

**A66 Northern Trans-Pennine Project  
TR010062**

**3.4 Environmental Statement  
Appendix 6.8 Terrestrial Invertebrate**

**APFP Regulations 5(2)(a)**

**Planning Act 2008**

**Infrastructure Planning (Applications: Prescribed Forms and  
Procedure) Regulations 2009**

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A66 Northern Trans-Pennine Project  
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**3.4 ENVIRONMENTAL STATEMENT  
APPENDIX 6.8 TERRESTRIAL INVERTERBRATES**

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## 6.8 Terrestrial Invertebrate

### 6.8.1 Introduction

#### Project background

- 6.8.1.1 The A66 Northern Trans-Pennine project ('the Project') is a programme of works to improve the A66 between the M6 at Penrith and A1 at Scotch Corner.
- 6.8.1.2 Between the M6 and the A1(M) the existing A66 is approximately 80km in length. Along this length it is intermittently dualled, with approximately 30km of single carriageway, in six separate sections, making the route accident prone and unreliable.
- 6.8.1.3 The route carries high levels of freight traffic and is an important route for tourism and connectivity to local communities. The variable road standards, together with the lack of available diversionary routes when incidents occur, affects road safety, reliability, resilience and attractiveness of the route. For a full project description see Chapter 2: The Project (Application Document 3.2).

#### Scope of the document

- 6.8.1.4 This report presents desk study data and baseline survey results for terrestrial invertebrates. Baseline surveys were conducted from October 2020 and throughout 2021. It is intended that the information in this report will be used to identify and assess potential implications of the Project in relation to terrestrial invertebrates and inform any mitigation and compensation required. This baseline report can be used to accompany any future planning application and associated Environmental Impact Assessment (EIA) for the Project.

### 6.8.2 Policy Framework

#### Legislation

- 6.8.2.1 A framework of international, European, national and local legislation and planning policy guidance exists to protect and conserve wildlife and habitats. This legislation is listed within Environment Statement (ES) Chapter 6: Biodiversity (Application Document 3.2). Terrestrial invertebrates are protected by a range of conservation legislation, including protection as European protected species (EPS), under schedule 5 of the Wildlife and Countryside Act 1981, and within several other pieces of legislation.

#### *Natural Environment and Rural Communities Act 2006*

- 6.8.2.2 The Natural Environment and Rural Communities Act (NERC) Act 2006 is designed to help achieve a rich and diverse natural environment and thriving rural communities. Section 41 (S41) of the Act requires the Secretary of State to publish a list of habitats and species which are of principal importance for the conservation of biodiversity in England. The S41 list is used to guide decision-makers such as public bodies, including local and regional authorities, in implementing their duty under

Section 40 (Joint Nature Conservation Committee and Department for Environment Food and Rural Affairs, 2012)<sup>1</sup> (Nature England, 2013)<sup>2</sup>.

- 6.8.2.3 Under Section 40 there is a Duty to conserve biodiversity; specifically, Subsection (1) states:

*“Every public authority must, in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity.”*

#### *EC Directive Conservation of Natural Habitats & Flora (92/43/EEC)*

- 6.8.2.4 The Conservation of Habitats and Species Regulations 2017 consolidated and updated the Conservation of Habitats and Species Regulations 2010 (as amended). They are the British response to the Habitats and Species Directive 1992 issued by the European Community (EC) (which is now the European Union (EU)). They offer protection to a number of plant and animal species throughout the EC via the designation of Special Areas of Conservation (SACs).

- 6.8.2.5 Core areas of habitat for species listed on Annex II of the Habitats Directive are designated as sites of Community importance (SCIs) and included in the Natura 2000 network. These sites must be managed in accordance with the ecological needs of the species for which they are designated.

#### *Wildlife and Countryside Act 1981*

- 6.8.2.6 Many invertebrate species receive partial legal protection in England and Wales, arising from Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) (WCA) which makes it an offence to intentionally kill or injure these species.

#### *National level policy*

- 6.8.2.7 The primary policy basis for deciding whether or not to grant a Development Consent Order (DCO) is the *National Policy Statement for National Networks (NPSNN)* (Department for Transport, 2014)<sup>3</sup>, which sets out policies to guide how DCO applications will be decided and how the effects of national networks infrastructure should be considered by the relevant decision maker. The policies for biodiversity and ecological conservation include statements that:

- 6.8.2.8 “Biodiversity is the variety of life in all its forms and encompasses all species of plants and animals and the complex ecosystems of which they are a part. Government policy for the natural environment is set out in the Natural Environment White Paper (NEWP). The NEWP sets out a vision of moving progressively from net biodiversity loss to net gain, by supporting healthy, well-functioning ecosystems and establishing more

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<sup>1</sup> Joint Nature Conservation Committee and Department for Environment Food and Rural Affairs (on behalf of the Four Countries’ Biodiversity Group) (2012) UK Post-2010 Biodiversity Framework

<sup>2</sup> Natural England (2013) Priority Actions for S41 Species

<sup>3</sup> Department for Transport (2014) National Policy Statement for National Networks

coherent ecological networks that are more resilient to current and future pressures...” (NPSNN paragraph 5.20)

6.8.2.9 The NPSNN also advises:

6.8.2.10 “In taking decisions, the Secretary of State should ensure that appropriate weight is attached to designated sites of international, national and local importance, protected species, habitats and other species of principal importance for the conservation of biodiversity, and to biodiversity and geological interests within the wider environment.” (NPSNN paragraph 5.26)

Table 1: NPSNN policies.

Relevant NPSNN paragraph reference Requirement of the NPSNN (paraphrase)	Relevant NPSNN paragraph reference Requirement of the NPSNN (paraphrase)
5.22	Outline any likely significant effects on internationally, nationally and locally designated sites of ecological or geological conservation importance on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity and that the statement considers the full range of potential impacts on ecosystems.
5.23	Demonstrate how the project has taken advantage of opportunities to conserve and enhance biodiversity conservation interests.
5.29	Ensure proposals mitigate the harmful aspects of the development and, where possible, to ensure the conservation and enhancement of the site’s biodiversity are acceptable.
5.33	Development proposals potentially provide many opportunities for building in beneficial biodiversity features. Opportunities to maximise beneficial biodiversity features should be considered. Planning obligations can be used where appropriate in order to ensure that such beneficial features are delivered.
5.34 and 5.35	Individual wildlife species receive statutory protection under a range of legislative provisions. Other species and habitats have been identified as being of principal importance for the conservation of biodiversity in England and Wales. Undertake measures to ensure these species and habitats are protected from adverse effects. Where appropriate, requirements or planning obligations may be used in order to deliver this protection.
5.36	Include appropriate mitigation measures as an integral part of their proposed development, including identifying where and how these will be secured
5.37	Consider what appropriate requirements should be attached to any consent and/or in any planning obligations entered into in order to ensure that mitigation measures are delivered.

Relevant NPSNN paragraph reference Requirement of the NPSNN (paraphrase)	Relevant NPSNN paragraph reference Requirement of the NPSNN (paraphrase)
5.38	Take account of what mitigation measures may have been agreed between the applicant and Natural England and/or the Marine Management Organisation (MMO), and whether Natural England and/or the MMO has granted or refused, or intends to grant or refuse, any relevant licences, including protected species mitigation licences.

### National planning policy framework

- 6.8.2.11 The *National planning policy framework (NPPF)* (Ministry of Housing, Communities & Local Government, 2021)<sup>4</sup> originally published in March 2012 and most recently updated in July 2021, sets out the government’s planning policies for England and provides a framework within which locally prepared plans can be produced. The *NPPF* is “an important and relevant matter to be considered in decision making for NSIP”<sup>5</sup>.

