A303 Amesbury to Berwick Down

Applicant's provision of technical reports supporting the Environmental Information Review

Butterfly and Pollinator Survey Report (2020)

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1 Introduction

1.1.1 This report presents the results of baseline butterfly and pollinator surveys for the A303 Amesbury to Berwick Down Scheme (hereafter referred to as the 'Scheme'). These surveys included butterfly transects, key butterfly species habitat assessment and flower-insect timed count surveys. The baseline information from these surveys recorded in this report will allow a comparison to be made of the current baseline against the future baseline (informed by repeated monitoring post-construction). This comparison will enable the identification of any changes in butterfly and pollinator species diversity and abundance that may be attributed to the Scheme and the associated habitat creation and management.

1.1.2 The Scheme will lead to a loss of existing arable habitat and some associated field margins but will create extensive new calcareous grassland adjacent to Parsonage Down Site of Special Scientific Interest (SSSI), and extending along much of the new highway. This together with some new planting of woodland is expected to increase the habitat available for butterflies and other pollinators and improve connectivity to help species move west to east to colonise other areas of habitat.

1.1.3 This report outlines the methodology and results for the butterfly and pollinator pre-construction baseline survey for the Scheme, carried out in 2020.

2 Methodology

2.1.1 The survey was based on walked transects. Transects were selected based on the post-construction outline design of the Scheme. The aim was to set up routes which can be surveyed from publicly accessible rights of way post-construction. The survey methods used were selected because of their use in regional or national monitoring programmes. It is intended that the data collected here and in subsequent surveys will contribute to these programmes, as well as providing evidence of the outcome of the Scheme.

2.1.2 The methods used were:

- Wider Countryside Butterfly Survey[1];
- Key butterfly habitat assessment, as used in Natural England's project 'Porton to Plain'[2], a study of ecological network connectivity in Wiltshire based on the A303 corridor, which uses butterflies of calcareous grassland and associated habitats as one of the indicators of connectivity;

[1] Butterfly Conservation (undated) Wider Countryside Butterfly Survey (WCBS) Guidance [Available Online] https://www.ukbms.org/Downloads/WCBS%20guidance%202019.pdf [Last Accessed 17/12/2020]

[2] Natural England (undated) Porton to Plain Wildlife Connections https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010025/TR010025-000710-Natural%20England-%20Porton%20to%20Plain%20Wildlife%20Connections%20Report.pdf [Available Online] [Last Accessed 17/12/2020]

- Pollinator Monitoring Scheme, using Flower-Insect Timed Counts[3].

2.1.3 All survey visits including transects and Flower-Insect Timed (FIT) counts were undertaken during suitable weather conditions; no rain or strong wind (less than Beaufort scale 5) and with temperatures above 13°C on clear days and above 17°C on overcast days (where cloud cover was over 4 oktas), as detailed in Table 1.

Table 1: Weather conditions for each survey visit

Date	Transect	Time		Temperature (°C)		Cloud cover (oktas)		Wind speed (Beaufort)		Wind direction		Rainfall	
		Start	End	Start	End	Start	End	Start	End	Start	End	Start	End
23/07/20	1	09:15	10:50	18	19	6	6	3	3	W	W	Nil	Nil
23/07/20	2	11:45	12:51	19	20	2	2	3	3	W	W	Nil	Nil
23/07/20	3	13:45	14:20	21	21	7	7	3	3	W	W	Nil	Nil
23/07/20	4	15:09	16:10	21	19	6	7	3	3	W	W	Nil	Nil
31/07/20	1	08:50	09:50	22.5	22.5	0	0	3	3	SSW	SSW	Nil	Nil
31/07/20	2	10:38	11:35	27	28	0	0	3	3	SSW	SSW	Nil	Nil
31/07/20	3	12:25	13:20	28	30	0	0	3	3	SW	SW	Nil	Nil
31/07/20	4	14:40	15:45	33	30	1	6	3	3	SSW	SSW	Nil	Nil
04/08/20	1	09:00	10:10	17	17	0	0	2	3	WSW	WSW	Nil	Nil
04/08/20	2	10:46	11:49	17	17	8	8	2	2	WSW	WSW	Nil	Nil
04/08/20	3	12:24	13:19	17	19	8	8	4	4	WSW	WSW	Nil	Nil
04/08/20	4	14:03	15:10	20	22	8	3	4	4	WSW	WSW	Nil	Nil
26/08/20	1	08:45	09:55	17	19	2	2	4	4	W	W	Nil	Nil
26/08/20	2	10:24	11:23	19	21	3	2	4	4	WSW	SW	Nil	Nil
26/08/20	3	12:00	12:44	20	18	4	7	4	4	W	WSW	Nil	Nil
26/08/20	4	13:50	15:07	20	20	7	4	4	4	WSW	WSW	Nil	Nil

2.1.4 The naming and species information for all butterfly species recorded in this report have been taken from information obtained from the butterfly conservation[4]. Appendix A.4 provides a summary of butterfly species information.

2.2 Butterfly transects

2.2.1 The butterfly surveys follow an amended version of the Wider Countryside Butterfly Survey (WCBS)[5]. The WCBS method involves a minimum of two visits to a randomly selected square between May and August to count butterflies along two 1km survey lines running roughly north-south through the square, which provides a randomised sample of butterflies across all the habitats within the square. In this case, however, the Scheme runs west to east and the primary purpose is to assess the land within the limits of the Scheme for butterflies before and after construction.

[3] UK Pollinator Monitoring Scheme (2019) Flower-Insect Timed Count guidance. Version 4. CEH Wallingford.

[4] Butterfly Conservation (undated) Butterflies Website [Available Online] https://butterfly-conservation.org/butterflies [Last Accessed 18/12/2020]

[5] Butterfly Conservation (undated) Wider Countryside Butterfly Survey (WCBS) Guidance [Available Online] https://www.ukbms.org/Downloads/WCBS%20guidance%202019.pdf [Last Accessed 17/12/2020]

2.2.2 Four predefined 1.5 - 3km transects were surveyed on four separate occasions between July – August 2020. The transects were divided into roughly eight sections (with the shortest transect divided into seven sections), each section was walked at a continuous pace, counting all butterflies seen within 2.5m either side of the transect route, 5m ahead and 5m from the ground, in accordance with WCBS method. All butterflies were counted as a new individual, unless they were confirmed by the surveyor that the same individual was being repeatedly recorded.

2.2.3 A habitat assessment of each individual transect was undertaken to summarise the typical habitat of the transect. Where numerous habitats occurred along the transect, additional habitat assessments were completed.

2.2.4 The transect routes and sections are shown on Figure 1, Appendix A.1.

2.3 Key Butterfly Species Habitat Assessment

2.3.1 An assessment of the habitat's suitability for the following key calcareous grassland butterfly species was undertaken for each transect:

1. marsh fritillary (*Euphydryas aurinia*);
2. Duke of Burgundy (*Hamearis lucina*);
3. adonis blue (*Polyommatus bellargus*);
4. brown hairstreak (*Thecla betulae*);
5. chalk hill blue (*Polyommatus coridon*); and
6. small blue (*Cupido minimus*).

