



Invertebrate Survey of the A30 and A38 road verges in Area 1 (Cornwall and Devon)

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Executive summary

- Between late May and late August 2015, Buglife Services carried out an invertebrate survey of the A30 and A38 in Devon and Cornwall. 41 visits to 23 sample points were undertaken on the A30 and 25 visits to 18 sampling points were undertaken on the A38, and a range of invertebrate groups were targeted.
- 866 taxa were recorded, the list being dominated by flies (361), beetles (177), butterflies & moths (109), bugs (82), bees, ants & aculeate wasps (53), spiders & harvestmen (50), grasshoppers & crickets (11) and dragonflies & damselflies (11). Pitfall trapping (not permitted) would have extended the beetle and bug lists greatly.
- The list included a number of rare and scarce species (notably the tachinid fly *Policheta unicolor* and lygaeid bug *Trapezonotus ullrichi*) and seemingly the first SW England record for the Southern oak bush-cricket (*Meconema meridionalis*) which is a recent British colonist.
- The richest sites were 24, 30 and 7b; sites 24 and 30 produced the best fly lists; sites 7 and 33 produced the best butterfly lists, site 22 produced the best bee lists and site 7b produced the best dragonfly list.
- The list reveals the tremendous variety of life cycle strategies and other ecological relationships associated with road verge invertebrates. Pollinators are very well represented within the species list.
- The list and sample sizes reveal the strong influence of surrounding habitat, geographic location, altitude and underlying geology/ground conditions. There is a discernible 'Bodmin Moor effect' (decreased abundance and diversity of thermophilic invertebrates with altitude) and a strong 'South Dartmoor effect' (increased abundance and diversity of thermophilic invertebrates on the A38 east of Dartmoor).
- The influence of road verge type could also be detected – narrow road verges are usually less productive than broader ones (pre-cutting), and sunny, south-facing verges have more thermophilic species and often greater overall value than shaded north-facing ones.
- The value of specific flowers for pollinators was observed, notably Hogweed *Heracleum sphondylium* (and any other umbellifers), thistles *Cirsium* and *Carduus*, Common ragwort *Senecio jacobaea*, Common knapweed *Centaurea nigra*, Hemp agrimony *Eupatorium cannabinum*, brambles *Rubus* spp., dandelions *Taraxacum* spp., Catsear *Hypochaeris radicata*, Oxeye daisy *Leucanthemum vulgare*, willowherbs *Epilobium* and *Chamerion* spp., Teasel *Dipsacus fullonum*, bird's-foot trefoils *Lotus* spp., clovers *Trifolium* spp., Black medick *Medicago lupulina* and vetches *Vicia* spp..
- The impact of extensive vegetation cutting was noted and it was felt that this could be modified in many places to avoid cutting verges at their flowering peaks or cutting too much of a verge in one go.
- The special role of conservation areas and other land packages within the control of Highways England was noted – these are opportunities to promote high quality grassland and wetland habitats with high quality invertebrate assemblages. There is also much scope to use conservation areas and wider verges to create stepping stones and better ecological linkages using the road network.

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). Government expects Highways England to support the objectives of Biodiversity2020 (the Government's strategy for biodiversity and ecosystem services) and in particular the National Pollinator Strategy, as well as wider environmental and ecological policy.

Buglife Services was commissioned in the spring of 2015 to carry out an initial investigation of assorted road verges alongside the A30 and A38 west of Exeter (Highways Agency Area 1). The objectives were to:

- assemble species lists to understand what sorts of invertebrates occur along verges and what range of lifecycle requirements are represented
- identify the presence of any rare or unusual species
- understand seasonality issues
- examine the impacts of cutting
- examine the impacts of other factors such as geographic locations and associated altitude, exposure and soil type
- better understand the interplay between road verges and adjacent/nearby habitats
- better understand the role of individual microhabitats, plant species and other road verge features in supporting invertebrate diversity

Methods

41 sites were covered, 23 along the A30 (a longer road) and 18 along the A38. 25 sites were surveyed twice, the remainder once. This meant that the A30 had 41 visits, and the A38 had 25 visits, making a total of 66 visits. Survey dates extended from 26 May until 28 August. Where both sides of the highway were covered, these were treated as separate sites e.g. 2a and 2b. Sites were selected with the aim to get a representative picture of roadside habitats along the A30 and A38 west of Exeter. Selected sites included areas of rank grassland, scrub, species rich grassland, rock and scree and bare ground.

Access and health and safety restrictions meant that sample areas needed to be served by nearby laybys or junctions (for parking) and no crossing of the active dual carriageway was possible. This meant that site selection was more complicated than seeing a good-looking stretch of road verge and selecting it for surveying, as many such verges are some distance from laybys or junctions. Roundabouts and broader central reservations could not be surveyed and surveying opposite sides of road verges needed to be done independently, often on different days. The aim was to survey three sites per day between 09.30am and 16.30 with minimal time lost to driving, parking or walking between sites.

Some sites were surveyed once, others twice. This was because it was only through the first set of visits to the 41 sites that the time and mileage cost implications of repeat visits could be judged, and it was clear that the budget would not stretch to 88 visits. So repeat visits were made to 25 sites, selecting these from along both roads.

Survey techniques included:

- i) sweeping and spot capture with a long handled insect net with transfer of material to a pooter, tubes or a killing jar (20-30 minutes)
- ii) sweeping with a heavy duty sweep net and transfer of material to a pooter, tubes or a killing jar (20-30 minutes)
- iii) checking elevated foliage with a beating tray and transfer of material to a pooter, tubes or a killing jar (20-30 minutes)
- iv) grubbing on the ground and amongst low vegetation and transfer of material to a pooter, tubes or a killing jar (20-30 minutes)
- v) visual observation during the above operations and listing species in a notebook
- vi) the use of pheromone lures for certain moths, seeing if any moths would be attracted during the 2 hour visit.

Each visit lasted 2 hours and was carried out in reasonably good to fine weather conditions above 15 degrees Celsius, avoiding wet, cool, foggy, excessively cloudy or excessively windy days. The use of pitfall traps was not permitted due to restrictions covering digging along road verges (which can contain utility cables at shallow depths).

Surveys concentrated on invertebrate groups that were more easily recorded and identified rather than attempting fully comprehensive coverage which would have generated a sample beyond the available budget. These groups were flies (Diptera), beetles (Coleoptera), bugs (Hemiptera, but not aphids and their allies), moths and butterflies (Lepidoptera), bees, ants and aculeate wasps (aculeate Hymenoptera), grasshoppers and crickets (Orthoptera), dragonflies and damselflies (Odonata), earwigs (Dermaptera), scorpion flies (Mecoptera), spiders and harvestmen (Arachnida), woodlice (Isopoda) and centipedes and millipedes (Myriapoda).

The need to pre-book each site visit (to ensure signage was put up) and to bundle up visits restricted freedom to switch between different parts of the network at short notice. Hence, the A30 had better early summer coverage

than the A38. Surveying of the latter did not start until mid-July and was rather blighted by cutting. Surveying and field identification was carried out by Mark Tunmore. Identification of invertebrate samples was carried out by Steven Falk, Mark Tunmore, Steve Lane and Chris Ayre. Report production was by Steven Falk.

The sites surveyed with precise grid references and dates of surveying are given in Appendix 2 (Site descriptions). Their location is shown in Fig 1.

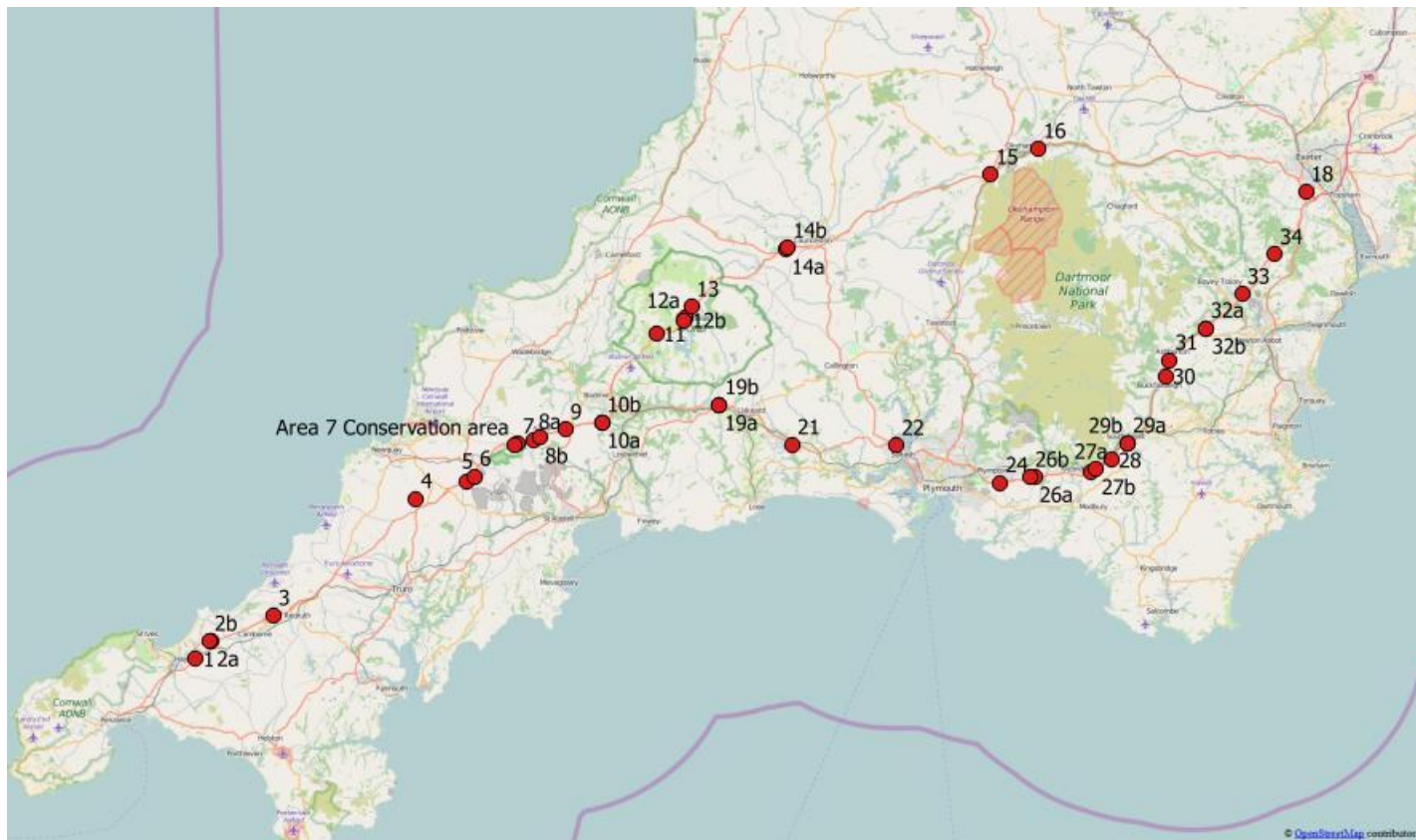


Fig. 1 Map showing the locations of the 41 sites. Sites 1-18 are located on the A30, sites 19-34 on the A38.

Results

866 taxa have been identified and are listed in Appendix 3. This includes 361 flies, 177 beetles, 109 butterflies and moths (of which 24 are butterflies), 82 bugs, 53 bees, ants and aculeate wasps (of which 31 are bees), 50 spiders and harvestmen (Arachnida), 11 grasshoppers and crickets, 11 dragonflies and damselflies (Odonata), 5 woodlice (Isopoda), 2 scorpion flies (Mecoptera), 2 earwigs (Dermaptera) and 1 lacewing (Neuroptera – a non-targeted group, so not representative).

The most productive visits were from survey sites 24 (103 species on 25 July), 30 (99 taxa on 28 August and 98 taxa on 25 July), 7 Conservation area (97 taxa on 6 August) and 22 (94 taxa on 31 July). These were the only sites to produce 90-plus species on a single visit. The least productive visits were from sites 21 (29 taxa on 30 July), 10b (32 taxa on 15 July), 2b (34 taxa on 11 August) and 33 (36 taxa on 28 August). The precise numbers of taxa for individual invertebrate groups can be seen in Table 1 and Appendix 3, but the following headlines are worth flagging:

- Site 24 produced the longest list from a single visit (103 species)
- Sites 7 and 33 produced the best butterfly lists (11 species)
- Site 22 produced the best bee list (11 species)
- Site 7b produced the best dragonfly/damselfly list (7 species)

Sixteen species with rarity statuses were recorded:

Acanthiophilus helianthi (Nationally Scarce) – a picture-winged fly

Acinia corniculata (Endangered) – a picture-winged fly

Barypeithes sulcifrons (Nationally Scarce) a weevil

Dioxyna bidentis (Nationally Scarce) – a picture-winged fly

Lasiochaeta pubescens (Nationally Scarce) – a chloropid fly

Lathrobium pallidipenne (Nationally Scarce) - a rove beetle

Leptura aurulenta (Nationally Scarce) – Golden-haired longhorn beetle

Longitarsus rutilus (Nationally Scarce) – a flea beetle

Megalonotus dilatatus (Nationally Scarce) – a ground bug

Meligethes fulvipes (Nationally Scarce) – a pollen beetle

Microdon myrmicae (Nationally Scarce) - a hoverfly

Policheta unicolor (Near Threatened) – tachinid fly

Psacadina verbekei (Nationally Scarce) – a snail-killing fly

Sarcophaga sinuata (Nationally Scarce) – a fleshfly

Sphaerophoria taeniata (Nationally Scarce) a hoverfly

Trapezonotus ullrichi (Vulnerable) – a ground bug

More information on these species is provided in Appendix 1.

Discussion and analysis

Description of invertebrate interest

Flies (Diptera)

These constitute the richest group of road verge invertebrates by quite a large margin (361 species). Better sampling of beetles would doubtlessly reduce this to some extent, though anecdotal data suggests that flies typically do top the poll. Flies also tend to dominate in abundance/biomass terms, especially lush and flowery verges. The fauna comprises species that clearly breed along the verge (e.g. phytophagous species associated with plants such as thistles, ragworts, knapweeds etc.) plus others that probably breed elsewhere (e.g. the dung of pasture or moorland) but are attracted by the flowers and warmth of some road verges or simply spill over from surrounding habitats as jetsam or through natural dispersal (i.e. 'tramp species'). This means that it is quite easy to guess at the nature of adjacent habitats by examining the fly list. An abundance of dung-feeding muscids and anthomyiids indicates adjacent pasture or sheep-grazed moorland, whilst an abundance of Cabbage root fly *Delia radicum* indicates nearby rape fields. Certain hoverflies indicate nearby woodland.

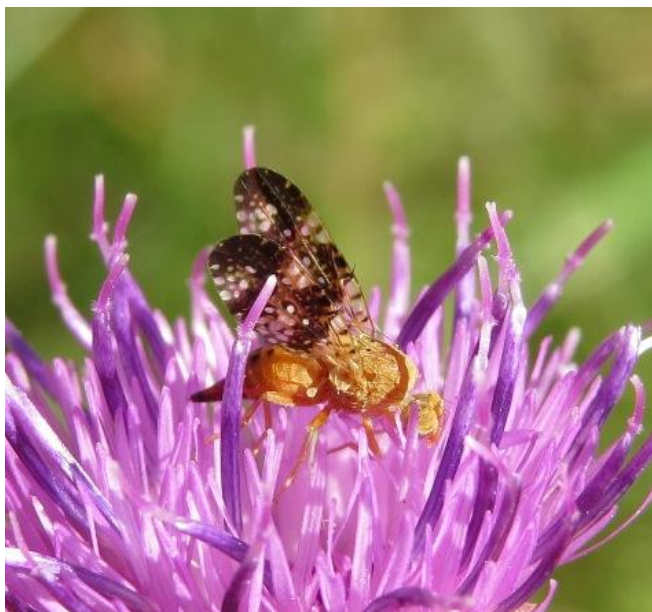
The fly species list encompasses a wide range of lifecycles, including:

- dung feeders (many of the listed anthomyiids, muscids, sepsid flies and dungflies)
- herbivores (e.g. tephritid and chloropod flies plus *Cheilosia* hoverflies)
- detritivores (e.g. the larvae of some listed soldierflies, lauxaniid flies)
- predators (e.g. the larvae of aphidophagous hoverflies on foliage, various fly larvae in soil, plus the adults of robberflies and danceflies)
- parasitoids (e.g. the larvae of tachinid flies using caterpillars, bugs etc. *Bellardia*, *Pollenia* and certain *Sarcophaga* flies using earthworms), sciomyzid flies and various *Sarcophaga* species using snails, pipunculids using planthoppers etc.)
- carrion feeders (e.g. the larvae of greenbottles and bluebottles)
- aquatic (e.g. the larvae of some hoverflies, snail-killing flies and long-legged flies, which include predators and detritivores)
- fungus-associated (e.g. the larvae of *Suilla variegata* and some *Phaonia* muscids)
- mammalian ectoparasites (e.g. Deer ked)
- blood-suckers (the adults of horseflies and clegs and larvae of *Protocalliphora* – see below)
- bird nest saprophages or predators (larvae of *Anthomyia* species, *Fannia* species and the nestling-attacking blowfly *Protocalliphora azurea*)
- developing in bee, wasp or ant nests (larvae of *Volucella*, *Xanthogramma* and *Microdon* hoverflies and certain *Fannia* species)
- dead wood and tree wound-associated (e.g. *Trichopeza longicornis* and *Myathropa florea*)

The adults of many species are flower visitors, and some are amongst our most important pollinators. Road verge flowers that attracted large numbers of flies include thistles (especially Creeping thistle *Cirsium arvense*), ragworts (especially Common ragwort), Common knapweed, Hemp agrimony, Yarrow *Achillea millefolium*, umbellifers (especially Hogweed, Cow parsley *Anthriscus sylvestris* and Upright hedge-parsley *Torilis japonica*), 'hawkish' composites like Catsear, hawkbits *Leontodon* spp. and hawksbeards *Crepis* spp., and buttercups *Ranunculus* spp.. Had surveying started earlier, the importance of spring blossoming shrubs such as willows/sallows *Salix* spp., Blackthorn *Prunus spinosa*, Common gorse *Ulex europaeus* and Hawthorn *Crataegus monogyna*, plus spring-flowering herbs such as dandelions would have been evident.

Flies with current rarity grades include: *Acanthiophilus helianthi* (Nationally Scarce), *Acinia cognata* (Endangered), *Dioxyna bidentis* (Nationally Scarce), *Lasiochaeta pubescens* (Nationally Scarce), *Microdon myrmicae* (Nationally

Scarce), *Policheta unicolor* (Near Threatened), *Psacadina verbekei* (Nationally Scarce), *Sarcophaga sinuata* (Nationally Scarce) and *Sphaerophoria taeniata* (Nationally Scarce). It should be noted that most of these are now known to be less rare and threatened than those grades suggest, and several may be expanding following a period of genuine rarity or simply under-recording.



Acinia corniculata (top left), one of the scarce picture-winged flies recorded; *Xanthogramma pedissequum* (top right) a hoverfly that needs ant nests in warm, sunny locations; Yellow dung fly (*Scathophaga stercoraria*) (bottom left) – one of the dung-feeding flies that can be abundant on verges; *Psacadina verbekei* (bottom right) – a scarce snail-killing fly of wetlands recorded from a roadside conservation area.

The best fly catches were from sites 24 and 30, though there is little indication of a major difference between the A30 and A38, nor of a 'Bodmin Moor effect' or 'South Dartmoor effect' on overall diversity, though some individual species were much influenced by it. Moorland and wet heath specialists prefer the verges of Bodmin Moor, whilst thermophilic species (e.g. *Acanthiophilus helianthi*) prefer the warmer, drier verges east of Dartmoor.

More detailed surveying of verges, including the use of water traps, malaise traps and emergence traps could extend the list several times and shed more light on how individual fly species are using the verges. There is still much to be learned about flies and road verges, but recent research on a short stretch of Devon Hedge (Wolton, 2015) reveals the potential richness of flies just along the hedgeline demarking a road verge.

Beetles (Coleoptera)

The list of 177 species would have been greatly extended by the use of pitfall traps, though it is typical for beetle diversity of habitats such as road verges and grasslands to fall just a little lower than fly diversity. However, the proportion of resident versus tramp species is usually higher as they tend to be less mobile.



The Swollen-thighed beetle (*Oedemera nobilis*) (top left) – , which can be abundant on flowers; the Bloody-nosed beetle (*Timarcha tenebricosa*) (top right), which requires bedstraws in warm and sunny places; *Leptura aurulenta* (bottom left) – a scarce longhorn beetle which was using tree stumps on one verge; the Dock leaf beetle (*Gastrophysa viridula*) (bottom right), but which can be common in more degraded, species-poor verges with docks.

Lifecycles are again varied e.g.

- predators (e.g. the larvae and adults of most dung and rove beetles)
- herbivores (e.g. flea beetles, leaf beetles)
- dung feeders (e.g. dung and dor beetles)
- dead wood-associated (e.g. the two longhorn beetles)

Beetles with current rarity grades include: *Barypeithes sulcifrons* (Nationally Scarce), *Lathrobium pallidipenne* (Nationally Scarce), *Leptura aurulenta* (Nationally Scarce), *Longitarsus rutilus* (Nationally Scarce) and *Meligethes fulvipes* (Nationally Scarce).

The best beetle lists came from sites 1, 2b and 3, and the data suggests that overall diversity is not dramatically impacted by the 'South Dartmoor effect' or 'Bodmin Moor effect', though pitfall trapping would be required to test this more thoroughly.

Butterflies and moths (Lepidoptera)



Common blue (top left) and Six-spot burnet moth (top right) both require warm, sunny verges with Bird's-foot trefoil; Marbled white has grass-feeding caterpillars; Alder moth caterpillar (bottom right) – one of the more striking caterpillars recorded.

Butterfly diversity can be a good indicator of road verge quality, especially where less common species are present. 24 species were recorded and most of these are likely to be breeding on the verge, though White Admiral *Leminitis camilla* will probably be a straggler from a nearby wood containing shaded Honeysuckle *Lonicera periclymenum* (the larval habitat). Key food plants include assorted grasses for 'browns' (including Marbled white *Melanargia galathea*, Gatekeeper *Pyronia tithonus*, Speckled Wood *Pararge aegeria* and Small heath *Coenonympha pamphilus*) and skippers, Common nettle *Urtica dioica* for Peacock *Aglais io*, Small tortoiseshell *Aglais urticae* and Red admiral

Vanessa atalanta), bird's-foot trefoils for Common blue (and also the Six-spot burnet moth *Zygaena filipendulae*), crucifers for 'whites' (including Orange tip *Anthocharis cardamines*), and docks *Rumex* spp. for the Small copper *Lycaenus phlaeus*. The best butterfly sites were 7 and 33 which both produced 11 species. The presence of Marble white and Common blue *Polyommatus icarus*, plus day-flying burnet moths, were felt to be indicators of better sites.