### Regional and local level policy

- 6.8.2.12 Although the UK Biodiversity Action Plan (BAP) has been superseded, BAPs are still widely used at county level to support Biodiversity 2020 (Department for Environment Food and Rural Affairs, 2011)<sup>6</sup>.
- 6.8.2.13 The chalk carpet moth *Scotopteryx bipunctaria*, cistus forrester *Adscita geryon*, dark green fritillary *Speyeria aglaja*, dingy skipper *Erynnis tages*, glow worm *Lampyrus noctiluca*, grayling *Hipparchia semele*, green hairstreak *Callophrys rubi*, least minor moth *Photedes captiuncula*, mud snail *Omphiscola glabra*, northern brown argus *Aricia artaxerxes*, small pearl-bordered fritillary *Boloria selene*, and white-letter hairstreak *Satyrion w-album* are listed as priority species on the North East England Nature Partnership (North East England Nature Partnership, 2013)<sup>7</sup>.
- 6.8.2.14 The sandbowl snail *Quickella arenaria*, whorl snail *Vertigo geyeri*, medicinal leech *Hirudo medicinalis*, iron blue mayfly *Nigrobaetis niger*, variable damselfly *Coenagrion pulchellum*, white-faced dragonfly *Leucorrhinia dubia*, northern dune tiger beetle *Cicindela hybridam*, lesser searcher *Calosoma inquisitor*, st. bees seed-eater *Harpalus honestus*, oxbow diving beetle *Hydroporus rufifrons*, hairy click beetle *Synaptus filiformis*, black oil-beetle *Meloe proscarabaeus*, violet oil-beetle *Meloe violaceus*, zircon reed beetle *Donacia aquatica*, caddisfly *Glossosoma intermedium*, river-shore crane fly *Rhabdomastix japonica*, Scottish yellow splinter *Lipsothrix ecucullata*, northern yellow splinter

<sup>4</sup> Ministry of Housing, Communities & Local Government (2021) National Planning Policy Framework

<sup>5</sup> Nationally Significant Infrastructure Projects (NSIP)

<sup>6</sup> Department for Environment Food and Rural Affairs (2011) Biodiversity 2020: A Strategy for England’s Wildlife and Ecosystem Services. Department for Environment, Food and Rural Affairs, London.

<sup>7</sup> North East England Nature Partnership (2013) Biodiversity Priorities



*Lipsothrix errans*, scarce yellow splinter *Lipsothrix nigristigma*, southern silver stiletto-fly *Clorismia rustica*, northern silver stiletto-fly *Dyschirius angustatus*, phantom hoverfly *Dorus profuges*, shining guest ant *Formicoxenus nitidulus*, red wood ant *Formica rufa*, northern colletes *Colletes floralis*, tormentil mining bee *Andrena tarsata*, wall mason bee *Osmia parietina*, moss carder-bee *Bombus muscorum*, sedge jumper *Sitticus caricis*, broad groove-head spider *Monocephalus castaneipes*, cloud-living spider *Semljicola caliginosus*, and triangle hammock-spider *Saaristoa firma* are listed as priority species on the Cumbria BAP (Cumbria Biodiversity Partnership, 2001)<sup>8</sup>

6.8.2.15 The following local planning policies are relevant to this report:

- *Eden Local Plan (2014-2032)* (Eden District Council, 2014)<sup>9</sup> Policy ENV1 and Policy ENV4
- *County Durham Plan (Adopted 2020)* (Durham County Council, 2020)<sup>10</sup> Policy 26, Policy 40, Policy 41, Policy 42 and Policy 43
- *Richmondshire Local Plan (2012-2028)* adopted 2014 (Richmondshire District Council, 2014)<sup>11</sup> Core Policy CP12
- *Richmondshire District Councils BAP* (Richmond County Council, 2014)<sup>12</sup>.

#### Other relevant policy and guidance

6.8.2.16 In addition to compliance with the *NPSNN* and *NPPF*, this report has been written in accordance with professional standards and guidance. The standards and guidance which relate to the assessment are:

- *Guidance for Ecological Impact Assessment in the United Kingdom Third Edition* (Chartered Institute of Ecology and Environmental Management, 2018)<sup>13</sup>

### 6.8.3 Methodology

#### Desk study

6.8.3.1 Targeted locations were identified following review of Phase 1 habitat survey data, aerial photography and maps.

6.8.3.2 Habitat information from Phase 1 Surveys, aerial photographs and ordnance survey (OS) maps was reviewed and compared with broad habitat types from Pantheon (Webb et al., 2018)<sup>14</sup> to evaluate associated habitats and resources, assemblage types (adapted from the

<sup>8</sup> Cumbria Biodiversity Partnership (2001) The Cumbria Biodiversity Action Plan

<sup>9</sup> Eden District Council (2014) Eden Local Plan 2014 to 2032

<sup>10</sup> Durham Council (2020) County Durham Plan – Adopted 2020

<sup>11</sup> Richmond County Council (2014) Richmondshire Local Plan 2012 - 2028 Core Strategy (Adopted 9 December 2014)

<sup>12</sup> Richmond County Council (2014) Richmondshire Biodiversity Action Plan

<sup>13</sup> Chartered Institute of Ecology and Environmental Management (2018) Guidance for Ecological Impact Assessment in the United Kingdom Third Edition

<sup>14</sup> Webb, J., Heaver, D., Lott, D., Dean, H.J., van Breda, J., Curson, J., Harvey, M.C., Gurney, M., Roy, D.B., van Breda, A., Drake, M., Alexander, K.N.A. and Foster, G. (2018) Pantheon - database version 3.7.6



Invertebrate Species-habitat Information System [ISIS]), and habitat fidelity scores.

- 6.8.3.3 The broad habitat types and habitat information were also assessed to identify the potential Species Assemblage Types (SATs) likely to be associated, which are an indicator of invertebrate assemblages of importance.
- 6.8.3.4 This review also identified areas with most likelihood to contain features of importance to terrestrial invertebrate species or with habitats known to be suitable for terrestrial invertebrates listed on UKBAP or LBAP.
- 6.8.3.5 This was done by scheme with a study area of 100m from the Order limits.
- 6.8.3.6 Species lists received from Local Ecological Records Centres which included all terrestrial invertebrate species recorded was analysed using Pantheon to evaluate associated habitats and resources, assemblage types (adapted from the Invertebrate Species-habitat Information System [ISIS]), habitat fidelity scores and other information for them. This also assesses if the species list qualifies as a SAT and indicates the condition of this.
- 6.8.3.7 This was done by scheme with a study area of 2km from the Order Limits.

#### Field survey

- 6.8.3.8 Terrestrial invertebrate surveys were undertaken in accordance with best practice guidelines (Drake et al., 2007)<sup>15</sup>.
- 6.8.3.9 Targeted locations, identified through the desk study, were subject to a walkover survey to assess potential invertebrate interest and decide on an appropriate survey methodology based on the habitats and features present.
- 6.8.3.10 The walkover surveys were undertaken in March 2021 and assessed the potential for habitats within the area to support invertebrate assemblages of importance, and the likelihood of significant rare or endangered species to be present.
- 6.8.3.11 This involved a visual inspection of the area, looking for and recording features which may be of potential interest to invertebrate species. These features included bare or disturbed ground, standing or fallen deadwood, grass tussocks, presence of pollinator and food plants, areas of micro-climates, and aspects known to be important for invertebrate activity such as land being south facing, key topographical features and water features.
- 6.8.3.12 The walkover surveys also identified and recorded areas of habitat mosaic, which offer opportunities for specialist invertebrates requiring varying habitats at differing life stages.

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<sup>15</sup> Drake CM, Lott DA, Alexander KNA and Webb J., (2007) Natural England Research Report NERR005 Surveying terrestrial and freshwater invertebrates for conservation evaluation

- 6.8.3.13 Based on the results of the walkover surveys, if further surveys were required (based on the habitats and features present), these comprised:
- Deadwood surveys – these involve hand search, sweeping, beating of standing and fallen deadwood. Target groups were beetles (Coleoptera) and flies (Diptera). Aculeates may be included where timber is exposed to the sun. These were undertaken in September or October, May or June, and July or August.
  - Arboreal surveys – these involve sweeping and beating of trees. Target groups are moths (Lepidoptera) and bugs (Heteroptera and Auchenorrhyncha). These were undertaken in April and May.
  - Marshland – these involve sweeping and ground search. Target group is beetles. These were undertaken between May and June.
  - Open mosaic habitat – these involve sweeping and hand search. Target groups are beetles, aculeates, grasshoppers (Orthoptera), heteropteran bugs, larger flies. These were undertaken between April and June.
  - Grassland/scrub (May - June) – these involve sweeping and hand search. Target groups any two of: beetles, flies, bugs and aculeates.
  - Bryophyte heath (May - June) – these involve sweeping and hand search. Target groups are beetles, spiders (Araneae) and homopteran bugs.
- 6.8.3.14 Species were collected and preserved for analysis off site.
- 6.8.3.15 Species lists from each survey area were analysed using Pantheon to evaluate associated habitats and resources, assemblage types (adapted from the Invertebrate Species-habitat Information System [ISIS]), habitat fidelity scores and other information.
- 6.8.3.16 This analysis also identified whether the species list qualified as an Species Assemblage Type and indicated the condition of this.

