Section 7 of The Environment (Wales) Act 2016 includes a list of 188 invertebrate species that are Species of Principal Importance (SPI) in Wales. Public bodies and planning authorities have a legal duty to have regard for conserving a species of principal importance when exercising their duties.

1.5 Consultation

- 1.5.1.1 The scope, methodology and findings of the terrestrial invertebrate surveys, including those undertaken beyond the current Mona Onshore Development Area, were discussed and agreed with stakeholders via regular Onshore Ecology Expert Working Group (EWG) meetings. Further detail regarding consultation undertaken with respect to onshore ecology, including terrestrial invertebrate surveys can be found in Volume 3, Chapter 3: Onshore ecology of the Environmental Statement and the Consultation Report (Document reference: E.3).

MONA OFFSHORE WIND PROJECT

1.6 Methodology

1.6.1 Overview

- 1.6.1.1 A combination of a desktop study and field surveys were undertaken to establish the likely presence or absence of terrestrial invertebrates within the terrestrial invertebrate study area. All field surveyors were suitably trained and experienced in undertaking the survey methodologies set out in the following sections of this report.
- 1.6.1.2 The results of the desktop study are presented in Volume 7, Annex 3.1: Onshore ecology desk study technical report, a summary of which are provided below, along with the site-specific survey results.

1.6.2 Desk study

- 1.6.2.1 Information on terrestrial invertebrates in the terrestrial invertebrate study area was collected from existing studies and datasets. These are summarised in Table 1.1.

Table 1.1: Summary of key desktop sources.

Title	Source	Year	Author
Historical biological records	Cofnod	2023	Cofnod
Multi Agency Geographic Information for the Countryside (MAGIC)	Defra	2023	Defra
DataMapWales	Welsh Government	2023	Welsh Government
Multi-Agency Geographic Information for the Countryside (MAGIC)	Department for the Environment, Food & Rural Affairs (Defra)	2023	Defra
UK Protected Area Joint Nature Conservation Committee (JNCC)	JNCC website	2023	JNCC
Invertebrate database	Pantheon	2023	Pantheon

1.6.3 Site-specific surveys

Extended phase 1 habitat surveys

- 1.6.3.1 Extended phase 1 habitat surveys undertaken between May 2022 and September 2023 were used to assess habitat suitability for protected and notable terrestrial invertebrates (see Volume 7, Annex 3.2: Extended phase 1 habitat survey technical report of the Environmental Statement).
- 1.6.3.2 All sites with potential to support protected or notable terrestrial invertebrates were subsequently assessed by experienced and competent terrestrial invertebrate specialists. The assessments scoped each site in or out for further, detailed terrestrial invertebrates' surveys. The assessment was informed by the diversity, extent and quality of the habitats present and

MONA OFFSHORE WIND PROJECT

professional judgement. Sites were defined as contiguous or connected habitats that were suitable for protected or notable terrestrial invertebrates. The sites were assigned a number from one to 18. Terrestrial invertebrate assemblage surveys were subsequently undertaken within the sites identified as potentially supporting suitable habitat.

Terrestrial invertebrate assemblage surveys

- 1.6.3.3 Site-specific surveys comprised a series of timed samples that followed methodologies defined in Surveying Terrestrial and Freshwater Invertebrates for Conservation Evaluation (Drake *et al.*, 2007). Site-specific surveys utilised a variety of search techniques, including sweep-netting, hand searching, spot searching and netting of flying insects.
- 1.6.3.4 Species groups targeted during the surveys comprised beetles (*Coleoptera*), bugs (*Hemiptera*), butterflies and day-flying moths (*Lepidoptera*), bees (*Aculeate Hymenoptera*), flies (*Diptera*, including larger *Brachycera* and hoverflies), and grasshoppers and bushcrickets (*Orthoptera*). Most protected species are readily identifiable in the field. Invertebrates species that could not be identified in the field were preserved in 70% alcohol (industrial methylated spirits) and identified following the survey, using identification aids (as per accepted methods in Drake *et al.*, 2007). Each habitat or group of connected habitats that were confirmed suitable to support terrestrial invertebrates and that was subject to survey were given a number and referred to as a 'site' (e.g. site 1, site 2 etc.).

1.6.4 Data analysis

- 1.6.4.1 Collected invertebrate samples were time standardised (Drake *et al.*, 2007) to allow analysis by Natural England's Pantheon System ('Pantheon') (Heaver *et al.*, 2017; Webb *et al.*, 2018). Natural England's Pantheon system is designed to analyse invertebrate sample data (Webb *et al.*, 2018) and determine the quality of the invertebrate assemblage in a national context. It assigns scores to each assemblage based on their rarity and site fidelity (i.e. how likely each assemblage is to occur only in one particular habitat or microhabitat).
- 1.6.4.2 Species that are recorded only in a particular habitat (habitat specialists forming part of a Specific Assemblage Type (SAT)) are also assessed as a percentage against the national pool of species that occur in that habitat. SAT are generated by Pantheon using the species composition obtained from field surveys and are coded with letters and numbers (e.g. F112 open short sward).
- 1.6.4.3 The Species Quality Index (SQI) is a measure of how many species are associated with a particular habitat. The higher the score the more likely it is that the assemblage is of high quality, as it contains a higher number of rare species associated with the habitat. The SQI is a numerical scoring system contained within Pantheon. Each species recorded from a sample is assigned a Species Quality Score (SQS) based on their conservation status (see Appendix B of this technical report). 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 a 1.00). At present, there is no published guidance on the levels of importance related

MONA OFFSHORE WIND PROJECT

to SQI. However, based on professional judgement, SQIs of 150 and above could be of ecological value.

1.6.4.4 For the purposes of habitat monitoring (and for condition assessment of protected sites such as Sites of Special Scientific Interest (SSSIs)), the number of species recorded, which are specific to a SAT, can also be used to assess the condition of the habitat for supporting higher quality assemblages, with degraded sites described as 'unfavourable' condition and habitats in good condition supporting high numbers of qualifying species described as 'favourable' condition.

1.6.4.5 Information on the status of each species was obtained from the most recent relevant species status reviews, details of which are provided in the references. A summary of relevant terrestrial invertebrate species conservation designations is provided in Appendix B of this technical report. Whilst it is acknowledged that the Pantheon is a tool developed for England, it has merit in its use in Wales given the similarities in species presence between England and Wales.

1.6.5 Limitations

1.6.5.1 Suitable habitats for terrestrial invertebrates were identified as part of the extended phase 1 habitat surveys in late spring 2023. One survey visit was undertaken at each site, where access was granted. Subsequent terrestrial invertebrate surveys were commenced in August 2023. As a result, early spring and early summer surveys to record emerging species were not completed. The species recorded during the surveys are, however, based on and reflect the habitat assemblages and species present at time of survey. This technical report therefore accurately reflects the invertebrate species and assemblages present at the time of survey.

1.6.5.2 The weather conditions during the site-specific surveys were initially sub-optimal due to intermittent rain but improved throughout duration of the survey. To prevent limitations to the results, surveys were paused in heavy rain and were only fully completed when sub-optimal conditions had improved.

1.6.5.3 Access was not granted for two of the sites that were scoped in for the terrestrial invertebrate surveys and were not surveyed as a result. Both sites were in the east of the Mona Onshore Development Area, with one site partially situated within the Onshore Substation footprint. The sites that were not surveyed will be subject to terrestrial invertebrate surveys prior to construction to confirm the presence or absence of protected and notable habitats and species. The requirements for pre-commencement surveys are set out in the Outline Code of Construction Practice (CoCP) (Document reference: J.26). In the absence of survey information and in line with the precautionary approach, these sites are assumed to support invertebrate assemblages with a minimum SQI of 150, indicating that they could be of ecological value.

MONA OFFSHORE WIND PROJECT

1.7 Results

1.7.1 Desk study

1.7.1.1 The desk study confirmed that there are more than 20,000 different species of macro-invertebrates in Wales, comprising terrestrial and freshwater habitats (biodiversitywales.org). Terrestrial invertebrates occupy all possible habitats, from crevices in intertidal rocks to birds' nests saturated in moss. With such a large diversity and distribution of terrestrial invertebrates throughout Wales, both common and endangered species are potentially present throughout north Wales.

1.7.1.2 The desk study identified 29 historic records comprises 19 notable terrestrial invertebrates' species within the terrestrial invertebrate study area. The records comprised six species of butterfly, 11 species of moth, one species of dragonfly and one species of weevil (weevil spotted bean). These are presented in Table 1.2 below and on Figure 2.16 of Volume 7, Annexe 3.1: Onshore Ecology Desk Study Technical Report. Only one record was recorded within the Mona Onshore Development Area. This was a record of a common darter *Sympetrum striolatum* in the west of the Mona Onshore Development Area, along the Conwy coast.

1.7.1.3 The following conservation statuses are referred to in this report: Endangered (EN) Vulnerable (VU), Nationally Scarce (NS), Data Deficient (DD), Nationally Scarce (Nationally Notable b (Nb)) and Species of Principal Importance (SPI) as listed on Section 7 of the Environment (Wales) Act (2016). Conservation statuses are defined in Appendix B of this technical report.

Table 1.2: Notable terrestrial invertebrate species within terrestrial invertebrate study area.

