Area 3 habitat assessments and pollinator surveys

October 2016 (Updated April 2017)

Jamie Robins

Executive Summary

Buglife Services were commissioned by Kier Group Ltd in July 2016 to undertake a series of baseline habitat surveys within the Area 3 network, to identify sites where improvements for pollinators could be implemented. These results were then used to identify ten sites with the highest potential and deliverability, using a ranking exercise, in addition to a Kier owned depot. Buglife Services undertook more detailed habitat assessments and pollinator surveys during brief site visits in August 2016.

Of the 11 sites surveyed, a total of 104 pollinator species were recorded. This comprised 18 Lepidoptera (butterflies and moths), 33 Hoverflies, 18 other Diptera (true flies), 14 bees, 6 other hymenoptera and 11 other minor pollinators (e.g. true bugs and beetles). A further 38 incidental (non-pollinator) species were also recorded. These results and habitat assessments were used to provide management suggestions to enhance the value of these sites for pollinators. Where possible suggestions aimed to benefit key species recorded during site surveys, such as the Chalk hill blue butterfly (*Polyommatus coridon*), the Section 41 priority species Straw belle moth (*Aspitates gilvaria*) and the scarce (Nb) wasp *Microdynerus exilis*. Finally, recommendations for future survey and monitoring were provided, aiming to inform Kier of the progression of habitat improvements for pollinators and advise future management.

Introduction

There has been a growing interest in managing road verges and other transport features more sensitively for biodiversity. In many parts of Britain, perhaps especially intensively farmed and heavily urbanised areas, they are an important source of flowery habitats and can also provide other habitats such as wet ditches, balancing pools, scrub, bare ground, south-facing slopes and mature trees. Sometimes these habitats are scarce in the surrounding countryside making road verges the most biodiverse features in the landscape. Road verges also act as wildlife corridors that facilitate the movement of species around the countryside and help to connect up important remnants of semi-natural habitat such as scattered patches of unimproved grassland, heathland or old woodland. But attention has tended to focus on bats and herptiles and to a lesser extent flora, with the largest sector of road verge biodiversity, invertebrates, remaining relatively poorly studied or understood. Yet we know that road verge management can profoundly impact the assemblages of road verge invertebrates, both in the short-term (following cutting), and the longer term (where ongoing management alters the quality or character of a verge for the better or worst).

Buglife Services was commissioned by Kier in 2016 to carry out an initial assessment of assorted road verges within the Highways Agency Area 3 network. The aim of this work was to identify a series of road verges of raised potential for invertebrates, which could be the focus of work to enhance their value for pollinators further through targeted management.

Buglife Services were then commissioned to undertake further work by Kier, examining ten verges and one of their depots in greater detail to provide a more thorough habitat assessment alongside brief pollinator surveys to provide some baseline data and identify key flora and habitat features for enhancement.

All field work was undertaken by Chris Ayre and Rory Dimond, with the report produced by Jamie Robins.

Methodology

Initial habitat assessments

In July 2016, Chris Ayre (Buglife Services) undertook a series of site visits with Martin Osman (Kier Group Ltd) with the aim of undertaking brief habitat assessments of the road verges identified by Kier as having potential interest from their own historic data. Notes were made during visits concerning:

- General site description and habitat characterisation
- Slope angle and aspect
- Surrounding land uses and habitats

- The presence of notable plant species
- The presence of invasive plant species
- Extent of moss, lichen and bare ground cover
- Scrub extent and type
- Rabbit grazing activity
- Current management regimes and potential new prescriptions
- Limitations for work (e.g. seasonal constraints, access, health and safety)
- Potential value for pollinator groups

All sites visited were selected by Kier from historic habitat data for the verge network. In line with health and safety regulations for the network, Chris Ayre worked with Martin Osman at all times. An initial list of sites were earmarked for habitat assessments, however, it quickly became apparent that a significant number of the proposed sites for assessment had succeeded to dense scrub and woodland, making them inappropriate for assessment within this work. In addition, it is important to note that due to access and health and safety limitations, a number of sites could not be properly assessed, with many assessments undertaken from a vehicle on the carriageway. This effectively limited the detail of many of the initial habitat assessments.

The initial habitat assessment data was then used to create a ranking series to prioritise the sites with greatest potential for enhancement for invertebrates. This ranking assigned scores for:

- Potential size of habitat creation/enhancement
- Quality of existing habitat
- Quality of connective habitat
- Diversity of habitat mosaic
- Impact on existing invertebrate ecology/interest

Sites were then ranked according to their potential to deliver for pollinators with habitat enhancements. This ranking system did not consider the potential impact of access and health and safety limitations, which it was agreed were best addressed by Kier. The rankings are included here as Appendix 1 for reference.

Further assessments and pollinator surveys

In August 2016, Rory Dimond (Buglife Services) undertook targeted pollinator surveys and more in depth habitat assessments, based on 10 sites selected by Kier from the initially assessed sites, in addition to the Ower Depot. All visits were accompanied by Martin Osman, and undertaken on 23rd, 24th, 25th, 30th and 31st August 2016.

Between 1 and 3 sites were visited per day, with all surveys under 2 hours in duration. It is important to note that invertebrate surveys in such a narrow survey window are inevitably only a snapshot in time and will miss the vast majority of the site's interest. The limited seasonality of the season means that all spring, early summer and autumn species will be overlooked, while the prevailing weather conditions can have a significant impact on species recorded on a site on any given day. Cool, damp or windy weather is likely to cause many summer pollinators to seek shelter and prevents them being on the wing, leading to under recording. Kier were made aware of the limitations of the survey, but it is hoped that they will provide an indication of the nature of the assemblage, value for key pollinator groups, and provide some baseline data with which habitat enhancement works can be compared.

Pollinators were surveyed using two methods; a walking transect and sweeping with a butterfly net. The walking transects were non-standardised, aiming to encompass all species of plants currently in flower on the site, as well as different microhabitats such as bare ground. All field-identifiable species of pollinators were noted and other species were taken for later identification (the latter being classed as 'swept' in the records to illustrate that the specimens were identified using keys).

Sweeps were similarly carried out. All specimens collected were keyed by Rory Dimond, except for non-syrphid Diptera which were identified by Diptera expert Alan Stubbs.

Pollinator records for each site are provided individually, but a complete list of recorded pollinators is also included here as Appendix 3. Incidental records of non-pollinating invertebrates seen on site or as by-catch from sweeping have also been collected and included as Appendix 4.

Lists of herbaceous wildflowers of benefit to pollinators on each site were also compiled during transects. Their relative abundances have been classified according to the DAFOR scale. The more detailed habitat assessments here aimed to identify key current floral resources and their potential value for key invertebrate groups

Phase 1 - Initial habitat assessments

All initial habitat assessment visits were made by Chris Ayre in July 2016. Site overviews are provided, as well as the site's current value for pollinators, followed by a brief discussion of potential management techniques to improve habitats for pollinators. Only flowering plants in flower were recorded due to the limited time available at each site. Photos are included of all sites, however, where a site visit wasn't possible and were only viewed from the vehicle due to health and safety restrictions, images from Google Earth Street View are provided (as agreed with Martin Osman) and descriptions are inevitably very brief in these instances.

All current management regimes are limited to sightline and sign clearance cuts unless stated otherwise.

Sites which were followed up with a more detailed site assessment and pollinator surveys are not included here with the initial assessments, to avoid repetition and to allow the pollinator survey results to sit alongside the assessments for ease of reference.

The resulting initial habitat assessments were then used to produce a table of rankings, as highlighted in the methodology and included here as Appendix 1.

A significant number of sites were briefly visited by Chris Ayre and Martin Osman and subsequently rejected for reasons such as existing wildlife interest, being heavily wooded or unsuitable for access, therefore not requiring an initial habitat assessment. Alternatively it was confirmed by Martin Osman that the management regime will be changed on some sites without requiring assessment. For reference, all non-assessed sites and the reason for their exclusion are included here in Appendix 2

Survey Site 1- A27 EB (50/7 – 51/7)

Site only viewed from vehicle and road bridge over carriageway, preventing more in depth assessment. Largely dominated by thick scrub and woodland margin, but with extensive stretches of dense bramble (*Rubus fruticosus* agg.). Grass verges restricted to the immediate roadside, but unable to gain access to provide an assessment of the potential forage provision. The current resource of bramble and scrub is likely to provide a useful nectar and pollen resource, particularly in spring, as well as acting as a useful buffer to surrounding wooded areas. The limited extent of grassland could likely be enhanced with an annual autumn cut and the removal of arisings, however, some unmanaged grassland in front of the scrub and woodland margins would provide a transition zone of varied vegetation structure.

Left: Banks of dense bramble scrub. Right: Woodland margin adjacent by narrow grass verge. © Google 2016, Google Earth Street View

Survey Site 2- A3 Surrey NB (24/5 – 23/5)

A 1km stretch of south-east facing slope on clay, bordering the River Wey Nature Reserve. The 20m wide verges are dominated by Common nettle (*Urtica dioica)* and Hogweed (*Heracleum sphondylium*), which in extensive stands can provide valuable humid shelter and forage for pollinators. Much of the ground layer vegetation is interspersed with Ash (*Fraxinus excelsior*) and Silver birch(*Betula pendula*) trees and banks of bramble. More disturbed grassland areas, particularly those nearer the carriageway also support nectar-rich ruderal species such as Wild mignonette (*Reseda lutea*), Common ragwort (*Senecio jacobaea*) and thistles (*Cirsium spp*.) which are favoured by a range of bees and flies.

Left: Dense ground layer vegetation and invading scrub/trees. Right: In disturbed areas, bramble clumps give way to nectar-rich ruderals favoured by many bees.
© Chris Ayre

Targeted clearance of trees and scrub invading the grassland areas would help to retain the open character of the grassland. Trees should be cut as low to the ground as possible and chemically treated to prevent their regrowth. A key feature to enhance for pollinators would be to expand the area of disturbed ground, by simply clearing the vegetation and disturbing the soils around existing areas of Wild mignonette, ragworts and thistles to allow larger stands to establish. The south-east facing nature of the area does raise its potential for thermophilic invertebrates. Cutting scalloped edges into the bramble scrub and nettle banks could help to create sunny, sheltered south-facing spaces for butterflies and other warmth-loving species to bask, as well as providing opportunities for wildflowers to better establish. Where bramble is being cleared to create such scallops, the site would likely benefit from scraping back to the bare clay and the removal of bramble roots, to prevent re-growth and also remove any unfavourable seed bank.

Survey Site 4- A3 Surrey SB (22/7 – 23/5)

Site only viewed from road bridge, preventing more in depth assessment. An 800m long steep slopes supporting narrow but dense nettle and bramble beds, backed by dense mature scrub and woodland. A few stretches closer to the carriageway offer narrow grassland strips, while some more open slopes support extensive areas of low growing bramble scrub free of mature trees.

Scrub and treeline close to carriageway offer only limited open habitat for pollinators © Chris Ayre

Beyond the spring nectar provided by scrub and mature trees, the forage provision for pollinators is currently limited to thin strips of grassland habitat immediately adjacent to the carriageway, which appear to support a limited flora supporting species such as ragworts and umbellifers.

Survey Site 7- M27 EB (33/6 – 34/3)

Site only viewed from vehicle, preventing more in depth assessment. The long stretch of verge is largely dominated by dense scrub of Gorse (*Ulex europaeus*), Broom (*Cytisus scoparius*), bramble and Silver birch, including small stands of mature trees. The limited extent of open grassland appear to be species poor, however assessment was not possible. The current resource of scrub is likely to provide a useful nectar and pollen resource but the introduction of grassland management may help to improve the floral resources across the site. Management should aim to maintain the extent of dense scrub, but prevent the encroachment into remaining grassland areas. The grassland areas should be managed with an annual cut and collect regime in autumn, however, retaining some unmanaged grassland fringes around some of the scrub banks to diversify the vegetation structure.

© Google 2016, Google Earth Street View

Survey Site 8- M27 EB (27/5 – 27/9)

A 400m stretch of 10m wide verge largely dominated by banks of bramble scrub interspersed with Ash, Silver birch and Broom which provides valuable forage April through to June. More open grasses support a strong resource of umbellifers, favoured by many pollinating flies, including hoverflies. Sections of the verge with open grasslands offer useful structural diversity, with open grassland gradually grading through to scrub, providing a range of vegetation heights and opportunities for pollinators.


Left: Dense bramble banks. Right: Open grass lenses within the scrub providing some sheltered forage © Chris Ayre

The site is unlikely to benefit hugely from wholesale clearance of bramble, which would likely regenerate rapidly. However, periodic brush cutting of dense bramble clump edges adjacent to grasslands would help to prevent encroachment. Grasslands could further be enhanced by having some areas cut annually in autumn with the arisings removed, to provide some shorter sward areas and opportunties for a more diverse flora to establish.

Any scrub clearance undertaken should aim to remove Silver birch, including seedlings before they have had the chance to establish, but to retain Broom which offers useful forage as well as supporting a number of dependent invertebrates.

Survey Site 10- M27 EB (7/1 – 7/6)

500m stretch of sloping verge which lead steeply towards a ditch. A 100m grass section in front of heavy scrub appears to offer the most value for pollinators. The roadside of the verge supports abundant Common ragwort and Ox-eye daisy (*Leucanthemum vulgare*), which provide forage for a range of common pollinators, especially flies and solitary bees. Banks of mature trees offer some spring nectar and pollen sources, while widespread young and established Gorse provides a pollen resource in spring and early summer.


Left: Extensive Goat's rue likely within bramble dominated stand. Right: Narrow grass verge with wildflowers, steeply give way to bramble and heavy scrub, including mature Gorse. © Chris Ayre

The site would benefit from periodic cutting, to keep the bramble line in check and maintain opportunities for wildflowers. Such work would be best focused on cutting back bramble where it is adjacent to the current areas of wildflower resource, rather than attempting to clear denser stands. This will ensure that the current flower resource is maintained and does not diminish over time. However, there is a risk in some areas that Goat's rue (*Galega officinalis*) could further establish itself should cutting and soil disturbance be targeted near existing stands. Goat's rue is a quick coloniser of disturbed ground and will often outcompete other wildflower species but offers nectar and pollen for a very narrow range of pollinators, though this does include some bumblebee species including rarities. Goat's rue's dominating nature means that once established, grasslands can

end up with a poor flora and very narrow flowering period, so should management be introduced here its removal should be a priority.

Any scrub clearance work here should also be mindful of the adjacent ditch, ensuring that a range of ditch conditions are maintained, retaining scrub and trees in some areas to provide a damp, dark environment suitable for many pollinating flies with aquatic larvae such as some hoverflies to breed (especially where water is held seasonally) and some areas opened up to provide sunny and sheltered conditions.

Survey Site 11- M27 WB (7/9 - 8/0)

This 200m long site has developed on steep, north facing slopes over heavy clay/loamy soils. Dense and continuous bramble dominates much of the site, often with a uniform structure and reaching 2-3 foot high, with some occasional vetches (*Viccia* spp) and emerging trees. Some banks have since developed more established wooded stretches, with banks of Ash and Sycamore (*Acer psuedoplatanus*).

Dense bramble and scattered trees, offering only limited forage for pollinators © Chris Ayre

The site's current value for pollinators lies within the extensive banks of bramble, which can offer valuable nectar and pollen from May until July, however, wildflowers are extremely limited in extent. The dense bramble structure does provide some benefits for pollinators such as shelter during inclement weather and potential overwintering habitat. The Sycamores in the tree line will also offer valuable spring forage for emerging bumblebee queens and other pollinators. However, overall the current value for pollinators is extremely limited, with forage provision for only periods of the year.

The north-facing nature of the site, likely dense and fertile soils and the current extent of bramble and trees makes it unlikely that significant work would enhance its value for pollinators. Some removal of mature trees which are beginning to shade out the underlying bramble may be of limited value, but retaining some Sycamore trees will ensure a spring forage resource.

Survey Site 12- M27 WB (22/5 – 21/9)

Site only viewed from vehicle, preventing more in depth assessment. Largely wide verges consisting of thick banks of bramble, Bracken (*Pteridium aquilinum*), Gorse and nettle, surrounded by trees of Oak, (Q*uercus spp.*), Ash and Sycamore. Grassland sections are rather restricted and subject to significant scrub encroachment, while their north-facing aspect is likely to reduce their potential value for pollinators. Introducing a cut and collect grassland management regime in autumn may potentially enhance the grasslands here for wildflowers and pollinators, also helping to limit the encroachment of bramble and other low scrub species.


© Google 2016, Google Earth Street View

Survey Site 13- A31 EB (32/9 – 32/6)

Site only viewed from vehicle, preventing more in depth assessment. Verges range from steep rough grassland, with scattered pockets of scrub, through to narrow rough verges adjacent to hedgerows. Some of the sloped grassland sections are suffering from significant Hawthorn (*Crataegus monogyna*) and bramble invasion, but there are some open sections likely to support common flowering species of value for pollinators, such as yellow Asteraceae and umbellifers. The site does also support some valuable variation in vegetation structure. The site could potentially be enhanced by cutting some of the rough grassland slopes annually and removing the arisings. This would give less competitive flowering species the opportunity to establish, however, large areas of rough grassland should be retained unmanaged. Cutting would also reduce the impact of scrub invasion.

Should the grasslands require seeding, a mix of species tolerant of tall, competitive grasses would be ideal, such as Naturescape's N2F Tall Herb Mix, which includes many species of high value for pollinators.