## 6.8.4 Assumptions and Limitations

- 6.8.4.1 This report does not identify features and habitats with the potential to support aquatic invertebrate assemblages of importance or assess the likelihood of significant rare or endangered aquatic invertebrate species to be present. Aquatic invertebrates are covered within Appendix 6.21 Aquatic Invertebrate (Application Document 3.4).
- 6.8.4.2 Desk study record searches which result in a lack of species records within an area may not reflect an actual absence of that species but could simply be a function of limited recording or survey effort in that area. As sufficient records were available to enable analysis of broad habitats and assemblages this was not a significant limitation.
- 6.8.4.3 This report highlights habitats and the potential for notable species or terrestrial invertebrate assemblages evident on the day of the survey visit. It does not record any ecological features that may only appear at other times of the year and therefore were not evident at the time of the visit. This includes invertebrates that are not readily identifiable outside of their adult life stage. This is accepted as a constraint to invertebrate

surveys generally within timeframes allowed and is therefore not a significant limitation.

- 6.8.4.4 Terrestrial invertebrate surveys are a sample of what is present at a particular time and place. Invertebrate populations fluctuate with localised extinctions and metapopulation dynamics which can only be fully assessed over a length of time and with multiple survey visits throughout the year. This is accepted as a constraint to invertebrate surveys generally within timeframes allowed and is therefore not a significant limitation.
- 6.8.4.5 Surveys involving pitfall traps were not used, due to health and safety restrictions on breaking ground so following Drake et al 2007 alternative survey techniques were used instead, this was not a significant limitation.
- 6.8.4.6 Surveys involving sweeping are heavily impacted by the weather. Sweeping vegetation is not possible during or following rainfall until the vegetation has dried out. Survey effort was constrained by showery periods throughout the 2021 season. Sufficient alternative information was obtained that this was not a significant limitation for this report.

## 6.8.5 Results

### Routewide

- 6.8.5.1 The road verges were generally a mix of rank grassland, scrub and plantation woodland, largely managed and without structure. While the connectivity provided by these offered some benefit to invertebrate populations in movement across the Project, the verges lacked floral diversity, tussocks and other structure, age variation of scrub or trees, and spatial variation.
- 6.8.5.2 Habitats present routewide of high value to terrestrial invertebrates include grassland, woodland, wetlands, ephemeral vegetation, hedgerows, heathland, scrub and open mosaic habitat (OMH) on previously developed land. Habitats of lower value include arable fields, heavily grazed grassland, hard standing and built environment, and amenity grassland. However, within these areas of lower value features such as standing and fallen deadwood or mature and older trees, animal dung and gardens may offer potential habitat for invertebrates of importance.
- 6.8.5.3 The desk study completed in February 2021 identified broad habitats, species and assemblages of potential importance to terrestrial invertebrates.
- 6.8.5.4 Habitat data from Phase 1 habitat surveys, aerial photographs and maps was reviewed and compared with broad habitat types from Pantheon to evaluate associated habitats and resources, assemblage types (adapted from the ISIS), and habitat fidelity scores. The broad habitat types and habitat data were also assessed to identify the potential Species Assemblage Types (SATs) likely to be associated, which are an indicator of invertebrate assemblages of importance.

6.8.5.5 The following potential Pantheon broad habitat types and associated SATs were identified routewide:

- DW1 Decaying Wood. Wood-decay (saproxylic) species are associated with the decomposition of woody tissues and their agents, notably fungi, or are predators of other saproxylic species. Many species develop in specific microhabitats, some of which are mostly or entirely restricted to mature trees. Many of the rarest species are dependent on the presence of ancient trees, whose age can be measured in centuries. Potential SATs present fungal fruiting bodies, epiphyte fauna, bark and sapwood decay, heartwood decay.
- A1 Arboreal. Arboreal species are associated with habitat in and on trees, including the canopy, trunks and branches. Potential SATs present fungal fruiting bodies, epiphyte fauna, bark and sapwood decay, heartwood decay, scrub edge. Potential for white letter hairstreak *Satyrium w-album* presence.
- F21 Tall Sward and Scrub. Tall sward and scrub species are associated with areas of dense herbage or partial shade where a humid microclimate is maintained at ground level. Dominance by woody plants is limited by exposure, grazing or cutting of vegetation, but they often form an important component of the habitat. Potential SATs present rich flower resource.
- S1 Shaded Woodland Floor. Shaded woodland floor species are associated with habitats found in closed canopy woodland and scrub, where it is separated vertically rather than horizontally from arboreal assemblage types. It is associated with low levels of disturbance. Plant cover at ground level is restricted by relatively low light levels and accumulations of leaf litter. Many characteristic species occur in or under leaf litter and are either saprophagous or predaceous. A smaller number of species are phytophagous and develop on shade-loving plants. Potential SATs present fungal fruiting bodies, epiphyte fauna, seepages.
- F22 Short Sward and Bare Ground. In lowland areas, short sward and bare ground habitat is where disturbance removes vegetation to create areas of bare or sparsely vegetated ground. Potential SATs present open short sward, rich flower resource and open water on disturbed mineral sediments.
- W24 Marshland. Marshland habitat is associated with still open water bodies and littoral areas on mineral substrates that may be subject to repeated disturbance, for example by flooding or grazing. Floodplain sites may be inundated for varying periods, either by surface run-off or by rising groundwater. Potential SATs present reed-fen and pools, undisturbed fluctuating marsh, and open water on disturbed mineral sediments.
- W23 Running Water. Running water species are associated with habitats along stretches of rivers, streams and stronger spring-fed seepages where water action removes or retards vegetation, scours sediment to reveal bedrock or boulders or deposits fresh shingle, sand or silt. Potential SATs present shingle banks, riparian sand, stream and river margin. Potential for shore bug *Sadula fucicola*, leaf beetle *Hydrothassa hannoverianna*, ground beetles *Bembidion*

*schuepelli*, *B. fluviatile* and *Asaphidian pallipes*, flies *Loncoptera meijeri*, *Camspicnemus marginatus* and *Rhaphium fractrum* presence.

6.8.5.6 Additionally, several areas of habitat were identified as potential OMH on previously developed land, a UK Priority Habitat (Lush et al., 2013)<sup>16</sup>. To qualify habitats must meet the following criteria:

- The area of OMH is at least 0.25ha in size
- There is a known history of disturbance at the site or evidence that soil has been removed or severely modified by previous use(s) of the site. Extraneous materials/substrates such as industrial spoil may have been added
- The site contains some vegetation. This will comprise early successional communities consisting mainly of stress-tolerant species (for example, indicative of low nutrient status or drought). Early successional communities are composed of (a) annuals, or (b) mosses/liverworts, or (c) lichens, or (d) ruderals, or (e) inundation species, or (f) open grassland, or (g) flower-rich grassland, or (h) heathland
- The site contains unvegetated, loose bare substrate and pools may be present
- The site shows spatial variation, forming a mosaic of one or more of the early successional communities (a) to (h) above (criterion 3) plus bare substrate, within 0.25ha.

6.8.5.7 Potential SATs present in OMH include open short sward, rich flower resource, scrub edge, bare sand and chalk and open water on disturbed mineral sediments.

6.8.5.8 Lists of species identified are not included in this appendix due to space limitations but are available on request.

#### M6 Junction 40 to Kemplay Bank

##### *Desk study*

6.8.5.9 One-hundred and forty-five protected, notable or species of conservation concern were identified from desk study records. These comprised one endangered species, three 'near threatened', three 'vulnerable', two 'nationally scarce', three notable, and 133 locally common. One species is also included in Section 41, with a further 14 species Section 41 for research only.

##### *Field survey*

6.8.5.10 Two-hundred and ninety-five species were recorded within the survey area of the M6 Junction 40 to Kemplay Bank scheme.

6.8.5.11 Analysis by Pantheon shows that 71 species are associated with the sward or the field layer of tall sward and scrub, 51 species with the canopy layer of arboreal habitat, and 47 associated with broadleaved

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<sup>16</sup> Lush, M.J., Kirby, P., Shepherd, P. (2013) Open Mosaic Habitat Survey Handbook. ExeGesIS Spatial Data Management Ltd, Powys

only arboreal habitat (Table 2: Habitat output from Pantheon for M6 Junction 40 to Kemplay Bank).