Common name	Latin name	Number of records	Within Mona Onshore Development Area	Notable Status
Cinnabar	<i>Tyria jacobaeae</i>	6	No	Species of Principal Importance (SPI)
Common Darter	<i>Sympetrum striolatum</i>	7	Yes	Data Deficient
Shaded Broad-bar	<i>Scotopteryx chenopodiata</i>	1	No	Species of Principal Importance
Wall	<i>Lasiommata megera</i>	1	No	Species of Principal Importance
Dingy Skipper	<i>Erynnis tages</i>	1	No	Species of Principal Importance
Small Heath	<i>Coenonympha pamphilus</i>	1	No	Species of Principal Importance
Grayling	<i>Hipparchia semele</i>	1	No	Species of Principal Importance
Silver-studded Blue	<i>Plebejus argus</i>	1	No	Species of Principal Importance

MONA OFFSHORE WIND PROJECT

Common name	Latin name	Number of records	Within Mona Onshore Development Area	Notable Status
Mouse Moth	<i>Amphipyra tragopoginis</i>	1	No	Species of Principal Importance
Dusky Brocade	<i>Apamea remissa</i>	1	No	Species of Principal Importance
Shoulder-striped Wainscot	<i>Leucania comma</i>	1	No	Species of Principal Importance
Dark Brocade	<i>Mniotype adusta</i>	1	No	Species of Principal Importance
Large Wainscot	<i>Rhizedra lutosa</i>	1	No	Species of Principal Importance
Latticed Heath	<i>Chiasmia clathrate</i>	1	No	Species of Principal Importance
Ghost Moth	<i>Hepialus humuli</i>	1	No	Species of Principal Importance
Chalk carpet	<i>Scotopteryx bipunctaria</i>	1	No	Species of Principal Importance
Coastal Pearl	<i>Mecyna asinalis</i>	1	No	Nationally Scarce
White-letter Hairstreak	<i>Satyrrium w-album</i>	1	No	Species of Principal Importance
Weevil spotted bean	<i>Sitona macularius</i>	1	Yes	Nationally Scarce

1.7.2 Site-specific surveys

1.7.2.1 The extended phase 1 habitat survey data identified 18 sites that had potential to support terrestrial invertebrates. Experienced and competent terrestrial invertebrate survey specialists subsequently surveyed the 18 sites and scoped seven in for further detailed terrestrial invertebrate assemblage surveys. The remaining 11 were scoped out. Details are provided below.

Sites scoped in

1.7.2.2 The seven sites that were scoped in as being suitable for protected or notable terrestrial invertebrate assemblage species were subject to detailed surveys. The description and rationale for scoping in the seven sites is presented in Table 1.3 below. The locations of the sites are displayed on Figure 1.2 of this technical report.

MONA OFFSHORE WIND PROJECT

Table 1.3: Sites subject to terrestrial invertebrate surveys.

Site number	Habitat description and rationale for scoping in	Survey Date
Site 1	Small areas of sand dune and coastal grassland north of the sea wall, comprising a small, degraded dune ridge to the west, coastal grassland of short turf in the centre and marginal dunes to the east.	16 August 2023
Site 2	Limestone grassland with small patches of exposed bedrock and pockets of natural vegetation.	15 August 2023
Site 3	Extensive limestone grassland with large exposures of bedrock outcrops, highly diverse flora and a sheltered south facing aspect. The marginal woodland was diverse.	16 August 2023
Site 4	Sheep grazed unimproved acid grassland and deciduous woodland on southeast slopes, grading into improved pastures and species poor woodland to the north.	17 August 2023
Site 5	Sheep grazed unimproved acid grassland hill, with sporadic bracken <i>Pteridium aquilinum</i> and gorse <i>Ulex europaeus</i> scrub.	17 August 2023
Site 6	Small deciduous woodland, predominantly oak <i>Quercus</i> spp., occasional ash <i>Fraxinus excelsior</i> , with an understorey of holly <i>Ilex aquifolium</i> , hazel <i>Corylus avellana</i> and hawthorn <i>Crataegus monogyna</i> . Dead wood (trees, logs) were relatively abundant.	14 August 2023
Site 7	Sheep grazed unimproved grassland fields with neglected tree lined boundaries, including standing dead trees. Small complex of ruderal habitats and newly created ponds with diverse margins to the northwest.	18 August 2023

1.7.2.3 The seven sites were subject to detailed terrestrial invertebrate assemblage surveys during five days in August 2023. Full surveys were only conducted when weather conditions were suitable, which include dry days with sunny spells. A summary of weather conditions during the terrestrial invertebrate surveys is provided in Table 1.4 of this technical report below.

Table 1.4: Survey conditions during terrestrial invertebrate surveys.

Survey date	Temperature (°C)	Weather Conditions
14 August 2023	20	Heavy intermittent rain, that became overcast and humid. Occasional bright spell.
15 August 2023	21	Overcast, warm, occasional light drizzle.
16 August 2023	18	Warm, sunny, light breeze, becoming warmer.
17 August 2023	18	Sunny, strong easterly breeze, becoming south westerly.

MONA OFFSHORE WIND PROJECT

Survey date	Temperature (°C)	Weather Conditions
18 August 2023	18	Overcast, strong breeze.

Sites scoped out

- 1.7.2.4 The 11 sites that were identified as providing poor or having no suitable habitat for protected or notable terrestrial invertebrate species were not subject to further site-specific surveys. This was done by undertaking a brief site walkover at each site to understand the habitat composition. As part of this walkover, incidental records of terrestrial invertebrates were noted, particularly where they were protected or notable. Notes on incidental species were used to supplement the assessment in Volume 3, Chapter 3: Onshore ecology of the Environmental Statement. The description and rationale for not undertaking further surveys at the 11 sites is presented in Table 1.5 below, including suitable justification. All 11 of these sites are included on Figure 1.2 of this technical report.

Table 1.5: Sites scoped out from further terrestrial invertebrate surveys.

Site number	Habitat description and rational for not being surveyed further	Survey Date
Site 8	Agricultural fields with a few areas of field margin to the north, which were overshadowed by non-native sycamore <i>Acer pseudoplatanus</i> . The hedges are diverse but heavily managed. Limited habitat mosaics, patchwork vegetation and botanical diversity. The site provides suitability for common and widespread species of terrestrial invertebrate only.	15 August 2023
Site 9	Agricultural field with marginal sycamore plantation. A small area of disturbed ground was located to the northeast with limited ruderal growth at margins of hard standing grading rapidly into dense bramble <i>Rubus fruticosus</i> agg. scrub with only limited potential to support protected and notable species. No suitable habitat mosaics or patchwork vegetation present. The site provides suitability for common and widespread species of terrestrial invertebrate only.	15 August 2023
Site 10	Improved grassland fields, mostly grazing pasture, with heavily managed hedge boundaries. Small area of neglected/grazed ash <i>Fraxinus excelsior</i> woodland in southeast field. Limited potential for the area to support protected and notable species due to limited resources and habitat mosaics.	15 August 2023
Site 11	Improved/semi-improved grassland fields partly under sown with seed mix for non-native wildfowl such pheasant. Small areas in the northeast with natural grassland and hedge margins dominated by ruderal species including nettle <i>Urtica dioica</i> and creeping thistle <i>Cirsium arvense</i> which provided limited resources. The site has an exposed northeast facing aspect, with limited cover and limited potential to support protected and notable species.	14 August 2023

MONA OFFSHORE WIND PROJECT

Site number	Habitat description and rational for not being surveyed further	Survey Date
Site 12	Improved grassland fields, mostly grazing pasture, with heavily managed hedge boundaries. The few areas of minor interest for terrestrial invertebrates were small area of a former quarry in the southwest which was devoid of vegetation, a centrally located wetland that retained stands of wild angelica <i>Angelica sylvestris</i> but had also been underplanted with non-native Norway spruce <i>Picea abies</i> . Given the exposed nature, limited vegetation and resources both areas had negligible potential to support notable species.	15 August 2023
Site 13	Improved grassland fields with heavily managed hedge boundaries. No habitat mosaics and patchwork vegetation identified. The site had limited resources and has negligible suitability for protected and notable species.	17 August 2023
Site 14	A small plantation woodland comprising predominantly non-native larch <i>Larix decidua</i> with a few mature oaks on north boundary. The site was limited in terms of its botanical diversity and its resources. The site was assessed as having negligible suitability for protected and notable species.	14 August 2023
Site 15	Sheep grazed improved grassland field with heavily managed hedge boundaries. No habitat mosaics or flower-rich vegetation. The site was assessed as having negligible suitability for protected and notable species.	14 August 2023
Site 16	Sheep grazed improved grassland fields and agricultural land with heavily managed hedge boundaries. No habitat mosaics or patchwork vegetation or areas with flower rich vegetation. A small group of mature oaks in one field but had limited potential to support protected and notable species.	14 August 2023
Site 17	Improved grassland fields, mostly grazing pasture, with heavily managed hedge boundaries and a central stream. Stream margins were heavily shaded by a mix of native and non-native mature trees with no features of interest for invertebrates. A single standing dead tree was present but was being felled. This site was assessed as having negligible suitability for protected and notable species.	18 August 2023
Site 18	Improved grassland field with small area of rank grassland, immature trees and a pond with a very limited margin of semi-aquatic plants. Whilst the rank grassland provided a feature for common and widespread species of terrestrial invertebrate, the site was assessed as having negligible suitability for protected and notable species.	18 August 2023

Site-specific results

- 1.7.2.5 The Pantheon analysis confirmed that six SATs were present. A SAT is an assemblage of invertebrates characterised by ecologically restricted species. The SATs comprised five assemblages associated with open habitats: F001 scrub edge; F003 scrub-heath and moorland; F111 bare sand and chalk; F112 open short sward and F221 montane and upland. One assemblage was associated with trees, A212 bark and sapwood decay. Each of the SATs and its association with a site is presented in Table 1.6. Conservation status definitions are given in Appendix B of this technical report.

