

Appendix 9.8

TERRESTRIAL INVERTEBRATE SURVEY

FORT HALSTEAD, KENT
TERRESTRIAL INVERTEBRATE SURVEY

A Report to: CBRE Ltd

Report No: RT-MME-127947-08 Rev A

Date Final Issued: November 2018
Date Rev A Issued: September 2019



Triumph House, Birmingham Road, Allesley, Coventry CV5 9AZ
Tel: 01676 525880 Fax: 01676 521400
E-mail: admin@middlemarch-environmental.com Web: www.middlemarch-environmental.com

REPORT VERIFICATION AND DECLARATION OF COMPLIANCE

This study has been undertaken in accordance with British Standard 42020:2013 “Biodiversity, Code of practice for planning and development”.

Report Version	Date	Completed by:	Checked by:	Approved by:
Rev A	12/09/2019	Hannah Train GradCIEEM (Senior Ecological Consultant)	Tom Docker MSc CEcol MCIEEM (Associate Director, EIA)	Dr Philip Fermor CEnv MCIEEM (Managing Director)
Final	28/11/2018	Richard Wright (Terrestrial Invertebrate Specialist) and James Calow MPhil CEnv MCIEEM MIEMA Mem.R.E.S (Ecological Consultant)	Tom Docker MSc MCIEEM (Ecological Impact Assessment Manager)	Dr Philip Fermor CEnv MCIEEM (Managing Director)

The information which we have prepared is true, and has been prepared and provided in accordance with the Chartered Institute of Ecology and Environmental Management’s Code of Professional Conduct. We confirm that the opinions expressed are our true and professional bona fide opinions.

DISCLAIMER

The contents of this report are the responsibility of Middlemarch Environmental Ltd. It should be noted that, whilst every effort is made to meet the client’s brief, no site investigation can ensure complete assessment or prediction of the natural environment.

Middlemarch Environmental Ltd accepts no responsibility or liability for any use that is made of this document other than by the client for the purposes for which it was originally commissioned and prepared.

VALIDITY OF DATA

The findings of this study are valid for a period of 24 months from the date of survey. If works have not commenced by this date, an updated site visit should be carried out by a suitably qualified ecologist to assess any changes in the habitats present on site, and to inform a review of the conclusions and recommendations made.

NON-TECHNICAL SUMMARY

Middlemarch Environmental Ltd was commissioned by CBRE Ltd to undertake a Terrestrial Invertebrate Survey at Fort Halstead in Kent. This survey is required to inform a hybrid planning application associated with the proposed redevelopment of the site, which will involve the demolition of the majority of existing industrial buildings and the construction of a new employment-led mixed-use village.

To fulfil the above brief, a terrestrial invertebrate survey was undertaken on 26th June, 17th July and 11th September 2018 by Richard Wright (Specialist Invertebrate Surveyor) and James Calow (Middlemarch Environmental Ltd).

The site comprises an area of land, including grazed chalk grassland, unmanaged grassland and woodland. Much of the site is enclosed within a security fence with numerous buildings, hardstanding and managed grassland. Previous invertebrate surveys in 2012 and 2014 identified two areas outside the security fence, designated areas 2 and 3B, as being the most important. From these reports, plus inspection of an area of woodland, only these two areas were surveyed.

A total of 203 species of invertebrate were recorded during the survey, nine of which are listed as being of conservation concern. Although for some of these the data used for assessment is out of date and the statuses are certain to be revised downwards in future. Using the Natural England ISIS application for analysis, the site was judged to be in favourable condition for Specific Assemblage Type (SAT) F112 *open short sward* and Broad Assemblage Type (BAT), F1 *unshaded early successional mosaic*. All of the species contributing to these assessments were recorded from the large area of chalk grassland to the south of the site and it is this area (Area 2 on the plan) which is by far the most significant. Conversely, the unmanaged grassland and woodland areas surveyed were found to be of little interest, with few features of significance for invertebrates.

Following the results of the Terrestrial Invertebrate Survey, the following recommendations have been made:

- R1** The existing calcareous grassland habitats should be retained and protected.
- R2** A Landscape and Ecological Management Plan (LEMP) should be produced for the site. This should detail improved management of habitats on site for invertebrates, particularly in the grassland and woodland areas.

CONTENTS

1. INTRODUCTION	4
1.1 PROJECT BACKGROUND	4
1.2 SITE DESCRIPTION AND CONTEXT	4
1.3 DOCUMENTATION PROVIDED	5
2. METHODOLOGY	6
2.1 DESK STUDY	6
2.2 TERRESTRIAL INVERTEBRATE HABITAT ASSESSMENT	6
2.3 TERRESTRIAL INVERTEBRATE SURVEY	6
2.4 DATA ANALYSIS	6
3. DESK STUDY	8
3.1 SPECIES RECORDS	8
3.2 PREVIOUS SURVEYS	8
4. SURVEY RESULTS	9
4.1 INTRODUCTION	9
4.2 CONSTRAINTS	9
4.3 HABITAT ASSESSMENT	9
4.4 INVERTEBRATE SURVEY RESULTS	10
4.5 ANALYSIS USING ISIS AND PANTHEON	12
5. DISCUSSION AND CONCLUSIONS	13
5.1 SUMMARY OF PROPOSALS	13
5.2 ASSESSMENT OF HABITATS	13
5.3 POTENTIAL IMPACTS ON INVERTEBRATES	13
6. RECOMMENDATIONS	14
7. PHOTOGRAPHS	15
REFERENCES AND BIBLIOGRAPHY	16
APPENDICES	17
APPENDIX 1	18
APPENDIX 2	22

1. INTRODUCTION

1.1 PROJECT BACKGROUND

Middlemarch Environmental Ltd was commissioned by CBRE Ltd to undertake a Terrestrial Invertebrate Survey at Fort Halstead in Kent. This survey is required to inform a hybrid planning application associated with the proposed redevelopment of the site, which will involve the demolition of the majority of existing industrial buildings and the construction of a new employment-led mixed-use village. It is understood that the new village will comprise business areas (Use Classes B1a/b/c with energetic testing operations), development of up to 750 residential dwellings, a village centre (Use Classes A1/A3/A4/A5/B1a/D1/D2), a one form entry primary school, use of the Fort Area and bunkers as an Historic Interpretation Centre (Use Class D1), together with amenity space, landscape and ecological enhancements both on the site and on the adjacent land within the Applicants ownership.