Table 2: Habitat output from Pantheon for M6 Junction 40 to Kemplay Bank

Broad biotope	Habitat	Resource	Number of species	% representation	Species with conservation status
Open habitats	Tall sward and scrub	habitats >> sward/field layer	71	4	60
Tree-associated	Arboreal	canopy	51	4	42
Tree-associated	Arboreal	conifer or broadleaved >> broadleaved only	47	5	39
Open habitats	Tall sward and scrub	habitats >> litter and ground layer	26	4	2
Open habitats	Tall sward and scrub	soil humidity >> dry	21	3	15
Open habitats	Tall sward and scrub	soil humidity >> variable humidity	19	4	5
Open habitats	Tall sward and scrub	soil humidity >> damp	18	4	8
Tree-associated	Shaded woodland floor	conifer or broadleaved >> broadleaved only	16	1	5
Tree-associated	N/A	canopy >> scrub at wood edge/glade	16	7	16
Tree-associated	N/A	flowers (adult)	13	9	13
Tree-associated	N/A	shadiness	12	2	2

6.8.5.12 Six species are associated with a SAT, rich flower resource, however this is an unfavourable condition for this SAT (Table 3: Specific Assemblage Type output from Pantheon for M6 Junction 40 to Kemplay Bank).

Table 3: Specific Assemblage Type output from Pantheon for M6 Junction 40 to Kemplay Bank

Broad biotope	Habitat	SAT	Number of species	% representation	Reported condition
Open habitats	N/A	rich flower resource	6	2	Unfavourable (6 species, 15 required)



Broad biotope	Habitat	SAT	Number of species	% representation	Reported condition
Open habitats	N/A	scrub-heath and moorland	3	<1	Unfavourable (3 species, 9 required)
Tree-associated	Decaying wood	bark and sapwood decay	3	<1	Unfavourable (3 species, 19 required)
N/A	N/A	seepage	1	2	Unfavourable (1 species, 6 required)
Open habitats	Short sward and bare ground	exposed sea-cliff	1	2	Unfavourable (1 species)
Open habitats	Tall sward and scrub	montane and upland	1	<1	Unfavourable (1 species, 8 required)
Open habitats	N/A	scrub edge	1	<1	Unfavourable (1 species, 11 required)

6.8.5.13 Areas identified as having potential for terrestrial invertebrate interest within the study area of the M6 Junction 40 to Kemplay Bank scheme were (Figure 6.3 Phase 1 Habitat and Terrestrial Invertebrate Survey (Application Document 3.3):

- Transect 21, Chainage 10100, Skirsgill Lane with broad habitats F21 Tall Sward and Scrub, F22 Short Sward and Bare Ground and A1 Arboreal
- Transect 22, Chainage 10000, Wetheriggs Country Park with broad habitats F21 Tall Sward and Scrub, F22 Short Sward and Bare Ground, A1 Arboreal and S1 Shaded Woodland Floor.

6.8.5.14 One area (Transect 21) was assessed for potential OMH on previously developed land. This area met all criteria for OMH as:

- The area was over 0.25ha at 1.4ha
- There was a known history of disturbance at the site with evidence of walls and other structures now partially vegetated
- The site contains some vegetation with short grass sward, bare ground, ephemeral vegetation and taller grasses present along with scrub and mature woodland borders
- The site contains unvegetated, loose bare substrate with several piles of stones and frequent rabbit activity however no pools were present
- The site shows spatial variation, with taller grassland and scattered scrub forming a mosaic around the early successional shorter sward and bare ground. The area is used by the local horse riding school which is maintaining the areas of bare ground.



6.8.5.15 This area was assessed as being a good quality OMH, likely to support an interesting and potentially important terrestrial invertebrate population.

*Penrith to Temple Sowerby*

*Desk study*

6.8.5.16 Three-hundred and sixteen protected, notable or species of conservation concern were identified from desk study records. This comprised three endangered species, 11 near threatened, six vulnerable, nine other red data book listed, 17 notable, two nationally rare, 27 nationally scarce, and 240 locally common. Five species are also included in Section 41, with a further 19 Section 41 for research only.

*Field survey*

6.8.5.17 One-thousand two-hundred and thirty-three species were recorded within the survey area of the Penrith to Temple Sowerby scheme.

6.8.5.18 Analysis by Pantheon shows that 180 species are associated with the shaded woodland floor of broadleaved woodland, 174 species with the sward or field layer of tall sward and scrub, 138 with the canopy layer of arboreal habitat, 102 associated with broadleaved only arboreal habitat and 100 associated with the shadiness of shaded woodland floor (Table 4: Habitat output from Pantheon for Penrith to Temple Sowerby).

Table 4: Habitat output from Pantheon for Penrith to Temple Sowerby

Broad biotope	Habitat	Resource	Number of species	% representation	Species with conservation status
Tree-associated	Shaded woodland floor	conifer or broadleaved >> broadleaved only	180	17	18
Open habitats	Tall sward and scrub	habitats >> sward/field layer	174	11	87
Tree-associated	Arboreal	canopy	138	11	83
Tree-associated	Arboreal	conifer or broadleaved >> broadleaved only	102	10	69
Tree-associated	Shaded woodland floor	shadiness	100	16	9
Wetland	Marshland	shallow freshwater pond	84	22	1

Broad biotope	Habitat	Resource	Number of species	% representation	Species with conservation status
Open habitats	Tall sward and scrub	habitats >> litter and ground layer	82	13	5
Open habitats	Tall sward and scrub	soil humidity >> dry	78	11	33
Tree-associated	Shaded woodland floor	shadiness >> heavy shade	61	14	2
Open habitats	Short sward and bare ground	soil humidity >> dry	60	6	43
Open habitats	Short sward and bare ground	habitats >> sward/field layer	58	7	43
Open habitats	Tall sward and scrub	soil humidity >> damp	54	13	13
Tree-associated	Shaded woodland floor	woodland habitat >> woodland litter	53	16	3
Wetland	Acid and sedge peats	shallow freshwater pond	51	16	5

6.8.5.19 Analysis in relation to SAT shows that the following conditions indicate a significant assemblage may be present in these habitats (Table 5: Specific Assemblage Type output from Pantheon for Penrith to Temple Sowerby):

- Thirty-three species are associated with a SAT, rich flower resource, which is of favourable condition
- Twenty-two species are associated with a SAT, bark and sapwood decay, which is of favourable condition
- Twenty-two species are associated with a SAT, scrub edge, which is of favourable condition
- Sixteen species are associated with a SAT, scrub-heath and moorland, which is of favourable condition
- Eleven species are associated with a SAT, shingle banks, which is of favourable condition
- Eight species are associated with a SAT, riparian sand, which is of favourable condition
- Six species are associated with a SAT, stream and river margin, which is of favourable condition.

6.8.5.20 Seven species are associated with a SAT, *Sphagnum* bog. This is an unfavourable condition for this SAT although further surveys may identify additional species.

Table 5: Specific Assemblage Type output from Pantheon for Penrith to Temple Sowerby

Broad biotope	Habitat	SAT	Number of species	% representation	Reported condition
Open habitats	N/A	rich flower resource	33	14	Favourable (33 species, 15 required)
Tree-associated	Decaying wood	bark and sapwood decay	22	4	Favourable (22 species, 19 required)
Open habitats	N/A	scrub edge	22	10	Favourable (22 species, 11 required)
Open habitats	N/A	scrub-heath and moorland	16	5	Favourable (16 species, 9 required)
Wetland	Running water	shingle banks	11	21	Favourable (11 species, 9 required)
Wetland	Running water	riparian sand	8	14	Favourable (8 species, 5 required)
Wetland	Acid and sedge peats	Sphagnum bog	7	6	Unfavourable (7 species, 8 required)
Open habitats	Short sward and bare ground	bare sand and chalk	6	1	Unfavourable (6 species, 19 required)
Wetland	Running water	stream and river margin	6	10	Favourable (6 species, 6 required)
Open habitats	Short sward and bare ground	open short sward	5	2	Unfavourable (5 species, 13 required)
Wetland	Acid and sedge peats	reed-fen and pools	3	3	Unfavourable (3 species, 11 required)
Wetland	Marshland	open water on disturbed mineral sediments	3	8	Unfavourable (3 species, 6 required)
Wetland	Marshland	undisturbed fluctuating marsh	2	5	Unfavourable (2 species, 4 required)
Tree-associated	Decaying wood	heartwood decay	2	1	Unfavourable (2 species, 6 required)

Broad biotope	Habitat	SAT	Number of species	% representation	Reported condition
N/A	N/A	epiphyte fauna	2	10	Unfavourable (2 species, 3 required)
Open habitats	Short sward and bare ground	exposed sea-cliff	2	5	Unfavourable (2 species)
Wetland	Acid and sedge peats	open water in acid mire	2	11	Unfavourable (2 species, 5 required)
Wetland	Marshland	northern lakes and lochs	1	6	Unfavourable (1 species, 3 required)
Wetland	Running water	seepage	1	2	Unfavourable (1 species, 6 required)

6.8.5.21 Areas identified as having potential for terrestrial invertebrate interest within the study area of the Penrith to Temple Sowerby scheme were (Figure 6.3: Phase 1 Habitat and Terrestrial Invertebrate Survey (Application Document 3.3):

- Transect 19, Chainage 23000, Centre Parcs with broad habitats F21 Tall Sward and Scrub, F22 Short Sward and Bare Ground
- Transect 20, Chainage 21600, Whinfell Park Cottages with broad habitats F21 Tall Sward and Scrub, F22 Short Sward and Bare Ground and W24 Marshland.