The list of moths is likely to be very incomplete as no night-time moth-trapping was carried out and recording moths in the day often relies on finding larvae or sampling a limited range of day-flying species. But there is potential for several hundred moths to be breeding along these roads, with floristically diverse, structural diversity and sheltered verges likely to be especially important.

The only species with rarity grade is the small moth *Cosmopteryx orchalcea* (Nationally Scarce), though four Lepidoptera species are Section 41-listed due to concerning rates of decline: Common heath (*Coenonympha pamphilus*), Wall brown (*Lasiommata megera*), White admiral (*Limenitis camilla*) and Cinnabar (*Tyria jacobaea*).

Bugs (Hemiptera)

Bug diversity is loosely correlated to that for butterflies, being much linked to floristic diversity and warmth. 82 taxa were recorded which included two species currently with rarity grades: *Megalonotus dilatatus* (Nationally Scarce) and *Trapezonotus ullrichi* (Vulnerable, very restricted). Good bug sites included sites 22, 30, 33 and 34, with the warmer and drier verges of the A38 east of Dartmoor proving the most productive.



The Gorse shieldbug (*Piezodorus lituratus*) (left) –which needs the presence of gorses; the Common froghopper (*Philaenus spumarius*) (right) – the froghopper responsible for cuckoo-spit and very common at some road verges.

Bees, ants and aculeate wasps (aculeate Hymenoptera)

Bees are some of our most important pollinators, and the list contains 31 species (all fairly widespread), though more targeted recording by a specialist recorder could probably double or treble that number for the sites covered here. A further 22 ants and aculeate wasps were recorded. For bees and wasps, the availability of both nesting habitat and foraging habitat(s) are crucial. Some species nest in the ground and require well-drained light soils e.g. *Andrena*, *Halictus* and *Lasioglossum* bees and digger wasps like *Mellinus arvensis*. Others are aerial nesters requiring

dead wood, hollow stems/twigs or walls e.g. some leafcutter bees, mason wasps and crabronid wasps such as *Passaloecus* and *Ectemnius* species. In all such instances, warm and sunny places are preferred. Bumblebee nesting is strongly linked to small mammal activity. Subterranean nesters such as the Buff-tailed bumblebee *Bombus terrestris* prefer the underground burrows of mice. Surface nesters like the Common carder bee *B. pascuorum* like vole nest in dense herbage such as grass tussocks. The Tree bumblebee *B. hypnorum* acts as an aerial nester, using hollow tree trunks, bird boxes, etc.



Andrena dorsata (top left) - a ground-nesting mining bee found at several of the sites; *Megachile centuncularis* (top right) – an aerial nesting leaf-cutter bee; *Ectemnius continuus* (bottom left) – a solitary wasp that nests in dead wood and hunts flies on umbellifer flowers; the Narrow-headed ant (*Formica exsecta*) (bottom right) – probably the rarest insect on this road network, with a single English colony that spills onto the A38 verge at Chudleigh Knighton.

Flowers are critical for bees, and whilst some show narrow foraging preferences over a relatively short flight period, others use a wide range of flowers over several months e.g. *Bombus*, *Halictus* and *Lasioglossum* species. Flowers of particular value for bees include legumes (e.g. clovers, vetches and bird's-foot trefoils), composites (dandelion/hawkish types, daisy/ragwort types, thistles and knapweeds), labiates (e.g. dead-nettles *Lamium* spp., woundworts *Stachys* spp., Ground ivy *Glechoma hederacea*, Self-heal *Prunella vulgaris*), willowherbs and blossoming shrubs (e.g. willows/sallows, Blackthorn and gorses).

Only 7 species of ant were recorded, though targeted searching could probably double that list. It should be noted that England's only remaining population of the Narrow-headed ant *Formica exsecta* occurs at Chudleigh Knighton Heath adjacent to the A38, with a few nests occurring on the road verge itself (site 33), though no *F. exsecta* were found during this survey (the population is regularly monitored by Stephen Carroll for the Devon Wildlife Trust and charity Hymettus).

The best bee catches tended to come from the A38, with sites 22 and 29a producing relatively good day catches. The A30 across Bodmin Moor often failed to produce any bee records. It should be noted that parasitic wasps (Hymenoptera: Parasitica) were not recorded because of the difficulty of identifying such insects. However, with some 5,000 species nationally, the potential number of species along a road verge could rival flies. Sawflies (Hymenoptera: Symphyta) were also ignored as few people can identify these.

Grasshoppers and crickets (Orthoptera)

Most grasshoppers and some bush-crickets like warm, grassy habitats, with certain species preferring shorter, sparser vegetation (e.g. Field grasshopper (*Chorthippus brunneus*)) whilst others prefer taller or lush conditions (e.g. Common green grasshopper (*Omocestus viridulus*), Great green bush-cricket (*Tettigonia viridissima*) and groundhoppers) or even scrub and trees (e.g. Speckled bush-cricket (*Leptophyes punctatissima*) and oak bush-crickets). 11 species were found, none especially rare, though Great green bush-cricket has declined in many parts of its former British range and Southern oak bush-cricket (*Meconema meridionale*) is a recent colonist that is expanding (this record seems to be the first for the SW peninsula). Mottled grasshopper (*Mymeleotettix maculatus*) was not recorded but its presence could be anticipated on some of the sandier, south-facing road verges east of Dartmoor.

Good Orthoptera sites included 2a (despite rather poor habitat being present), 22, 29a, 30, 31 and 33. Not surprisingly, the better sites tend to be concentrated along the drier, warmer section of the A38 east of Dartmoor.



The Field grasshopper (*Chorthippus brunneus*) (left), which likes short-cropped or sparse vegetation; the larger Great green bush-cricket (*Tettigonia viridissima*) (right) – the large Great green bush-cricket requires taller and denser vegetation.

Dragonflies and damselflies (Odonata)

11 species were recorded. Road verges can provide good quality hunting habitat, especially warm, sheltered locations with plenty of flowers to attract smaller insects and breeding habitat nearby. Breeding is also possible within the transport corridor using wet roadside ditches and balancing pools. The pools of Site 7b supported a

particularly good assemblage (10 species). No particularly scarce species were found, though the Keeled skimmer (*Orthetrum coerulescens*) is rather restricted and southern-biased. It should be noted that the Four-spotted chaser (*Libellula quadrimaculata*) was noted at Site 7b on an earlier visit (and is likely to be breeding in the pools here), but not recorded by the formal survey.



The Keeled Skimmer (*Orthetrum coerulescens*) (left), a rather restricted species of base-poor water bodies; the Blue-tailed damselfly (*Ischnura elegans*) (right), a more widespread and adaptable species.

Spiders

50 taxa were recorded, though a proportion of these were immature stages that could not be identified to species level. The samples were dominated by orbweavers (families Araneidae and Tetragnathidae) and sampling by a spider expert would probably have extended the list substantially by recording more ground-dwelling species (e.g. lycosids). No scarce species were recorded.



Two of the commonest spiders of SW road verges, the Common candy-stripe spider (*Enoplognatha ovata*) (left) and Garden cross spider (*Araneus diadematus*) (right).

Other small orders/groups

5 species of woodlouse, 2 species of earwig, 2 species of scorpion fly, 1 species of millipede and 1 species of centipede were recorded. None of these are rare or unexpected along road verge. One species of lacewing was recorded, though this group was not targeted, and there is potential for several dozen species.



The centipede *Lithobius forficatus* (left) and woodlouse *Philoscius muscorum* (right) are some of the invertebrates that like sites with scree, stones or other debris that provides damp and shelter.

Factors affecting road verge invertebrates richness and quality

Various factors are at play and it would take much more detailed research to examine and better understand those factors individually. But the following are all likely to be significant:

Altitude, exposure and geographic location

Along the A30, a distinct 'Bodmin Moor effect' is discernible, which is probably linked to a combination of altitude, exposure, high precipitation, surrounding habitat (often moorland and acid grassland) and acidic soil conditions. It results in relatively impoverished sites with lower abundances of invertebrates (especially bees, butterflies and grasshoppers) at the highest and most exposed sections of road verge. The samples also tend to contain a higher proportion of dung-associated flies (reflecting nearby stock grazing) and contain moorland and wet heathland-associated species such as the Keeled skimmer dragonfly and the flies *Coenosia femoralis*, *Dolichopus atratus* and *Sphaerophoria philanthus*. The abundance and diversity of Orthoptera, butterflies, Hemiptera and aculeates is clearly affected by altitude, making the A30 generally poorer for these groups.

The A38 lacks any sections quite as exposed as those on Bodmin Moor, but features a 'South Dartmoor effect'. This results in some relatively warm, dry and sheltered sites, sometimes adjacent to heathland and old clay quarries, in the stretch east of Dartmoor between Buckfastleigh and Exeter which is one of the warmest and driest parts of Highways Area 1. This noticeably boosted the abundance and diversity of Orthoptera, butterflies, Hemiptera and aculeates, though the delayed visits to the A38 (which meant surveying was blighted by summer mowing) has affected the data somewhat.

Altitude and exposure is also known to affect seasonality, and this is fairly well documented in South west England. Spring flowers can peak up to 4 weeks later on parts of Bodmin Moor and Dartmoor than in low-lying, sheltered areas just a few miles away. Many invertebrates show a similar delay in their appearance and peaking, especially bees and butterflies.



Left: Example of a high altitude, exposed verge exhibiting the 'Bodmin Moor Effect' (Site 11) and right: a low altitude, more sheltered verge exhibiting the 'South Dartmoor Effect' (Site 30).

Road verge width

Narrow verges are generally less rich than wider ones. This is evident in sites 2a, 21 and 28, and there are likely to be a number of reasons for this:

- narrow verges often lack the habitat diversity and gradations associated with wider verges
- narrow verges can be more impacted by the wind generated by moving vehicles
- narrow verges are more affected by salt spray and dust which can impact the quality of the soil and vegetation markedly
- any mowing regimes along narrow verges tend to impact a greater proportion of the verge
- mowing is often more regular along such verges
- narrow verges are more prone to becoming shaded by adjacent trees and shrubs, especially if north-facing
- narrow verges are more prone to being disturbed by vehicle activity

However the narrow verge of 2b produced a very good list and suggests that various other factors such as geographical locations, adjacent habitat, shelter and floweriness can elevate the richness of a narrow verge.



Left: Example of a narrow verge with limited value for invertebrates (Site 21) and right: a much more productive wide verge (Site 31).

Adjacent habitats

There is a strong two-way interplay between road verges and surrounding habitats that can increase the diversity of invertebrates in the landscape. Road verges can be the most flowery and sheltered locations within certain

landscapes and provide important foraging areas for flower-visiting flies from nearby woodland, farmland, grassland, moorland, wetland etc.). The assemblages of road verges also contain tramp species that interact less strongly with the verge but simply reflect what habitats are nearby. If the adjacent habitat involves woodland or trees, there may also be a shading effect, which can affect the duration and amount of direct sunshine falling on a verge.

In most of the samples, it was possible to tell whether the verge occurred in an arable, pastoral, mixed or moorland setting because of an abundance (or simply presence) of certain species, especially dung-feeders (e.g. Yellow dungfly (*Scathophaga stercoraria*) and anthomyiids of the genus *Pegoplata* and *Hylemya*) or species like the Cabbage root fly (*Delia radicum*) (a pest of Rape and other cultivated crucifers).

Soil conditions

The samples gathered reveal that soil conditions and other ground conditions have a significant influence on invertebrate assemblages. The better assemblages of ground-nesting aculeates tend to be associated with verges featuring bare or sparsely-vegetated, well-drained, light or sandy soils (e.g. site 22). Verges with scree, gravel and other stones are best for woodlice, centipedes, millipedes and certain beetle groups. Verges with more bare and sparsely-vegetated ground (especially where associated with sunny, south-facing slopes) tend to produce warmer microclimates that can be important for both adult activity and larval development of the more thermophilic (warmth-loving) invertebrates such as ground-nesting aculeates.

Aspect/slope

A south-facing slope that receives plenty of sunshine will produce warmer microclimates and have better-drained soils. This can be important for thermophilic invertebrates e.g. solitary bees, wasps, grasshoppers and certain bugs, beetles and butterflies, especially where coupled with bare or sparsely-vegetated soil. North-facing slopes are generally cooler and damper. Examples of good south-facing verges include sites 19a, 26a and 32a. Even if they have a flora and vegetation broadly similar to a south-facing verge, some species are likely to favour the latter e.g. certain butterflies, beetles, bugs and aculeates. West-facing slopes will tend to be more exposed to the prevailing wind, and this is likely to be particularly important for verges at higher altitudes. West-facing slopes may not receive full sunshine until later in the day. East-facing slopes tends to warm up quicker in the mornings, but may become shaded by the afternoon. Some road verge invertebrates (usually species characteristic of woodland or dense scrub) may prefer cooler, shadier verges. In excessively hot weather or droughts, north-facing verges may become more important, especially if south-facing verges have 'burnt-off' early (i.e. vegetation and flowers have died off earlier than normal).



Left: A 'warmer' south-facing verge (Site 26a) contrasted with right: a 'cooler' north-facing verge (Site 32b).

'Floweriness' and floristic diversity

Botany is a crucial aspect of road verges and is comprised of several distinct elements that can significantly influence the invertebrate assemblage present. 'Floweriness' is simply the abundance of flowers. 'Floristic diversity' is the

variety of flowering plants. ‘Dominance’ is the prevalence of certain plant or flower species. Floristically-diverse verges are good for promoting a good variety of herbivorous invertebrates. However, a long and dominating stand of flowering Creeping thistle, Common ragwort, Cow parsley or Hogweed can pull in a huge abundance and variety of pollinators, often far more than could be expected from a more species-rich yet less flowery verge. A verge dominated by Common nettle or Bracken is far less valuable for pollinators and is ideal for grassland creation. This study revealed the great relative value of certain flowers for pollinator abundance and diversity when locally dominant, notably thistles, ragworts, knapweeds, umbellifers, willowherbs, brambles, and legumes (the last for bees especially). It is good to have some large stands of these, especially where they complement but don’t displace less flowery but more floristically diverse areas.



Two examples of a flowery verge: Site 10b (left), showing an abundance of Hogweed and Site 13 (right) with a large stand of flowering Rosebay willowherb.

Floweriness can be reduced or even eradicated by cutting, and this was often observed to take place at peak flowering periods in July, resulting in a major reduction in invertebrate diversity and abundance (see Cutting/management regimes section below).

Seasonality

Seasonality strongly influences the floweriness and sward structure of a verge and in turn the species diversity, composition and abundance of invertebrates. Between late October and early March relatively little invertebrate activity is detectable along a road verge, though many species can still be present as eggs, larvae, pupae or hibernating adults. Insect activity shoots up once the first spring blossom appears, which might be mid-March in a warm, sheltered low-altitude verge (e.g. the A38 east of Dartmoor) or late-April at the highest levels of Bodmin Moor. In the autumn, insect activity usually tails off rapidly once the Ivy blossom has gone over, or (in more exposed areas lacking Ivy *Hedera helix*) when plants like Devil’s-bit Scabious *Succisa pratensis*, Ling *Calluna vulgaris* and Yarrow have gone over. But cutting regimes can bring about an artificial end to the season which should not be confused with seasonality.

This study concentrated on summer months (June to August) but even over this three month period seasonality is evident with records of some species concentrated in the first few weeks of the survey (e.g. the dance fly *Empis tessellata*) and others at the end (e.g. the picture-winged fly *Acanthiophilus helianthi*). Grasshoppers, bush crickets and many bugs did not reach adulthood until the end of the survey.

Cutting/management regimes

Road verges tend to be subject to two main categories of management: annual or more regular mowing of non-woody herbage such as grasses and tall herb; and periodic control (usually every few years) of woody species such as scrub, young woodland and individual trees. Such cutting is primarily done with safety in mind, though without management, verges will naturally revert to woodland and would lose important unshaded, flowery conditions and

diverse invertebrate assemblages. Most of the verges surveyed were subject to at least one cut during the survey period. This might be a cut affecting the full width of a verge, or just a strip alongside the carriageway. Where cutting affects the greater width of a verge for a considerable distance, the impact on invertebrates is considerable and results in a catastrophic drop in invertebrate diversity and abundance. Flowers for pollinators, food plants for herbivores and prey/hosts for predators and parasites became much reduced, if not eliminated from cut areas. If the verge is providing conditions that are scarce in the wider countryside (such as floristically-rich grassland in a moorland or arable setting), then this is a substantial nature conservation impact that could be affecting insects like pollinators at a landscape scale.

Some of the sites surveyed twice have produced data before and after an extensive cut. Examples include site 22 (90 species on 31 July before a cut and 39 species on 27 August following a cut) and site 2b (90 species on 30 May before a cut and 29 species on 11 August following a cut). During the surveying there were numerous instances where verge cutting was felt to be excessive in coverage given the circumstances of the verge, or badly timed so that cutting took place during the peak flowering of plants such as Hogweed, thistles, ragworts and Common knapweed, which were attracting large numbers of pollinators. Cutting between May and September can be very damaging to pollinators.



Left: an uncut verge with much insect activity (Site 34) contrasted with right: a newly cut verge with much reduced activity (Site 8a).

Summary of issues

- Existing cutting regimes – summer cuts are often more than the 1 metre kerbside cuts specified and can affect a big proportion of a verge, rendering it flowerless and structureless.
- Scrub, bracken and coarse grass encroachment can take place in less frequently cut areas, reducing the floweriness and structural diversity of a road verge (and associated invertebrate diversity) where encroachment is excessive.
- Shading out – due to overhanging trees or built structures, especially on north-facing slopes
- Isolation and fragmentation – small and isolated fragments of habitat have less potential for diverse invertebrate assemblages and the presence of rare species. Many good road verges are relatively isolated.
- Site quality – highly variable along the network, with much potential for improvement
- Making the most of available land – using areas additional to verges to create more conservation areas

Recommendations

1. Cutting

From an entomological viewpoint, cutting of grass and tall herb should be undertaken from late September onwards (unless strictly necessary for safety or access reasons) to ensure that a complete sequence of flowering is possible, including the late flowering of any thistles, Ragwort and Devil's-bit scabious. Botanical guidelines for road verges have often suggested a July cut, to mimic the traditional cutting of hay meadow. However, this timing is designed for producing high quality hay, and as that is rarely the objective of road

verge cutting, a later date is much better. There is little evidence that such late cutting reduces the quality of the vegetation and Plantlife have recently changed their stance to accommodate the needs of pollinators (Trevor Dines correspondence to Jeff Ollerton in Jeff Ollerton's biodiversity blog).

Where possible (especially wider verges), differential cutting should be employed to create structural diversity in the road verge vegetation. An ideal road verge is a wide one supporting a habitat mosaic comprising a hedge, a less intensively managed fringe of bramble or tall herb, perhaps a little scrub or some isolated shrubs, a zone of taller grassland and (beside the kerb) a zone of shorter, more regularly-mown grassland (which may be a good source of clovers, Catsear, Common bird's-foot trefoil, Autumn hawksbeard etc.).

It is also ideal if some parts of a wider verge can remain uncut for 2-5 years, both to provide an undisturbed overwintering habitat for invertebrates and also to permit tall herb, bramble and young scrub development (and the additional floral resources that can be associated with these), albeit in a controlled fashion.

On floristically-diverse verges, it is important that arisings are removed. This stops the arisings smothering out finer plant species and also helps 'nutrient strip' a verge i.e. reducing the nutrient load/fertility of the soil (fertile soils is a bad thing for road verge biodiversity).



Differential summer cutting of a Warwickshire road verge that allows the full flowering of Hogweed, ragwort and thistles.

New road verge creation and management and use of wildflower seed mixes

A number of the road verges surveyed were new (notably 19a and 19b). New road verges can provide a valuable opportunity to create high quality habitat capable of supporting a high diversity of plants and invertebrates. Avoiding the use of top soil is key to this, as interesting natural floras and invertebrate assemblages develop better on low fertility subsoil or spoil. Wildflower seed mixtures should also be avoided where the indigenous seed bank can produce a good show of flowers on its own. Pollinators sometimes interact better with

indigenous floras than imposed ones, because they may prefer the flowers or require the plants in some other way (e.g. as a larval foodplant or a source of larval prey).

If the indigenous seed bank is not producing an adequate response, the use of appropriate seed mixes or locally-sourced green hay is recommended. Seed and green hay suppliers can advise on what is best for a given receptor site and which options work best for pollinators. In some circumstances (verges of lower ecological value in more urbanised areas) a colourful annual seed mix (e.g. cornfield annuals) is an option that can help to make a road verge more attractive to people and pollinators.

Creating stepping stones and linkages

The A30 and A38 already contribute to a critically important network of wildlife corridors in Cornwall and Devon, but there remains substantial scope for improving this role. This could be achieved in several ways:

- Improving the quality of existing road verges so that they act as better corridors, serving a greater number of invertebrate species
- Using other highways authority landholdings to create high quality conservation areas (like site 7b) that augment verges and act as more substantial stepping stones with flowery grassland and wetland features
- Using new road verges and engineering of existing roads to create new high quality habitat where it did not exist previously
- Working with Buglife to help develop B-lines (i.e. B-lines that incorporate sections of major roads – see Buglife’s B-lines web pages)

Ongoing survey, research and monitoring

The current survey provides some useful baseline data but does not constitute a detailed study of any individual verge or any particular invertebrate group. Further surveying and monitoring, especially that which investigates specific issues in detail such as the fine-scale impacts of different management regimes or road verge characteristics, or the ecology and conservation requirements of particular species or assemblages (e.g. bees, butterflies, pollinators generally) is to be strongly recommended. Much of this work would be suited to PhD and MSc students of local universities (notably Exeter and Plymouth). This would allow deeper analysis of specific issues.