© Google 2016, Google Earth Street View

Survey Sites 14 & 18- A31 EB (34/1 – 33/3) & A31 WB (33/3 – 34/1)

Steep-sided high verges which gradually narrow to thin verge strips. Some of the steep slopes support extensive bramble and nettle, with patches of Foxglove (*Digitalis purpurea*), Spear thistle (*Cirsium vulgare*), ragworts and Mugwort (*Artemesia vulgaris*), with occasional patches of scrub. However, as the verge levels and narrows only thin grassland strips remain adjacent to Hawthorn hedgerows or mature treelines. These thin grasslands are rather species poor, with only limited Common hogweed, Common sorrel (*Rumex acetosa*), ragworts and Spear thistle. The overall value for pollinators is rather low, however, the forage within the tall banks will provide some opportunities, enhanced by the humid environment created by the nettle and bramble scrub. Patches of Foxglove and Spear thistle are likely to be the key interest here for bumblebees.


Left: Steep scrubby slopes with scattered Foxglove and thistle resources. Right: Thin strips of species-poor grassland adjacent to Hawthorn hedgerow © Chris Ayre

Management interventions will only be able to have limited benefits for invertebrates, notably by controlling the encroachment of scrub into the more flower-rich areas, however, the extent of nettle and bramble makes enhancement difficult. Some brush cutting of nettle and bramble patches may enable some of the taller and more competitive flowering species currently on site to increase their extent. Consider seeding with taller, competitive species such as vetches and Wild carrot.

Survey Site 19- A31 WB/EB (32/6 – 32/9)

Verges are largely steep north-west facing slopes west bound and south-east facing slopes east bound, dominated by nettles, Common hogweed, bramble and tall grasses, bordering stands of Ash and Sycamore. However, areas of open grassland adjacent to slip roads support patches of early successional habitats, with sparsely vegetated ground, mossy areas and localised patches of forage for pollinators. These open, short sward grassland areas are likely to provide suitable opportunities for some ground nesting aculeate hymenoptera, basking opportunities and useful forage from wildflowers only able to persist in short swards. Additional forage is provided by the scrubbier verge banks, particularly in spring.


Left: Open early successional verges of raised interest. Right: Scrubby edges dominated by nettles adjacent to treeline © Chris Ayre

In light of the current absence of management, much of the higher value early sparsely vegetated ground and open grassland is likely to be maintained through rabbit activity, preventing the need for management intervention. Should these habitats begin to develop a taller sward over time, disturbance management may be ideal, creating scrapes of bare ground for early successional habitats to re-establish. Scraped off material could be used to create an adjacent bank, with the more nutrient-rich topsoil buried, providing some variation in topography for basking and ground nesting bees and wasps. It is important that scrub be prevented from encroaching into the grasslands. If scrub invasion becomes an issue, it may be worth considering cutting back the edges of the scrub bank annually.

Survey Site 20- A31 WB (20/6 – 21/3)

Verge dominated by a thick band of scrub, offering very limited open grassland habitat, restricted to only a thin strip alongside the carriageway. Extensive banks of Gorse, bramble, Common nettle and Bracken, with occasional stands of both homogenous

and mixed stands of Silver birch and pines (*Pinus* sp.), offering only limited opportunities for wildflowers to establish. Forage appears to be largely limited to scrub species and a small amount of Black horehound (*Ballota nigra*), Ox-eye daisy and Spear thistle.

Left: Bracken and Gorse dominated verges. Right: Extensive bank of bramble © Chris Ayre

It is unlikely that significant biodiversity gains can be achieved with only minor intervention. This site also contains Giant hogweed (*Heracleum mantegazzianum*) which will require immediate attention/removal.

Survey Site 21- A303 EB (120/3 – 120/8)

Site only viewed from vehicle, preventing more in depth assessment. Largely dominated by tall, species-poor grassland interspersed with scattered bramble and Gorse scrub. Forage appears to be limited to tall competitive species such as umbellifers and ragworts, although the sparsely vegetated slopes immediately adjacent to the carriageway may provide pockets of ruderal vegetation at appropriate times of year. Much of the site is flanked, and at times invaded by, scrub and young woodland.

The species-poor grasslands are likely to benefit from the introduction of an annual autumn cut with the removal of arisings, while the south-facing nature of the site suggests that brush cutting scalloped areas out of bramble banks could create some microclimate variation and create warm, sheltered pockets for thermophilic species. Should seeding be considered, a mixture such as Naturescape's N2F Tall Herb Mix would likely be suitable, with species able to tolerate competition from tall grasses.

© Google 2016, Google Earth Street View

Survey Site 22- A303 EB (110/4 – 109/7)

Extensive open and dry chalk grassland supporting valuable diverse forage with large patches of Lady's bedstraw (*Galium verum*), Bristly oxtongue (*Picris echioides*), Wild carrot, Ox-eye daisy, St John's worts (*Hypericum spp*.), and thistles as well as

occasional Field scabious (*Knautia arvensis*). This grassland area almost certainly provides high value for pollinators and invertebrates of chalk environments. The adjacent chalk banks include valuable sparsely vegetated areas. The bare chalk banks contain significant areas of bare ground, but appear to be suffering from scrub encroachment, including by Blackthorn (*Prunus spinosa*), Buddleia (*Buddleia davidii*) and Silver birch. The top of the bank then gives way to dense scrub.

Left: Flower-rich chalk grassland adjacent to slope. Right: Encroaching scrub in otherwise sparsely vegetated chalk banks © Chris Ayre

An essential management aim should be the removal of scrub from the bare chalk slope, particularly Buddleia and Silver birch which can encroach significantly into chalk grassland environments, particularly those with patches of bare ground, overshadowing more diverse vegetation and outcompeting other wildflowers. Some patches of Blackthorn would be valuable to retain, but these should be kept in control to prevent their encroachment. The grasslands themselves would likely benefit from the introduction of an annual cut in autumn, with the arisings removed. However, to provide a diverse chalk grassland habitat and to ensure the continuity of Field scabious, which is sensitive to cutting, large areas should be retained uncut each year. The grassland verge may also benefit from some areas being stripped of topsoil, to expose the underlying chalk and allow early successional features to develop, suitable for chalk specialist flora and fauna. It is likely that many chalk specialist plant species are already found on the site or nearby, however, if required suitable chalk soil mixes include Emorsgate Seeds EM6 – Meadow mixture for chalk and limestone soils or Boston Seeds BS2: Chalk & Limestone Soils Mixture. However, natural regeneration and colonisation from adjacent chalk areas should always be favoured where feasible.

Survey Site 25- A303 EB (104/9 – 104/0)

Site only viewed from vehicle, preventing more in depth assessment. Verges range from wide species-poor grassland, interspersed with individual trees and stands of young woodland, through to nettle dominated verges adjacent to dense young woodland. Long sections also appear to slope down to a sheltered and often overshadowed ditch. The current value for pollinators seems rather limited, but the species-poor grasslands would likely benefit from introducing an annual autumn cut with collection of arisings.


© Google 2016, Google Earth Street View

Survey Site 26- A303 EB (102/4 – 101/4)

Site only viewed from vehicle, preventing more in depth assessment. South-facing verges are largely dominated by young woodland, with Beech (*Fagus sylvatica*), Silver birch, Rowan, Hazel (*Corylus avellana*) and Hawthorn. Limited areas of grassland appear to be dominated by tall grasses. The site is best retained as woodland, due to the limited opportunities to enhance the site for pollinators.


© Google 2016, Google Earth Street View

Survey Site 27- A303 EB (90/3 – 90/4)

100m stretch of south-facing verge, with forage-rich areas largely limited to sheltered, tall herb dominated lenses nearer the roadside. Even in these areas, flowering plants are rather limited in extent but dominated by Common ragwort, alongside smaller numbers of St John's wort and Ox-eye daisy. Large stretches are dominated by scrub species, including banks of encroaching low bramble and Wild clematis (*Clematis vitalba*) which in places has formed dense low level beds, swamping other vegetation. Some small areas of sparsely vegetated, often mossy, early successional habitats have persisted within the tall herb area near the carriageway, which provide some local diversification and opportunities for other flowering species. However, overall their value for pollinators is rather limited. The most valuable areas are likely to be the more sheltered, sunny and forage rich pockets of tall herb.

Left: Sheltered, south-facing areas with more open and tall herb dominated grassland lenses. Right: Clematis dominated area, smothering all other vegetation © Chris Ayre

The widespread nature of Clematis suggests the verge has developed over chalk, indicating that there could be potential to enhance the area. However, the encroachment of scrub would need to be addressed by significantly clearing large stands. More wildflower-rich, sunny and sheltered scallops could be created by removing all of the vegetation and scraping off the topsoil to expose the underlying chalk. Exposed chalk would be best situated away from the scrubbier areas, to reduce the impact of scrub regeneration. Natural regeneration of the chalk may be difficult here due to the limited extent of open grassland as a source of seed, so consideration should be given to sowing seed mixtures such as Emorsgate Seeds EM6 – Meadow mixture for chalk and limestone soils or Boston Seeds BS2: Chalk & Limestone Soils Mixture.

Survey Site 29- A303 WB (107/6 – 108/4)

An extensive flat, open grassland with abundant common low growing flowering species. The short sward grassland abruptly meets a sloped bank, including bare patches and some sparsely vegetated ground, with flowering tall herbs which gradually grades into dense scrub. This area is likely to be of moderate value to common pollinators, utilising common grassland species such as Daisy (*Bellis perennis*) and buttercups (*Ranunculus spp*.).

Short sward grassland adjacent to tall herb dominated slope and dense scrub © Chris Ayre

It is likely that the short sward grassland are maintained by a combination of low nutrient underlying substrates and rabbit grazing which is sufficient to maintain the current interest. Grassland management may be considered if the sward becomes increasingly tall over time, with an annual late cut and the removal of arisings ideal.

Survey Site 30- A303 WB (104/2 – 104/9)

Site only viewed from vehicle, preventing more in depth assessment. The site supports young woodland often with a narrow tall grassland fringe with forage limited to tall competitive species such as thistles, ragwort and Yarrow (*Achillea millefolium*). Some stretches are dominated by low scrub of Gorse and bramble. Some significant sections of bare ground were noted, however, these are unlikely to prove of high value for pollinators due to the north-facing aspect and shielding by the adjacent treeline. These bare areas may have some potential for colonisation by ruderals which would diversify the forage opportunities for pollinators. The limited areas of grassland could be enhanced for pollinators with an annual autumn cut and removal of arisings to provide opportunities for less competitive wildflower species. Wooded areas, however, are best left in their current state.


© Google 2016, Google Earth Street View

Survey Site 31- (A303 WB (101/4 – 102/1))

Site only viewed from vehicle, preventing more in depth assessment . Narrow verges are dominated by tall and likely species-poor grasslands, with forage limited to more competitive flowering species such as tall umbellifers, yellow Asteraceae and composites. Narrower verges appear in places where the verges back onto woodland areas, which encroach to very near the roadside. Trees here are likely to provide valuable early season forage and sheltering opportunities.

The wooded areas are best left unmanaged, but, species-poor tall grassland verges could benefit from a late autumn cut and the removal of arisings to remove nutrients, plant material and provide opportunities for less competitive wildflower species.


© Google 2016, Google Earth Street View

Survey Site 40- A34 NB (13/8 – 15/1)

Site only viewed from vehicle, preventing more in depth assessment. Largely dominated by grassland with varying degrees of scrub encroachment from young woodland, as well as stands of Gorse, bramble, Common nettle and planted Juniper (*Juniperus*

communis). Forage is limited largely to scrub species and ruderal species such as ragworts able to persist in tall grasses. The persistence of planted Juniper suggests an underlying calcareous character to the soil, indicating that if management was introduced to cut and collect existing grassland areas, a more flower-rich and potential calcareous community could be encouraged over time. Sections may also benefit from turf stripping to expose underlying chalk to allow early successional flowering species to establish. Natural generation should be prioritised, however, if there are few chalk specialist grasslands nearby then the use of mixtures such as Emorsgate Seeds EM6 – Meadow mixture for chalk and limestone soils or Boston Seeds BS2: Chalk & Limestone Soils Mixture may be useful to enhance the site for pollinators.


Scrub dominated verges with little open grassland or diversity of forage © Google 2016, Google Earth Street View

Survey Site 41- A34 central reservation (15/1 – 16/3)

Site only viewed from vehicle, preventing more in depth assessment. It appears to be dominated by extensive flat grassland which support scabious, suggesting a calcareous influence. Scrub was noted to be establishing variably along the reservation, with bramble and Common nettle observed. Google Earth Street View images suggest an open grassland, with variation in sward height. The site would likely benefit from the introduction of an annual cut and collection of arisings, however, scabious species can be intolerant of cutting so some areas should be retained as uncut each year. Should more chalk specialist species be recorded, the reservation may benefit from the creation of some scrapes by topsoil stripping and exposing the underlying chalk. The creation of scrapes across the reservation every few years may allow for a mosaic of early successional calcareous habitats to develop should the seed bank be present, which would significantly enhance the site's value for pollinators in the area.


Extensive grassland central reservation, with some encroachment of low level scrub © Google 2016, Google Earth Street View

Survey Site 42- A34 NB (28/9 - 29/6)

Site only viewed from vehicle, preventing more in depth assessment. The site is dominated by East-facing grassland with encroaching scrub. The presence of scabious flowers indicates an underlying calcareous influence, while Ox-eye daisy could also be seen flowering in abundance at the time of the visit. The open grasslands appear to be rather dominated by tall grasses, suggesting that an annual cut with the collection of arisings could enhance the site's floristic diversity and value to pollinators significantly. To preserve the site's scabious interest, it is essential that some grassland areas are retained uncut every year. Scattered blocks of scrub within the grassland should be maintained, however, where cutting is failing to prevent scrub encroachment, some hand pulling of saplings would be beneficial. Where scrub is in more continuous blocks, they should be retained as scrub and will continue to provide a valuable forage resource.

More grass dominated swards may require topsoil stripping or the creation of scrapes to raise their floristic diversity, exposing the underlying chalk to create some early successional habitat resource.

Grassland verges showing significant invasion of scattered scrub © Google 2016, Google Earth Street View

Survey Site 45- A34 NB (60/0 - 60/9)

Site only viewed from vehicle, preventing more in depth assessment. Extensive East-facing, steep sided slopes supporting sections of short sward grassland which are likely maintained by drought stress, and patches of invading scrub. The short sward grasslands were noted as supporting scabious species, indicating an underlying chalk soil, as well as abundant Ox-eye daisy. Along some verge sections, scrub has taken hold, including heavy understories of bramble and nettle in stands of Sycamore.

The shorter sward grasslands are unlikely to require a cutting regime, but management plans should include pulling or cutting down invading scrub and treating stumps, to prevent significant scrub invasion into the open grassland. Some scattered clumps of scrub within the open grassland should be retained though, to diversify the vegetation structure. The site is likely to benefit from the creation of scattered scrapes to expose the underlying chalk. This would allow a mosaic of early successional, sparsely vegetated habitats to develop within the short sward grasslands and both provide a greater diversity of forage for pollinators and provide nesting and basking areas for bare chalk specialists. Scabious suggests seeding will not be necessary, but if required suitable mixes would be Emorsgate Seeds EM6 – Meadow mixture for chalk and limestone soils or Boston Seeds BS2: Chalk & Limestone Soils Mixture.

Left: Short sward grassland on steep chalk verges. Right: Heavily scrub invaded sections of verge © Google 2016, Google Earth Street View

Survey Site 50- A34 NB (77/5 – 77/8)

300m long east-facing grassland verges , grading into young established woodland. The tall grassland supports a good amount of valuable forage in St John's wort, Common centaury (*Centaurium erythraea*), Mugwort, Meadow vetchling (*Lathyrus pratensis*), Pyramidal orchid (*Anacamptis pyramidalis*) and Wild carrot, providing abundant forage for a diverse range of pollinators. Young woodland has established away from the roadside, dominated by Ash and Sycamore and threatening to invade the already limited extent of grassland.


Left: Flower-rich east-facing slopes with encroaching young trees. Right: Floristically diverse sward. © Chris Ayre

The encroaching young woodland needs to be addressed to safeguard the current value of the grassland area. Trees should be cut as close to the ground as possible and stumps treated to prevent re-growth. Saplings should also be pulled across the site where they are invading the grasslands to prevent them establishing. Much of the grassland could benefit from an annual autumn cut and removal of arisings due to the vigorous grass growth, which would also limit the impacts of scrub invasion. Some uncut areas should be retained annually however to diversity vegetation structure and provide some continuation of forage later into the season.

Survey Site 52- A34 NB (88/5 – 89/3)

Site only viewed from vehicle, preventing more in depth assessment. Extensive east-facing grass verges with scattered scrub. Google Earth Street View images suggest the site supports an abundance of Ox-eye daisy, which is used by a wide range of common pollinators. Despite the site's east-facing aspect, it is likely that the scattered scrub has created some pockets of more sheltered, sunny habitat. The grassland does not appear to be dominated by coarse grasses and would likely benefit from the introduction of an annual autumn cut and collection of arisings. Scrub should be maintained but not allowed to encroach into the grasslands, although small islands of scattered scrub are likely to be beneficial within the grasslands by providing some localised variation in vegetation structure.