MONA OFFSHORE WIND PROJECT

- 1.7.2.6 All identified SATs were represented within the Mona Onshore Development Area by five sites. The best represented assemblages per site are summarised in Table 1.6. The SATs were represented at site 1 (located near the Conwy coast), site 3 (located to the southwest of Abergele), site 4 and 5 (located near Moelfre) and site 7 to the south of St. Asaph near the Permanent Access Route.
- 1.7.2.7 The quality of any assemblage type can be measured by the number of the specialist species that occur within in it. A benchmark score of the presence of any of these specialist species is required for the SAT to be favourable, otherwise Pantheon returns a condition of unfavourable.
- 1.7.2.8 Reported conditions of each SAT based on the species composition is listed in Table 1.6 below with all sites assessed as unfavourable. None of the assemblages qualified as being in favourable condition as insufficient qualifying species were recorded, however, all sites had at least one represented assemblage.
- 1.7.2.9 SQIs were calculated based on the SQS of each species within a sample, with SQIs ranging between 100 and 225. Two assemblages were assigned an SQI of over 100 as the assemblages contained species which were also species of conservation concern. These were F111 bare sand and chalk which had an SQI of 175, recorded only at site 1, and F001 scrub edge recorded at site 7, which had an SQI of 220. Both sites were located within the Mona Onshore Development Area. A small part of site 7 is located within the Permanent Access Route and site 1 is located along the Conwy coast.
- 1.7.2.10 In total 116 species of terrestrial invertebrate were recorded during the terrestrial invertebrate assemblage surveys. The species recorded included common and widespread and protected or notable species. This included 49 incidental records from sites subsequently not subject to further surveys. Details of the 116 species are presented in Appendix A of this technical report. Of the 116 species, 10 were notable species of conservation concern, which included two SPI, the grayling butterfly (Endangered-EN) recorded at site 1, and the small heath butterfly (Vulnerable-VU), which were recorded at sites 2, 3 and 4. The full list of notable species are presented in in Table 1.7. Conservations statuses are referred to in paragraph 1.7.1.3 and defined in Appendix B of this technical report. Locations of protected and notable species during the site-specific surveys are displayed on Figure 1.2.
- 1.7.2.11 Species that have undergone changes in distribution since publication of the relevant review (Fox *et al.*, (2010), Foster (2010) or Fox *et al.* (2022)) are denoted by square brackets as their status required an update. Conservation status definitions are given in Appendix B of this technical report.

MONA OFFSHORE WIND PROJECT

Table 1.6: Invertebrate assemblages derived from Pantheon

Broad biotope/ habitat	SAT	SQI	Reported condition	Number of associated species (conservation status)	Sites with best representation
Open habitats, short sward and bare ground	F112 open short sward	100	Unfavourable (eight species, 13 required)	Two (one SPI/VU; one DD)	Site 3 (five of eight qualifying species); site 2; site 1 (three of eight qualifying species).
Open habitats	F001 scrub edge	220	Unfavourable (five species, 11 required)	Two (one NS; 1 one Nb)	Site 7 (three of five qualifying species, including all NS/Nb species), site 3; site 4 (three of five qualifying species).
Open habitats	F003 scrub-heath and moorland	100	Unfavourable (four species, nine required)	None	Site 3 (two of four qualifying species).
Open habitats, short sward and bare ground	F111 bare sand and chalk	175	Unfavourable (four species, 19 required)	Two (1 SPI/EN; 1 NS)	Site 1 (All four qualifying species).
Tree- associated, decaying wood	A212 bark and sapwood decay	100	Unfavourable (two species, 19 required)	None	Site 6; site 7, (one qualifying species per site).
Open habitats, tall sward and scrub	F221 montane and upland	100	Unfavourable (one species, eight required)	None	Site 5 (one qualifying species).

MONA OFFSHORE WIND PROJECT

Table 1.7: Species of conservation concern recorded during field surveys.

Group (common name)	Species	Status	Distribution and habitat	Site number
Coleoptera: <i>Carabidae</i> (a ground beetle)	<i>Amara fulva</i>	Nationally Scarce (NS)	In a range of dry sandy or gravelly habitats including sand dunes, sand and gravel pits on lakeshores or the coast locally throughout Great Britain. In Wales scarce. Part of the F111 assemblage.	Site 1
Coleoptera: <i>Chrysomelidae</i> (a leaf beetle)	<i>Agelastica alni</i>	Data Deficient (DD) [Nationally Rare (NR)]	Considered extinct in Great Britain until recorded in northwest England in 2004 (Stenhouse, 2006), has subsequently spread and has now been recorded in several counties from the south of England north to the midlands. Associated with alder (<i>Alnus</i> spp.) and birch (<i>Betula</i> spp.) (Ramsay, 2009). First recorded in Wales in 2013 (Formstone, 2014) and is spreading. No longer NR.	Site 4, site 12 (recorded incidentally), site 6
Coleoptera: <i>Scarabaeidae</i> (a dung beetle)	<i>Bodiloides ictericus</i>	Nationally Scarce (NS)	Widespread in south and east England, scarce in Scotland and Wales.	Site 5
Diptera: <i>Asilidae</i> (a robber fly)	<i>Dioctria cothurnata</i>	Nationally Scarce (NS)	Disjunct distribution in north Scotland and in south England, also recorded from mid-Wales and the Welsh borders, mostly from wet woodland and margins, but also in saltmarsh grasslands and coastal sand dunes. Part of the F001 assemblage.	Site 7
Diptera: <i>Asilidae</i> (a robber fly)	<i>Leptarthrus vitripennis</i>	Nationally Rare (NR)	Locally on calcareous sites in the south of England, it has not previously been recorded in Wales. First recorded in Great Britain in 1996 but older records exist.	Site 4
Hemiptera: <i>Delphacidae</i> (a planthopper)	<i>Stiroma bicarinata</i>	Nationally Scarce (Nb)	Scattered but local throughout Great Britain, mainly in woodlands and woodland margins amongst taller grasses. Part of the F001 assemblage.	Site 7
Hemiptera: <i>Rhyparochromidae</i> (a seed bug)	<i>Drymus latus</i>	Nationally Scarce (Nb)	Predominantly recorded from south and east England, north to Yorkshire, where it is recorded from a variety of habitats with sparse vegetation and moss on both acid and calcareous soils. Very rare in Wales with only one previous record.	Site 3

MONA OFFSHORE WIND PROJECT

Group (common name)	Species	Status	Distribution and habitat	Site number
Lepidoptera: <i>Nymphalidae</i> (small heath butterfly)	<i>Coenonympha pamphilus</i>	Species of Principal Importance Vulnerable (VU)	In open habitats including grasslands, heathland, moorland. Larvae on a wide range of grasses including annual meadow grass <i>Poa annua</i> , sheep's fescue <i>Festuca ovina</i> , mat-grass <i>Nardus stricta</i> . Part of the F112 assemblage.	Site 2, site 3, site 4
Lepidoptera: <i>Nymphalidae</i> (grayling butterfly)	<i>Hipparchia semele</i>	Species of Principal Importance (SPI) Endangered (EN)	Widespread but declining around the coast of England, Wales and Scotland and increasingly rare inland. Requires short, open sparsely vegetated habitats where turf is broken or stony and can occur in range of habitats utilising different grasses dependent on habitat, including tufted hair-grass <i>Deschampsia cespitosa</i> , fescues <i>Festuca</i> spp. including sheep's fescue and red fescue <i>F. rubra</i> , early hair-grass <i>Aira praecox</i> , bristle bent <i>Agrostis curtisii</i> and marram grass <i>Ammophila arenaria</i> . Part of the F111 assemblage.	Site 1
Mollusca: <i>Hygromiidae</i> (a snail)	<i>Ceriuella virgata</i>	Data Deficient (DD)	Widespread in open calcareous habitats in south and east England, becoming coastal in west England, Wales and east Scotland. A second closely related species, <i>C. aginnica</i> has been recorded from southeast England and as the two species are difficult to separate a data deficient assessment has been applied. Part of the F112 assemblage.	Site 1

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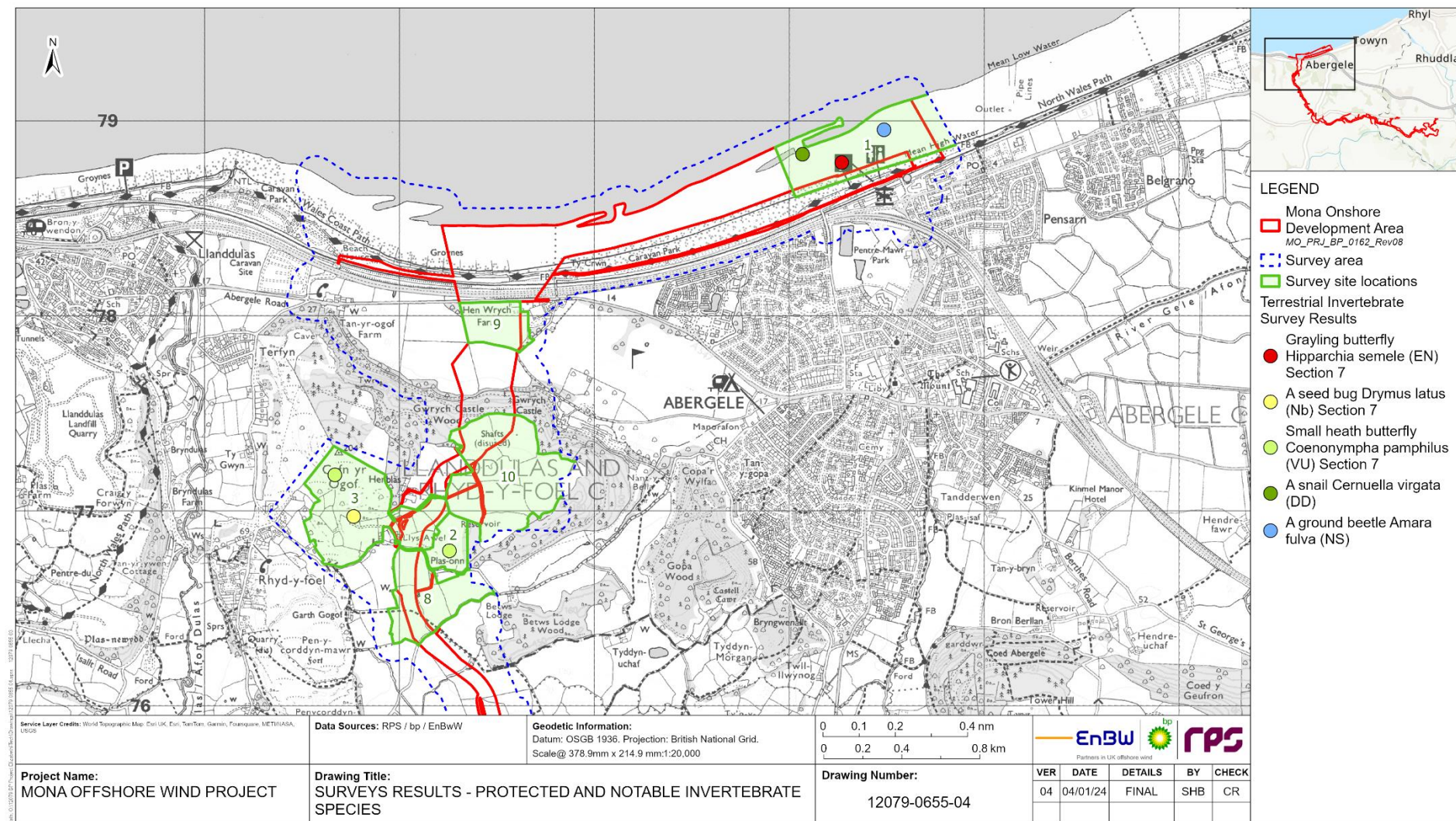