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Table 1. Taxa numbers recorded from each site on a given date (altitude also provided)

Site No.	Date	Altitude (m)	Arachnida	Coleoptera	Dermaptera	Diptera	Hemiptera	Hymenoptera	Isopoda	Lepidoptera (butterflies)	Lepidoptera (moths)	Mecoptera	Myriopoda	Neuroptera	Odonata	Orthoptera	TOTAL SPP
1	27.5	6	5	32	2	16	2	5	1	0	1	0	0	0	0	0	64
1	10.8	6	3	12	1	44	11	3	1	4	0	0	0	0	0	5	84
2a	27.5	61	8	6	0	18	2	1	0	1	1	0	0	0	0	1	38
2a	10.8	61	4	2	1	19	3	2	1	1	0	0	1	0	0	6	40
2b	30.5	26	4	36	1	39	3	3	1	0	3	1	1	0	0	2	94
2b	11.8	26	5	6	1	13	5	1	1	0	2	0	0	0	0	0	34
3	3.6	97	5	31	0	26	4	5	0	1	4	0	1	0	0	2	79
3	11.8	97	4	9	0	25	7	8	1	3	2	0	0	0	0	3	62
4	26.5	140	0	17	1	7	4	2	0	4	3	0	0	0	0	1	39
4	6.8	140	3	7	1	36	8	5	0	5	5	0	1	0	0	1	72
5	26.5	114	6	14	0	8	3	2	1	0	3	0	0	0	0	0	37
5	11.8	114	5	7	1	50	13	4	0	2	0	0	1	0	0	1	84
6	3.6	189	4	16	0	20	1	1	1	0	4	0	0	0	0	0	47
6	15.8	189	4	10	1	34	9	2	0	2	3	0	1	0	0	0	66
7	5.6.	150	7	19	0	44	2	0	0	3	5	0	0	0	2	4	86
7	6.8	150	5	5	0	31	9	4	2	10	5	0	0	0	0	4	75
7b	5.6	148	0	13	0	26	3	0	0	0	2	0	0	0	4	0	48
7b	6.8.	148	7	7	1	43	12	4	0	10	2	0	0	0	7	4	97
8a	6.6.	152	6	10	0	30	3	1	0	0	0	1	0	0	1	0	52
8a	15.8	152	0	5	0	31	11	4	1	3	1	0	0	0	0	2	58
8b	6.6.	144	3	6	0	24	2	1	0	2	3	0	0	0	1	0	42
8b	15.8	144	7	1	1	27	0	5	0	4	4	0	1	0	1	4	55
9	9.6.	140	1	13	0	20	2	1	0	2	5	1	0	0	0	2	47
9	17.8	140	3	3	0	29	11	3	0	6	1	0	0	0	0	0	57
10a	9.6	133	3	13	1	27	3	1	1	0	3	0	0	0	0	1	55
10a	17.8	133	2	2	0	19	7	5	1	0	4	0	2	0	0	3	44
10b	15.7	138	6	6	0	14	2	2	0	1	0	0	0	0	0	1	32

10b	16.8	138	0	3	1	18	10	2	0	0	4	0	0	0	0	2	40
11	16.6.	245	3	16	0	39	1	4	0	2	9	1	0	0	0	0	75
11	17.8	245	0	4	1	44	9	1	0	3	3	0	0	0	0	1	67
12a	14.6	295	0	14	0	26	0	4	0	2	4	0	1	0	0	1	52
12a	17.8	295	6	1	0	36	6	4	1	0	3	0	0	0	0	1	58
12b	14.6	290	7	10	0	20	2	2	0	3	5	0	1	0	0	0	50
12b	18.8	290	6	5	1	24	7	5	0	2	4	0	0	0	0	2	56
13	16.6	252	7	8	0	24	0	1	0	5	11	0	0	0	1	1	58
13	18.8	252	5	3	1	31	12	5	0	4	8	0	0	0	1	2	72
14a	19.7	184	4	5	0	11	4	0	0	3	5	0	0	0	0	0	32
14b	9.7	184	3	5	1	35	6	1	0	3	2	0	0	0	0	0	56
15	9.7	289	6	6	0	33	11	0	0	4	3	0	1	0	2	2	68
16	10.7	218	0	4	1	43	9	5	0	3	3	0	0	0	0	0	68
18	15.7	48	2	7	1	34	10	0	0	4	1	0	0	0	0	1	60
19a	30.7	151	3	4	0	23	1	5	0	6	3	0	0	0	0	3	47
19a	26.8	151	4	4	1	21	12	4	0	1	2	0	0	0	0	2	51
19b	30.7	151	6	6	1	37	10	10	0	7	4	0	0	0	0	3	85
19b	26.8	151	3	5	0	17	6	2	1	4	1	0	1	0	0	3	42
21	30.7	54	2	3	1	8	7	5	0	2	0	0	0	0	0	1	29
21	26.8	54	5	5	1	16	5	0	1	0	3	0	0	1	0	2	39
22	31.7	38	4	8	0	41	15	12	0	6	3	0	0	0	0	5	94
22	27.8	38	6	1	1	20	10	3	0	0	3	0	0	0	0	2	45
24	25.7	68	4	9	0	64	10	9	0	5	0	0	0	0	1	1	103
26a	31.7	74	7	5	1	13	5	6	2	7	3	0	0	1	0	2	52
26b	31.7	74	2	0	0	20	6	2	0	0	0	0	0	0	0	2	32
27a	29.7	89	3	2	0	18	4	9	0	5	1	0	0	0	0	3	45
27b	18.7	86	2	4	0	18	7	0	0	0	2	0	1	0	0	1	35
28	29.7	111	2	4	1	16	2	5	0	0	3	0	0	0	0	3	37
29a	25.7	121	2	5	0	26	11	12	0	5	4	0	0	0	1	5	71
29b	18.7	121	0	4	0	42	6	6	0	4	2	0	0	0	0	2	66
30	25.7	37	6	5	0	57	10	4	0	5	6	0	0	0	0	5	98
30	28.8	37	6	8	0	54	12	10	0	4	2	0	0	0	0	3	99

31	22.7	89	4	10	0	39	11	4	0	5	4	0	0	0	0	5	82
32a	22.7	102	5	10	1	34	6	9	0	7	4	0	0	0	0	4	80
32b	17.7	109	5	6	0	23	8	1	0	1	0	0	0	0	0	5	49
33	17.7	23	6	9	0	21	10	10	0	9	4	0	0	0	0	5	74
33	28.8	23	7	1	1	9	8	4	1	2	0	0	0	0	0	3	36
34	18.7	103	7	10	0	31	12	5	0	7	4	0	0	0	0	3	79
34	29.8	103	9	2	1	31	12	1	0	0	3	0	0	0	0	2	61
TOTAL SPP	-	-	50	177	2	361	82	53	5	24	85	2	2	1	11	11	866

Appendix 1. Notes on rare and scarce species

***Acanthiophilus helianthi* (Nationally Scarce) – a picture-winged fly**

In Britain, typically associated with Common knapweed in warm, dry, grassy locations. NBN map: <https://data.nbn.org.uk/Taxa/NBNSYS0000012930>.

***Acinia corniculata* (Endangered) – a picture-winged fly**

In Britain, typically associated with Common knapweed in warm, dry, grassy locations. NBN map: <https://data.nbn.org.uk/Taxa/NBNSYS0000012900>

***Barypeithes sulcifrons* (Nationally Scarce) a weevil**

A widespread but localised species associated with nice grasslands and coastal cliffs. It feeds on the roots of various plant species. NBN map: <https://data.nbn.org.uk/Taxa/NHMSYS0020151485>.

***Dioxyna bidentis* (Nationally Scarce) – a picture-winged fly**

Associated with bur-marigolds *Bidens* spp. and possibly other Asteraceae as it can often turn up far from obvious sources of bur-marigolds. The larvae develop in the flower heads. NBN map: <https://data.nbn.org.uk/Taxa/NBNSYS0000132499>.

***Lasiochaeta pubescens* (Nationally Scarce) – a chloropid fly**

Associated with wet habitats, especially acid mire. Larvae possibly developing in sedges (like the related genus *Elachiptera*). NBN map: <https://data.nbn.org.uk/Taxa/NBNSYS0100003967>.

***Lathrobium pallidipenne* (Nationally Scarce) - a rove beetle**

A widespread but localised species associated with damp habitats, but hard to identify and with precise needs poorly understood. NBN map: <https://data.nbn.org.uk/Taxa/NHMSYS0001718706>.

***Leptura aurulenta* (Nationally Scarce) – Golden-haired longhorn**

Mainly associated with old broadleaved woodland. The saproxylic larvae develop in stumps and fallen trunks of assorted broadleaved trees including oak *Quercus* and birch *Betula*. NBN map: <https://data.nbn.org.uk/Taxa/NHMSYS0020152406>.

***Longitarsus rutilus* (Nationally Scarce) – a flea beetle**

Associated with figworts *Scrophularia* spp. in assorted habitats (usually damp). The adults feed on the leaves, the larvae probably in the roots. NBN map: <https://data.nbn.org.uk/Taxa/NBNSYS0000011266>

***Megalonotus dilatatus* (Nationally Scarce) – a ground bug**

A species of sandy, sparsely-vegetated habitats (heathland, dry grassland, dunes). It feeds on seeds, though it is not known if any specific plants are required. NBN map: <https://data.nbn.org.uk/Taxa/NHMSYS0020309433>.

***Meligethes fulvipes* (Nationally Scarce) – a pollen beetle**

One of our scarcer pollen beetles. Precise needs poorly understood. NBN map: <https://data.nbn.org.uk/Taxa/NHMSYS0020152602>.

***Microdon myrmicae* (Nationally Scarce) - a hoverfly**

A scarce hoverfly of *Molinia*-rich wet mire and pasture. The slug-like larvae develop in ant nests. NBN map: <https://data.nbn.org.uk/Taxa/NBNSYS0100027470>.

***Policheta unicolor* (Near Threatened) – tachinid fly**

Mostly recorded from SW England. The larvae are parasitoids of chrysomelid larvae, especially *Chrysolina* species.

NBN map: <https://data.nbn.org.uk/Taxa/NHMSYS0020971534>.

***Psacadina verbekei* (Nationally Scarce) – a snail-killing fly**

A species of rather base-poor (but not really boggy) wetlands and wet woods. The larvae feed on aquatic snails and their egg masses, at water edges. NBN map: <https://data.nbn.org.uk/Taxa/NBNSYS0000013007>.

***Sarcophaga sinuata* (Nationally Scarce) – a fleshfly**

A species of wetlands. The typical lifecycle is unclear as rearing records include grasshoppers, carrion and caterpillars. NBN map: <https://data.nbn.org.uk/Taxa/NBNSYS0000156295>.

***Sphaerophoria taeniata* (Nationally Scarce) a hoverfly**

A species of warm, flowery habitats, especially where Creeping thistle and mayweeds are present. The larvae feed on aphids. A rapidly expanding species no longer worthy of a rarity grade. NBN map:

<https://data.nbn.org.uk/Taxa/NBNSYS0000006960>.

***Trapezonotus ullrichi* (Vulnerable) – a ground bug**

A very rare species mostly recorded from cliff tops in southern and western coasts of England and Wales, where it is associated with stands of ox-eye daisy. NBN map: <https://data.nbn.org.uk/Taxa/NHMSYS0020309913>.

Appendix 2. Site descriptions

Site 1: A30 at Hayle Bypass on the westbound carriageway

Grid reference: SW57473735

Altitude: 6 metres

Date of visit(s): 27 May and 10 August

Description: Steep west-facing bank, floristically diverse. Narrow band of bramble and hawthorn at the top of the slope, mixed deciduous plantation at extreme north. Nectar plants abundant, including buttercup, vetches and Red campion.

Comments: This site produced records of two scarce beetles *Barypeithes sulcifrons* and *Lathrobium pallidipenne* and was one of the best beetle sites encountered. Management should aim to maintain high quality grassland here, and retain some bramble and hawthorn scrub at the top of the slope by using infrequent cutting here. Non-urgent grass cutting should be undertaken from September (perhaps cutting only half the site in any year) and arisings removed.



Site 2a: A30 Connors Down eastbound

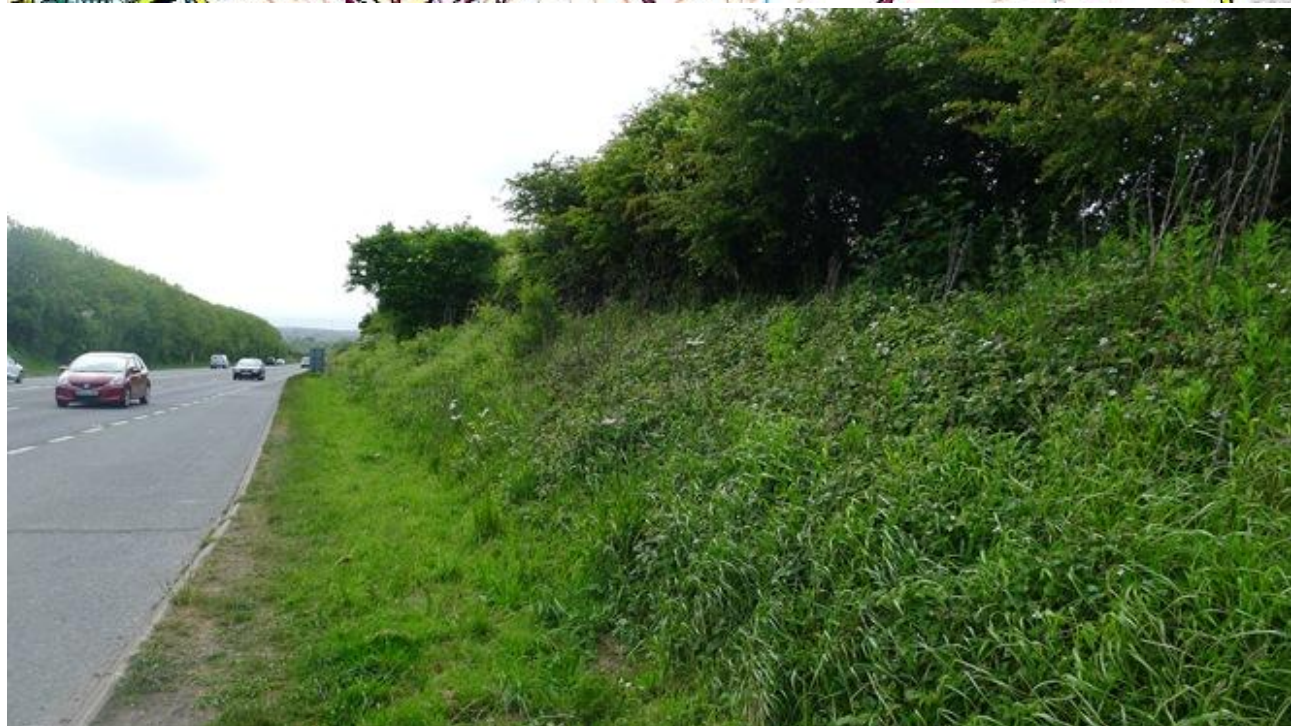
Grid reference: SW59483948

Altitude: 61 metres

Date of visit(s): 27 May and 10 August

Description: Fairly narrow verge with south-facing slope with row of Hawthorn, Ivy and Elder at the top. Good range of nectar sources, including Hawthorn blossom, Elder blossom, Red campion, bramble, Cow parsley, Common Gorse, bindweed.

Comments: Not a very rich site though it produced a record of the scarce flea beetle *Longitarsus rutilus* which is associated with figworts. The site already receives differential cutting. The taller herbage beside the hedge should not be cut in a wholesale manner but perhaps best on a three-year rotation i.e. one third a year. This should be done from September.



Site 2b: A30 Connors Down westbound

Grid reference: SW59203942

Altitude: 26 metres

Date of visit(s): 30 May and 11 August

Description: Narrow north-facing verge, 1.5m wide. Bordered with mature deciduous trees - Sycamore, Ash, Hawthorn - growing on steep bank. Open meadow areas each end with a variety of nectar sources - Cow parsley, buttercup, dandelion, Bluebell, Herb robert, Great willowherb.

Comments: The long list produced by this site on 30th May is surprising given its narrow, north-facing nature. The scarce pollen beetle *Meligethes fulvipes* was recorded, though its precise needs are unknown. Management should aim to increase the extent of taller, flowery vegetation here.



Site 3: A30 at Tolvaddon, eastbound

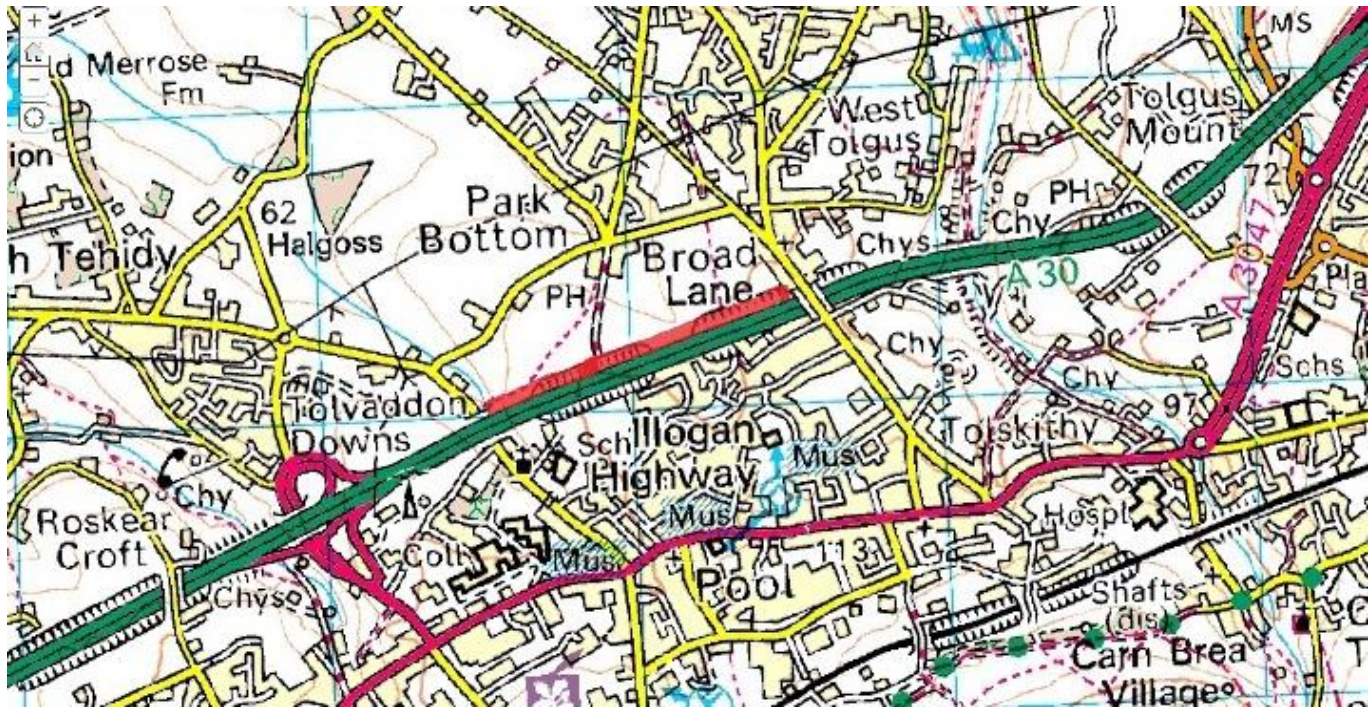
Grid reference: SW67014215

Altitude: 97 metres

Date of visit(s): 3 June and 11 August

Description: Sloping, south-facing verge with shorter turf at the foot and more densely vegetated banks with a range of nectar plants including Red campion, Hemp agrimony, Red and white clover, Teasel, thistles and Cow parsley. A narrow band of semi-mature trees present at the top of the slope, including Oak, Ash, Hazel.

Comments: A fairly productive site that produced a record of the rare tachinid fly *Policheta unicolor*. Management already leaves a zone of infrequently cut bramble and tall herb and this is good practice. Any cutting of this zone should be piecemeal, perhaps on a 3-5 year cycle. This should be done from September.



Site 4: A30 eastbound by Carland Cross roundabout

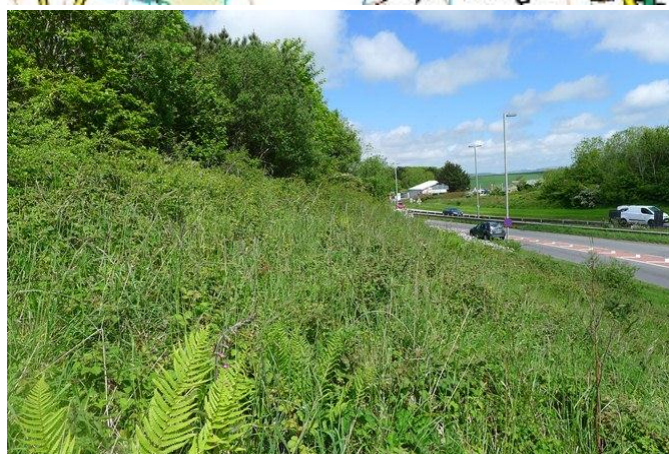
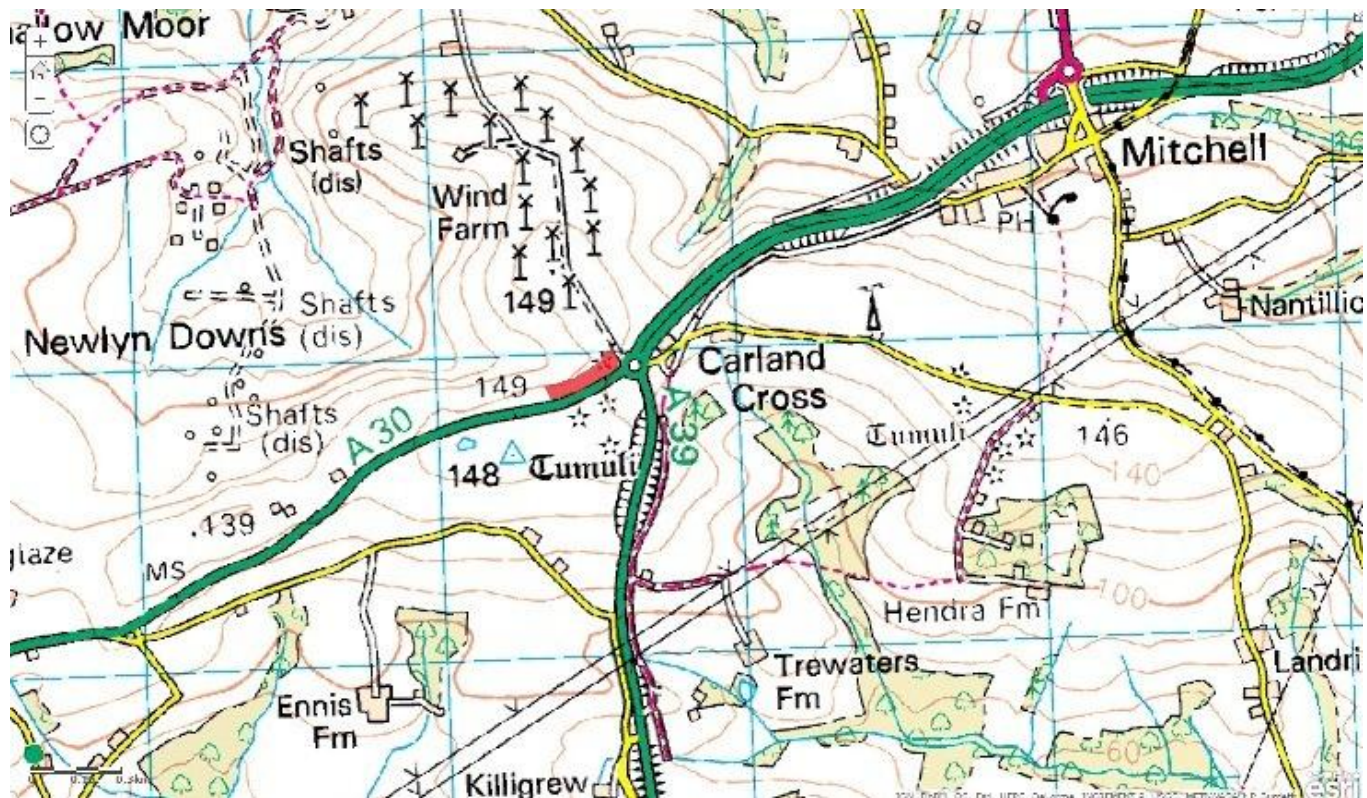
Grid reference: SW84655400

Altitude: 140 metres

Date of visit(s): 26 May and 8 August

Description: South-facing slope beside large roundabout and road to adjacent wind farm. Bordered by strip of deciduous woodland with a Hawthorn, Hazel and Gorse shrub layer. Slopes contained abundant nectar sources - buttercups, Bluebell, thistles, Cow parsley, Primrose, vetches, Common ragwort, Fleabane, Hemp agrimony. Beside the slip road, steep bare soil slope with rock fragments, no aculeate holes evident.