2.3.2 This assessment included an abundance evaluation for the following features in relation to each key species:

1. suitable site/ slope aspect;
2. foodplant in suitable condition;
3. suitable sward height;
4. suitable sward structure;
5. bare ground patches;
6. overwintering habitat; and
7. suitable shelter.

2.3.3 A tally of any of the listed foodplants were noted along with the abundance. The listed foodplants associated with the key calcareous grassland butterfly species included:

1. horseshoe vetch (*Hippocrepis comosa*);
2. kidney vetch (*Anthyllis vulneraria*);
3. devil's-bit scabious (*Succisa pratensis*);
4. field scabious (*Knautia arvensis*);
5. small scabious (*Scabiosa columbaria*);
6. cowslip (*Primula veris*);
7. primrose (*Primula vulgaris*);
8. blackthorn (*Prunus spinosa*); and
9. hemp-agrimony (*Eupatorium cannabinum*).

2.3.4 Once each feature had been evaluated for its suitability to support each of the key species, an assessment was made to determine if breeding habitat for each species was present, absent or marginal.

2.4 Flower-Insect Timed Count

2.4.1 The Flower-Insect Timed (FIT) count broadly followed the methodology outlined in the Pollinator Monitoring Scheme[6]. Two counts were undertaken on each transect, on each visit, with each count lasting for 10 minutes.

2.4.2 Whenever possible, counts were undertaken on the following target flower species, although if these were not present then other suitable flowing species were chosen.

- buttercup – *Ranunculu*s species;
- dandelion - *Taraxacum officinale;*
- hawthorn – *Crataegus* species;
- white dead-nettle - *Lamium album;*
- bramble - *Rubus fruticosus* agg.*;*
- lavender (English) - *Lavandula angustifolia;*
- hogweed - *Heracleum sphondylium;*
- knapweed (common or greater) - *Centarea nigra* or *C. scabiosa;*
- ragwort - *Senecio jacobaea* and relatives;
- white clover - *Trifolium repens;*
- buddleja – *Buddleja davidii*;
- *Calluna vulgaris* or *Erica* species;
- thistle - *Cirsium* or *Carduus*; and
- ivy - *Hedera helix*.

2.4.3 A 50cm by 50cm area of the selected flower species was chosen. Within this area the percentage cover of the selected flowers was calculated, and the number of flower units was determined. A flower unit includes a single flower for simple flowers, or flower heads for more complex flowers (e.g., umbel, raceme, spike, panicle, cyme, corymb, spikelet, thyrse and capitulum). To simplify this, an estimate was made of the number of flower units to the nearest 5.

2.4.4 During the 10-minute survey period a tally count of every insect that landed on one of the identified flower units was recorded. Insects were only counted if they landed on the flowers. Each insect was identified to a broad group (e.g. bumblebees, hoverflies). Tiny insects (up to 3mm long, including pollen beetles) were counted as “Small insects under 3mm long”. Insect over 3mm long which could not be identified to a species group were classed as “Other insects”. Insects that did not land on the identified flowers, all non-pollinating insects or insects that did not move during the 10-minute counting period were ignored.

[6] UK Pollinator Monitoring Scheme (2019) Flower-Insect Timed Count guidance. Version 4. CEH Wallingford.

2.5 Limitations

2.5.1 The survey provides an indication of the butterfly population within proximity to the Scheme, it is likely that not all butterfly species present were recorded. In addition, as the surveys were undertaken in July and August the adult flight periods for several butterfly species were missed. This included key calcareous species including marsh fritillary (mid-May to late June), Duke of Burgundy (mid-April to mid-June) and the first brood of small blue (early May to late June). Also missed were some common butterfly species such as orange-tip (*Anthocharis cardamines*) (April to June). This is not considered a significant limitation as an assessment of the habitat was undertaken to determine its suitability as breeding habitat for the identified key calcareous butterfly species. The survey was not intended as a comprehensive record of butterfly species throughout a whole season.

2.5.2 As the surveys were undertaken at the end of the summer (July and August) in 2020, many of the flower species had gone to seed, giving a relative lack of available flowers to survey. As such, it was not always possible to survey the target flower species, so other available flowering species were selected, such as hedge bind weed (*Calystegia sepium*), wild parsnip (*Pastinaca sativa*) and bird's foot trefoil (*Lotus corniculatus*). In some circumstances, especially when the area covered by the transect had been recently cut or grazed, it was not possible to find a patch of flowering species that covered the full 50x50 cm area. Instead, a smaller patch of flowering plants was selected. This is not considered a significant limitation, as it was still possible to undertake two FIT counts for each transect on each visit, providing a large enough sample to allow the collection of a baseline for the Scheme.

2.5.3 The transects were mainly along field margins, to avoid accessing crops, so they sampled the least intensively managed areas of farmland, i.e. the areas most suitable for butterflies and pollinators. The alignment of some of the transects will differ slightly post-construction when the new public rights of way are available.

3 Results

3.1 Butterfly transects

3.1.1 Across the four transects and four survey visits a total of 1347 individual butterflies were recorded which comprised of 23 different butterfly species. Meadow brown (*Maniola jurtina*) was the most commonly recorded species, forming 40% of the total butterflies recorded. Small heath (*Coenonympha pamphilus*), was the second most commonly recorded species forming 15% of the total. Other commonly recorded species were common blue (*Polyommatus icarus*), large white (*Pieris brassicae*) and small white (*Pieris rapae*). These five species made up 87% of the total.

3.1.2 Other abundant but less commonly recorded species were small tortoiseshell (*Aglais urticae*), brown argus (*Aricia agestis*), ringlet (*Aphantopus hyperantus*), gatekeeper (*Pyronia tithonus*), peacock (*Aglais io*) and red admiral (*Vanessa atalanta*).

3.1.3 Rarely recorded species included marbled white (*Melanargia galathea*), small copper (*Lycaena phlaeas*), wall (*Lasiommata megera*), speckled wood (*Pararge aegeria*), brimstone (*Gonepteryx rhamni*), adonis blue, large skipper (*Ochlodes sylvanus*), clouded yellow (*Colias croceus*) and comma (*Polygonia c-album*).

3.1.4 Small and Essex skipper were also recorded, but due to the difficulty in identifying between these two species they were often grouped together. In total 28 small/ Essex skippers (*Thymelicus* sp.) were recorded with an additional three Essex skippers (*T. lineola*) and one small skipper (*T. sylvestris*) recorded to species level.

3.1.5 The transect with the highest butterfly count across the four surveys was Transect 4 along the south side of the A303 east of Longbarrow Roundabout, with 38% of all the butterflies recorded, whilst the lowest scoring transect was Transect 3 with 14% of the butterflies recorded.

3.1.6 Full results are provided in Appendix A.2.

Transect 1

3.1.7 Transect 1 had the greatest species diversity with 18 different species across the four visits. It also had the highest count of meadow browns (254 individuals recorded) and the only records of marbled white (6 individuals recorded).

3.1.8 The greatest number of meadow browns were recorded on section 5 of the transect, which was also the highest scoring section, with 125 individual butterflies recorded. This section of the transect formed a tussocky grass margin of an arable field, adjacent to calcareous grassland downland at Parsonage Down SSSI.

