



Bevern Stream

The River Ouse Project Report No. 9

University of Sussex



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Front cover

Re-seeded meadow near Chapel Farm, Bevern Stream.

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1 Introduction

This is one of series of reports produced by The River Ouse Project (University of Sussex) about sites in the Upper Ouse catchment. This report provides information to the Environment Agency, Ouse Upstream Thinking (OUT), Sussex Wildlife Trust and other interested stakeholders to enable appropriate decisions to be made about biodiversity enhancement of streamside land linked to flood alleviation and run-off prevention.

Our work has focused particularly on streamside grassland, but we have also surveyed streamside woodland in upstream areas. The two main objectives for grassland sites were to characterise species-rich sites using the National Vegetation Classification (NVC) and to assess the suitability of species-poor sites for either grassland enhancement or wet woodland restoration. Our objectives for woodland sites were to assess their contribution to preventing run-off and to characterise species-rich sites using a floristic table developed from data collected from streamside woodland in the upper Ouse catchment between 2006 and 2011.

The report sets our work in context (Section 2) and describes the methods we used (Section 3). Site descriptions (Section 4) give location and a description of present-day vegetation including: NVC type and an indication of biodiversity value; and relevant changes in land-use over the last 200 years. An assessment of the ecosystem services currently provided by the site is considered in relation to the potential for enhanced prevention of run-off by changes in agricultural use of land (such as a change from arable to permanent grassland or hedgerow planting). Suitably-placed debris dams and/or tree planting can also be used to slow the flow of water (Newcastle University and Environment Agency, 2011; Nisbet *et al.*, 2011) and hold back sediment.

2 Context

2.1 Slowing the flow of water to prevent run-off

The river Ouse in Sussex is a flashy river, which rises quickly after prolonged heavy rain and then soon subsides. It has a wide catchment area with a large number of small streams including the Bevorn Stream and its tributaries (Figure 1 and Figure 2). The Bevorn system is mostly bordered by agricultural land with small areas of woodland on imperfect- or poor-draining soils.

Rain falling at the end of a dry period is absorbed initially but, once the ground becomes saturated, any extra rainfall causes flow rates to increase rapidly in these streams. The result is a sudden and dramatic rise in water level downstream. Some of this water spills out on to land bordering the Ouse and its tributaries. Land subject to such flooding is known as 'flash washland' because the flooding lasts only a few days, unlike washlands on the Cambridgeshire Ouse, which remain flooded throughout spring. The deepening of streams in the 1970s and 1980s to drain agricultural land have reduced the amount of land subject to this 'flash' flooding and this, together with changes in land-use, have contributed to the amount of sediment accumulating in Barcombe reservoir. The Bevorn Stream (Figure 2) is one of three pilot catchments in the Ouse Upstream Thinking project (OUT) in which South East Water hopes to demonstrate that changes in land-use can lead to significant reduction in run-off with its attendant pesticide and sediment load.

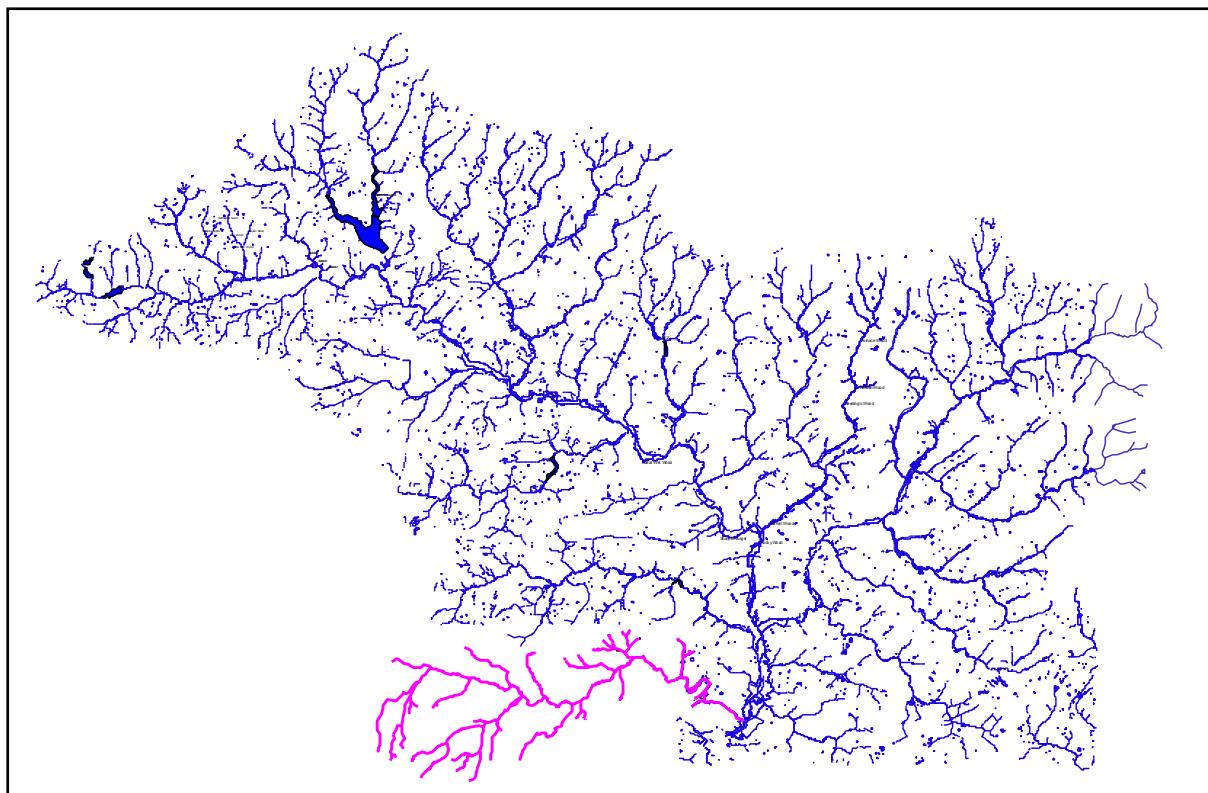


Figure 1. Stream system in the Upper Ouse (above Barcombe) showing position of Bevern Stream in purple.

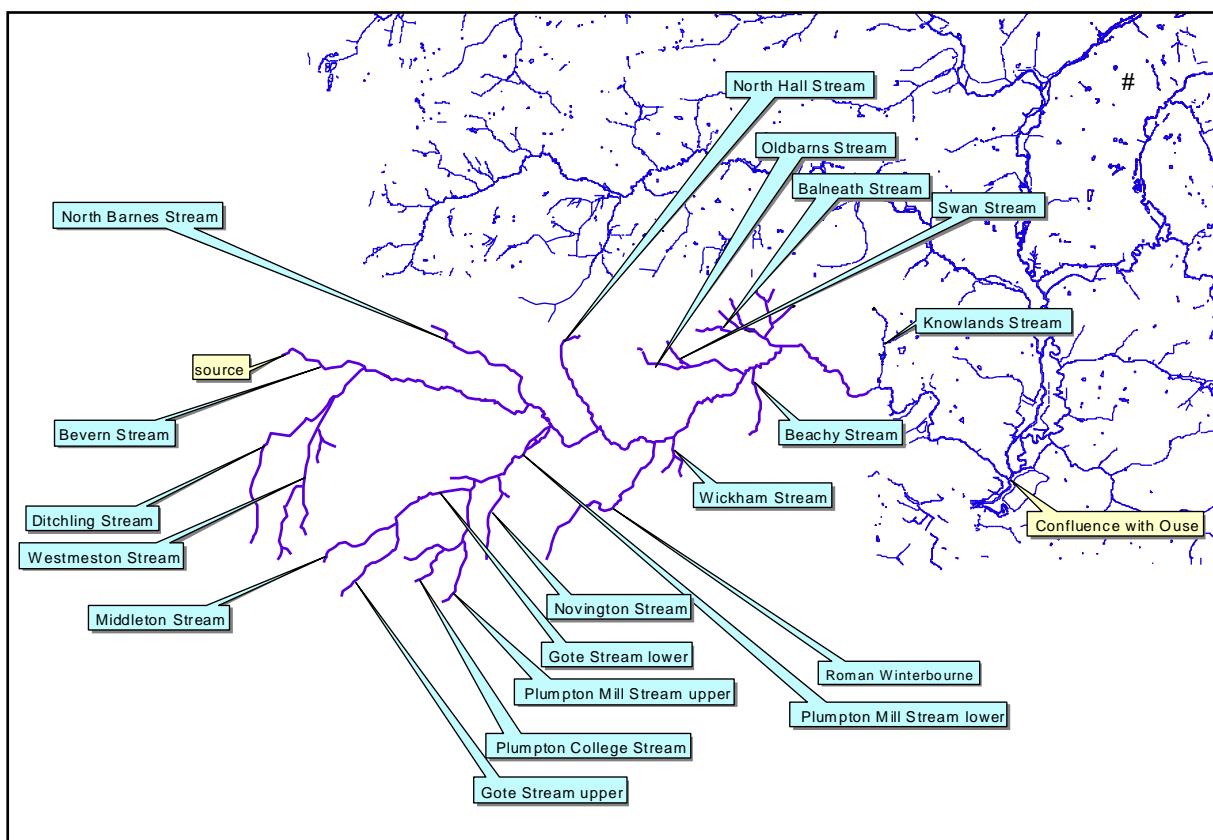


Figure 2. Tributaries of Bevern Stream.

2.2 Flash Washlands along the Bevvern Stream

Flash washlands along the Bevvern share the following properties with washlands in the Upper Ouse:

- flood for 2–3 days during periods of peak flow after heavy and prolonged rain, usually during winter;
- until the middle of the 20th century most were managed as hay-meadows or pasture with flower-rich ‘Crested Dog’s-tail–Common Knapweed Grassland’ (MG5 grassland in the National Vegetation Classification – see section 3.1), which tolerates short duration flooding;
- are too dry for most of the year to support wetland plants unless they contain permanently wet areas fed by springs;
- have maximum biodiversity when a matrix of spring-fed wetland areas occurs within MG5 grassland.

2.3 Wildflower meadows full of butterflies and bumblebees – a Biodiversity Action Plan target plant community

Wildflower meadows (such as MG5 in the National Vegetation Classification) are rare. Despite the 1995 Biodiversity Action Plan target of no further depletion of this habitat, they have continued to vanish from our landscape. The decline in native bumblebees, which are essential crop pollinators, particularly early in the year when hive bees are inactive, is linked to the decline in flower-rich meadows.

In the days of horse transport, the best land was often used as hay meadow and all along the Bevvern Stream there were extensive hay meadows and pastures (Figure 3). Wild flowers such as Common Knapweed (*Centaurea nigra*) and Oxeye Daisy (*Leucanthemum vulgare*) grew in profusion. Now only small pockets of flower-rich grassland remain and the connected meadow-scape essential for bumblebees has gone. The linear landscape along streams such as the Bevvern Stream provides a wonderful opportunity for re-connecting the flower-rich fragments through grassland enhancement of suitable sites.

Our research shows that this can be done on sites where the soil fertility is low by planting wildflower plugs and sowing locally-sourced wildflower seed (The River Ouse Project Report 8). Such enhancement would retain agricultural land in good condition, enabling a return to low-input farming when oil-driven agriculture is no longer possible.

2.4 Preventing run-off by absorbing rainwater on valley slopes

The amount of water entering the stream system after heavy rain will be greatly affected by how the land on which the rain is falling is used: whether it is wooded, permanent grassland, arable or built-up. In the Bevvern catchment, the land is predominately agricultural and in recent years there has been an increase in the amount of land that has been converted from permanent grassland to arable maize to provide winter feed for cattle or short-term Perennial Rye Grass ley. This is a high input–high output system, which is not a sustainable method of food production (Webbelmann *et al.*, 2013). It is widely recognized that it is better to use permanent grassland for animal production and arable for growing food that is eaten directly by humans. In the present context, converting permanent grassland to maize or short-term Perennial Rye Grass ley on the valley slopes along the

Bevern Stream also has an adverse effect on water retention leading to increased run-off and leaching of fertilizer, sediment and pesticides into the water course.