Comments: A moderately productive site but no unusual species recorded. Management should aim to maintain flowery grassland and some bramble/scrub, keeping the latter under control using piecemeal cutting during winter. Any grass cutting should be from September.



Site 5: A30 eastbound at Fraddon

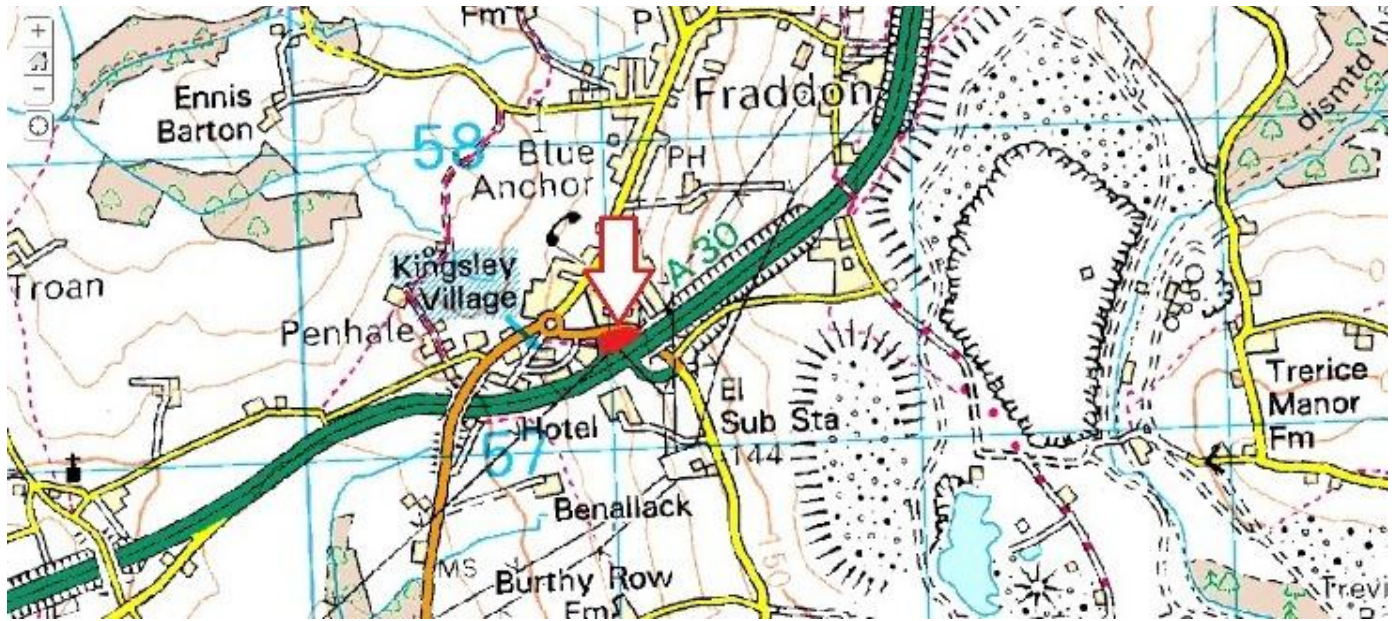
Grid reference: SW90925726

Altitude: 114 metres

Date of visit(s): 26 May and 11 August

Description: Sheltered area in lee of short 1m high bank and stone wall next to service area. Fleabane, thistles, Red campion, vetch, Common knapweed, etc. Very overgrown by mid-August.

Comments: A moderately productive site though no scarce species recorded. Management should aim to promote a mosaic of flowery grassland, scrub and bramble here, using piecemeal cutting in autumn and winter to prevent flowery grassland from being swamped out.



Site 6: A30 westbound at Fraddon by footbridge

Grid reference: SW91805781

Altitude: 189 metres

Date of visit(s): 3 June and 15 August

Description: Steep, west-facing bank with flat 3m verge at the foot. Floristically diverse - nectar plants included Red campion, Red clover, Common Knapweed, Fleabane, thistles, Hemp agrimony and Yarrow. Higher up the bank shrubby gorse, hawthorn, willow and oak.

Comments: Not exceptionally rich and no scarce species recorded - probably blighted by exposure and its west-facing orientation. The cutting that took place in the peak-flowering period of July or August seemed excessive in extent. Management should aim at maximising floweriness throughout summer months and promoting structural diversity by retaining some young scrub and bramble higher up, managing this in a piecemeal manner. The grassland should be cut from September and arisings removed.



3 June (left) and 15 August after cut (right)

Site 7: A30 westbound, Goss Moor

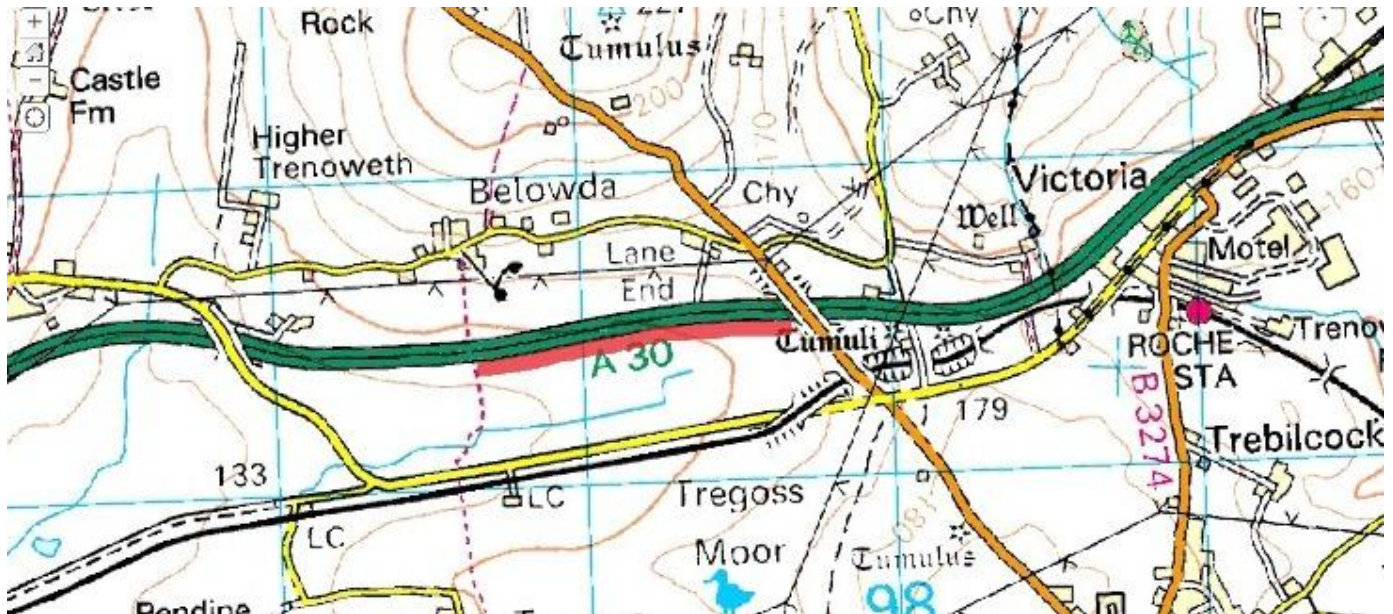
Grid reference: SW97106150

Altitude: 150 metres

Date of visit(s): 5 June and 6 August

Description: Herb-rich south-facing slope with short vegetation containing birds-foot trefoil and scattered bare ground. Longer sward at the bottom of the slope where Red campion and Ragged robin occur. Also thistles, Purple loosestrife, ragwort, dandelion.

Comments: A fairly productive site which produced a record of the rare fly *Policheta unicolor* and also the longest list of butterflies. Management should aim to retain species-rich grassland preferably cutting this on a 2-3 year rotation using cutting dates from September onwards. Arisings should be removed. Permit a little scrub and bramble development along the southern edge.



Site 7b Goss Moor NNR south of A30

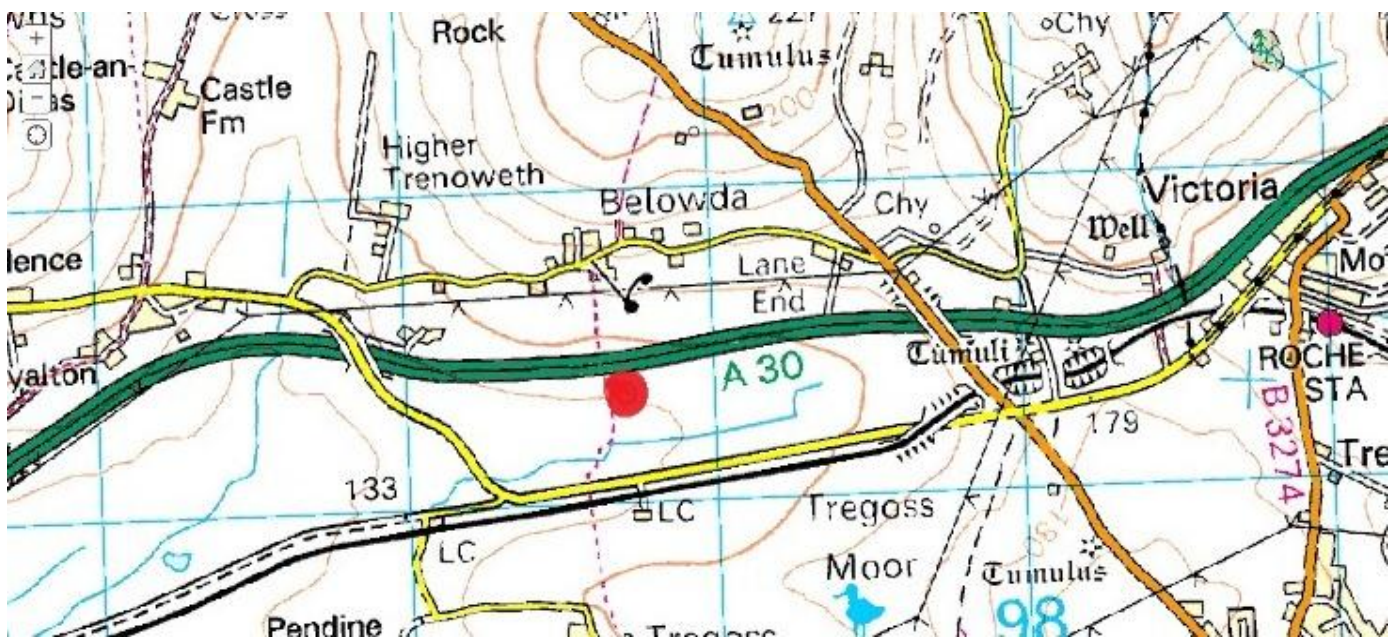
Grid reference: SW96726134

Altitude: 148 metres

Date of visit(s): 5 June and 6 August

Description: Two large artificial ponds in a wet meadow that fall within Goss Moor NNR. Field bordered by luxuriant hedgerows, including Common gorse, Hawthorn and Grey Willow. The larger of the two ponds had sloping bare banks as well as emergent vegetation and an obvious aquatic flora. Nectar sources included Marsh thistle, Lady's-smock, Ragged robin and Red campion.

Comments: A rich site supporting a valuable assemblage of dragonflies and other wetland invertebrates (despite being a very new site). It also produced a record of the rare fly *Policheta unicolor*. Management should aim at maintaining a wetland-grassland mosaic, with rotational cutting of the grassland after September. The site might also be suitable for winter grazing (October-March).



Site 8a: A30 eastbound at Victoria

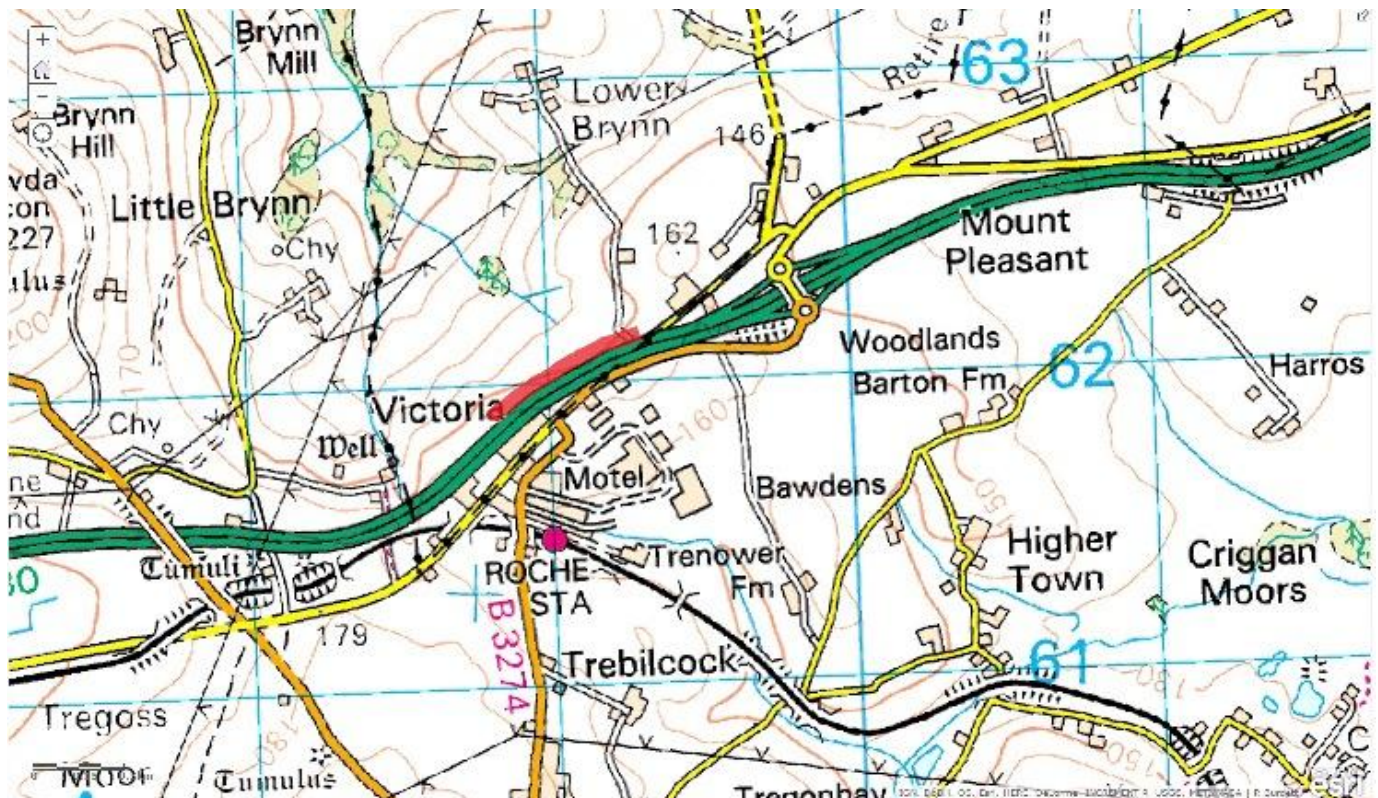
Grid reference: SW99016193

Altitude: 152 metres

Date of visit(s): 6 June and 15 August

Description: Flat verge immediately beside the road with nectar plants including Red campion, thistles and buttercups, sloping into a scrub-dominated lower section with willow, Hazel, Common Gorse and Hawthorn, as well as a dried up damp ditch which is likely to be seasonally wet.

Comments: A fairly unproductive site, possibly blighted by exposure. By the time of the second visit the verge had been closely mown, affecting a very large area and even extending down the bank some distance. Management should aim to decrease the extent of cutting and to delay this until at least September to provide a longer period of flowering and tall herbage.



6 June (left) and 15 August after extensive cut (right)

Site 8b: A30 westbound at Victoria

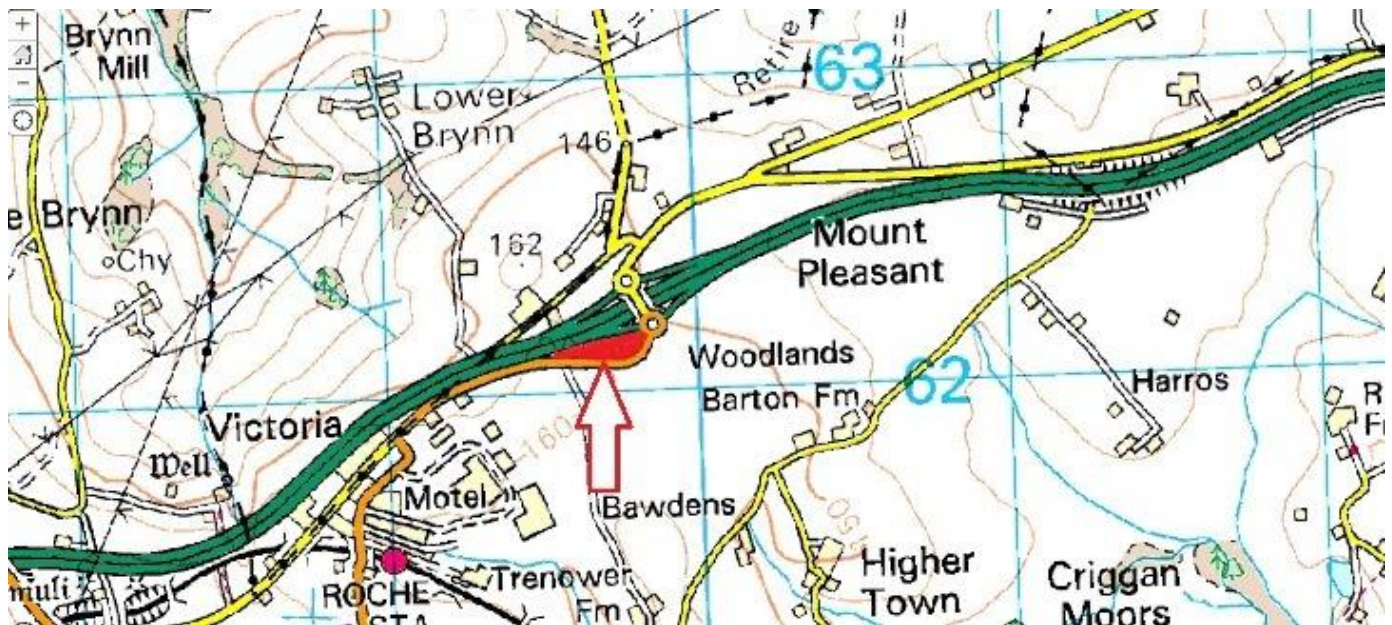
Grid reference: SW99796213

Altitude: 144 metres

Date of visit(s): 6 June and 15 August

Description: Large flat 'island' between A30 and adjacent Victoria road. Excellent habitat. Floristically diverse with a carpet of Common bird's-foot tefoil, buttercups, vetches and abundant thistles plus clumps of rushes in damper areas. Some scattered small areas of bare ground and two dried up watercourses. Bordered by a thick hawthorn hedge.

Comments: Not as productive as its appearance would suggest but probably blighted by exposure. Management should aim to maximise the floweriness of the area using rotational grass cutting on a 3-year basis (cutting one-third in a given year). Cutting should take place from September and arisings removed.



Site 9: A30 eastbound at Innis Downs

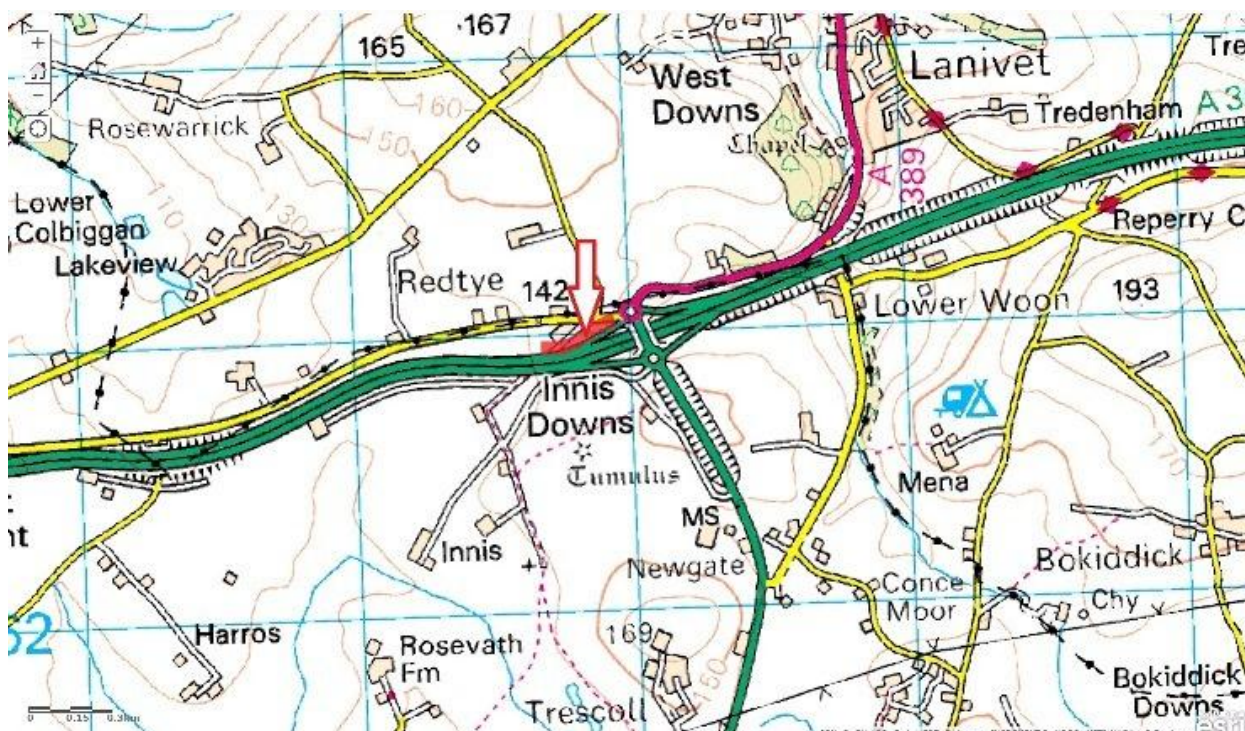
Grid reference: SX02856299

Altitude: 140 metres

Date of visit(s): 9 June and 17 August

Description: Steep-sided, south-facing embankment beside slip road. Some extensive areas of bare ground. Nectar sources included vetches, thistles, Red and White clover. Some stunted gorse and heather patches on the slopes. Line of semi-mature tree present at the top of the slope where a short dry-stone wall is also present. Some damper habitat present by the roundabout with rushes.