Table 2: Transect 1 survey results

Transect Section	Habitat	Butterfly species																		
		Brimstone	Brown Argus	Common Blue	Essex Skipper	Gatekeeper	Large Skipper	Large White	Marbled White	Meadow Brown	Peacock	Red Admiral	Ringlet	Small / Essex Skipper	Small Copper	Small Heath	Small Skipper	Small Tortoiseshell	Small White	Wall	Grand Total
1	Tussocky arable field margin- adjacent to A303							2		6									2		**10**
2	Tussocky arable field margin- adjacent to A303						1		1	19	1			2	1	1			2		**28**
3	Tussocky arable field margin and margin adjacent to stone curlew plot							2		36	1			1					5		**45**
4	Tussocky arable field margin adjacent to stone curlew plot and calcareous grassland			3				3		54	1		2	2		4		1	4		**74**
5	Tussocky arable field margin adjacent to calcareous grassland			5		1		5	5	82	1	1	2	2		3	1	2	14	1	**125**
6	Tussocky arable field margin adjacent to woodland		1	13	1	4		5		38	2		4	1	1	1		1	5		**77**
7	Tussocky arable field margin	1	4	9				2		11				1		2			4		**34**
8	Tussocky arable field margin			4				2		8						1					**15**
Total for each species		**1**	**5**	**34**	**1**	**5**	**1**	**21**	**6**	**254**	**6**	**1**	**8**	**9**	**2**	**12**	**1**	**4**	**36**	**1**	**408**

Transect 2

3.1.9 Transect 2 had a species diversity of at least 17 species. It supported the greatest number of small and large whites recorded and the only two recorded adonis blues.

3.1.10 The transect sections with the highest records of individual butterflies were sections 4 and 5 which recorded 52 and 58 individuals respectively.

Table 3: Transect 2 survey results

Transect Section	Habitat	Butterfly species																		
		Adonis Blue	Brown Argus	Clouded Yellow	Common Blue	Essex Skipper	Gatekeeper	Large White	Meadow Brown	Peacock	Red Admiral	Ringlet	Small / Essex Skipper	Small Copper	Small Heath	Small Tortoiseshell	Small White	Speckled Wood	Wall	Grand Total
1	Fence line and associated grassland between arable fields							6	5	2	1				1		2			**17**
2	Tussocky arable field margin adjacent to hedgerow				1			3	5							1	1			**11**
3	Tussocky arable field margin adjacent to hedgerow		1		1			4	4		1					1	8			**20**
4	Tussocky arable field margin adjacent to hedgerow		1		2	2	1	16	12			2	1		2	1	12			**52**
5	Tussocky arable field margin adjacent to hedgerow	1	3	1	3		3	17	7	1	1	1	1		1	2	14	1	1	**58**
6	Tussocky arable field margin adjacent to hedgerow	1	2					10	7	1				2	2	1	9			**35**
7	Tussocky arable field margin							13	8		3			1	1	1	9			**36**
8	Tussocky arable field margin							4									3			**7**
Total for each species		**2**	**7**	**1**	**7**	**2**	**4**	**73**	**48**	**4**	**6**	**3**	**2**	**3**	**7**	**7**	**58**	**1**	**1**	**236**

Transect 3

3.1.11 Transect 3 had a species diversity of at least 12 species and supported the greatest number of small heath butterflies with 110 individuals recorded.

3.1.12 The greatest number of small heaths were recorded on section 4 (44 individuals recorded) which also recorded the highest number individual butterflies (60 individuals recorded).

Table 4: Transect 3 survey results

Transect Section	Habitat	Butterfly species												
		Brimstone	Brown Argus	Common Blue	Gatekeeper	Large White	Meadow Brown	Red Admiral	Ringlet	Small / Essex Skipper	Small Heath	Small Tortoiseshell	Small White	Grand Total
1	Arable reversion – recently cut						3				14			**17**
2	Arable reversion – recently cut					1	2				10			**13**
3	Arable reversion – recently cut						1		1		13		1	**16**
4	Arable reversion – recently cut			3			9	1	1	1	44	1		**60**
5	Arable reversion – recently cut			4			12				17	1		**34**
6	Arable reversion – recently cut partially adjacent to woodland			1	1	2	8				9			**21**
7	Arable reversion – recently cut adjacent to woodland	1	1	1	1	4	5	2	2		3		7	**27**
Total for each species		**1**	**1**	**9**	**2**	**7**	**40**	**3**	**4**	**1**	**110**	**2**	**8**	**188**

Transect 4

3.1.13 Transect 4 had a species diversity of at least 15 species. It supported the greatest number of common blue butterflies with 116 individuals recorded and high numbers of meadow brown (193).

3.1.14 The transect sections with the highest records of individual butterflies were sections 5 and 6 which recorded 117 and 110 respectfully.

Table 5: Transect 4 survey results

Transect Section	Habitat	Butterfly species														
		Brown Argus	Comma	Common Blue	Gatekeeper	Large Skipper	Large White	Meadow Brown	Peacock	Red Admiral	Ringlet	Small / Essex Skipper	Small Heath	Small Tortoiseshell	Small White	Speckled Wood	Grand Total
1	Tussocky arable field margin adjacent to hedgerow		1		1		10	11				1	1		6		**31**
2	Tussocky arable field margin adjacent to hedgerow	3		19	1	1	7	11	1	1	1	6	3	1	2		**57**
3	Tussocky arable field margin in Higher Level Stewardship (HLS)	4		25	1		8	14			1	3	5		2		**63**

4	Tussocky arable field margin in HLS	3		18			5	17	1			3	4	3	7	1	**62**
5	Tussocky arable field margin in HLS	2		29	2		2	60	2			2	10	7	1		**117**
6	Tussocky arable field margin in HLS	3		25	2		1	47			3	1	21	6	1		**110**
7	Arable reversion						1	32			1		17				**51**
8	Arable reversion							1					23				**24**
Total for each species		**15**	**1**	**116**	**7**	**1**	**34**	**193**	**4**	**1**	**6**	**16**	**84**	**17**	**19**	**1**	**515**

3.2 Key Butterfly Species Habitat Assessment

3.2.1 None of the transects had suitable breeding habitat for the key butterfly species outlined in Section 2.3.1. Only one of those species was recorded, adonis blue, and only two individuals.