© Google 2016, Google Earth Street View

Survey Site 53- A34 SB (89/6 – 88/5)

Site only viewed from vehicle, preventing more in depth assessment. Extensive west-facing grasslands on steep slopes supporting relatively species-poor grassland and scattered scrub, which is also invading from the adjacent scrub boundary. Hawthorn and bramble appear to dominate the scrub, both providing a useful resource for pollinators, however, the grasslands appear to be of only limited value. They would likely benefit from the introduction of an annual autumn cut and removal of arisings and may potentially benefit from sowing a general seed mix such as Boston Seeds BS1: General Purpose Mixture

© Google 2016, Google Earth Street View

Survey Site 54- A34 SB (77/8 – 77/5)

Site only viewed from vehicle, preventing more in depth assessment. Verges are largely dominated by young woodland with abundant Silver birch, Ash and Sycamore on steep slopes. The young woodland includes a dense scrub understory in places, with grasslands very limited in extent to small lenses or roadside strips. The site is likely to provide a reasonable amount of forage for pollinators considering the extent of scrub but could be enhanced with a woodland edge mixture such as Boston Seeds BS7 100%: Hedgerow & Light Shade Wildflower Seed which includes species able to tolerate the light shade encountered at woodland edges. Such a mix would be suitable for the interface between scrub and young woodland with the narrow grassland strips nearer the roadside.

© Google 2016, Google Earth Street View

Survey Site 56- A34 SB (60/9 – 60/0)

Site only viewed from vehicle, preventing more in depth assessment. Verges are largely dominated by young woodland with abundant Silver birch, Ash and Sycamore on steep slopes. Some slopes remain open and support abundant ruderal wildflowers

likely to provide useful, sheltered forage for common pollinators. Small patches of sparsely vegetated ground and open sunny sections, possibly from management activity could provide nesting opportunities for ground nesting bees and wasps despite being west-facing. However, where the verge narrows young woodland appears to predominate, reducing the potential value for pollinators. The open sunny areas should be maintained by preventing encroachment of surrounding scrub and woodland through an annual cut. Where the woodland dominates the verge but still allows for dappled light a woodland edge mixture such as Boston Seeds BS7 100%: Hedgerow & Light Shade Wildflower Seed may enhance forage locally.


© Google 2017, Google Earth Street View

Survey Site 60- A34 SB (16/3 – 13/8)

Site only viewed from vehicle, preventing more in depth assessment. Includes significant areas of species-poor grass with sections of encroaching scrub. Sections of verge have been used for Juniper planting. The limited extent of grassland appears to be quite free-draining but rather species-poor. Bare ground here is likely to be of limited value due to the shaded locations and limited forage, which is mainly from scrub species and a narrow range of common flowering species such as Common daisy and ragworts.

The introduction of an annual cut and removal of arisings would likely enhance the grassland areas for pollinators. Targeted scrub clearance or thinning of trees in more open settings would enhance sites for pollinators to some extent.


© Google 2016, Google Earth Street View

Survey Site 61- A34 SB (11/0 – 10/6)

Site viewed from road bridge, preventing more in depth assessment. South-west facing verges suffering from significant scrub encroachment. Open flowery areas appear to be extremely restricted to small tall grass lenses, with some ragwort, bramble and nettle scrub appears to be extensive along the roadside but quickly gives way to dense scrub.


Road verges with only very limited open grassland edges, showing the extent of scrub

Options to significantly enhance the site for pollinators without wholesale vegetation clearance are limited. However, the existing grassland pockets could be expanded by targeting scrub clearance around the edges.

Survey Site 62- A404 NB (57/3 - 58/2) & 63- A404 SB (58/3 – 57/3)

Site only viewed from vehicle, preventing more in depth assessment.. The verge is largely dominated by steep, narrow grass verges interspersed with scattered scrub and woodland. Scattered Hawthorn, bramble and nettles frequently invade grasslands, however, encroachment by woodland dominated by Ash and Sycamore is also taking place. It is likely that extensive grasslands which currently appear rather species poor could be enhanced with the introduction of an autumn annual cut and the raking off of arisings. Grassland verges adjacent to the woodland could be enhanced with a woodland edge mixture such as Boston Seeds BS7 100%: Hedgerow & Light Shade Wildflower Seed which includes species able to tolerate the light shade encountered at woodland edges.


© Google 2016, Google Earth Street View

Survey Site 66- M4 WB (75/4 – 76/1)

700m long north-facing chalk verge , with distinct sections. Some long stretches support open, tall grassland rich in nectar producing ruderals such as Teasel (*Diapsacus fullonum*), Common ragwort, Common hogweed, Ribbed melilot (*Melilotus officinalis*) and hawkweeds (*Hieracium spp*.) which provide diverse forage for a range of pollinators including bumblebees and solitary bees. However, the verges are interspersed with large scrub patches throughout, dominated by low banks of bramble together with tall coarse grasses and extensive mature scrub, with Elder (*Sambucus nigra*) featuring strongly.


Left: Open grassland verges rich in tall herbs providing forage. Right: Mature trees and scrub encroaching into open grasslands © Chris Ayre

The extensive stretches of grassland could benefit from a rotational cutting regime, with large areas cut back to short sward with arisings removed in autumn after flowering and seed setting, while ensuring that some areas are retained uncut every year to diversify structure and provide sheltering opportunities. It is essential that bramble and Elder are prevented from encroaching further into the remaining open grassland areas. Seedling Elder can easily be hand pulled, while bramble can be kept in check with brush cutting.

Survey Site 71- M4 WB (101/2 – 101/4)

North-facing, steeply sloping chalk banks supporting 10m wide verges dominated by bramble and nettle scrub, interspersed with mature trees for the entire 200m length. Reportedly once species-rich grassland, but currently subject to significant localised scrub invasion and shading.


© Google 2016, Google Earth Street View

The historic presence of species-rich grassland suggests that the site may still have some potential to support valuable pollinator habitats despite the north-facing aspect. Even with the current extent of nettles and bramble, it might be that the site could benefit from wholesale vegetation clearance and scraping off of topsoil. The removal of topsoil will reduce the nutrient status as well as any potential unfavourable seed bank. Newly exposed subsoils and chalk may still retain a seed bank from the former cover of species-rich grassland, alternatively seeding with suitable commercial calcareous mixes could help to create a valuable local resource for pollinators. Suitable mixes include Emorsgate Seeds EM6 – Meadow mixture for chalk and limestone soils or Boston Seeds BS2: Chalk & Limestone Soils Mixture although some specialist species may not thrive without a south-facing aspect and the associated warmer microclimate. Such work should be followed by the introduction of rotational cutting as a key management technique to provide both short sward and taller sward grasslands.

Survey Site 75- M4 WB (114/2 – 115/5)

1300m stretch of north-facing slopes on chalk, including a range of slope angles. Variations across the length include open grassland stretches with abundant Wild carrot, Common hogweed and Creeping thistle (*Cirsium arvense*), with scattered Hawthorn, steep sparsely vegetated chalk slopes and blocks of mature scrub, with occasional ditches. Some stretches do include extensive bramble and nettle, particularly away from the roadside. Despite the northern aspect, it is likely that the site retains good value for pollinators, with the varied structure, range of flowering plants and the presence of sparsely vegetated ground likely to support nectar-rich ruderals.

Left: Open grasslands with scattered Hawthorn scrub. Right: Sparsely vegetated chalk slopes © Chris Ayre

A rotational mowing regime would be preferable with much of the site cut to a short sward after flowering and seeding in autumn, but other areas retained as unmanaged to provide a continuation of forage later in the season as well as overwintering opportunities. Occasional scrape creation, removing topsoil could also provide localised opportunities for typical calcareous species to establish and provide opportunities for more nectar-rich ruderals. Scattered Hawthorn should be retained within the open grasslands as it provides localised variation and shelter for invertebrates, but not allowed to encroach into the remaining open grasslands, with seedlings either hand pulled or cut and treated.

Survey Site 76- M4 WB (118/2 – 120/1)

1400m of flat tall herb dominated grassland developed over chalk, with occasional stands of Ash. Abundant thistles, Common hogweed and Bristly oxtongue provide useful forage for pollinators, despite a limited floral diversity. Banks of bramble and Hawthorn scrub diversify the vegetation structure and provide further useful forage.

Tall herb dominated, species poor grass verges © Chris Ayre

Introduced management could have some limited improvement here, such as occasional cutting of the tall herb grassland areas so long as cuttings can be removed, potentially providing opportunities for less competitive flowering species to establish and diversify the sward.

Survey Site 80- M4 EB (120/1 – 119/7)

South-facing chalk bank, dominated by bramble scrub fringed with tall grasses, interrupted by clumps of Elder. Localised open grassland patches provide some forage in the form of thistles, ragwort, Yarrow and Ox-eye daisy, however, the site's limited value for pollinators is largely restricted to forage from flowering bramble and shelter.


Left: Bramble dominated grasslands and Elder scrub offering limited opportunities for pollinators. Right: Patches of raised floristic diversity offer localised opportunities for pollinators © Chris Ayre.

Existing areas of benefit could benefit from periodic clearance of vegetation by brush cutting with arisings removed. This would create shorter areas of vegetation and provide opportunities for the flora to diversify. In patches of raised interest where the chalk underlies only thin soils, it may be that the site could benefit from topsoil removal/scraping to expose the underlying low nutrient chalk to provide opportunities for chalk specialists, working with the bank's south-facing aspect, but only areas with a minimal bramble issue should be considered. Adjacent bramble areas could be enhanced by scalloping up slope to create sheltered, warm south-facing areas adjacent to the forage, while also helping to reduce the encroachment of bramble scrub.

Survey Site 81- M4 EB (119/6 – 118/2)

1900m stretch of steep south-facing chalk supporting some extensive stands of diverse forage, with ragwort, Wild carrot, Yarrow and sparsely vegetated chalk likely to support characteristic chalk species and ruderals with closer study. The south-facing slopes make them ideal to support many of the typical calcareous specialists which are often warmth loving and will benefit from the basking spots the bare chalk offers, as well as opportunities for specialist ground-nesting bees and wasps. Scattered Hawthorn diversifies the grassland and provides valuable shelter in warm conditions.


Left: Flower-rich grasslands offering high quality forage for invertebrates. Right: Sparsely vegetated south-facing chalk slopes of high value for invertebrates © Chris Ayre

The site could benefit significantly from the introduction of a cutting regime to areas of grassland dominated by taller species, to provide opportunities for less competitive wildflower species to establish. The extent of Hawthorn should be restricted to existing stands and scattered individuals, preventing its encroachment into the flower-rich grassland areas. Areas where the

grassland has become quite closed and species-poor could also benefit from topsoil striping to expose the underlying chalk, this would create early successional habitat areas within otherwise more homogeneous stands. Natural regeneration of newly created bare ground should be prioritised, however, if over time few species characteristic of calcareous environments establish it may be worth considering a commercial seed mixture such as Emorsgate Seeds EM6 – Meadow mixture for chalk and limestone soils or Boston Seeds BS2: Chalk & Limestone Soils Mixture.

Survey Site 82- M4 EB (117/0 – 116/3)

Species-poor grassland verges with both north-facing slopes and south-facing steep sided slopes. The grasslands are dominated by tall grass species, with forage limited to a very scattered resource of ragworts, yellow Asteraceae species, Yarrow, Creeping thistle and Mugwort. The steeper slopes appear to offer by far the greater forage resource, likely due to drought stress keeping the grasses under control and from occasional slipping opening up germination sites.

Scrub has also taken hold on some stretches, noticeably Hawthorn which is found throughout much of the verge as both scattered individuals and increasingly dense clumps. Some less steep, narrow verges also show significant invasion by Common nettle.

The site is of limited value for pollinators, with the scattered wildflower resource offering some opportunities for common species, supplemented by flowering scrub species, particularly in spring.

Left: Species poor grasslands with scattered scrub. Right: Species poor tall grassland. © Chris Ayre

The steep sided grasslands could benefit from the introduction of a cutting regime, with an autumn cut followed by the removal of arisings. This will minimise the impacts of scrub encroachment, although some removal of dense blocks of Hawthorn would increase the open habitat resource for pollinators in a south-facing setting. Where nettles and scrub have become to invade the narrower, less steep verges with much less forage value, they may be best left to natural succeed to scrub and to provide shelter and a spring forage resource.

Survey Site 83- M4 EB (115/6 – 113/7)

Extensive south-facing, rather species poor grasslands. Forage within the grasslands is limited to common species suitable for generalist pollinators, such as Common daisy (*Bellis perennis*), yellow Asteraceae, ragworts and Yarrow. The grasslands are interrupted by blocks of scrub, which have begun to invade the open grassland, with scattered patches establishing.

Similar to Survey Site 82, Common nettle appears to be a problem where verges become level and narrow, suggesting that they are relatively well controlled on the adjacent steeper slopes by drought stress and temperature.


Steep species- poor grassland slopes with scattered scrub © Chris Ayre

The steep sided grasslands could benefit from the introduction of a cutting regime, with an autumn cut followed by the removal of arisings. This will minimise the impacts of scrub encroachment, although some removal of dense blocks of scrub would increase the open habitat resource for pollinators in a south-facing setting. Where nettles and scrub have become to invade the narrower, less steep verges with much less forage value, they may be best left to natural succeed to scrub and to provide shelter and a spring forage resource.

Survey Site 90- M4 EB (99/3 – 98/9)

This 400m long south-facing chalk slope supports largely species-poor grassland with scattered patches of scrub. However, some small areas are of raised value for pollinators, with patches of well established Ribbed melilot, Common ragwort, Ox-eye daisy, St John's wort, Mugwort and a range of umbellifer species. Patches of Common nettle appear to be establishing within the grassland, as are young Hawthorn and what appears to be Clematis. Some solid stands of scrub are also well established.


Left: Flower-rich patches of grassland. Right: Encroaching scrub (c0 Chris Ayre

The open grassland slopes have the potential for enhancement, with the introduction of a cutting regime to progressively reduce nutrients from the site and keep the more competitive tall grasses in check, providing opportunities for less competitive wildflowers to establish. The site could also benefit from a scrub management regime, where some islands or patches of scrub are tolerated, but preventing from encroaching widely into the grasslands. The south-facing nature of the site suggests that retaining some small banks of scrub could created sheltered, sunny areas for thermophilic invertebrates. The south-facing nature of the slope and nature of the underlying substrate also suggests that the site may benefit from some turf stripping or creation of scrapes to expose the underlying chalk and allow a more characteristically calcareous flora to develop. Natural regeneration of newly created bare ground should be prioritised, however, if over time few species characteristic of calcareous environments establish it may be worth considering a commercial seed mixture such as Emorsgate Seeds EM6 – Meadow mixture for chalk and limestone soils or Boston Seeds BS2: Chalk & Limestone Soils Mixture.

Survey Site 93- M4 EB (89/7 – 89/0)

South-facing, rather species-poor tall grassland over chalk soils interspersed with scrub and individual trees. Forage is extremely limited and scattered within the tall grassland, with ragworts, Yarrow, Teasel, Agrimony (*Agrimonia eupatoria*), yellow Asteraceae species and Great mullein (*Verbascum thapsus*) all recorded. In places there is significant encroachment by bramble scrub and Common nettle as well as seedlings establishing from the treeline.


Left: Bramble invaded grassland. Right: Species-poor tall grassland © Chris Ayre

The site would benefit from the introduction of an annual cut in late summer and the removal of arisings to open up the grassland sward for less competitive wildflowers to establish. Cutting would also go some way to reducing the encroachment of scrub into the remaining open grassland areas although hand pulling of young tree saplings may be needed initially.

Survey Site 94- M4 EB (88/1 – 87/8)

Species-poor grass verge with encroaching brambles and dense stands of Bracken. The forage for pollinators is extremely limited, with only scattered Creeping thistle, Ox-eye daisy, Common ragwort and Common hogweed at low levels. The species-poor grasslands appear to be quite heavily invaded by bramble and Common nettle. The banks of bramble and Bracken beyond the narrow grassland verge are very dense, with additional forage limited to St John's wort and a small number of yellow Asteraceae species. Within the developing scrub, Gorse plants will provide some pollen resources, as will some of the mature willows (*Salix spp*.)


Left: Species poor grassland strip. Right: Dense bank of Bracken offering very little for pollinators. © Chris Ayre

Options to enhance this site for pollinators are very limited. The site may be best retained as stablished scrub, providing shelter and a reasonable amount of spring forage.

Park Gate Depot

Key features within the depot are the grasslands on verges, islands and unused areas of land around depot infrastructure. The most apparently high value area for pollinators is the limited areas of disturbed ground, where vegetation has established on

rubble, hardcore and other materials. The low nutrient and free-draining nature of these areas encourages ruderal species which produce an abundance of nectar. These areas support species such as Ribbed melilot, yellow Asteraceae, Weld (*Reseda luteola*), ragworts and umbellifers. This area is best left unmanaged, but should scrub begin to invade or the site begin to grass over, simple disturbance of the underlying material, or even the addition of new materials such as road scalpings or rubble which may be available on site could be spread to provide a fresh low nutrient exposure.

Some corners of the site are currently under scrub, with Gorse, bramble and Common nettle notable. However, grassland areas which are currently managed by cutting could benefit from the introduction of annual cuts in autumn, with arisings removed. As the photographs below show, the cuttings are currently left in situ, smothering the underlying vegetation and returning nutrients to the grassland. These areas could be managed with some site aesthetics in mind if the 0.5m edges of the grasslands are cut more regularly, so the site appears managed for visitors, with the central core cut annually from autumn onwards. The grasslands would likely be suitable for wildflower seeding, such as with a general purpose wildflower mixture such as Boston Seeds BS1: General Purpose Mixture which contains some generalist wildflowers able to survive in most soils, many of which are high value for pollinators.


Made up ground with rubble and hardcore, as well as nutrient disturbed areas create localised conditions for nectar-rich ruderal species © Chris Ayre


Mown verges, islands and unused space the potential to be enhanced for pollinators © Chris Ayre

Phase 2- Detailed assessments, surveys and advice

Following the initial baseline surveys and rankings exercise, pollinator surveys were undertaken alongside a more detailed habitat assessment of their value for pollinators and recommendations for management techniques to enhance the value of the sites for pollinators.