Comments: A fairly unproductive site (possibly blighted by exposure) though it produced another record of the rare tachinid *Policheta unicolor*. Management should aim to maximise the floweriness of the area using rotational grass cutting on a 3-year basis (cutting one-third in a given year). Cutting should take place from September and arisings removed.



Site 10a: A30 eastbound at Innis Downs

Grid reference: SX07256370

Altitude: 133 metres

Date of visit(s): 9 June and 16 August

Description: Narrow verge, flat or gently sloping. Long sward, scattered nectar sources - Rosebay willowherb, Hemp agrimony, Red campion, thistles, Scarlet pimpernel etc. Verge narrows into an area of semi-mature deciduous trees at the back – Oak and Ash with Red campion and Bluebells below.

Comments: A relatively unproductive site. Its value could be enhanced by encouraging greater floweriness. This might be a verge suitable for seeding or green hay. Hogweed, thistles and bramble should also be encouraged.



Site 10b: A30 westbound at Innis Downs

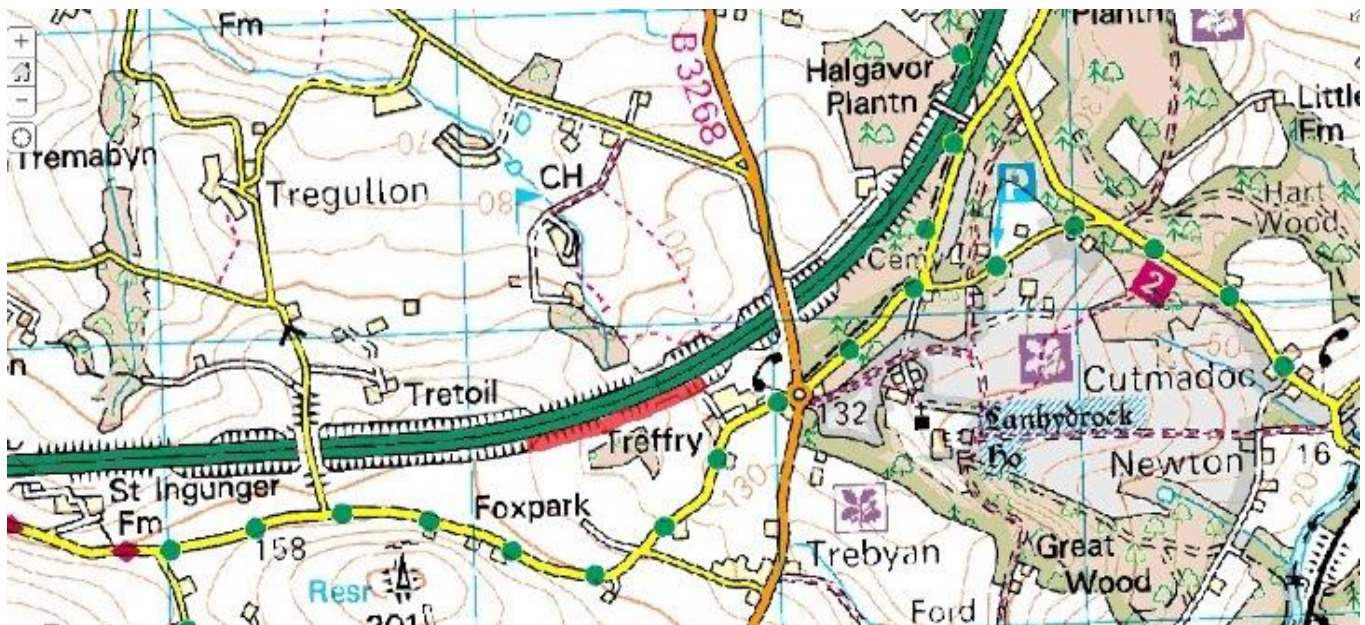
Grid reference: SX07256367

Altitude: 138 metres

Date of visit(s): 15 July and 16 August

Description: Sloping verge by layby, north-facing. Mature hawthorn hedge at the top of the slope and scattered mature deciduous trees. Lower slopes contained a dense sward of umbellifers, Rosebay willowherb, vetches etc.

Comments: A relatively unproductive site. Its value could be enhanced by encouraging greater floweriness. This might be a verge suitable for seeding or green hay. Hogweed, thistles and bramble should also be encouraged.



Site 11: A30 eastbound, Temple, Bodmin Moor

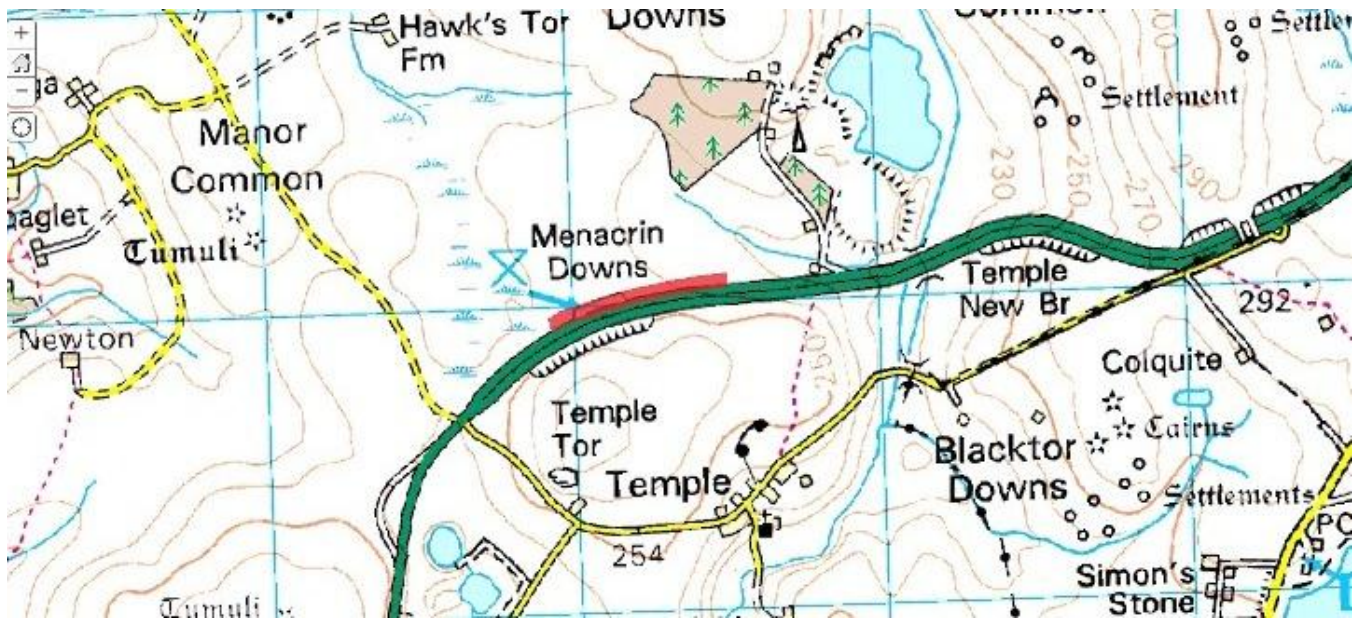
Grid reference: SX14107399

Altitude: 245 metres

Date of visit(s): 16 June and 17 August

Description: South-facing, flattish verge by layby bordering acid grassland moor. Bank of Rosebay willowherb at the back of the site. Patches of willow at the northern end. Some stunted heather and gorse. Nectar sources included Tormentil, Meadow buttercup, Red campion and thistles.

Comments: A moderately productive site though no records of any scarce species and probably blighted by exposure and altitude. Management should aim to maximise the floweriness of the area using rotational grass cutting on a 3-year basis (cutting one-third in a given year). Cutting should take place from September and arisings removed.



Site 12a: A30 eastbound at Bolventor

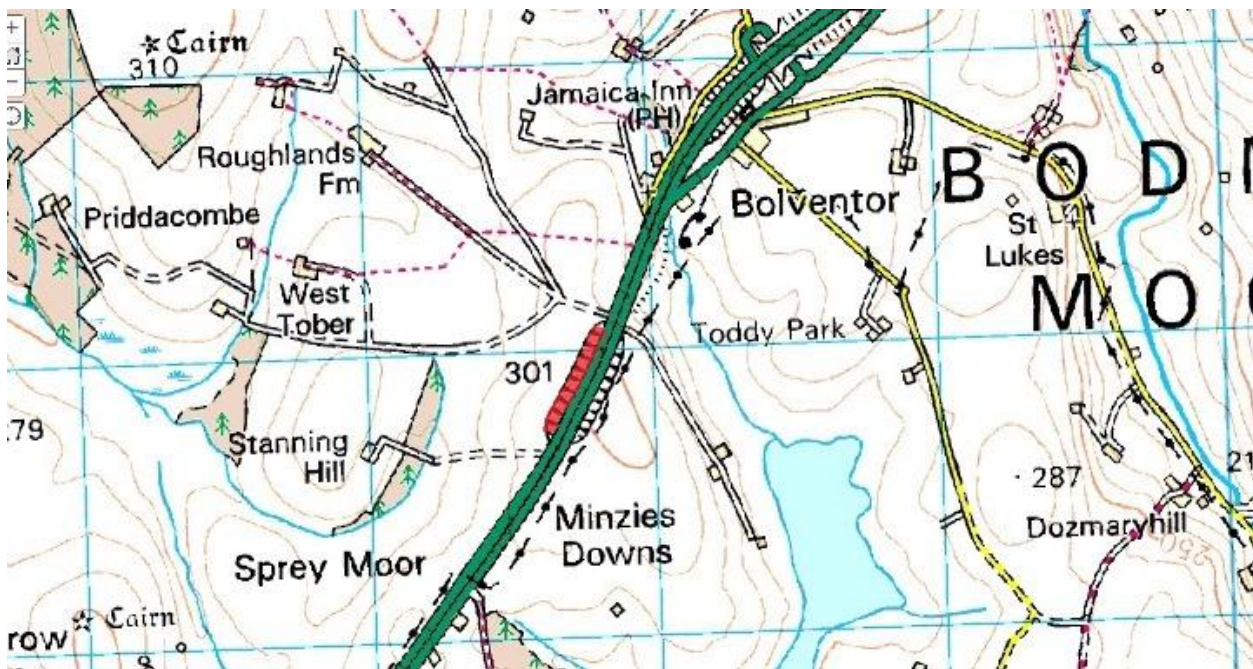
Grid reference: SX17687573

Altitude: 295 metres

Date of visit(s): 14 June and 17 August

Description: East-facing slope with short turf containing heather, Tormentil, bedstraw, Red campion, Yarrow and Rosebay willowherb. Longer sward present at top of slope. Mature hawthorn and gorse present at northern end.

Comments: A rather unproductive site probably blighted by exposure and altitude, though it did produce a record of the scarce fly *Sarcophaga sinuata* (probably a straggler breeding elsewhere). Management should aim to maximise the floweriness of the area using rotational grass cutting on a 3-year basis (cutting one-third in a given year). Cutting should take place from September and arisings removed.



Site 12b: A30 westbound at Bolventor

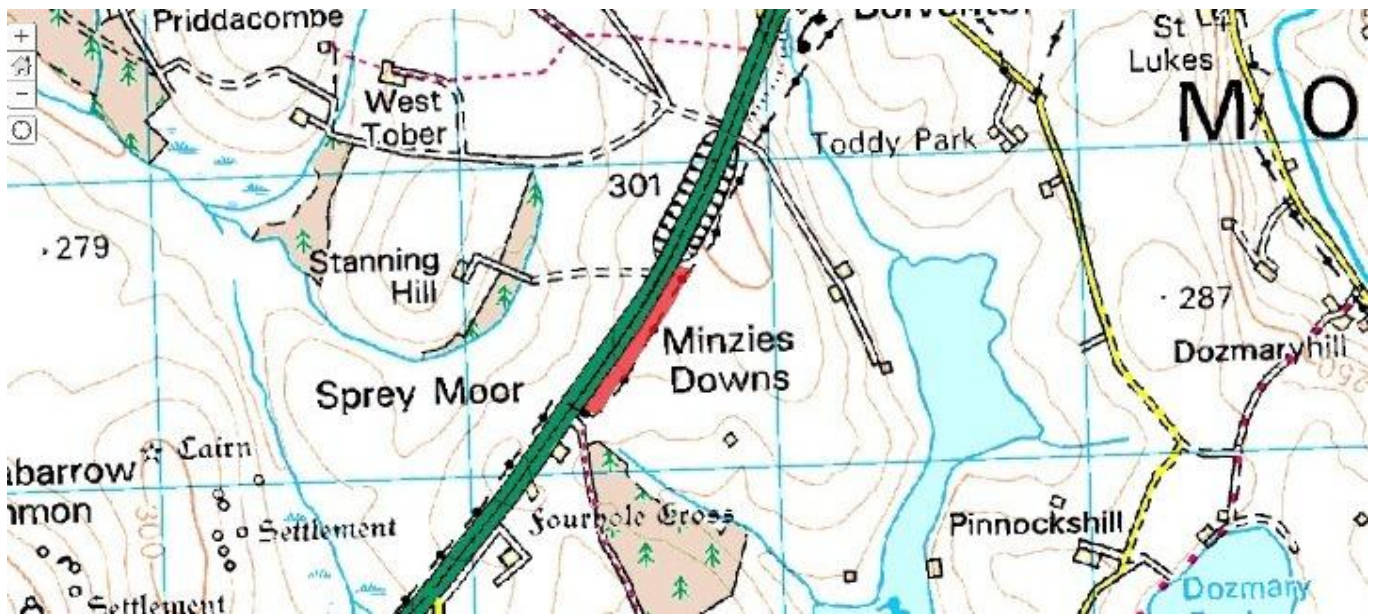
Grid reference: SX17567549

Altitude: 290 metres

Date of visit(s): 14 June and 18 August

Description: Wide west-facing verge, very exposed site. Dense strip of bramble and gorse on landward side and occasional willows. Bordering acid grassland moor. Red campion, Common Ragwort, thistles, nettles and rushes present; also some bare ground.

Comments: A rather unproductive site probably blighted by exposure and altitude. Management should aim to maximise the floweriness of the area using rotational grass cutting on a 3-year basis (cutting one-third in a given year). Cutting should take place from September and arisings removed.



Site 13: A30 eastbound at Bolventor junction

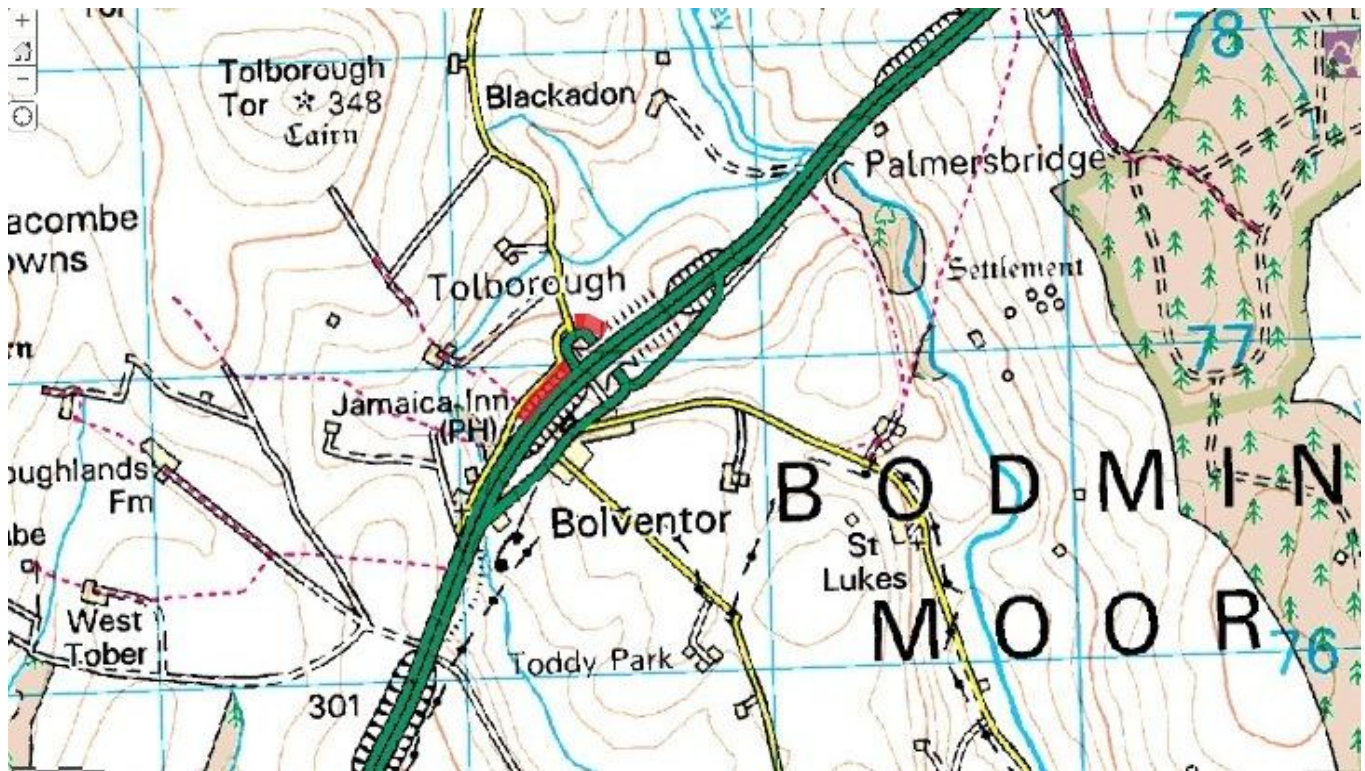
Grid reference: SX18437707

Altitude: 252 metres

Date of visit(s): 16 June and 18 August

Description: Large area with bank sloping down from the A30 leading to a large flat area flanking the slip road. Dominated by Rosebay willowherb (area 1). Red campion and buttercup also present plus some bare ground. On the opposite side of the road (area 2) was an area of damp grassland with rushes and abundant gorse, bordering acid grassland moor.

Comments: A rather unproductive site probably blighted by exposure and altitude, though it did produce an unexpected record of the scarce hoverfly *Microdon myrmicae* (probably a straggler from nearby damp grassland). Management should aim to maximise the floweriness of the area. Cutting should take place from September and arisings removed. Given the exposed nature of the site, management could be very occasional, and dense stands of tall herbs (e.g. willowherb) and bramble-scrub are probably very valuable landscape features here.



Area 1 (left) and Area 2 (left)

Site 14a: A30 eastbound at Kennards House

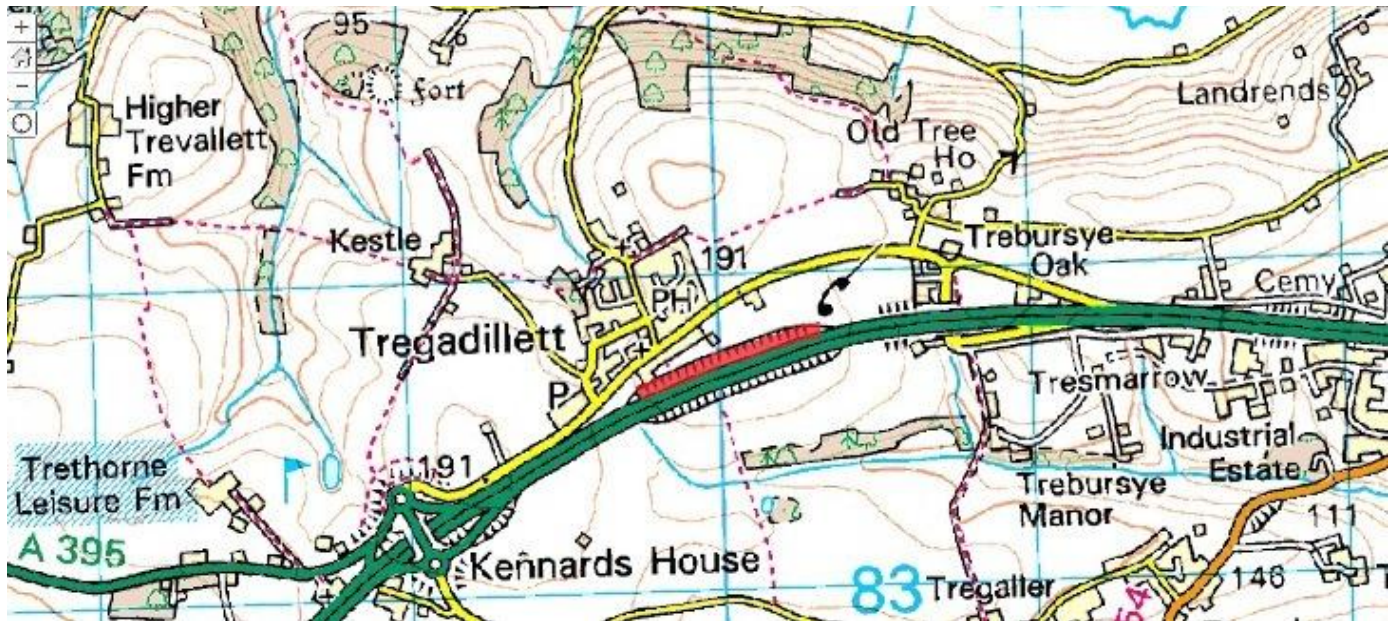
Grid reference: SX29968363

Altitude: 184 metres

Date of visit(s): 9 July

Description: Steep, south-facing slope with abundant nectar sources including Bird's-foot trefoil and vetches. Gorse and Hawthorn present at the top of the slope.

Comments: A particularly unproductive site possibly blighted by exposure and altitude. Management should aim to maximise the floweriness of the area using rotational grass cutting on a 3-year basis (cutting one-third in a given year). Cutting should take place from September and arisings removed.