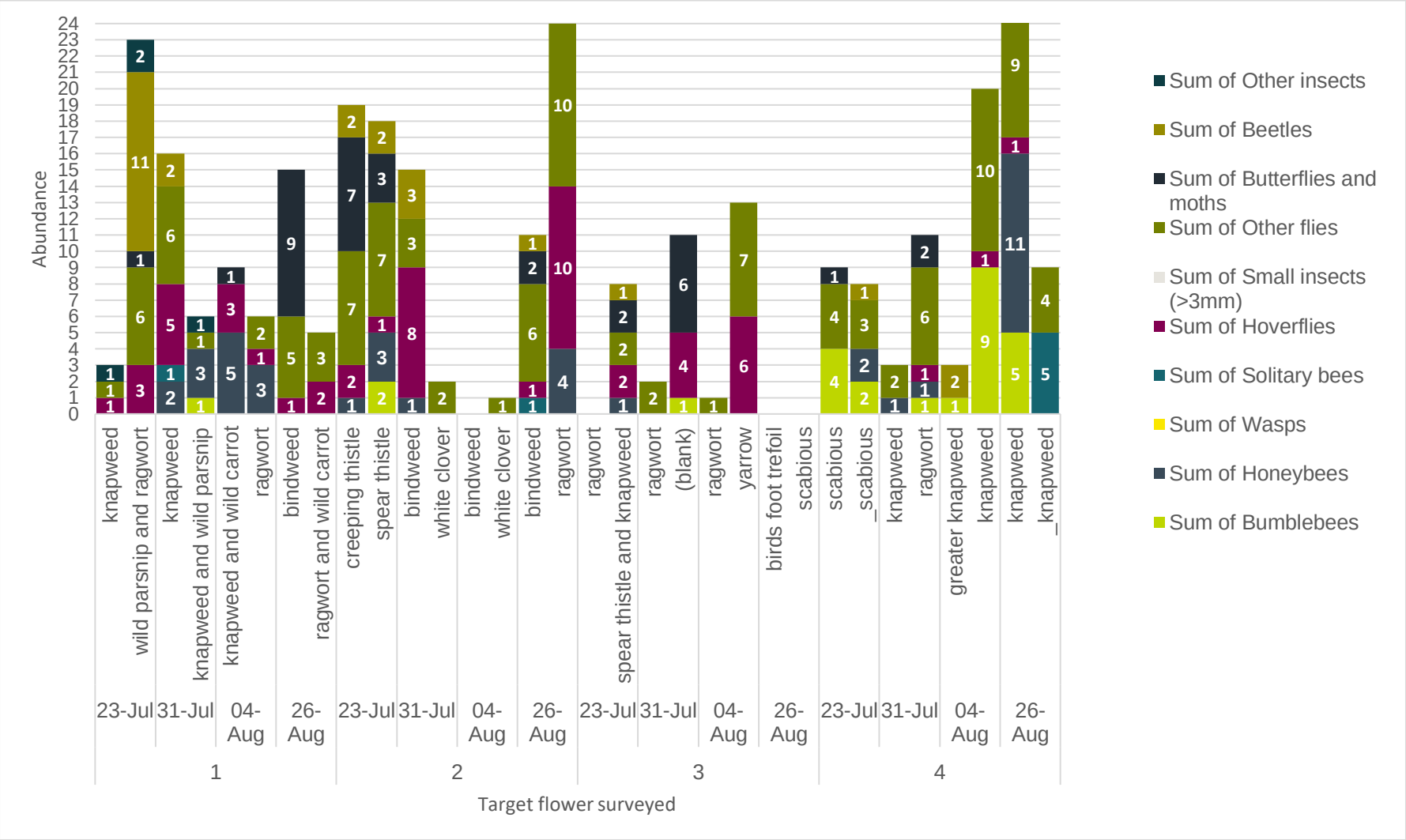
3.2.2 A full assessment of the habitats is provided in Appendix A.3.

3.3 Flower-Insect Timed Count

3.3.1 The results of the flower-insect timed count are summarised in Chart 1. A range of pollinator species were recorded across the four survey visits including beetles, butterflies, moths, other flies, small insects, hoverflies, solitary bees, wasps, honeybees and bumblebees. Of note was the marbled clover moth (*Heliothis viriplaca*) a Rare Red Data Book category 3 species.

3.3.2 The timed counts were undertaken on flowering species including the following target species knapweed, ragwort, creeping thistle (*Cirsium arvense*), spear thistle (*C. vulgare*) and white clover. As there was a lack of flowering species available on some transects the following non-target species were chosen: wild parsnip, hedge bindweed, bird's foot trefoil and scabious species. As the survey visits were undertaken in late July and August the availability of target flower species reduced towards the end of the survey period.

Chart 1: Pollinator abundance for each flower-insect timed count



4 Discussion and Conclusion

4.1 Butterflies

4.1.1 A wide range of butterfly species were recorded across the four transects and four survey visits. This included adonis blue, a key calcareous grassland and target species. The habitats covered by the transects were either arable field margins or arable reversion.

4.1.2 A summary of species information for the butterfly species recorded and the key calcareous grassland species is provided in Appendix A.4.

4.1.3 Transect 1 was the only transect to record marbled white. This butterfly was mainly recorded on the section of the transect adjacent to Parsonage Down Site of Special Scientific Interest (SSSI), an area of well-grazed chalk downland which is known to support this species[7]. Marbled white prefers unimproved grassland with a tall sward, with the largest populations found on chalk or limestone grasslands. It is likely that the marbled whites recorded during the transect originated from Parsonage Down SSSI. This section (section 5) also recorded the highest number of individual butterflies, the highest number of meadow browns and the second highest species diversity, with 14 different species recorded across the four survey visits. The abundance and variety of butterflies recorded here is most probably due to the variety of habitats present within proximity to the transect including, calcareous grassland, arable crops, tall arable field margin and woodland in the local area.

4.1.4 The highest species diversity (16 species) was recorded on Transect 2 section 5, habitat within this section comprised a tussocky arable field margin sheltered by a tall thick hedgerow. The high species diversity is likely due to the shelter and protection provided by the hedgerow, as well as the diversity of habitats present including arable crops, tall arable field margin and hedgerow. One of the two recorded adonis blues was also recorded along this section of the transect, with the second adonis blue recorded in the following section. These two individuals must have flown in from local chalk grassland as its larval food plant, horseshoe vetch, was not recorded on the transect route.

4.1.5 Meadow brown was the most commonly recorded species, this butterfly uses a range of grasses as its larval foodplant and its main habitat is a wide range of grasslands. As the habitats covered by the transects all consisted of rough grassland associated with hedges and arable field margins it is very likely that meadow brown is breeding within habitats across the Scheme.

4.1.6 Small heath was the second most commonly recorded species, this species is listed as a Section 41 species of principal importance under the NERC Act. This species uses fine grasses as its larval foodplant and its main

[7] Natural England (undated) Parsonage Down Site of Special Scientific Interest (SSSI) citation. [Available Online] https://designatedsites.naturalengland.org.uk/PDFsForWeb/Citation/1004185.pdf [Last Accessed 14/12/2020]

habitat is grassland, especially dry well-drained sites where the sward is short and sparse. During the surveys, this species was recorded on all the transects with the largest numbers recorded on the arable reversion grassland on Transects 3 and 4. It is likely that this species uses habitats within the Scheme for breeding.

4.1.7 As outlined within the limitations as the surveys were undertaken in July and August the adult flight periods for a number of butterfly species were missed. This included the following key species, marsh fritillary, Duke of Burgundy and the first brood of small blue.

4.2 Habitat Assessment

4.2.1 Although a wide range of species were recorded including adonis blue, none of the transects recorded suitable breeding habitat for the key calcareous grassland species. The main reason for the lack of suitable breeding habitat was the absence of the species larval foodplant. None of the transects supported horseshoe vetch, the larval food plant for adonis blue and chalk hill blue, nor kidney vetch, the larval food plant for small blue.

4.3 Pollinators

4.3.1 A range of pollinator species were recorded across the four survey visits including beetles, butterflies, moths, other flies, small insects, hoverflies, solitary bees, wasps, honeybees and bumblebees.

4.3.2 Marbled clover moth, a Red Data Book category 3 species, was recorded in suitable habitat within its known breeding range, which includes the Brecks of Norfolk and Suffolk as well as the Suffolk coat, Wiltshire and possibly north Hampshire[8].