A suite of baseline surveys have been completed by Waterman Group between 2006 and 2013, the results of which are provided in an Ecological Appraisal (Report EED12715-102.R.2.3.7.LM) and Protected Species and Habitat Survey (Report EED12715-102.R.3.3.6.LM), and summarised in the ecology chapter of an EIA associated with a previous application, for which outline planning consent was granted.

Due to the amount of time that has elapsed since the previous surveys were completed, updated ecological surveys were required for the current planning application.

To fulfil the above brief, a terrestrial invertebrate survey was undertaken on 26th June, 17th July and 11th September 2018.

In addition, Middlemarch Environmental Ltd has been commissioned to undertake the following assessments:

- Preliminary Ecological Appraisal (Report RT-MME-127947-01);
- Preliminary Bat Roost Assessment (Report RT-MME-127947-02);
- Nocturnal Emergence and Dawn Re-entry Bat Surveys (Report RT-MME-127947-03);
- Bat Activity Surveys (Report RT-MME-127947-04);
- Badger Survey (Report RT-MME-127947-05);
- Breeding Bird Survey (Report RT-MME-127947-06);
- Botanical Survey (Report RT-MME-127947-07);
- Reptile Survey (Report RT-MME-127947-09);
- Dormouse Survey (Report RT-MME-127947-10);
- Winter Bird Survey (Report RT-MME-127947-11);
- Pre-development Arboricultural Survey (Report RT-MME-128206-01); and,
- Arboricultural Impact Assessment (Report RT-MME-128206-02).

1.2 SITE DESCRIPTION AND CONTEXT

The site is located off Star Hill Road in Halstead, Kent, centred at National Grid Reference TQ 4970 5922. It is an irregular shaped parcel of land that measures 131.89 ha in size.

At the time of the survey, the site comprised a defence research facility which contained a number of buildings with associated areas of hardstanding, surrounded by parcels of semi-natural and plantation woodland. Areas of neutral grassland, calcareous grassland and amenity grassland were also present, as well as patches of scrub and tall ruderal vegetation.

The site was bordered by the A224 Polhill to the north-east and Star Hill Road to the south-west. A mixture of arable and pastoral fields, pockets of woodland and farm buildings surround the site. The wider landscape was dominated by a rural setting, consisting of agricultural land interspersed with pockets of woodland and small settlements.

1.3 DOCUMENTATION PROVIDED

The conclusions and recommendations made in this report are based on information provided by the client regarding the scope of the project. Documentation made available by the client is listed in Table 1.1.

Document Name / Drawing Number	Author
Fort Halstead – Design and Access Statement: 00556I	John Thompson and Partners
Site Location Plan: 00556I_S01 Rev D5	John Thompson and Partners
Land Use and Green Infrastructure Plan: 00556I_PP01 Rev D10	John Thompson and Partners
Building Heights Plan: 00556I_PP02 Rev D10	John Thompson and Partners
Access and Movement: 00556I_PP03 Rev D9	John Thompson and Partners
Demolition Plan: 00556I_PP04 Rev D8	John Thompson and Partners
Ecological Appraisal: EED12715-102.R.2.3.7.LM	Waterman Group
Protected Species and Habitats Survey: EED12715-102.R.3.3.6.LM	Waterman Group
Environmental Statement - Ecology and Nature Conservation	Waterman Group
Decision Notice (planning application number SE/15/00628/OUT)	Sevenoaks District Council

Table 1.1: Documentation Provided by Client

2. METHODOLOGY

2.1 DESK STUDY

As part of the Preliminary Ecological Appraisal (Report RT-MME-127947-01) an ecological desk study was undertaken within a 2 km radius of the site. The consultee for the desk study was Kent and Medway Biological Records Centre.

Middlemarch Environmental Ltd then assimilated and reviewed the desk study data provided by this organisation. Relevant invertebrate data are discussed in Chapter 3. In compliance with the terms and conditions relating to its commercial use, the full desk study data are not provided within this report.

2.2 TERRESTRIAL INVERTEBRATE HABITAT ASSESSMENT

The habitats on site were assessed for their suitability to support different terrestrial invertebrates by an experienced field entomologist.

2.3 TERRESTRIAL INVERTEBRATE SURVEY

The target groups were surveyed using recognised sampling methodologies including both active methods consisting of sweep netting, vegetation beating and direct searching, together with passive sampling, involving pitfall trapping for ground dwelling species and water traps for aerial species.

2.3.1 Pitfall Traps

Pitfall trapping was carried out within all survey areas. Methodology followed that of Luff (1996), with five pitfall traps set in a straight line and situated at roughly 2 m intervals, to produce a trap line approximately 10 m in length. Pitfall traps consisted of 500 ml polypropylene pots, which were sunk into the ground sufficiently so that the top of the pot was level with the ground surface. A small quantity of saturated salt solution was then poured into the bottom of the pot to act as a preservative and killing agent for any organism that fell into the trap. Wire mesh was placed over the top of each pitfall trap to prevent by-catch of small rodents and amphibians. At the end of each sampling period the contents from the individual traps were pooled to produce a single sample from each row.

Though pitfall traps were used in all habitats, they were not placed evenly over the site but rather were mainly concentrated in habitats considered most likely to produce a good number of species.

2.3.2 Water Traps

Plastic bowls with diameter of approximately 20 cm and a depth of approximately 8 cm were employed to sample aerial insect fauna including true flies and Hymenoptera. Traps were filled with a saturated salt solution and washing up liquid (to remove surface tension) and lines of 5 traps about 2 m apart were placed at ground level. Each line consisted of three white, one yellow and one blue bowl. At the end of the sampling period the contents of the traps were poured through a plastic sieve with 1 mm diameter mesh and then stored in 70% ethanol for subsequent identification.

2.3.3 Sweep Netting and Vegetation Beating

Sweep netting of vegetation and the beating of tall vegetation to sample arboreal invertebrate species was carried within all survey areas on all site visits. Both the lightweight net, for Diptera and Hymenoptera, and the heavyweight net, for Coleoptera and Heteroptera, were used.