Figure 1.2: Protected and notable terrestrial invertebrate species (sheet 1).

MONA OFFSHORE WIND PROJECT

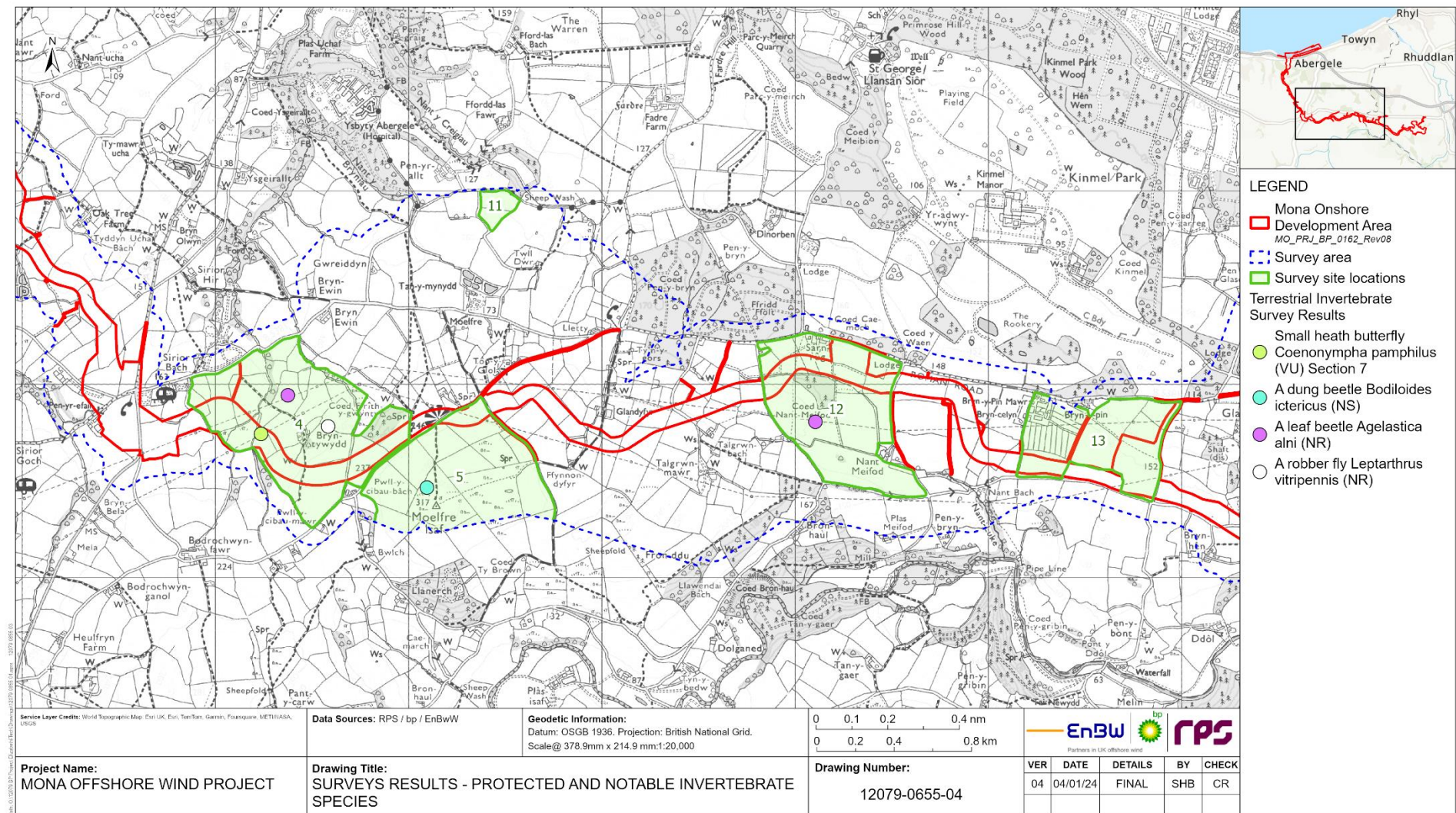


Figure 1.3: Protected and notable terrestrial invertebrate species (sheet 2).

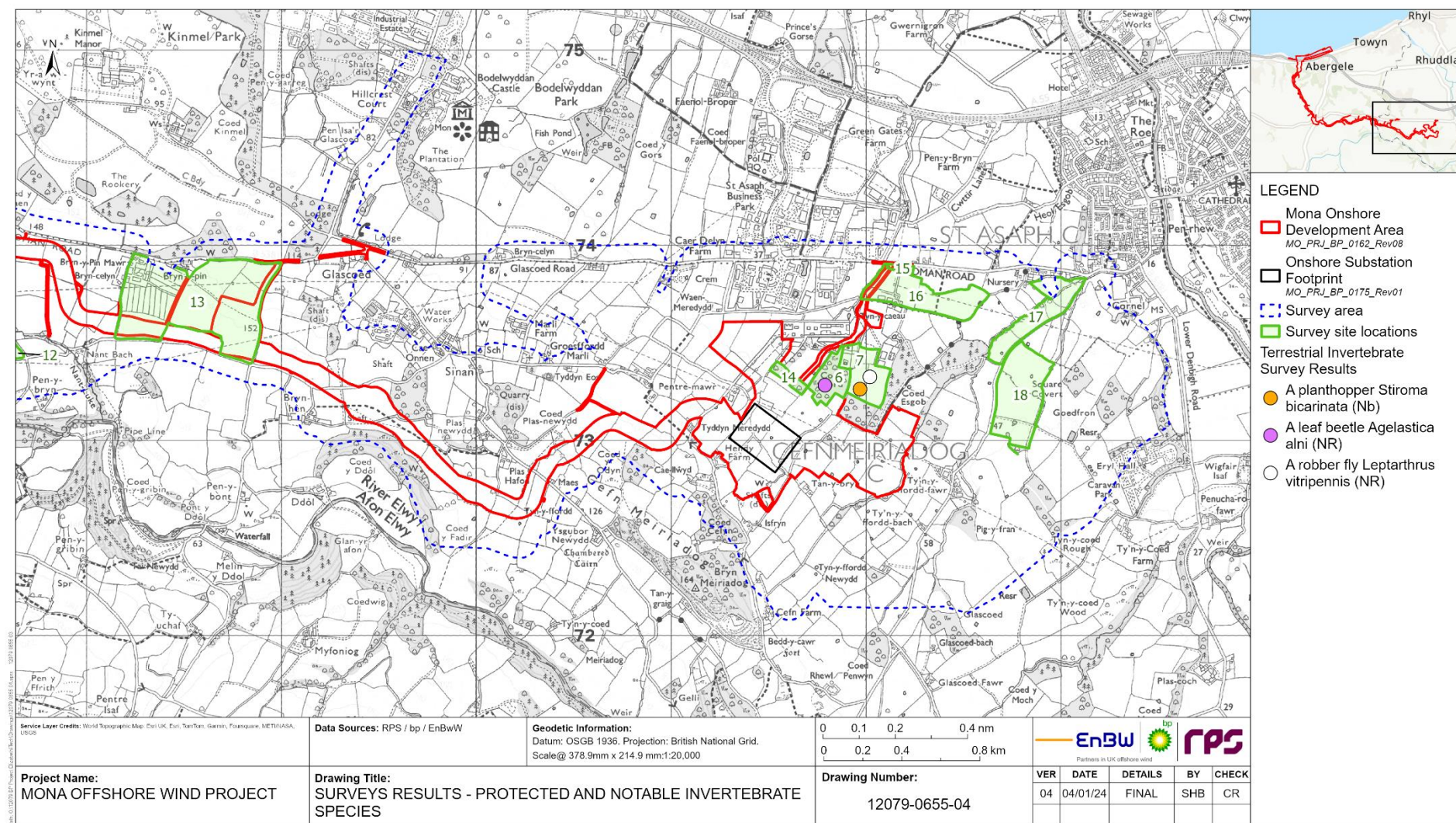
MONA OFFSHORE WIND PROJECT

Figure 1.4: Protected and notable terrestrial invertebrate species (sheet 3).

