HORIZON NUCLEAR POWER

WYLFA NEWYDD

ENERGY WORKING FOR BRITAIN

Wylfa Newydd Project

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Wylfa Newydd Project

Horizon Nuclear Power (Wylfa) Ltd

Terrestrial Invertebrate Technical Summary Report

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Contents

Executive Summary

Horizon Nuclear Power Wylfa Ltd. (Horizon) is currently planning to develop a new nuclear power station on Anglesey (the Wylfa Newydd Generating Station) as identified in the National Policy Statement for Nuclear Power Generation (EN-6). The Wylfa Newydd Project (the Project) will require a number of applications to be made under different legislation to different regulators. Jacobs UK Ltd (Jacobs) was commissioned to collect baseline data to inform the various applications, assessments and permits that will be submitted for approval to construct and operate the Wylfa Newydd Generating Station.

Terrestrial invertebrates were identified as a potentially significant ecological receptor that could be affected by the Wylfa Newydd Project. Baseline data was therefore required from surveys and a review of background information sources.

The study area has been surveyed for invertebrates over a period of four years (2011 to 2014) using a wide variety of different survey methods, including a background data search of records within a 2.5km radius. The amount of data available is therefore considered to be sufficient to inform an accurate impact assessment for the Project.

Survey data from 17 different sites within the study area recorded a total of 717 species, 88 of which are notable (i.e. species listed on Section 42 of the Natural Environment and Rural Communities Act (NERC) or species that are classified as nationally 'rare' or 'scarce'). This ratio gives a site quality index (SQI) score of 5.3, making it unlikely that it is a site of high conservation value to invertebrates. However, the score does indicate a good diversity overall.

The background data search returned fewer species than were recorded during the field surveys (536 species) and fewer notable species (75). This has been attributed to the detailed level of field survey effort and is highlighted by the low number (10) of notable species that occur in both the data search and survey data. This also suggests that there is very limited value in comparing the data from background information with survey data in great detail.

Four species were found during field surveys that are listed on Section 42 of the NERC Act. Records of these species were also returned in the background data search. The four species are: grayling butterfly *Hipparchia semele*, small heath butterfly *Coenonympha pamphilus*, wall butterfly *Lasiommata merger* and cinnabar moth *Tyria jacobaeae*. The habitats most valuable to these species are flowering shrubs and species-rich grassland. Improved areas of grassland containing ragwort *Senecio jacobaea* are also important for the cinnabar moth. In addition to these habitats the results strongly suggest that wetter habitats support the greatest diversity and the highest number of invertebrate species.

The data suggests that it is not appropriate for any species-specific assessment to be carried out to determine the potential effects of the Project. It is recommended that a habitat scale approach is adopted for the impact assessment that would calculate potential impacts on habitats and the likely associated invertebrate assemblages that they might support. This approach will facilitate the development of simple metrics that can be used to quantify impacts more effectively than focussing down to specific family, genus or species level. It is considered likely that using metrics for mitigation design would prove beneficial in determining the residual impacts to invertebrates of any habitat creation or restoration proposals. This would be achieved by using the habitat loss/gain calculations developed for proposed biodiversity offsetting. These metrics establish the quantities and values of habitats lost and compare them to what would be reinstated. This data can then be used to influence the design process and target beneficial residual impacts on invertebrate habitats as a whole.

1. Introduction

This report provides a technical summary of the data collected on terrestrial invertebrates within the Wylfa Newydd Development Area and from sites within a 500m buffer zone around the boundary of the Wylfa Newydd Development Area.

1.1 Overview

Horizon Nuclear Power Ltd. (Horizon) is currently planning to develop a new nuclear power station on Anglesey as identified in the National Policy Statement for Nuclear Power Generation (EN-6). The Wylfa Newydd Project (the Project) will require a number of applications to be made under various pieces of legislation to a variety of regulators. As a nationally significant infrastructure project under the Planning Act 2008, the construction and operation must be authorised by a Development Consent Order.

Jacobs UK Ltd (Jacobs) was commissioned by Horizon to undertake ecological surveys to inform the various applications, assessments and permits that will be submitted for approval to construct and operate the Power Station and associated developments.

1.2 Wylfa Newydd Project

The Project includes the Wylfa Newydd Generating Station and Associated Development[1]. The Wylfa Newydd Generating Station includes two UK Advanced Boiling Water Reactors to be supplied by Hitachi-GE Nuclear Energy Ltd, associated plant and ancillary structures and features. In addition to the reactors, development on the Power Station Site (the indicative area of land and sea within which the majority of the permanent Wylfa Newydd Generating Station buildings, plant and structures would be situated) will include steam turbines, control and service buildings, operational plant, radioactive waste storage buildings, ancillary structures, offices and coastal developments. The coastal developments will include a Cooling Water System (CWS) and breakwater, and a Marine Off-Loading Facility (MOLF).

1.3 Site Description

The Wylfa Newydd Development Area (the indicative areas of land and sea, including the Power Station Site, the Wylfa NPS[2] Site and the surrounding areas that would be used for the construction and operation of the Wylfa Newydd Generating Station) covers an area of approximately 380ha. It is bounded to the north by the coast and the existing Magnox power station (the Existing Power Station). To the east, it is separated from Cemaes by a narrow corridor of agricultural land. The A5025 and residential properties define part of the south-east boundary, with a small parcel of land spanning the road to the north-east of Tregele. To the south and west, the Wylfa Newydd Development Area abuts agricultural land, and to the west it adjoins the coastal hinterland.

The Wylfa Newydd Development Area includes the headland south of Wylfa Head candidate Wildlife Site. There is one designated site for nature conservation within the Wylfa Newydd Development Area; Tre'r Gof Site of Special Scientific Interest (SSSI). It is also within 1km of the Cae Gwyn SSSI, Cemlyn Bay Special Area of Conservation (SAC) and SSSI, and the Ynys Feurig, the Skerries and Cemlyn Bay Special Protection Area (SPA).

Tre'r Gof is a small basin mire adjacent to the Existing Power Station, west of Cemaes. The area receives mineral-enriched waters from the surrounding boulder clay leading to the development of notable flora. It is the botanical interest that provides the reason for the designation of the site as a SSSI.

[1] Development needed to support delivery of the Wylfa Newydd Generating Station is referred to as Associated Development. This includes highway improvements along the A5025, park and ride facilities for construction workers, Logistics Centre, Temporary Workers' Accommodation, specialist training facilities, Horizon's Visitor Centre and media briefing facilities.

[2] The site identified on Anglesey by the National Policy Statement for Energy EN-6/NPS EN-6 as potentially suitable for the deployment of a new nuclear power station.

Cae Gwyn SSSI is located immediately to the south of the site to the west of Llanfechell. The site comprises two wetland areas separated by an outcrop of rock with heathland vegetation. The southern wetland is confined by a rock basin and is dominated by bogmoss (*Sphagnum* spp.) and a wide variety of common wetland herbs. The northern wetland has a different flora containing denser areas of willow (*Salix* spp.) and common reed (*Phragmites communis*).

1.4 Report Aims and Objectives

This report is intended to provide a technical summary of the data collected on terrestrial invertebrates within the Wylfa Newydd Development Area and from sites within a 500m buffer zone. The Wylfa Newydd Development Area and 500m buffer zone combined are referred to as the "study area" in this report, and are shown in figure 7.1.

The report collates all data from previous surveys and background data available and uses them to assess the comparative importance of different habitats present to invertebrates. This is achieved by looking at the relative species diversity of the site and considering the ecology and conservation status of individual notable species, where appropriate.

1.5 Previous Work

Surveys of the study area have taken place in consecutive years between 2011 and 2014 by Rachel Hacking Ecology Ltd. under the contract from Ove Arup and Partners in 2011 and 2012 and under Jacobs in 2013 and 2014.

A background data search exercise was completed by Jacobs in 2013 in order to inform the scope of surveys required as part of a future Environmental Impact Assessment (EIA) and Habitats Regulations Assessments (HRA). This included a request to Cofnod (North Wales Environmental Information Service) who provided a spreadsheet containing all plant and animal species records from within 2.5km of the study area. Jacobs has also been maintaining records of incidental invertebrate observations during other field surveys. Both datasets were used in this report to increase understanding of the study area.

1.6 Legal Status

Numerous species of terrestrial invertebrate receive protection under wildlife legislation in the UK. There are also species that are of increased nature conservation status due to their relative rarity or importance at a local, regional, national or international scale. The legislation and nature conservation designations relevant to the species recorded during the surveys are given in the following sections.

1.6.1 Natural Environment and Rural Communities (NERC) Act 2006

The NERC Act 2006 places a statutory duty on public bodies to have regard to the conservation of biodiversity whilst exercising its functions. In Wales, this is sanctioned by Section 42 which lists habitats and species of 'principal importance' whose conservation the Welsh Assembly must take reasonable steps to further or promote. These species and habitats are material considerations in the planning process. There are currently 187 invertebrate species listed under Section 42 (including aquatic species).

1.6.2 UK Post 2010 Biodiversity Framework

The UK Biodiversity Action Plan (UK BAP), published in 1994, was the UK's response to the commitments of the Rio Convention on Biological Diversity (1992). This has since been replaced by the UK Post-2010 Biodiversity Framework. This framework covers the period 2011 – 2020 and forms the UK government's response to the new strategic plan of the United Nations Convention on Biodiversity (CBD) published in 2010. The UK BAP partnership therefore no longer operates, with a framework replacing it which promotes a focus on individual countries delivering targets for protection of biodiversity through their own strategies.