Survey Site 5- A3 Surrey Milford Interchange (35/9 – 37/0)

Habitat assessment

A 900m stretch of flat verges as well as east and west facing slopes which have developed on chalk and gravel, with open grassland adjacent to areas of young woodland/mature hedgerow. The site was severely drought stressed at the time of the site visit, which may have caused the vast majority of flowering species to have ceased flowering and gone to seed. However, by examining seed heads it was possible to confirm that the site supports abundant Wild carrot, interspersed with both Common knapweed (*Centaurea nigra*) and Greater knapweed (*Centaurea scabiosa*) and some ragworts. The absence of flowers is likely to have significantly reduced the pollinator numbers during the single site visit. However, the initial site visits in August suggested the site also supported a strong forage resource of Common hogweed, scabious (*Knautia spp*.), Ox-eye daisy and Yarrow, likely to support a wide range of common pollinators.

Grassland habitats are suffering from some encroaching scrub from the sloping margins. Some bare ground on the sloping verge banks may also offer some nesting opportunities for ground nesting bees and wasps.


Left: Flower-rich grasslands. Right: Invading scrub reducing the extent of open habitats. © Chris Ayre

Common name	Scientific name	Abundance
Wild carrot	*Daucus carota*	Abundant
Common knapweed	*Centaurea nigra*	Frequent
Greater knapweed	*Centaurea scabiosa*	Occasional
Ragwort	*Senecio sp.*	Occasional

Table: Flowering species recorded 25/08/2016

Pollinator survey results

Site surveyed 25th August 2016

Species name	Common name	Method	Notes	Type
Orthops basalis	A Plant bug	Sweep	Local distribution	Hemiptera (True bugs)
Phytocoris varipes	A Plant bug	Sweep		Hemiptera (True bugs)
Eurithia anthophila	A parasitic fly	Transect		Other True Fly
Cheilosia vulpina	A hoverfly	Sweep		Hoverfly
Eristalis tenax	Common drone fly	Transect		Hoverfly
Eupeodes corollae	A hoverfly	Transect		Hoverfly
Sphaerophoria scripta	Long hoverfly	Transect		Hoverfly
Anthophila fabriciana	Nettle tap moth	Transect		Moth
Adalia 7-punctata	Seven-spot ladybird	Transect		Beetle
Oedemera lurida	A Flower beetle	Sweep		Beetle

The pollinators recorded were limited due to the drought stressed conditions leading many flowering species to cease flowering and go to seed. However, the localised plant bug *Orthops basalis* was recorded, which relies on umbellifers such as Wild carrot which was abundant on the site.

Management recommendations

The site would benefit from the introduction of an annual cutting regime, with the arisings removed to reduce the nutrient status and open up the sward for less competitive wildflower species. However, it is essential that some areas of grassland are retained uncut in any year to provide opportunities for invertebrates which overwinter in seed heads, stems and leaves to complete their lifecycle, as well as providing overwintering opportunities.

Where scrub is significantly invading the open grassland habitats, these areas would benefit from the removal of scrub. Scrub and trees should be cut and the stumps treated to prevent re-growth. Where chalk is immediately underlying topsoil, some localised scraping and removal of topsoil would also create more calcareous environments likely to benefit specialist flora and their associated invertebrates. This would also remove any unfavourable seed bank, increasing the chances of more flower-rich calcareous habitats developing.

Natural regeneration of swards should be prioritised in this area, with monitoring of vegetation establishment undertaken to assess whether the site is developing a characteristic calcareous flora. Should natural regeneration be unsuccessful, then the sowing of calcareous species may be an option on the site, particularly where the topsoil has been removed to expose the underlying chalk. A suitable seed mix here would include the Emorsgate Seeds EM6 – Meadow mixture for chalk and limestone soils or Boston Seeds BS2: Chalk & Limestone Soils Mixture. These contain several of the species already present on site, but would provide a well-rounded mix for pollinators on chalky soils as it includes both generalists and calcareous species which would benefit pollinators with specific associations with chalk habitats. Where the aim is to enhance existing swards, where topsoil has not been removed, it is essential that a suitable ground preparation technique is undertaken to prepare the site for seeding, such as scarifying or harrowing to remove any grass thatch and open up germination sites in the soil. Seeding is best undertaken in autumn after any cutting, to allow seeds to germinate and establish before the vigorous growth of existing vegetation in spring.

Survey Site 9- M27 EB (20/8 – 23/0)

Habitat assessment

The roadside supports a 2200m long steep, north-east facing slop, with a mosaic of neutral grassland interspersed with patches of bare ground and thick scrub. Much of the site is dominated by tall, often species poor neutral grassland between a settling pond and Blackthorn hedge. Within the grassland areas localised areas offer extensive patches of Common fleabane (*Pulicaria dysenterica*), Ribbed melilot and Tufted vetch (*Viccia cracca*). Common fleabane supports a variety of pollinators whilst legumes such as Tufted vetch and Ribbed melilot are particularly valuable for bees. Nearer the roadside, valuable forage is also provided by Common ragwort

The balancing pond has been natively planted and supports reedbed, providing valuable breeding habitat for hoverflies with aquatic larvae, such as *Myathropa florea, Helophilus* and *Eristalis* species which were recorded during the site visit. The Blackthorn hedge on site is likely to provide valuable spring forage for bumblebees, as well early-emerging solitary bees and overwintering hoverflies. This is likely complimented by the open wooded rides which provide patches of forage in a sheltered environment.

Localised patches of raised forage value diversify the rather species poor grasslands © Chris Ayre


Left: Sheltered wooded ride supporting pockets of wildflower-rich habitat. Right: Species poor tall grassland grading into scrub © Chris Ayre

Common name	**Scientific name**	**Abundance**
Common fleabane	*Pulicaria dysenterica*	Abundant
Common Ragwort	*Senecio vulgaris*	Frequent
Tufted vetch	*Viccia cracca*	Frequent
Fennel	*Foeniculum vulgare*	Occasional
Melilot	*Melilotus sp.*	Occasional

Table: Flowering species recorded 24/08/2016

Pollinator survey results

Site surveyed 24th August 2016

Species name	**Common name**	**Method**	**Notes**	**Type**
Nabis limbatus	Marsh damsel bug	Sweep		Hemiptera (True bugs)
Pieris brassicae	Large white butterfly	Transect		Butterfly
Eriothrix rufomaculata	A parasitic fly	Transect		Other true fly
Phania funesta	A parasitic fly	Transect	Shieldbug parasite	Other true fly
Chrysotoxum bicinctum	Yellow-belted hoverfly	Transect		Hoverfly
Eristalis nemorum	Stripe-faced drone fly	Transect	Aquatic larvae	Hoverfly
Helophilus pendulus	Common tiger hoverfly	Transect	Aquatic larvae	Hoverfly

Myathropa florea	Batman hoverfly	Transect	Aquatic larvae	Hoverfly
Sphaerophoria scripta	Long hoverfly	Transect		Hoverfly
Vespula vulgaris	Common wasp	Transect		Wasp
Apis mellifera	Honeybee	Transect		Bee
Bombus lapidarius	Red-tailed bumblebee	Transect		Bee
Bombus pascuorum	Common carder bee	Transect		Bee
Halictus tumulorum	Bronze furrow bee	Sweep		Bee
Lasioglossum albipes	Bloomed furrow bee	Sweep		Bee

The site supports an assemblage of common pollinator species with some wetland-associated invertebrates such as Marsh damselbug (*Nabis limbatus*), Common tiger hoverfly (*Helophilus pendulus*) and the Batman hoverfly (*Myathropa florea*) suggesting the value of the balancing ponds in providing breeding opportunities. The presence of the Yellow-belted hoverfly (*Chrysotoxum bicinctum*, which is associated with shadier grassland habitats demonstrates the habitat diversity currently provided by the shrubs and trees on site adjacent to open grasslands.

Management recommendations

Introduced management should aim to introduce a cutting regime, with arisings removed, to control he dominance of tall grasses and provide opportunities for less competitive wildflowers to establish. Cutting would also go some way to prevent the encroachment of Blackthorn into grassland areas. The size of the site allows for a rotational cutting regime, with areas being cut in alternate years.

Scrub control is essential to maintain and enhance the site's value for pollinators. The sheltered rides should be maintained, to ensure the ground layer supports a diverse flora, by preventing scrub encroachment. Where possible clearing scrub edges to create sheltered, scalloped areas should be undertaken, particularly where there is a south-facing aspect.

In extensive areas dominated by more species poor swards, it may be appropriate to consider wildflower seeding. The loamy nature of the soils makes it suitable for the Emorsgate Seed EM5 – Meadow mixture for loamy soils mix or Boston Seeds BS4: Loam & Alluvial Soils Mixture. These mixtures differ significantly in their content, however, both would significantly diversify the forage on site and fill any potential hunger gaps for pollinators.

Survey Site 23- A303 EB (108/0 – 107/6)

Habitat assessment

A largely wildflower-rich, dry calcareous grassland with a sparsely-vegetated chalk slope and an adjacent wooded area. Strips of shorter sward following the curb and along paths are mown. The flora includes frequent Small scabious (*Scabiosa columbaria*), Wild carrot, Wild marjoram (*Origanum vulgare*) and Nipplewort (*Lapsana communis*), however, there are extensive grass dominated areas. Wild carrot and ragworts support the wasp *Tiphia femorata*, while the picture-winged fly *Sphenella marginata*, uses ragworts as a host on the site. With the addition of scattered Common knapweed (*Centaurea nigra*) and records of Lady's bedstraw from the earlier initial assessment, the site appears to be a valuable resource for pollinators.

The adjacent chalk slope is almost bare of herbaceous vegetation, but is currently undergoing afforestation, with Larch (*Larix decidua*) planted as a nurse crop for woodland. Ideally the chalk slope would be allowed to develop into a sparsely vegetated chalk slope, conflicting with the current management aim of slope stabilisation. The slope is also suffering from encroaching Buddleia and Cotoneaster (*Cotoneaster spp*.) which can both quickly come to dominate bare chalk sites.

However, maintaining this open habitat conflicts with current management aiming to stabilise the slope through afforestation where Larch (*Larix decidua*) has been planted as a nurse crop for woodland. Open habitats are also threatened by the establishment and spread of Buddleia and Goat willow (*Salix caprea*) on the slope.

The woodland edge and base of the slope support growth of Hemp agrimony (*Eupatorium cannabinum*), bramble and Goat willow (*Salix caprea*)scrub, which offer valuable additions to flower resources for pollinators providing they are controlled.

Overall the site supports an extensive flower-rich chalk grassland resource, with a number of calcareous specialist plants such as Dwarf thistle (*Cirsium acaule*), Salad burnet (*Sanguisorba minor*) and Blue fleabane (*Erigeron acer*) suggesting the site has significant value for invertebrates.


Left: Flower-rich grassland adjacent to scrub bank. Right: Flower-rich sward of high value © Chris Ayre

Common name	Scientific name	Abundance	Notes
Small scabious	*Scabiosa columbaria*	Frequent	Calcareous grassland specialist
Wild carrot	*Daucus carota*	Frequent	Main nectar source for *Tiphia femorata* on site
Wild marjoram	*Origanum vulgare*	Frequent	Foodplant for mint moth on site
Buddleia	*Buddleia davidii*	Frequent	Non-native invasive
Ragwort	*Senecio sp.*	Frequent	Host plant for *Sphenella marginata* on site
Nipplewort	*Lapsana communis*	Frequent	Early-successional plant
Common knapweed	*Centaurea nigra*	Occasional	
Common Hogweed	*Heracleum sphondylium*	Occasional	
Betony	*Stachys officinalis*	Occasional	
Hemp agrimony	*Eupatorium cannabinum*	Occasional	
Salad burnet	*Sanguisorba minor*	Occasional	Calcareous grassland specialist
Dwarf thistle	*Cirsium acaule*	Rare	Calcareous grassland specialist
Common toadflax	*Linaria vulgaris*	Rare	Early-successional plant
Blue fleabane	*Erigeron acer*	Rare	Dry grassland/calcareous grassland specialist

Table: Flowering species recorded 24/08/2016

Pollinator survey results

Site surveyed 24th August 2016

Species name	**Common name**	**Method**	**Notes**	**Type**
Adelphocoris lineolatus	Lucerne bug	Sweep		Hemiptera (True bugs)
Orthops	A plant bug	Sweep	Reliant on wild parsnip as larval foodplant	Hemiptera

campestris				(True bugs)
Gonepteryx rhamni	Brimstone butterfly	Transect		Butterfly
Maniola jurtina	Meadow brown butterfly	Transect		Butterfly
Pieris brassicae	Large white butterfly	Transect		Butterfly
Vanessa atalanta	Red admiral butterfly	Transect		Butterfly
Aplocera plagiata	Treble-bar moth	Transect		Moth
Aspitates gilvaria	Straw belle moth	Transect	**Section 41 Priority species**. Chalk grassland specialist.	Moth
Autographa gamma	Silver-Y moth	Transect		Moth
Epirrhoe alternata	Common carpet moth	Transect		Moth
Pyrausta aurata	Mint moth	Transect	Wild marjoram is main larval and adult foodplant on site.	Moth
Xanthoroe fluctuate	Garden carpet moth	Transect		Moth
Zygaena filipendulae	Six-spot burnet moth	Transect		Moth
Eurithia anthophila	A parasitic fly	Transect		Other true fly
Sphenella marginata	A picture-winged fly	Sweep	Reliant on Ragwort as larval foodplant	Other true fly
Cheilosia impressa	Burdock Cheilosia	Sweep	Reliant on Burdocks as larval foodplant. Adults nectar on umbellifers.	Hoverfly
Eristalis tenax	Common drone fly	Transect		Hoverfly
Helophilus pendulus	Common tiger hoverfly	Transect		Hoverfly
Helophilus trivittatus	Large tiger hoverfly	Transect		Hoverfly
Melanostoma scalare	A Hoverfly	Sweep		Hoverfly
Sphaerophoria scripta	Long hoverfly	Transect		Hoverfly
Tenthredo marginella	A Sawfly	Transect		Sawfly
Tiphia femorata	A Solitary wasp	Transect	Largely dependant on Wild carrot on site	Wasp
Apis mellifera	Honeybee	Transect		Bee
Bombus hypnorum	Tree bumblebee	Transect		Bee
Bombus lapidarius	Red-tailed bumblebee	Transect		Bee
Bombus lucorum	White-tailed bumblebee	Transect	Male	Bee
Bombus pascuorum	Common carder bee	Transect		Bee
Bombus terrestris	Buff-tailed bumblebee	Transect		Bee
Adalia 7-punctata	Seven-spot	Transect		Beetle

	ladybird			

Key species include the scarce Straw belle moth (*Aspitates gilvaria*), a Section 41 Priority species under the Natural Environment and Rural Communtiies (NERC) Act 2006. It is a specialist of chalk grassland habitats, feeding on a range of herbaceous plants.

Other significant invertebrate species found were the localised rough grassland spider *Araneus quadratus*.

Management recommendations

Management should aim to retain the condition of the chalk grassland and prevent the encroachment of scrub through annual late summer cutting after flowering and seeding, and the removal of arisings to control nutrients and avoid smothering low growing species. Some scrub areas should be maintained for pollinators with species such as Goat willow providing valuable early pollen sources for bumblebees, mining bees and hoverflies, whilst bramble flowers benefit a wide range of pollinators in early summer. Management should aim to ensure a range of grassland sward heights, as well as retaining uncut areas to allow species such as the gall producing picture-winged flies on site to complete their lifecycle. Such uncut areas may be suitable alongside retained scrub edges, to create a transition from scrub and tall herb-rich grass, through to shorter sward grasslands..

The Straw belle moth requires a range of sward heights to complete its lifecycle, often sheltering in taller grass but using short sward areas for egg laying, with their larvae favouring the warm microclimates often associated with broken calcareous turf or scattered patches of bare ground within short swards. More information is available in the Butterfly Conservation Straw Belle Factsheet. It is recommended that specialist advice for the species be sought directly from Butterfly Conservation due to the species status and paucity of records.

Highly-invasive Cotoneaster should be eradicated from the site and adjacent verges as it can quickly dominate sites and outcompete the less competitive habitat specialists. In addition Buddleia should be removed from the site, with saplings hand pulled and established plants cut as low to the ground as possible and the stumps treated with a herbicide to prevent regrowth, as it can similarly come to dominate sites at the expense of more valuable wildflower-rich habitats.

The afforestation of the chalk slopes would benefit by retaining some open areas where it does not conflict with the requirement to stabilise the slope. These areas could over time develop a valuable sparsely vegetated cover of high value for many chalk habitat specialists.

Grassland areas dominated by tall grasses present opportunities to create bare ground plots, by either turf stripping or scraping to allow early successional chalk grassland species to establish. Ideally, new scrapes should be created on a regular basis and created scrapes left to succeed, which over time would allow a mosaic of successional stages of chalk grassland to develop. As an additional diversifying habitat feature, any arisings from scrape creation can be used to create a bund, providing topographical and microclimate variation, best aligned east-west to provide a long section of south-facing slopes suitable for thermophilic species to bask. Any bunds would benefit from any available chalky material being used to cap bunds. Extensive information on scrape creation is provided by Butterfly Conservation's 'Creating scrapes for butterflies and moth' factsheet.