1.8 Summary

- 1.8.1.1 This technical report presents the results of the terrestrial invertebrate desk study and the field surveys undertaken to inform Volume 3: Chapter 3: Onshore ecology of the Environmental Statement.
- 1.8.1.2 The desk study confirmed that terrestrial invertebrates are widespread and common throughout Wales and that endangered or notable species could also be present throughout north Wales. A total of 19 notable terrestrial invertebrates species were identified comprising 29 records. These comprised six species of butterfly, 11 species of moth, one species of dragonfly and one species of weevil (weevil spotted bean). Of the 19 species, one was recorded within the Mona Onshore Development Area. This was a record of common darter, a dragonfly, located along the Conwy coast.
- 1.8.1.3 The extended phase 1 habitat survey data was used to identify 18 sites with potential for terrestrial invertebrates. Experienced and competent terrestrial invertebrate specialists surveyed the 18 sites assessing the type, extent and quality of the habitats and concluding if there was potential to support protected or notable species. Of the 18 sites, 14 were within the Mona Proposed Onshore Development Area and four were outside. Seven sites were subsequently scoped in for further terrestrial invertebrate assemblage surveys. All seven overlapped with the Mona Onshore Development Area. The remaining 11 sites were considered unsuitable and were scoped out.
- 1.8.1.4 The seven sites scoped in for further survey, sites 1 to 7, were subject to terrestrial invertebrate assemblage surveys in August 2023. A total of 10 species of conservation concern were recorded during field surveys, including two SPI species, the grayling butterfly (Endangered-(EN)) recorded from site 1 and the small heath butterfly (Vulnerable (VU)), recorded from three sites, sites 2, 3 and 4. The grayling butterfly and small heath butterfly have recently had their conservation status re-assessed (Fox *et al.*, 2022) and have been upgraded from previous status of Vulnerable (VU) and Near Threatened (NT) respectively due to continuing declines (Fox *et al.*, 2010). The grayling butterfly was recorded within the Mona Onshore Development Area in the north, along the Conwy coast. The small heath butterfly was also recorded within the Mona Onshore Development Area, at site 4, near Moelfre.
- 1.8.1.5 The Nationally Rare (NR) robber fly was recorded at site 4, at present, no other records can be found for this species in Wales. This species was located outside of the Mona Onshore Development Area, near Moelfre. Five Nationally Scarce (NS/Nb) species were also recorded at a range of Sites. These included the seed bug, recorded at site 3 outside of the Mona Onshore Development Area, to the north west. This is only the second record of this species in Wales. Other species included the ground beetle (recorded at site 1), the dung beetle (recorded at site 5), the robber fly (recorded at site 7), and the planthopper (also recorded at site 7). Of these species, the ground beetle was recorded within the Mona Onshore Development Area, near the Conwy coast. The planthopper and the robber fly were located just outside of the Mona Onshore Development Area, to the north of the Temporary Construction Compounds, north of the Onshore Substation. All other species were recorded outside of Mona Onshore Development Area.

MONA OFFSHORE WIND PROJECT

- 1.8.1.6 The leaf beetle (Data Deficient-DD/[NR]) was recorded at three sites, sites 4 and 6 and incidentally at site 12. Whilst the survey record for this species at site 6 was located outside of the Mona Onshore Development Area, it was recorded immediately north of the Temporary Construction Compounds, north of the Onshore Substation. The snail *Cerzuela virgata* (DD) was recorded in site 1, within the Mona Onshore Development Area. At least one species of conservation concern was recorded in each of the seven sites (1-7).
- 1.8.1.7 Two SATs had a high SQI of over 150, F111 bare sand and chalk assemblage, with an SQI of 175 represented at site 1, and F001 scrub edge assemblage, with a score of 220 represented at site 7. SQIs scores of 150 and above represent sites that could be of ecological value.
- 1.8.1.8 Of the seven sites subject to further terrestrial invertebrate assemblage surveys, 67 terrestrial invertebrate species were identified. Of the 67 species, 10 were identified as notable and include two SPI (one Endangered (EN) and one Vulnerable (VU)), one Nationally Rare (NR) species (one of which is new to Wales), five Nationally Rare species (with one species being the second record in Wales) and two Data Deficient (DD) species.

1.9 References

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Appendix A: Survey Data

ApX Table 1 below presents the findings of the site-specific surveys. The conservation status definitions are given in Appendix B. Species that have undergone changes in distribution or threat since publication of the relevant reviews (in Fox *et al.*, (2010), Foster (2010) and Fox *et al.* (2022)) are denoted by square brackets as their status is under review.

A.1.1 Raw data for Site 1

ApX Table 1: Raw data for Site 1.

Site number	Date	Site section (W=West; C=Central; E=East)	Sample type	Order	Family	Species	Conservation status
Site 1	16 August 2023	W,C	Hand search	<i>Coleoptera</i>	<i>Anthicidae</i>	<i>Notoxus monoceros</i>	
Site 1	16 August 2023	W,C	Hand search	<i>Coleoptera</i>	<i>Carabidae</i>	<i>Amara aenea</i>	
Site 1	16 August 2023	W,C	Hand search	<i>Coleoptera</i>	<i>Carabidae</i>	<i>Amara familiaris</i>	
Site 1	16 August 2023	E	Hand search	<i>Coleoptera</i>	<i>Carabidae</i>	<i>Amara fulva</i>	Nationally Scarce (NS)
Site 1	16 August 2023	E	Spot search	<i>Coleoptera</i>	<i>Carabidae</i>	<i>Pterostichus madidus</i>	
Site 1	16 August 2023	W,C	Hand search	<i>Coleoptera</i>	<i>Carabidae</i>	<i>Syntomus foveatus</i>	
Site 1	16 August 2023	E	Hand search	<i>Coleoptera</i>	<i>Coccinellidae</i>	<i>Coccinella 11-punctata</i>	
Site 1	16 August 2023	E	Hand search	<i>Coleoptera</i>	<i>Curculionidae</i>	<i>Otiorhynchus ovatus</i>	
Site 1	16 August 2023	E	Hand search	<i>Coleoptera</i>	<i>Curculionidae</i>	<i>Philopodon plagiatum</i>	

MONA OFFSHORE WIND PROJECT

Site number	Date	Site section (W=West; C=Central; E=East)	Sample type	Order	Family	Species	Conservation status
Site 1	16 August 2023	C	Hand search	<i>Coleoptera</i>	<i>Curculionidae</i>	<i>Sitona humeralis</i>	
Site 1	16 August 2023	W,C	Spot search	<i>Dermaptera</i>	<i>Forficulidae</i>	<i>Forficula auricularia</i>	
Site 1	16 August 2023	C	Spot search	<i>Diptera</i>	<i>Syrphidae</i>	<i>Eristalis tenax</i>	
Site 1	16 August 2023	E	Hand search	<i>Hemiptera</i>	<i>Berytidae</i>	<i>Gampsocoris punctipes</i>	
Site 1	16 August 2023	W,C,E	Hand search	<i>Hemiptera</i>	<i>Lygaeidae</i>	<i>Nysius ericae</i>	
Site 1	16 August 2023	C,E	Spot search	<i>Hemiptera</i>	<i>Pentatomidae</i>	<i>Dolycoris baccarum</i>	
Site 1	16 August 2023	E	Hand search	<i>Hemiptera</i>	<i>Rhyparochromidae</i>	<i>Drymus sylvaticus</i>	
Site 1	16 August 2023	W,E	Spot search	<i>Hymenoptera</i>	<i>Apidae</i>	<i>Bombus pascuorum</i>	
Site 1	16 August 2023	E	Spot search	<i>Lepidoptera</i>	<i>Lycaenidae</i>	<i>Lycaena phlaeas</i>	
Site 1	16 August 2023	W,C,E	Spot search	<i>Lepidoptera</i>	<i>Lycaenidae</i>	<i>Polyommatus icarus</i>	
Site 1	16 August 2023	E	Spot search	<i>Lepidoptera</i>	<i>Nymphalidae</i>	<i>Hipparchia semele</i>	Special of Principal Importance; Endangered (EN)
Site 1	16 August 2023	E	Spot search	<i>Lepidoptera</i>	<i>Zygaenidae</i>	<i>Zygaena filipendulae</i>	
Site 1	16 August 2023	W,C,E	Spot search	<i>Orthoptera</i>	<i>Acrididae</i>	<i>Chorthippus brunneus</i>	
Site 1	16 August 2023	W,E	Hand search	<i>Pulmonata</i>	<i>Cochlicellidae</i>	<i>Cochlicella acuta</i>	
Site 1	16 August 2023	E	Spot search	<i>Pulmonata</i>	<i>Helicidae</i>	<i>Cepaea nemoralis</i>	

MONA OFFSHORE WIND PROJECT

Site number	Date	Site section (W=West; C=Central; E=East)	Sample type	Order	Family	Species	Conservation status
Site 1	16 August 2023	E	Spot search	<i>Pulmonata</i>	<i>Helicidae</i>	<i>Cornu aspersum</i>	
Site 1	16 August 2023	W,C	Hand search	<i>Pulmonata</i>	<i>Hygromiidae</i>	<i>Cernuella virgata</i>	Data Deficient (DD)

A.1.2 Raw data for Site 2

Apx Table 2: Raw data for Site 2.