2.3.4 Direct Searching and Hand Netting

This method was used to target the aculeate Hymenoptera (bees, ants and wasps) and True flies (Order Diptera), with individuals collected from flowers. The method was carried out within all survey areas on each visit.

2.4 DATA ANALYSIS

Species recorded were checked to see if any are considered to be of conservation concern. These statuses were taken from the most recently available relevant publications, which are listed in the References and Bibliography section.

Most species of invertebrate were assigned statuses using a now outdated set of criteria and categories. The definitions and criteria for ascribing species to these scarcity/threat categories are detailed in Table 2.1. Species of conservation concern are assigned either Red Data Book (RDB) categories or Nationally Scarce categories depending on the level of threat.

Status Category	Definition and Criteria
RDB1: Endangered	Taxa in danger of extinction whose numbers have been reduced to a critical level or habitat has been reduced such that they are deemed to be in immediate danger of extinction. Species known or believed to occur only as a single population within one 10 km square of the National Grid.
RDB2: Vulnerable	Taxa believed likely to move into the endangered category in the near future if causal factors continue to operate. Included are taxa of which most or all of the populations are declining.
RDB3: Rare	Taxa with small populations that are not at present Endangered or Vulnerable, but are at risk. Species which are estimated to exist in only 15 or fewer post 1970 10km squares of the National Grid.
RDBK: Insufficiently Known	Taxa suspected to fall within the Red Data Book categories but with too little information to allow confident assignment to any of the previous categories.
Nationally Scarce: Category A (Na)	Taxa which do not fall within RDB categories but which are considered to be uncommon in Great Britain. Species occurring in 30 or fewer 10km squares of the National Grid.
Nationally Scarce: Category B (Nb)	Taxa which do not fall within RDB categories but which are considered to be uncommon in Great Britain. Species occurring in between 31 – 100 10km squares of the National Grid.

Table 2.1: Definitions and Criteria for Scarcity / Threat Categories for Invertebrates (Old)

However, many groups have been re-evaluated using the revised criteria of the IUCN. This process is ongoing so that many groups have still only been evaluated using the older criteria and categories. The definitions and criteria for ascribing species to these scarcity/threat categories are detailed in Table 2.2.

Status Category	Definition and Criteria
Critically Endangered (CR)	A taxon is Critically Endangered when it is facing an extremely high risk of extinction in the wild in the immediate future.
Endangered (EN)	A taxon is Endangered when it is not Critically Endangered but is facing a very high risk of extinction in the wild in the near future.
Vulnerable (VU)	A taxon is Vulnerable when it is not Critically Endangered or Endangered but is facing a high risk of extinction in the wild in the medium-term future.
Lower Risk (LR)	A taxon is Lower Risk when it has been evaluated but does not satisfy the criteria for any of the categories Critically Endangered, Endangered or Vulnerable. Taxa included in the Lower Risk category can be separated into three sub-categories: <i>Conservation Dependent (cd). Taxa which are the focus of a continuing taxon-specific or habitat-specific conservation programme targeted towards the taxon in question, the cessation of which would result in the taxon qualifying for one of the threatened categories above within a period of five years.</i> <i>Near Threatened (nt). Taxa which do not qualify for Lower Risk (Conservation Dependent), but which are close to qualifying for Vulnerable.</i> <i>Least Concern (lc). Taxa which do not qualify for Lower Risk (Conservation Dependent) or Lower Risk (Near Threatened).</i>

Table 2.2: Definitions and Criteria for Scarcity / Threat Categories for Invertebrates (New)

3. DESK STUDY

3.1 SPECIES RECORDS

The data search was carried out in July 2018 by Kent and Medway Biological Records Centre. Records of terrestrial invertebrate species within a 2 km radius of the survey area provided by the consultee are summarised below. It should be noted that the absence of records should not be taken as confirmation that a species is absent from the search area.

The desk study revealed records of numerous invertebrates that are listed as Species of Principal Importance, including:

- 42 species of moth, including blood vein *Timandra comae*, cinnabar *Tyria jacobaeae*, ghost moth *Hepialus humuli*, knot grass *Acronicta rumicis*, latticed heath *Chiasmia clathrate*, mottled rustic *Caradrina morpheus*, oak hook-tip *Watsonalla binaria*, shaded broad-bar *Scotopteryx chenopodiata* and small square-spot *Diarsia rubi*.
- five species of butterfly namely dingy skipper *Erynnis tages*, grizzled skipper *Pyrgus malvae*, small heath *Coenonympha pamphilus*, wall *Lasiommata megera* and white admiral *Limenitis Camilla*;
- two species of beetle namely necklace ground beetle *Carabus monilis* and scarlet malachite beetle *Malachius aeneus*; and,
- a single species of bee namely red-shanked carder-bee *Bombus ruderarius*.

3.2 PREVIOUS SURVEYS

Invertebrate surveys have previously been undertaken at Fort Halstead in 2007, 2012 and 2014. The results of these surveys have been consistent over the years, keeping in mind the reduced survey area in 2014, which concentrated on the most valuable habitats to terrestrial invertebrates including sections of woodland edge and unimproved calcareous grassland. The species diversity recorded was consistent with 273 recorded in 2007, 325 recorded in 2012 and 202 recorded in 2014. No invertebrate species that are afforded direct legal protection under any UK or European wildlife legislation were encountered during any of the surveys undertaken. However, species of conservation interest were recorded during the surveys, including British RDB species, Nationally Scarce Species and Nationally Local Species.

Based on the invertebrate survey results and the extent of the woodland, semi-improved and calcareous grassland, the invertebrate community is considered to be of county value. However, owing to the limited extent of woodland and calcareous grassland within the site, the invertebrate population on site was considered to be of district value.

4. SURVEY RESULTS

4.1 INTRODUCTION

The terrestrial invertebrate survey was undertaken on 26th June, 17th July and 11th September 2018 by Richard Wright (Specialist Invertebrate Surveyor) and James Calow (Ecological Consultant). Weather conditions were recorded and are presented in Table 4.1.