Survey Site 24- A303 Picket 20 (106/9 – 106/2)

Habitat assessment

An expanse of wildflower-rich dry, calcareous grassland adjacent to a sparsely-vegetated chalk slope, with areas of significant scrub developing. The level grassland contains abundant Wild carrot with frequent Wild marjoram and ragworts, all important plants for pollinators. Specifically, the Wild carrot and ragworts support the wasp *Tiphia femorata*, while ragworts, especially Hoary ragwort (*Senecio erucifoliusci*) host the localised gall-making fly *Merzomyia westermanni* whilst marjoram provides the adult and larval foodplant for Mint moth *Pyrausta aurata* on the site. Variations in sward height increase the value of the site for invertebrates and provide opportunities for different wild flowers to establish. Throughout the site a number of chalk specialists were identified, including Dwarf thistle, Yellow-wort (*Blackstonia perfoliata*), Blue fleabane and Horseshoe vetch (*Hippocrepis comosa*), suggesting a well established calcareous grassland although these species are currently only in low numbers and widely scattered on the site.

The chalk slope provides the main resource of bare and sparsely-vegetated ground on the site. This is especially important for the Chalk hill blue butterfly (*Polyommatus coridon*) observed here as it supports its foodplant, Horseshoe vetch. However, maintaining this open habitat conflicts with current management aiming to stabilise the slope through afforestation where Larch (*Larix decidua*) has been planted as a nurse crop for woodland. Open habitats are also threatened by the establishment and spread of Buddleia and Goat willow (*Salix caprea*) on the slope.

The open chalk grassland and sparsely vegetated slopes are likely to support a range of scarce invertebrates and chalk specialists such as solitary bees, solitary wasps and bare-ground associated hoverflies. However, the narrow survey window is likely to have missed the active period for many of these species.

Despite the encroachment of scrub, it remains a valuable feature in its own right, and is likely to be key in supporting the scarce potter wasp *Microdynerus exilis* collected from the site, while Buddleia on the site supported feeding Red admiral (*Vanessa atalanta*), Peacock (*Aglais io*) and Large white (*Pieris brassicae*) butterflies. In addition, the Goat willow will provide important early forage for bumblebees, mining bees and hoverflies.

Flower-rich calcareous grasslands adjacent to scrubbing over bank © Chris Ayre

Common name	**Scientific name**	**Abundance**	**Notes**
Wild carrot	*Daucus carota*	Abundant	Main nectar source for *Tiphia femorata* on site
Yellow Asteraceae (Cat's-ear, Hawkbits, Hawkweeds)	*Asteraceae*	Abundant	
Wild marjoram	*Origanum vulgare*	Frequent	Foodplant for mint moth on site
Ragwort	*Senecio sp.*	Frequent	Host plants for *Merzomyia westermanni* on site
Eyebright	*Euphrasy sp.*	Frequent	
Buddleia	*Buddleia davidii*	Frequent	Non-native invasive
Centaury	*Centaurium sp.*	Occasional	Early-successional plant
Greater knapweed	*Centaurea scabiosa*	Occasional	
Bristly oxtongue	*Helminthotheca echioides*	Occasional	
Horseshoe vetch	*Hippocrepis comosa*	Occasional	Foodplant for Chalk hill blue butterfly. Early-successional calcareous specialist.
Betony	*Stachys officinalis*	Occasional	

Field scabious	*Knautia arvensis*	Rare	Calcareous grassland plant
Dwarf thistle	*Cirsium acaule*	Rare	Calcareous grassland specialist
Yellow-wort	*Blackstonia perfoliata*	Rare	Early-successional plant, Calcareous grassland plant.
Blue fleabane	*Erigeron acer*	Rare	Dry grassland/calcareous grassland specialist

Table: Flowering species recorded 24/08/2016

Pollinator survey results

Site surveyed 24th August 2016

Species name	**Common name**	**Method**	**Notes**	**Type**
Nabis rugosus	Common damsel bug	Sweep		Hemiptera (True bugs)
Adelphocoris lineolatus	Lucerne bug	Sweep		Hemiptera (True bugs)
Closterotomus norwegicus	Potato capsid	Sweep		Hemiptera (True bugs)
Himacerus mirmicoides	Ant damsel bug	Sweep		Hemiptera (True bugs)
Phytocoris varipes	A Plant bug	Sweep		Hemiptera (True bugs)
Aglais io	Peacock butterfly	Transect		Butterfly
Aglais urticae	Small tortoiseshell butterfly	Transect		Butterfly
Maniola jurtina	Meadow brown butterfly	Transect		Butterfly
Pieris brassicae	Large white butterfly	Transect		Butterfly
Polyommatus coridon	Chalk hill blue butterfly	Transect	Chalk grassland specialist.	Butterfly
Vanessa atalanta	Red admiral butterfly	Transect		Butterfly
Aplocera plagiata	Treble-bar moth	Transect		Moth
Cilix glaucata	Chinese character moth	Transect		Moth
Pyrausta aurata	Mint moth	Transect	Wild marjoram is main larval & adult foodplant on site.	Moth
Fannia sp.	A muscid fly	Sweep		Other True Fly
Merzomyia westermanni	A Picture-winged fly	Sweep	Local. Larval foodplant is Ragworts (usually Hoary ragwort).	Other True Fly
Sarcophaga carnaria	A Flesh fly	Sweep		Other True Fly
Eristalis nemorum	Stripe-faced dronefly	Transect		Hoverfly
Eristalis nemorum		Sweep		Hoverfly
Eristalis tenax	Common	Transect		Hoverfly

	drone fly			
Eumerus strigatus		Sweep		Hoverfly
Helophilus trivittatus	Large tiger hoverfly	Transect		Hoverfly
Melanostoma scalare	A Hoverfly	Sweep		Hoverfly
Paragus haemorrhous	A Hoverfly	Sweep		Hoverfly
Sphaerophoria scripta	Long hoverfly	Transect		Hoverfly
Xylota segnis	A Hoverfly	Transect		Hoverfly
Athalia rosae	Turnip sawfly	Sweep		Sawfly
Tenthredo marginella	A Sawfly	Transect		Sawfly
Microdynerus exilis	A Potter wasp	Sweep	**Scarce (Nb)**	Wasp
Tiphia femorata	A solitary wasp	Transect	Largely dependant on Wild carrot on site	Wasp
Apis mellifera	Honeybee	Transect		Bee
Bombus lapidarius	Red-tailed bumblebee	Transect		Bee
Bombus pascuorum	Common carder bee	Transect		Bee
Bombus terrestris	Buff-tailed bumblebee	Transect		Bee
Lasioglossum albipes	A furrow bee	Sweep		Bee
Adalia 7-punctata	Seven-spot ladybird	Transect		Beetle
Oedemera lurida	A flower beetle	Sweep		Beetle
Rhagonycha fulva	Common red soldier beetle	Transect		Beetle

Notable records include the scarce potter wasp *Microdynerus exilis*, which nests in old beetle burrows in dead wood and occasionally in bramble stems, suggesting an association with the developing scrub on the site. The adults are likely to feed on the abundant yellow Asteraceae flowers such as Hawkweeds and Hawkbits found on the site, and collecting weevil larvae from the species-rich grassland areas to provision their nests.

The locally distributed picture-winged fly *Merzomyia westermanni* was also recorded, which forms galls in the flower heads of ragworts, particularly Hoary ragwort.

The Chalk hill blue butterfly is reliant on growth of Horseshoe vetch on the sparsely-vegetated bank. Although it has no statutory protection beyond its sale, its numbers have declined in recent decades and it is listed as a 'Medium' conservation priority species by Butterfly Conservation, making it of raised interest.

Management recommendations

Retain and increase the wildflower richness through annual cutting and removal of arisings. Ideally this should involve different cutting regimes different distances from the road to retain variations in sward heights. It is important to retain some uncut areas annually, to allow species such as *Merzomyia westermanni* to complete their life cycle.

There is a clear conflict between the need to stabilise the chalk slope through tree planting and the key value of the sparsely vegetated chalk slopes. These slopes support the foodplant of the Chalk hill blue and have the potential to attract a whole range of chalk specialists not detected in the narrow survey window. A key management aim should be to identify areas of the slope which could be retained as sparsely vegetated slopes without impacting on slope stabilisation. Any suitable areas should be managed by regularly pulling up saplings and cutting back surrounding scrub.

Scrub species, especially Buddleia and Goat willow should not be allowed to establish in the open grassland areas. The introduction of grass cutting will go some way to keeping scrub encroachment to a minimum, however, Buddleia in particular is best addressed by pulling up of saplings or cutting of young trees and treatment with a herbicide to prevent re-growth.

The loss of sparsely vegetated chalk slopes to scrub encroachment and succession could in part be offset by the creation of bare ground plots. Plots could be created by turf stripping or scraping to allow early successional chalk grassland species to establish. Ideally, new scrapes should be created on a regular basis and created scrapes left to succeed, which over time would allow a mosaic of successional stages of chalk grassland to develop. Though the drifts of Wild carrot are important for a wide range of pollinators, areas with shorter sward will encourage the spread of chalk grassland specialist plants such as Yellow-wort, Horseshoe vetch and Dwarf thistle. These short sward areas will increase the diversity of forage available to pollinators, as well as providing breeding habitat for solitary bees, solitary wasps and Chalk hill blue butterfly away from succeeding bank.

To specifically benefit Chalk hill blue butterflies, bare chalk plots could be seeded with Horseshoe vetch, however, it is difficult to source commercially. Hand collection of seed is also difficult as it is sporadic in going to seed, however, attempts to hand collect seed could be beneficial. Seeding with Field scabious, which is currently rare on the site, would be beneficial for butterflies and long-tongued bumblebees, providing a rich pollen and nectar source in late summer when other flowers with long corollas have gone to seed, as well as an alternative to the Buddleia. However, it is essential that no seed mixes are introduced to the site, as it already supports a number of chalk grassland indicator species that are adapted to the local conditions. With suitable habitat management, it is likely that many of these chalk specialists and their associated invertebrate specialists will utilise the site.

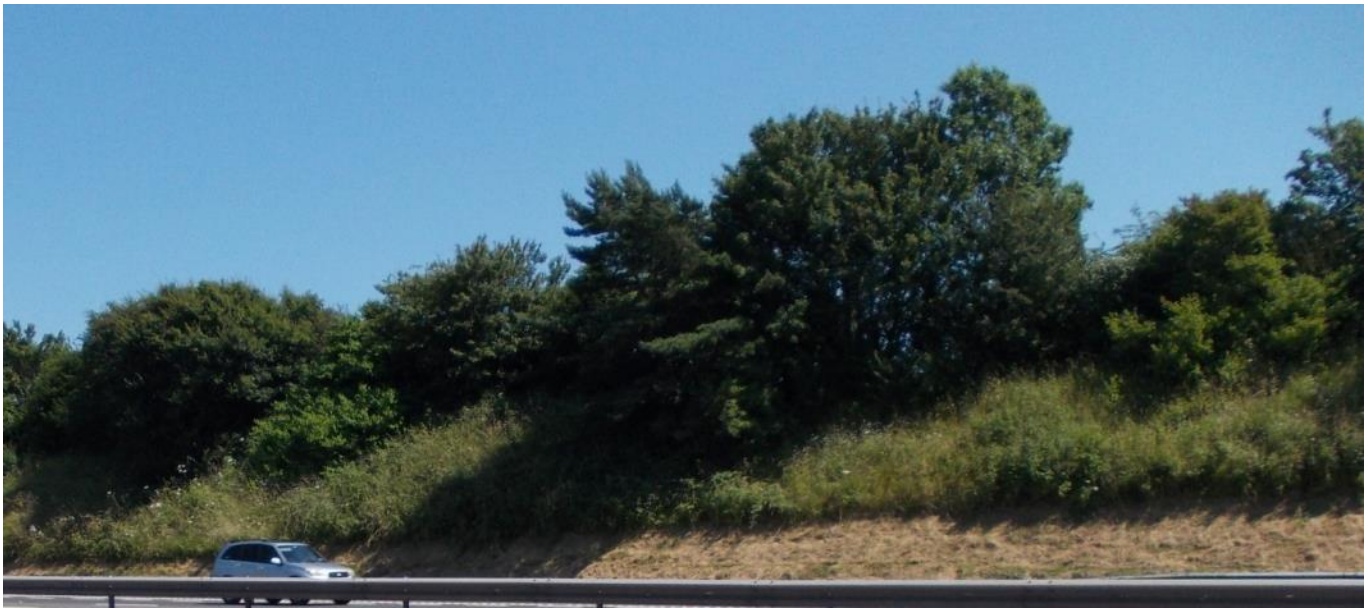
As an additional diversifying habitat feature, any arisings from scrape creation can be used to create a bund, providing topographical and microclimate variation, best aligned east-west to provide a long section of south-facing slopes suitable for thermophilic species to bask as well as desirable nesting sites for solitary bees and solitary wasps. Any bunds would benefit from any available chalky material being used to cap bunds. Extensive information on scrape creation is provided by Butterfly Conservation's 'Creating scrapes for butterflies and moth' factsheet.

Survey Site 34- M3 SB (83/1 – 84/2)

Habitat assessment

Area 34 itself is a narrow verge of rough grassland with a bank of young woodland, but due to safety concerns, the site could not be accessed. An assessment from distance suggests that the rough grassland is rather species poor, with forage limited to ragworts and tall umbellifers. Together with an understory of bramble the site is likely to offer only limited forage for a range of common pollinators. The young woodland includes Sycamore, Elder and a limited extent of Spindle (*Euonymus europaeus*) and Rowan (*Sorbus aucuparia*) which will also provide some forage for common species.

Due to the health and safety issues associated with working on the site, it was agreed that a grassland strip adjacent to the bank would surveyed to record the likely pollinating species at the location. The survey areas was a rank neutral grass margin of an arable field on the other side of the bank to Area 34's rough grassland, separated by the young woodland strip. Although not species, rich, the presence of common nectar-rich species such as thistles, ragworts, Teasel, Common hogweed, Great willowherb and occasional Red bartsia (*Odontites vernus*) suggests a reasonable forage resource. However, the fauna is always likely to be influenced by the management of the adjacent arable field such as applications of fertiliser and pesticides and the presence of the nearby wooded strip.



Bank of rough grassland and young woodland © Chris Ayre

Common name	Scientific name	DAFOR	Notes
Field bindweed	*Convolvulus arvensis*	Frequent	
Centaury	*Centaurium sp.*	Occasional	Early-successional plant
Creeping thistle	*Cirsium arvense*	Occasional	
Teasel	*Dipsacus fullonum*	Occasional	
Common hogweed	*Heracleum sphondylium*	Occasional	
Common ragwort	*Senecio jacobaea*	Occasional	Host plant for *Sphenella marginata* on site
Great willowherb	*Epilobium hirsutum*	Occasional	
Spear thistle	*Cirsium vulgare*	Rare	
Red bartsia	*Odontites vernus*	Rare	

Table: Flowering species recorded 25/08/2016

Pollinator survey results

Site surveyed 25th August 2016

Species name	Common name	Method	Notes	Type
Closterotomus norwegicus	Potato capsid	Sweep		Hemiptera (True bugs)
Pararge aegeria	Speckled wood butterfly	Transect		Butterfly
Auographa gamma	Silver Y moth	Transect		Moth
Dilophus febrilis	Fever fly	Sweep		Other True Fly
Sarcophaga sp.	A Flesh fly	Sweep		Other True Fly
Lucillia sp.	A Green bottle	Sweep		Other True Fly
Orthellia sp.	A Green bottle	Sweep		Other True Fly
Epistrophe grossulariae	A Hoverfly	Sweep		Hoverfly
Episyrphus balteatus	Marmalade hoverfly	Transect		Hoverfly
Eristalis nemorum	Stripe-faced drone fly	Transect		Hoverfly
Eristalis tenax	Common drone fly	Transect		Hoverfly
Melanostoma scalare	A Hoverfly	Sweep		Hoverfly
Rhingia campestris	Common snout-hoverfly	Transect		Hoverfly
Sphaerophoria scripta	Long hoverfly	Transect		Hoverfly

Sphaerophoria sp	A Hoverfly	Sweep		Hoverfly
Tenthredo notha	A sawfly	Sweep	Female	Sawfly
Bombus lapidarius	Red-tailed bumblebee	Transect		Bee
Bombus lucorum	White-tailed bumblebee	Transect	Male	Bee
Bombus pascuorum	Common carder bee	Transect		Bee
Lasioglossum albipes/calceatum	A Furrow bee	Transect		Bee
Adalia 7-punctata	Seven-spot ladybird	Transect		Beetle

The survey data indicates a site heavily influenced by the adjacent arable field and its management, and the young woodland upslope from the survey site, with the majority of species being common grassland generalists or common woodland specie such as Speckled wood butterfly (*Pararge aegeria*), the hoverfly *Epistrophe grossulariae*, and the Common snout-hoverfly (*Rhingia campestris*).

Management recommendations

It is difficult to provide detailed management prescriptions without a more thorough assessment of the Area 3 habitats themselves.

Rough grassland can provide valuable shelter and adds structural variation to verge networks, however, without management it is vulnerable to bramble and scrub encroachment. An appropriate regime here would be a rotational cutting approach, with half of the site cut annually in late summer after flowering and seeding, and half left unmanaged. For ease of management it may be suitable to manage the grassland here in horizontal strips.

The rough grassland currently appears to be relatively species poor, so would likely benefit from some work to enhance the forage available for pollinators. Suitable seed mixes can be purchased for species tolerant of tussocky and infrequently managed grasslands, such as the Emorsgate Seeds EM10F – Tussock wild flowers mix, which includes umbellifers, vetches and knapweeds which are all extremely valuable for pollinators. Within rough grassland areas, patches should have the vegetation and topsoil removed in autumn to create bare ground for germination and the seed broadcast over the area and raked in. The creation of patches of wildflower within the extensive rough grassland area will allow the wildflowers to establish in the cleared areas and seed into the remainder of the verge.