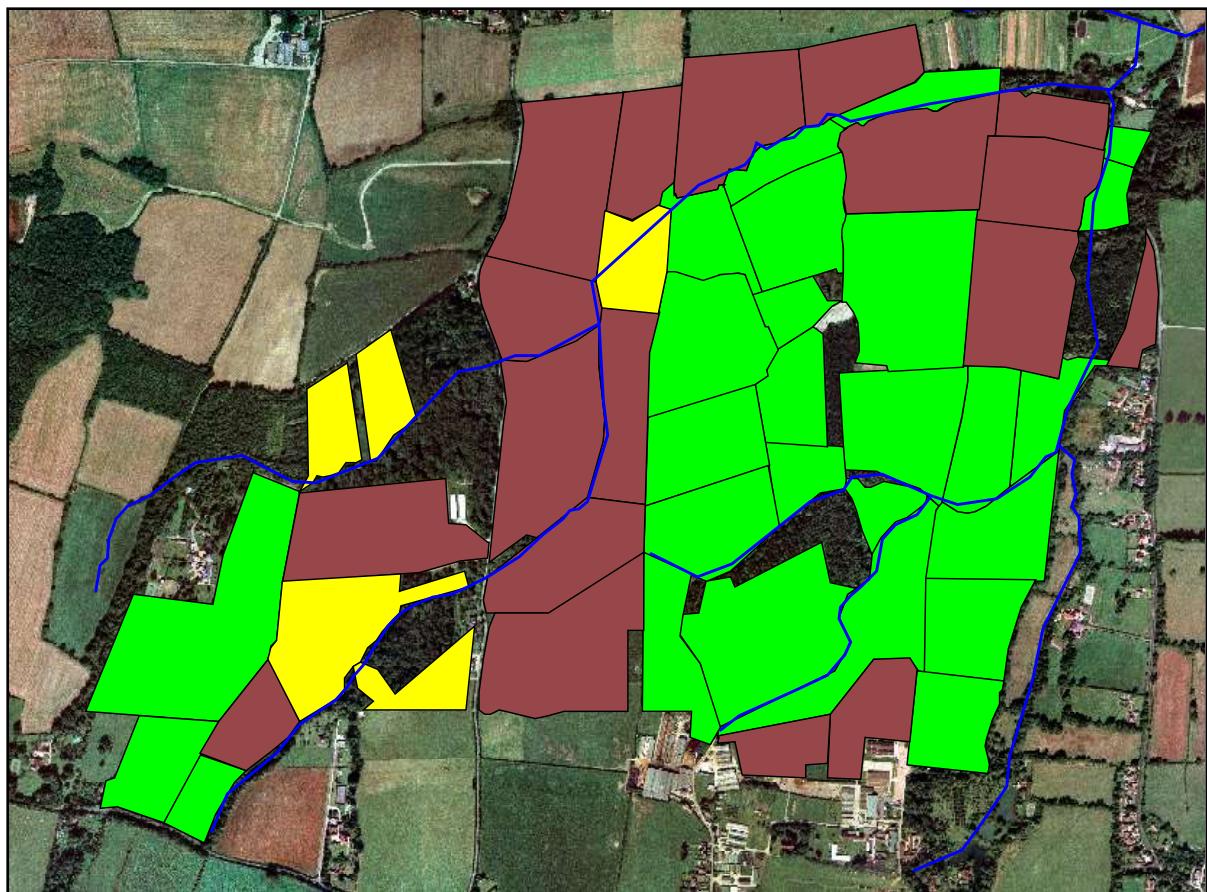


Figure 3. Plumpton College area showing extent of pasture (green), meadow (yellow) and arable (brown) from relevant Tithe maps (1838 Streat, 1839 Plumpton and 1842 Middleton Park and Westmeston).

In contrast, permanent grassland with earthworm tunnels absorbs rainwater: “Our research shows that farmers can make a huge difference in helping to mitigate the effects of climate change. When fields are not ploughed the soil condition is improved naturally by the tunnelling of earthworms, which absorb water at a rate of four to ten times that of fields without worm tunnels. This in turn helps the soil to take up water during storms and retain it during drought.” (Chris Stoate, Game and Wildlife Conservation Trust Press Release, 2011.) The absorptive nature of such grassland is even further enhanced in species-rich examples because they contain deep-rooting perennials such as Yarrow and Ribwort Plantain (Wilkinson, 2011).

Trees and shrubs are more deep-rooting than grassland plants, so areas of woodland within the Bevern catchment, are making an important contribution to preventing surface run-off. The Pontbren Project in Wales (Flood Risk Management Research Consortium, 2008 and The Woodland Trust Wales, 2013) has demonstrated that both planting small areas of woodland and putting in hedgerows along contours prevent rapid run-off and retain water, sediment and nutrients. In the past, there was usually a hedge between the streamside meadows or ‘brooks’ and the arable fields on the slope above. We identify areas where this pattern could be reinstated.

2.5 Riparian woodland planting

Hydrological modelling on the river Laver in North Yorkshire showed that 40 ha of woodland planting spread over four sites would delay the arrival of a 1-in-100-year flood in downstream Ripon by almost 1 hour (Nisbet and Thomas, 2008). However, the woodland planting did not go ahead for a number of reasons (see The River Ouse Project Report 7, p.8). The report concluded that the most effective places to plant woodland are low lying, wet sections and where there are relic side channels. Even small woodland plantings (20 m wide) would generate a lag effect. Washlands with riparian tree planting are more effective at holding back water than grassland sites, but may be a less attractive option to farmers. We identify the sites where we think this would be appropriate.

2.6 Large woody debris dams

Large woody debris dams are an effective way of holding water back in the upper reaches of rivers (Nisbet and Thomas, 2008). Dam construction leads to high rates of sedimentation in the upstream pool, which raises water levels and re-connects the stream with the floodplain. Water quality is improved by removal of sediment and associated nutrients such as phosphate.

These dams can be constructed around an existing overhanging fallen tree by cutting so that one end drops into the watercourse and then dragging another log (1.5 times the channel width) into place to form a cross. Debris builds up on the upstream side. The debris may be washed out during storm events, so these dams should not be constructed just upstream from culverts, which might block. However, in the upper reaches of the watercourse escaping debris is usually retained by a downstream debris dam (Nisbet and Thomas, 2008). Many of the woodland streams we have surveyed in the Ouse catchment have small, naturally occurring debris dams, which are already holding back the water and creating habitat diversity.

3 Methods

3.1 National Vegetation Classification (NVC) survey of principal grassland habitats bordering the Bevorn Stream

The NVC is the most widely used system for describing vegetation and is particularly useful in the context of the present report because it relates to soil properties and site management. We followed the methods described in Rodwell (1992). The starting point is a botanical survey, which records the abundance (determined by a visual estimate of percentage cover using the Domin scale; see Box 1 for a description) of all the species present in a series of sample squares (quadrats) of either 2 x 2 or 4 x 4 metres. From this dataset we assign an NVC community to the present-day grassland based on the frequency (percentage of quadrats in which each species is present) and abundance of each species. Points of difference between our data and the average for this type of grassland are noted. We can then draw conclusions about how this grassland has evolved in the context of past land use and about how it can be transformed in future.

3.2 Determination of historical land use and flooding

The historical land use of sites was investigated through document analysis and oral history interviews with local farmers.

Box 1**Frequency**

I – occurs in 1-20% of samples; II – occurs in 21-40% of samples; III – occurs in 41-60% of samples; IV – occurs in 61-80% of samples; V – occurs in 81-100% of samples.

Domin values: percentage cover being assessed by eye in each sample

10, 91-100%; 9, 76-90%; 8, 51-75%; 7, 34-50%, 6, 26-33%, 5, 11-25%; 4, 4-10%; 3, <4% with many individuals; 2, <4% with several individuals; 1, <4% with few individuals.

3.3 Streamside Wood surveys

Previous gill surveys have used the NVC to describe the whole area of woodland in which the stream occurred (Burnside *et al.*, 2006). In The River Ouse Project we have taken a different approach and used linear samples of 30-m lengths of stream valley; recording all the plants present in each 30-m sample. Using samples from 18 gills surveyed between 2006 and 2012 in the upper Ouse Catchment we have divided the gills into four groups. These Gill Groups are described by a floristic table (Table 1) based on average frequency of species within each group. As our studies have continued, it has become clear that the plant community that we find in steep-sided wooded valleys recognisable as gills also occurs in wooded headstreams with shallow sides and the same floristic groups can be used to describe both. The streamside woods surveyed in this report have been assigned to a Floristic Group based on frequency of species occurring in at least five samples and points of difference between the particular example and the average given in the floristic table are noted. For example, we tabulate any species with expected frequencies of IV or V which have lower frequencies than this in the particular streamside wood. We also tabulate (as additional constants) those species which have a frequency of V, rather than the frequency expected in that floristic group.

Table 1. Ouse Gill and Streamside Woodland Floristic Table: average frequency of species occurring in 30-m lengths of stream valley.

| | Group 1 | Group 2 | Group 3A | Group 3B |
|----------------------------------|---------|---------|----------|----------|
| Constants | | | | |
| <i>Pellia epiphylla</i> | V | V | V | V |
| <i>Mnium hornum</i> | V | V | V | V |
| <i>Rubus fruticosus</i> | V | V | V | V |
| <i>Dryopteris dilatata</i> | V | V | V | V |
| <i>Atrichum undulatum</i> | IV | V | V | V |
| <i>Hyacinthoides non-scripta</i> | V | IV | V | V |
| <i>Oxalis acetosella</i> | V | IV | V | V |
| <i>Lonicera periclymenum</i> | V | V | IV | IV |
| <i>Ilex aquifolium</i> | IV | V | IV | IV |
| <i>Fraxinus excelsior</i> | III | III | IV | IV |
| Discriminators for Group 1 | | | | |
| <i>Scapania undulata</i> | IV | II | I | I |
| <i>Chiloscyphus polyanthos</i> | IV | III | III | III |
| <i>Isothecium myosuroides</i> | IV | III | III | I |
| <i>Betula pubescens</i> | IV | III | I | II |
| <i>Veronica montana</i> | III | IV | V | V |
| <i>Cardamine flexuosa</i> | III | V | V | IV |

| | | | | |
|--------------------------------------|-----|-----|-----|-----|
| <i>Circaea lutetiana</i> | I | V | IV | V |
| <i>Carex pendula</i> | | III | III | III |
| Discriminators for Group 2 | | | | |
| <i>Ajuga reptans</i> | I | V | I | II |
| <i>Athyrium filix-femina</i> | I | V | II | IV |
| <i>Lysimachia nemorum</i> | II | V | I | III |
| <i>Quercus robur</i> | III | V | III | III |
| <i>Fagus sylvatica</i> | III | IV | I | II |
| <i>Sorbus aucuparia</i> | II | IV | | I |
| <i>Carex remota</i> | II | IV | I | II |
| <i>Isopyterygium elegans</i> | II | IV | II | II |
| <i>Pteridium aquilinum</i> | II | IV | I | I |
| <i>Dryopteris aemula</i> | I | II | | |
| <i>Ranunculus flammula</i> | I | II | | |
| <i>Eurhynchium praelongum</i> | V | III | V | V |
| <i>Ranunculus ficaria</i> | V | II | V | V |
| <i>Corylus avellana</i> | IV | II | V | V |
| <i>Hedera helix</i> | IV | II | IV | V |
| <i>Cardamine pratensis</i> | V | I | V | V |
| <i>Anemone nemorosa</i> | V | I | V | IV |
| <i>Carpinus betulus</i> | II | | III | II |
| Discriminators for Group 3 | | | | |
| <i>Lamiastrum galeobdolon</i> | III | III | V | V |
| <i>Dryopteris affinis</i> | II | III | IV | V |
| <i>Chrysosplenium oppositifolium</i> | III | | V | IV |
| <i>Alnus glutinosa</i> | II | III | IV | IV |
| <i>Thamnobryum alopecurum</i> | | I | II | II |
| <i>Thuidium tamariscinum</i> | V | IV | I | II |
| Discriminators for Group 3A | | | | |
| <i>Poa trivialis</i> | II | III | V | III |
| <i>Plagiomnium undulatum</i> | III | III | IV | III |
| <i>Brachythecium rutabulum</i> | I | III | IV | II |
| <i>Arum maculatum</i> | I | I | IV | II |
| <i>Hypnum cupressiforme</i> | III | III | IV | I |
| <i>Fissidens taxifolius</i> | II | I | IV | I |
| <i>Deschampsia cespitosa</i> | I | | IV | III |
| <i>Conocephalum conicum</i> | I | | IV | III |
| <i>Primula vulgaris</i> | I | II | III | II |
| <i>Conopodium majus</i> | I | | III | II |
| <i>Adoxa moschatellina</i> | | | III | II |
| <i>Galium odoratum</i> | | | I | |
| <i>Allium ursinum</i> | | | I | |
| <i>Blechnum spicant</i> | V | V | II | IV |
| Discriminators for Group 3B | | | | |
| <i>Mercurialis perennis</i> | I | | II | III |
| <i>Angelica sylvestris</i> | I | | II | III |
| <i>Acer campestre</i> | | | I | II |

| | | | | |
|---------------------------|-----|-----|-----|-----|
| Rhizomnium punctatum | V | IV | V | III |
| Associates | | | | |
| Plagiothecium succulentum | III | IV | III | II |
| Geum urbanum | | III | II | III |

3.4 Assessment of Ecosystem Services (ES) provided by site

Ecosystem Services have been defined as: “the benefits provided by ecosystems that contribute to making human life both possible and worth living” (Millennium Ecosystem Assessment, 2005). It can be difficult to assess these benefits in strictly economic terms, but the concept can still be usefully applied to land-use decisions by drawing attention to the benefits or detrimental effects of different land-use scenarios (Natural England, 2012). Possible benefits and detrimental effects of different land-use scenarios are listed below. These are discussed for the sites studied and where appropriate recommendations made about changes that should be made.

Adverse effects of industrial/non-biological farming practices

- Decline in crop pollinators and other beneficial insects.
- Increase in amount of sediment, metaldehyde (widely used to control slugs) and nutrients such as phosphate getting into the river system [necessitating expensive artificial and chemical treatment of water].
- Increase in run-off leading to flooding and increased sediment load downstream.
- More expensive and less healthy winter feed for animals with associated increase in harmful greenhouse gases.

Ecosystem Services – benefits of permanent grassland

- Reduces run-off and the amount of sediment, metaldehyde and nutrients (e.g. phosphate) getting into the river system. Water companies have begun to favour catchment management solutions to tackle water quality issues rather than expensive and less sustainable artificial treatment of water (Natural England, 2012). Woodland is even more effective.
- Absorbs rainwater in worm tunnels.
- Provides grazing for sheep and/or cattle: a more sustainable and healthy option for farm animals, which results in less greenhouse gas emissions than feeding grain-crop silage to indoor animals.
- Provides winter feed for animals on sites that are cut for hay, haylage or silage.