Parameter	26/06/2018	17/07/2018	11/09/2018
Temperature (°C)	21	19	18
Cloud Cover (%)	<10	10	20
Precipitation	Nil	Nil	Nil
Wind Speed (Beaufort)	F0	F0	F4

Table 4.1: Weather Conditions During the Preliminary Bat Roost Assessment

4.2 CONSTRAINTS

Only two areas of the site were surveyed in detail, although these were areas which previous surveys and consideration of the habitats present had determined to be of the highest value to invertebrates. Due to the presence of grazing sheep, traps could not be used. Had pitfall and water traps been used, more species would almost certainly have been recorded. The weather during the summer of 2018 was very hot and dry, causing much of the vegetation to become desiccated early in the season which probably had a negative impact on some species.

4.3 HABITAT ASSESSMENT

Based on the previous surveys summarised in Section 3.2 and a consideration of the habitats present, the 2018 survey covered only areas 2 and 3B, which are shown in Figure 4.1 below. Area 2, a substantial area of sheep-grazed chalk downland, had the potential to be the most important part of the site for invertebrates and required the most survey effort. Areas 3A and 3B appeared to have essentially the same habitats as each other, but access to 3A was more difficult and the grassland there was regularly cut short for operational reasons and so this area was excluded.

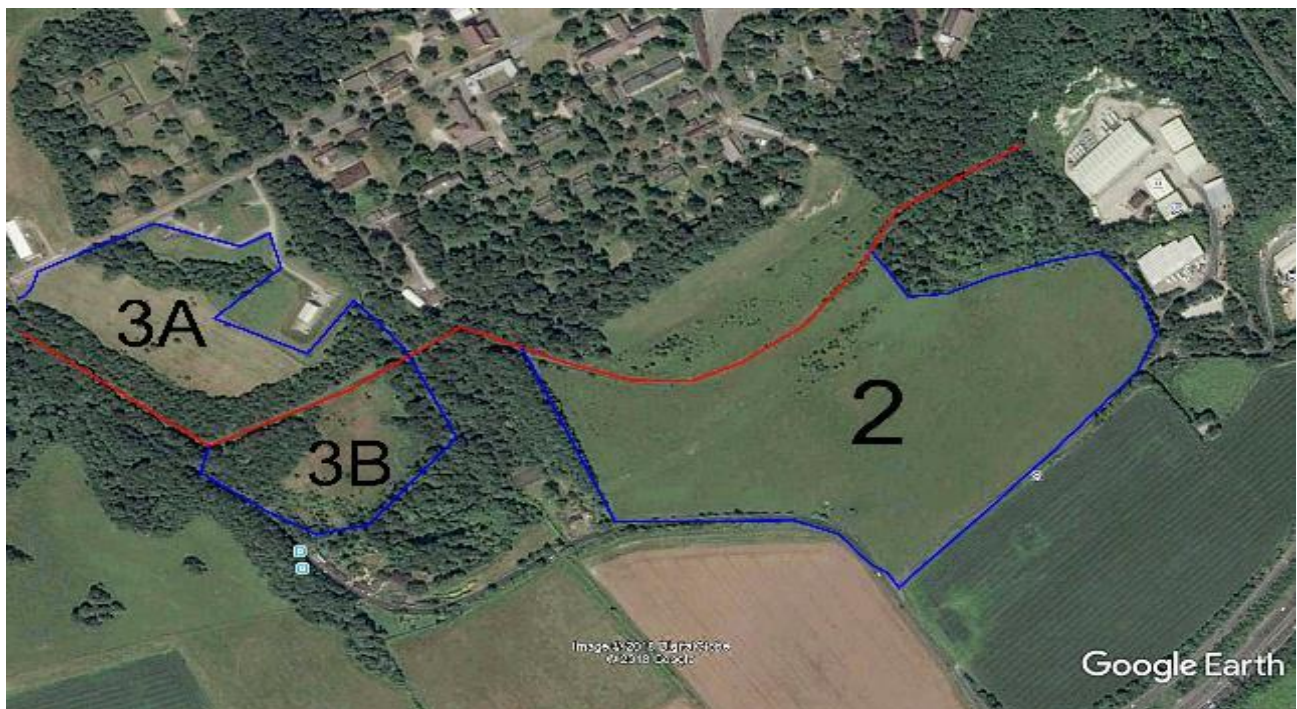


Figure 4.1: Areas surveyed as part of Terrestrial Invertebrate Survey. Red line indicates security fence

An inspection was made of the large area of woodland in the east of the site, but this was mainly non-native sweet chestnut and sycamore, with an understorey of bramble and very limited ground flora. It lacked extensive dead wood or any other features likely to be of invertebrate interest and so this was also excluded from the survey.

In general, apart from the calcareous grassland, none of the habitats present appeared likely to support particularly interesting invertebrate assemblages or scarce species.

Table 4.2 presents an assessment of the value of the habitats within the site to invertebrates.

Habitat	Description	Value to Invertebrates
Short sward grassland	Calcareous grassland grazed by sheep on the higher part of Area 2.	High
Tall grassland	Lightly grazed grassland in parts of Area 2 and most of Area 3B.	Low
Woodland	Very dark and shaded, some with non-native tree species, mainly with bare ground and sparse ground cover, very poor ground flora.	Low
Scrub	Largely dominated by hawthorn and mainly open.	Low

Table 4.2: Invertebrate Habitat Assessment - Summary Information

4.4 INVERTEBRATE SURVEY RESULTS

A total of 203 species of invertebrate were recorded during the survey (the full species list is provided in Appendix 1). While not a very large number this total is considered adequate for a robust site assessment of the site's invertebrate value to be made, Table 4.3 provides a summary of the numbers of invertebrates recorded by taxonomic group.

The total number of invertebrates recorded in the 2018 survey is very similar to the number recorded during the 2014 survey from areas 2, 3A and 3B, although there were considerable differences in detail. It is a larger number than recorded from the equivalent areas in 2012.

Group	English Name	Number of Species Recorded	Species of Conservation Concern
Coleoptera	Beetles	69	5
Diptera	Flies	19	0
Hymenoptera	Bees, wasps and ants	14	1
Arachnida	Spiders	21	0
Hemiptera	True bugs and leafhoppers	54	0
Lepidoptera	Butterflies and moths	14	2
Orthoptera	Grasshoppers and crickets	7	1
Other	-	5	0

Table 4.3: Invertebrates Recorded by Group

The data in Table 4.4 below shows that the results for each survey year are broadly comparable.