6.8.5.22 One area (Transect 20) was assessed for potential OMH on previously developed land. This did not fulfil all criteria for OMH as:

- The area was over 0.25ha at 1.17 ha
- There was no known history of disturbance at the site, disturbance was relatively recent although some spoil heaps were vegetating over and showed evidence of colonisation by solitary bees
- The site contains some vegetation with ephemeral vegetation, short grass sward, bare ground and taller grasses present along with marsh and wetland vegetation surrounding a stream and pond
- The site contains unvegetated, loose bare substrate with several piles of earth and areas of recent earth movement by machinery. One large pool was present
- The site shows spatial variation, with taller grassland and marshy vegetation forming a mosaic around the early successional shorter sward and bare ground. The area was being bulldozed which is expanding the areas of bare ground.

6.8.5.23 This area was assessed as not being OMH due to lack of a history of disturbance however the combination of wetland with surrounding vegetation may support an interesting and potentially important terrestrial invertebrate population.

## Temple Sowerby to Appleby

### Desk study

6.8.5.24 Three-hundred and eleven protected, notable or species of conservation concern were identified from records. This comprised two endangered species, 14 near threatened, 11 vulnerable, five other red data book listed, nine notable, three nationally rare, 20 nationally scarce, and 247 locally common. One species is also included in Section 41, with a further 33 species Section 41 for research only.

### Field survey

6.8.5.25 Seven-hundred and five species were recorded from Temple Sowerby to Appleby.

6.8.5.26 Analysis by Pantheon shows that 145 species are associated with the sward or field layer of tall sward and scrub, 127 species with the canopy layer of arboreal habitat, and 110 associated with broadleaved only arboreal habitat (Table 6: Habitat output from Pantheon for Temple Sowerby to Appleby).

Table 6: Habitat output from Pantheon for Temple Sowerby to Appleby

Broad biotope	Habitat	Resource	Number of species	% representation	Species with conservation status
Open habitats	Tall sward and scrub	habitats >> sward/field layer	145	9	97
Tree-associated	Arboreal	canopy	127	10	107
Tree-associated	Arboreal	conifer or broadleaved >> broadleaved only	110	11	96
Open habitats	Tall sward and scrub	soil humidity >> dry	52	7	36
Tree-associated	Shaded woodland floor	conifer or broadleaved >> broadleaved only	49	5	11
Wetland	Running water	unmodified fast flowing streams	43	21	9
Wetland	Running water	exposed riverine sediments	42	19	16
Open habitats	Tall sward and scrub	soil humidity >> damp	42	10	13

Broad biotope	Habitat	Resource	Number of species	% representation	Species with conservation status
Tree-associated	Arboreal	canopy >> scrub at wood edge/glade	40	17	40

6.8.5.27 Analysis in relation to SAT shows that the following conditions indicate a significant assemblage may be present in these habitats (Table 1-6):

- Eighteen species are associated with a SAT, rich flower resource, which is of favourable condition
- Twelve species are associated with a SAT, shingle banks, which is of favourable condition
- Twelve species are associated with a SAT, scrub edge, which is of favourable condition
- Nine species are associated with a SAT, stream and river margin, which is of favourable condition m
- Nine species are associated with a SAT, riparian sand, which is of favourable condition.

6.8.5.28 Thirteen species are associated with a SAT, bark and sapwood decay. This is an unfavourable condition for this SAT although further surveys may identify additional species.

Table 7: Specific Assemblage Type output from Pantheon for Temple Sowerby to Appleby

Broad biotope	Habitat	SAT	Number of species	% representation	Reported condition
Open habitats	N/A	rich flower resource	18	7	Favourable (18 species, 15 required)
Tree-associated	Decaying wood	bark and sapwood decay	13	3	Unfavourable (13 species, 19 required)
Wetland	Running water	shingle banks	12	23	Favourable (12 species, 9 required)
Open habitats	N/A	scrub edge	12	5	Favourable (12 species, 11 required)
Wetland	Running water	stream and river margin	9	15	Favourable (9 species, 6 required)
Wetland	Running water	riparian sand	9	16	Favourable (9 species, 5 required)
Open habitats	N/A	scrub-heath and moorland	6	2	Unfavourable (6 species, 9 required)

Broad biotope	Habitat	SAT	Number of species	% representation	Reported condition
Open habitats	Short sward and bare ground	bare sand and chalk	4	<1	Unfavourable (4 species, 19 required)
Open habitats	Short sward and bare ground	exposed sea-cliff	2	5	Unfavourable (2 species)
Wetland	Running water	slow-flowing rivers	2	8	Unfavourable (2 species, 4 required)
Wetland	Acid and sedge peats	Sphagnum bog	1	<1	Unfavourable (1 species, 8 required)
N/A	N/A	epiphyte fauna	1	5	Unfavourable (1 species, 3 required)
Open habitats	Short sward and bare ground	open short sward	1	<1	Unfavourable (1 species, 13 required)
Wetland	Running water	seepage	1	2	Unfavourable (1 species, 6 required)
Wetland	Marshland	undisturbed fluctuating marsh	1	3	Unfavourable (1 species, 4 required)
Tree-associated	Decaying wood	heartwood decay	1	<1	Unfavourable (1 species, 6 required)

6.8.5.29 Areas identified as having potential for terrestrial invertebrate interest in the Study area of the Temple Sowerby to Appleby scheme were (Figure 6.3: Phase 1 Habitat and Terrestrial Invertebrate Survey (Application Document 3.3)):

- Transect 17, Chainage 38150, Colby Laithes with broad habitats F21 Tall Sward and Scrub and F22 Short Sward and Bare Ground
- Transect 18, Chainage 37100, Roger Head with broad habitats F21 Tall Sward and Scrub, DW1 Decaying Wood and A1 Arboreal
- Transect 24, Chainage 34200, Trout Beck at Sleastonhow with broad habitats W23 Running Water.

6.8.5.30 Shingle banks were identified in Transect 24, at national grid reference (NGR) NY 6507 2452, however these were within the river channel and therefore it was not possible to sample (ES Figure 6.3: Phase 1 Habitat and Terrestrial Invertebrate Survey (Application Document 3.3)).



## Appleby to Brough

### Desk study

6.8.5.31 Two-hundred and sixty protected, notable or species of conservation concern were identified from records. This comprised two endangered species, 11 near threatened, four vulnerable, two other red data book listed, 11 notable, two nationally rare, 16 nationally scarce, and 212 locally common. Three species are also included in Section 41, with a further 25 species Section 41 for research only.

### Field survey

6.8.5.32 Six-hundred and fifty-six species were recorded within the survey area of the Appleby to Brough scheme.

6.8.5.33 Analysis by Pantheon shows that 148 species are associated with the sward or field layer of tall sward and scrub, 101 species with the canopy layer of arboreal habitat, 86 associated with broadleaved only arboreal habitat and 56 associated with exposed riverine sediments (Table 8: Habitat output from Pantheon for Appleby to Brough).