In Wales the strategy that has been adopted transferred of the species and habitats listed under the defunct UK BAP to Section 42 of the NERC Act (described above). However, many of the tools and resources originally

developed under the UK BAP still remain of use, including background information on UK BAP priority habitats and species which form the basis of county level biodiversity protection initiatives e.g. Local Biodiversity Action Plans (LBAP).

1.6.3 Conservation Classification of Nationally Rare/Scarce/Notable species

The following terms are used for species with elevated conservation designations (summarised from definitions in Jacobs 2014b):

- *Nationally Rare* species are those that have been recorded in less than 15 10km squares in the UK; and
- *Nationally Scarce* species are those that have been recorded in 16-100 10km squares.

Nationally Scarce species can be further divided into the following groups:

- *Nationally Scarce: Notable A species* – recorded in 16-30 10km squares; and
- *Nationally Scarce: Notable B species* – recorded in 31-100 10km squares.

The term “Nationally Notable” is also used in this report where a species conservation status is either ‘Nationally Scarce: Notable A’ or ‘Nationally Scarce: Notable B’, but has not been divided up further in previous reports.

1.6.4 Local Species

A species described as being “Local” in this report does not receive any particular protection or conservation status but has a restricted range, being generally found in 101–300 10km squares.

1.6.5 Red Data Book Species

In addition to the classifications above, the background data search refers to those species that are listed in Red Data Books. The Red Data Book system was initiated by the International Union for Conservation of Nature (IUCN) in 1996. The books deal with many plants, fungi and animals at a global, country and regional scale. The aim has been to identify those species at greatest risk of extinction and to identify the factors responsible in order to inform conservation approaches. Species are classified according to their breeding status within each site and by their conservation status.

2. Field Study Methodology

2.1 Survey Locations

The extent of the study area has evolved since the start of terrestrial invertebrate surveys in 2011. At the start of the survey programme the surveys generally only included the Wylfa Newydd Development Area, whereas the 2014 surveys included sample sites within the 500m buffer zone. The extension to the study area was provided to contextualise the results gathered within the Wylfa Newydd Development Area.

The study area is 380ha in extent and so due to its size it has not been practical to survey the entire area exhaustively. The approach used was to take samples of invertebrates using the methods given below in specific locations only. These locations were chosen based on their ecological characteristics e.g. botanical composition and/or abiotic features. Particular attention was paid to areas with a potential increased likelihood of supporting diverse terrestrial invertebrate assemblages and included the two SSSIs, wetland, heathland, and semi-improved grassland areas. The majority of the remaining study area comprised improved grassland of limited value for invertebrates and so fewer survey sites were sampled.

The locations of the 17 individual survey sites (2001 – 2014) are given in Figure 7.1. These locations have been identified differently within each annual baseline report (Arup 2011 and 2012, Jacobs 2013 and 2014), therefore in order to enable clear interpretation of the results, the sites have been re-numbered so they can be shown on a single figure and can be clearly described.

Descriptions of the survey sites are taken from the most recent survey of that site with references provided where necessary.

2.2 Desktop Study

A spreadsheet of notable invertebrate records obtained from Cofnod was analysed to compare the results of the field surveys to historical invertebrate data from within a 2.5km search radius of the boundary of the study area. A review of the incidental records spreadsheet maintained by ecologists from Jacobs since 2013 was also carried out.

2.3 Sampling Methods

There have been a variety of different methods used to sample populations of terrestrial invertebrates within the study area between 2011 and 2014, these are summarised in Table 1.

Table 1: Summary of Survey Methodologies

Survey Methodology	2011	2012	2013	2014
Hand-searching	Y	Y	Y	Y
Pitfall trapping	Y	Y	Y	N
Pootering	Y	Y	N	Y
Suction sampling	N	Y	N	Y
Sweep-netting	Y	Y	Y	Y

Survey Methodology	2011	2012	2013	2014
Yellow-bowl trapping	Y	Y	N	N

2.4 Survey Seasons

Each site was visited several times within each survey year in order to provide a range of samples. This enabled surveyors to target a wider range of invertebrates owing to the different flying seasons and lifecycles of different species. Generally survey sites were visited a minimum of twice between June and September, which is the peak period during the invertebrate active season.

2.5 Quality Control

The independent verification of species identification was conducted for several groups of invertebrates due to the difficulty in identifying them to species level. These are referenced in the annual baseline reports produced for each season of survey and are not repeated here.

2.6 Limitations

Where limitations were present they are discussed within each individual annual baseline report (see Arup 2011 and 2012, Jacobs 2013 and 2014).

During each year of field survey the sampling method used and survey sites selected were not standardised. This was caused by a number of factors including:

- limited access being available;
- changes in scope;
- poor weather; and
- presence of livestock.

This means that the survey data cannot be directly compared between years, although this is not considered to be a significant constraint as the surveys were designed to record the presence of notable assemblages or species within the study area and not to monitor their relative abundance or distribution over time.

The study area is extremely large and so it is not practical, or necessary, to exhaustively search every habitat and record every species present. As with all surveys, there is the potential for individual species or small assemblages of invertebrates to be overlooked, especially as each survey can only provide a ‘snap-shot in time’. However, the amount of data collated following four years of surveys is considerable and as the surveys have been designed to focus on the habitats with the greatest potential for supporting diverse invertebrate assemblages, the likelihood of finding additional protected/notable terrestrial invertebrate species in the study area that have not been previously recorded is considered to be low. As such, this baseline is considered to be robust.

The surveys did not include several methods of surveying for invertebrates that could have been used. This includes transects for butterflies and moth trapping. These species belong to a group (Lepidoptera) that is popular with the public because they are colourful and easy to identify. This often makes them a group that is well represented in background data searches. The results from the background data search in this report support this theory with many more species records of Lepidoptera provided in the data from Cofnod than were recorded during the field surveys. This is not considered to significantly affect the interpretation of the results.

3. Results

3.1 Desktop Study

The background data search from Cofnod returned 536 species of terrestrial invertebrate within 2.5km of the Wylfa Newydd Development Area. Of these species, 75 are listed in the Red Data Book, Section 42 of the NERC Act, and/or a local BAP. The data search does not provide the conservation status of species with respect to notability (i.e. Notable A/Notable B/Nationally Scarce/Local). A full list is provided in Appendix B.

The incidental records spreadsheet returned 38 species of which one is a notable butterfly and had not been previously recorded within the study area (grayling). The remaining 37 species do not have any elevated conservation status, and include ten species that have not previously been recorded during dedicated surveys.

Table 2 provides a summary of the numbers of notable species from Cofnod data and data from the incidental records database.

Table 2: Summary of number of notable species recorded by Cofnod within 2.5km of Wylfa Newydd Development Area boundary

Order[3]	Red Data Book 1 and LBAP	Red Data Book 1	Red Data Book 2	S42 (UKBAP)	S42 (UKBAP) and LBAP	LBAP	Total
Coleoptera (Beetles)	-	2	1	-	-	-	3
Hymenoptera (Bumblebees)	-	-	-	-	-	5 (3)	5
Lepidoptera (Butterflies)	-	-		1 (1)	4 (2)	1	6
Lepidoptera (Moths)	-	4	1	6	38 (1)	5	54
Odonata (Damselflies)	1	-	-	-	-	4	5
Odonata (Dragonflies)	-	-	-	-	-	3 (3)	3
Totals recorded in study area[4]	1 (0)	6 (0)	2 (0)	7 (1)	42 (3)	18 (6)	76 (10)

[3] Broad divisions are also shown. With respect to hymenoptera, bumblebees are the only family represented in the data search.
[4] Species recorded in the study area in any of the years of survey are shown in brackets.

3.1.1 Red Data Book Species

There are nine species within the background data search that are listed in Red Data Books. None of these species have been recorded within the study area.

3.1.2 Section 42 NERC Act Species

Forty-nine species were returned in the background data search that are listed on Section 42 of the NERC Act. Of these species, four have been previously recorded in the study area. These are:

- Butterfly – grayling *Hipparchia semele*;
- Butterfly – small heath *Coenonympha pamphilus*;
- Butterfly – wall *Lasiommata mergera*; and
- Moth – cinnabar moth *Tyria jacobaeae*.

3.1.3 Local Biodiversity Action Plan Species

The background data shows that there are 60 species that have LBAP status in north Wales. However, none of these species are included on the Anglesey LBAP (UK BARS, 2015). The species that have been recorded in the study area are:

- Bumblebee – Flintshire LBAP buff-tailed bumblebee *Bombus terrestris*;
- Bumblebee – Flintshire LBAP common carder bee *Bombus pascuorum*;
- Bumblebee – Flintshire LBAP red-tailed bumblebee *Bombus lapidarius*;
- Damselfly – Snowdonia LBAP blue-tailed damselfly *Ischnura elegans*;
- Damselfly – Snowdonia LBAP large red damselfly *Pyrrhosoma nymphula*; and
- Dragonfly – Snowdonia LBAP common darter *Sympetrum striolatum*.