Year	Area 2	Area 3B
2012	94	37
2014	139	101 (including 3A)
2018	172	73

Table 4.4: Number of species recorded in each survey year by area

Pollinator insects, particularly bees and hoverflies, were noticeably scarce with few species and very few individuals. This may have been partly due to the hot dry weather leading to a short flowering season for many plants, although there has been a general decline of these species in recent years in many areas.

A few species which have been considered of conservation concern were recorded on the survey, but some of these have recently expanded their range and abundance and no longer justify scarce status.

Squamapion cineraceum (Coleoptera, Apionidae)

Nationally Notable "A". A seed weevil which develops in the seeds of Self-heal *Prunella vulgaris*. Scattered records in southern, central and eastern England. Probably overlooked as it is a very small ground dwelling beetle. Several specimens in suction samples from short sward in Area 2. Also recorded in 2014.

Aphanisticus pusillus (Coleoptera, Buprestidae)

Nationally Scarce. A very small species of jewel beetle associated with small species of rush *Juncus* growing in calcareous grassland. Widespread in suitable habitat in much of southern, central and eastern England, probably often overlooked. Two specimens in suction samples from short sward in Area 2. Also recorded in 2014.

Trachys scrobiculatus (Coleoptera, Buprestidae)

Nationally Scarce. Another very small species of jewel beetle, associated with Ground Ivy *Glechoma hederacea* growing in open grassland. Widespread in suitable habitat in much of southern, central and eastern England, probably often overlooked. Two specimens in suction samples from short sward in Area 2. Not recorded in 2012 or 2014.

Tychius squamulatus (Coleoptera, Curculionidae)

Nationally Notable "B". A small weevil whose food plant is Bird's-foot Trefoil *Lotus corniculatus*. Mainly coastal, inland in a few areas including south-east England. Several specimens in suction samples from short sward in Area 2. Also recorded in 2014.

Athous campyloides (Coleoptera, Elateridae)

Nationally Notable "B". A click beetle generally found in grassland where it develops on plant roots. Mainly in south-east England, much scarcer further north. Three specimens swept from tall grassland in the lower part of Area 2. Not recorded in 2012 or 2014.

Rufous Grasshopper ***Gomphocerippus rufus***. (Orthoptera, Acrididae)

Nationally Scarce. Widely distributed through southern England, typically on dry calcareous grassland. A single specimen was swept from Area 2. Recorded there also in 2012 and 2014.

Lasioglossum pauxillum (Hymenoptera, Halictidae)

Nationally Notable "A". A solitary bee characteristic of open sites, particularly calcareous grassland. Widespread in southern and eastern England, now known to be much commoner than previously believed and no longer deserving of scarce status. A single female swept from short sward in Area 2. Recorded also in 2012 and 2014.

Small Heath ***Coenonympha pamphilus*** (Lepidoptera, Nymphalidae)

Section 41 Priority Species. A grassland butterfly which is considered to have undergone recent decline, although still widespread throughout Britain. Numerous specimens observed in Area 2, few in Area 3B. Recorded from both in 2012 and 2014.

Cinnabar moth ***Tyria jacobaeae*** (Lepidoptera, Erebididae)

Section 41 Priority Species - research only – not for conservation evaluation. A moth which is considered to have declined nationally, but still widespread and common. Numerous larvae on ragwort *Senecio jacobaea* in Area 2B. Recorded in 2012 and 2014.

Two species previously considered to be of conservation significance, but which have now spread widely and are often common or abundant, were recorded on the 2014 survey (and listed as scarce) and also in 2018. These are Roesel's Bush Cricket *Metrioptera roeselii* and a flea beetle *Longitarsus parvulus*.

Two further species recorded in 2014 but not in 2018, are also now relatively widespread and common and no longer of conservation importance. These are a plant bug *Lygus pratensis* and a hoverfly *Volucella inanis*.

Some species of butterfly not found on the invertebrate survey were recorded in other parts of the site during other surveys carried out by Middlemarch Environmental Ltd. These included the woodland species Purple Emperor *Apatura iris* and White Admiral *Limnitis camilla* suggesting that the woodland may have some significance for Lepidoptera.

4.5 ANALYSIS USING ISIS AND PANTHEON

ISIS is an Excel based application developed by Natural England to identify invertebrate assemblage types and scores each assemblage type according to its conservation value. ISIS is based on a definition of an assemblage as a suite of species occurring in the same piece of homogenous habitat. Two levels of assemblage type are recognised by ISIS:

- Broad Assemblage Types (BATs): These are characterised by species that are more widespread;
- Specific Assemblage Types (SATs): These are characterised by stenotopic species that are habitat specialists and considered to have intrinsic conservation value and are generally found on sites with conservation interest.

SATs are more narrowly defined in terms of habitat type than BATs and each SAT is nested within a parent BAT. Assemblage types are linked to species by a coding system that carries information on the closeness of their relationship. BATs are identified by a two-digit code and SATs by a four-digit code.

An assessment of the value of the invertebrate assemblages present within a site is then undertaken using the results generated and the species information provided by ISIS.

The species list from the site was fed into ISIS and the following results were obtained.

Not all invertebrate species are included within ISIS and here 159 of the 203 species were used in the analysis.

One SAT was adjudged to be in Favourable condition, F112 ***open short sward***, with 15 species, while a single BAT was also considered Favourable, F1 ***unshaded early successional mosaic*** with 31 species. All of the associated species were recorded from short sward on Area 2 which emphasises that this is by far the most significant habitat on the site.

The majority of species were allocated by ISIS to BAT F2 ***grassland and scrub mosaic***. These species are typical of the general countryside, are generally widespread and common and have no conservation significance. Only small and insignificant numbers of species were allocated to other BATs and SATs. Pantheon is a newer application which Natural England is developing to replace ISIS. The data was fed into Pantheon and the results were essentially the same as from ISIS. Additional information from Pantheon was that all nine of the species of conservation concern discussed in 3.5 above are associated with open habitats, further emphasising the importance of this habitat.

In addition, twenty species are noted by Pantheon as having some degree of association with calcareous grassland, 5 strong, 7 moderate, 1 moderate to low and 7 low.