Site 14b: A30 westbound at Kennards House

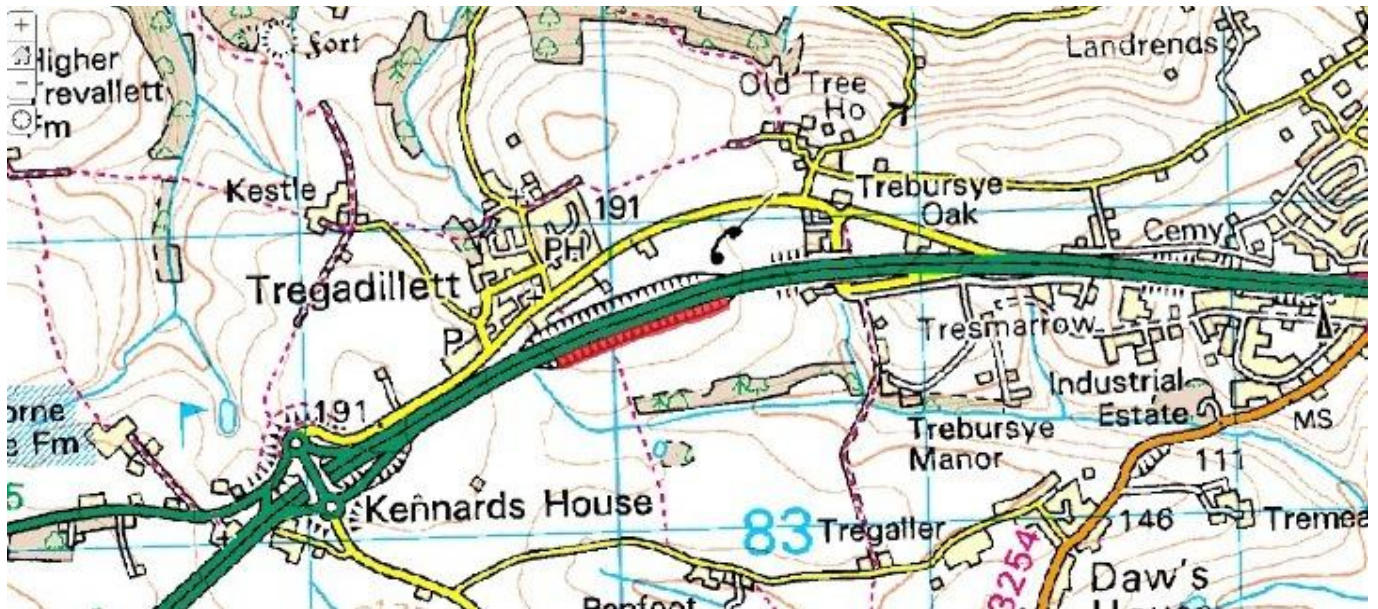
Grid reference: SX30138366

Altitude: 184 metres

Date of visit(s): 9 July

Description: Steep, north-facing slope with a border of hawthorn at the top. Bramble, vetches, nettle and Bird's-foot trefoil present.

Comments: A rather unproductive site probably blighted by exposure, altitude and orientation. Management should aim to maximise the floweriness of the area using rotational grass cutting on a 3-year basis (cutting one-third in a given year). Cutting should take place from September and arisings removed.



Site 15: A30 eastbound at Sourton Cross junction

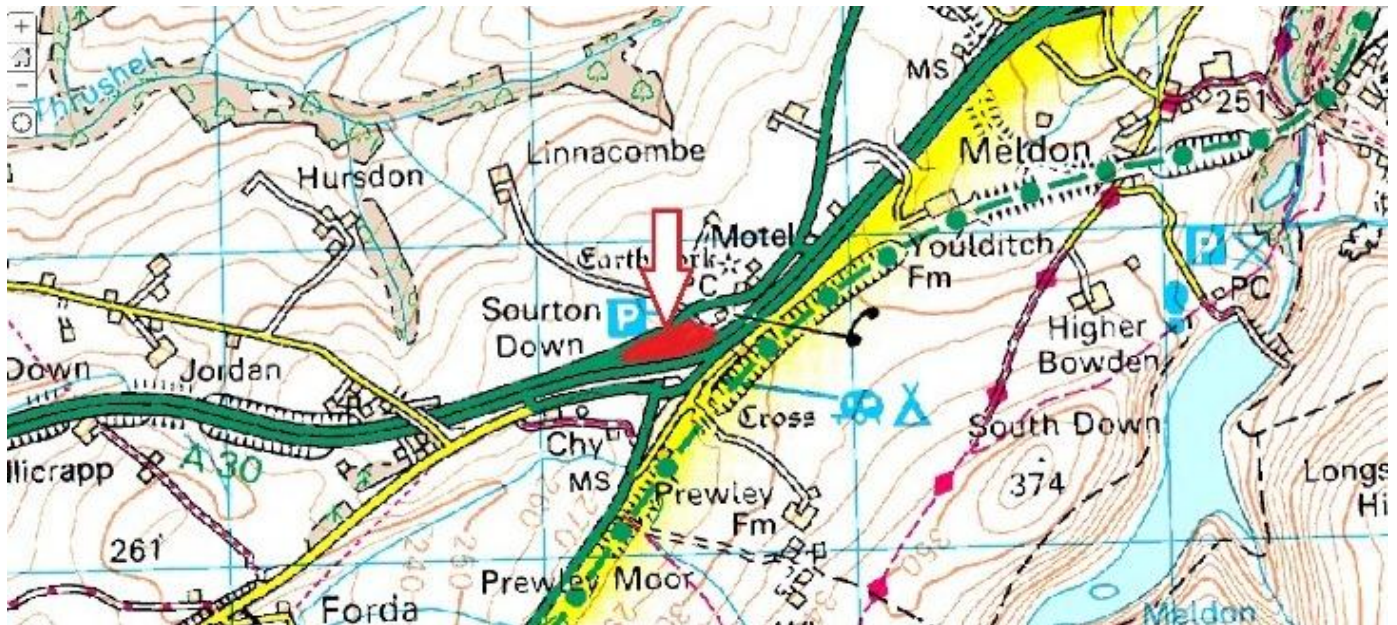
Grid reference: SX54509168

Altitude: 289 metres

Date of visit(s): 9 July

Description: Junction by service station. Long sward with mown path through it. Thistles, bramble, Bird's-foot trefoil, rushes and umbellifers present. Bordering Hazel, Hawthorn scrub and pines. Resembles woodland edge habitat with combination of sunny and shaded areas.

Comments: A moderately productive site but no scarce species recorded. Management should aim to promote a grassland-scrub mosaic here with patches of brambles. Maximise the floweriness of the area cutting any grass on a 3-year basis (cutting one-third in a given year). Cutting should take place from September and arisings removed.



Site 16: A30 westbound, Okehampton bypass

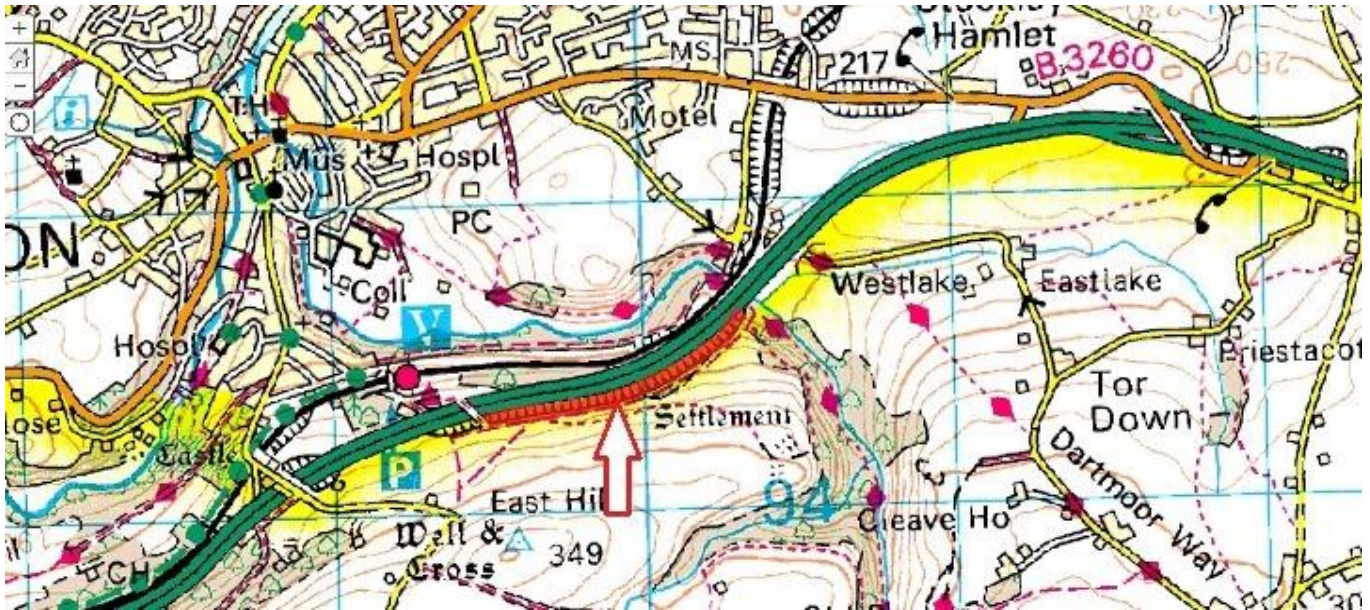
Grid reference: SX60259460

Altitude: 218 metres

Date of visit(s): 10 July

Description: South-facing slope with mature deciduous woodland on the northern boundary. On the slope Foxglove *Digitalis purpurea*, thistles, bramble, vetches and a lot of Bracken *Pteridium aquilinum*. Low growing bramble on the edge of the woodland was attracting bees and hoverflies

Comments: A moderately productive site though no scarce species were recorded. Management should aim to maximise the floweriness of the area cutting any grass on a 3-year basis (cutting one-third in a given year). Cutting should take place from September and arisings removed. A scrub-bramble fringe should be retained alongside the woodland edge.



Site 18: A30 westbound at Alphington

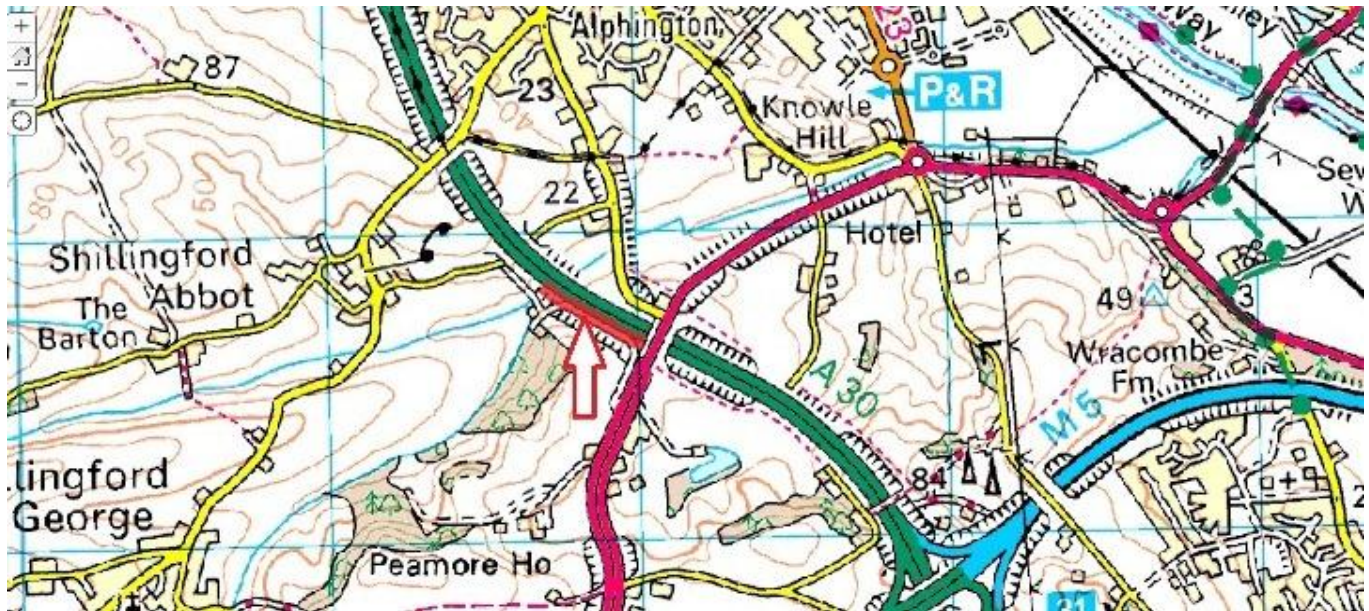
Grid reference: SX91898872

Altitude: 48 metres

Date of visit(s): 15 July

Description: Narrow verge by layby. Steep, north-facing bank with dense sward, bordered by mature deciduous trees. Nectar sources sparse - some Common ragwort, thistles, umbellifers.

Comments: A rather unproductive site. Management should aim to maximise the floweriness of the area and to retain a tall herb-bramble-scrub zone on the higher parts of the bank which can be managed on a 3-5 year rotation.



Site 19a: A38 eastbound at Dobwalls

Grid reference: SX21346531

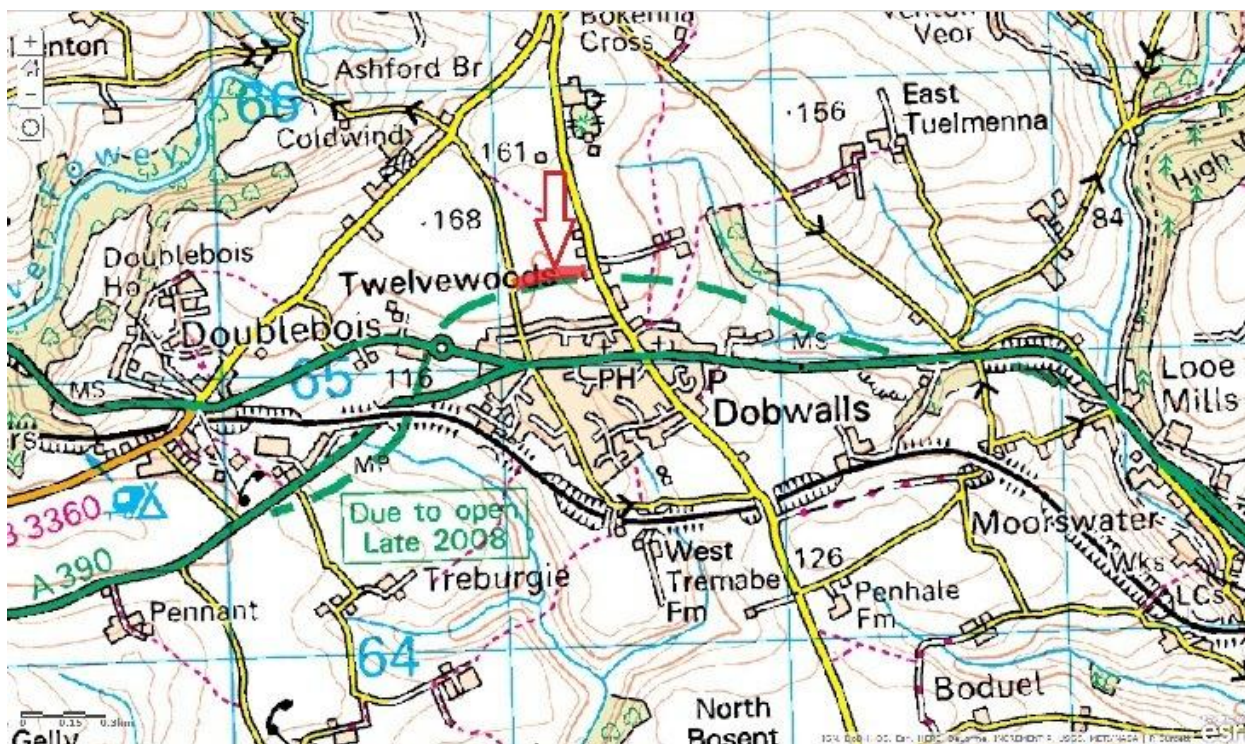
Altitude: 151 metres

Date of visit(s): 30 July and 26 August

Description: South-facing steep scree slope with scattered low vegetation and bare ground. Very warm and sheltered corner by the bridge particularly attractive to invertebrates. Bird's-foot trefoil, thistles, Common ragwort, brambles and Common centaurry all common. On the opposite side of the cycle path was an overgrown area with a small pond.

Comments: A rather unproductive site, but still new and with great potential to gain interest, especially if early successional stages and bare/sparsely-vegetated floristically diverse conditions are encouraged. One scarce species was recorded, the picture-winged fly *Acanthiophilus helianthi*, which likes knapweeds in warm locations.

Management decisions should be based on how the vegetation develops.



Site 19b: A38 westbound at Dobwalls

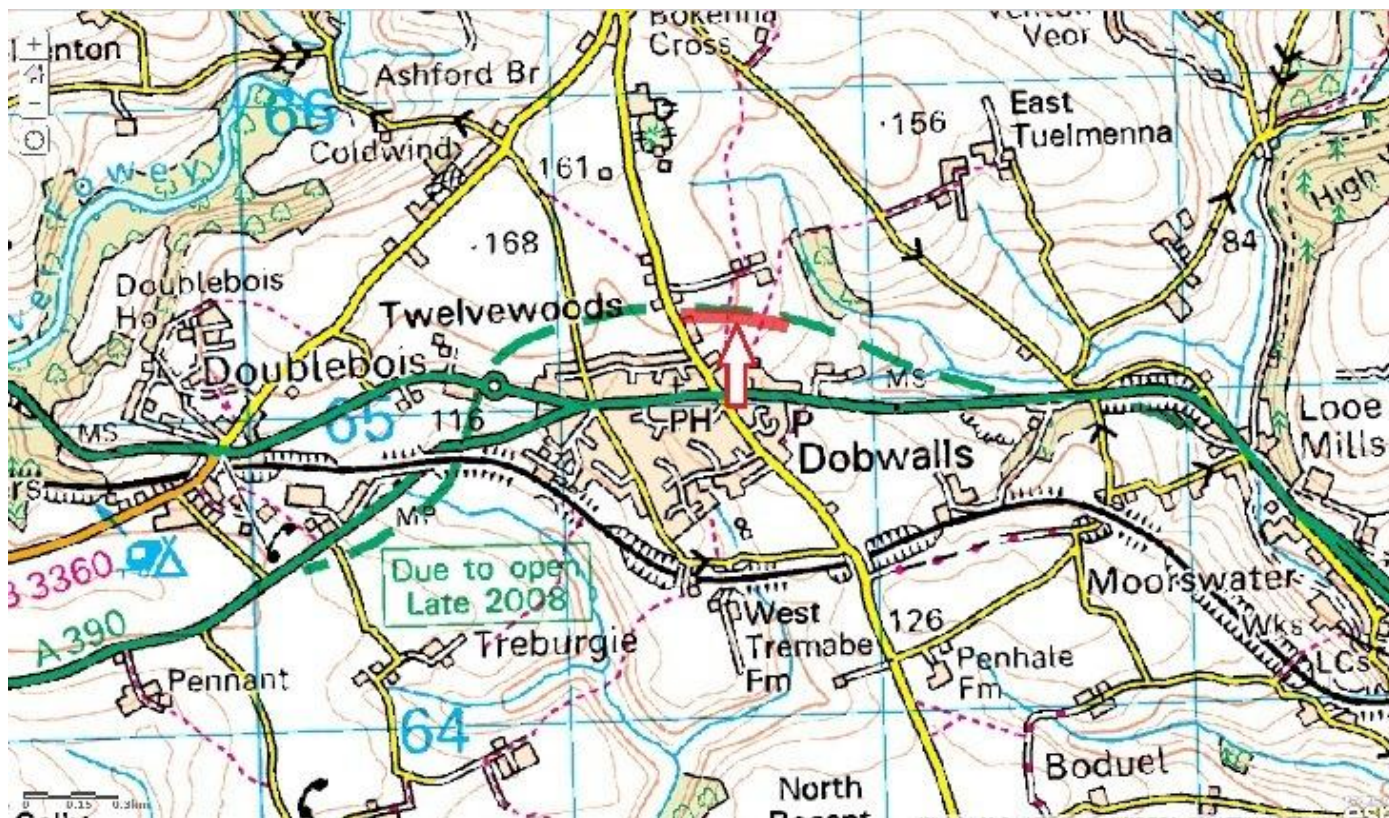
Grid reference: SX21396528

Altitude: 151 metres

Date of visit(s): 30 July and 26 August

Description: Steep rocky slope with scattered short vegetation and low-growing plants at base. At the top several rank grass fields with abundant thistles. Willow, Hazel and Hawthorn bordering fields. Bird's-foot Trefoil, Hemp agrimony, Ragwort, umbellifers and Buddleia present.

Comments: A moderately productive site, but the verge is still new and with potential to gain greater interest, especially if early successional stages and bare/sparsely-vegetated floristically diverse conditions are encouraged. The fields at the top could be used to create a conservation area encouraging a mosaic of flowery grassland, tall herb and scrub, managed in a piecemeal manner.



Road verge (left) and one of the fields at the top of the bank (right).

Site 21: A38 eastbound at Menheniot

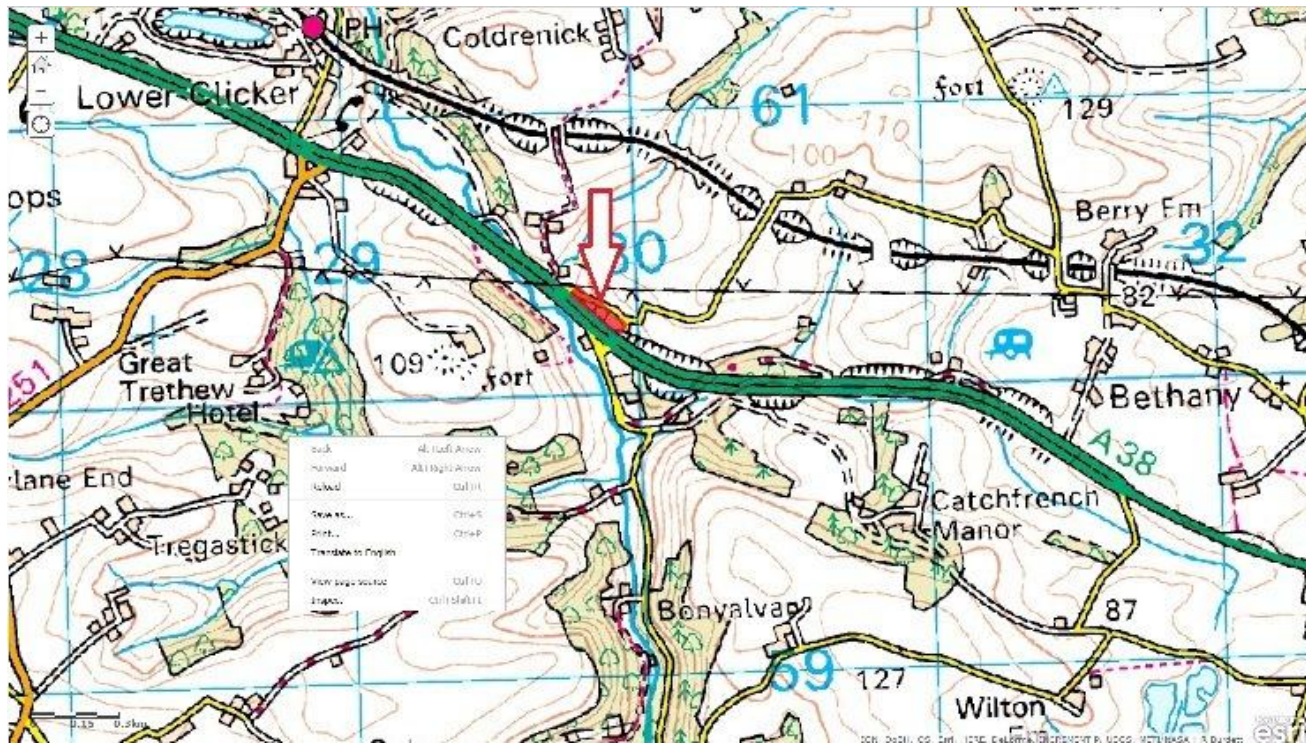
Grid reference: SX29916021

Altitude: 54 metres

Date of visit(s): 30 July and 26 August

Description: Very narrow verge bordering mature woodland. Mown margin, layer of dense bramble and thistles grading into Oak, Ash and Alder woodland.