These species are all relatively common and widespread, but can have low local abundances, or have suffered local declines. None of these six species are of conservation concern in Anglesey, but are still classed as notable due to the proximity of the study area to Flintshire and Snowdonia.

3.1.4 Study Area Descriptions and Total Numbers of Species Recorded

A total of 17 sites have been sampled within the study area between 2011 and 2014. These are shown in Figure 7.1 and brief descriptions of each site are provided in Table 3 (taken from the most recent survey visits to those sites). Table 3 also shows the total number of species recorded each year at each site. The total number of notable species recorded shown is collated from all years of survey. This value is derived from comparing data between all the years to prevent species that are recorded in multiple years being double-counted. The raw data containing the notable species records is provided in Appendix C.

In summary:

- In 2011 there were 403 species recorded from 14 survey sites;
- In 2012 there were 484 species recorded from 12 survey sites;
- In 2013 there were 582 species recorded from 14 survey sites; and

- In 2014 there were 198 species recorded from four survey sites.

Table 3: Site Habitat Descriptions

Survey Site	Site Description and Year of Most Recent Survey	Total species recorded 2014				Total notable species recorded
		2011	2012	2013	2014	
1	Site 1 is located to the north of the existing Magnox Power Station and south of Wylfa Head. It is an area of species-rich grassland and scattered scrub. Site 1 is a good site for invertebrates as there are a large number of flowering plant species present and the structural diversity of the habitat is excellent. Plant species include black knapweed *Centaurea nigra*, pale flax *Linum bienne*, red bartsia *Odontites vernus*, Smith's pepperwort *Lepidium heterophyllum* and yarrow *Achillea millefolium*. Last surveyed 2013.	123	142	127	-	15
2	Site 2 comprises Wylfa Head. The habitats are predominantly unimproved coastal grassland with scrub, heath and marshy grassland. An ephemeral pool exists within the centre of the site. The headland is exposed and the vegetation is low-growing. Species typical of coastal grassland occur here and include buck's-horn plantain *Plantago coronopus*, devil's-bit scabious *Succisa pratensis*, sea-milkwort *Glaux maritima*, and yellow bartsia *Parentucellia viscosa*. During 2012, a small patch of petty whin *Genista anglica* was located on the western side of the headland. This was re-found during 2013 and was in flower. Last surveyed 2013.	38	119	29	-	13
3	Site 3 is the grassland slope north of Tre'r Gof SSSI. Plant species at this site include common hogweed *Heracleum sphondylium*, meadow buttercup *Ranunculus acris*, yarrow and yellow rattle *Rhinanthus minor*. Last surveyed 2012.	30	26	-	-	1

4	Site 4 comprises Tre'r Gof SSSI and is an extensive area of fen, ditches, open water, marshy grassland and woodland. A large part of Tre'r Gof is dominated by common reed *Phragmites australis*. Within the centre of the site is a dense patch of willow *Salix* carr. The marsh vegetation is species-rich and includes bog pimpernel *Anagallis tenella*, great fen sedge *Cladium mariscus*, marsh bedstraw *Galium palustre*, marsh lousewort *Pedicularis palustris*, water mint *Mentha aquatica* and yellow flag iris *Iris pseudacorus*. A stream runs through the middle of the SSSI and a few ditches are present. The stream is base-rich and flows into an acidic habitat, making this site valuable and rare in the UK. Last surveyed 2013.	152	162	51	-	15
5	Site 5 comprises a woodland glade and forms part of the Nature Walk within the plantation woodland to the east of Magnox Power Station. The path goes through the woodland and dense scrub habitats. Flowering plants are plentiful and the path provides edge habitat which is sheltered and full of nectar and pollen sources. The plant species include colt's-foot *Tussilago farfara*, foxglove *Digitalis purpurea*, gorse *Ulex europaeus*, and red campion *Silene dioica*. Last surveyed 2013.	72	120	148	-	17
6	Site 6 comprises a pond, stream and associated marshy grassland south of the visitor centre behind the Lodge. The stream and the small pond to the south hold water in the early part of the year only. The pond is covered in common duckweed *Lemna minor*. The marginal marshy vegetation comprises greater bird's-foot trefoil *Lotus pedunculatus*, soft rush *Juncus effusus*, and water mint. Water-cress *Nasturtium officinale* grows in the stream as well as greater willowherb *Epilobium hirsutum*. Last surveyed 2013.	34	33	102	-	3
7	Site 7 is an area of marshy grassland associated with a pond and a well with some low-lying boggy areas, situated within the landholding of Caerdegog Isaf. The grassland supports an abundance of species such as cuckooflower *Cardamine pratensis*, marsh cinquefoil *Potentilla palustris*, meadowsweet *Filipendula ulmaria*, soft rush and spotted orchid *Dactylorhiza sp*. In wetter areas, there were stands of yellow flag iris. Last surveyed 2013.	57	46	96	-	8

8	Site 8 is an extension of Site 7 and is similar in character. Last surveyed 2013.	-	-	67	-	9
9	Site 9 is the Cae Gwyn SSSI and has only been accessed and surveyed in 2013. The SSSI mainly comprises two areas of fen (the northern basin and the southern basin) and a large outcrop of rock with dry heath. Dense scrub and bracken occurs in other parts. The northern basin comprises species such as broad-leaved pondweed *Potamogeton natans*, common cottongrass *Eriophorum angustifolium*, common spike-rush *Eleocharis palustris*, creeping willow *Salix repens*, cross-leaved heath *Erica tetralix*, marsh St. John's-wort *Hypericum elodes*, meadowsweet, and water mint. The southern basin comprises all of the above species plus others including cranberry *Vaccinium oxycoccos* and marsh fern *Thelypteris palustris*. The heathland (gorse and heather) occurs predominantly over the rock outcrop, although towards the base of the outcrop, the heath is wet and dominated by cross-leaved heath. The site is species-diverse and structurally diverse and offers an excellent habitat for invertebrates. Last surveyed 2013.	-	-	157	-	14
10	Site 10 is a stream corridor which runs along the western boundary of the entire study area. The stream corridor is well-vegetated with species such as fool's-watercress *Apium nodiflorum*, greater willowherb and peppermint *Mentha spicata* along its length. Last surveyed 2013.	59	113	113	-	18
11	Site 11 is the fen and associated marshy grassland to the west of Pont Cafnan. The fen is fed by a stream which was wet during the 2013 survey season. The fen is similar to parts of Tre'r Gof SSSI, with stands of common reed and a similar flora in the low-lying marshy areas. Here, gipsywort *Lycopus europaeus*, marsh bedstraw and marsh cinquefoil all provide abundant pollen and nectar sources for invertebrates. Last surveyed 2013.	16	144	128	-	22

12	Site 12 comprises a large expanse of relatively species-rich grassland, bordered to the south by a stream. To the west the habitat becomes more similar to coastal grassland. The grassland species-mix is similar to Site 1, with many flowering plants. Towards the coast, plants occur including kidney vetch *Anthyllis vulneraria*, sheep's-bit *Jasione montana*, and thrift *Armeria maritima*. The stream corridor supported lesser water-parsnip *Berula erecta*. Last surveyed 2013.	166	80	88	-	12
13	Site 13 comprises part of the National Trust-owned coastline, also known as Trwyn Pencarreg. The coastline here is dominated by heather *Calluna vulgaris* with bell heather *Erica cinerea*, cross-leaved heath and purple moor-grass *Molinia caerulea*. A number of flushes occur which were dry during the 2013 summer visits. The flushes support plants indicative of wet habitats such as bog pimpernel, marsh pennywort *Hydrocotyle vulgaris* and water mint. Last surveyed 2013.	27	133	77	-	17
14	Site 14 comprises a large stretch of coastal heathland, with wet flushes. The site is open to walkers and is periodically cattle-grazed. Management in the form of bracken rolling and heather cutting was noted on past visits. The heathland comprises a mixture of dry dwarf shrub heath and wet dwarf shrub heath. Heather and purple moor-grass dominates the heathland. Other plants present include tormentil *Potentilla erecta*, heath milkwort *Polygala serpyllifolia* and heath spotted-orchid *Dactylorhiza maculata*. The wet flushes are species-rich and included marsh pennywort, lesser spearwort *Ranunculus flammula*, marsh lousewort and bog pimpernel. Last survey in 2014.	-	-	-	56	7
15	Site 15 comprises well vegetated shingle with bare shingle still evident in places. The shingle spit is used by walkers. The botanical species present reflect the maritime influence of the habitat. Grasses such as cock's-foot *Dactylis glomerata*, false oat-grass *Arrhenatherum elatius*, and red fescue *Festuca rubra* are interspersed with sea campion *Silene uniflora*, sea-kale *Crambe maritima*, sea-milkwort and thrift. Large patches of wild carrot *Daucus carota ssp. carota* also occur within the habitat, attracting a large number of flying insects Last survey in 2014.	-	-	-	72	2

16	Site 16 is a depression where two fields meet. The ground is boggy and comprises fen and marshy grassland habitats. The field to the east supports a pond. The grassland and fen habitat include species such as greater bird's-foot trefoil, lesser spearwort, marsh cinquefoil, marsh bedstraw, meadowsweet and ragged-robin *Lychnis flos-cuculi*. The pond supports soft rush and water horsetail *Equisetum fluviatile*. Last survey in 2014.	-	-	-	68	2
17	Cemaes Bay woodland follows the Afon Wygyr as it approaches the harbour from where it flows beneath the A5025. The plantation woodland is a mixture of native and non-native deciduous and coniferous tree and scrub species, including blackthorn *Prunus spinosa*, cotoneaster *Cotoneaster var.*, butterfly-bush *Buddleja davidii*, field maple *Acer campestre*, Himalayan honeysuckle *Leycesteria formosa*, purple beech *Fagus sylvatica f. purpurea*, purple hazel *Corylus maxima purpurea*, sycamore *Acer pseudoplatanus* and wych elm *Ulmus glabra*. Large open areas are also present which support grassland. These areas appear to have been periodically mown. The grassland areas comprise species such as creeping buttercup *Ranunculus repens*, cut-leaved crane's-bill *Geranium dissectum*, hemlock water-dropwort *Oenanthe crocata*, ox-eye daisy *Leucanthemum vulgare*, and Yorkshire fog *Holcus lanatus*. Last survey in 2014.	-	-	-	78	2

4. Discussion

This section brings together the results from both the analysis of the background data search and the four years of field survey data.