Ecosystem Services – additional benefits of species-rich grassland

- Provides pollen and nectar sources for bumblebees and other beneficial insects.
- Takes up rainwater by roots of plants at different levels in the soil. Woodland is even more effective.

Ecosystem Services – additional benefits of washland grassland

- Contributes to flood alleviation by holding back peak flow. Woodland is even more effective.
- Contributes to flood alleviation and reduction in sediment load downstream by increasing roughness of the flood plain.

- Reduces the effect of climate change, which is likely to lead to more extreme and unpredictable weather patterns.

4 Site descriptions

Most of the Bevvern stream system has been walked and is presented in the report reach by reach and stream by stream starting at the upstream end and working downstream.

Descriptions of sites are ordered according to position in the stream system with upstream sites being considered first (Figure 4 and Table 2). The location of each site is shown in the accompanying figure and the OS grid reference for the centre of the site is given.

Grassland sites, where a full botanical survey was conducted, were analysed using the National Vegetation Classification (NVC) and are presented as NVC type with important specific differences tabulated. Present-day management is noted. Our target plant community is MG5 Crested Dog's-tail–Common Knapweed grassland with 22 (12–38) species per sample. Where springs occur within the meadow leading to areas of rush vegetation the biodiversity increases, but the wet ground is unable to absorb floodwaters so the washland is less effective in reducing the surface run-off. The less species-rich plant community MG6 Perennial Rye Grass–Crested Dog's-tail grassland with 13 (4-26) species per sample is also of interest particularly as many examples of this community along the Ouse and its tributaries approach MG5 in species-richness.

Crested Dog's-tail (*Cynosurus cristatus*), a Constant species in MG5 and MG6 grassland, generally occurs at low frequency or is absent from these grasslands in the Ouse catchment. Similarly, Perennial Rye Grass (*Lolium perenne*), which is a Constant species in MG6 grassland and preferential for MG5a, also occurs at low frequency in the Ouse catchment.

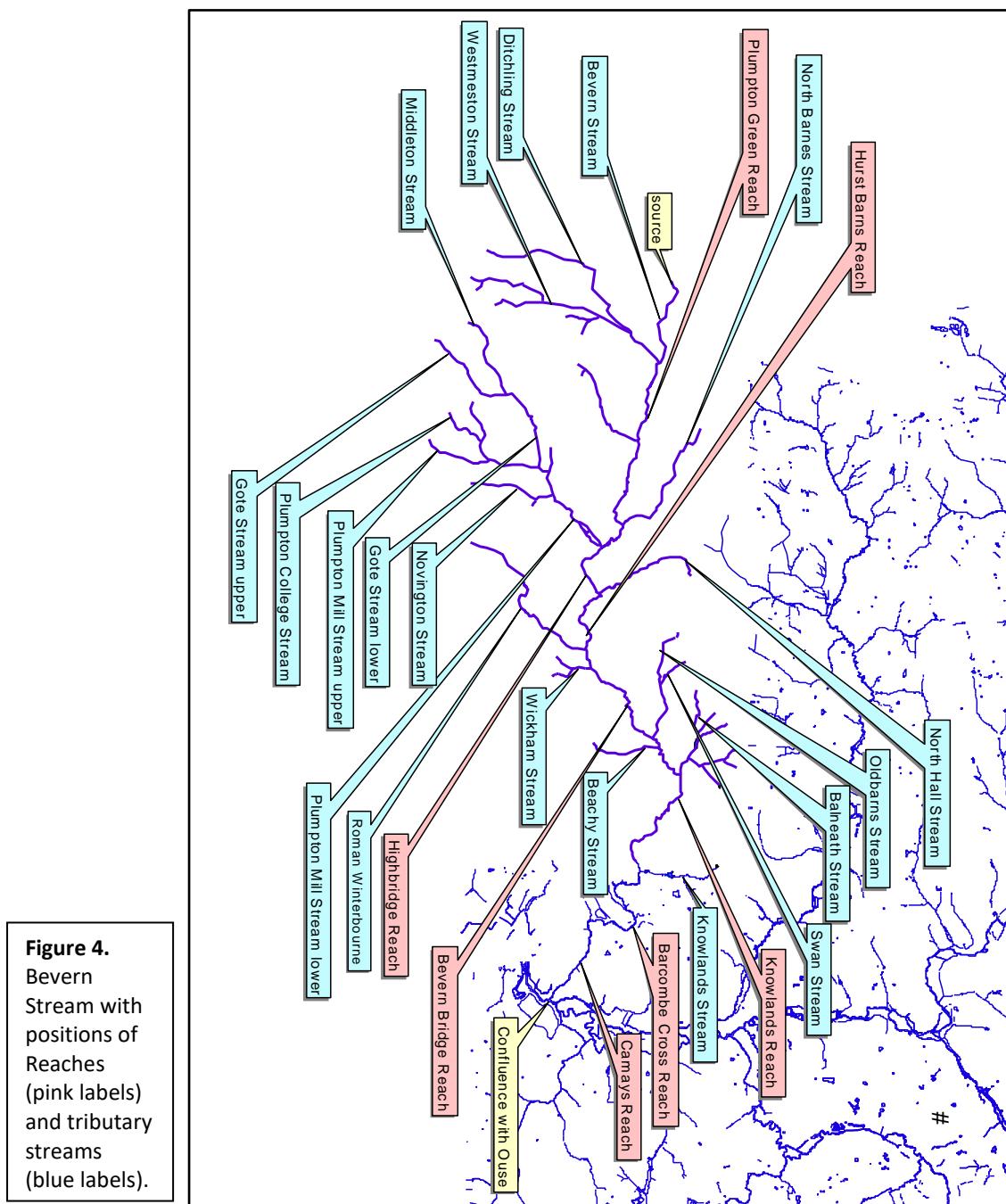
Site descriptions for streamside woodland sites give the equivalent gill group and any important specific differences (see Table 1 and Section 3.3). The number of debris dams in the surveyed length is given with their approximate heights. Scientific names follow those in Rodwell (1991 and 1992) and English names follow Dony *et al.*(1974). Where appropriate, historical information based on document research and oral history interviews with landowners is given.

4.1 Bevvern Stream (Figure 5, Table 2)

According to the Environment Agency, the source of the Bevvern Stream is in a field to the west of Field J.

Field J (TQ339169) was viewed from the road on 1 October 2016. It was being invaded by scrub, but contained a lot of Common Bird's-foot-trefoil (*Lotus corniculatus*) and Creeping Cinquefoil (*Potentilla reptans*). It will be providing Ecosystem Services 1, 2, 5 and 6.

Northern Golf Course (streamside between TQ340169 to TQ347168). Apart from a small area of scrub bounded by un-managed grassland at TQ342168, most of the grass on both sides of the stream is kept mown short. This is permanent grassland so it will be providing Ecosystem Services 1 and 2.



Area H (Golf Course between TQ346168 to TQ 348167). The stream runs close to the railway embankment here with woodland on the northern side and a strip of unmanaged grassland on the southern side. On 1 October 2016 the most obvious grasses were Red Fescue (*Festuca rubra*) and Yorkshire-fog (*Holcus lanatus*) with Hard Rush (*Juncus inflexus*) and Grey Sedge (*Carex divisa*). The following species were also present: Cow Parsley (*Anthriscus sylvestris*), Spear Thistle (*Cirsium vulgare*), Ground-ivy (*Glechoma hederacea*), Common Fleabane (*Pulicaria dysenterica*), Lesser Hawkbit (*Leontodon taraxacoides*), Creeping Cinquefoil (*Potentilla reptans*), Tufted Vetch (*Vicia cracca*) and Smooth Tare (*Vicia tetrasperma*). This area is providing Ecosystem Services 1, 2, 5 and 6.

Table 2 Position of survey sites in stream system. Species lists were made for * sites; all other sites listed were surveyed using samples.

| Name of stream or reach | Name of site |
|---------------------------------------|---------------------------|
| Bevern Stream | |
| Ditchling Stream | |
| Westmeston Stream | |
| Plumpton Green Reach of Bevern Stream | Kiln Meadow |
| | Barn Field |
| North Barnes Stream | |
| Plumpton Mill Stream upper | The Severals |
| | Sheepwash Field |
| | The Plot |
| Plumpton College Stream | |
| Plumpton Mill Stream below confluence | Little Wales West* |
| | Reed Pond, alderwood* |
| | South Bottom |
| Gote Stream upper | Sheepwash Wood |
| Middleton Stream | Middleton Plantation* |
| Gote Stream lower | The Lag |
| | Stem Field |
| | South Mead* |
| | Pondtail |
| | Five Acres, west part |
| | Five Acres, east part |
| Novington Stream | |
| Plumpton Mill Stream lower | |
| Highbridge Reach of Bevern Stream | Blacksmiths C |
| North Hall Stream | Ditchy A |
| | Ditchy B |
| | Ditchy C |
| | Blacksmiths A and B |
| Hurst Barns Reach of Bevern Stream | Pipers Brook |
| Roman Winterbourne | Lower Pells |
| | Deer Park |
| | Stag Run |
| | Comps* |
| Bevern Bridge Reach of Bevern Stream | Great Stopford Washland |
| Wickham Stream | Wickham |
| Oldbarns Stream | western arm of Swan Wood* |
| Swan Stream | Swan Mead |
| | Pit Field* |
| | Swan Wood north* |
| Beachy Wood Stream | Beachy Wood |
| Balneath Stream | |
| Knowlands Reach of Bevern Stream | Downsview |
| | Hole Wish |
| Knowlands Stream | |
| Barcombe Cross Reach of Bevern Stream | Roundabout |
| Camays Reach of Bevern Stream | Horse Brooks |
| | Chilly Wood Brook |

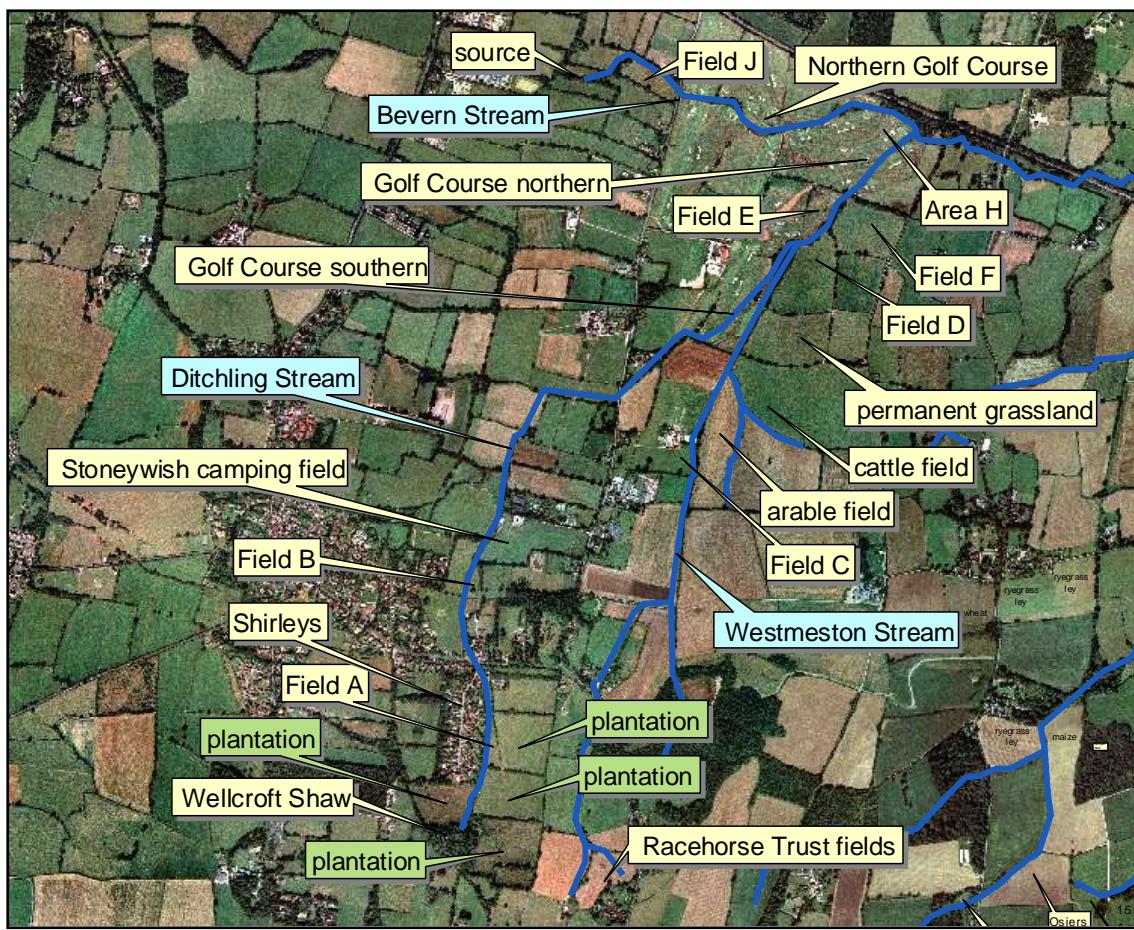


Figure 5. Source of Bevern Stream with Ditchling and Westmeston Streams.