4.4 Future Monitoring

4.4.1 The results within this report provide a baseline for further monitoring post-construction. The methodology within this report will be repeated post-construction to allow the comparison between the current baseline against the future baseline. This comparison will determine whether the Scheme and associated habitats have had a positive effect on butterfly and pollinator populations in proximity to the Scheme.

[8] Butterfly Conservation (undated) Marbled Clover Webpage. [Available Online] https://butterfly-conservation.org/moths/marbled-clover [Last Accessed: 15/12/2020]

Appendices

A.1 Figure 1 – Butterfly Transect

NOTES / LEGEND

- Start of transect
- End of transect
- Transect 1
- Transect 2
- Transect 3
- Transect 4

Revision Details	By / Check	Date	Suffix

Purpose of issue

FOR INFORMATION

Client
Highways England

Working on behalf of
highways england

Project Title

A303 AMESBURY
TO BERWICK DOWN

Drawing Title

BUTTERFLY TRANSECT

Designed	Drawn	Checked	Approved	Date
AM	AM	GM	HS	26/11/20

Internal Project No.
60631413

Scale @ A3	Zone
1:20,000	SW

Highways England
Temple Quay House
2 The Square, Temple Quay
Bristol
BS1 6HA

AmW
AECOM + mace + WSP

Drawing Number Highways England PIN	Originator	Volume			Rev
HE551506	AMW	GEN			01
SCHEME WIDE	DR	GI	00781		
Location	Type	Role	Number		

Filename: pw:\pw:\\UKLON3AP114.aecomonline.local:PWAECOM_EU\Documents\60541439-A303 Stonehenge Technical Partner\0300 Non Deliverables\0330 Environmental Management Team\GIS\Figures\HE551506-AMW-DR-GI-00781 - Butterfly Transect.mxd

A.2 Butterfly Survey Raw Data

Transect	Date	Species	Transect Section								Total for Transect
			1	2	3	4	5	6	7	8	
1	23/07/2020	Small Skipper	0	0	0	0	1	0	0	0	1
		Essex Skipper	0	0	0	0	0	1	0	0	1
		Small / Essex Skipper	0	1	1	2	2	1	0	0	7
		Small White	0	1	3	0	4	0	2	0	10
		Brown Argus	0	0	0	0	0	0	1	0	1
		Common Blue	0	0	0	0	0	0	4	0	4
		Red Admiral	0	0	0	0	1	0	0	0	1
		Small Tortoiseshell	0	0	0	0	1	0	0	0	1
		Peacock	0	1	1	1	1	2	0	0	6
		Marbled White	0	0	0	0	4	0	0	0	4
		Meadow Brown	5	2	21	35	24	7	7	0	101
		Small Heath	0	1	0	1	0	0	2	0	4
		Ringlet	0	0	0	0	1	0	0	0	1
	31/07/2020	Small / Essex Skipper	0	1	0	0	0	0	1	0	2
		Large Skipper	0	1	0	0	0	0	0	0	1
		Brimstone	0	0	0	0	0	0	1	0	1
		Large White	1	0	0	0	0	0	1	0	2
		Small White	2	1	1	0	0	0	2	0	6
		Small Copper	0	1	0	0	0	0	0	0	1
		Brown Argus	0	0	0	0	0	1	1	0	2
		Common Blue	0	0	0	1	0	0	3	0	4
		Small Tortoiseshell	0	0	0	1	0	1	0	0	2
		Marbled White	0	1	0	0	0	0	0	0	1
		Gatekeeper	0	0	0	0	0	2	0	0	2
		Meadow Brown	1	15	10	9	27	15	2	4	83
		Small Heath	0	0	0	2	0	0	0	0	2
	04/08/2020	Large White	1	0	0	3	0	2	0	0	6
		Small White	0	0	0	2	0	2	0	0	4
		Small Copper	0	0	0	0	0	1	0	0	1
		Brown Argus	0	0	0	0	0	0	2	0	2
		Common Blue	0	0	0	2	3	12	2	3	22
		Small Tortoiseshell	0	0	0	0	1	0	0	0	1
		Wall	0	0	0	0	1	0	0	0	1
		Marbled White	0	0	0	0	1	0	0	0	1
		Gatekeeper	0	0	0	0	0	2	0	0	2
		Meadow Brown	0	2	5	9	27	15	2	4	64
		Small Heath	0	0	0	1	2	1	0	1	5
		Ringlet	0	0	0	2	1	4	0	0	7
	26/08/2020	Large White	0	0	2	0	5	3	1	2	13
		Small White	0	0	1	2	10	3	0	0	16
		Common Blue	0	0	0	0	2	1	0	1	4
		Gatekeeper	0	0	0	0	1	0	0	0	1
		Meadow Brown	0	0	0	1	4	1	0	0	6
		Small Heath	0	0	0	0	1	0	0	0	1
2	23/07/2020	Small / Essex Skipper	0	0	0	1	0	0	0	0	1
		Large White	6	0	2	2	2	2	9	0	23
		Small White	2	0	2	1	3	1	3	0	12
		Small Copper	0	0	0	0	0	1	1	0	2
		Common Blue	0	0	0	1	0	0	0	0	1
		Adonis Blue	0	0	0	0	1	1	0	0	2
		Red Admiral	1	0	0	0	1	0	3	0	5
		Small Tortoiseshell	0	0	0	1	2	0	1	0	4
		Peacock	2	0	0	0	1	0	0	0	3