The background data search shows that 77% of the notable species recorded were butterflies or moths. This is likely to be due to the popularity of the group and ease with which they can be surveyed and identified without any specialist equipment. As a result more people are likely to attempt to record these species in their area. This is also why other species that are more diverse are likely to be under represented in the data search results with beetles (Coleoptera) being the most obvious example as they are one of the most diverse groups in the world and are represented by over 4000 species in the UK (Duff, 2012) and account for around 14% of the total number of animals species found in this country (Natural England, 2014). In the background data search there are 93 records of beetles compared to 4013 records of butterflies and moths. There is therefore clearly a disparity between the likely number of species present, and the number actually recorded within many species groups.

However, in the context of the field survey results it is considered that the reverse is true and Coleoptera are perhaps over represented. This is most striking when looking at the notable species actually recorded during the surveys of which 79% were Coleoptera. This is due to the sampling methods used and that moth trapping and butterfly transects were not included within the scope of surveys completed within the study area. There is therefore the potential for the study area to support more notable butterflies and moths than the empirical data would suggest. This should be included within caveats to inform mitigation and for the long-term management of the study area.

4.1 Notable Species

The notable species that were recorded in both the background data search and the survey data are described in greater detail below.

4.1.1 Grayling – *Hipparchia semele*

The grayling is the largest of the “browns” and although conspicuous in flight, it is very cryptic when at rest and difficult to see. The species is found on sheltered, sunny and dry sites where vegetation is sparse. This includes heathland, sand dunes, coastal grassland and quarries. The food plants of the larvae include fescue grasses, bristle bent *Agrostis curtisii* and tufted hair-grass *Deschampsia cespitosa*. The adults feed on brambles, thistles clovers and teasels (UK Butterflies, 2015a).

The species was recorded in the summer of 2013 during NVC surveys of heathland habitats in the study area. The species was seen five times in 2013 and up to five individuals were recorded at any one time. Populations of the species are therefore likely to be well established in the study area. The distribution of the species suggests that it is not unusual for the species to be found in any coastal areas, especially on the western side of the country (UK Butterflies, 2015a). The distribution map also shows that the species is rarely found in the centre of the country and is virtually absent from landlocked counties. The distribution of the species across Anglesey is unknown.

The coastal grassland habitat and heathland mosaics around Wylfa Head and Trwyn Pencarreg are areas that are likely to support grayling, and this is where the species was recorded by surveyors. The heathland habitats within Cae Gwyn SSSI also support the species and it was also recorded here.

4.1.2 Small heath - *Coenonympha pamphilus*

The small heath is a species of butterfly from the Satyrinae family and is the smallest of the “browns” (UK Butterflies, 2015b). The species is often associated with heaths but is not confined to them as it is often found in grassland habitats. In the study area the species was recorded in Site 9 (Figure 7.1); the grassland north-east of the Cae Gwyn SSSI (Site 10). This area is adjacent to heathland habitat within the SSSI and so its presence is not unexpected. Larvae feed on a variety of grass species e.g. bents *Agrostis spp.* and fescue

grasses while adults feed on bramble, buttercups *Ranunculus spp.* devil's-bit scabious, fleabane *Pulicaria dysenterica*, greater stitchwort *Stellaria holostea*¸ kidney vetch *Anthyilis vulneraria*, ragwort, tormentil and yarrow.

Small heath is a species that has a distribution covering almost all of the UK, although it does become rarer in the far north of Scotland (UK Butterflies, 2015b). The presence of the species within the study area is therefore not unexpected geographically. However, the species has only been recorded from one survey site and so may be uncommon in the local area. The distribution of the species across Anglesey is unknown.

The habitats that are likely to support the species are widespread and common within the study area and so it is surprising that the species was only recorded from one area.

4.1.3 Wall brown – *Lasiommata mergera*

The wall butterfly gets its name from its characteristic behaviour of resting with wings two-thirds open on bare surfaces such as walls, bare ground and pathways (UK Butterflies, 2015b). The larval food plants of the species are similar to those of the small heath (above). Adult nectar sources are also similar to the small heath with the addition of hawkweeds *Hieracium/Hypochoeris spp.*, knapweeds *Centaurea spp.* and thistles.

The species has suffered severe decline and is now confined to coastal regions in many areas (UK Butterflies, 2015b) and has disappeared from many sites in central, eastern and south-east England. The distribution of the species across Anglesey is unknown. The distribution map also shows that wall brown is likely to be at its northern-most range as it is absent from all but the south-western regions of Scotland. The north Anglesey coast is therefore within the normal range of the species. This butterfly has only been recorded once in the study area which suggests that it is not particularly abundant in the area, and typical of its habit of living in small self-contained colonies. However, the species is known to rapidly colonise new areas, if there is suitable habitat present.

The species was recorded in five locations in the study area (Sites 6, 9, 10, 12 and 14), which support wetter habitats, grassland, and heath. Interestingly, Areas 6, 9 and 10 are not adjacent to the coast and so indicate that the species has a distribution that is not limited to coastal areas in the north of Anglesey.

4.1.4 Cinnabar moth – *Tyria jacobaeae*

The cinnabar moth is a medium-sized red and black species found most often on common ragwort, other ragwort species and groundsel *Senecio vulgaris* (Butterfly Conservation, 2015). The species is frequent in open grassy habitats including waste ground, railway banks, gardens and woodland rides. However, the species is often most abundant on well drained rabbit-grazed grassland, mature sand-dunes and heathland.

The species abundance is reported to have fallen by more than 80% in the past 35 years, a reduction that has been attributed to the removal of ragwort from fields used for livestock grazing (The Wildlife Trusts, 2015). The species has been most regularly recorded in fields where grazing animals are present, and is generally less well represented in fields where grassland habitats have been allowed to grow long. This is typical of the pattern seen across the UK caused by ragwort being swamped by more dominant grass (Buglife, 2015). The distribution of the species on Anglesey in general is not known, but is likely to be heavily influenced by the abundance of ragwort.

The species was recorded at three locations in the study area: Sites 1, 5 and 12. Sites 1 and 12 are both representative of typical habitat of the species as they mostly comprise rabbit and sheep grazed coastal grassland abundant with larval and adult food plants. The record from Site 5 is surprising as the habitat here is primarily woodland.

4.1.5 Non-Anglesey LBAP Species

Three bumblebee species were recorded in the study area during surveys, which are LBAP species (buff-tailed bumblebee, common carder bee, and red-tailed bumblebee). These species are all common and widespread but have suffered declines due to agricultural intensification and urbanisation. All three species are considered

to be generalists in their habits, and will occupy grassland, woodland and hedgerows for nesting and finding sources of nectar for food.

The three Odonata species (blue-tailed damselfly, large red damselfly and common darter) are also common and widespread but have also local significance in the nearby districts of Flintshire and Snowdonia, leading to them having LBAPs. These species are all aquatic and are not discussed in the context of the effect on terrestrial habitats (see Jacobs 2015 for more information).

These six species are not considered separately within the interpretation of the results as they are not of relevance to the study area, and are also not listed within any of the other "notable" classifications.

4.2 Assessing the value of the survey areas for invertebrates

An assessment of the value of habitat types present within the study area has been undertaken to establish their relative importance for invertebrates.

One method that has been applied to classifying relative importance of habitats was proposed by Ball (1986) using Species Quality Index (SQI). This method assigns scores to all species according to their nature conservation status as shown in Table 4.

Table 4: Species Quality Index scoring system (taken from Ball, 1986)

Conservation Status	Score
Red data book species	100 points
Notable A species	50 points
Notable B species	40 points
Notable (scarce) species	40 points
Local species[5]	20 points
Common species	No score
Status not formally known	No score

The score for each site is calculated as the total score of all notable species recorded at that location divided by the maximum number of species recorded, as shown in Table 5.

Table 5: Study area Species Quality Analysis site scores

Site No.	Total SQA score	Maximum number of species recorded[6]	SQI
1	300	142	2.1

[5] This includes Section 42 NERC Act listed species in this assessment.
[6] The maximum number of species recorded is used instead of total number of species recorded across all years due to the data not being collated in such a way to compare which species were recorded in multiple years across all species. There is therefore a potential source of error in the final SQI scores. However, these adjusted scores are likely to bias sites towards being of higher importance and so are considered suitable.