4.2 Ditchling Stream (Figure 5, Table 2)

This stream rises in Wellcroft Shaw, a small area of Oak and Hazel woodland with a ground flora dominated by Bluebells (*Hyacinthoides non-scripta*) lying to the south of Shirleys. The boundary bank along the public footpath has Ash (*Fraxinus excelsior*), Spindle (*Euonymus europaeus*) and Willow (*Salix* species) with patches of Dog's Mercury (*Mercurialis perennis*) in the ground flora. The fields to the east and north, still open in 1999, are now Oak and Ash plantation with some Birch (*Betula* species) and Alder (*Alnus glutinosa*). There is also a considerable amount of Dogwood (*Cornus sanguinea*) and Spindle. Field A remains but the adjacent field to the east is also plantation now. This extensive area of tree planting will help compensate for the loss of water-absorbing land following the building of Shirleys and could serve as an example for other developments.

Field A (TQ333145, Figure 5). This meadow, to the east of Shirleys near the source of the stream, was unmanaged on 1 October 2015. It contained Common Nettle (*Urtica dioica*), Bramble (*Rubus fruticosus*) and Creeping Thistle (*Cirsium arvense*), but also Hemp-agrimony (*Eupatoria cannabinum*), Pepper-saxifrage (*Silaum silaus*), Common Fleabane (*Pulicaria dysenterica*), Common Sorrel (*Rumex acetosa*), Silverweed (*Potentilla anserina*), Common Mouse-ear (*Cerastium fontanum*) and Creeping Buttercup (*Ranunculus repens*) with the following indigenous grasses: Bent grass (*Agrostis* species), Cock's-foot (*Dactylis glomerata*), Red Fescue (*Festuca rubra*) and Yorkshire-fog (*Holcus lanatus*). A full survey was not done,

but it was clear that the site was providing Ecosystem Services 1, 2, 5 and 6, and is supplementing the Services provided by the surrounding tree planting.

Field B (TQ333151, Figure 5). On 1 October 2015 this field was being grazed by sheep. We didn't have access to the field, but from the public footpath on the south side of the southern hedge it looked well-managed and is likely to be providing Ecosystem Services 1, 2, and 3 and possibly 4 and 6.

Stoneywish camping field (TQ334153, Figure 5). On 1 October 2015 this permanent grassland (Ecosystem Services 1 and 2) contained many MG5 species including Red Clover (*Trifolium pratense*), Common Knapweed (*Centaurea nigra*), Meadow Buttercup (*Ranunculus acris*) and Common Sorrel (*Rumex acetosa*) (Ecosystem Service 5) as well as the deep-rooting perennials Ribwort Plantain (*Plantago lanceolata*) and Dandelion (*Taraxacum officinale*) (Ecosystem Service 6).

Golf Course southern (streamside TQ341160 to 344163, Figure 5). The mown grass of the golf course gives way along the streamside here to unmanaged grassland and a strip of Blackthorn (*Prunus spinosa*). On 1 October 2015 the grass was largely composed of Bent grass (*Agrostis* species) and Cock's-foot (*Dactylis glomerata*) with Yarrow (*Achillea millefolium*), Common Knapweed (*Centaurea nigra*), Common Bird's-foot-trefoil (*Lotus corniculatus*), Meadow Vetchling (*Lathyrus pratensis*) and Creeping Cinquefoil (*Potentilla reptans*). The lack of cutting, though, meant that False Oat-grass (*Arrhenatherum elatius*), Hogweed (*Heracleum sphondylium*), Field Horsetail (*Equisetum arvense*), Ground-ivy (*Glechoma hederacea*) and Hedge Parsley (*Torilis japonica*) were also present. However, the grassland will be providing Ecosystem Services 1, 2, 5 and 6.

Field E (TQ345164, Figure 5). This small unmanaged streamside field in the mid-section of the golf course lies between the mown grass of the golf course and the streamside. On 1 October 2016 it contained Common Nettle (*Urtica dioica*) and Meadowsweet (*Filipendula ulmaria*) with lots of Meadow Vetchling (*Lathyrus pratensis*). Bent grasses (*Agrostis capillaris* and *Agrostis stolonifera*) were abundant with Red Fescue (*Festuca rubra*) and Yorkshire-fog (*Holcus lanatus*) as well as MG5 forbs Yarrow (*Achillea millefolium*), Common Knapweed (*Centaurea nigra*), Common Bird's-foot-trefoil (*Lotus corniculatus*), Ribwort Plantain (*Plantago lanceolata*), Agrimony (*Agrimonia eupatoria*) and Creeping Buttercup (*Ranunculus repens*). The grassland is providing Ecosystem Services 1, 2, 5 and 6.

Field F (TQ 346164, Figure 5). This Perennial Rye Grass (*Lolium perenne*) field had been recently spread with muck on 1 October 2016. It contained the following forbs: Meadow Buttercup (*Ranunculus acris*), Creeping Buttercup (*R. repens*), Red Clover (*Trifolium pratense*), White Clover (*T. repens*), Common Daisy (*Bellis perennis*), Dandelion (*Taraxacum officinale*) and Broad-leaved Dock (*Rumex obtusifolius*). This field is providing Ecosystem Services 5 and 6, but it would be better to leave it as permanent grassland and not to go on treating it as Perennial Rye Grass ley.

Golf Course northern (streamside TQ346165 to TQ 348167, Figure 5). For this section of the stream the mown grass of the golf course comes right down to the stream on both sides, but on 1 October 2015 the stream bed had Watercress (*Rorippa nasturtium-aquaticum*) and

Reedmace (*Typha latifolia*) growing in it. This is permanent grassland so it will be providing Ecosystem Services 1 and 2.

4.3 Westmeston Stream (Figure 5, Table 2)

Westmeston Stream rises at two points in an area of re-seeded grassland belonging to the Moore Racehorse Trust which was being beautifully grazed by horses on 25 January 2016 and contained Meadow Buttercup and Creeping Buttercup (*Ranunculus acris* and *R. repens*), Ribwort Plantain (*Plantago lanceolata*) and White Clover (*Trifolium repens*) as well as Perennial Rye Grass (*Lolium perenne*).

Field C (TQ339156, Figure 5). This field lies on the west side of the stream and on 1 October 2015 it was being grazed by horses. It contained native grasses but few broad-leaved flowering plants.

Arable Field (on east side of stream at TQ342157, Figure 5). On 1 October 2015 this arable field had the stubble from the previous wheat crop still visible and a mix of grasses coming up. The adjacent field to the east was being managed in the same way. It is likely that the wheat had been under-sown with grass thus reducing tillage and helping to prevent run-off and soil compaction. However, converting these fields, which are bounded by water courses, to permanent grassland would increase the effectiveness of reduction in run-off and absorption of rainwater (Ecosystem Services 1 and 2).

Cattle Field (on east side of stream TQ344158, Figure 5). On 1 October 2015 this species-poor grassland was being grazed by cattle (Ecosystem Service 3). It contained Common Couch (*Elymus repens*), which suggests it had been ploughed fairly recently, but also Meadow Buttercup (*Ranunculus acris*), Creeping Buttercup (*Ranunculus repens*), White Clover (*Trifolium repens*) and Dandelion (*Taraxacum officinale*), which will be providing Ecosystem Services 5 and 6. Converting this field to permanent grassland would increase the effectiveness of reduction in run-off and absorption of rainwater (Ecosystem Services 1 and 2).

The permanent grassland on east side of stream (TQ344160, labelled ‘permanent grassland’ in Figure 5). On 1 October 2015 this field looked as though it was permanent grassland.

Field D (TQ344162, Figure 5). This field on the east side of the stream was being grazed by horses on 1 October 2015. It contained Common Couch (*Elymus repens*), which suggests it may have been ploughed fairly recently, but there was also a good mix of MG5 species including Crested Dog’s-tail (*Cynosurus cristatus*), Cat’s-ear (*Hypochaeris radicata*), Lesser Hawkbit (*Leontodon taraxacoides*), Meadow Buttercup (*Ranunculus acris*), Creeping Buttercup (*Ranunculus repens*), White Clover (*Trifolium repens*), Red Clover (*Trifolium pratense*) and Dandelion (*Taraxacum officinale*), which will be providing Ecosystem Services 5 and 6. Managing this field as permanent grassland would increase the effectiveness of reduction in run-off and absorption of rainwater (Ecosystem Services 1 and 2).

4.4 Plumpton Green Reach of Bevvern Stream (Figure 6, Table 2)

Plumpton Green Reach (Environment Agency J703) follows along the south side of the railway line through largely unmanaged grassland and scrub before passing north under the railway.

Kiln Meadow (TQ359164, Figure 6, Table 2) on the south side of the stream is sandwiched between the stream and the railway line. In 1842 this area was part of two arable fields: Kiln Field and Little Witney (Tithe Survey), but by 1931 it was being managed as meadow (Land Utilisation Survey).



Figure 6. Plumpton Green Reach (J703) of Bevvern Stream.

Kiln Meadow was unmanaged when surveyed on 5 July 2012, but had been grazed by cattle in the past (personal communication from a local resident). It was MG6a *Lolium perenne*–*Cynosurus cristatus* grassland, typical sub-community, and much more species-rich than the average with 17 (13-26) species per quadrat. Kiln Meadow is providing Ecosystem Services 1, 2, 5 and 6.

| Name of meadow and date of survey | NVC | absent constants | low frequency constants | additional constants |
|-----------------------------------|------|---|--|---|
| Kiln Meadow 5 July 2012 | MG6a | <i>Lolium perenne</i> <i>Cynosurus cristatus</i> | <i>Trifolium repens</i> <i>Cerastium fontanum</i> | <i>Agrostis stolonifera</i> <i>Potentilla reptans</i> <i>Stellaria graminea</i> |

The fields to the north of the stream are improved pasture and grazed by cattle and sheep. A local resident remembers them as species-rich meadows 30 years ago. These fields are now only providing Ecosystem Service 3, but converting to species-rich permanent grassland

would increase their value by providing Ecosystem Services 1, 2, 3, 5, 6 and potentially 4 too.

A small stream rises to the south of two species-rich fields, Godley Meadow (TQ349157) and a larger meadow 'TQ350157' beside Streat Lane, and flows northwards to join Plumpton Green Reach to the west of Kiln Field (Figure 6). Godley Meadow and the adjacent meadow at TQ350157 are to be surveyed in 2018. In 1838 Godley Meadow and most of the surrounding meadows were being managed as meadow (Tithe Survey); the Tithe Survey contained no information about the meadow at TQ350157.

Barn Field (TQ366163, Figure 6), further downstream and to the east of the road, was pasture in 1842 (Tithe Survey) and in 1925 it was designated as one of the King George V Playing Fields. Since then it has been used for a range of field sports and leisure activities. In 2012 the northern, lower, stream-side part was designated as a wildflower meadow by Plumpton Parish Council, at the recommendation of the Plumpton and East Chiltington Wildlife Group, as a celebration of the Queen's jubilee. On 5 July 2012 this meadow, known as Jubilee Meadow, was species-rich MG6a *Lolium perenne*-*Cynosurus cristatus* grassland, typical sub-community with an average of 20 (17-24) species per quadrat.

| Name of meadow and date of survey | NVC | absent constants | low frequency constants | additional constants |
|-----------------------------------|------|----------------------------|-------------------------|--|
| Jubilee Meadow 5 July 2012 | MG6a | <i>Cynosurus cristatus</i> | | <i>Agrostis stolonifera</i> <i>Phleum pratense</i> <i>Prunella vulgaris</i> <i>Stellaria graminea</i> |

It was managed successfully as a hay meadow until 2014 when the Playing Fields Committee deemed it was incompatible with the needs of sports people, who lost balls and arrows in the long grass.

4.5 North Barnes Stream (Figure 7, Table 2)

North Barnes Stream rises in meadowland to the east of Plumpton Green and flows through a series of relatively species-rich, semi-improved meadows, which have been grazed by sheep and, occasionally, beef cattle, for many years. Sheep were present on 30 January 2016 when the stream had flooded into parts of Five Acres and Eight Acres (Figure 7 and 8).

At the time of the Tithe survey (1841) the stream flowed diagonally across Five Acres but has since been channelled into ditches on the west and south sides. In 1841 Street Green Field, Eight Acres and North Field were arable while Sandpit Field, Hovel Mead and Brook Mead were pasture. By 1931 the map prepared for the Land Utilisation Survey of Britain shows all the meadows as permanent pasture. Most of the fields have not been ploughed since 1945 and have been grazed by livestock, mostly by sheep. No chemical fertilisers have been used and in general the fields have been left to grow a mix of native grass and broadleaf herbs (Millum, 2006). Millum (2006) recorded 22 species in Street Green Field including Adder's-tongue (*Ophioglossum vulgatum*), Ragged-robin (*Lychnis flos-cuculi*), Red Clover (*Trifolium pretense*), Common Sorrel (*Rumex acetosa*), Common Bird's-foot-trefoil (*Lotus corniculatus*), Meadow Vetchling (*Lathyrus pratensis*), Crested Dog's-tail (*Cynosurus cristatus*) and Sweet Vernal-grass (*Anthoxanthum odoratum*). The Plumpton Wildlife Habitat Survey recorded this field as species-rich (Hutson, 2011). We were refused access for a

botanical survey in 2016 and understand that the owners are hoping for housing development in Eight Acres, Brook Mead and Hovel Mead (<http://www.plumptonpc.co.uk/neighbourhoodplan/docs/PPNP%20Site%20Assessment%20Report.pdf>).