Site number	Date	Sample type	Order	Family	Species	Conservation status
Site 2	15 August 2023	Spot search	<i>Coleoptera</i>	<i>Carabidae</i>	<i>Amara aenea</i>	
Site 2	15 August 2023	Spot search	<i>Coleoptera</i>	<i>Carabidae</i>	<i>Harpalus rufipes</i>	
Site 2	15 August 2023	Spot search	<i>Coleoptera</i>	<i>Coccinellidae</i>	<i>Coccinella 7-punctata</i>	
Site 2	15 August 2023	Spot search	<i>Dermaptera</i>	<i>Forficulidae</i>	<i>Forficula auricularia</i>	
Site 2	15 August 2023	Spot search	<i>Diptera</i>	<i>Muscidae</i>	<i>Mesembrina meridiana</i>	
Site 2	15 August 2023	Spot search	<i>Diptera</i>	<i>Syrphidae</i>	<i>Eristalis tenax</i>	
Site 2	15 August 2023	Spot search	<i>Hymenoptera</i>	<i>Formicidae</i>	<i>Lasius flavus</i>	
Site 2	15 August 2023	Spot search	<i>Lepidoptera</i>	<i>Lycaenidae</i>	<i>Arícia agestis</i>	
Site 2	15 August 2023	Spot search	<i>Lepidoptera</i>	<i>Lycaenidae</i>	<i>Polyommatus icarus</i>	
Site 2	15 August 2023	Spot search	<i>Lepidoptera</i>	<i>Nymphalidae</i>	<i>Coenonympha pamphilus</i>	Special of Principal Importance (SPI), Vulnerable (VU)

MONA OFFSHORE WIND PROJECT

Site number	Date	Sample type	Order	Family	Species	Conservation status
Site 2	15 August 2023	Spot search	<i>Lepidoptera</i>	<i>Nymphalidae</i>	<i>Maniola jurtina</i>	
Site 2	15 August 2023	Spot search	<i>Lepidoptera</i>	<i>Nymphalidae</i>	<i>Pyronia tithonus</i>	
Site 2	15 August 2023	Spot search	<i>Lepidoptera</i>	<i>Nymphalidae</i>	<i>Vanessa atalanta</i>	
Site 2	15 August 2023	Spot search	<i>Orthoptera</i>	<i>Acrididae</i>	<i>Chorthippus brunneus</i>	
Site 2	15 August 2023	Spot search	<i>Pulmonata</i>	<i>Limacidae</i>	<i>Limax maximus</i>	

A.1.3 Raw data for Site 3

ApX Table 3: Raw data for Site 3.

Site number	Date	Sample type	Order	Family	Species	Conservation status
Site 3	16 August 2023	Spot search	Araneae	Araneidae	<i>Araneus diadematus</i>	
Site 3	16 August 2023	Spot search/Hand search	Coleoptera	Carabidae	<i>Amara aenea</i>	
Site 3	16 August 2023	Spot search	Coleoptera	Carabidae	<i>Carabus problematicus</i>	
Site 3	16 August 2023	Spot search	Coleoptera	Carabidae	<i>Pterostichus madidus</i>	
Site 3	16 August 2023	Spot search/Hand search	Coleoptera	Chrysomelidae	<i>Cryptocephalus fulvus</i>	
Site 3	16 August 2023	Spot search/Hand search	Coleoptera	Curculionidae	<i>Sitona lineatus</i>	
Site 3	16 August 2023	Spot search/Hand search	Coleoptera	Staphylinidae	<i>Ocypus brunnipes</i>	

MONA OFFSHORE WIND PROJECT

Site number	Date	Sample type	Order	Family	Species	Conservation status
Site 3	16 August 2023	Spot search	Dermaptera	Forficulidae	<i>Forficula auricularia</i>	
Site 3	16 August 2023	Spot search/Hand search	Diptera	Asilidae	<i>Machimus atricapillus</i>	
Site 3	16 August 2023	Spot search/Hand search	Diptera	Syrphidae	<i>Ferdinandea cuprea</i>	
Site 3	16 August 2023	Spot search/Hand search	Hemiptera	Coreidae	<i>Coriomeris denticulatus</i>	
Site 3	16 August 2023	Spot search/Hand search	Hemiptera	Lygaeidae	<i>Nysius ericae</i>	
Site 3	16 August 2023	Spot search/Hand search	Hemiptera	Nabidae	<i>Himacerus mirmicoides</i>	
Site 3	16 August 2023	Spot search	Hemiptera	Pentatomidae	<i>Dolycoris baccarum</i>	
Site 3	16 August 2023	Spot search	Hemiptera	Pentatomidae	<i>Piezodorus lituratus</i>	
Site 3	16 August 2023	Spot search/Hand search	Hemiptera	Rhyparochromidae	<i>Drymus latus</i>	Nationally Scarce (Nb)
Site 3	16 August 2023	Spot search/Hand search	Hemiptera	Rhyparochromidae	<i>Megalonotus chiragra</i>	
Site 3	16 August 2023	Spot search	Hymenoptera	Apidae	<i>Apis mellifera</i>	
Site 3	16 August 2023	Spot search	Hymenoptera	Formicidae	<i>Lasius flavus</i>	
Site 3	16 August 2023	Spot search	Lepidoptera	Lycaenidae	<i>Aricia agestis</i>	
Site 3	16 August 2023	Spot search	Lepidoptera	Lycaenidae	<i>Celastrina argiolus</i>	
Site 3	16 August 2023	Spot search	Lepidoptera	Lycaenidae	<i>Polyommatus icarus</i>	
Site 3	16 August 2023	Spot search	Lepidoptera	Nymphalidae	<i>Coenonympha pamphilus</i>	Species of Principal Importance (SPI), Vulnerable (VU)

MONA OFFSHORE WIND PROJECT

Site number	Date	Sample type	Order	Family	Species	Conservation status
Site 3	16 August 2023	Spot search	Lepidoptera	Nymphalidae	<i>Maniola jurtina</i>	
Site 3	16 August 2023	Spot search	Lepidoptera	Nymphalidae	<i>Pararge aegeria</i>	
Site 3	16 August 2023	Spot search	Lepidoptera	Nymphalidae	<i>Polygonia c-album</i>	
Site 3	16 August 2023	Spot search	Lepidoptera	Nymphalidae	<i>Pyronia tithonus</i>	
Site 3	16 August 2023	Spot search	Orthoptera	Acrididae	<i>Chorthippus brunneus</i>	
Site 3	16 August 2023	Spot search	Orthoptera	Acrididae	<i>Myrmeleotettix maculatus</i>	
Site 3	16 August 2023	Spot search	Orthoptera	Acrididae	<i>Omocestus viridulus</i>	
Site 3	16 August 2023	Spot search/Hand search	Stylommatophora	Geomitridae	<i>Xeroplexa intersecta</i>	

A.1.4 Raw data for Site 4

ApX Table 4: Raw data for Site 4.

Site number	Date	Sample type	Order	Family	Species	Conservation status
Site 4	17 August 2023	Spot search	Coleoptera	Chrysomelidae	<i>Agelastica alni</i>	Data Deficient [NR]
Site 4	17 August 2023	Spot search	Coleoptera	Scarabaeidae	<i>Onthophagus coenobita</i>	
Site 4	17 August 2023	Spot search	Dermoptera	Forficulidae	<i>Forficula auricularia</i>	
Site 4	17 August 2023	Spot search	Diptera	Asilidae	<i>Leptarthrus vitripennis</i>	Nationally Rare (NR)

MONA OFFSHORE WIND PROJECT

Site number	Date	Sample type	Order	Family	Species	Conservation status
Site 4	17 August 2023	Spot search	Diptera	Muscidae	<i>Mesembrina meridiana</i>	
Site 4	17 August 2023	Spot search	Diptera	Scathophagidae	<i>Scathophaga stercoraria</i>	
Site 4	17 August 2023	Spot search	Diptera	Syrphidae	<i>Eristalis tenax</i>	
Site 4	17 August 2023	Spot search	Hemiptera	Acanthosomatidae	<i>Acanthosoma haemorrhoidale</i>	
Site 4	17 August 2023	Sweep netting	Hemiptera	Aphrophoridae	<i>Neophilaenus lineatus</i>	
Site 4	17 August 2023	Sweep netting	Hemiptera	Aphrophoridae	<i>Philaenus spumarius</i>	
Site 4	17 August 2023	Spot search	Hemiptera	Cymidae	<i>Cymus melanocephalus</i>	
Site 4	17 August 2023	Sweep netting	Hemiptera	Delphacidae	<i>Conomelus anceps</i>	
Site 4	17 August 2023	Spot search	Hemiptera	Miridae	<i>Orthops campestris</i>	
Site 4	17 August 2023	Spot search	Hemiptera	Miridae	<i>Plagiognathus chrysanthemi</i>	
Site 4	17 August 2023	Spot search	Hemiptera	Pentatomidae	<i>Dolycoris baccarum</i>	
Site 4	17 August 2023	Spot search	Hemiptera	Pentatomidae	<i>Piezodorus lituratus</i>	
Site 4	17 August 2023	Spot search	Hymenoptera	Apidae	<i>Bombus hortorum</i>	
Site 4	17 August 2023	Spot search	Hymenoptera	Apidae	<i>Bombus pascuorum</i>	
Site 4	17 August 2023	Spot search	Lepidoptera	Lycaenidae	<i>Celastrina argiolus</i>	
Site 4	17 August 2023	Spot search	Lepidoptera	Lycaenidae	<i>Lycaena phlaeas</i>	
Site 4	17 August 2023	Spot search	Lepidoptera	Nymphalidae	<i>Aglais io</i>	

MONA OFFSHORE WIND PROJECT

Site number	Date	Sample type	Order	Family	Species	Conservation status
Site 4	17 August 2023	Spot search	Lepidoptera	Nymphalidae	<i>Coenonympha pamphilus</i>	Species of Principal Importance (SPI), Vulnerable (VU)
Site 4	17 August 2023	Spot search	Lepidoptera	Nymphalidae	<i>Maniola jurtina</i>	
Site 4	17 August 2023	Spot search	Lepidoptera	Nymphalidae	<i>Pararge aegeria</i>	
Site 4	17 August 2023	Spot search	Lepidoptera	Nymphalidae	<i>Pyronia tithonus</i>	
Site 4	17 August 2023	Spot search	Odonata	Aeshnidae	<i>Aeshna cyanea</i>	
Site 4	17 August 2023	Sweep netting	Opiliones	Phalangidae	<i>Leiobunum rotundum</i>	
Site 4	17 August 2023	Spot search	Opiliones	Phalangidae	<i>Phalangium opilio</i>	
Site 4	17 August 2023	Spot search	Orthoptera	Acrididae	<i>Chorthippus brunneus</i>	
Site 4	17 August 2023	Spot search	Orthoptera	Acrididae	<i>Omocestus viridulus</i>	
Site 4	17 August 2023	Spot search	Orthoptera	Acrididae	<i>Pseudochorthippus parallelus</i>	

A.1.5 Raw data for Site 5

ApX Table 5: Raw data for Site 5.