Transect	Date	Species	Transect Section								Total for Transect
			1	2	3	4	5	6	7	8	
		Meadow Brown	5	3	2	3	4	6	5	0	28
		Small Heath	1	0	0	0	0	2	0	0	3
		Ringlet	0	0	0	2	0	0	0	0	2
	31/07/2020	Small / Essex Skipper	0	0	0	0	1	0	0	0	1
		Clouded Yellow	0	0	0	0	1	0	0	0	1
		Large White	0	3	1	5	10	0	0	0	19
		Small White	0	1	5	4	8	0	0	0	18
		Red Admiral	0	0	1	0	0	0	0	0	1
		Small Tortoiseshell	0	1	1	0	0	1	0	0	3
		Gatekeeper	0	0	0	0	2	0	0	0	2
		Meadow Brown	0	1	1	4	2	0	2	0	10
		Small Heath	0	0	0	1	1	0	0	0	2
		Ringlet	0	0	0	0	1	0	0	0	1
	04/08/2020	Essex Skipper	0	0	0	2	0	0	0	0	2
		Large White	0	0	0	7	3	4	0	0	14
		Small White	0	0	0	6	0	1	0	0	7
		Brown Argus	0	0	0	0	1	0	0	0	1
		Common Blue	0	1	1	1	3	0	0	0	6
		Gatekeeper	0	0	0	1	1	0	0	0	2
		Meadow Brown	0	1	1	5	1	1	1	0	10
		Small Heath	0	0	0	1	0	0	1	0	2
	26/08/2020	Large White	0	0	1	2	2	4	4	4	17
		Small White	0	0	1	1	3	7	6	3	21
		Small Copper	0	0	0	0	0	1	0	0	1
		Brown Argus	0	0	1	1	2	2	0	0	6
		Peacock	0	0	0	0	0	1	0	0	1
		Speckled Wood	0	0	0	0	1	0	0	0	1
		Wall	0	0	0	0	1	0	0	0	1
3	23/07/2020	Red Admiral	0	0	0	1	0	0	0	0	1
		Meadow Brown	0	0	0	3	6	0	0	0	9
		Small Heath	0	0	0	1	0	0	0	0	1
	31/07/2020	Small / Essex Skipper	0	0	0	1	0	0	0	0	1
		Brimstone	0	0	0	0	0	0	1	0	1
		Large White	0	0	0	0	0	0	4	0	4
		Small White	0	0	0	0	0	0	6	0	6
		Brown Argus	0	0	0	0	0	0	1	0	1
		Common Blue	0	0	0	3	4	1	1	0	9
		Red Admiral	0	0	0	0	0	0	2	0	2
		Small Tortoiseshell	0	0	0	0	1	0	0	0	1
		Gatekeeper	0	0	0	0	0	1	1	0	2
		Meadow Brown	3	2	1	4	6	8	5	0	29
		Small Heath	5	5	5	7	6	5	2	0	35
		Ringlet	0	0	1	1	0	0	2	0	4
	04/08/2020	Large White	0	1	0	0	0	2	0	0	3
		Small White	0	0	1	0	0	0	0	0	1
		Small Tortoiseshell	0	0	0	1	0	0	0	0	1
		Meadow Brown	0	0	0	2	0	0	0	0	2
		Small Heath	4	2	2	10	8	0	1	0	27
	26/08/2020	Small White	0	0	0	0	0	0	1	0	1
		Small Heath	5	3	6	26	3	4	0	0	47
	23/07/2020	Small / Essex Skipper	0	1	1	2	0	0	0	0	4
		Large White	5	4	6	0	0	0	1	0	16
		Common Blue	0	3	0	0	0	1	0	0	4
		Small Tortoiseshell	0	1	0	2	5	0	0	0	8
		Peacock	0	1	0	1	2	0	0	0	4
		Meadow Brown	10	5	9	10	27	6	18	0	85
		Small Heath	0	0	0	0	0	1	5	0	6

Transect	Date	Species	Transect Section								Total for Transect
			1	2	3	4	5	6	7	8	
4	31/07/2020	Small / Essex Skipper	1	5	0	0	0	0	0	0	6
		Large Skipper	0	1	0	0	0	0	0	0	1
		Large White	4	1	0	0	0	0	0	0	5
		Small White	4	1	0	0	0	0	0	0	5
		Brown Argus	0	2	0	0	0	0	0	0	2
		Common Blue	0	11	6	2	1	0	0	0	20
		Small Tortoiseshell	0	0	0	1	0	0	0	0	1
		Gatekeeper	1	1	0	0	1	2	0	0	5
		Meadow Brown	1	3	1	4	18	15	6	0	48
		Small Heath	1	2	1	1	3	15	2	0	25
	04/08/2020	Small / Essex Skipper	0	0	2	1	2	1	0	0	6
		Large White	0	1	1	2	1	0	0	0	5
		Small White	0	1	1	2	0	1	0	0	5
		Brown Argus	0	1	4	2	2	3	0	0	12
		Common Blue	0	5	18	11	17	24	0	0	75
		Small Tortoiseshell	0	0	0	0	2	6	0	0	8
		Speckled Wood	0	0	0	1	0	0	0	0	1
		Gatekeeper	0	0	1	0	1	0	0	0	2
		Meadow Brown	0	3	3	1	15	26	8	1	57
		Small Heath	0	1	2	1	5	4	6	18	37
		Ringlet	0	1	1	0	0	3	1	0	6
	26/08/2020	Large White	1	1	1	3	1	1	0	0	8
		Small White	2	0	1	5	1	0	0	0	9
		Brown Argus	0	0	0	1	0	0	0	0	1
		Common Blue	0	0	1	5	11	0	0	0	17
		Red Admiral	0	1	0	0	0	0	0	0	1
		Comma	1	0	0	0	0	0	0	0	1
		Meadow Brown	0	0	1	2	0	0	0	0	3
		Small Heath	0	0	2	2	2	1	4	5	16

A.3 Key Butterfly Species Habitat Assessment

A.3.1 Transect 1

Transect Features	Butterfly species					
	Marsh Fritillary	Duke of Burgundy	Adonis Blue	Brown Hairstreak	Chalk Hill Blue	Small Blue
Suitable site/ slope aspect	1	1	1	n/a	1	n/a
Foodplant in suitable condition	0	0	0	1	0	0
Suitable sward height	0	1	0	n/a	0	n/a
Suitable sward structure	0	1	0	n/a	0	1
Suitable bare ground patches	n/a	n/a	n/a	n/a	n/a	1
Overwintering habitat	4	2	n/a	n/a	n/a	4
Suitable shelter	3	3	3	3	3	3
BREEDING HABITAT PRESENT	No	No	No	No	No	No

Abundance of each feature scored for whole transect where: 0=none seen, 1=rare, 2=occasional, 3=frequent and 4=abundant.
Green shaded cells show essential features for each species.

A.3.2 Transect 2

Transect Features	Butterfly species					
	Marsh Fritillary	Duke of Burgundy	Adonis Blue	Brown Hairstreak	Chalk Hill Blue	Small Blue
Suitable site/slope aspect	1	1	1	n/a	1	n/a
Foodplant in suitable condition	0	0	0	1	0	0
Suitable sward height	1	1	1	n/a	1	n/a
Suitable sward structure	1	1	1	n/a	1	1
Bare ground patches	n/a	n/a	n/a	n/a	n/a	1
Overwintering habitat	4	2	n/a	n/a	n/a	4
Suitable shelter	3	3	3	3	3	3
BREEDING HABITAT PRESENT	No	No	No	No	No	No

Abundance of each feature scored for whole transect where: 0=none seen, 1=rare, 2=occasional, 3=frequent and 4=abundant.
Green shaded cells show essential features for each species.

A.3.3 Transect 3

Transect Features	Butterfly species					
	Marsh Fritillary	Duke of Burgundy	Adonis Blue	Brown Hairstreak	Chalk Hill Blue	Small Blue
Suitable site/slope aspect	0	0	0	n/a	0	n/a
Foodplant in suitable condition	0	0	0	1	0	0
Suitable sward height	4	4	4	n/a	4	n/a
Suitable sward structure	2	2	3	n/a	4	2
Bare ground patches	n/a	n/a	n/a	n/a	n/a	1
Overwintering habitat	2	2	n/a	n/a	n/a	4
Suitable shelter	2	2	2	2	2	2
BREEDING HABITAT PRESENT	No	No	No	No	No	No

Abundance of each feature scored for whole transect where: 0=none seen, 1=rare, 2=occasional, 3=frequent and 4=abundant.
Green shaded cells show essential features for each species.