Figure 7. Plumpton Green Meadows.

To the east of the road the stream flows through a species-rich meadow, South Long Field, which 'has been uncultivated for at least 30 years' (Hutson, 2011). South Long Field and Further Field, which were arable and pasture, respectively, at the time of the Tithe survey (1841), have been leased for horse-grazing in recent years but horses have not been present for the past 3 years and the grassland is now very rank. We were refused permission for a survey in 2016 and understand that this land has also been offered for development (http://www.plumptonpc.co.uk/neighbourhoodplan/docs/PPNP_Site_Assessment_Report.pdf). South of Further Field the land on both sides of the stream is in short-term, grassland ley (Figure 9).

Converting this land to species-rich permanent grassland would increase the Services provided from Ecosystem Service 3 to Ecosystem Services 1, 2, 3, 5, 6 and potentially 4.



Figure 8. Five Acres with floodwater 30 January 2016.



Figure 9. Looking south towards North Barnes Farm (distant left) over short-term grassland ley. Line of trees along North Barnes Stream can be seen in distance.

4.6 Plumpton Mill Stream upper (Figure 10, Table 2)

This stream rises in Plumpton Place and then flows past two meadows belonging to Drews Farm: The Severals and The Plot. These meadows, which are on clay soil, are too wet to cattle-graze in winter, although the land has not been known to flood in the past 30 years (Personal communication from owner). Another meadow, Sheepwash, lying to the east of the stream is on a small tributary of Plumpton Mill Stream. Until 15 years ago all three meadows were cattle-grazed and cut for hay. It is becoming increasingly difficult to find people to do a hay cut and in some years the arisings are left lying on the ground. They have not been grazed recently.



Figure 10. Plumpton College Stream, and Plumpton Mill Stream above and below confluence.

The Severals (TQ362140), Figure 10 was surveyed on 6 June 2013. The meadow was MG5a but less species-rich than average with only 18 (14-26) species per 4 m by 4 m quadrat.

| Name of meadow and date of survey | NVC | absent constants | low frequency constants | additional constants |
|-----------------------------------|------|---|--|---|
| The Severals 6 June 2013 | MG5a | <i>Cynosurus cristatus</i> <i>Trifolium repens</i> | <i>Lotus corniculatus</i> <i>Plantago lanceolata</i> <i>Centaurea nigra</i> <i>Trifolium pratense</i> | <i>Alopecurus pratense</i> <i>Cerastium fontanum</i> <i>Rumex acetosa</i> <i>Ranunculus repens</i> |

In 1931, The Severals was managed as meadow (Land Utilisation Survey) and in 1839 as pasture (Tithe Survey). The Severals is providing Ecosystem Services 1, 2, 3, 5 and 6.

Sheepwash Field (TQ363139), Figure 10 was surveyed on 6 June 2013. The meadow was MG5a but less species-rich than average with only 19 (17-25) species per 4 m by 4 m quadrat. In 1931, Sheepwash Field was meadow (Land Utilisation Survey) and in 1839 pasture (Tithe Survey). Sheepwash Field is providing Ecosystem Services 1, 2, 3, 5 and 6.

| Name of meadow and date of survey | NVC | absent constants | low frequency constants | additional constants |
|-----------------------------------|------|---------------------------|---|---|
| Sheepwash Field 6 June 2013 | MG5a | <i>Lotus corniculatus</i> | <i>Festuca rubra</i> <i>Trifolium repens</i> <i>Centaurea nigra</i> | <i>Alopecurus pratensis</i> <i>Rumex acetosa</i> |

The Plot (TQ362141), Figure 10 was surveyed on 6 June 2013. The meadow was MG6b *Lolium perenne*-*Cynosurus cristatus* grassland, *Anthoxanthum odoratum* sub-community (Sweet Vernal-grass sub-community) but less species-rich than average with only 11 (8-16) species per 4 m by 4 m quadrat. In 1839, The Plot was pasture (Tithe Survey) and it was not recorded during the Land Utilisation Survey of 1931. The Plot is providing Ecosystem Services 1, 2, 3, 5, and 6.

| Name of meadow and date of survey | NVC | absent constants | low frequency constants | additional constants |
|-----------------------------------|------|---|---|---|
| The Plot 6 June 2013 | MG6b | <i>Cynosurus cristatus</i> <i>Trifolium repens</i> | <i>Lolium perenne</i> <i>Festuca rubra</i> | <i>Alopecurus pratensis</i> <i>Rumex acetosa</i> <i>Ranunculus repens</i> |

A short distance downstream from The Plot, Plumpton Mill Stream is joined by Plumpton College Stream.

4.7 Plumpton College Stream (Figure 10, Table 2)

Plumpton College Stream rises in two places within Plumpton College grounds: the more northerly branch flows between arable fields (Spring Field, Summer Field and Pages Croft to the north; and Wales Croft and 15 Acres to the south). The more southerly branch flows between arable fields (15 Acres and Church Leg) to start with, but then there were some fields which were grass at the time of our visit (Stream Field, Ox Pasture and Autumn Field) as well as a small area of woodland known as Grannies Wood. After the two branches join, the stream continues eastwards with Pages Croft and Little Wales West to the north and Rockett to the south. Plumpton College Stream then flows into Plumpton Mill Stream at the south-eastern corner of Little Wales West.

4.8 Plumpton Mill Stream below confluence with Plumpton College Stream (Figure 10, Table 2)

Plumpton Mill Stream continues northwards with Little Wales West on its western bank and gardens rising steeply on its eastern bank. The stream then flows through an area of wet alderwood known as Reed Pond which was formerly the pond supplying the mill before reaching South bottom on the east side and an arable field, Sixty Acres, on the west side.

Little Wales West (TQ 362144 Figure 10) consists of a drier east-facing slope above an extensive flat area which extends to the stream. It was wet at the bottom of the slope on 5 May 2016 with Floating Sweet Grass (*Glyceria fluitans*), Soft Rush (*Juncus effusus*) and Creeping Buttercup (*Ranunculus repens*), but drier in parts with Sweet Vernal-grass (*Anthoxanthum odoratum*) and Meadow Buttercup (*Ranunculus acris*). The slope was dominated by Red Fescue (*Festuca rubra*) with Yorkshire-fog (*Holcus lanatus*), Sweet Vernal-grass (*Anthoxanthum odoratum*), Lesser Celandine (*Ranunculus ficaria*) and Field Wood-rush (*Luzula campestris*); and scattered Hard Rush (*Juncus inflexus*), Hairy Sedge (*Carex hirta*) and Pond Sedge (*Carex riparia*).

The field was cut late summer 2015 and the bottom area was flooded all last winter (personal communication, Mr Wood, 5 May 2016). At the time of the Tithe survey (31 May 1839) this 5-acre field was known as Hengrove and was pasture and in 1931 it was meadow (Land Utilisation Survey). Little Wales West is providing Ecosystem Services 1, 2, 3, 4, 5, 6, 7, 8 and 9. On 5 May 2016, the sheep in Little Wales West had access to Little Wales East, which lies on the slope above Reed Pond Wood. This 3-acre field was Taylor's Garden in 1839 (Tithe Survey) and in 1931 it was meadow (Land Utilisation Survey).

Reed Pond (TQ 363146, Figure 10). This alderwood has deep water in places, but is drier on the eastern bank. Sycamore (*Acer pseudoplatanus*) is seeding mainly in the south-west corner from a mature tree. There are a few older Alders (*Alnus glutinosa*) but most are of similar age and have been coppiced in the past. There is frequent Elder (*Sambucus nigra*) and occasional Goat Willow (*Salix caprea*) in the wet area; and Ash (*Fraxinus excelsior*) and Pedunculate Oak (*Quercus robur*) with an understorey of Hazel (*Corylus avellana*) and Elder (*Sambucus nigra*) on the drier slope above. Ground flora included Moschatel (*Adoxa moschatellina*), Ramsons (*Allium ursinum*), Marsh-marigold (*Caltha palustris*), Lady's-smock (*Cardamine pratensis*), Opposite-leaved Golden Saxifrage (*Chrysosplenium oppositifolia*), Marsh Bedstraw (*Galium palustre*), Yellow Archangel (*Lamiastrum galeobdolon*), Hemlock Water-dropwort (*Oenanthe crocata*), Yellow Iris (*Iris pseudacorus*), Lesser Celandine (*Ranunculus ficaria*), Common Nettle (*Urtica dioica*) and Rough Meadow Grass (*Poa trivialis*). There is a lot of grass cover in the wood. This wood is providing Ecosystem Services 1, 2, 5, 6, 7, 8 and 9.

South Bottom, Upper Mill (TQ364149, Figure 10) was surveyed on 1 May 2013. This sheep-grazed MG6a meadow (*Lolium perenne-Cynosurus cristatus* grassland, typical sub-community) has had low stock densities since 2012 and was slightly more species-rich than the average with 14 (13-15) species per sample. In 1931, South Bottom was managed as meadow (Land Utilisation Survey) and in 1839 as pasture (Tithe Survey). South Bottom is providing Ecosystem Services 1, 2, 3, 5 and 6.

| Name of meadow and date of survey | NVC | absent constants | low frequency constants | additional constants |
|-----------------------------------|------|--|-------------------------|---|
| South Bottom 1 May 2013 | MG6a | <i>Cynosurus cristatus</i> <i>Festuca rubra</i> | | <i>Cardamine pratensis</i> <i>Ranunculus repens</i> <i>Rumex obtusifolius</i> |

A short distance downstream, Plumpton Mill Stream is joined by Gote Stream. Five Acres East lies on the confluence, but will be described along with Five Acres West in section 4.11 (p. 29) because the two areas of Five Acres are managed in the same way.

4.9 Gote Stream upper (Figure 11, Table 2)

Gote Stream rises at the foot of the South Downs and passes between Perennial Rye Grass ley in Middleton Park to the west and a vineyard to the east before entering Sheepwash Wood. The stream in Sheepwash Wood is close to the western boundary and an arable field, Sheepwash, which was growing wheat in 2015. Little Sheepwash on the north bank is unmanaged grassland with Hairy Sedge (*Carex hirta*) and Giant Horsetail (*Equisetum telmateia*). Downstream from Sheepwash Wood the stream is bordered by arable fields (Jubilee and Sandpits to the west and Osiers, Pond Field and West Slope to the east) down to the confluence with Middleton Stream. Converting these fields to permanent grassland would provide Ecosystem Services 1, 2, 3 and 4.

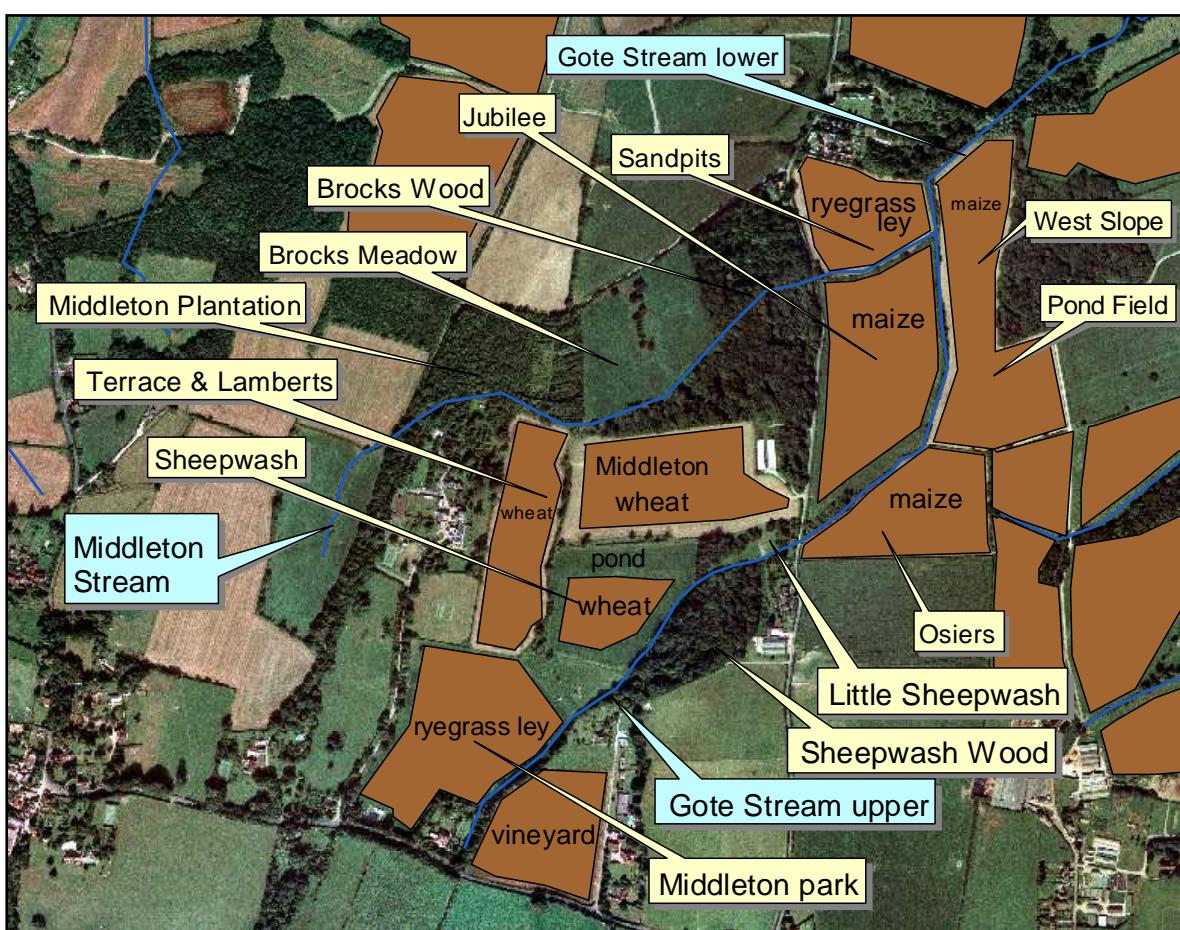


Figure 11. Gote Stream upper and Middleton Stream with arable fields (17 September 2015) shown in brown.