Site number	Date	Sample type	Order	Family	Species	Conservation status
Site 5	16 August 2023	Spot search	Araneae	Araneidae	<i>Araneus diadematus</i>	
Site 5	17 August 2023	Hand search	Coleoptera	Carabidae	<i>Calathus melanocephalus</i>	
Site 5	17 August 2023	Spot search	Coleoptera	Carabidae	<i>Pterostichus madidus</i>	

MONA OFFSHORE WIND PROJECT

Site 5	17 August 2023	Hand search	Coleoptera	Scarabaeidae	<i>Acrossus rufipes</i>	
Site 5	17 August 2023	Hand search	Coleoptera	Scarabaeidae	<i>Agoliinus lapponum</i>	
Site 5	17 August 2023	Hand search	Coleoptera	Scarabaeidae	<i>Bodiloides ictericus</i>	Nationally Scarce (NS)
Site 5	17 August 2023	Spot search	Coleoptera	Staphylinidae	<i>Ocypus aeneocephalus</i>	
Site 5	17 August 2023	Spot search	Diptera	Muscidae	<i>Mesembrina meridiana</i>	
Site 5	17 August 2023	Spot search	Diptera	Syrphidae	<i>Eristalis tenax</i>	
Site 5	17 August 2023	Spot search	Hymenoptera	Apidae	<i>Apis mellifera</i>	
Site 5	16 August 2023	Spot search	Lepidoptera	Nymphalidae	<i>Pyronia tithonus</i>	
Site 5	17 August 2023	Spot search	Orthoptera	Acrididae	<i>Chorthippus brunneus</i>	

A.1.6 Raw data for Site 6

Apx Table 6: Raw data for Site 6.

Site number	Date	Sample type	Order	Family	Species	Conservation status
Site 6	14 August 2023	Hand search	Coleoptera	Carabidae	<i>Abax parallelepipedus</i>	
Site 6	14 August 2023	Hand search	Coleoptera	Carabidae	<i>Leistus rufomarginatus</i>	
Site 6	14 August 2023	Hand search	Coleoptera	Carabidae	<i>Nebria brevicollis</i>	
Site 6	14 August 2023	Hand search	Coleoptera	Carabidae	<i>Pterostichus madidus</i>	
Site 6	14 August 2023	Hand search	Coleoptera	Chrysomelidae	<i>Agelastica alni</i>	Data Deficient (DD) [NR]

MONA OFFSHORE WIND PROJECT

Site number	Date	Sample type	Order	Family	Species	Conservation status
Site 6	14 August 2023	Hand search	Coleoptera	Curculionidae	<i>Hylesinus crenatus</i>	
Site 6	14 August 2023	Hand search	Coleoptera	Ptinidae	<i>Anobium</i> spp.	Nationally Scarce (NS)
Site 6	14 August 2023	Hand search	Coleoptera	Staphylinidae	<i>Ocypus olens</i>	
Site 6	14 August 2023	Hand search	Coleoptera	Staphylinidae	<i>Tasgius morsitans</i>	
Site 6	14 August 2023	Hand search	Hymenoptera	Apidae	<i>Bombus terrestris</i>	
Site 6	14 August 2023	Hand search	Pulmonata	Limacidae	<i>Limax maximus</i>	

A.1.7 Raw data for Site 7

Apx Table 7: Raw data for Site 7.

Site number	Date	Sample type	Order	Family	Species	Conservation status
Site 7	18 August 2023	Spot search	Araneae	Thomisidae	<i>Xysticus cristatus</i>	
Site 7	18 August 2023	Spot search	Coleoptera	Chrysomelidae	<i>Altica lythri</i>	
Site 7	18 August 2023	Spot search	Coleoptera	Coccinellidae	<i>Coccidula rufa</i>	
Site 7	18 August 2023	Spot search	Coleoptera	Coccinellidae	<i>Propylea 14-punctata</i>	
Site 7	18 August 2023	Spot search	Coleoptera	Curculionidae	<i>Hylesinus crenatus</i>	
Site 7	18 August 2023	Spot search	Dermaptera	Forficulidae	<i>Forficula auricularia</i>	
Site 7	18 August 2023	Spot search	Diptera	Asilidae	<i>Dioctria cothurnata</i>	Nationally Scarce NS
Site 7	18 August 2023	Spot search	Diptera	Syrphidae	<i>Eristalis tenax</i>	
Site 7	18 August 2023	Spot search	Diptera	Syrphidae	<i>Eristalis tenax</i>	

MONA OFFSHORE WIND PROJECT

Site number	Date	Sample type	Order	Family	Species	Conservation status
Site 7	18 August 2023	Spot search	Hemiptera	Aphrophoridae	<i>Neophilaenus lineatus</i>	
Site 7	18 August 2023	Spot search	Hemiptera	Aphrophoridae	<i>Philaenus spumarius</i>	
Site 7	18 August 2023	Spot search	Hemiptera	Arthenidae	<i>Chilacis typhae</i>	
Site 7	18 August 2023	Spot search	Hemiptera	Cicadellidae	<i>Arthaldeus pascuellus</i>	
Site 7	18 August 2023	Spot search	Hemiptera	Cicadellidae	<i>Cicadella viridis</i>	
Site 7	18 August 2023	Spot search	Hemiptera	Cicadellidae	<i>Euscelis incisus</i>	
Site 7	18 August 2023	Spot search	Hemiptera	Cymidae	<i>Cymus melanocephalus</i>	
Site 7	18 August 2023	Spot search	Hemiptera	Delphacidae	<i>Stiroma bicarinata</i>	Nationally Scarce (Nb)
Site 7	18 August 2023	Spot search	Hemiptera	Miridae	<i>Liocoris tripustulatus</i>	
Site 7	18 August 2023	Spot search	Hemiptera	Miridae	<i>Notostira elongata</i>	
Site 7	18 August 2023	Spot search	Hemiptera	Miridae	<i>Stenodema calcarata</i>	
Site 7	18 August 2023	Spot search	Hemiptera	Miridae	<i>Stenodema laevigata</i>	
Site 7	18 August 2023	Spot search	Hemiptera	Nabidae	<i>Nabis lineatus</i>	
Site 7	18 August 2023	Spot search	Hemiptera	Pentatomidae	<i>Aelia acuminata</i>	
Site 7	18 August 2023	Spot search	Hemiptera	Pentatomidae	<i>Dolycoris baccarum</i>	
Site 7	18 August 2023	Spot search	Hemiptera	Pentatomidae	<i>Palomena prasina</i>	
Site 7	18 August 2023	Spot search	Hymenoptera	Apidae	<i>Apis mellifera</i>	
Site 7	18 August 2023	Spot search	Hymenoptera	Apidae	<i>Bombus lucorum</i>	
Site 7	18 August 2023	Spot search	Lepidoptera	Nymphalidae	<i>Maniola jurtina</i>	
Site 7	18 August 2023	Spot search	Lepidoptera	Nymphalidae	<i>Pyronia tithonus</i>	

MONA OFFSHORE WIND PROJECT

Site number	Date	Sample type	Order	Family	Species	Conservation status
Site 7	18 August 2023	Spot search	Lepidoptera	Pieridae	<i>Pieris napi</i>	
Site 7	18 August 2023	Spot search	Odonata	Libellulidae	<i>Sympetrum striolatum</i>	
Site 7	18 August 2023	Spot search	Orthoptera	Acrididae	<i>Chorthippus brunneus</i>	
Site 7	18 August 2023	Spot search	Orthoptera	Acrididae	<i>Pseudochorthippus parallelus</i>	

MONA OFFSHORE WIND PROJECT

A.1.8 Incidental species recorded from Sites scoped out from further surveys

Apx Table 8: Incidental species recorded from Sites scoped out from further surveys.

Site number	Date	Sample type	Order	Family	Species	Conservation status
Site 7	15 August 2023	Spot search	<i>Coleoptera</i>	<i>Coccinellidae</i>	<i>Coccinella 7-punctata</i>	
Site 7	15 August 2023	Spot search	<i>Coleoptera</i>	<i>Pyrochroidae</i>	<i>Pyrochroa serraticornis</i>	
Site 7	15 August 2023	Spot search	<i>Diptera</i>	<i>Syrphidae</i>	<i>Episyrphus balteatus</i>	
Site 7	15 August 2023	Spot search	<i>Diptera</i>	<i>Syrphidae</i>	<i>Eristalis tenax</i>	
Site 7	15 August 2023	Spot search	<i>Diptera</i>	<i>Muscidae</i>	<i>Mesembrina meridiana</i>	
Site 7	15 August 2023	Spot search	<i>Diptera</i>	<i>Scathophagidae</i>	<i>Scathophaga stercoraria</i>	
Site 7	15 August 2023	Spot search	<i>Diptera</i>	<i>Syrphidae</i>	<i>Syrpita pipiens</i>	
Site 7	15 August 2023	Spot search	<i>Diptera</i>	<i>Syrphidae</i>	<i>Syrphus ribesii</i>	
Site 7	15 August 2023	Spot search	<i>Hemiptera</i>	<i>Pentatomidae</i>	<i>Dolycoris baccarum</i>	
Site 7	15 August 2023	Spot search	<i>Hemiptera</i>	<i>Pentatomidae</i>	<i>Palomena prasina</i>	
Site 7	15 August 2023	Spot search	<i>Hymenoptera</i>	<i>Apidae</i>	<i>Bombus hortorum</i>	
Site 7	15 August 2023	Spot search	<i>Hymenoptera</i>	<i>Apidae</i>	<i>Bombus lucorum</i>	
Site 7	15 August 2023	Spot search	<i>Hymenoptera</i>	<i>Apidae</i>	<i>Bombus pascuorum</i>	
Site 7	15 August 2023	Spot search	<i>Hymenoptera</i>	<i>Cynipidae</i>	<i>Diplolepis rosae</i>	
Site 7	15 August 2023	Spot search	<i>Lepidoptera</i>	<i>Noctuidae</i>	<i>Autographa gamma</i>	
Site 7	15 August 2023	Spot search	<i>Lepidoptera</i>	<i>Nymphalidae</i>	<i>Maniola jurtina</i>	
Site 7	15 August 2023	Spot search	<i>Lepidoptera</i>	<i>Nymphalidae</i>	<i>Pararge aegeria</i>	