Site No.	Total SQA score	Maximum number of species recorded[6]	SQI
2	300	127	2.4
3	20	30	0.7
4	360	181	2.0
5	320	148	2.2
6	60	102	0.6
7	180	96	1.9
8	200	67	3.0
9	280	170	1.6
10	390	113	3.5
11	460	144	3.2
12	240	166	1.4
13	410	144	2.8
14	140	58	2.4
15	40	72	0.6
16	40	68	0.6
17	40	78	0.5
Average site Score	222.4	112	1.85

Table 5 shows that the sites that support the highest average Species Quality Analysis score are Sites 8, 10 and 11. These are all considered to be wet habitats (see Table 3). This form of analysis further suggests that sites that support wet habitats are the most valuable within the study area. The SQI scores also show that Sites 3, 6 and 15-17 are the least valuable as they generally support fewer species, and have proportionally lower SQI scores. This is mirrored by the results in Table 5 which place all four sites in the bottom half when ranked according to the combined total diversity and notable species that each area supports.

The SQI scores for the combined survey areas range between 0.5 (Site 15) and 3.5 (Site 10). These scores must be compared to data collected for other sites in order to provide meaningful conclusions. It has not been

possible to find examples of this approach being used in north Wales but in Essex sites with “good” invertebrate diversity would have values above 5.0, “excellent” sites might have a value above 7.5 and sites with scores approaching 10.0 are likely to be of “national significance”. While it is likely that the thresholds for these classifications will be lower due to diversity being affected by latitude (i.e. climate and shorter seasons) and island biogeography (i.e. isolation effects of not being connected to the mainland), it is considered that the index would suggest that the areas sampled within the study area are not of particularly high invertebrate diversity.

This is a very simplistic test and would ideally be compared with the data from the background search having been scrutinised in the same way. However, within the background data the conservation status of all 536 species has not been provided and the survey efforts are in no way comparable. It is therefore considered that there would be no value in producing an SQI value for the 2.5km background search area.

4.3 Habitats

The information from the desk study field survey is considered suitable and sufficient to inform any impact assessment produced for the development area and so no further surveys are proposed. This is based on the number of notable species being recorded being sufficient to inform which habitats are of lesser or greater value in relative terms within the development area.

4.4 Site Comparisons

Appendix C provides the list of notable species that have been recorded in the study area and what their habitat requirements are (if known). Appendix C is summarised below in Table 6. Table 6 ranks the sites according to the maximum number of species that were found at each site in any one year (Row 2), and provides a second rank showing the sites in order of the total number of notable species found in each site across all years (Row 3). The third rank combines the two values by assigning them values between one and 17 according to increasing position within each rank. This is based on the assumption that all notable species are of equal value. It is accepted that this is not the case within any conservation valuation system but it is considered that for the purposes of aiding the understanding of this site, the calculation is useful.

A worked example is provided below:

- Site 17 is sixth lowest in the ranking of number of species and therefore scores 6 points;
- Site 17 is fourth lowest in the ranking of number of notable species and therefore scores 4 points; therefore
- Site 17 has a combined score of 10 points.

The value of ten is then ranked according to the scores of other survey sites to determine those of comparably higher or lower value to invertebrates.

This analysis shows that in combination, Site 3 is probably the least valuable to invertebrates and Site 11 is probably the most valuable to invertebrates.

Table 6: Summary of Notable Species Data Recorded in the Study Area

	Site Rank – Lowest Rank Scores 1, Highest Rank Scores 17																
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	15th	16th	17th
Site number in rank order according to maximum number of species per site in one year (number of species is shown in brackets)	Site 3 (30 sp.)	Site 14 (58 sp.)	Site 8 (67 sp.)	Site 16 (68 sp.)	Site 15 (72 sp.)	Site 17 (78 sp.)	Site 7 (96 sp.)	Site 6 (102 sp.)	Site 10 (113 sp.)	Site 2 (119 sp.)	Site 13 (133 sp.)	Site 1 (142 sp.)	Site 11 (144 sp.)	Site 5 (148 sp.)	Site 9 (157 sp.)	Site 4 (162 sp.)	Site 12 (166 sp.)
Site number in rank order according to maximum number of notable species per site in one year (number of species is shown in brackets)	Site 3 (1 sp.)	Site 15 (2 sp.)	Site 16 (2 sp.)	Site 17 (2 sp.)	Site 6 (3 sp.)	Site 14 (7 sp.)	Site 7 (8 sp.)	Site 8 (9 sp.)	Site 12 (12 sp.)	Site 2 (13 sp.)	Site 9 (14 sp.)	Site 1 (15 sp.)	Site 4 (15 sp.)	Site 5 (17 sp.)	Site 13 (17 sp.)	Site 10 (18 sp.)	Site 11 (22 sp.)
Site number in combined rank score order (combined total rank score shown in brackets[7])	Site 3 (2)	Site 15 (7)	Site 16 (7)	Site 14 (8)	Site 17 (10)	Site 8 (11)	Site 6 (13)	Site 7 (14)	Site 2 (20)	Site 1 (24)	Site 10 (25)	Site 9 (26)	Site 12 (26)	Site 13 (26)	Site 5 (28)	Site 4 (29)	Site 11 (30)
Predominant habitat[8]	Grass	Grass	Wet	Heath	Wood	Wet	Wet	Wet	Grass	Grass	Wet	Heath	Grass	Heath	Wood	Wet	Wet

[7] Where scores are tied the maximum total number of species that the site has been shown to support is used as the tie-breaker.

[8] Grassland is not divided into coastal, improved or unimproved habitat types, and wet habitats include bog, fen, marshy grassland and riparian habitats in general.

4.5 Habitat and Invertebrate Family Comparisons

Table 7 shows that there are eight broad habitat types used by the notable species found within the study area. The classification *Unknown* is assigned to notable species where it has not been possible to determine the habitats they use. A summary of the species these habitats support is provided in Table 7.

Table 7: Habitat and invertebrate family comparisons

Habitat type	Orders	Families	Species
Unknown	2	12	30
Hygrophilous[9]	3	12	25
Grassland – generalist	2	7	13
Grassland – unimproved	5	4	6
Heath	3	5	5
Grassland – improved	1	3	4
Woodland	1	1	2
Aquatic	1	1	1
Scrub	1	1	1

The table shows that there were more hygrophilous notable species recorded during the field surveys than species occupying any other habitat. This is substantiated to some degree by the data in Table 5 which shows that Sites 4 and 11 were the most species diverse and predominantly wet habitat areas. The data in Table 4 and Table 7 also show that improved grassland supports relatively few notable species which is potentially significant given the relative amounts of improved grassland compared to other habitats e.g. heath, which is only represented in very small amounts in the study area.

The species for which habitats could not be assigned are ignored in the analysis of Table 7 and for the purposes of Section 4 are assumed to be represented in similar proportions within each habitat classification as the other species.

[9] Hygrophilous – species preferring wet habitats.

5. Conclusions and Recommendations

The study area has been surveyed for terrestrial invertebrates over a period of four years (2011 – 2014) using a wide variety of different survey methods. The field survey data has been supplemented by a background data search covering a 2.5 km radius from the boundary of the development area.

The background data search returned 536 species of terrestrial invertebrate, of which 75 are either Red Data Book listed Species, listed on Section 42 of the NERC Act or are LBAP species. Nine of these species have been recorded within the study area.

The field survey data from 17 different sites within the study area recorded maximums of between 198 and 582 species per year with a total number of species of 717, 87 of which are notable (i.e. Section 42 NERC Act listed or have elevated conservation status). This ratio gives a SQI score of 5.3 which would make it unlikely to be a site of high conservation value to invertebrates, although it does support a good level of diversity.

The highest level of protection status of any species in the study area is afforded to the four species listed on Section 42 of the NERC Act (cinnabar moth, grayling, small heath and cinnabar moth). These four species are generally considered to be fairly common and widespread but have significantly reduced in number in recent years. An important habitat feature required for all these species is food availability in the form of sources of nectar. These would include habitats containing an abundance of flowering shrubs and species rich grassland, including some agriculturally improved areas containing ragwort for the cinnabar moth.

In addition to the important habitats described above, the results strongly suggest that the habitats that support the greatest diversity and the highest number of species are the wetter habitats.

The data suggests that it would not be appropriate for any species specific assessment to be carried out to determine the potential effects of the Project. Rather, it is suggested that a habitat scale approach is adopted that calculates effects on habitats and likely associated invertebrate assemblages that they support.

In terms of application when determining mitigation approaches, the highest value habitats could then be prioritised for avoidance and minimisation of habitat loss ahead of lower value habitats in the first instance. Furthermore, areas of lower diversity could be targeted for enhancement. Using this approach would also facilitate the development of simple metrics that can be used to quantify residual impacts much more effectively than focussing down to family, genus or species level.