Sheepwash Wood (TQ 349139, Figure 11) was surveyed on 21 April 2016. It was Group 3A (Table 1, pp. 9–11). The calcicole liverwort *Pellia endiviifolia* replaced *P. epiphylla*, which is characteristic of more acidic environments. There were two debris dams in the length of stream surveyed and these were holding the water back to a depth of 30 cm and 40 cm. Sheepwash Wood is providing Ecosystem Services 1, 2, 5 and 6, which are particularly important in the context of the surrounding arable land.

| Name of Wood date of survey | Group | absent constants | low frequency constants | additional constants |
|--------------------------------|-------|--|---|--|
| 21 April 2016 | 3A | <i>Pellia epiphylla</i> <i>Atrichum undulatum</i> <i>Lonicera periclymenum</i> | <i>Mnium hornum</i> <i>Dryopteris dilatata</i> <i>Oxalis acetosella</i> | <i>Isothecium myosuroides</i> <i>Quercus robur</i> <i>Thamnobryum alopecurum</i> |

4.10 Middleton Stream (Figure 11, Table 2)

Middleton Stream rises in permanent grassland to the west of Middleton Manor and flows through Middleton Plantation. This area of woodland was visited on 17 March 2016, but has not been surveyed. It is mainly hazel coppice at the upstream end and broad-leaf plantation with some Alder (*Alnus glutinosa*) further downstream. The streamside had Holly (*Ilex aquifolia*) and Wild Privet (*Ligustrum vulgare*) in the understorey. Ground flora included *Pellia endiviifolia*, Wood Anemone (*Anemone nemorosa*), Moschatel (*Adoxa moschatellina*), Primrose (*Primula vulgaris*), Lady's-smock (*Cardamine pratensis*), Lords-and-ladies (*Arum maculatum*) and Lesser Celandine (*Ranunculus ficaria*) with massed Bluebells (*Hyacinthoides non-scripta*) at the downstream end. The stream in this western part of the wood is very close to the arable field, Terrace and Lamberts, which grew wheat in 2015. Middleton Plantation is providing Ecosystem Services 1,2, 5 and 6.

Downstream from the Plantation, Brocks Meadow lies to the north (grassland but not surveyed) and a narrow strip of Brocks Wood to the south separating the stream from another arable field (Middleton), which grew wheat in 2015. The stream then flows through a more extensive area of Brocks Wood before reaching the arable land around the confluence with Gote Stream. When we visited on 17 September 2015 the field to the north (Sandpits) was Perennial Rye Grass ley and the field to the south (Jubilee) was maize. Converting these fields to permanent grassland would provide Ecosystem Services 1, 2, 3 and 4.

4.11 Gote Stream lower (Figure 12, Table 2)

Lower Gote Stream starts with arable fields (Sandpits and West Slope) on both sides before flowing through The Pines: an area of mixed woodland with abundant Hazel (*Corylus avellana*) and Elder (*Sambucus nigra*) together with Goat Willow (*Salix caprea*) and Ash (*Fraxinus excelsior*). Field Maple (*Acer campestre*), Birch (*Betula pendula* and *B. pubescens*), Sweet Chestnut (*Castanea sativa*), Beech (*Fagus sylvatica*), Pedunculate Oak (*Quercus robur*), Scots Pine (*Pinus sylvestris*) and Blackthorn (*Prunus spinosa*) occurred occasionally. Bluebells (*Hyacinthoides non-scripta*) were abundant in the ground flora in April 2016 and there was lots of Bramble (*Rubus fruticosus*), Bracken (*Pteridium aquilinum*) and Ivy (*Hedera helix*). Moschatel (*Adoxa moschatellina*), Wood Anemone (*Anemone nemorosa*), Opposite-leaved Golden Saxifrage (*Chrysosplenium oppositifolium*), Yellow Archangel (*Lamiastrum galeobdolon*), Dog's Mercury (*Mercurialis perennis*) and Wood Speedwell (*Veronica montana*) occurred occasionally with typical streamside bryophytes including *Conocephalum conicum*, *Oxyrrhynchium hians*, *Plagiomnium undulatum* and *Thamnobryum alopecurum*. The species of *Pellia* which favours calcareous substrates, *Pellia endiviifolia*, was present rather than *Pellia epiphylla*. On the Tithe map it is shown as a small wood next to the stream but it has since been extended up the slope. The Pines forms the western

boundary of The Lag: a 3-acre meadow bordered by tall hedgerows and trees on the north and south sides with the stream forming the eastern and northern borders.

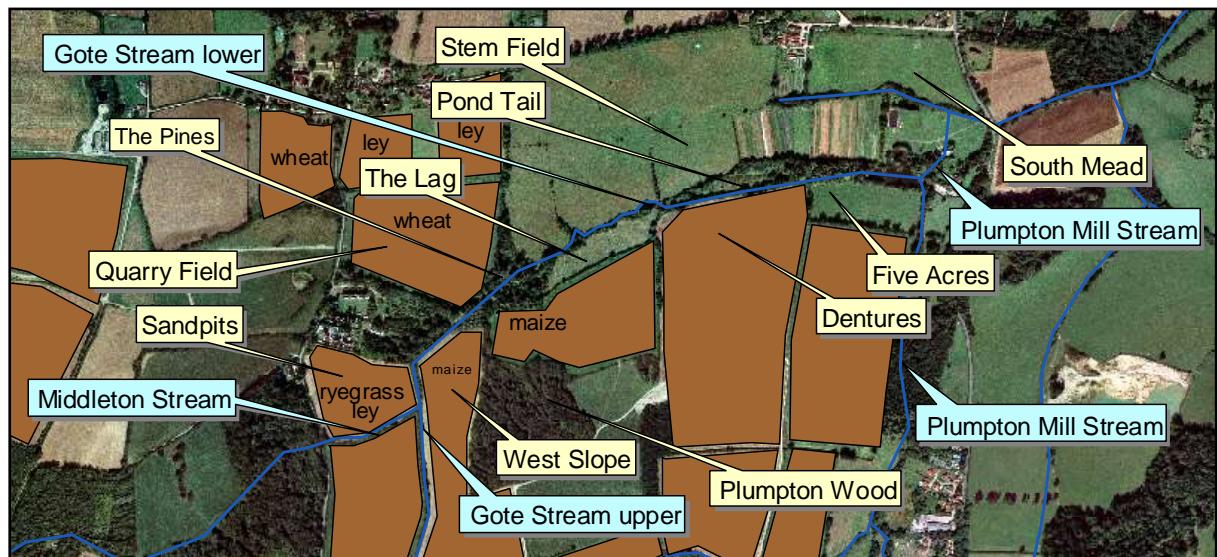


Figure 12. Gote Stream lower with arable fields (17 September 2015) shown in brown.

The Lag (TQ360150, Figure 12) was surveyed on 28 June 2017. This very tussocky meadow with a deep thatch was MG1e *Arrhenatherum elatius* grassland, *Centaurea nigra* sub-community (False Oat-grass grassland–Common Knapweed sub-community) and was of average species-richness with 21 (13-31) species per 4 m by 4 m quadrat. Quadrats were placed to avoid patches of Meadowsweet (*Filipendula ulmaria*) and the dense stands of Common Nettle (*Urtica dioica*) along the southern edge. Pepper-saxifrage (*Silaum silaus*) occurred in three out of the five quadrats. Butterflies were abundant and included Meadow Brown, Marbled White, Ringlet and Small Skipper. The meadow had not been cut in 2016 and it had not been grazed by cattle for at least 6 years (personal communication from farmer). In 1839 The Lag was pasture (Tithe Survey) and it was not recorded in the Land Utilisation Survey of 1931. The meadow is providing Ecosystem Services 1, 2, 5 and 6.

| Name of meadow and date of survey | NVC | absent constants | low frequency constants | additional constants |
|-----------------------------------|------|---------------------------|-------------------------|-----------------------|
| The Lag 28 June 2017 | MG1e | <i>Lotus corniculatus</i> | <i>Centaurea nigra</i> | <i>Holcus lanatus</i> |

Stem Field (TQ 358150, Figure 12). The lower part of this field, which is on a gentle slope was surveyed on 28 June 2017. It was MG5a but with only 18 (15-20) species per 2 m by 2 m quadrat was less species-rich than average. In 1994 (SNCI survey) Stem Field was grazed by cattle, but now it is grazed by sheep. At the time of our survey they were confined to the northern part by an electric fence, but droppings in the area surveyed indicated their recent presence. In 1839, Stem field was arable (Tithe Survey). Stem Field is providing Ecosystem Services 1, 2, 3, 5 and 6.

| Name of meadow and date of survey | NVC | absent constants | low frequency constants | additional constants |
|-----------------------------------|------|---|--|------------------------|
| Stem Field 28 June 2017 | MG5a | <i>Plantago lanceolata</i> <i>Dactylis glomerata</i> | <i>Cynosurus cristatus</i> <i>Centaurea nigra</i> | <i>Cirsium arvense</i> |

South Mead (TQ362152, Figure 12), another species-rich meadow, lies further north on a small tributary of Plumpton Mill Stream. On 13 August 2017 it contained MG5a species including Sneezewort (*Achillea ptarmica*). A NVC survey is planned for 2018.

Pond Tail (TQ356149, Figure 12) is surrounded by tall hedgerows and trees and bordered by the stream on the southern side. The eastern part was very wet with patches dominated by either Hemlock Water-dropwort (*Oenanthe crocata*), rushes (*Juncus* species), Meadowsweet (*Filipendula ulmaria*) or Creeping Cinquefoil (*Potentilla reptans*). Yorkshire-fog (*Holcus lanatus*) appeared to be the most common grass and was dominant in some areas. The western end appeared to be improved grassland, perhaps seeded in the past.

The meadow was surveyed on 5 May 2016 with four 4 m by 4 m quadrats and re-visited on 28 June 2017. It was MG1c *Arrhenatherum elatius* grassland, *Filipendula ulmaria* sub-community (False Oat-grass grassland, Meadowsweet sub-community), but contained MG5a species and was considerably more species-rich than the average with 25 (20-29) species per quadrat. The presence of False Oat-grass (*Arrhenatherum elatius*), difficult to identify in May, was confirmed on the June visit.

| Name of site and date of survey | NVC | absent constants | low frequency constants | additional constants |
|---------------------------------|------|------------------|------------------------------|-----------------------------|
| Pond Tail | MG1c | | <i>Arrhenatherum elatius</i> | <i>Alopecurus pratensis</i> |
| 5 May 2016 | | | <i>Dactylis glomerata</i> | <i>Cardamine pratensis</i> |
| | | | | <i>Lathyrus pratensis</i> |
| | | | | <i>Ranunculus ficaria</i> |
| | | | | <i>Rumex obtusifolius</i> |

Pond Tail had not been cut in 2016 and it had not been grazed by cattle for at least 6 years (personal communication from farmer). The grass was tussocky and the thatch deep. It was recorded as pasture on the Plumpton Tithe map (1839) and was not recorded in the Land Utilisation Survey of 1931. The meadow leads into a small area of recent woodland which was not recorded as woodland on the Tithe map. Pond Tail is providing Ecosystem Services 1, 2, 5 and 6.

Dentures, an arable field, lies on the south side of the stream opposite Pond Tail. Downstream from this and opposite the recent woodland is Five Acres which was surveyed in 2013 in two parts: west and east.

Five Acres, west part (TQ361150), Figure 12 on the southern bank at the downstream end of Gote Stream lower, was surveyed on 1 May 2013. This MG6b meadow (*Lolium perenne*-*Cynosurus cristatus* grassland, *Anthoxanthum odoratum* sub-community) was less species-rich than the average with 12 (11-16) species per sample.

| Name of meadow and date of survey | NVC | absent constants | low frequency constants | additional constants |
|-----------------------------------|------|--|-------------------------|---|
| Five Acres West 1 May 2013 | MG6b | <i>Cynosurus cristatus</i> <i>Festuca rubra</i> | | <i>Alopecurus pratensis</i> <i>Ranunculus repens</i> |

Five Acres, east part (TQ363150), Figure 12) lies on the confluence with Plumpton Mill Stream but is dealt with here because the two parts of the meadow have been managed in the same way. This MG6b meadow (*Lolium perenne-Cynosurus cristatus* grassland, typical sub-community) was surveyed on 1 May 2013 and is slightly more species-rich than the average with 15 (13-18) species per sample.

| Name of meadow and date of survey | NVC | absent constants | low frequency constants | additional constants |
|-----------------------------------|------|----------------------------|-------------------------|--------------------------------|
| Five Acres East 1 May 2013 | MG6b | <i>Cynosurus cristatus</i> | <i>Festuca rubra</i> | <i>Brachythecium rutabulum</i> |

In 1931, Five Acres was managed as meadow (Land Utilisation Survey) and in 1839 it was pasture (Tithe Survey). It has not been ploughed since 1963. Clover seed was broadcast in 1975 and it was fertilised with crushed calcified seaweed. Until 2003 it was grazed by sheep all year round on a rotational basis, but now it is grazed in spring and summer with the sheep carefully rotated. Five Acres is providing Ecosystem Services 1, 2, 3, 5 and 6.