Comments: A very unproductive site. The fringe of brambles and thistles should be retained.



Site 22: A38 eastbound near Saltash Tunnel

Grid reference: SX42375974

Altitude: 38 metres

Date of visit(s): 31 July

Description: Shallow sloping verge with medium-sized mature trees at back - Hawthorn, maple, Oak Hazel. Nectar sources included Common knapweed and umbellifers.

Comments: A productive site that produced one of the best lists of bees. Unfortunately diversity plummeted after cutting. Management should aim to maximise the floweriness of the area cutting any grass on a 3-year basis (cutting one-third in a given year). Cutting should take place from September and arisings removed. A scrub-bramble fringe should be retained alongside the woodland edge.



31 July prior to cutting (left) and 27 August after cutting (right)

Site 24: A38 eastbound at Plympton

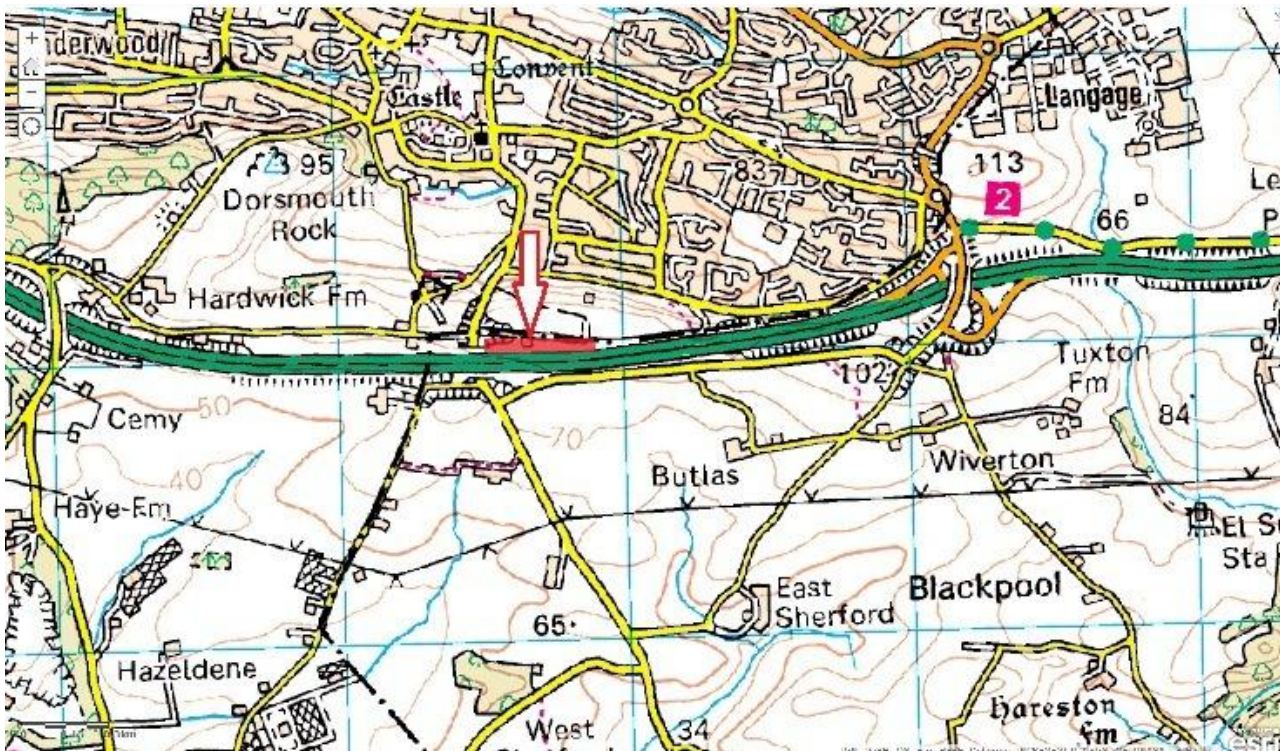
Grid reference: SX54645495

Altitude: 68 metres

Date of visit(s): 25 July

Description: Verge by layby with bramble, Rosebay willowherb and umbellifers. Shrub layer grading to mature Hawthorn and Ash trees.

Comments: A productive site, with one scarce species recorded (the fly *Lasiochaeta pubescens*). Management should aim to maximise the floweriness of the area cutting any grass on a 3-year basis (cutting one-third in a given year). Cutting should take place from September and arisings removed. A scrub-bramble-tall herb fringe should be retained.



Site 26a: A38 eastbound at Smithaleigh

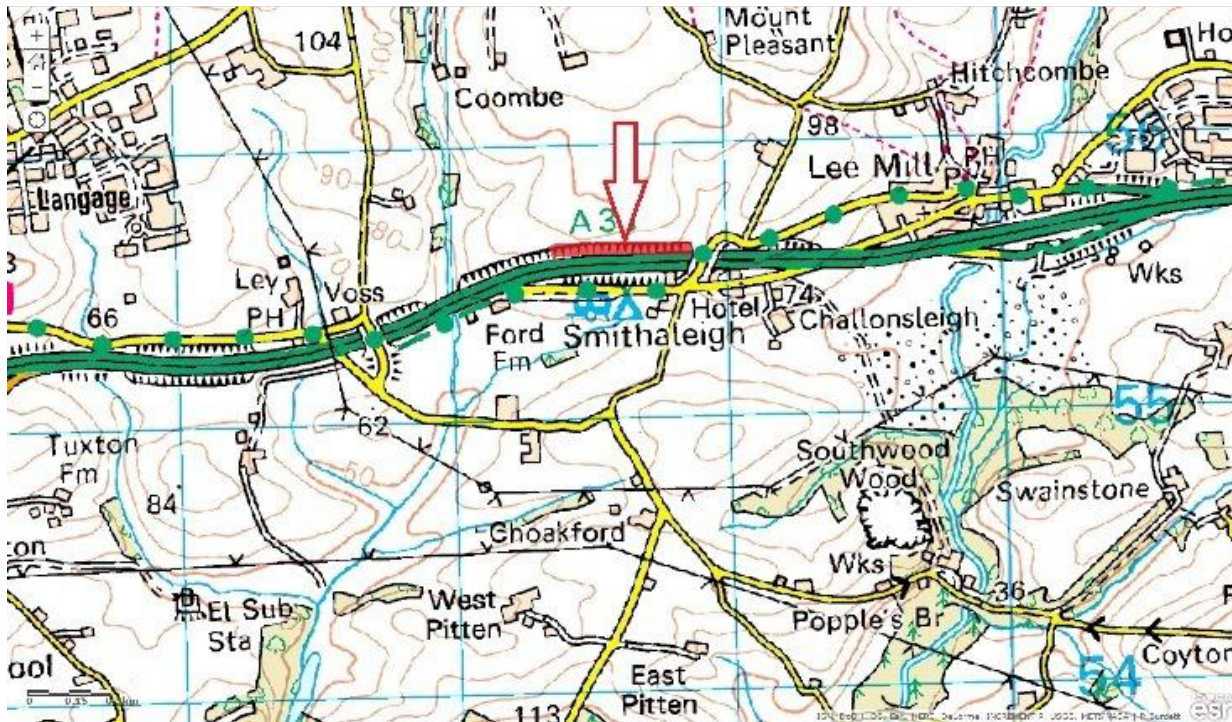
Grid reference: SX58735558

Altitude: 74 metres

Date of visit(s): 31 July

Description: Steep exposed south-facing rock/scree slope with woodland along the top. Gorse, Buddleia and stunted oaks on the slopes. Not possible to access these slopes. At the bottom, lots of bramble, Buddleia, Common Ragwort, Fleabane, Common centaury, Bird's-foot trefoil and thistles.

Comments: A rather unproductive site but difficult to survey. Management should aim to retain a mix of flowery grassland, bare rock and scattered shrubs/scrub, preventing scrub from becoming over dominant.



Site 26b: A38 westbound at Smithhaleigh

Grid reference: SX58195550

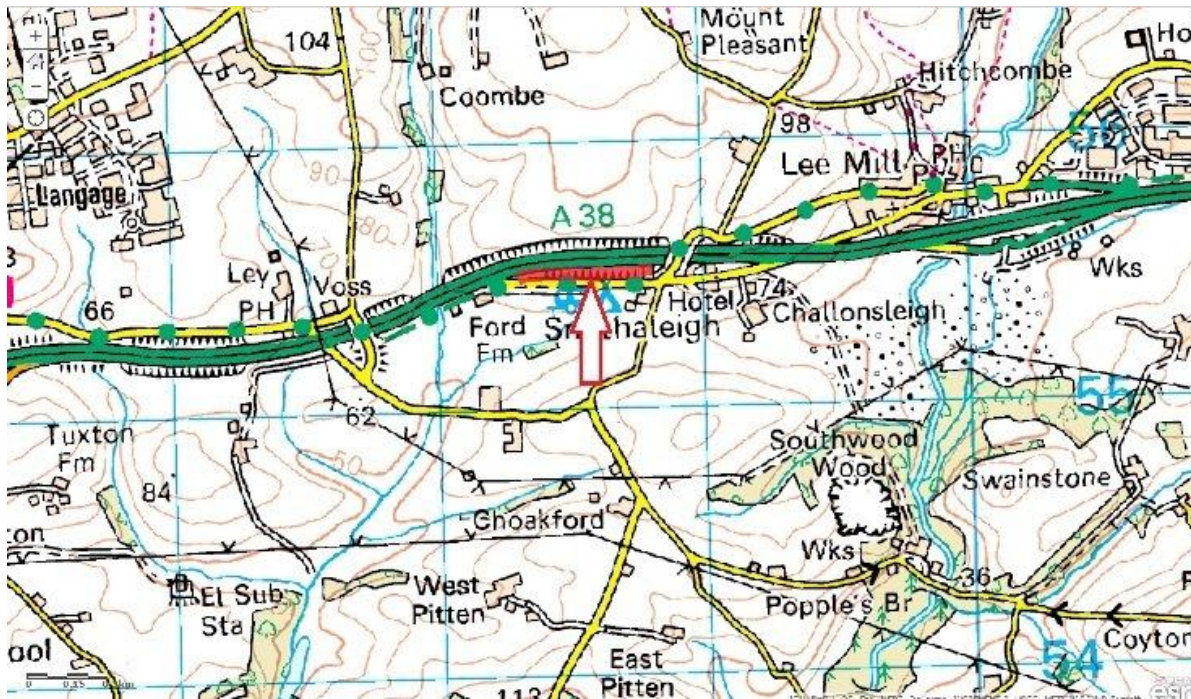
Altitude: 74 metres

Date of visit(s): 31 July

Description: Layby with sloping embankment. Some exposed scree slopes with a Hawthorn hedge at the top. Slopes contained a lot of bramble, some small Ash, Red valerian, umbellifers, thistles and Common centaury.

Comments: A particularly unproductive site, probably because the dense bramble made sampling difficult.

Management should aim to trim back some of the bramble and see if flowery grassland or tall herb can be encouraged to form. This is not high priority though because even a bramble fringe has value and can complement surrounding habitats as a source of flowers, foliage and shelter.



Site 27a: A38 eastbound between Ivybridge and Bittaford

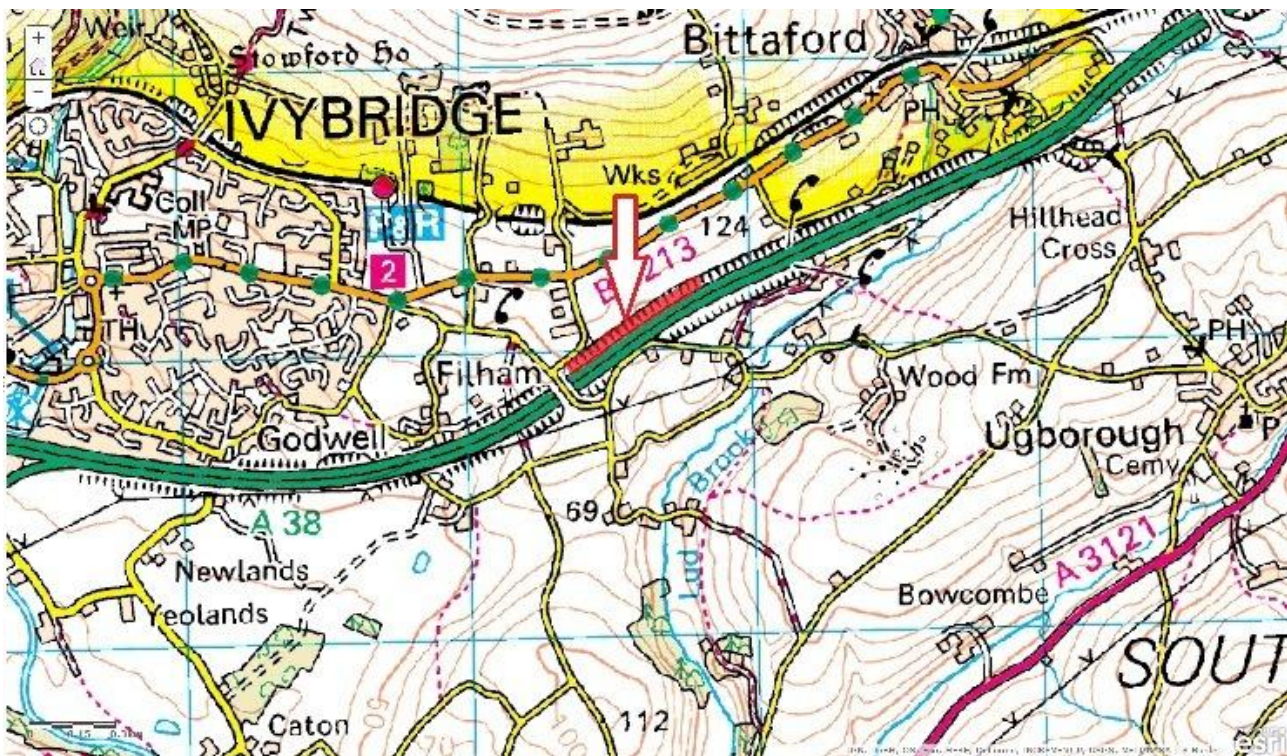
Grid reference: SX65545599

Altitude: 89 metres

Date of visit(s): 29 July

Description: Sloping bank with dense scrub. Mature deciduous trees at the top of the slope. On the bank a lot of gorse, thistles, hawthorn and dense bramble. Ragwort also present.

Comments: Another particularly unproductive site due to dense bramble and scrub, though the scarce fly *Lasiochaeta pubescens* was recorded. Management should aim to trim back some of the bramble and see if flowery grassland or tall herb can be encouraged to form. This is not high priority though because even a bramble area has value and can complement surrounding habitats as a source of flowers, foliage and shelter.



Site 27b: A38 westbound between Ivybridge and Bittaford

Grid reference: SX66175630

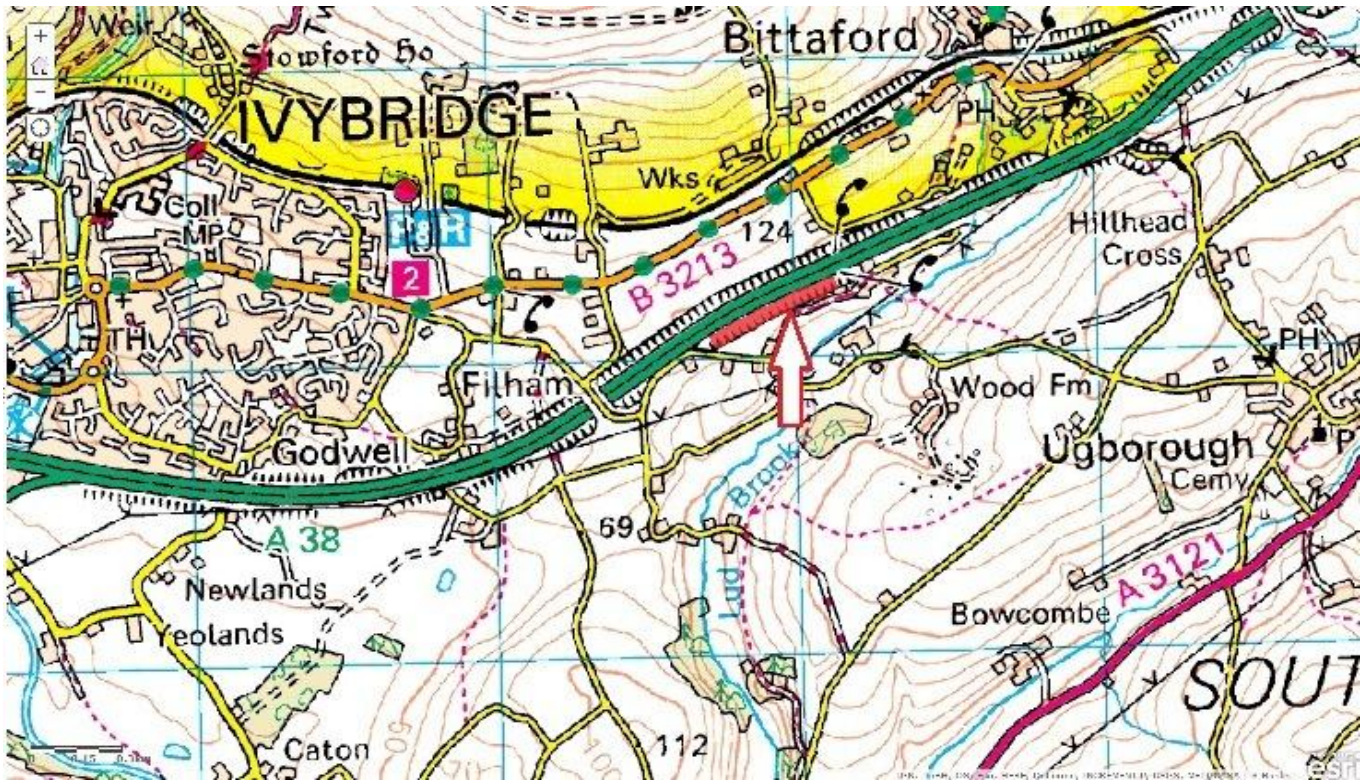
Altitude: 86 metres

Date of visit(s): 18 July

Description: Narrow verge by layby. Tangle of bramble, Red campion, umbellifers and Common ragwort. Mixed deciduous trees included Sycamore, Ash and Hawthorn.

Comments: One of the least productive sites but producing a record of the scarce fly *Lasiochaeta pubescens*.

Management should aim to retain a flowery tall herb and bramble fringe.



Site 28: A38 eastbound at Wrangaton

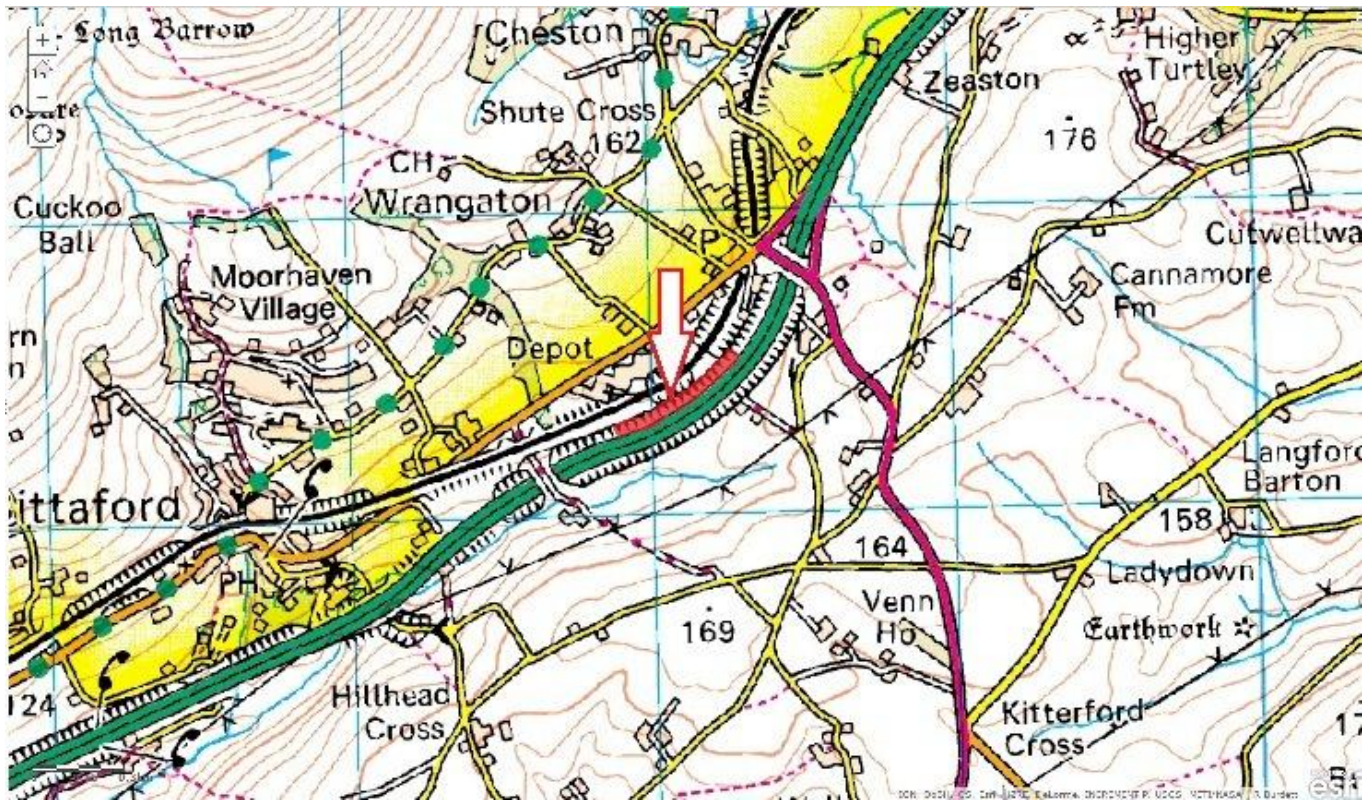
Grid reference: SX67995730

Altitude: 111 metres

Date of visit(s): 29 July

Description: Poor quality verge. Sloping bank covered with dense scrub - bramble, Buddleia, Blackthorn, Hawthorn, Hazel - grading into line of mature trees at top - Oak, Ash etc. Short vegetation area present by road.