This system is already being used for producing loss/gain calculations with a view to promoting the use of biodiversity offsetting as a means of mitigation for large infrastructure projects (National Assembly for Wales, 2014). This conservation tool was developed by Defra and assigns values to habitat types based on distinctiveness. These scores are then multiplied by the areas of habitat that will be lost in order to convert them in into “biodiversity credits”. The total number of lost biodiversity credits is then calculated. To provide mitigation for this loss the developer then establishes what habitats would be recreated or enhanced elsewhere, and assigns scores for those areas based on the same criteria. The developer is then able to balance the equation to provide a neutral impact development, or more usually, attempt to create habitats with higher scores thereby providing a net gain in biodiversity value.

It is considered that this habitat level approach can be applied to mitigation for invertebrates because areas with higher distinctiveness values are invariably those habitats known to support higher numbers and diversities of invertebrates. By using biodiversity-offsetting to favour the creation and enhancement of species-rich grassland and wetland habitats in particular, terrestrial invertebrate diversity in the study area can be safeguarded and potentially improved.

The development of biodiversity offsetting is therefore fundamental in determining effective mitigation for the Project. In addition to favouring higher value habitats, overall structural heterogeneity is also considered to be important. The provision of different kinds of field boundary, plantation woodland and agricultural uses should therefore be considered in the long term for the management of the study area for promotion of an area with the potential to support an improving invertebrate diversity.

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Appendix A: Figures

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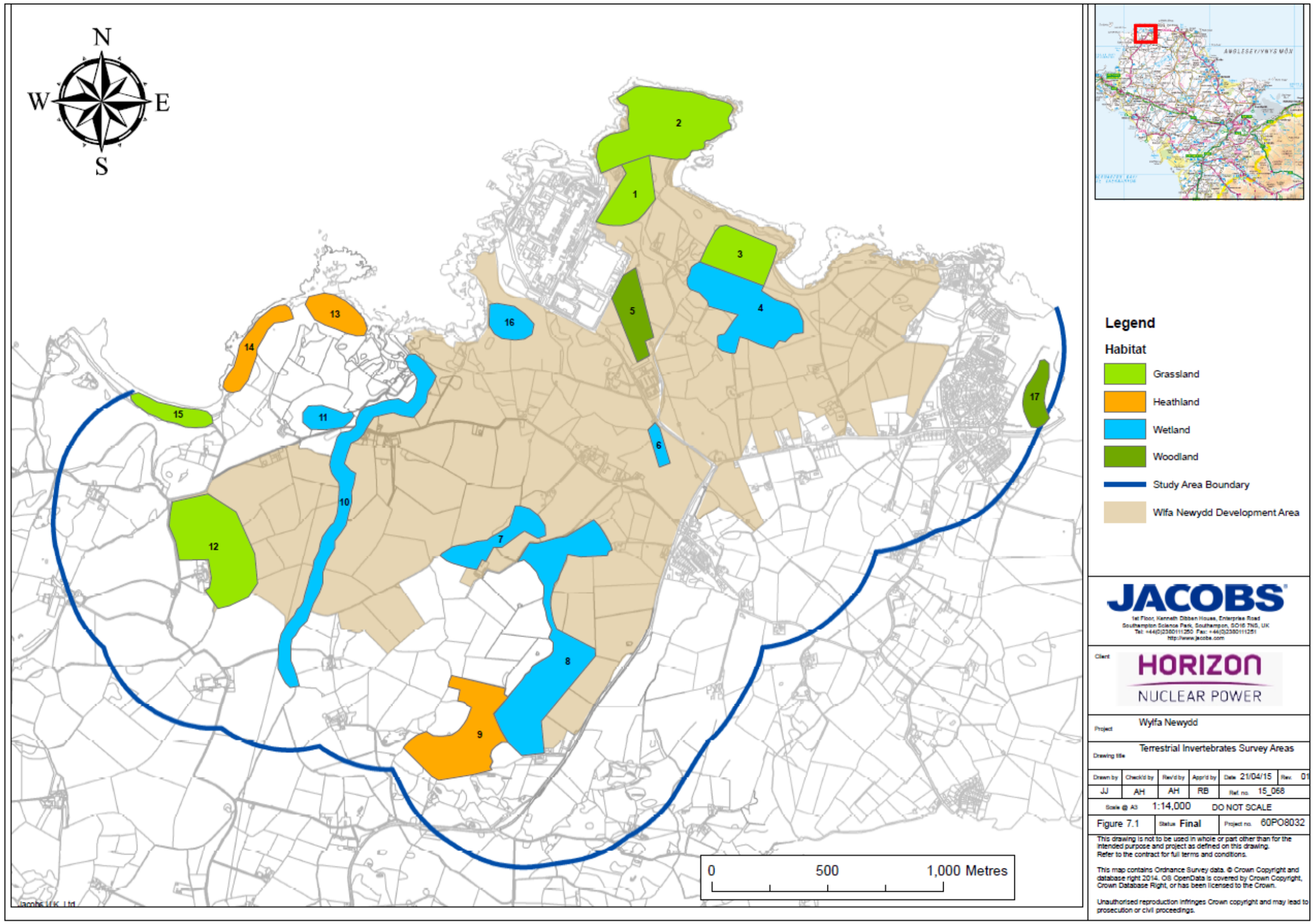

Figure 7.1: Study area and terrestrial invertebrate survey sites

Appendix B: Notable Species Returned from Background Data

Order	Habit	Species	Red Data Book	Section 42 (UKBAP)	Non-Anglesey LBAP	Recorded during surveys
Lepidoptera	Butterfly	*Coenonympha pamphilus*	-	Yes	Yes	Yes
Lepidoptera	Butterfly	*Lasiommata megera*	-	Yes	Yes	Yes
Lepidoptera	Moth	*Tyria jacobaeae*	-	Yes	Yes	Yes
Lepidoptera	Butterfly	*Hipparchia semele*	-	Yes	-	Yes
Hymenopteran	Bumblebee	*Bombus (Bombus) terrestris*	-	-	Yes	Yes
Hymenopteran	Bumblebee	*Bombus (Melanobombus) lapidarius*	-	-	Yes	Yes
Hymenopteran	Bumblebee	*Bombus (Thoracobombus) pascuorum*	-	-	Yes	Yes
Odonata	Damselfly	*Ischnura elegans*	-	-	Yes	Yes
Odonata	Damselfly	*Pyrrhosoma nymphula*	-	-	Yes	Yes
Odonata	Dragonfly	*Sympetrum striolatum*	-	-	Yes	Yes
Lepidoptera	Butterfly	*Boloria selene*	-	Yes	Yes	No
Lepidoptera	Moth	*Acronicta psi*	-	Yes	Yes	No
Lepidoptera	Moth	*Acronicta rumicis*	-	Yes	Yes	No
Lepidoptera	Moth	*Agrochola lychnidis*	-	Yes	Yes	No
Lepidoptera	Moth	*Amphipoea oculea*	-	Yes	Yes	No
Lepidoptera	Moth	*Amphipyra tragopoginis*	-	Yes	Yes	No
Lepidoptera	Moth	*Apamea remissa*	-	Yes	Yes	No
Lepidoptera	Moth	*Aporophyla lutulenta*	-	Yes	Yes	No
Lepidoptera	Moth	*Arctia caja*	-	Yes	Yes	No
Lepidoptera	Moth	*Blepharita adusta*	-	Yes	Yes	No
Lepidoptera	Moth	*Brachylomia viminalis*	-	Yes	Yes	No
Lepidoptera	Moth	*Caradrina morpheus*	-	Yes	Yes	No
Lepidoptera	Moth	*Celaena haworthii*	-	Yes	Yes	No
Lepidoptera	Moth	*Diarsia rubi*	-	Yes	Yes	No
Lepidoptera	Moth	*Epirrhoe galiata*	-	Yes	Yes	No
Lepidoptera	Moth	*Eugnorisma glareosa*	-	Yes	Yes	No
Lepidoptera	Moth	*Eulithis mellinata*	-	Yes	Yes	No
Lepidoptera	Moth	*Euxoa nigricans*	-	Yes	Yes	No
Lepidoptera	Moth	*Euxoa tritici*	-	Yes	Yes	No
Lepidoptera	Moth	*Hemistola chrysoprasaria*	-	Yes	Yes	No
Lepidoptera	Moth	*Hepialus humuli*	-	Yes	Yes	No
Lepidoptera	Moth	*Hoplodrina blanda*	-	Yes	Yes	No
Lepidoptera	Moth	*Hydraecia micacea*	-	Yes	Yes	No
Lepidoptera	Moth	*Malacosoma neustria*	-	Yes	Yes	No
Lepidoptera	Moth	*Melanchra pisi*	-	Yes	Yes	No
Lepidoptera	Moth	*Mesoligia literosa*	-	Yes	Yes	No
Lepidoptera	Moth	*Mythimna comma*	-	Yes	Yes	No
Lepidoptera	Moth	*Noctua orbona*	-	Yes	Yes	No
Lepidoptera	Moth	*Rhizedra lutosa*	-	Yes	Yes	No
Lepidoptera	Moth	*Scopula marginepunctata*	-	Yes	Yes	No