Table 8: Habitat output from Pantheon for Appleby to Brough

Broad biotope	Habitat	Resource	Number of species	% representation	Species with conservation status
Open habitats	Tall sward and scrub	habitats >> sward/field layer	148	9	93
Tree-associated	Arboreal	canopy	101	8	81
Tree-associated	Arboreal	conifer or broadleaved >> broadleaved only	86	8	71
Wetland	Running water	exposed riverine sediments	56	26	19
Open habitats	Tall sward and scrub	habitats >> litter and ground layer	52	8	4
Open habitats	Tall sward and scrub	soil humidity >> dry	45	6	33
Open habitats	Tall sward and scrub	soil humidity >> damp	44	11	14
Tree-associated	Shaded woodland floor	conifer or broadleaved >> broadleaved only	42	4	10

Broad biotope	Habitat	Resource	Number of species	% representation	Species with conservation status
Open habitats	Tall sward and scrub	soil humidity >> variable humidity	37	8	5
Tree-associated	Shaded woodland floor	shadiness	35	5	8
Tree-associated	Arboreal	canopy >> scrub at wood edge/glade	33	14	33
Wetland	Running water	exposed riverine sediments >> riparian sand	33	23	11

6.8.5.34 Analysis in relation to SAT shows that the following conditions indicate a significant assemblage may be present in these habitats (Table 8: Habitat output from Pantheon for Appleby to Brough):

- Fifteen species are associated with a SAT, shingle banks, which is of favourable condition
- Twelve species are associated with a SAT, stream and river margin, which is of favourable condition
- Nine species are associated with a SAT, riparian sand, which is of favourable condition
- Nine species are associated with a SAT, scrub-heath and moorland, which is of favourable condition.

Table 9: Specific Assemblage Type output from Pantheon for Appleby to Brough

Broad biotope	Habitat	SAT	Number of species	% representation	Reported condition
Wetland	Running water	Shingle banks	15	28	Favourable (15 species, 9 required)
Wetland	Running water	Stream and river margin	12	20	Favourable (12 species, 6 required)
Wetland	Running water	Riparian sand	9	16	Favourable (9 species, 5 required)
Open habitats	N/A	Scrub-heath and moorland	9	3	Favourable (9 species, 9 required)
Open habitats	N/A	Scrub edge	7	3	Unfavourable (7 species, 11 required)

Broad biotope	Habitat	SAT	Number of species	% representation	Reported condition
Open habitats	Short sward and bare ground	Open short sward	4	2	Unfavourable (4 species, 13 required)
Tree-associated	Decaying wood	Heartwood decay	3	2	Unfavourable (3 species, 6 required)
Tree-associated	Decaying wood	Bark and sapwood decay	2	<1	Unfavourable (2 species, 19 required)
Open habitats	Short sward and bare ground	Bare sand and chalk	1	<1	Unfavourable (1 species, 19 required)
Open habitats	N/A	Rich flower resource	1	<1	Unfavourable (1 species, 15 required)
Wetland	Running water	Slow-flowing rivers	1	4	Unfavourable (1 species, 4 required)
Wetland	Marshland	Northern lakes and lochs	1	6	Unfavourable (1 species, 3 required)
Wetland	Marshland	Undisturbed fluctuating marsh	1	3	Unfavourable (1 species, 4 required)
Wetland	Acid and sedge peats	Sphagnum bog	1	<1	Unfavourable (1 species, 8 required)
Open habitats	Short sward and bare ground	Exposed sea-cliff	1	2	Unfavourable (1 species)
Wetland	Acid and sedge peats	Reed-fen and pools	1	<1	Unfavourable (1 species, 11 required)

6.8.5.35 Areas identified as having potential for terrestrial invertebrate interest in the study area of the Appleby to Brough scheme were (ES Figure 6.3: Phase 1 Habitat and Terrestrial Invertebrate Survey (Application Document 3.3)):

- Transect 10, Chainage 44750, Meadow Bank View with broad habitats DW1 Decaying Wood and A1 Arboreal
- Transect 12, Chainage 41950, B6259 with broad habitat W24 Marshland
- Transect 13, Chainage 41300, opposite Sandford Mire with broad habitat W24 Marshland

- Transect 15, Chainage 40700, Opposite New Hall with broad habitats F21 Tall Sward and Scrub and W24 Marshland
- Transect 16, Chainage 40000, Ketland Moor with broad habitats to sample F22 Short Sward and Bare Ground and F24 Upland
- Transect 28, Chainage 44400, Toddygill Plantation with broad habitats F21 Tall Sward and Scrub, F22 Short Sward and Bare Ground and W24 Marshland
- Transect 29, Chainage 47000, West View with Broad habitats F21 Tall Sward and Scrub and F22 Short Sward and Bare Ground.

6.8.5.36 One area (Transect 11) was assessed for potential OMH on previously developed land. This did not fulfil all criteria for OMH as:

- The area was over 0.25ha at 0.40 ha
- There was a known history of disturbance at the site, this was a former railway line now being maintained as a heritage railway
- The site contains some vegetation but with little ephemeral vegetation or short sward being largely bare and heavily shaded by lines of trees
- The site contains unvegetated, loose bare substrate with railway ballast although this was of large extent and maintained as such. No pools were present
- The site showed little spatial variation, with heavy shading restricting much development of vegetation along the railway.

6.8.5.37 This area was assessed as not being OMH.

6.8.5.38 A further area (Transect 28) was also assessed for potential OMH on previously developed land. This did not hit all criteria for OMH as:

- The area was over 0.25ha at 0.73 ha
- There was a known history of disturbance at the site, this area was being used as an assault course with evidence of previous military use
- The site contains some vegetation with ephemeral vegetation, short grass sward, bare ground and taller grasses present along with marsh and wetland vegetation surrounding a stream
- The site contains unvegetated, loose bare substrate with sand pits and other disturbance from its use as an assault course. No pools were present but a vegetated stream was adjacent
- The site showed spatial variation, with areas of heavy footfall creating varied vegetation and taller vegetation at the margins and along the side of the stream

6.8.5.39 This area was assessed as being a moderate quality OMH, likely to support an interesting and potentially important terrestrial invertebrate population.

6.8.5.40 Additional habitat present within the Order Limits of the Appleby to Brough scheme includes F24 Upland (Transect 16). Upland habitat is associated with often open habitats usually above 300m altitude, frequently consisting of moorland, blanket bogs, *Nardus* grassland, snowbed, montane heaths and boulder screes. It is also characteristic of some lowland biotopes including heath grassland and open woodland, which survive as islands of low ecological productivity in a sea of high

input agricultural land. Potential SATs present scrub heath and moorland, and open short sward (ES Figure 6.3: Phase 1 Habitat and Terrestrial Invertebrate Survey (Application Document 3.3)).

### Bowes Bypass

#### Desk study

6.8.5.41 Twenty-two protected, notable or species of conservation concern were identified from records. This comprised one near threatened, two other red data book listed, three notable and 16 locally common. One species is also included in Section 41.

#### Field survey

6.8.5.42 Sixty-eight species were recorded within the survey area of the Bowes Bypass scheme.

6.8.5.43 Analysis by Pantheon shows the majority of species (22) are associated with the sward or field layer of tall sward and scrub (Table 10: Habitat output from Pantheon for Bowes Bypass.).

Table 10: Habitat output from Pantheon for Bowes Bypass.

Broad biotope	Habitat	Resource	Number of species	% representation	Species with conservation status
Open habitats	Tall sward and scrub	habitats >> sward/field layer	22	1	
Tree-associated	Shaded woodland floor	conifer or broadleaved >> broadleaved only	9	<1	2
Tree-associated	Shaded woodland floor	shadiness	8	1	2
Tree-associated	Arboreal	foliage	6	1	
Tree-associated	Shaded woodland floor	Shadiness >> heavy shade	6	1	1
Tree-associated	Arboreal	canopy	6	<1	
Wetland	Running water	woodland stream	6	4	1
Tree-associated	Shaded woodland floor	humidity >> wet	6	2	1
Wetland	Wet woodland	woodland stream	6	4	1

6.8.5.44 Three species are associated with a SAT, rich flower resource. This is an unfavourable condition for this SAT (Table 11: Specific Assemblage Type output from Pantheon for Bowes Bypass).