Scrub encroachment is likely to be a key management issue. The introduction of a rotational cutting regime should go some way to reducing the impacts of scrub encroachment, but it is likely to be necessary to remove some blocks of younger scrub and bramble to preserve the open rough grassland areas. Scrub should be cut as low to the ground as possible and stumps treated with a herbicide to prevent regrowth, with all saplings hand pulled where possible. Some retention of dead wood, both within the blocks of scrub and in open, sunny grassland could provide some additional habitat variation and provide nesting sites for aerial-nesting solitary bee and solitary wasp species. Where possible, blocks of scrub which are overshadowing rough grassland areas should be prioritised for clearance, as sunnier area s of grassland are likely to support flowering species.

Survey Site 36- M3 NB (84/0 – 83/1)

Habitat assessment

The verges of Area 36 include stretches of both north and south-facing slopes, on steep bank slopes and also downhill from the carriageway. The verges are largely grassland dominated, with a calcareous influence to the flora. The majority of the grassland areas are rather species poor, with only scattered wildflowers bar some extensive areas of Field scabious and Common ragwort, both valuable late-flowering plants for a variety of pollinators. The initial assessment visits also identified some areas supporting Creeping thistle, Mugwort, Teasel, Bristly ox-tongue and Yarrow which are likely to be of localised raised value for pollinators. The verge supports a variety of sward heights, however, some areas appear to be of raised fertility and are now succumbing to

Common nettle, clematis and bramble. A mature hedge bank adjacent to an arable field supports roses (*Rosa* sp.) and Hawthorn, providing important early- season forage for pollinators.

Alongside the carriageway, shorter grass supports a more early successional flora with Red Bartsia, Common centaury and Nipplewort, useful for low-flying pollinators such as some solitary bees and hoverflies.


Left: Flower-rich patches of grassland. Right: Extensive steep grassland verges © Chris Ayre

Common name	Scientific name	DAFOR	Notes
Field scabious	*Knautia arvensis*	Frequent	Calcareous grassland plant. Sensitive to cutting.
Common ragwort	*Senecio jacobaea*	Frequent	
Centaury	*Centaurium sp.*	Occasional	Early-successional plant
Red bartsia	*Odontites vernus*	Occasional	
St John's wort	*Hypericum sp.*	Occasional	
Betony	*Stachys officinalis*	Occasional	
Blue fleabane	*Erigeron acer*	Rare	Dry grassland/calcareous grassland specialist
Common hogweed	*Heracleum sphondylium*	Rare	

Table: Flowering species recorded 25/08/2016

Pollinator survey results

Site surveyed 25th August 2016

Species name	Common name	Method	Notes	Type
Phytocoris varipes	A Plant bug	Sweep		Hemiptera (True bugs)
Pieris brassicae	Large white butterfly	Transect		Butterfly
Anthophila fabriciana	Nettle tap moth	Transect		Moth
Autographa gamma	Silver Y moth	Transect		Moth
Dilophus febrilis	Fever fly	Sweep		Other True Fly
Eurithia anthophila	A Parasitic fly	Transect		Other True Fly
Sphenella marginata	A Picture-winged fly	Sweep	Reliant on Ragwort as larval foodplant	Other True Fly
Eristalis nemorum	Stripe-faced dronefly	Transect		Hoverfly
Eristalis tenax	Common drone fly	Transect		Hoverfly
Melanostoma scalare	A Hoverfly	Sweep		Hoverfly
Platycheirus	Chequered hoverfly	Transect		Hoverfly

albimanus				
Rhingia campestris	Common snout hoverfly	Transect		Hoverfly
Sphaerophoria scripta	Long hoverfly	Transect		Hoverfly
Syritta pipiens	Thick-legged hoverfly	Transect		Hoverfly
Apis mellifera	Honeybee	Transect		Bee
Bombus lapidarius	Red-tailed bumblebee	Transect		Bee
Bombus lucorum	White-tailed bumblebee	Transect	Male	Bee
Bombus pascuorum	Common carder bee	Transect		Bee
Bombus terrestris	Buff-tailed bumblebee	Transect		Bee
Oedemera nobilis	Thick-legged flower beetle	Sweep		Beetle

The site supports a common assemblage of grassland pollinators. The diversity of hoverfly species is likely a result of the prevalence of ragwort, which was the main plant observed being used as forage by flies and bumblebees.

Management recommendations

The introduction of a cutting regime would go some way to helping enhance floristic diversity. An annual cut should be undertaken in autumn after flowering and seed set, with arisings removed. An annual cutting regime would also go some way to limiting the expansion of Common nettle, clematis and bramble, but some targeted removal of bramble using hand tools would be ideal. This should involve as much root being pulled as possible.

Where Common nettle is particularly dense, it may be worth considering topsoil stripping to remove the seed bank and root network that can make nettle control so difficult to control. This would also expose some of the underlying chalky soil to allow early successional patches to establish within the rather grass dominated banks. If nettles are periodically controlled in such a fashion his will also encourage mosaic of successional stages to develop within the wider grassland.

Kier have confirmed that the verge is currently set as a ragwort control area, despite the absence of adjacent pasture. Ragwort control should be reviewed here as it is one of the most common flowering species and a valuable resource for pollinators, with its removal seemingly unnecessary in terms of surrounding land uses.

Survey Site 55- A34 SB (69/6 - 67/6)

Habitat assessment

An extensive bank with a near- continuous swathe of common fleabane dominated short sward grassland, interspersed with asters (*Aster spp.*) and scattered scrub along with frequent Wild carrot, Bristly oxtongue and Common ragwort. This provides both a high-value area for pollinators and a high visual impact. The value of the flora here is illustrated by the highest species count of Hoverflies for all sites surveyed. There is bramble growth on the top of the bank, and sections of the verge are being invaded by scrub.


© Google 2016, Google Earth Street View

Common name	Scientific name	DAFOR	Notes
Common fleabane	*Pulicaria dysenterica*	Abundant	
Aster	*Aster sp.*	Frequent	
Wild carrot	*Daucus carota*	Frequent	
Bristly oxtongue	*Helminthotheca echioides*	Frequent	
Common ragwort	*Senecio jacobaea*	Frequent	Host plants for *Cheilosia bergenstammi* on site

Table: Flowering species recorded 31/08/2016

Pollinator survey results

Site surveyed on 31st August 2016

Species name	Common name	Method	Notes	Type
Nabis ferus	Field damsel bug	Sweep		Hemiptera (True bugs)
Pieris brassicae	Large white butterfly	Transect		Butterfly
Vanessa atalanta	Red admiral butterfly	Transect		Butterfly
Sarcophaga sp.	A Flesh fly	Sweep		Other True Fly
Cheilosia bergenstammi	Ragwort Cheilosia	Sweep	Localised. Uses ragwort as larval host plant	Hoverfly
Cheilosia latifrons	Small hawkbit-Cheilosia	Sweep	Localised. Uses Hawkbits and Hawkbeards as larval host plant	Hoverfly
Episyrphus balteatus	Marmalade hoverfly	Transect		Hoverfly
Eristalis arbustorum	Plain-faced drone fly	Transect		Hoverfly
Eristalis nemorum	Stripe-faced dronefly	Transect		Hoverfly
Eristalis tenax	Common drone fly	Transect		Hoverfly
Eupeodes corollae	A hoverfly	Sweep		Hoverfly
Eupeodes luniger	A hoverfly	Transect		Hoverfly
Helophilus pendulus	Common tiger hoverfly	Transect		Hoverfly
Helophilus trivitattus	Large tiger hoverfly	Sweep		Hoverfly
Melanostoma	A hoverfly	Sweep		Hoverfly

mellinum				
Melanostoma scalare	A hoverfly	Sweep		Hoverfly
Platycheirus albimanus	Chequered hoverfly	Sweep		Hoverfly
Sphaerophoria scripta	Long hoverfly	Transect		Hoverfly
Syritta pipiens	Thick-legged hoverfly	Transect		Hoverfly
Syrphus ribesii	Humming syrphus	Sweep		Hoverfly
Bombus lapidarius	Red-tailed bumblebee	Transect		Bee
Bombus pascuorum	Common carder bee	Transect		Bee
Bombus terrestris	Buff-tailed bumblebee	Transect		Bee
Colletes sp.	Plasterer bee	Transect		Bee
Lasioglossum albipes/calceatum	A Furrow bee	Transect		Bee
Nomada flavoguttata	Small nomad bee	Transect		Bee

The greatest diversity of hoverflies was recorded from this site, which together with the short-tongued solitary bees (*Colletes* and *Lasioglossum*) is likely due to the high prevalence of Asteraceae on the site, particularly Common fleabane at the time of surveying. The presence of *Nomada flavoguttata* also indicates populations of late-flying mining bees (*Andrena spp*.) in the area, since it is a nest parasite of various species in this genus which will also benefit from the Asteraceae.

Management recommendations

Scrub should be removed before it becomes too established, followed by an annual late summer cut (September-November) to retain the fleabane and asters whilst suppressing grass and bramble growth. Turf stripping near the roadside may be desirable to allow the growth of less-competitive wildflower species.

Survey Site 64- A404M SB (45/8 – 45/1)

Habitat assessment

A 700m long north east-facing verge bank, dominated by sparsely vegetated ground and drought stressed grassland adjacent to a patch of meadow habitat. The site progressively becomes more vegetated towards the foot of the slope, grading through from low sprawling scrub, through to denser scrub and mature trees. Most of the grassland is towards the eastern end of the verge, with bramble and Gorse encroachment in other areas.

At the time of the habitat assessment the site was extremely drought stressed, resulting in many flowering species having already completed flowering and gone to seed. However, the site still supported extensive areas of Common fleabane with scattered ragwort and Nipplewort, as well as occasional Teasel, umbellifers and yellow Asteraceae species, ensuring a strong nectar and pollen provision for pollinators. Encroaching bramble and gorse have established in the western areas of the side, reducing the floristic diversity of part of the site, while shading from the treeline will also reduce the value of some areas for pollinators. The adjacent meadow is complementary to the sparsely vegetated slope, with a dominance of Common fleabane, a high value plant for pollinators

The presence of *Xanthogramma spp*. and *Pipizella spp*. of hoverflies indicates this is generally a dry/sparsely vegetated area, though since it is north-facing the bank has limited value for nesting solitary bees and wasps as reflected in the survey results.


Dry grassland with abundant tall herbs, with encroaching scrub © Chris Ayre

Common name	Species name	DAFOR	Notes
St John's wort	*Hypericum spp.*	Frequent	
Ragwort	*Senecio spp.*	Frequent	
Nipplewort	*Lapsana communis*	Frequent	
Bristly oxtongue	*Helminthotheca echioides*	Occasional	
Teasel	*Dipsacus fullonum*	Occasional	
Buddleia	*Buddleia davidii*	Occasional	Non-native invasive
Common fleabane	*Pulicaria dysenterica*	Occasional	
Blue fleabane	*Erigeron acer*	Rare	Dry grassland/calcareous grassland specialist
Fennel	*Foeniculum vulgare*	Rare	
Common hogweed	*Heracleum sphondylium*	Rare	
Red valerian	*Centranthus ruber*	Rare	Non-native invasive

Table: Flowering species recorded 23/08/2016

Pollinator survey results

Site surveyed 23rd August 2016

Species name	**Common name**	**Method**	**Notes**	**Type**
Pieris brassicae	Large white butterfly	Transect		Butterfly
Acronicta rumicis	Knotgrass moth	Transect	Larva	Moth
Aplocera plagiata	Treble-bar moth	Transect		Moth
Nowickia ferox	A parasitic fly	Transect	Parasite of the moth *Apamea monoglypha*	Other True Fly
Phania funesta	A parasitic fly	Transect	Parasite of shield bugs	Other True Fly
Sarcophaga sp.	A Flesh fly	Sweep		Other True Fly
Episyrphus balteatus	Marmalade hoverfly	Transect		Hoverfly
Eristalis arbustorum	Plain-faced dronefly	Transect		Hoverfly
Eristalis nemorum	Stripe-faced dronefly	Transect		Hoverfly
Eupeodes luniger	A hoverfly	Transect		Hoverfly
Helophilus pendulus	Common tiger hoverfly	Transect		Hoverfly
Melanostoma scalare	Chequered hoverfly	Sweep		Hoverfly

Myathropa florea	Batman hoverfly	Transect		Hoverfly
Paragus constrictus/tibialis	A hoverfly	Sweep		Hoverfly
Pipizella viduata	A hoverfly	Sweep	Dry grassland/bare ground specialist	Hoverfly
Platycheirus albimanus	White-footed hoverfly	Sweep		Hoverfly
Sphaerophoria scripta	Long hoverfly	Transect		Hoverfly
Syritta pipiens	Thick-legged hoverfly	Transect		Hoverfly
Syrphus ribesii	A hoverfly	Sweep		Hoverfly
Xanthogramma sp.	Ant-hill hoverfly	Transect	Associated with ant's nests	Hoverfly
Vespula vulgaris	Common wasp	Transect		Wasp
Andrena (Micrandrena) sp.	A Mini mining bee	Sweep		Bee
Apis mellifera	Honeybee	Transect		Bee
Bombus lucorum	White-tailed bumblebee	Transect	Male	Bee
Bombus pascuorum	Common carder bee	Transect		Bee
Adalia 7-punctata	7-spot ladybird	Transect		Beetle

The site supports a common assemblage of grassland pollinators, with certain hoverfly species indicating a generally bare or sparsely vegetated character (*Paragus sp., Xanthogramma sp.*)

Management recommendations

Management should aim to retain the early-successional character of the site, push back encroaching bramble and prevent the establishment of scrub. Martin Osman of Kier has confirmed the desire to turf strip and re-seed the area. It might be that natural regeneration is preferable to seeding as the area is likely to have strong seed bank and many of the characteristic ruderal species of disturbed or drought stress habitats are difficult to source commercially. Due to the early successional nature of the habitats, and the likely thin, low nutrient soils that the site supports, it is unlikely that significant topsoil stripping is likely to be required. Where material is scraped off, however, arisings could be re-used on site to create a network of bee banks so long as surface material with its higher nutrient and unfavourable seed bank is buried underneath subsoil material. These banks would effectively diversify the topography of the site, creating areas of level ground and south-facing slope that would enhance the site's value for thermophilic invertebrates and ground nesting bees and wasps. This would also provide different microclimates that would encourage a more diverse flora, benefiting a wider range of pollinators.

Early successional habitats such as sparsely vegetated ground are likely to suffer from raised soil fertility over time as a result of nitrogen deposition from vehicle fumes. This allows more dominant and often perennial vegetation to establish at the expense of nectar producing ruderals, and can cause the loss of bare ground. A site-wide mosaic of early successional habitats can be easily maintained using periodic disturbance management. New areas of bare ground can be created every few years either with machinery or with hand tools. New areas are then left unmanaged to gradually succeed, with creation of new areas over time ensuring that a variety of successional stages are maintained, supporting a more diverse flora and hence variety of pollinators.

Open drought stressed habitats can often be vulnerable to invasion by bramble and scrub. The open habitats would likely benefit from the cutting back of bramble, and the grubbing up of roots in areas of the site where it is only recently established. Bramble is likely to need addressing every couple of years, however, its spread can be controlled with targeted brush cutting.

The meadow areas of the site would benefit from the removal of non-native invasive Buddleia and Red valerian. Both are currently at low numbers so removal using pulling and hand tools at this stage should be straight forward and would avoid the impacts that dominant Buddleia can cause.

Survey Sites 70- M4 WB (93/7 - 95/7)

Habitat assessment

A 2000m long chalk verge, with both steep north-facing slopes and level grassland areas. The site is largely a mosaic of tall, species-poor grassland interspersed with extensive patches of Common nettle and bramble. Wildflower resources are quite limited, with forage often limited to Common ragwort, Creeping thistle, Wild carrot, Yarrow and Field bindweed (*Convolvulus arvensis*) which are able to compete with the fast growing grasses which dominate the verge.

The underlying calcareous influence isn't noticeable significantly in the site's flora, with Field scabious the sole indicator of the underlying calcareous soils. Differences in exposure, aspect, slope angle and probably the extent of underlying chalk have ensured a range of sward heights along various stretches, providing different vegetation structures which will likely enhance their value for a greater range of pollinators.

The rear of the verge includes long stretches of *Leylandii sp.* hedging and encroaching scrub including rose species. Ditches which were dry during the habitat assessment are also likely to be of value when wet, as breeding habitat for hoverflies with aquatic larvae and other pollinating flies.