All of the analysis together shows that the open habitats are the most significant and that within these the short sward calcareous grassland is the most important.

5. DISCUSSION AND CONCLUSIONS

5.1 SUMMARY OF PROPOSALS

The proposals for the site are as follows:

Hybrid planning permission comprising:

In detail:

- *Demolition of existing buildings;*
- *Change of use and works to buildings Q13 and Q14 (including landscaping and public realm);*
- *Primary and secondary accesses.*

In outline:

- *Development of business space (use classes B1a/b/c) of up to 27,659 sq m GEA;*
- *Works within the 'X' enclave relating to energetic testing operations, including fencing, access, car parking;*
- *Development of up to 750 residential dwellings;*
- *Development of a mixed-use village centre (use classes A1/A3/A4/A5/B1a/D1/D2);*
- *Development of a one form entry primary school;*
- *Change of use of Fort Area and bunkers to Historic Interpretation Centre (use class D1) with workshop space;*
- *Roads, pedestrian and cycle routes, public transport infrastructure, car parking, utilities infrastructure, drainage;*
- *Landscaping, landforming and ecological mitigation works.*

5.2 ASSESSMENT OF HABITATS

It is clear that the area of chalk grassland is of considerable invertebrate interest, particularly for species requiring open short sward. However, the area of open short sward was rather small, perhaps reflecting limited grazing pressure. None of the other habitats appear to be significant, although the woodland does have some butterfly interest.

5.3 POTENTIAL IMPACTS ON INVERTEBRATES

The significant species are those of the open short sward chalk grassland and therefore appropriate management of this habitat is all that is required. Unless major changes to this area are planned, there will be no impact on these species.

6. RECOMMENDATIONS

All recommendations provided in this section are based on Middlemarch Environmental Ltd's current understanding of the site proposals, correct at the time the report was compiled. Should the proposals alter, the conclusions and recommendations made in the report should be reviewed to ensure that they remain appropriate.

- R1** The existing calcareous grassland habitats should be retained and protected.
- R2** A Landscape and Ecological Management Plan (LEMP) should be produced for the site. This should detail improved management of habitats on site for invertebrates, particularly in the grassland and woodland areas.

7. PHOTOGRAPHS



Plate 7.1: Short sward on higher ground in Area 2



Plate 7.2: Longer sward on lower ground in Area 2



Plate 7.3: Coarse vegetation in north-western corner of Area 2



Plate 7.4: Coarse vegetation typical of Area 3B

REFERENCES AND BIBLIOGRAPHY

- Alexander, K.N.A.A. 2014. *A review of the scarce and threatened beetles of Great Britain*. Buprestidae, Cantharidae, Cleridae, Dasytidae, Drilidae, Lampyridae, Lycidae, Lymexylidae, Malachiidae, Phloiophilidae and Trogossitidae. Species Status No.16. Natural England.
- Falk, S. 1991a. *A review of the scarce and threatened bees, wasps and ants of Great Britain*. Research and Survey in Nature Conservation, No.35. JNCC, Peterborough.
- Hyman, P.S. & Parsons, M.S. 1992. *A review of the scarce and threatened Coleoptera of Great Britain*, Part 1. Research and Survey in Nature Conservation, No.3. JNCC, Peterborough.
- Kirby, P. 1992. *A review of the scarce and threatened Hemiptera of Great Britain*. Research and Survey in Nature Conservation, No.2. JNCC, Peterborough.
- Waterman Group (2015) *Ecological Appraisal: Fort Halstead, Kent*. Report Number EED12715-102.R.2.3.7.LM.
- Waterman Group (2015) *Protected Species and Habitats Survey: Fort Halstead, Kent*. Report Number EED12715-102.R.3.3.6.LM
- Waterman Group (2015) *Environmental Statement - Ecology and Nature Conservation: Fort Halstead, Kent*.

APPENDICES

Appendix 1: Invertebrate Species List

Appendix 2: Overview of Invertebrate Legislation

APPENDIX 1

INVERTEBRATE SPECIES LIST

Order	Family	Species	English Name	Area		
				2	3b	
Isopoda woodlice	Armadillidae	<i>Armadillidium vulgare</i>	Common Pill Woodlouse	1	1	
	Oniscidae	<i>Oniscus asellus</i>	Common Shiny Woodlouse	1	-	
	Philoscidae	<i>Philoscia muscorum</i>	Common Striped Woodlouse	1	1	
	Porcellionidae	<i>Porcellio scaber</i>	Common Rough Woodlouse	-	1	
Orthoptera grasshoppers and crickets	Acrididae	<i>Chorthippus brunneus</i>	Common Field Grasshopper	1	1	
		<i>Chorthippus parallelus</i>	Meadow Grasshopper	1	-	
		<i>Gomphocerippus rufus</i>	Rufous Grasshopper	1	-	
		<i>Stenobothrus lineatus</i>	Stripe-winged Grasshopper	1	1	
	Conocephalidae	<i>Conocephalus fuscus</i>	Long-winged Cone-head	1	-	
	Phaneropteridae	<i>Leptophyes punctatissima</i>	Speckled Bush Cricket	1	-	
	Tettigoniidae	<i>Metrioptera roeselii</i>	Roesel's Bush Cricket	1	-	
Dermaptera earwigs	Forficulidae	<i>Forficula auricularia</i>	Common Earwig	1	1	
Heteroptera true bugs	Anthocoridae	<i>Anthocoris nemoralis</i>		-	1	
		<i>Anthocoris nemorum</i>		-	1	
	Lygaeidae	<i>Ischnodemus sabuleti</i>	European Cinchbug	-	1	
		<i>Megalonotus chiragra</i>		-	1	
		<i>Peritrechus geniculatus</i>		1	-	
		<i>Stenozygum punctatum</i>		1	-	
	Miridae	<i>Adelphocoris lineolatus</i>		-	1	
		<i>Capsus ater</i>		1	-	
		<i>Chlamydatus saltitans</i>		1	-	
		<i>Closterotomus norwegicus</i>		1	-	
		<i>Deraeocoris ruber</i>		1	-	
		<i>Leptopterna dolabrata</i>		1	1	
		<i>Liocoris tripustulatus</i>		-	1	
		<i>Lygocoris pabulinus</i>		1	-	
		<i>Lygus rugulipennis</i>		1	1	
		<i>Lygus wagneri</i>		-	1	
		<i>Megaloceroea recticornis</i>		1	1	
		<i>Orthocephalus saltator</i>		1	-	
		<i>Phytocoris varipes</i>		1	-	
		<i>Pithanus maerkelii</i>		1	-	
		<i>Plagiognathus arbustorum</i>		1	1	
		<i>Plagiognathus chrysanthemi</i>		-	1	
	<i>Psallus ambiguus</i>		1	-		
	<i>Stenotus binotatus</i>		1	1		
	Nabidae	<i>Nabis rugosus</i>	Common Damsel Bug	1	-	
	Pentatomidae	<i>Aelia acuminata</i>	Bishop's Mitre	1	-	
		<i>Dolycoris baccarum</i>	Hairy Shieldbug	-	1	
		<i>Palomena prasina</i>	Common Green Shieldbug	1	-	
	Rhopalidae	<i>Myrmus miriformis</i>		1	-	
	Scutelleridae	<i>Eurygaster testudinaria</i>	Tortoise Shieldbug	1	-	
	Tingidae	<i>Acalypta parvula</i>		1	-	
		<i>Tingis ampliata</i>	Creeping Thistle Lacebug	1	-	
		<i>Tingis cardui</i>	Spear Thistle Lacebug	-	1	
	Auchenorrhyncha leafhoppers	Aphrophoridae	<i>Aphrophora alni</i>		1	1
			<i>Neophilaenus lineatus</i>		1	1
			<i>Philaenus spumarius</i>	Common Froghopper	1	1
		Cicadellidae	<i>Adarrus ocellaris</i>		1	-
<i>Agallia consobrina</i>				1	-	
<i>Anoscopus serratulae</i>				1	-	
<i>Aphrodes serratulae</i>				1	-	