Table 11: Specific Assemblage Type output from Pantheon for Bowes Bypass

Broad biotope	Habitat	SAT	Number of species	% representation	Reported condition
Open habitats	N/A	Rich flower resource	3	1	Unfavourable (3 of 15 species)
Open habitats	N/A	Scrub edge	1	<1	Unfavourable (1 of 11 species)
Open habitats	N/A	Scrub-heath and moorland	1	<1	Unfavourable (1 of 9 species)
Open habitats	Short sward and bare ground	Open short sward	1	<1	Unfavourable (1 of 13 species)

6.8.5.45 Areas identified as having potential for terrestrial invertebrate interest in the study area of the Bowes Bypass scheme were (ES Figure 6.3: Phase 1 Habitat and Terrestrial Invertebrate Survey (Application Document 3.3)):

- Transect 5, Chainage 51300, Myre Keld Farm with broad habitats F21 Tall Sward and Scrub and F22 Short Sward and Bare Ground
- Transect 6, Chainage 50700, Annums Farm with broad habitats F21 Tall Sward and Scrub and F22 Short Sward and Bare Ground.

6.8.5.46 One area (Transect 5) was assessed for potential OMH on previously developed land. This are fulfilled all criteria for OMH as:

- The area was over 0.25ha at 0.28 ha
- There was known history of disturbance at the site, historical imagery shows this as part of a railway line which has gone out of use and retaining walls are still present on site
- The site contains some vegetation with short sward and some ephemeral vegetation and taller sward with dense scrub
- The site contains unvegetated, loose bare substrate with rubble piles evident and some dumped waste as well as partly collapsed structures and extensive rabbit activity. A pool was present at the east end of the area
- The site showed spatial variation, with current and historic disturbance creating a matrix of shorter and taller vegetation and bare ground.

6.8.5.47 This area was assessed as being a good quality OMH likely to support an interesting and potentially important terrestrial invertebrate population.

- 6.8.5.48 The area around the former station to the west was also considered, but assessed as too small to qualify and, due to hard standing, farmed areas and a large barn, was not considered to be sufficiently connected to the former railway line to be included within that priority habitat.
- 6.8.5.49 A further area (Transect 6) was assessed for potential OMH on previously developed land. This did not fulfil all criteria for OMH as:
- The area was over 0.25ha at 0.47 ha
  - There was no known history of disturbance at the site, historical imagery shows this as part of a field system which has gone out of use and is now largely unmanaged
  - The site contains some vegetation but with little ephemeral vegetation or short sward being largely taller sward with dense scrub, although some areas of broken hard standing exist
  - The site contains no unvegetated, loose bare substrate although some rubble piles were evident close to existing buildings and no pools were present
  - The site showed little spatial variation, with little current disturbance to maintain shorter vegetation.
- 6.8.5.50 This area was assessed as not being OMH, however it's aspect and sheltered nature did offer some potential as a useful site for invertebrates.

#### Cross Lanes to Rokeby

##### *Desk study*

- 6.8.5.51 Two-hundred and sixty protected, notable or species of conservation concern were identified from records. This comprised four endangered species, 11 near threatened, five vulnerable, three other red data book listed, three notable, three nationally scarce, and 145 locally common. Six species are also included in Section 41, with a further 21 species Section 41 for research only.

##### *Field survey*

- 6.8.5.52 Two-hundred and ninety-five species were recorded from Cross Lanes to Rokeby.
- 6.8.5.53 Analysis by Pantheon shows that 81 species are associated with the sward or field layer of tall sward and scrub, 69 species with the canopy layer of arboreal habitat, and 62 associated with broadleaved only arboreal habitat (Table 12: Habitat output from Pantheon for Cross Lanes to Rokeby).



Table 12: Habitat output from Pantheon for Cross Lanes to Rokeby

Broad biotope	Habitat	Resource	Number of species	% representation	Species with conservation status
Open habitats	Tall sward and scrub	habitats >> sward/field layer	81	5	11
Tree-associated	Arboreal	canopy	69	5	8
Tree-associated	Arboreal	conifer or broadleaved >> broadleaved only	62	6	8
Open habitats	Tall sward and scrub	soil humidity >> dry	25	3	5
Tree-associated	Arboreal	foliage	25	5	4
Tree-associated	Shaded woodland floor	conifer or broadleaved >> broadleaved only	20	2	1
Tree-associated	Arboreal	canopy >> scrub at wood edge/glade	17	7	1
Tree-associated	Arboreal	canopy >> mature tree canopy	15	18	4

6.8.5.54 Analysis in relation to SAT shows that the following conditions indicate a significant assemblage may be present in these habitats (Table 13: Specific Assemblage Type output from Pantheon for Cross Lanes to Rokeby):

- Thirteen species are associated with a SAT, scrub-heath and moorland, which is of favourable condition meaning a significant assemblage may be present.
- Ten species are associated with a SAT, rich flower resource. This is an unfavourable condition for this SAT although further surveys may identify additional species.

Table 13: Specific Assemblage Type output from Pantheon for Cross Lanes to Rokeby

Broad biotope	Habitat	SAT	Number of species	% representation	Reported condition
Open habitats	N/A	Scrub-heath and moorland	13	4	Favourable
Open habitats	N/A	Rich flower resource	10	4	Unfavourable (10 of 15 species)
Tree-associated	Decaying wood	Bark and sapwood decay	3	<1	Unfavourable (3 of 19 species)
Open habitats	N/A	Scrub edge	3	1	Unfavourable (3 of 11 species)
Open habitats	Short sward and bare ground	Open short sward	2	1	Unfavourable (2 of 13 species)
Wetland	Marshland	Open water on disturbed mineral sediments	1	2	Unfavourable (1 of 6 species)
Open habitats	Short sward and bare ground	Bare sand and chalk	1	<1	Unfavourable (1 of 19 species)
Open habitats	Short sward and bare ground	Exposed sea-cliff	1	2	Unfavourable (1 species)

6.8.5.55 Areas identified as having potential for terrestrial invertebrate interest in the Study area of the Cross Lanes to Rokeby scheme were (Figure 6.3: Phase 1 Habitat and Terrestrial Invertebrate Survey (Application Document 3.3)):

- Transect 1, Chainage 63300, Rokeby Park with broad habitat DW1 Decaying Wood
- Transect 2, Chainage 63500, Greta Bridge with broad habitat DW1 Decaying Wood
- Transect 3, Chainage 62600, Church Plantation with broad habitats DW1 Decaying Wood and A1 Arboreal
- Transect 4, Chainage 60300, Cross Lanes with broad habitats DW1 Decaying Wood and A1 Arboreal
- Transect 30, Chainage 59850, Princess Charlotte Wood with broad habitats DW1 Decaying Wood and A1 Arboreal
- Transect 31, Chainage 60050, Smithy Cottage with broad habitats F21 Tall Sward and Scrub and DW1 Decaying Wood

- Transect 32, Chainage 59850, North Bitts with broad habitat to sample W24 Marshland.

**Stephen Bank to Carkin Moor**

*Desk study*

6.8.5.56 Thirty-two protected, notable or species of conservation concern were identified from records. This comprised one endangered species, two near threatened and 29 locally common. Two species are also included in Section 41.

*Field survey*

6.8.5.57 Seventy-five species were recorded within the survey area of the Stephen Bank to Carkin Moor scheme.

6.8.5.58 Analysis by Pantheon shows that 18 species are associated with shallow freshwater ponds, 13 species are associated with tall sward and scrub, 11 species with short sward and bare ground habitat, 10 associated with unmodified fast flowing streams and 10 associated with broadleaved shaded woodland floor habitat (Table 14: Habitat output from Pantheon for Stephen Bank to Carkin Moor).

Table 14: Habitat output from Pantheon for Stephen Bank to Carkin Moor

Broad biotope	Habitat	Resource	Number of species	% representation	Species with conservation status
Wetland	Marshland	shallow freshwater pond	18	5	
Open habitats	Tall sward and scrub	habitats >> sward/field layer	13	<1	
Open habitats	Short sward and bare ground	habitats >> sward/field layer	11	1	2
Wetland	Running water	unmodified fast flowing streams	10	5	1
Tree-associated	Shaded woodland floor	conifer or broadleaved >> broadleaved only	10	<1	
Open habitats	Short sward and bare ground	soil humidity >> dry	10	<1	2

6.8.5.59 Thirteen species are associated with a SAT, rich flower resource. This is slightly short of favourable condition for this SAT although further surveys may identify additional species (Table 15: Specific Assemblage Type output from Pantheon for Stephen Bank to Carkin Moor).