Order	Habit	*Species*	Red Data Book	Section 42 (UKBAP)	Non-Anglesey LBAP	Recorded during surveys
Lepidoptera	Moth	*Spilosoma lubricipeda*	-	Yes	Yes	No
Lepidoptera	Moth	*Spilosoma luteum*	-	Yes	Yes	No
Lepidoptera	Moth	*Stilbia anomala*	-	Yes	Yes	No
Lepidoptera	Moth	*Tholera cespitis*	-	Yes	Yes	No
Lepidoptera	Moth	*Trichiura crataegi*	-	Yes	Yes	No
Lepidoptera	Moth	*Watsonalla binaria*	-	Yes	Yes	No
Lepidoptera	Moth	*Xanthia icteritia*	-	Yes	Yes	No
Lepidoptera	Moth	*Xylena exsoleta*	-	Yes	Yes	No
Lepidoptera	Moth	*Celaena leucostigma*	-	Yes	-	No
Lepidoptera	Moth	*Cosmia diffinis*	-	Yes	-	No
Lepidoptera	Moth	*Orthonama vittata*	-	Yes	-	No
Lepidoptera	Moth	*Tholera decimalis*	-	Yes	-	No
Lepidoptera	Moth	*Xanthorhoe decoloraria*	-	Yes	-	No
Lepidoptera	Moth	*Xanthorhoe ferrugata*	-	Yes	-	No
Hymenopteran	Bumblebee	*Bombus (Psithyrus) campestris*	-	-	Yes	No
Hymenopteran	Bumblebee	*Bombus (Pyrobombus) jonellus*	-	-	Yes	No
Lepidoptera	Butterfly	*Argynnis aglaja*	-	-	Yes	No
Odonata	Damselfly	*Ischnura pumilio*	Yes	-	Yes	No
Odonata	Damselfly	*Enallagma cyathigerum*	-	-	Yes	No
Odonata	Damselfly	*Lestes sponsa*	-	-	Yes	No
Odonata	Dragonfly	*Aeshna juncea*	-	-	Yes	No
Odonata	Dragonfly	*Sympetrum danae*	-	-	Yes	No
Lepidoptera	Moth	*Agrotis cinerea*	-	-	Yes	No
Lepidoptera	Moth	*Agrotis trux*	-	-	Yes	No
Lepidoptera	Moth	*Celastrina argiolus*	-	-	Yes	No
Lepidoptera	Moth	*Coenagrion puella*	-	-	Yes	No
Lepidoptera	Moth	*Synansphecia muscaeformis*	-	-	Yes	No
Coleoptera	Beetle	*Gyrinus natator*	Yes	-	-	No
Coleoptera	Beetle	*Hydrophilus piceus*	Yes	-	-	No
Coleoptera	Beetle	*Cryptorhynchus lapathi*	Yes	-	-	No
Lepidoptera	Moth	*Lymantria dispar*	Yes	-	-	No
Lepidoptera	Moth	*Malacosoma castrensis*	Yes	-	-	No
Lepidoptera	Moth	*Peribatodes secundaria*	Yes	-	-	No
Lepidoptera	Moth	*Xanthorhoe biriviata*	Yes	-	-	No
Lepidoptera	Moth	*Crambus pratella*	Yes	-	-	No

Appendix C: Notable Species Recorded in the Study Area – All years

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Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Designation	Order	Family	Habit	Habitat
Acupalpus dubius	-	-	-	-	-	-	P	-	-	-	-	-	-	-	-	-	-	Local	Coleoptera	Carabidae	Ground beetle	Heath
Acupalpus parvulus	-	-	-	-	-	-	-	-	-	-	P	-	-	-	-	-	-	Local	Coleoptera	Carabidae	Ground beetle	Hygrophilous
Admontia grandicornis	-	-	-	P	P	-	-	P	-	-	-	-	-	-	-	-	-	Local	Diptera	Tachinidae	Fly	Unknown
Agathidium laevigatum	-	-	-	-	-	-	-	-	-	P	-	-	-	-	-	-	-	Local	Coleoptera	Leiodidae	Beetle	Woodland
Agonum emarginatum	-	-	-	-	P	-	-	-	-	-	P	-	-	-	-	-	-	Local	Coleoptera	Carabidae	Ground beetle	Hygrophilous
Amara lunicollis	P	-	-	-	P	-	-	-	-	P	P	P	P	-	-	-	-	Local	Coleoptera	Carabidae	Ground beetle	Hygrophilous
Anasimyia interpuncta	-	-	-	-	-	-	P	-	-	-	-	-	-	-	-	-	-	Nationally Scarce	Diptera	Syrphidae	Hover Fly	Hygrophilous
Anisosticta novemdecimpunctata	-	-	-	-	-	-	-	-	-	-	-	-	-	P	-	-	-	Local	Coleoptera	Coccinellidae	Ladybird	Hygrophilous
Anthonomus brunnipennis	-	-	-	-	-	-	-	-	-	P	-	-	-	-	P	-	-	Local	Coleoptera	Curculionidae	Weevil	Unknown
Aphthona nonstriata	-	-	-	P	-	-	-	-	-	-	-	-	-	-	-	-	-	Local	Coleoptera	Chrysomelidae	Leaf beetle	Hygrophilous
Atheta vaga	-	-	-	-	P	P	-	-	-	-	-	-	-	-	-	-	-	Local	Coleoptera	Staphylinidae	Rove beetle	Unknown
Badister dilatatus	-	-	-	P	-	-	-	-	-	-	-	-	-	-	-	-	-	notable b	Coleoptera	Carabidae	Ground beetle	Hygrophilous
Bembidion mannerheimi	-	-	-	P	-	-	-	-	-	-	P	-	-	-	-	-	-	Local	Coleoptera	Carabidae	Ground beetle	Unknown
Beris clavipes	-	-	-	-	-	-	-	-	-	-	P	-	-	-	-	-	-	Nationally Notable	Diptera	Stratiomyidae	Soldier Fly	Unknown
Caenopsis waltoni	-	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Local	Coleoptera	Curculionidae	Weevil	Heath
Cafius fucicola	-	-	-	P	-	-	-	-	-	-	-	-	P	-	-	-	-	Local	Coleoptera	Staphylinidae	Rove beetle	Unknown
Cantharis thoracica	-	-	-	P	-	-	-	-	-	-	-	-	-	-	-	-	-	Local	Coleoptera	Cantharidae	Soldier beetle	Hygrophilous
Cassida hemisphaerica	-	-	-	-	-	-	-	-	-	P	-	-	P	-	-	-	-	Notable A	Coleoptera	Chrysomelidae	Leaf beetle	Grassland - generalist
Catapion pubescens	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Notable B	Coleoptera	Curculionidae	Weevil	Grassland - generalist
Chilocorus bipustulatus	-	-	-	-	-	-	-	-	-	P	-	-	P	-	-	-	-	Local	Coleoptera	Coccinellidae	Ladybird	Heath
Chlaenius nigricornis	-	-	-	-	-	-	-	-	-	-	-	P	-	-	-	-	-	Local	Coleoptera	Carabidae	Ground beetle	Hygrophilous
Chrysolina banksi	-	-	-	-	-	-	-	P	P	-	P	-	-	-	-	-	-	Local	Coleoptera	Chrysomelidae	Leaf beetle	Grassland - generalist
Chrysolina brunsvicensis	-	-	-	-	-	-	-	-	P	-	-	-	-	-	-	-	-	Local	Coleoptera	Chrysomelidae	Leaf beetle	Unknown
Chrysolina haemoptera	-	P	-	-	-	-	-	-	-	P	-	P	P	-	-	-	-	Notable B	Coleoptera	Chrysomelidae	Leaf beetle	Scrub
Coelositona cambricus	-	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Local	Coleoptera	Curculionidae	Weevil	Grassland - generalist
Coenonympha pamphilus	-	-	-	-	-	-	-	-	P	-	-	-	-	-	-	-	-	S42	Lepidoptera	Nymphalidae	Butterfly	Heath
Coenosia lacteipennis	-	-	-	-	-	-	-	-	-	-	-	-	-	P	-	-	-	Local	Diptera	Muscidae	Fly	Unknown
Cytilus sericeus	-	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Local	Coleoptera	Byrrhidae	Pill beetle	Grassland - generalist
Dolichopus notatus	-	-	-	P	-	-	-	P	-	-	-	-	-	-	-	-	-	Nationally Scarce	Diptera	Dolichopodidae	Fly	Unknown
Dolichopus signifer	-	-	-	-	-	-	-	-	-	-	-	-	P	-	-	-	-	Local	Diptera	Dolichopodidae	Fly	Unknown
Donacia simplex	-	-	-	-	-	-	-	P	-	-	-	-	-	-	-	-	-	Local	Coleoptera	Chrysomelidae	Leaf beetle	Hygrophilous
Dryops ernesti	-	-	-	P	P	-	-	-	-	-	P	-	-	-	-	-	-	Local	Coleoptera	Dryopidae	Marsh beetle	Hygrophilous