A.3.4 Transect 4

Transect Features	Butterfly species					
	Marsh Fritillary	Duke of Burgundy	Adonis Blue	Brown Hairstreak	Chalk Hill Blue	Small Blue
Suitable site/slope aspect	1	1	1	n/a	1	n/a
Foodplant in suitable condition	3	2	0	1	0	0
Suitable sward height	2	3	2	n/a	2	n/a
Suitable sward structure	2	2	2	n/a	2	1
Bare ground patches	n/a	n/a	n/a	n/a	n/a	1
Overwintering habitat	3	2	n/a	n/a	n/a	4
Suitable shelter	3	2	3	2	2	3
BREEDING HABITAT PRESENT	No	No	No	No	No	No

Abundance of each feature scored for whole transect where: 0=none seen, 1=rare, 2=occasional, 3=frequent and 4=abundant.
Green shaded cells show essential features for each species.

A.4 Butterfly Species Information (adapted from Butterfly Conservation undated[9])

Species	Key calcareous grassland species (Y/N)	Butterfly conservation priority	Foodplant	Habitat	Adult flight period	Distribution
Peacock *Aglais io*	N	Low	Common nettle (*Urtica dioica*), although occasionally small nettle (*Urtica urens*) and hop (*Humulus lupulus*).	Common and found in a range of habitats.	All year, hibernates over winter	Throughout Britain and Ireland.
Small tortoiseshell *Aglais urticae*	N	Low	Common nettle and small nettle.	Wide variety of habitats.	All year round, hibernates over winter	Throughout Britain and Ireland.
Ringlet *Aphantopus hyperantus*	N	Low	Prefer coarser grasses, including cock's-foot, (*Dactylis glomerata*) false brome (*Brachypodium sylvaticum),* tufted hair-grass (*Deschampsia cespitosa*), common couch (*Elytrigia repens*), and meadow-grasses (*Poa* spp.).	Woodland rides and glades and damp grassland where grasses are lush and tall.	Mid-June to early August	Everywhere apart from northern Scotland.
Brown argus *Aricia agestis*	N	Low	Common rock-rose (*Helianthemum nummularium*) exclusively on calcareous grasslands. In other habitats dove's-foot crane's-bill (*Geranium molle*) and common stork'-bill (*Erodium cicutarium*).	Main habitats are chalk and limestone grassland	May-September	Widespread in southern and central England as far north as Yorkshire. Less common and mainly coastal in Wales and south-west England.
Small heath *Coenonympha pamphilus*	N	High: Section 41 species of principal importance under the NERC Act	Fine grasses, especially fescues (*Festuca* spp.), meadow-grasses, and bents (*Agrostis* spp.).	Grassland where there are fine grasses, especially in dry, well-drained situations where the sward is short and sparse.	Late May to mid-September	Throughout Britain and Ireland.
Clouded yellow *Colias croceus*	N	Low	A range of leguminous plants, including wild and cultivated clovers (*Trifolium spp*.), lucerne	May be seen in any habitat but congregate in flowery places	Migratory species from Europe.	Anywhere, but most commonly close to the coast in southern England.

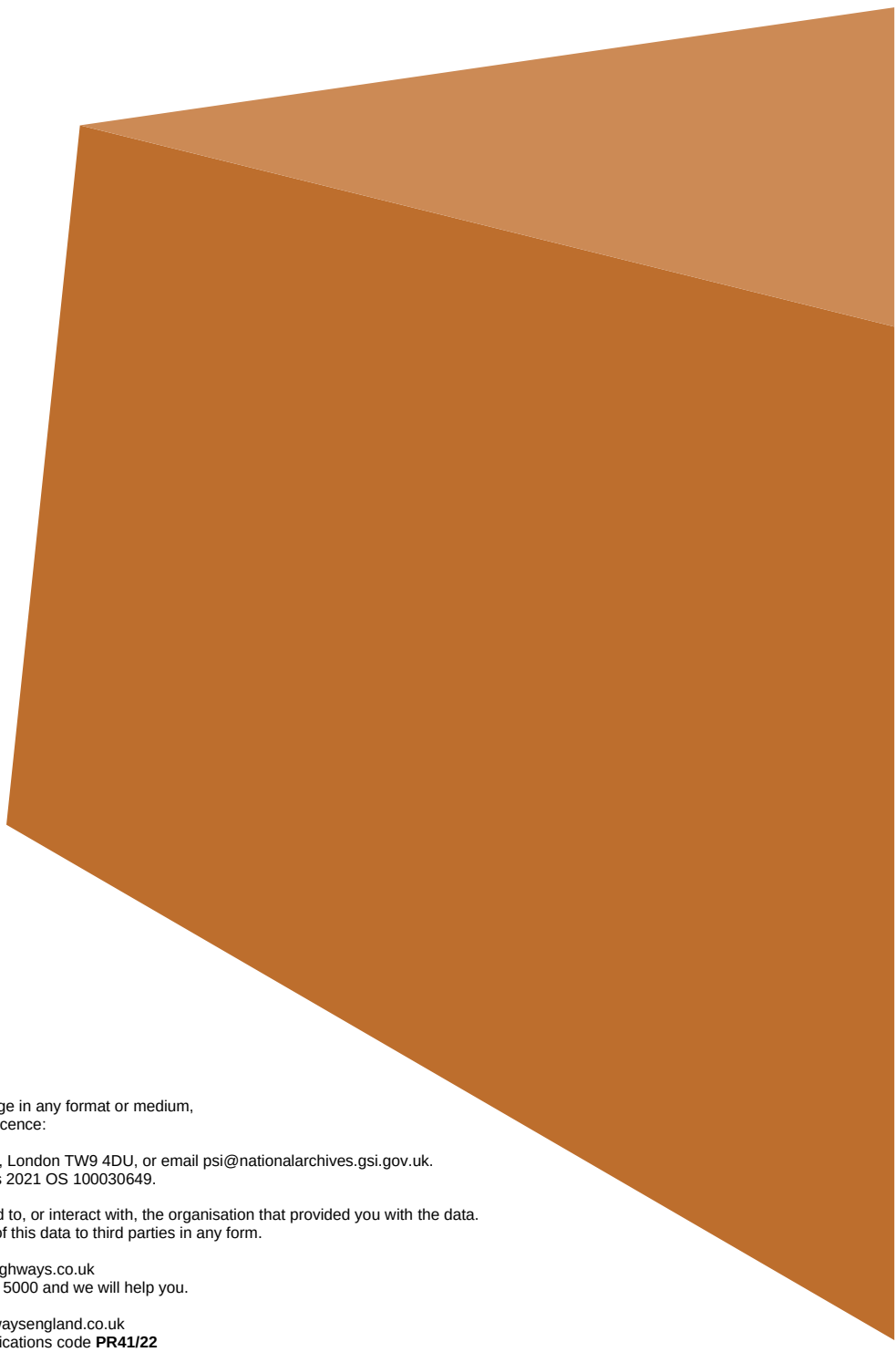
[9] Butterfly Conservation (undated) A-Z of UK butterflies [Available Online] https://butterfly-conservation.org/uk-butterflies/a-to-z [Last Accessed 14/12/2020]