MONA OFFSHORE WIND PROJECT

Site number	Date	Sample type	Order	Family	Species	Conservation status
Site 7	15 August 2023	Spot search	<i>Lepidoptera</i>	<i>Pieridae</i>	<i>Pieris napi</i>	
Site 7	15 August 2023	Spot search	<i>Orthoptera</i>	<i>Acrididae</i>	<i>Chorthippus brunneus</i>	
Site 7	15 August 2023	Spot search	<i>Orthoptera</i>	<i>Acrididae</i>	<i>Pseudochorthippus parallelus</i>	
Site 7	15 August 2023	Spot search	<i>Lepidoptera</i>	<i>Nymphalidae</i>	<i>Maniola jurtina</i>	
Site 7	14 August 2023	Spot search	<i>Hemiptera</i>	<i>Miridae</i>	<i>Closterotomus norwegicus</i>	
Site 7	14 August 2023	Spot search	<i>Hymenoptera</i>	<i>Apidae</i>	<i>Apis mellifera</i>	
Site 7	14 August 2023	Spot search	<i>Lepidoptera</i>	<i>Lycaenidae</i>	<i>Polyommatus icarus</i>	
Site 7	15 August 2023	Spot search	<i>Coleoptera</i>	<i>Chrysomelidae</i>	<i>Agelastica alni</i>	Dat Deficient (DD) [NR]
Site 7	15 August 2023	Spot search/Sweep netting	<i>Diptera</i>	<i>Muscidae</i>	<i>Mesembrina meridiana</i>	
Site 7	15 August 2023	Spot search/Sweep netting	<i>Diptera</i>	<i>Syrphidae</i>	<i>Eristalis tenax</i>	
Site 7	15 August 2023	Spot search/Sweep netting	<i>Hemiptera</i>	<i>Miridae</i>	<i>Dicyphus epilobii</i>	
Site 7	15 August 2023	Spot search/Sweep netting	<i>Hemiptera</i>	<i>Miridae</i>	<i>Orthops campestris</i>	
Site 7	15 August 2023	Spot search/Sweep netting	<i>Hemiptera</i>	<i>Pentatomidae</i>	<i>Palomena prasina</i>	
Site 7	15 August 2023	Spot search/Sweep netting	<i>Hymenoptera</i>	<i>Apidae</i>	<i>Apis mellifera</i>	
Site 7	15 August 2023	Spot search/Sweep netting	<i>Hymenoptera</i>	<i>Apidae</i>	<i>Bombus hortorum</i>	

MONA OFFSHORE WIND PROJECT

Site number	Date	Sample type	Order	Family	Species	Conservation status
Site 7	15 August 2023	Spot search/Sweep netting	<i>Hymenoptera</i>	<i>Apidae</i>	<i>Bombus pascuorum</i>	
Site 7	15 August 2023	Spot search	<i>Lepidoptera</i>	<i>Geometridae</i>	<i>Abraxas grossulariata</i>	
Site 7	15 August 2023	Spot search/Sweep netting	<i>Lepidoptera</i>	<i>Nymphalidae</i>	<i>Pyronia tithonus</i>	
Site 7	17 August 2023	Spot search	<i>Diptera</i>	<i>Tipulidae</i>	<i>Tipula paludosa</i>	
Site 7	14 August 2023	Spot search	<i>Coleoptera</i>	<i>Staphylinidae</i>	<i>Tasgius morsitans</i>	
Site 7	14 August 2023	Spot search	<i>Diptera</i>	<i>Syrphidae</i>	<i>Eristalis tenax</i>	
Site 7	14 August 2023	Spot search	<i>Diptera</i>	<i>Tachinidae</i>	<i>Tachina fera</i>	
Site 7	14 August 2023	Spot search	<i>Hemiptera</i>	<i>Miridae</i>	<i>Orthops campestris</i>	
Site 7	14 August 2023	Spot search	<i>Lepidoptera</i>	<i>Nymphalidae</i>	<i>Maniola jurtina</i>	
Site 7	14 August 2023	Spot search	<i>Lepidoptera</i>	<i>Nymphalidae</i>	<i>Pyronia tithonus</i>	
Site 7	14 August 2023	Spot search	<i>Lepidoptera</i>	<i>Pieridae</i>	<i>Pieris napi</i>	
Site 7	14 August 2023	Spot search	<i>Coleoptera</i>	<i>Carabidae</i>	<i>Philorhizus melanocephalus</i>	
Site 7	18 August 2023	Spot search	<i>Coleoptera</i>	<i>Chrysomelidae</i>	<i>Altica lythri</i>	
Site 7	18 August 2023	Spot search	<i>Hemiptera</i>	<i>Miridae</i>	<i>Liocoris tripustulatus</i>	
Site 7	18 August 2023	Spot search	<i>Hymenoptera</i>	<i>Apidae</i>	<i>Apis mellifera</i>	
Site 7	18 August 2023	Spot search	<i>Lepidoptera</i>	<i>Pieridae</i>	<i>Pieris napi</i>	

Appendix B: Invertebrate conservation criteria

Certain species of invertebrate are rare or scarce in Great Britain, and until relatively recently an assessment of rarity was based on occupancy at a 10 km square level. More recent assessments, however, are based on the degree of threat and vulnerability to extinction (International Union for Conservation of Nature (IUCN), 2001). Due to difficulties with assessing population sizes of invertebrates and specific evidence of decline, the majority of recent invertebrate species status reviews (e.g. Foster, 2010) have focused on Area of Occupancy to assess status within Great Britain. Only some invertebrate groups have been reassessed under IUCN (2001) criteria, and so until such time as reassessment is complete both systems are currently in use. The category definitions currently in use are shown in the Apx Table 9 below.

Apx Table 9: Invertebrate conservation criteria, abbreviations and definitions.

Criteria	Abbreviation	Category	Definition
Pre IUCN (2001)	N	Notable/Nationally Scarce	Species which are not in a Red Data Book (RDB) category but occurring in only 100 10 km squares in Great Britain.
Pre IUCN (2001)	Nb	Notable B/Nationally Scarce	Species which are not in an RDB category but occurring in between 31 and 100 10 km squares in Great Britain.
Pre IUCN (2001)	Na	Notable A/Nationally Scarce	Species which are not in an RDB category but occurring in less than 30 10 km squares in Great Britain.
Pre IUCN (2001)	RDBK	Red Data Book K: Insufficiently Known	Species suspected of falling within a RDB category but lacking sufficient information to be certain. Species may be cryptic, newly discovered, under recorded, difficult to identify or be present in poorly worked habitats. Species may be native or have been accidentally introduced.
Pre IUCN (2001)	RDB3	Red Data Book 3: Rare	Species with small populations not RDB2 or RDB1, with restricted geographic or habitat occurrence in Great Britain or thinly scattered across range.
Pre IUCN (2001)	RDB2	Red Data Book 2: Vulnerable	Species which are rare and are declining or in vulnerable habitats.

MONA OFFSHORE WIND PROJECT

Criteria	Abbreviation	Category	Definition
Pre IUCN (2001)	RDB1	Red Data Book 1: Endangered	Species restricted to a single Site within one 10 km square in Great Britain, or only occurring in vulnerable habitats with evidence of a rapid and continuous decline or potentially extinct but have been recorded within last 100 years.
Pre IUCN (2001)	RDB-App	Red Data Book- Appendix: Extinct	Species which are considered to be extinct in Great Britain.
IUCN (2001)	NS	Nationally Scarce	A native species recorded from between 16 and 100 hectares of the Ordnance Survey national grid in Great Britain since 1990, and there is reasonable confidence that exhaustive recording would not find them in more than 100 hectares, and it occurs as a breeding species within each of these hectares. Not a category of threat. Recent reassessments of some poorly known groups have included pNS to denote provisional status.
IUCN (2001)	NR	Nationally Rare	A native species recorded from between 1 and 15 hectares of the Ordnance Survey national grid in Great Britain since 1990, and there is reasonable confidence that exhaustive recording would not find them in more than 15 hectares, and occurring as a breeding species within each of these hectares. This category includes species that are possibly extinct. Not a category of threat.
IUCN (2001)	NT	Near Threatened	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. Recent reassessments of some poorly known groups have included pNT to denote provisional status.
IUCN (2001)	VU	Vulnerable	Area of Occupancy <2,000 km ² + two of the following: severely fragmented or no more than 10 locations; continuing decline; extreme fluctuations. Recorded from <2,000 km ² is equivalent to being present in five to ten hectares from 1980 onwards or from a later specified date if the species has been subject to a special survey of its status since 1980.
IUCN (2001)	EN	Endangered	Area of occupancy <500 km ² + two of the following: severely fragmented or no more than 5 locations; continuing decline; extreme fluctuations. Recorded from <500 km ² ; is equivalent to being recorded in at least two locations and up to five hectares from 1980 onwards or from a later specified date if the species has been subject to a special survey of its status since 1980.

MONA OFFSHORE WIND PROJECT

Criteria	Abbreviation	Category	Definition
IUCN (2001)	CR	Critically Endangered	Area of occupancy <10 km ² + two of the following: -severely fragmented or only a single location; continuing decline; extreme fluctuations. Recorded from <10 km ² ; is equivalent to being recorded at a single location from 1980 onwards or from a later specified date if the species has been subject to a special survey of its status since 1980.