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Designation	Order	Family	Habit	Habitat
Dyschirius globosus	-	P	-	-	-	-	-	-	-	-	-	-	P	-	-	-	-	Local	Coleoptera	Dyschirius	Ground beetle	Hygrophilous
Erioptera nielseni	-	-	-	P	-	-	-	-	-	-	-	-	-	-	-	-	-	Nationally Notable	Diptera	Limoniidae	Cranefly	Hygrophilous
Galerucella sagittariae	-	-	-	-	-	-	P	-	-	-	-	-	-	-	-	P	P	Local	Coleoptera	Chrysomelidae	Leaf beetle	Hygrophilous
Glocianus punctiger	-	-	-	-	-	-	-	-	-	-	-	P	-	-	-	-	-	Notable B	Coleoptera	Curculionidae	Weevil	Grassland - generalist
Gnypeta carbonaria	-	-	-	P	-	-	-	-	-	-	-	-	-	-	-	-	-	Local	Coleoptera	Staphylinidae	Rove beetle	Unknown
Graptus triguttatus	-	P	P	P	P	-	-	-	-	-	-	-	P	-	-	-	-	Local	Coleoptera	Curculionidae	Weevil	Hygrophilous
Gymnusa brevicollis	-	-	-	-	-	-	-	-	-	-	P	-	-	-	-	-	-	Local	Coleoptera	Staphylinidae	Rove beetle	Unknown
Hypera pollux	-	-	-	-	-	-	-	P	-	-	-	-	-	-	-	-	-	Local	Coleoptera	Curculionidae	Weevil	Hygrophilous
Ischnopterapion modestum	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Local	Coleoptera	Curculionidae	Weevil	Unknown
Lasiommata mergera	-	-	-	-	P	-	-	-	P	P	-	P	-	P	-	-	-	S42	Lepidoptera	Nymphalidae	Butterfly	Grassland - generalist
Leistus fulvibarbis	-	-	-	-	P	-	-	-	P	P	P	-	P	-	-	-	P	Local	Coleoptera	Carabidae	Ground beetle	Woodland
Lema cyanella	-	-	-	-	P	-	-	-	-	-	-	-	-	-	-	-	-	Local	Coleoptera	Chrysomelidae	Leaf beetle	Grassland - improved
Lonchaea corusca	-	-	-	-	P	-	-	-	-	-	-	-	-	-	-	-	-	Nationally Notable	Diptera	Lonchaeidae	Lance fly	Unknown
Longitarsus exoletus	-	P	-	-	-	-	-	-	-	-	P	-	-	-	-	-	-	Local	Coleoptera	Chrysomelidae	Leaf beetle	Unknown
Macquartia tenebricosa	-	-	-	-	-	-	-	-	-	-	-	-	-	P	-	-	-	Local	Diptera	Tachinidae	Tachinid fly	Unknown
Mantura chrysanthemi	-	-	-	-	-	-	-	-	-	-	-	-	P	-	-	-	-	Local	Coleoptera	Chrysomelidae	Leaf beetle	Grassland - unimproved
Margarinotus neglectus	-	-	-	P	-	-	-	-	-	-	-	-	-	-	-	-	-	Local	Coleoptera	Histeridae	Histerid beetle	Unknown
Microdota boreella	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Local	Coleoptera	Staphylinidae	Rove beetle	Unknown
Molophilus pleuralis	-	-	-	P	-	-	-	-	-	-	-	P	P	-	-	-	-	Local	Diptera	Limoniidae	Cranefly	Hygrophilous
Mydaea ancilla	-	-	-	-	-	-	-	-	-	-	-	-	-	P	-	-	-	Local	Diptera	Muscidae	Fly	Unknown
Neliocarus nebulosus	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Local	Coleoptera	Curculionidae	Weevil	Grassland - generalist
Notiophilus aquaticus	P	P	-	-	-	-	-	-	-	-	-	-	P	-	-	-	-	Local	Coleoptera	Carabidae	Ground beetle	Grassland - unimproved
Notiophilus germinyi	-	-	-	-	-	-	-	-	-	P	-	-	-	-	-	-	-	Local	Coleoptera	Carabidae	Ground beetle	Grassland - unimproved
Notiophilus substriatus	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Local	Coleoptera	Carabidae	Ground beetle	Grassland - generalist
Ocypus aeneocephalus	-	P	-	-	-	-	-	-	-	P	P	P	P	-	-	-	-	Local	Coleoptera	Staphylinidae	Rove beetle	Grassland - generalist
Oedemera lurida	P	-	-	-	P	-	P	-	P	-	P	-	-	-	P	P	-	Local	Coleoptera	Oedemeridae	Blister beetle	Grassland - generalist
Pachybrachius fracticollis	-	-	-	-	-	-	-	-	P	-	-	-	-	-	-	-	-	Local	Hemiptera	Lygaeidae	True bug	Hygrophilous
Paederus riparius	-	-	-	P	P	-	-	P	P	-	P	-	-	-	-	-	-	Local	Coleoptera	Staphylinidae	Rove beetle	Unknown
Perapion immune	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Local	Coleoptera	Curculionidae	Weevil	Unknown
Perapion marchicum	P	-	-	-	-	-	-	-	-	P	-	P	-	-	-	-	-	Local	Coleoptera	Curculionidae	Weevil	Grassland - improved
Phaedon tumidulus	-	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Local	Coleoptera	Chrysomelidae	Leaf beetle	Grassland - generalist
Phalacrocera replicata	-	-	-	-	-	-	-	-	P	-	-	-	-	-	-	-	-	Nationally Notable	Diptera	Tipulidae	Cranefly	Hygrophilous
Philonthus nigrita	-	-	-	-	-	-	P	-	P	-	P	-	P	-	-	-	-	Local	Coleoptera	Staphylinidae	Rove beetle	Unknown
Philorhizus notatus	-	-	-	-	-	-	-	-	-	P	-	-	-	-	-	-	-	Local	Coleoptera	Carabidae	Ground beetle	Grassland - unimproved

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Designation	Order	Family	Habit	Habitat
Phylidorea abdominalis	-	-	-	-	-	-	-	-	P	-	-	-	-	-	-	-	-	Nationally Notable	Diptera	Limoniidae	Cranefly	Hygrophilous
Phyllobius virideaeris	P	-	-	-	-	-	-	P	-	P	-	-	-	-	-	-	-	Local	Coleoptera	Curculionidae	Weevil	Grassland - generalist
Phyllotreta exclamationis	-	-	-	-	-	-	-	-	-	P	P	-	-	-	-	-	-	Local	Coleoptera	Chrysomelidae	Leaf beetle	Hygrophilous
Pirapion immune	-	-	-	-	-	-	-	-	-	-	-	-	-	P	-	-	-	Local	Coleoptera	Apionidae	Weevil	Unknown
Plateumaris discolor	-	-	-	P	-	-	-	P	P	-	-	-	-	-	-	-	-	Local	Coleoptera	Chrysomelidae	Leaf beetle	Hygrophilous
Platydracus stercorarius	-	-	-	-	-	-	-	-	-	-	-	-	P	-	-	-	-	Local	Coleoptera	Staphylinidae	Rove beetle	Hygrophilous
Prasocuris junci	-	P	-	-	P	P	P	P	P	-	P	P	-	-	-	-	-	Local	Coleoptera	Chrysomelidae	Leaf beetle	Hygrophilous
Psylliodes picina	-	-	-	-	-	-	-	-	-	P	P	-	-	-	-	-	-	Local	Coleoptera	Chrysomelidae	Leaf beetle	Unknown
Rhacognathus punctatus	-	-	-	-	-	-	-	-	-	P	-	-	-	-	-	-	-	Local	Hemiptera	Pentatomidae	Shieldbug	Heath
Rhinoncus bruchoides	-	-	-	-	-	-	-	-	-	-	-	P	-	-	-	-	-	Local	Coleoptera	Curculionidae	Weevil	Unknown
Silpha tristis	P	P	-	-	P	P	-	-	P	P	P	P	P	-	-	-	-	Local	Coleoptera	Silphidae	Beetle	Unknown
Sitona lineellus	-	-	-	-	-	-	-	-	-	-	-	-	-	P	-	-	-	Local	Coleoptera	Curculionidae	Weevil	Grassland - unimproved
Staphylinus erythropterus	-	-	-	-	P	-	-	-	-	-	-	-	-	-	-	-	-	Local	Coleoptera	Staphylinidae	Rove beetle	Unknown
Stenus cicindeloides	-	-	-	-	-	-	P	-	-	-	P	-	-	-	-	-	-	Local	Coleoptera	Staphylinidae	Rove beetle	Hygrophilous
Stictotarsus duodecimpustulatus	-	-	-	-	-	-	-	-	-	-	P	-	-	-	-	-	-	Local	Coleoptera	Dytiscidae	Water beetle	Aquatic
Synapion ebeninum	-	-	-	-	P	-	-	-	-	-	P	-	-	-	-	-	-	Local	Coleoptera	Curculionidae	Weevil	Grassland - unimproved
Tachinus laticollis	-	-	-	-	-	-	-	-	-	P	-	-	-	-	-	-	-	Local	Coleoptera	Staphylinidae	Rove beetle	Unknown
Tachyporus atriceps	P	P	-	-	-	-	-	-	-	-	-	-	P	-	-	-	-	Local	Coleoptera	Staphylinidae	Rove beetle	Unknown
Tachyporus pallidus	-	-	-	-	-	-	P	-	-	-	P	-	-	-	-	-	-	Local	Coleoptera	Staphylinidae	Rove beetle	Unknown
Trichosirocalus troglodytes	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Local	Coleoptera	Curculionidae	Weevil	Grassland - improved
Tyria jacobaeae	P	-	-	-	P	-	-	-	-	-	-	P	-	-	-	-	-	S42	Lepidoptera	Arctiidae	Moth	Grassland - improved
Total	15	13	1	15	17	3	8	9	14	18	22	12	17	7	2	2	2					