Table 15: Specific Assemblage Type output from Pantheon for Stephen Bank to Carkin Moor

Broad biotope	Habitat	SAT	Number of species	% representation	Reported condition
Open habitats	N/A	Rich flower resource	13	5	Unfavourable (13 of 15 species)
Tree-associated	Decaying wood	Bark and sapwood decay	3	<1	Unfavourable (3 of 19 species)
Open habitats	Short sward and bare ground	Open short sward	2	1	Unfavourable (2 of 13 species)
Open habitats	N/A	Scrub edge	1	<1	Unfavourable (1 of 11 species)
Wetland	Running water	Stream and river margin	1	2	Unfavourable (1 of 6 species)

6.8.5.60 Areas identified as having potential for terrestrial invertebrate interest in the study area of the Stephen Bank to Carkin Moor scheme were (Figure 6.3: Phase 1 Habitat and Terrestrial Invertebrate (Application Document 3.3):

- Transect 7, Chainage 73900, Mainsgill Plantation with broad habitats DW1 Decaying Wood, A1 Arboreal and S1 Shaded Woodland Floor
- Transect 8, Chainage 72300, Ravensworth Lodge with broad habitats DW1 Decaying Wood and A1 Arboreal and S1 Shaded Woodland Floor
- Transect 9, Chainage 74700, Warrener Lane with broad habitats to sample F21 Tall Sward and Scrub, F22 Short Sward and Bare Ground and W24 Marshland.

6.8.5.61 One area (Transect 9) was assessed for potential OMH on previously developed land. This did not fulfil all criteria for OMH as:

- The area was over 0.25ha at 0.83 ha
- There was no known history of disturbance at the site, historical imagery shows this as part of a field system up until 2006
- The site contains some vegetation with ephemeral vegetation and short sward along with taller sward, reed beds and scattered trees
- The site contains unvegetated, loose bare substrate with gravel access tracks becoming vegetated but breaking up in places and with some rabbit disturbance. Two pools were present
- The site showed spatial variation, with patches of bare ground, short sward and taller vegetation including aquatic vegetation and reedbed habitats.

6.8.5.62 This area was assessed as not being OMH due to lack of historical disturbance, although it has many of the characteristics of OMH and therefore offers potential as a beneficial site for invertebrates.

## A1(M) Junction 53 Scotch Corner

### Desk study

- 6.8.5.63 One protected, notable or species of conservation concern was identified from records, this was categorised as an endangered species. This species is also included in Section 41.

### Field survey

- 6.8.5.64 Twenty-two species were recorded from A1(M) Junction 53 Scotch Corner.
- 6.8.5.65 Analysis by Pantheon shows that nine species are associated with the sward or field layer of tall sward and scrub, six species are associated with shallow freshwater ponds, and six species with soil and roots of tall sward and scrub habitat (Table 16: Habitat output from Pantheon for A1(M) Junction 53 Scotch Corner).

Table 16: Habitat output from Pantheon for A1(M) Junction 53 Scotch Corner

Broad biotope	Habitat	Resource	Number of species	% representation	Species with conservation status
Open habitats	Tall sward and scrub	habitats >> sward/field layer	9	<1	
Wetland	Marshland	Shallow freshwater pond	6	2	
Open habitats	Tall sward and scrub	habitats >> soil and roots	6	3	
Open habitats	Tall sward and scrub	soil humidity >> damp	5	1	
Tree-associated	Arboreal	foliage	4	<1	1
Tree-associated	Arboreal	canopy	4	<1	1

- 6.8.5.66 Two species are associated with a SAT, open water on disturbed mineral sediments. This is an unfavourable condition for this SAT although further surveys may identify additional species (Table 17: Specific Assemblage Type output from Pantheon for A1(M) Junction 53 Scotch Corner).

Table 17: Specific Assemblage Type output from Pantheon for A1(M) Junction 53 Scotch Corner

Broad biotope	Habitat	SAT	Number of species	% representation	Reported condition
Wetland	Marshland	Open water on disturbed mineral sediments	2	5	Unfavourable (2 of 6 species)

6.8.5.67 No areas were identified as having potential for terrestrial invertebrate interest in the study area of the A1(M) Junction 53 Scotch Corner scheme.

#### Future baseline

6.8.5.68 The ecological baseline conditions described above represent those which exist in the absence of the Project and at the time of survey. As stated in Section 3 of CIEEM's Guidelines for Ecological Impact Assessment in the UK and Ireland (Chartered Institute for Ecology and Environment Management, 2018)<sup>17</sup>, potential changes in baseline conditions also need to be identified in order to assess impacts.

6.8.5.69 Based on the above information, survey data collected and current land use at the time of survey, the future baseline in the absence of the scheme Project is unlikely to change significantly.

6.8.5.70 Terrestrial invertebrates in the UK have suffered a 58.5% reduction in actively flying insects between 2004 and 2021 and this trend is expected to continue<sup>18</sup>. The water beetle *Laccornis oblongus*, present within Temple Sowerby Moss, may have populations in the wider area which are likely to be negatively impacted by continued habitat fragmentation and drainage, and the population within the Moss is vulnerable to extinction events without metapopulations available to repopulate. Species known to be threatened in Cumbria, Durham and North Yorkshire and likely to be present within the vicinity of the Project include Pearl-Bordered Fritillary *Boloria Euphrosyne*, Marsh Fritillary *Euphydryas aurinia*, Variable Damselfly *Coenagrion pulchellum*, water beetle *Hydroporus rufifrons*, the caddisfly Small grey sedge *Glossosoma intermedium*, Dark Green Fritillary *Speyeria aglaja*, Dingy Skipper *Erynnis tages*, Glow Worm *Lampyrus noctiluca*, Grayling *Hipparchia semele*, Green Hairstreak *Callophrys rubi*, Least Minor moth *Photedes captiuncula*, Mud Snail *Omphiscola glabra*, Northern Brown Argus *Aricia Artaxerxes*, Small Pearl-bordered fritillary *Boloria selene*, White-letter Hairstreak *Satyrrium w-album*, Square-spotted clay moth *Xestia stigmatica*, and Angle-striped sallow moth *Enargia paleacea*. All of these are likely to undergo further decline without intervention.

6.8.5.71 Subtle changes are expected due to climate change, such as some localised movements of certain terrestrial invertebrate species and local population changes; and there would be a likely reduction in ash trees and tree canopy habitats due to ash dieback disease. However, the overall habitats and species composition in the study area are expected to be broadly similar to that of the existing baseline. Therefore, the future baseline would remain the same as set out in the existing baseline.

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<sup>17</sup> Chartered Institute for Ecology and Environmental Management (2018) Guidance for Ecological Impact Assessment in the United Kingdom Third Edition

<sup>18</sup> Ball, L., Still, R., Riggs, A., Skilbeck, A., Shardlow, M., Whitehouse, A., Tinsley-Marshall, P., (2021) The Bugs Matter Citizen Science Survey: counting insect splats on vehicle number plates reveals a 58.5% reduction in the abundance of actively flying insects in the UK between 2004 and 2021.

## 6.8.6 Discussion

- 6.8.6.1 Habitats suitable for terrestrial invertebrates are present routewide including structured mature broadleaved woodland canopy, tall sward and scrub and short sward and bare ground. While these are suitable habitats for a range of terrestrial invertebrates including pollinator species, these are, in general, common habitats within the area with no specific invertebrate assemblages of importance present.
- 6.8.6.2 Shingle banks within the River Eden SSSI are designated in part for the presence of a number of terrestrial invertebrate species; shore bug *Sadula fucicola*; leaf beetle *Hydrothassa hannoverianna*; ground beetles *Bembidion schuepelli*, *B. fluvatile* and *Asaphidian pallipes*; flies *Loncoptera meijeri*, *Camspicnemus marginatus* and *Rhaphium fractrum*. The shingle banks found were upstream north of the proposed route and outside of the scheme boundary and therefore no direct significant impacts are expected on any assemblages using these. There is likely to be some shading impacts on a short stretch of stream and river margin, and some temporary construction impacts on the habitats themselves however any temporary loss to populations is likely to be quickly made up and enhancement and creation of additional riverine habitat will result in an increase in quality and amount of useable habitat for this assemblage. No riparian sand was identified as currently present within the Order Limits of the Project. For both shingle banks and riparian sand, it should be noted that these can move significantly during high water flow events and therefore surveys will be undertaken to ensure none are present when construction is due to begin.

## 6.8.7 References

Drake CM, Lott DA, Alexander KNA and Webb J., Natural England Research Report NERR005 Surveying terrestrial and freshwater invertebrates for conservation evaluation (2007)

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

Chartered Institute for Ecology and Environmental Management (CIEEM) Guidance for Ecological Impact Assessment in the United Kingdom Third Edition (2018)