Order	Family	Species	English Name	Area	
				2	3b
		<i>Arboridia ribauti</i>		-	1
		<i>Evacanthus interruptus</i>		-	1
		<i>Eupelix cuspidata</i>		1	-
		<i>Eupteryx notata</i>		1	-
		<i>Eupteryx vittata</i>		1	-
		<i>Eurhadina pulchella</i>		-	1
		<i>Mocydia crocea</i>		1	-
		<i>Psammotettix confinis</i>		1	-
		<i>Streptanus sordidus</i>		-	1
		<i>Turrutus socialis</i>		1	-
		<i>Zyginidia scutellaris</i>		1	-
	Delphacidae	<i>Hyledelphax elegantulus</i>		-	1
		<i>Javesella pellucida</i>		1	-
		<i>Stenocranus minutus</i>		1	-
<i>Xanthodelphax stramineus</i>			1	-	
Lepidoptera butterflies and moths	Hesperiidae	<i>Thymelicus lineola</i>	Essex Skipper	1	1
		<i>Thymelicus sylvestris</i>	Small Skipper	1	-
	Lycaenidae	<i>Lycaena phlaeas</i>	Small Copper	1	-
		<i>Polyommatus icarus</i>	Common Blue	1	-
	Nymphalidae	<i>Aglais urticae</i>	Small Tortoiseshell	-	1
		<i>Aphantopus hyperantus</i>	Ringlet	1	1
		<i>Coenonympha pamphilus</i>	Small Heath	1	-
		<i>Maniola jurtina</i>	Meadow Brown	1	1
		<i>Melanargia galathea</i>	Marbled White	1	-
		<i>Pararge aegeria</i>	Speckled Wood	-	1
		<i>Pyronia tithonus</i>	Gatekeeper	-	1
		<i>Vanessa atalanta</i>	Red Admiral	-	1
		Arctiidae	<i>Tyria jacobaeae</i>	Cinnabar Moth	-
	Zygaenidae	<i>Zygaena filipendulae</i>	Six-spot Burnet	1	1
Coleoptera beetles	Apionidae	<i>Apion cruentatum</i>		1	-
		<i>Ceratapion onopordi</i>		1	-
		<i>Ischnopterapion loti</i>		1	-
		<i>Perapion curtirostre</i>		1	-
		<i>Perapion hydrolapathi</i>		-	1
		<i>Perapion violaceum</i>		1	-
		<i>Protapion apricans</i>		1	-
		<i>Protapion fulvipes</i>		1	-
		<i>Squamapion cineraceum</i>		1	-
	Buprestidae	<i>Aphanisticus pusillus</i>		1	-
		<i>Trachys scrobiculatus</i>	Ground-ivy Jewel Beetle	1	-
	Cantharidae	<i>Cantharis nigra</i>		1	-
		<i>Cantharis pellucida</i>		1	-
		<i>Rhagonycha fulva</i>		1	1
	Chrysomelidae	<i>Aphthona euphorbiae</i>		1	-
		<i>Bruchidius varius</i>		1	-
		<i>Bruchus loti</i>		1	-
		<i>Cassida rubiginosa</i>	Thistle Tortoise Beetle	1	1
		<i>Chaetocnema hortensis</i>		1	-
		<i>Cryptocephalus aureolus</i>		1	-
		<i>Cryptocephalus fulvus</i>		1	-
		<i>Longitarsus flavicornis</i>		-	1
		<i>Longitarsus luridus</i>		1	-
		<i>Longitarsus melanocephalus</i>		1	-
		<i>Longitarsus parvulus</i>		1	-
		<i>Longitarsus pratensis</i>		1	1