Left: Open grass verges supporting a variety of sward heights and key forage species. Right: Nettle and bramble encroached rank grasslands © Chris Ayre

Common name	Scientific name	DAFOR	Notes
Common ragwort	*Senecio jacobaea*	Frequent	
Wild carrot	*Daucus carota*	Frequent	
Yarrow	*Achillea millefolium*	Frequent	
Field bindweed	*Convolvulus arvensis*	Frequent	
Field scabious	*Knautia arvensis*	Rare	Calcareous grassland plant. Sensitive to cutting.
Centaury	*Centaurium sp.*	Rare	Early-successional plant
Chicory	*Cichorium intybus*	Rare	Early-successional plant
Fennel	*Foeniculum vulgare*	Rare	
Other Yellow Asteraceae (Cat's-ear, Hawkbits, Hawkweeds)	*Asteraceae*	Rare	Host plants for *Cheilosia latifrons* on site

Table: Flowering species recorded 30/08/2016

Pollinator survey results

Site surveyed 30th August 2016

Species name	Common name	Method	Notes	Type
Closterotomus norwegicus	Potato capsid	Sweep		Hemiptera (True bugs)
Orthops basalis/kalmii	A Plant bug	Sweep	Reliant on umbellifers	Hemiptera (True bugs)
Orthops campestris	A plant bug	Sweep	Reliant on wild parsnip as larval foodplant	Hemiptera (True bugs)
Pieris brassicae	Large white butterfly	Transect		Butterfly
Dilophus febrilis	Fever fly	Sweep		Other True fly
Coenosia sp.	A muscid fly	Sweep		Other True fly
Orthellia sp.	A Green bottle	Sweep		Other True fly
Sarcophaga sp.	A Flesh fly	Sweep		Other True fly
Stomorhina lunata	Locust Blowfly	Transect	Parasite of grasshopper eggs	Other True fly
Cheilosia latifrons	Small hawkbit hoverfly	Sweep	Uses hawkbits and hawkbeards as larval foodplant	Hoverfly
Malanostoma mellinum	A hoverfly	Sweep		Hoverfly
Platycheirus rosarum	A hoverfly	Sweep		Hoverfly
Platycheirus scutatus	A hoverfly	Sweep		Hoverfly
Sphaerophoria scripta	Long hoverfly	Transect		Hoverfly
Syritta pipiens	Thick-legged hoverfly	Transect		Hoverfly
Bombus lapidarius	Red-tailed bumblebee	Transect		Bee
Bombus lucorum	White-tailed bumblebee	Transect	Male	Bee
Bombus pascuorum	Common carder bee	Transect		Bee
Lasioglossum albipes	Bloomed furrow bee	Transect		Bee
Lasioglossum leucopus	White-footed furrow bee	Sweep		Bee
Lasioglossum morio	Common green furrow bee	Sweep		Bee
Osmia spinulosa	Spined mason-bee	Sweep		Bee
Oedemera nobilis	Thick-legged flower beetle	Sweep		Beetle

Although the site lacks many characteristic calcareous flowering plants, the underlying chalk is having some influence on the site's invertebrate assemblage, indicated by the presence of two species with a chalk grassland association- the Spined mason-bee (*Osmia spinulosa*) and the Small hawkbit hoverfly (*Cheilosia latifrons*).

Management recommendations

The site's grasslands would benefit significantly from the introduction of a cutting regime. Rotational cutting in autumn and the removal of arisings will help to reduce the dominance of tall grasses over time, which are currently outcompeting the vast majority of flowering species. However, it is important that some areas of grassland are retained uncut every year to continue

providing structural variation and overwintering opportunities. These uncut areas are likely to be of value for the Spined mason bee (*Osmia spunulosa*) which although not rare, is characteristic of unmanaged calcareous environments where it will nest in snail shells within grass tussock leaf litter, feeding on yellow Asteraceae species. Uncut areas are also likely to provide nesting opportunities for the Common carder bee (*Bombus pascuorum*) and other bumblebees which will occupy small mammal holes. Uncut areas should not be focused on areas with extensive beds of Common nettle or bramble as this will only allow themselves to establish further.

Bramble and Common nettle banks are the biggest obstacle to enhancing the site for pollinators. Small patches can easily be targeted by removing the above ground vegetation and digging up the root systems. Larger extensive areas are likely to only be improved by the removal of significant areas of topsoil, possibly removing the top 50-100m of topsoil which will likely contain an unfavourable seed bank and a great deal of root material. The exposed underlying chalky soils will provide germination opportunities for many of the flowering species already recorded on site, as well as specialists of chalk habitat.

Ditches can be an extremely valuable habitat for pollinators, able to produce vast amounts of adult flies. The ditch itself was not visited here, but management should aim to diversify the ditch habitat to include some open and sunny areas and some sheltered by scrub and vegetation to create dark, humid conditions. This diversification should provide breeding conditions for a wider range of invertebrates. Should any ditch re-profiling or dredging work be undertaken, it would likely benefit from the slope angle being reduced to extend the draw down zone and provide a greater area of wet mud around margins which is favoured by many fly species.

Survey Site 91- M4 EB (95/7 - 93/7)

Habitat assessment

A patchwork of mostly tall rank grassland with bramble-dominated areas and some raised banks. Much of the verge is dominated by tall, species poor grassland only able to support more competitive species such as Common ragwort, Wild carrot, Field bindweed and Yarrow. Sections of the verge have now become extremely bramble dominated, with only very limited additional forage.

However, some long stretches of the verge with steep slopes have developed an early successional mosaic of shorter sward grassland and bare ground likely to be of value for a range of pollinators. Small amounts of scattered scrub here do provide some localised microclimate variation, but are a threat to the open habitat's persistence.

Mown areas around motorway infrastructure, along with occasional sparsely-vegetated gravel banks provide areas of early successional flora (e.g. Nipplewort, Common centaury) and bare substrate used by solitary bees and low-flying hoverflies.

Mosaic of short sward grasslands, bare ground and scattered scrub © Chris Ayre

Common name	Scientific name	DAFOR	Notes
Common ragwort	*Senecio jacobaea*	Frequent	

Wild carrot	*Daucus carota*	Frequent	
Yarrow	*Achillea millefolium*	Frequent	
Field bindweed	*Convolvulus arvensis*	Frequent	
Other Yellow Asteraceae (Cat's-ear, Hawkbits, Hawkweeds)	*Asteraceae*	Occasional	
Fennel	*Foeniculum vulgare*	Occasional	
Nipplewort	*Lapsana communis*	Occasional	Early successional plant
Field scabious	*Knautia arvensis*	Rare	Calcareous grassland plant. Sensitive to cutting.
Greater knapweed	*Centaurea scabiosa*	Rare	

Table: Flowering species recorded 30/08/2016

Pollinator survey results

Site surveyed 30th August 2016

Species name	Common name	Method	Notes	Type
Orthops basalis/kalmii	A Plant bug	Sweep	Reliant on umbellifers	Hemiptera (True bugs)
Pieris brassicae	Large white butterfly	Transect		Butterfly
Anthophila fabriciana	Nettle tap moth	Transect		Moth
Stomorhina lunata	Locust blowfly	Transect	Parasite of grasshopper eggs	Other True Fly
Cheilosia proxima	Common thistle-Cheilosia	Sweep		Hoverfly
Episyrphus balteatus	Marmalade hoverfly	Transect		Hoverfly
Melanogaster hirtella	A Hoverfly	Sweep		Hoverfly
Melanostoma scalare	A Hoverfly	Sweep		Hoverfly
Sphaerophoria sp.	A Hoverfly	Sweep		Hoverfly
Syritta pipiens	Thick-legged hoverfly	Transect		Hoverfly
Siphona sp.	A Parasitic fly	Sweep		Other True fly
Bombus lapidarius	Red-tailed bumblebee	Transect		Bee
Bombus pascuorum	Common carder bee	Transect		Bee
Bombus terrestris	Buff-tailed bumblebee	Transect		Bee
Oedemera nobilis	Thick-legged flower beetle	Sweep		Beetle

The site supports a common assemblage of grassland pollinator species.

Management recommendations

The key early successional mosaics of short sward grassland and bare ground are likely to be relatively self maintaining due to drought stress and thin soils making cutting unnecessary. However, it is essential that the majority of scrub is controlled to retain the site's invertebrate interest. Some scattered blocks of scrub should be retained to provide some microhabitat and structural variation, but the remainder should be cut as low to the ground as possible using hand tools and treated with a

herbicide to prevent regrowth. Should the resource of bare ground reduce significantly through succession, areas of topsoil could be stripped to expose the underlying low nutrient substrates.

The tall, species-poor grassland areas of Site 91 would benefit from an annual cut in autumn, with the arisings removed to drive down nutrient status. Topsoil stripping in these areas would provide some opportunity for an enhanced grassland strip with more forage to develop, however, this would have to be in extensive areas to prevent the dominant grasses from encroaching rapidly. Where brambles have been established, they should either be maintained to their current extent and kept in check with annual brush cutting. Should management want to remove large bramble banks, this will likely only be possible with extensive topsoil stripping and the grubbing up of roots. Bramble should not be allowed to establish in the more flower-rich, short sward grasslands, with young pioneer plants hand pulled and more mature stands cut and the roots grubbed out.

Where large clumps of scrub have established, making removal uneconomical, brush cutters could be used to scallop out sheltered, south-facing pockets which would retain a warm microclimate. This would also provide opportunities for tall competitive wildflowers such as Wild carrot and Common ragwort to establish and enhance the bramble banks.

Ower Depot

Habitat assessment

Wildflower grassland strips and banks in a motorway depot containing frequent wild carrot, common fleabane and Bristly ox-tongue. Adjacent pasture provides complementary habitat. There is invasion of Goat's rue in some areas as well as non-native Aquilegia (though the latter is favoured by long-tongued bumblebees). Pollinator records are limited due to the timing of the survey on a cool morning.

Left: Ruderal vegetation around disturbed and made up ground. Right: Less-forage rich areas of the depot © Chris Ayre

Grassy corners and verges within the depot with the potential for enhancements to benefit pollinators ©

Common name	Scientific name	DAFOR	Notes
Wild carrot	*Daucus carota*	F	Likely main foodplant for *Orthops kalmii* on site
Common fleabane	*Pulicaria dysenterica*	F	
Bristly oxtongue	*Helminthotheca echioides*	F	
Goat's rue	*Galega officinalis*	F	Non-native invasive
Common ragwort	*Senecio jacobaea*	O	
Centaury	*Centaurium sp.*	O	Early-successional plant
Bird's-foot trefoil	*Lotus corniculatus*	O	
Columbine	*Aquilegia sp.*	R	

Table: Flowering species recorded 31/08/2016

Pollinator survey results

Site surveyed 31st August 2016

Species name	Common name	Method	Notes	Type
Nabis ferus	Field damsel bug	Sweep		Hemiptera (True bugs)
Lygocoris pabulinus	Common green capsid	Sweep		Hemiptera (True bugs)
Orthops kalmii	A Plant bug	Sweep	Reliant on umbellifers	Hemiptera (True bugs)
Coenosia tigrina	A fly	Sweep		Other True Fly
Lucillia sericata	A Green bottle	Sweep		Other True Fly
Neomyia caesaria	A Green bottle	Sweep		Other True Fly
Melanostoma mellinum	A Hoverfly	Sweep		Hoverfly

Management recommendations

Management should include a late-summer cut to suppress grasses whilst maintaining wild carrot and fleabane. Goat's rue should be removed (e.g. by hand-pulling). The value of the site for pollinators could be improved by turf-stripping a sunny, south-facing area to provide nesting habitat for solitary bees.

Survey limitations and recommendations for future survey and monitoring

The pollinator surveys undertaken on each site were restricted to a single day in late August, with all visits under 2 hours. This inevitably means that the pollinator records provide only a very brief snapshot of a site's interest, with all spring, early summer or autumn interest overlooked. Indeed some sites were visited on cool and wet days, making it even less likely that scarce pollinator species would be recorded, with many being thermophilic so likely to be seeking shelter in inclement weather. The nature of the visits also limited the methods which could be used to survey, with no time available for pan traps which would likely provide useful additional data.

As a result of the limited survey, only very general assessments can be made of the individual value of a site for pollinators, with the exception of chalk sites where associated species such as the Chalk hill blue and Straw belle moth were recorded.

To better understand the value of the key verge sites, it is advised that more in depth surveys are carried out across the active survey season, from April until September to fully assess the site's value for pollinators. This would utilise both active methods such as sweeping and active searches alongside passive trapping techniques such as pan traps. Ideally any full surveys should be undertaken in advance of changes to site management, to provide a proper baseline to which monitoring can be compared.

Should any of the suggested management prescriptions be adopted, monitoring is an essential tool to understand the success of the habitat work and to allow for fine-tuning to further improve management. Vegetation monitoring would help to assess the improvements to a site's forage resource, particularly where advice includes activities such as wildflower seeding (to assess the establishment of introduced species), topsoil stripping or scrape creation (to assess colonisation or natural regeneration) or scrub clearance (to examine whether the grassland is increasing in floristic diversity).

Fixed point photographs may be a useful tool for monitoring, particularly due to the ease of identifying points if milemarker posts are used. If images are captured at similar times of year, it will provide a useful visual comparison where scrub has been cleared or where sward enhancement is a key aim of management.

Invertebrate monitoring would best be undertaken 2 and 5 years after the initial habitat work, to provide sufficient time for seeded species to establish, existing vegetation to improve and for invertebrates to identify and utilise new habitat resources. The results of the second year surveys can then be used to identify any potential management which needs to be introduced early on to help direct habitats in the desired direction for pollinators.

Appendix 1: Area 3 site rankings

Survey Site number	Site name	Potential size of habitat creation (1-low, 5-high)	Quality of existing habitat (1-low, 5-high)	Quality of connective habitat (1-low, 5-high)	Diversity of habitat mosaic (1-low, 5-high)	Impact on existing invertebrate ecology (1-high, 5-low)	Score	Rank
5	**A3 Surrey Milford interchange**	3	3	5	3	4	18	1
9	**M27 EB (20/8 - 23/0)**	4	4	3	4	3	18	1
23	**A303 EB (108/0 - 107/6)**	3	2	5	4	4	18	1
24	**A303 Picket 20 (106/9 - 106/2)**	3	2	5	4	4	18	1
42	**A34 NB (28/9 - 29/6)**	3	5	4	3	2	17	2
64	**A404M (45/8 - 45/1)**	3	2	4	4	4	17	2
20	**A31 WB (20/6 - 21/3)**	2	5	4	3	2	16	3
40	**A34 NB (13/8 - 15/1)**	4	2	4	4	2	16	3
50	**A34 NB (77/5 - 77/8)**	3	2	5	3	3	16	3
54	**A34 SB (77/5 - 77/5)**	3	2	5	3	3	16	3
60	**A34 SB (16/3 - 13/8)**	4	2	4	4	2	16	3
61	**A34 SB (11/0 - 10/6)**	4	2	4	4	2	16	3
62	**A404 NB (57/3 - 58/2)**	5	2	3	3	3	16	3
63	**A404 SB (45/8 - 45/1)**	5	2	3	3	3	16	3
70	**M4 WB (93/7 - 95/7)**	4	2	4	3	3	16	3
91	**M4 EB (95/7 - 93/7)**	4	2	4	3	3	16	3
52	**A34 NB (88/5 - 89/3)**	4	2	4	3	2	15	4
53	**A34 SB (89/2 - 88/5)**	4	2	4	3	2	15	4
21	**A303 EB (120/4 - 120/8)**	3	2	4	3	2	14	5
22	**A303 EB (110/4 - 109/7)**	2	2	4	3	3	14	5
29	**A303 WB (107/4 - 108/4)**	2	2	4	3	3	14	5
41	**A34 C RES (15/1 - 16/3)**	3	2	4	3	2	14	5
45	**A34 NB (60/0 - 60/9)**	3	2	4	3	2	14	5
83	**M4 EB (115/6 - 113/7)**	5	2	2	3	2	14	5
2	**A3 Surrey NB (24/5 - 23/5)**	2	5	1	1	4	13	6

8	**M27 EB (27/5 - 27/9)**	2	2	2	3	4	13	6
13	**A31 EB (32/9 - 32/6)**	2	2	3	3	3	13	6
14	**A31 EB (34/1 - 33/3)**	3	2	3	2	3	13	6
18	**A31 WB (33/3 - 34/1)**	3	2	3	2	3	13	6
25	**A303 EB (104/9 - 104/0)**	3	2	3	3	2	13	6
30	**A303 WB (104/2 - 104/9)**	3	2	3	3	2	13	6
34	**M3 SB (83/1 - 84/2)**	3	2	3	2	3	13	6
36	**M3 SB (84/0 - 83/1)**	3	2	3	2	3	13	6
66	**M4 WB (75/4 - 76/1)**	3	2	3	1	4	13	6
75	**M4 WB (114/2 - 115/5**	5	2	2	2	2	13	6
82	**M4 EB (115/6 - 113/7)**	5	2	2	3	2	13	6
1	**A27 EB (50/7 - 51/7)**	2	3	2	1	4	12	7
10	**M27 EB (7/1 - 7/6)**	2	2	2	2	4	12	7
11	**M27 WB (7/7 - 7/9)**	2	2	2	2	4	12	7
12	**M27 WB (22/5 - 21/9)**	2	2	2	2	4	12	7
19	**A31 WB (32/6 - 32/9)**	2	2	3	2	3	12	7
37	**M3 NB (81/5 - 81/2)**	2	2	4	2	2	12	7
76	**M4 WB (118/2 - 120/1)**	4	2	2	2	2	12	7
94	**M4 EB (88/1- 87/8)**	3	2	3	2	2	12	7
4	**A3 Surrey SB (22/7 - 23/5)**	2	2	1	1	4	10	8
7	**M27 EB (33/6 - 34/3)**	2	2	2	2	2	10	8
26	**A303 EB (102/4 - 101/4)**	2	2	2	2	2	10	8
31	**A303 WB (101/4 - 102/4)**	2	2	2	2	2	10	8
80	**M4 EB (120/1 - 119/7)**	2	2	2	2	2	10	8
81	**M4 EB (119/6 - 118/2)**	2	2	2	2	2	10	8
90	**M4 EB (99/4 - 98/8)**	2	2	2	2	2	10	8
27	**A303 EB (90/3 - 90/7)**	1	2	2	2	1	9	9
59	**A34 SB (28/0 - 27/3)**	2	2	3	1	1	9	9
71	**M4 WB (101/2 - 101/4)**	1	2	2	2	2	9	9
94	**M4 EB (88/1 - 87/8)**	2	2	2	2	1	9	9