Comments: Another unproductive site. Management should aim to retain a flowery tall herb and bramble fringe perhaps by clearing some of the scrub.



Site 29a: A38 eastbound at South Brent

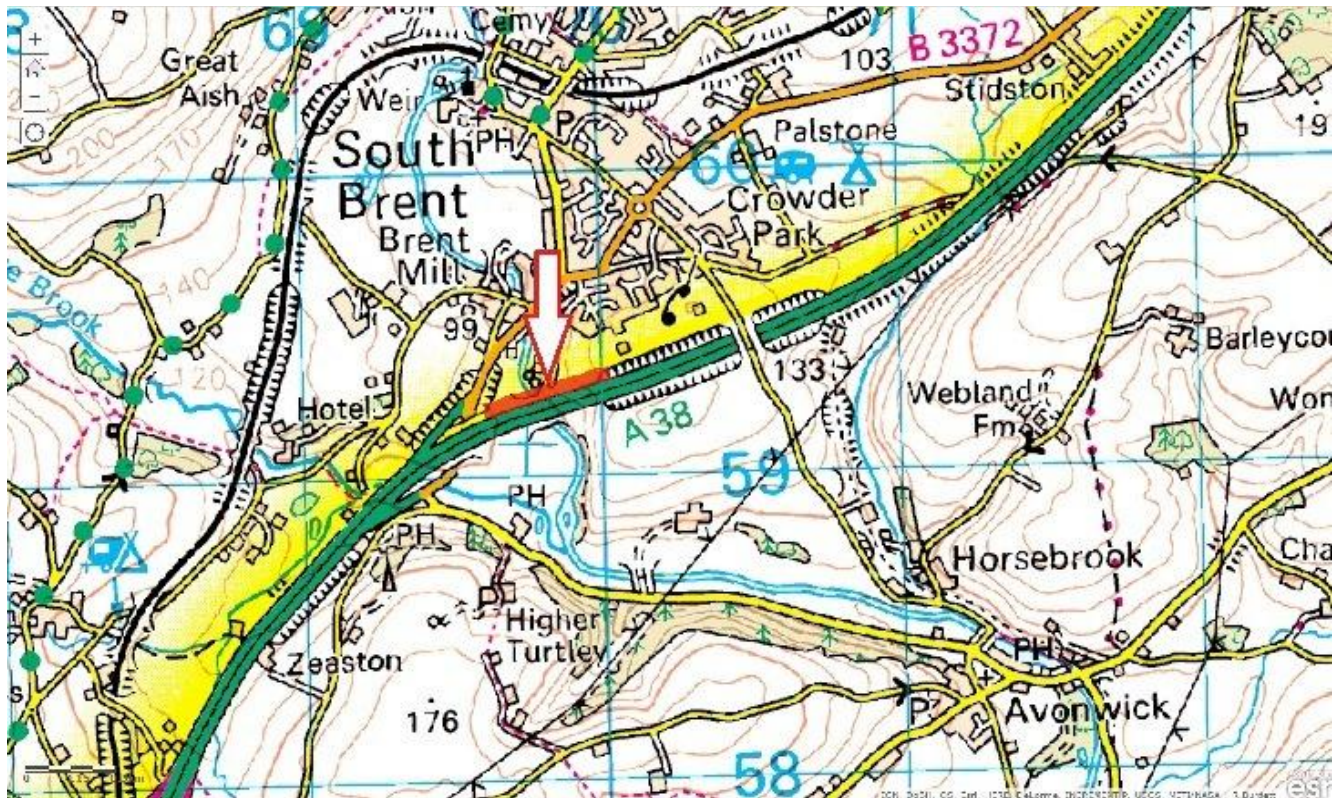
Grid reference: SX69995928

Altitude: 121 metres

Date of visit(s): 25 July and 28 August

Description: Sloping south-facing bank bordering semi-mature woodland belt - Hazel, Oak and Ash. Lot of Gorse present on the bank. Warm microclimate, nectar sources including Red valerian, mint, etc.

Comments: A fairly productive site that produced records of two scarce bugs, *Trapezonotos ullrichi* and *Megalonotus ditatatus*, both species of dry, flowery habitats. Management should aim to trim back some of the gorse or scrub to increase the presence of flowery grassland, using a piecemeal approach.



Site 29b: A38 westbound at South Brent

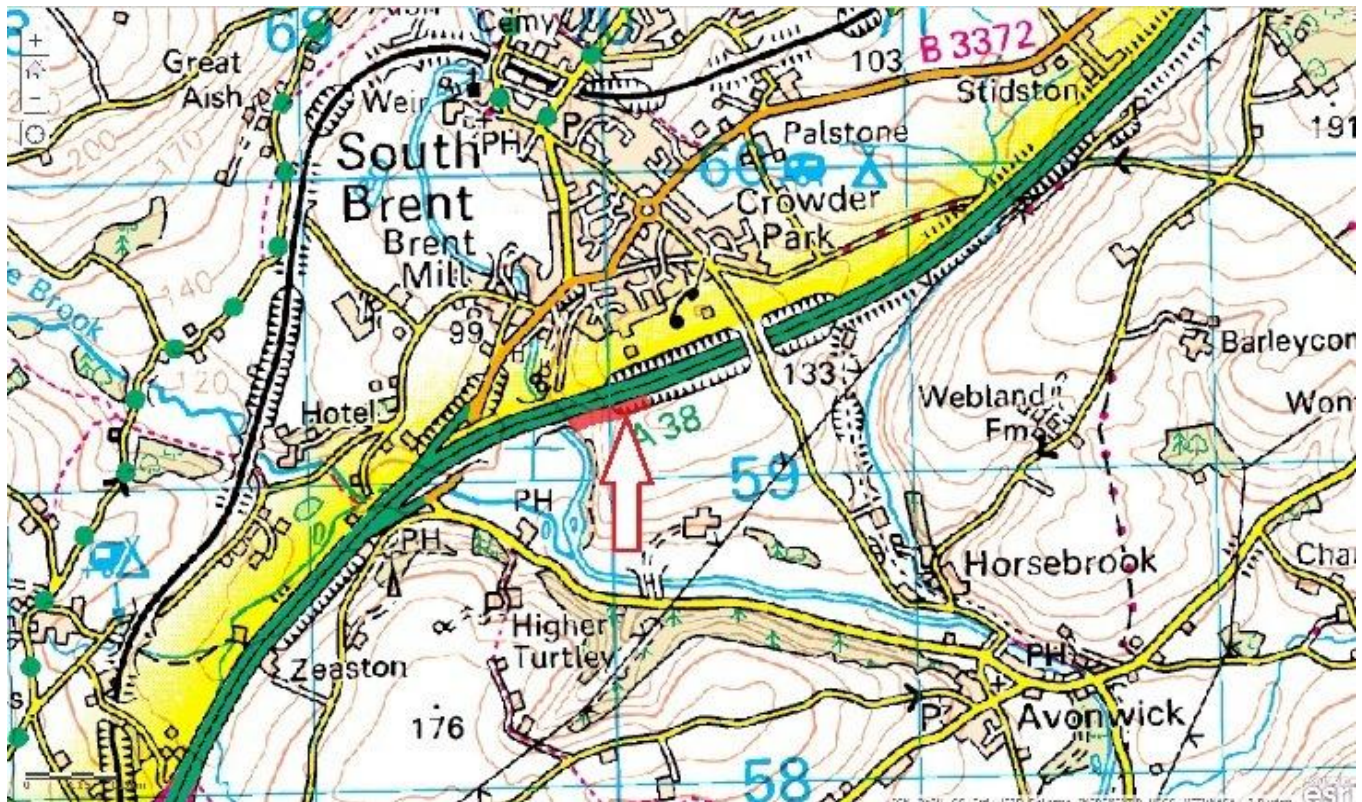
Grid reference: SX69985925

Altitude: 121 metres

Date of visit(s): 18 July

Description: Generally sloping verge, flat at one end. Gorse, Bracken, umbellifers, Bird's-foot trefoil, thistles, Rosebay willowherb and bramble present. Continuous line of mature trees at the back. Sheltered location.

Comments: A moderately productive site despite its narrow, north-facing character. Management should aim to promote a flowery tall herb and bramble fringe perhaps by clearing some of the scrub and bracken.



Site 30: A38 eastbound north of Buckfastleigh

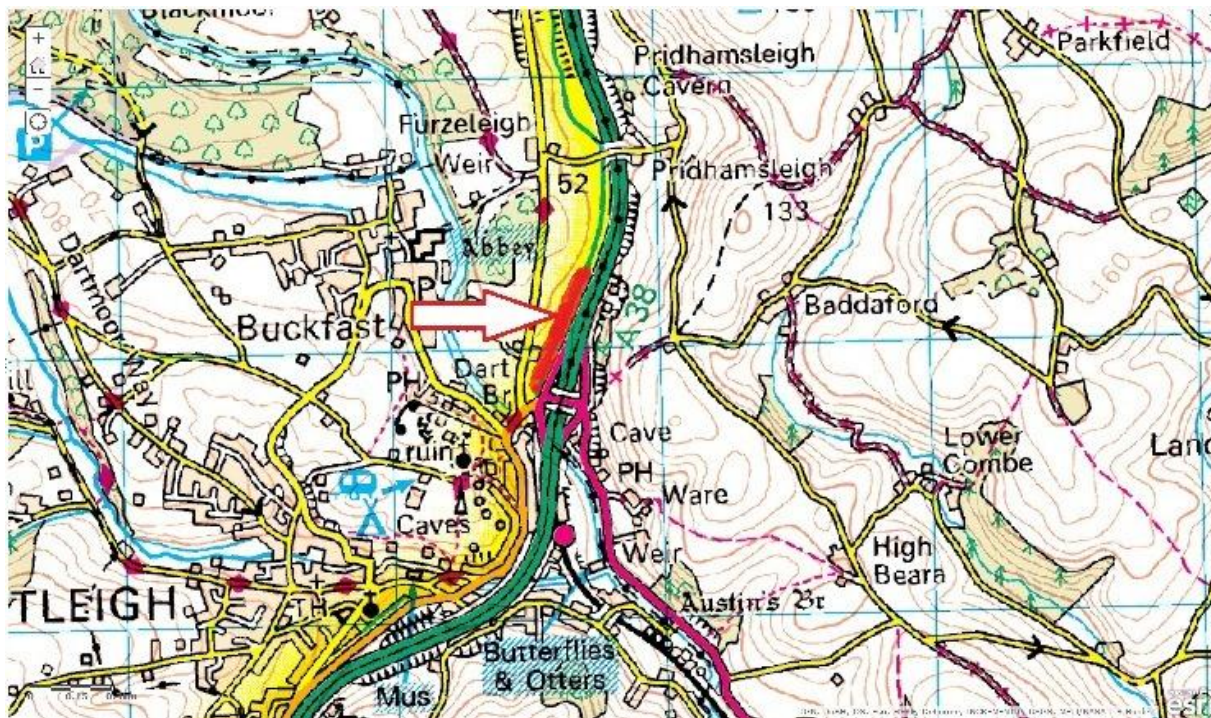
Grid reference: SX74706714

Altitude: 37 metres

Date of visit(s): 25 July and 28 August

Description: High quality invertebrate habitat. Very wide verge - around 20m. Meadow habitat beside overgrown river lined by mature Hawthorn and Ash. Mint, Meadowsweet, Fleabane, Bird's-foot trefoil, Purple loosestrife all present.

Comments: One of the more productive sites. It produced records of four scarce flies: *Acanthiophilus helianthi* and *Acinia corniculata* (both associated with knapweeds in warm locations), *Dioxyna bidentis* (usually associated with bur-marigolds and possibly a vagrant here) and *Lasiochaeta pubescens* (which likes damp habitats). Management should aim to retain species-rich grassland, perhaps managing it on a three-year rotation (cutting one-third each year) from September and removing arisings.



Site 31: A38 westbound near Ashburton

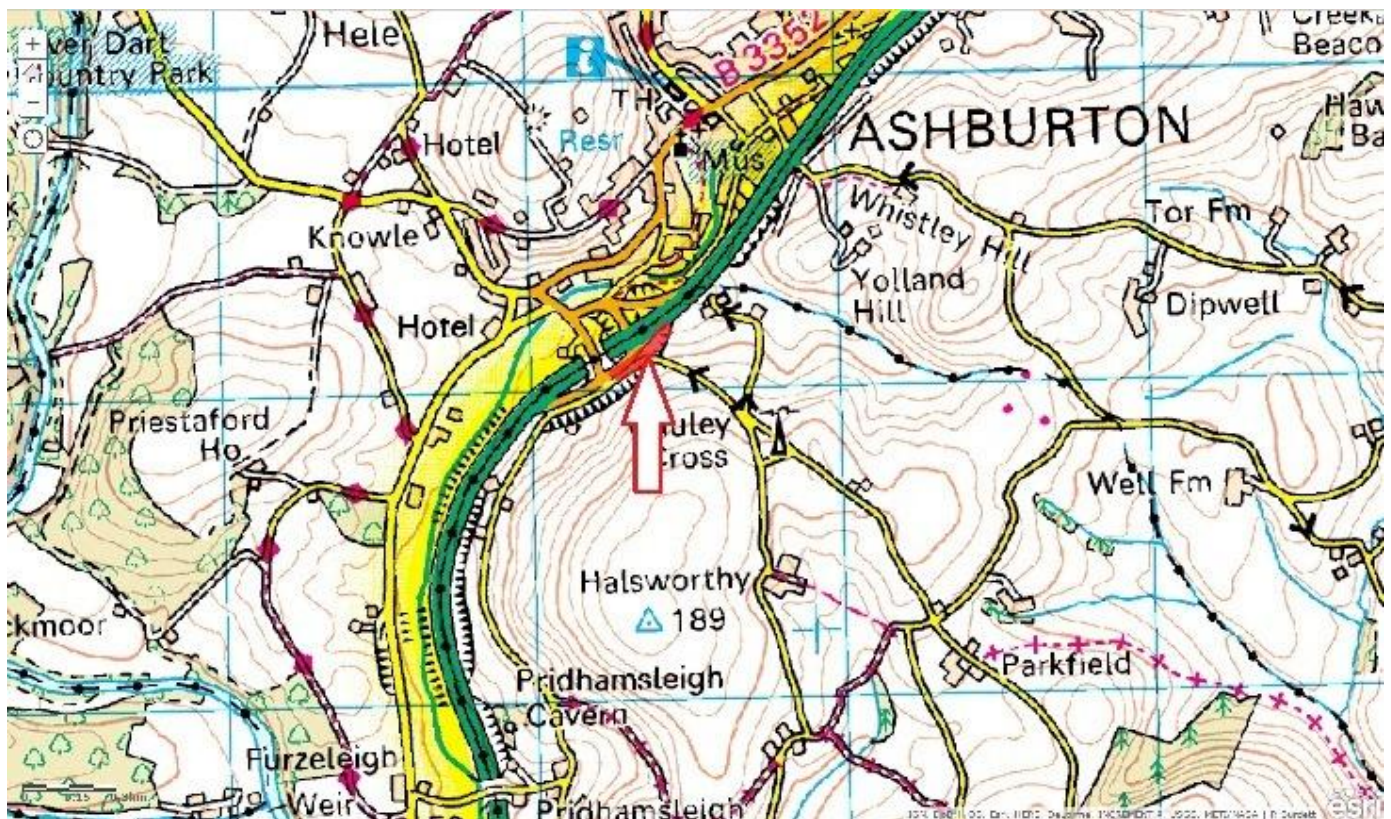
Grid reference: SX75286905

Altitude: 89 metres

Date of visit(s): 22 July

Description: Two areas of steep sloping banks with scattered nectar sources and extensive bare ground. Bird's-foot trefoil, Rosebay willowherb, thistles, umbellifers, Common knapweed, bramble and Fleabane. Warm microclimate.

Comments: A fairly productive site that produced records of two scarce flies, *Acanthiophilus helianthi* and *Sphaerophoria taeniata*, both species characteristic of warm, flowery, dry grasslands (the former species specifically requiring knapweeds). Management should aim to promote flowery species-rich grassland, managing it on a three-year rotation (cutting one-third each year) from September and removing arisings.



Site 32a: A38 eastbound near Bickington

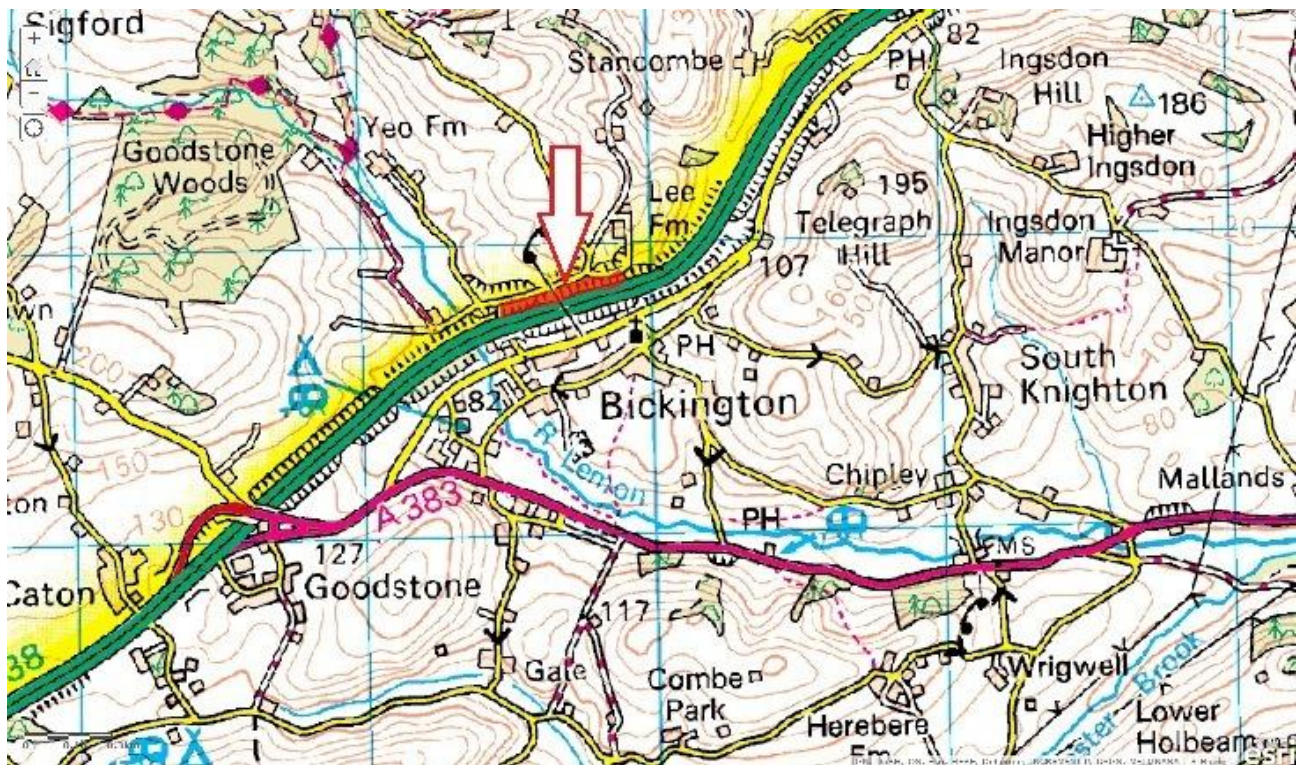
Grid reference: SX79607277

Altitude: 102 metres

Date of visit(s): 22 July

Description: Sloping south-facing verge with semi-mature deciduous woodland at the top of the slope, including Hawthorn, Maple, Ash. The grassy bank contained nectar sources such as Hemp agrimony, thistles and umbellifers.

Comments: A fairly productive site, though no scarce species were encountered. Management should aim to promote flowery species-rich grassland, managing it on a three-year rotation (cutting one-third each year) from September and removing arisings.



Site 32b: A38 westbound near Bickington

Grid reference: SX79757278

Altitude: 109 metres

Date of visit(s): 17 July

Description: Sloping north-facing bank with mature deciduous trees at the top of the slope. Bramble, knapweed, thistles and Bird's-foot trefoil present.

Comments: One of the less productive sites. Management should aim to promote flowery species-rich grassland, perhaps managing it on a three-year rotation (cutting one-third each year) from September and removing arisings. Some bramble and young scrub should be retained higher up on the slope.



Site 33: A38 eastbound by Chudleigh Knighton Heath

Grid reference: SX84067672

Altitude: 23 metres

Date of visit(s): 17 July and 28 August

Description: Verge beside slip road bordering nature reserve (Chudleigh Knighton Heath). Long sward with Bird's-foot trefoil, umbellifers and knapweed sloping to ditch bordering the nature reserve. Several dead tree stumps on this slope plus scattered mature trees - Oak, Ash and Silver birch. Gravel area with short growing nectar plants beside cycle path.

Comments: A fairly productive site that is probably influenced by the nearby nature reserve. The scarce longhorn beetle *Leptura aurulenta* seems to be breeding here using dead tree stumps. The Endangered (RDB1) ant *Formica exsecta* is also known to occupy this verge (1-2 nests that represent outliers from the main population in the nature reserve). Management should aim to promote flowery species-rich grassland, perhaps managing it on a three-year rotation (cutting one-third each year) from September and removing arisings. But contact should be made within Stephen Carroll (via the Devon Wildlife Trust) as all management decisions should account for the Narrow-headed ant.



Site 34: A38 eastbound near Haldon Hill

Grid reference: SX88068133

Altitude: 103 metres

Date of visit(s): 18 July and 29 August

Description: 'Island' between slip road and A38. Dense vegetation and abundant nectar sources: Common knapweed, thistles, vetches, Hemp agrimony, Great willowherb, Fleabane, Meadowsweet, Common centaury, Common ragwort and mint. Mature Ash, Silver birch and willow bordering the site.

Comments: A moderately productive site, though no scarce species were recorded. Management should aim to promote flowery species-rich grassland and tall herb, managing these on a three-year rotation (cutting one-third each year) from September and arisings.