4.12 Novington Stream (Figure 13, Table 2)

This stream rises in Novington Manor and flows through re-seeded grassland ley to a narrow strip of alderwood with Hazel (*Corylus avellana*), Elder (*Sambucus nigra*), Birch (*Betula* species), Holly (*Ilex aquifolium*) and Ash (*Fraxinus excelsior*) on the drier high ground at the edge. Ground flora in the drier parts contained Dog's Mercury (*Mercurialis perennis*) and Yellow Archangel (*Lamiastrum galeobdolon*). The wet areas contained Pendulous Sedge (*Carex pendula*), Opposite-leaved Golden Saxifrage (*Chrysosplenium oppositifolium*) with Broad Buckler-fern (*Dryopteris dilatata*), Hard Shield-fern (*Polystichum aculeatum*) and Hart's-tongue (*Phyllitis scolopendrium*). The field above on the west side was being grazed by sheep on 27 November 2015 and the field on the east side downstream from the wood had been grazed by horses. This field extends down to the south side of Plumpton Mill Stream lower.

4.13 Plumpton Mill Stream lower (Figure 13, Table 2)

Plumpton Mill Stream lower (Environment Agency J704) is mainly bordered by re-seeded grassland leys: even the typical streamside meadow (see Frontispiece photo) had recently been ploughed and re-seeded when viewed on 27 November 2015.

Shortly before passing under the railway line, the stream divides into two channels and flows through a tree-lined swampy area. The main stream is on the south side.

Downstream from the railway, a small rushy meadow is bounded by the railway embankment on the south side and a stream on both the east and the west side. This is a typical arrangement for hay meadows designed to allow stream water to be fed on to the land. Unfortunately this meadow was ploughed and re-seeded in June 2016.

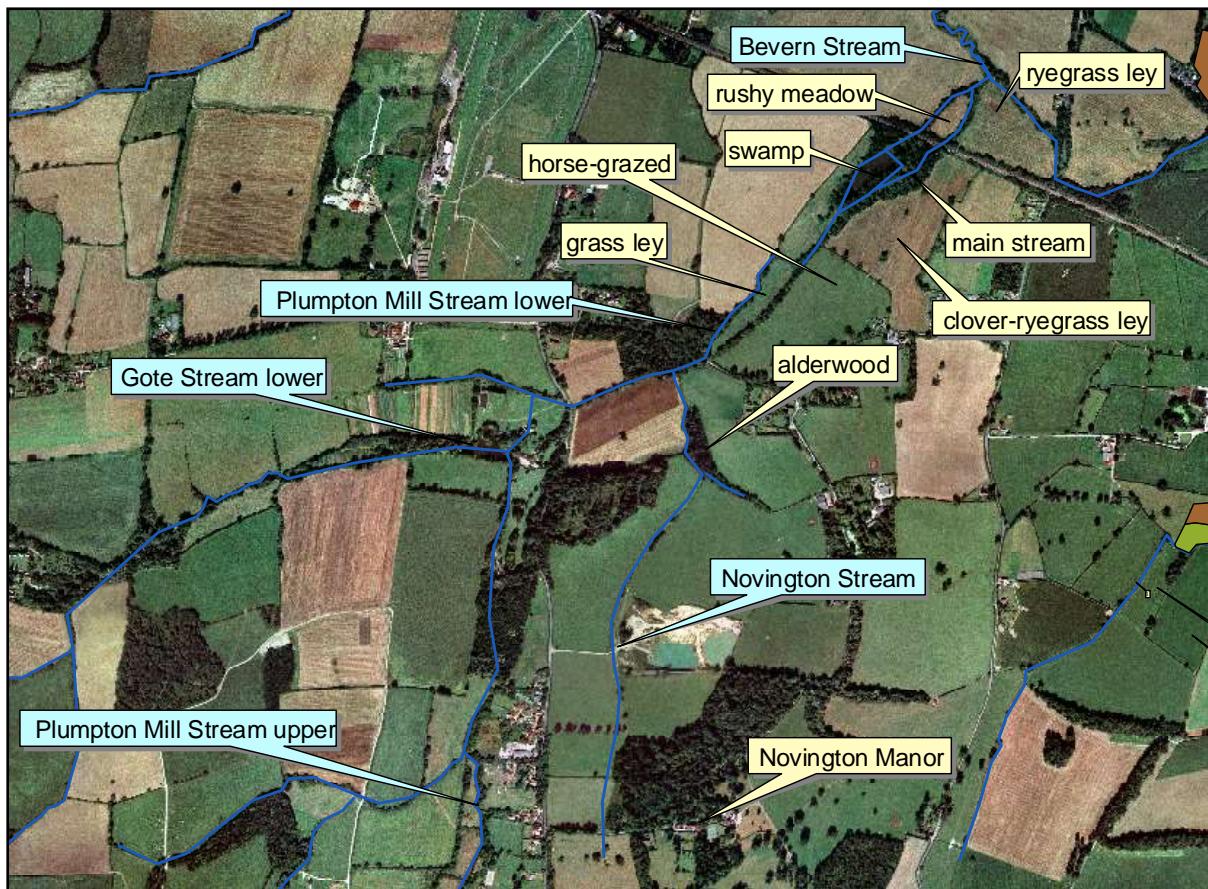


Figure 13. Novington Stream and Plumpton Mill Stream lower.

4.14 Highbridge Reach of Bevern Stream (Figure 14, Table 2)

Highbridge Reach on Bevern Stream has Perennial Rye Grass leys on both sides of the first section and then another large Perennial Rye Grass ley to the north and finally Blacksmiths C, which lies on the confluence with North Hall Stream. Blacksmiths C was surveyed along with Blacksmiths A and B and is dealt with in Section 4.15 below. To the south, downstream from the constriction with the railway embankment, there is a horse paddock and then Highbridge Meadow with planted specimen trees and permanent grassland and finally a field called Highbridge, which is being converted to woodland.

4.15 North Hall Stream (Figure 15, Table 2)

North Hall Stream flows through fields that are mostly managed as short-term grassland ley before reaching the northern corner of Ditchy. Ditchy A (TQ381161) and Ditchy B (TQ380162), Figure 15) rise up steeply from North Hall Stream on the eastern side with Ditchy C (TQ380161), Figure 15) rising up similarly on the western side. All 3 areas of Ditchy were surveyed on 15 June 2016 and showed an interesting gradation towards more species-richness from A to C.

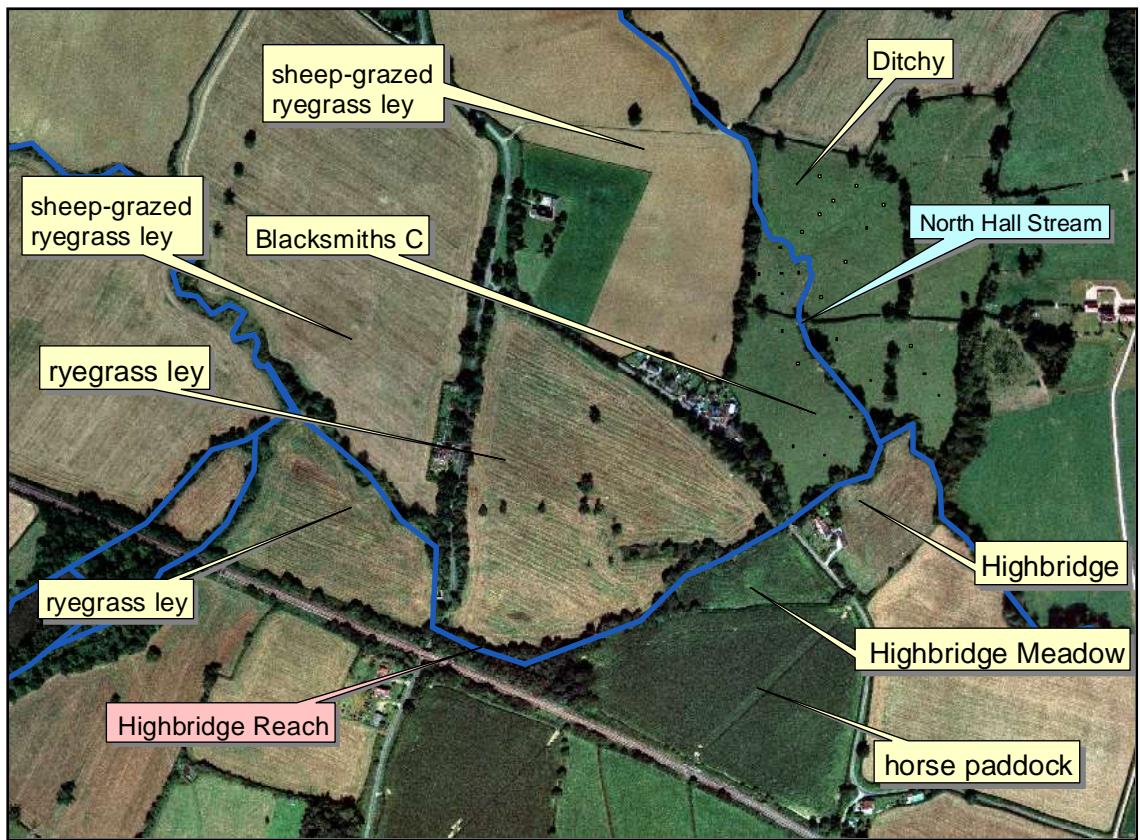


Figure 14. Highbridge Reach.



Figure 15. North Hall Stream and confluence with main Bevorn at start of Hurst Barns Reach.

Ditchy A, the least species-rich, was the *Alopecurus pratensis* variant of MG6a (*Lolium perenne*-*Cynosurus cristatus* grassland, typical sub-community). It was, though, considerably more species-rich than the average for this community with 15 (13-18) species per sample.

| Name of meadow and date of survey | NVC | absent constants | low frequency constants | additional constants |
|-----------------------------------|---|------------------|-------------------------|---|
| Ditchy A 15 June 2016 | MG6a <i>Alopecurus pratensis</i> variant | | | <i>Ranunculus acris</i> <i>Rumex acetosa</i> |

Ditchy B was MG6b (*Lolium perenne*-*Cynosurus cristatus* grassland, *Anthoxanthum odoratum* sub-community) and, again, considerably more species-rich than the average for this community with 17 (15-20) species per sample.

| Name of meadow and date of survey | NVC | absent constants | low frequency constants | additional constants |
|-----------------------------------|------|------------------|---------------------------|--|
| Ditchy B 15 June 2016 | MG6b | | <i>Cerastium fontanum</i> | <i>Hordeum secalinum</i> <i>Poa trivialis</i> <i>Rumex acetosa</i> |

In 1838 (Tithe Survey) and in 1931 (Land Utilisation Survey) Ditchy A and B were being managed as meadow. According to the owner they haven't been ploughed in living memory. Recently they have been grazed by sheep, but for the last 2 years sheep have grazed only in winter until late March and cattle have grazed in the summer (oral history interview with the farm manager, January 2017).

Ditchy A and B are separated by a ditch, which contained the following additional species: Floating Sweet Grass (*Glyceria fluitans*), Sharp-flowered Rush (*Juncus acutiflorus*) and Soft Rush (*Juncus effusus*).

Ditchy C, on the west side of North Hall Stream, was MG5a, but was species-poor for this plant community with only 17 (14-20) species per sample.

| Name of meadow and date of survey | NVC | absent constants | low frequency constants | additional constants |
|-----------------------------------|------|---|---|--|
| Ditchy C | MG5a | <i>Plantago lanceolata</i> <i>Cynosurus in field</i> | <i>Lotus corniculatus</i> <i>Trifolium repens</i> <i>Centaurea nigra</i> <i>Trifolium pratense</i> | <i>Rumex acetosa</i> <i>Poa trivialis</i> <i>Carex hirta</i> |

In 1838 (Tithe Survey) and in 1931 (Land Utilisation Survey) Ditchy C was being managed as meadow. According to the owner it hasn't been ploughed in living memory. Recently this part of Ditchy has been largely unmanaged because grazing has been by sheep, which would have been reluctant to cross the stream, but for the last 2 years sheep have only grazed in winter and cattle have grazed in the summer (oral history interview with the farm manager, January 2017). The improved management of the last 2 years is likely to increase the species-richness of all three areas of Ditchy.

Down-stream from Ditchy, North Hall Stream flows between Blacksmiths C and Blacksmiths B (Figure 15), which were two separate fields in 1838 (Tithe Survey) but are now connected by a wide cattle bridge over the stream. Similarly Blacksmiths B was separated from Blacksmiths A by a hedge but all that remains are three large oaks and the three former fields are grazed by stock as one field. Until 2010, grazing was by sheep, but for the last 2 years sheep have grazed only in winter with cattle grazing in the summer (oral history interview with the farm manager, January 2017). They are now grazed extensively by four British White cattle. Blacksmiths C was cut for hay in 2002/3. The small flatter area alongside the Bevern had much more Perennial Rye Grass (*Lolium perenne*), less Creeping Buttercup (*Ranunculus acris*) and more Meadow Foxtail (*Alopecurus pratensis*) than the rest of the fields. Blacksmiths fields are not marked in the 1931 Land Use Survey, but in 1838 all three areas were arable. On the south side, Blacksmiths is bounded by the main Bevern Stream: Blacksmiths C by Highbridge Reach and Blacksmiths B and A by Hurst Barns Reach (Figure 15).