Order	Family	Species	English Name	Area	
				2	3b
		<i>Longitarsus suturellus</i>		-	1
		<i>Neocrepidodera ferruginea</i>		1	1
		<i>Sermylassa halensis</i>		1	-
		<i>Sphaeroderma testaceum</i>		1	-
	Coccinellidae	<i>Coccinella septempunctata</i>	7-spot Ladybird	-	1
		<i>Halyzia sedecimguttata</i>	Orange Ladybird	-	1
		<i>Propylea quattuordecimpunctata</i>	14-spot Ladybird	1	1
		<i>Psyllobora vigintiduopunctata</i>	22-spot Ladybird	1	-
		<i>Rhyzobius litura</i>		1	-
		<i>Scymnus frontalis</i>		1	-
		<i>Subcoccinella vigintiquattuor punctata</i>	24-spot Ladybird	1	1
		<i>Tytthaspis sedecimpunctata</i>	16-spot Ladybird	1	-
		Curculionidae	<i>Anthonomus rubi</i>		1
	<i>Barypeithes pellucidus</i>			1	-
	<i>Mecinus pascuorum</i>			1	-
	<i>Nedyus quadrimaculatus</i>			1	1
	<i>Sitona lineatus</i>			1	-
	<i>Trachyphloeus scabriculus</i>			1	-
	<i>Tychius picirostris</i>			1	-
	<i>Tychius squamulatus</i>			1	-
	Dermestidae	<i>Anthrenus fuscus</i>		1	-
	Elateridae	<i>Agrypnus murinus</i>		1	-
		<i>Athous bicolor</i>		1	-
		<i>Athous campyloides</i>		1	-
	Hydrophilidae	<i>Cercyon pygmaeus</i>		1	-
		<i>Megasternum concinnum</i>		1	-
	Kateretidae	<i>Brachypterus urticae</i>		-	1
	Latridiidae	<i>Corticara gibbosa</i>		1	-
	Nitidulidae	<i>Eपुरaea aestiva</i>		1	-
		<i>Meligethes aeneus</i>		1	1
		<i>Meligethes carinulatus</i>		1	-
	Oedemeridae	<i>Oedemera lurida</i>		1	1
		<i>Oedemera nobilis</i>		1	1
	Phalacridae	<i>Olibrus aeneus</i>		1	-
	Scraptiidae	<i>Anaspis frontalis</i>		1	-
		<i>Anaspis garneysi</i>		1	-
		<i>Anaspis maculata</i>		1	-
	Staphylinidae	<i>Paederus littoralis</i>		1	-
		<i>Quedius levicollis</i>		1	-
		<i>Stenus brunripes</i>		1	-
		<i>Stenus cicindeloides</i>		1	-
<i>Stenus fulvicornis</i>			1	-	
<i>Tachyporus hypnorum</i>			1	-	
Diptera flies	Asilidae	<i>Leptogaster cylindrica</i>	Striped Slender Robberfly	1	-
	Chloropidae	<i>Chlorops hypostigma</i>		1	-
		<i>Trachysiphonella scutellata</i>		1	-
	Dolichopodidae	<i>Chrysotus gramineus</i>		-	1
		<i>Dolichopus festivus</i>		1	-
		<i>Sciapus platypterus</i>		1	-
	Empididae	<i>Empis livida</i>		1	1
	Opomyzidae	<i>Geomyza tripunctata</i>		1	-
		<i>Opomyza germinationis</i>		1	-
Sepsidae	<i>Sepsis fulgens</i>		1	-	

Order	Family	Species	English Name	Area	
				2	3b
	Stratiomyidae	<i>Chloromyia formosa</i>	Broad Centurion	1	1
		<i>Pachygaster atra</i>	Dark-winged Black	1	-
	Syrphidae	<i>Episyrphus balteatus</i>		1	1
		<i>Melanostoma mellinum</i>		1	1
		<i>Melanostoma scalare</i>		1	-
		<i>Platycheirus scutatus sens. str.</i>		1	-
		<i>Syrpita pipiens</i>		1	-
	Tephritidae	<i>Urophora cardui</i>		1	-
<i>Urophora jaceana</i>			1	-	
Hymenoptera bees, ants and wasps	Apidae	<i>Bombus lapidarius</i>	Large Red-tailed Bumble Bee	1	1
		<i>Bombus pascuorum</i>	Common Carder Bee	1	1
		<i>Bombus terrestris</i>	Buff-tailed Bumble Bee	1	1
	Halictidae	<i>Lasioglossum albipes</i>		-	1
		<i>Lasioglossum calceatum</i>		1	-
		<i>Lasioglossum fulvicorne</i>		1	-
		<i>Lasioglossum pauxillum</i>		1	-
		<i>Lasioglossum villosulum</i>		1	-
	Formicidae	<i>Formica fusca</i>		1	-
		<i>Lasius flavus</i>	Yellow Meadow Ant	1	-
		<i>Lasius niger sens. str.</i>	Black Ant	1	1
		<i>Myrmica ruginodis</i>	Red Ant	1	1
		<i>Myrmica scabrinodis</i>		1	-
	Vespidae	<i>Vespa vulgaris</i>	Common Wasp	-	1
	Arachnida spiders	Araneidae	<i>Araneus diadematus</i>		1
<i>Araniella cucurbitina sens. str.</i>				1	1
<i>Mangora acalypha</i>				1	-
<i>Neoscona adianta</i>				1	-
Clubionidae		<i>Cheiracanthium erraticum</i>		1	-
Dictynidae		<i>Dictyna arundinacea</i>		1	1
Linyphiidae		<i>Erigone atra</i>		1	-
		<i>Linyphia hortensis</i>		-	1
		<i>Tenuiphantes tenuis</i>		1	-
Lycosidae		<i>Alopecosa pulverulenta</i>		1	-
Philodromidae		<i>Philodromus aureolus</i>		1	-
		<i>Tibellus oblongus</i>		1	1
Pisauridae		<i>Pisaura mirabilis</i>	Nursery Web Spider	-	1
Salticidae		<i>Euophrys frontalis</i>		1	-
		<i>Heliophanus cupreus</i>		1	-
		<i>Heliophanus flavipes</i>		1	-
Tetragnathidae		<i>Metellina mengei</i>		-	1
		<i>Metellina segmentata sens. str.</i>		1	-
		<i>Tetragnatha montana</i>		1	-
Theridiidae		<i>Enoplognatha ovata sens. str.</i>		1	1
Thomisidae	<i>Xysticus cristatus</i>		1	-	
Total				172	73

APPENDIX 2

LEGISLATION

Several species of invertebrate have been afforded statutory protection under the Wildlife and Countryside Act 1981 (as amended). A number of invertebrate species are listed as priority species on the United Kingdom Biodiversity Action Plan (BAP), Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 and the Local Biodiversity Action Plan. Species of conservation concern have also been identified and listed in the British Red Data Book for Insects (Shirt, 1987) as well as in a number of reviews of scarce and threatened invertebrates, published by the Joint Nature Conservation Committee (JNCC).