Appendix 2: Non-assessed site list

Survey Site 3- A3 Surrey SB (20/0 – 21/4): Already open grassland

Survey Site 6- A3 Hants SB (3/7 – 2/4): Unsuitable

Survey Site 15- A31 EB (40/1 – 40/3): Unsuitable

Survey Site 16- A31 WB (40/3 – 40/1): Not suitable for management

Survey Site 17- A31 WB (35/3 -): Management for pollinators already initiated

Survey Site 28- A303 WB (109/7 – 110/4): No sightlines for traffic

Survey Site 32- M3 SB (60/9 – 63/5): Unsuitable

Survey Site 33- M3 SB (79/6 – 80/7): Unsuitable

Survey Site 35 – M3 SB (86/6 – 87/0): Heavily wooded

Survey Site 37- M3 NB (81/5 – 81/2): Martin Osman confirmed management regime will be changed without assessment

Survey Site 38- M3 NB (66/7 – 65/5): Very thin verge

Survey Site 39- M3 NB (63/5 – 60/9): Heavily wooded

Survey Site 43- A34 NB (57/1 – 58/1): Unsuitable

Survey Site 44- A34 NB (58/7 – 59/6): Unsuitable

Survey Site 46- A34 NB (67/6 – 69/6): Already open grassland

Survey Site 47- A34 NB (70/6 – 71/8): Already open grassland

Survey Site 48- A34 NB (73/7 – 75/2): Already open grassland

Survey Site 49- A34 NB (75/2- 76/5): Heavily wooded

Survey Site 51- A34 SB (69/8 – 67/6): Already open grassland

Survey Site 56- A34 SB (60/9 – 60/0): Unsuitable

Survey Site 57- A34 SB (59/6 – 58/7): Unsuitable

Survey Site 58- A34 SB (37/6 – 36/8): Unsuitable

Survey Site 59- A34 SB (28/0 – 27/3): Martin Osman confirmed management regime will be changed without assessment

Survey Site 65- A308M WB (start – end): Unsuitable

Survey Site 67- M4 WB (78/4 – 79/5): Heavily wooded

Survey Site 68- M4 WB (85/9 – 86/6): Heavily wooded

Survey Site 69- M4 WB (92/9 – 93/7): Wooded plus containing established meadows

Survey Site 72- M4 WB (103/9 – 104/9): Already wildflower-rich

Survey Site 73- M4 WB (107/5 – 108/5): Afforested with young trees

Survey Site 74- M4 WB (110/5 – 111/3): Difficult terrain

Survey Site 77- M4 WB (120/2 – 122/9): Already wildflower-rich

Survey Site 78- M4 EB (122/8 – 121/2): Already wildflower-rich

Survey Site 79- M4 EB (121/2 – 120/2): Already wildflower-rich

Survey Site 84- M4 EB (109/7 – 108/5): Heavily wooded plus containing established meadows

Survey Site 85- M4 EB (108/5 – 107/5): Heavily wooded

Survey Site 86- M4 EB (106/0 – 105/0): Wooded and undergoing ragwort treatment

Survey Site 87- M4 EB (104/5 – 103/9): Existing grassland

Survey Site 88- M4 EB (103/3 – 102/7): Heavily wooded and possible Dormouse (*Muscardinus avellanarius*) habitat

Survey Site 89- M4 EB (101/4 – 100/1): Heavily wooded

Survey Site 92- M4 EB (93/7 – 92/9): Heavily wooded

Survey Site 95- M4 EB (86/6 – 85/9): Dormouse habitat

Survey Site 96- M4 EB (83/7 – 83/0): Heavily wooded

Survey Site 97- M4 EB (79/5 – 78/4): Heavily wooded

Survey Site 98- M4 EB (78/4 – 76/8): Heavily wooded

Survey Site 99- M4 EB (76/4 – 75/4): Heavily wooded

Appendix 3: Complete list of recorded pollinating species

Species name	Common name	Method	Notes	Type
Nabis ferus	Field damsel bug	Sweep		Hemiptera (True bugs)
Nabis rugosus	Common damsel bug	Sweep		Hemiptera (True bugs)
Acronicta rumicis	Knotgrass moth	Transect	Larva	Moth
Adalia 7-punctata	7-spot ladybird	Transect		Beetle
Adelphocoris lineolatus	Lucerne bug	Sweep		Hemiptera (True bugs)
Aglais io	Peacock butterfly	Transect		Butterfly
Aglais urticae	Small tortoiseshell butterfly	Transect		Butterfly
Andrena (Micrandrena) sp.	A Mini mining bee	Sweep		Bee
Anthophila fabriciana	Nettle tap moth	Transect		Moth
Apis mellifera	Honeybee	Transect		Bee
Aplocera plagiata	Treble-bar moth	Transect		Moth
Aspitates gilvaria	Straw belle moth	Transect	**Section 41 Priority species**. Chalk grassland specialist.	Moth
Athalia rosae	Turnip sawfly	Sweep		Sawfly
Auographa gamma	Silver Y moth	Transect		Moth
Bombus hypnorum	Tree bumblebee	Transect		Bee
Bombus lapidarius	Red-tailed bumblebee	Transect		Bee
Bombus lucorum	White-tailed bumblebee	Transect	Male	Bee
Bombus pascuorum	Common carder bee	Transect		Bee
Bombus terrestris	Buff-tailed bumblebee	Transect		Bee
Cheilosia bergenstammi	Ragwort Cheilosia	Sweep	Localised. Uses ragwort as larval host plant	Hoverfly
Cheilosia impressa	Burdock Cheilosia	Sweep	Reliant on Burdocks as larval foodplant. Adults nectar on umbellifers.	Hoverfly
Cheilosia latifrons	Small hawkbit hoverfly	Sweep	Uses hawkbits and hawkbeards as larval foodplant	Hoverfly
Cheilosia proxima	Common thistle-Cheilosia	Sweep		Hoverfly
Cheilosia vulpina	Vulpine Cheilosia	Sweep		Hoverfly

Chrysotoxum bicinctum	Yellow-belted hoverfly	Transect		Hoverfly
Cilix glaucata	Chinese character moth	Transect		Moth
Closterotomus norwegicus	Potato capsid	Sweep		Hemiptera (True bugs)
Coenosia sp.	A muscid fly	Sweep		Other True fly
Coenosia tigrina	A fly	Sweep		Other True Fly
Colletes sp.	Plasterer bee	Transect		Bee
Dilophus febrilis	Fever fly	Sweep		Other True Fly
Epirrhoe alternata	Common carpet moth	Transect		Moth
Epistrophe grossulariae	A Hoverfly	Sweep		Hoverfly
Episyrphus balteatus	Marmalade hoverfly	Transect		Hoverfly
Eriothrix rufomaculata	A parasitic fly	Transect		Other true fly
Eristalis arbustorum	Plain-faced dronefly	Transect		Hoverfly
Eristalis nemorum	Stripe-faced dronefly	Transect		Hoverfly
Eristalis tenax	Common drone fly	Transect		Hoverfly
Eumerus strigatus		Sweep		Hoverfly
Eupeodes corollae	A hoverfly	Transect		Hoverfly
Eupeodes luniger	A hoverfly	Transect		Hoverfly
Eurithia anthophila	A parasitic fly	Transect		Other true fly
Fannia sp.	A muscid fly	Sweep		Other True Fly
Gonepteryx rhamni	Brimstone butterfly	Transect		Butterfly
Halictus tumulorum	Bronze furrow bee	Sweep		Bee
Helophilus pendulus	Common tiger hoverfly	Transect		Hoverfly
Helophilus trivittatus	Large tiger hoverfly	Transect		Hoverfly
Himacerus mirmicoides	Ant damsel bug	Sweep		Hemiptera (True bugs)
Lasioglossum albipes	A furrow bee	Sweep		Bee
Lasioglossum albipes/calceatum	A Furrow bee	Transect		Bee
Lasioglossum leucopus	White-footed furrow bee	Sweep		Bee

Lasioglossum morio	Common green furrow bee	Sweep		Bee
Lucillia sericata	A Green bottle	Sweep		Other True Fly
Lucillia sp.	A Green bottle	Sweep		Other True Fly
Lygocoris pabulinus	Common green capsid	Sweep		Hemiptera (True bugs)
Malanostoma mellinum	A hoverfly	Sweep		Hoverfly
Maniola jurtina	Meadow brown butterfly	Transect		Butterfly
Melanogaster hirtella	A Hoverfly	Sweep		Hoverfly
Melanostoma mellinum	A Hoverfly	Sweep		Hoverfly
Melanostoma scalare	A hoverfly	Sweep		Hoverfly
Merzomyia westermanni	A Picture-winged fly	Sweep	Local. Larval foodplant is Ragworts (usually Hoary ragwort).	Other True Fly
Microdynerus exilis	A Potter wasp	Sweep	**Scarce (Nb)**	Wasp
Myathropa florea	Batman hoverfly	Transect		Hoverfly
Nabis limbatus	Marsh damsel bug	Sweep		Hemiptera (True bugs)
Neomyia caesaria	A Green bottle	Sweep		Other True Fly
Nomada flavoguttata	Small nomad bee	Transect		Bee
Nowickia ferox	A parasitic fly	Transect	Parasite of the moth *Apamea monoglypha*	Other True Fly
Oedemera lurida	A flower beetle	Sweep		Beetle
Oedemera nobilis	Thick-legged flower beetle	Sweep		Beetle
Orthellia sp.	A Green bottle	Sweep		Other True Fly
Orthops basalis	A Plant bug	Sweep	Reliant on umbellifers. Locally common	Hemiptera (True bugs)
Orthops kalmii	A Plant bug	Sweep	Reliant on umbellifers	Hemiptera (True bugs)
Orthops campestris	A plant bug	Sweep	Reliant on wild parsnip as larval foodplant	Hemiptera (True bugs)
Orthops kalmii	A Plant bug	Sweep	Reliant on umbellifers	Hemiptera (True bugs)
Osmia spinulosa	Spined mason-bee	Sweep		Bee
Paragus constrictus/tibialis	A hoverfly	Sweep		Hoverfly
Paragus	A Hoverfly	Sweep		Hoverfly

haemorrhous				
Pararge aegeria	Speckled wood butterfly	Transect		Butterfly
Phania funesta	A parasitic fly	Transect	Parasite of shieldbugs	Other True Fly
Phytocoris varipes	A Plant bug	Sweep		Hemiptera (True bugs)
Pieris brassicae	Large white butterfly	Transect		Butterfly
Pipizella viduata	A hoverfly	Sweep	Dry grassland/bare ground specialist	Hoverfly
Platycheirus albimanus	White-footed hoverfly	Sweep		Hoverfly
Platycheirus rosarum	A hoverfly	Sweep		Hoverfly
Platycheirus scutatus	A hoverfly	Sweep		Hoverfly
Polyommatus coridon	Chalk hill blue butterfly	Transect	Chalk grassland specialist. Reliant on growth of Horseshoe Vetch on the sparsely-vegetated bank. Listed as a 'Medium' conservation priority species by Butterfly Conservation.	Butterfly
Pyrausta aurata	Mint moth	Transect	Wild marjoram is main larval and adult foodplant on site.	Moth
Rhagonycha fulva	Common red soldier beetle	Transect		Beetle
Rhingia campestris	Common snout-hoverfly	Transect		Hoverfly
Sarcophaga carnaria	A Flesh fly	Sweep		Other True Fly
Sarcophaga sp.	A Flesh fly	Sweep		Other True Fly
Siphona sp.	A Parasitic fly	Sweep		Other True fly
Sphaerophoria scripta	Long hoverfly	Transect		Hoverfly
Sphaerophoria sp.	A Hoverfly	Sweep		Hoverfly
Sphenella marginata	A picture-winged fly	Sweep	Reliant on Ragwort as larval foodplant	Other true fly
Stomorhina lunata	Locust Blowfly	Transect	Parasite of grasshopper eggs	Other True fly
Syritta pipiens	Thick-legged hoverfly	Transect		Hoverfly
Syrphus ribesii	Humming syrphus	Sweep		Hoverfly
Tenthredo notha	A sawfly	Sweep	Female	Sawfly
Tenthredo marginella	A Sawfly	Transect		Sawfly
Tiphia femorata	A solitary wasp	Transect	Largely dependant on wild carrot on site	Wasp
Vanessa atalanta	Red admiral butterfly	Transect		Butterfly

Vespula vulgaris	Common wasp	Transect		Wasp
Xanthogramma sp.	Ant-hill hoverfly	Transect		Hoverfly
Xanthoroe fluctuata	Garden carpet moth	Transect		Moth
Xylota segnis	A Hoverfly	Transect		Hoverfly
Zygaena filipendulae	Six-spot burnet moth	Transect		Moth

Appendix 4: Incidental non-pollinator records

Date	Survey site	Species name	Common name	Method	Type	Notes
23/08/2016	64	*Misumena vatia*	Flower crab spider	Sweep	Spider (Araneae)	
23/08/2016	64	*Anax imperator*	Emperor dragonfly	Transect	Dragonfly (Odonata)	
23/08/2016	64	*Pentatoma rufipes*	Red-legged shieldbug	Sweep	True bug (Hemiptera)	
23/08/2016	64	*Propylea quatuordecimpunctata*	14-spot ladybird	Sweep	Beetle (Coleoptera)	
23/08/2016	64	*Psyllobora vigintiduopunctata*	22-spot ladybird	Sweep	Beetle (Coleoptera)	
24/08/2016	24	*Misumena vatia*	Flower crab spider	Sweep	Spider (Araneae)	
24/08/2016	24	*Araneus diadematus*	Garden spider	Sweep	Spider (Aranae)	
24/08/2016	24	*Metrioptera roeselii*	Roesel's bush cricket	Transect	Cricket or Grasshopper (Orthoptera)	
24/08/2016	24	*Chorthippus brunneus*	Field grasshopper	Transect	Cricket or Grasshopper (Orthoptera)	
24/08/2016	24	*Dolycoris baccarum*	Hairy shieldbug	Sweep	True bug (Hemiptera)	
24/08/2016	24	*Anthomyza gracilis*	An Anthomyzid fly	Sweep	True fly (Diptera)	
24/08/2016	24	*Minettia tabidiventris*	A Lauxaniid fly	Sweep	True fly (Diptera)	
24/08/2016	24	*Opomyza germinationus*	A Picture-winged fly	Sweep	True fly (Diptera)	Larvae live in grass stems
24/08/2016	24	*Pherbellia cinerella*	A Snail-killing fly	Sweep	True fly (Diptera)	Larvae parasitise snails
24/08/2016	24	*Psyllobora vigintiduopunctata*	22-spot ladybird	Sweep	Beetle (Coleoptera)	
24/08/2016	24	*Propylea quatuordecimpunctata*	14-spot ladybird	Sweep	Beetle (Coleoptera)	
24/08/2016	24	*Harmonia axyridis*	Harlequin ladybird	Sweep	Beetle (Coleoptera)	
24/08/2016	23	*Misumena vatia*	Flower crab spider	Sweep	Spider (Araneae)	

24/08/2016	23	*Araneus diadematus*	Garden spider	Sweep	Spider (Araneae)	
24/08/2016	23	*Araneus quadratus*	Four-spot orb weaver	Transect	Spider (Araneae)	Localised. Rough grassland specialist
24/08/2016	23	*Hypsosinga sp.*	An orb weaver	Transect	Spider (Araneae)	Rough grassland/heathland specialist
24/08/2016	23	*Dolycoris baccarum*	Hairy shieldbug	Sweep	True bug (Hemiptera)	
24/08/2016	23	*Palomena prasina*	Common green shieldbug	Sweep	True bug (Hemiptera)	
24/08/2016	23	*Anthomyza gracilis*	An Anthomyzid fly	Sweep	True fly (Diptera)	
24/08/2016	9	*Misumena vatia*	Flower crab spider	Sweep	Spider (Araneae)	
24/08/2016	9	*Araneus diadematus*	Garden spider	Transect	Spider (Araneae)	
25/08/2016	34	*Anthomyza gracilis*	An Anthomyzid fly	Sweep	True fly (Diptera)	
25/08/2016	34	*Geomyza tripunctata*	A Picture-winged fly	Sweep	True fly (Diptera)	
25/08/2016	36	*Meromyza sp.*	A grass fly	Sweep	True fly (Diptera)	Larvae develop in grass stems
25/08/2016	36	*Cephalops sp.*	A Big-headed fly	Sweep	True fly (Diptera)	Parasite of leafhoppers
25/08/2016	5	*Pisaura mirabilis*	Nursery-web spider	Sweep	Spider (Araneae)	
25/08/2016	5	*Aelia acuminata*	Bishops mitre	Sweep	True bug (Hemiptera)	Rough grassland specialist
25/08/2016	5	*Sapromyza sexpunctata*	A Lauxaniid fly	Sweep	True fly (Diptera)	
30/08/2016	70	*Opomyza germinationus*	A Picture-winged fly	Sweep	True fly (Diptera)	
31/08/2016	Ower Depot	*Opomyza germinationus*	A Picture-winged fly	Sweep	True fly (Diptera)	
31/08/2016	Ower Depot	*Pherbellia cinerella*	A Snail-killing fly	Sweep	True fly (Diptera)	Larvae parasitise snails
31/08/2016	55	*Herina lugubris*	A Picture-winged fly	Sweep	True fly (Diptera)	
31/08/2016	55	*Opomyza germinationis*	A Picture-winged fly	Sweep	True fly (Diptera)	

Contact us: Buglife Services, Bug House, Ham Lane, Orton Waterville, Peterborough, PE2 5UU

www.buglife.org.uk/buglife-services

Tel: 01733 201210

Email: Services@buglife.org.uk

#BuglifeCo

Photo credits L-R; Ladybird spider *(Eresus sandaliatus)* © S. Dalton, Jellyfish © D. Huffman, Tansy beetle (*Chrysolina graminis*) © S. Falk and Large garden bumblebee (*Bombus ruderatus*) © S. Falk

Buglife Services is the trading company subsidiary of the charity Buglife
VAT registered: 203 4910 46, Company No: 4132695