Species	Key calcareous grassland species (Y/N)	Butterfly conservation priority	Foodplant	Habitat	Adult flight period	Distribution
			(*Medicago sativa*), and less frequently, common bird's-foot-trefoil (*Lotus corniculatus*).	where the larval foodplants grow.	Late May to early November.	
Small blue *Cupido minimus*	Y	Medium - Section 41 species of principal importance under the NERC Act.	Kidney vetch (*Anthyllis vulneraria*).	Sheltered, warm grassland habitats with kidney vetch and sparse or eroding vegetation with bare ground where kidney vetch can flourish. Tall grasses and/or topographical shelter are essential.	Early May to late June and late July to early August.	Mainly South-central England and south Wales but can be found along some eastern Scottish coasts and both the east and west coast of Ireland.
Marsh fritillary *Euphydryas aurinia*	Y	High – Fully protected under Wildlife and Countryside Act 1981(as amended) and Section 41 species of principal importance under the NERC Act.	Devil's-bit-scabious (*Succisa pratensis*) and occasionally field scabious (*Knautia arvensis*) and small scabious (*Scabiosa columbaria*).	Three main habitat types: damp grasslands dominated by tussock forming grasses and chalk grasslands (usually on the west or south-facing slopes) and shorter coastal grasslands. Prefers uneven patchwork of short and long vegetation (average height of 5-12 cm on chalk grassland site). Caterpillars overwinter in a dense grass tussock.	Mid-May to late June.	Massively declined and now restricted to the west coast of Scotland, south and west Wales, Northern Ireland and south-west and central southern England.
Brimstone *Gonepteryx rhamni*	N	Low	Buckthorn (*Rhamnus cathartica*), which occurs mainly on calcareous soils, and alder buckthorn (*Frangula alnus*).	Scrubby grassland and woodland	All year round, hibernates over winter	Common in England and Wales, less common in Ireland and very rare in Scotland.
Duke of Burgundy *Hamearis lucina*	Y	High - Section 41 species of principal importance under the NERC Act.	Cowslip (*Primula veris*) and primrose (*P. vulgaris*).	Two main habitats; chalk and limestone grassland with plenty of shelter from scrub or slopes or clearings on ancient woodland sites. They prefer steep slopes and short swards with areas of taller swards for protection.	Mid-April to mid-June.	Much reduced over recent decades, with its remaining strongholds in central southern England.

Species	Key calcareous grassland species (Y/N)	Butterfly conservation priority	Foodplant	Habitat	Adult flight period	Distribution
Wall *Lasiommata megera*	N	High: Section 41 species of principal importance under the NERC Act	Various grasses are used, including tor-grass (*Brachypodium pinnatum*), false brome, cock's-foot, bents, wavy hair-grass (*Deschampsia flexuosa*) and Yorkshire-fog (*Holcus lanatus*).	Short, open grassland, where turf is broken or stony.	Late April to mid-September	Widespread in England, Wales and Ireland, but increasingly scarce inland.
Small copper *Lycaena phlaeas*	N	Low	Common sorrel (*Rumex acetosa*) and sheep's sorrel (*R. acetosella*) are the main foodplants. broad-leaved dock (*R. obtusifolius*) may be occasionally used.	Occurs in a wide variety of habitats.	Mid-April to mid-October	Throughout Britain and Ireland except the uplands of northern Britain.
Meadow brown *Maniola jurtina*	N	Low	A wide range of grasses	Grasslands	June to early October	Throughout Britain and Ireland
Marbled white *Melanargia galathea*	N	Low	Red fescue (*Festuca rubra*), sheep's-fescue (*F. ovina*), Yorkshire-fog, and tor-grass.	Unimproved grassland with tall sward. The strongest populations are found on chalk or limestone grasslands.	Mid-June to end of July	Southern and central England, north to Yorkshire, and South West Wales.
Large skipper *Ochlodes sylvanus*	N	Low	Cock's-foot and occasionally purple moor-grass (*Molinia caerulea*) and false brome.	Grassy areas, where foodplants grow in sheltered, often damp, situations and remain tall and uncut.	Mid-April to mid-September	Throughout England and in the Dumfries and Galloway area in Scotland. Not present in Ireland.
Speckled wood *Pararge aegeria*	N	Low	False brome, cock's-foot, Yorkshire-fog and common couch.	Woodland rides and glades, gardens, parks and hedgerows.	Late march to October	Throughout England (except the far north), Wales and Ireland, and in northern Scotland.
Large white *Pieris brassicae*	N	Low	Wild or cultivated species of the Cruciferae family, with a strong preference for cultivated varieties.	Variety of habitats	Mid-April to mid-September	Throughout Britain and Ireland.
Small white *Pieris rapae*	N	Low	Cultivated brassicas and wild crucifers.	Variety of habitats particularly where cabbages are grown	Mid-April to mid-September	Widespread throughout Britain and Ireland.

Species	Key calcareous grassland species (Y/N)	Butterfly conservation priority	Foodplant	Habitat	Adult flight period	Distribution
Comma *Polygonia c-album*	N	Low	Common nettle. Other species used include hop, elms (*Ulmus* spp.), currants (*Ribes* spp.), and willows (*Salix* spp).	Open woodland and wood edges	All year, hibernates over winter	Widespread in England and Wales, rare in southern Scotland and Northern Ireland.
Adonis blue *Polyommatus bellargus*	Y	Medium	Horseshoe vetch (*Hippocrepis comosa*).	Dry chalk or limestone grassland with abundant horseshoe vetch in short turf. Prefer short turf on south-facing slopes with sheltered hollows.	May-September.	Restricted to southern England, but not in the far south-wes.t
Chalk hill blue *Polyommatus coridon*	Y	Medium	Horseshoe vetch.	Restricted to chalk and limestone grassland. Prefers a short sward with warm south and west facing slopes.	Mid-July to early September.	Restricted to southern England, but not in the far south-west
Common blue *Polyommatus icarus*	N	Low	Common bird's-foot-trefoil is the main foodplant.	Very common and found in a variety of habitats especially sunny sheltered spots.	May - September	Found throughout Britain and Ireland.
Gatekeeper *Pyronia tithonus*	N	Low	Various grasses, with a preference for fine grasses.	Found where tall grasses grow close to hedges, trees or scrub.	Late June to early September	Southern Britain and the far south of Ireland.
Brown hairstreak *Thecla betulae*	Y	High - Section 41 species of principal importance under the NERC Act.	Blackthorn (*Prunus spinosa*) and occasionally other prunus species such as bullace (*P. domestica*).	Extensive networks of hedgerows, scrub and woodland edge where blackthorn is prominent and not flailed every year.	Mid-July to early October.	Restricted in the UK to three main centres: south-west Wales, Devon/Somerset and Surrey/Sussex. Other smaller populations occur around Oxford and on Salisbury Plain.
Essex skipper *Thymelicus lineola*	N	Low	The main species is cock's-foot, although may use several other grasses.	Found in tall, dry grasslands in open sunny situations	Mid-June to mid-August	Widespread in southern and central England, but not in the far south-west.
Small skipper *Thymelicus sylvestris*	N	Low	Almost exclusively Yorkshire-fog, although several other grasses have been recorded.	Open places with long grass.	Mid-June to mid-August	Widespread up to North Yorkshire and Scottish border.

Species	Key calcareous grassland species (Y/N)	Butterfly conservation priority	Foodplant	Habitat	Adult flight period	Distribution
Red admiral *Vanessa atalanta*	N	Low	Common nettle, although occasionally small nettle, pellitory-of-the-wall (*Parietaria judaica*) and hop.	Found in a range of habitats	Throughout the year with migrants arriving May and June.	Throughout Britain and Ireland.



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