Blacksmiths A (TQ382160), B (TQ381160) and C (TQ380159), Figure 15. Blacksmiths A and B, surveyed as one field on 30 June 2016, were MG7b *Lolium perenne-Poa trivialis* ley (Perennial Rye Grass – Rough Meadow Grass ley), but considerably more species-rich than the average with 11 (10-13) species per sample. Blacksmiths C, surveyed as a separate field on 30 June 2016 was also MG7b and even more species-rich than Blacksmiths A and B with, 12 (9-14) species per sample. The three areas are presented together in the following table.

| Name of meadow and date of survey | NVC | absent constants | low frequency constants | additional constants |
|---------------------------------------|------|------------------|-------------------------|---|
| Blacksmiths A , B & C 30 June 2016 | MG7b | | | <i>Cynosurus cristatus</i> <i>Holcus lanatus</i> <i>Ranunculus acris</i> <i>Trifolium repens</i> |

Ditchy and Blacksmiths are providing Ecosystem Services 1, 2, 3, 5, and 6.

4.16 Hurst Barns Reach (Figure 16, Table 2)

As mentioned above, this reach of the Bevern Stream is bordered by Blacksmiths A and B on the north side and Highbridge on the south side. Highbridge floods at this point and very sensibly there are plans to convert this field to woodland (personal communication from owner 10 December 2015).

Downstream on the north side, Park West and Park East were both pasture in 1838 (Tithe Survey) and meadow and arable, respectively, in 1931 (Land Utilisation Survey). Recently they were arable until 2005 and were then reseeded with Perennial Rye Grass (interview with farm manager 18 January 2017). By 24 September 2015, the sown Italian Perennial Rye Grass (*Lolium multiflorum*) in Park East had acquired additional meadow species such as Red Clover (*Trifolium pratense*), Ribwort Plantain (*Plantago lanceolata*), Common Bird's-foot-trefoil (*Lotus corniculatus*), Meadow Buttercup (*Ranunculus acris*) and Hairy Tare (*Vicia hirsuta*). Areas along the stream in both Park West and Park East are subject to flooding, although this occurs rarely in Park East (personal communication from owner, 10 December 2015). Further downstream on the north side, the grassy fields of Deans Mead and Warren

also contained meadow species: Meadow Vetchling (*Lathyrus pratensis*), Red Clover (*Trifolium pratensis*), Meadow Buttercup (*Ranunculus acris*), Ribwort Plantain (*Plantago lanceolata*), Common Knapweed (*Centaurea nigra*), Red Fescue (*Festuca rubra*), Common Sorrel (*Rumex acetosa*) and Common Bird's-foot-trefoil (*Lotus corniculatus*). Deans Mead is grazed by horses, but horses are excluded from Warren (personal communication from owner 10 December 2015). There are plans to plant woodland by the streamside in Deans Mead (personal communication from owner 10 December 2015). The south-eastern streamside corner of Warren floods (personal communication from owner, 10 December 2015). On the south side, Pipers West and Pipers East were reseeded with Italian Perennial Rye Grass in 2005 and there are plans to plant woodland along the streamside in Pipers West (personal communication from owner, 10 December 2015). Apart from Deans Mead, all these fields are winter-grazed by keep-sheep from Romney Marsh. A small streamside area of Pipers East, known as Pipers Brook, is separated from the rest of the field by a hedge. In 1838, Deans Mead was meadow, Piper's Brook was pasture, and Pipers West and most of Pipers East were arable (Tithe Survey). In 1931, Pipers West was arable, and Pipers Brook and Pipers East were meadow (Land Utilisation Survey). In recent years, Pipers Brook has been unmanaged (interview with farm manager 18 January 2017).

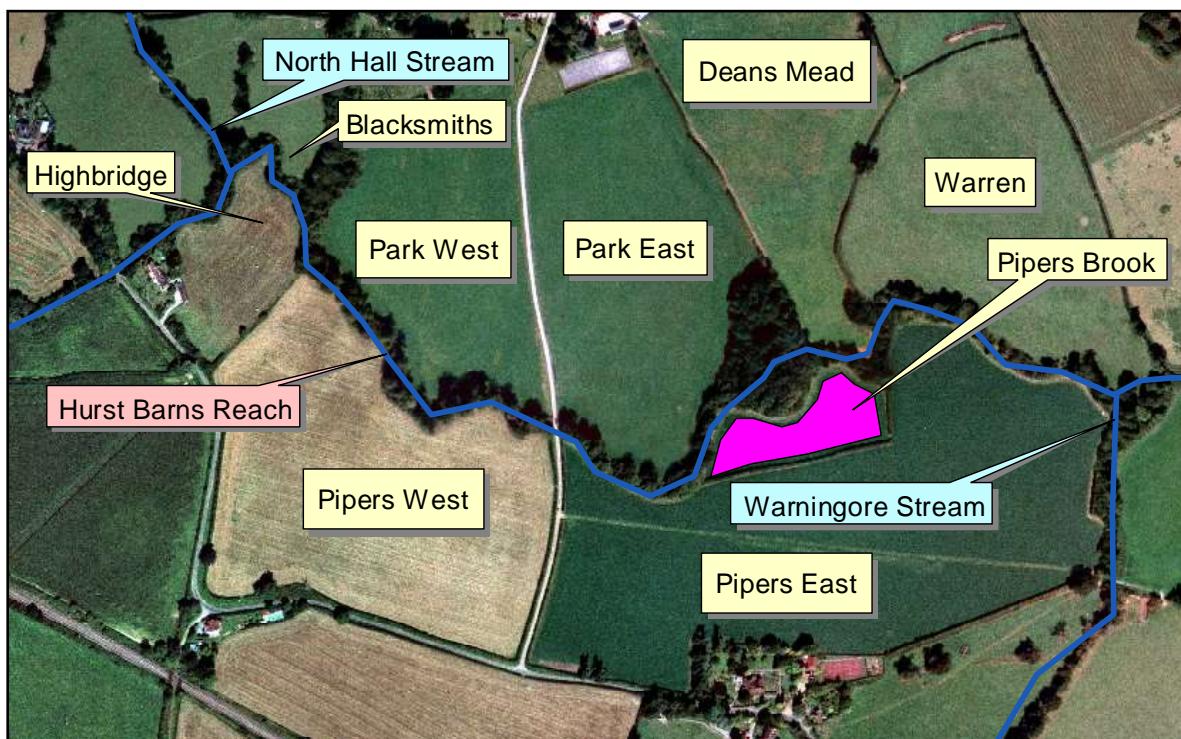


Figure 16. Hurst Barns Reach.

Pipers Brook (TQ386156, Figure 16) was surveyed on 20 May 2015. It contained large patches of Common Nettle (*Urtica dioica*) and Broad-leaved Dock (*Rumex obtusifolia*); quadrats were placed within the remaining area, but even this had thick thatch and the remains of last year's seed-heads on Common Bird's-foot-trefoil (*Lotus corniculatus*) indicating that it hadn't been cut or grazed. It was species-poor MG5a with only 17 (15-18) species per quadrat. Greater Bird's-foot-trefoil (*Lotus uliginosus*) was present in quadrats which lacked Common Bird's-foot-trefoil (*Lotus corniculatus*). Currently Pipers Brook is providing Ecosystem Services 1, 2, 5 and 6.

| Name of meadow and date of survey | NVC | absent constants | low frequency constants | additional constants |
|-----------------------------------|------|--|--|---|
| Pipers Brook 20 May 2015 | MG5a | <i>Cynosurus cristatus</i> <i>Centaurea nigra</i> | <i>Lotus corniculatus</i> <i>Dactylis glomerata</i> <i>Trifolium repens</i> <i>Trifolium pratense</i> | <i>Poa trivialis</i> <i>Stellaria graminea</i> <i>Vicia tetrasperma</i> |

4.17 Roman Winterbourne (Figure 17, Table 2)

The Roman Winterbourne was walked on 1 October 2014. It rises at Warningore Farm and flows on the east side of a long-narrow cattle-grazed field (Lower East Mead) composed of mainly indigenous grasses. A hedge along the east side of the stream separates it from an arable field. The next field downstream on the west side, Upper Lands, was more species-rich with Common Knapweed (*Centaurea nigra*), Oxeye Daisy (*Leucanthemum vulgare*), Tufted Vetch (*Vicia cracca*) and Chicory (*Cichorium intybus*), but downstream again, Lower Lands, was being managed as Perennial Rye Grass ley. In 1838, the named fields were being managed as pasture (Tithe Survey). Lower Pells was surveyed on 22 June 2014 in two parts: a rush-dominated part (labelled Lower Pells rush in Figure 17) and a much drier part (labelled Lower Pells dry in Figure 17).

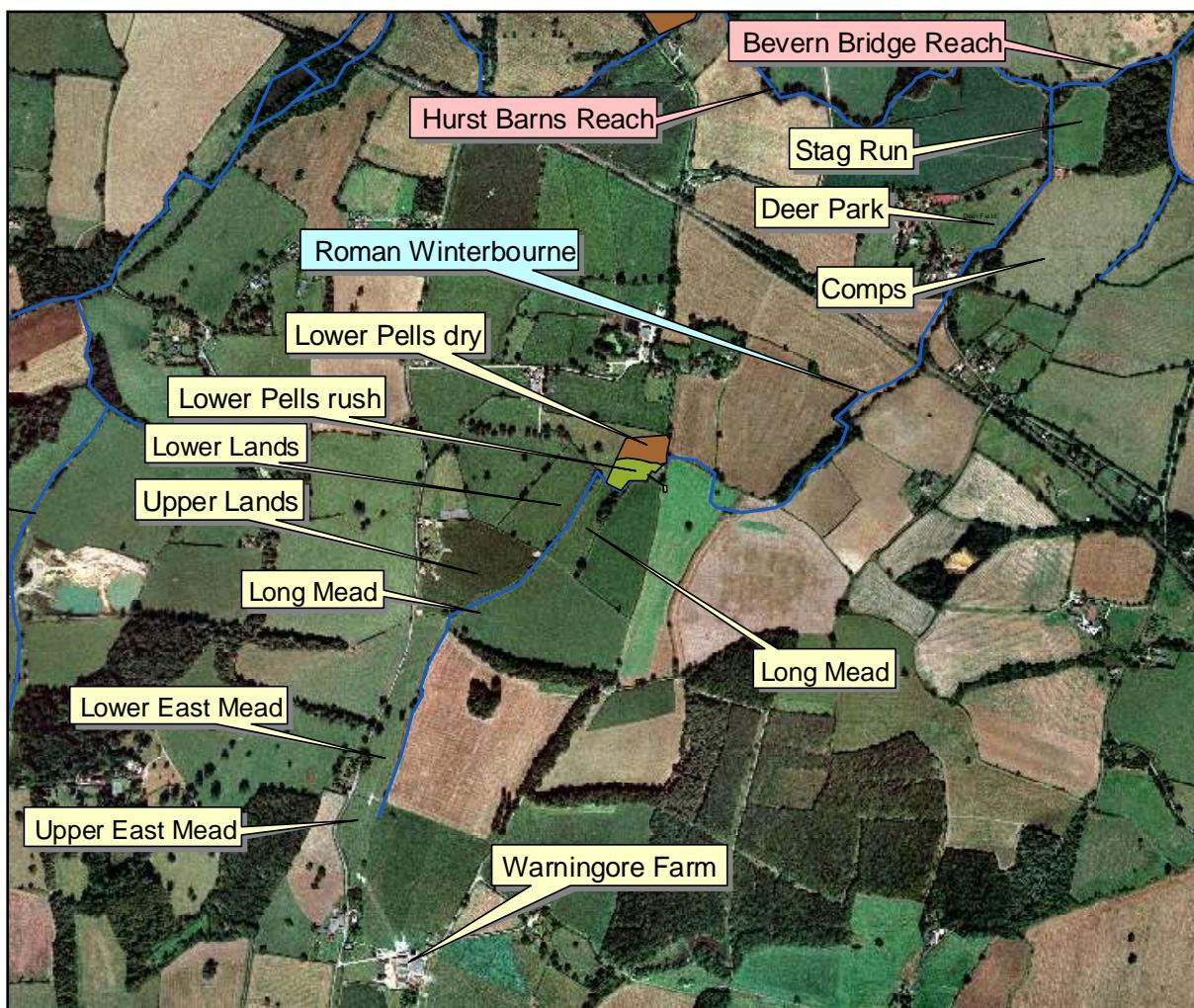


Figure 17. Roman Winterbourne.

Lower Pells dry (TQ379149, Figure 17) was surveyed on 22 June 2014. Before our survey, stock had been kept out of most of Lower Pells by an electric fence. The sward was long and dominated by tall flowering grasses (600 mm high) in the dry part. Outside the electric fence the grass had been cut and grazed and Common Daisy (*Bellis perennis*) was frequent. The surveyed area was MG7b *Lolium perenne-Poa trivialis* ley (Perennial Rye Grass – Rough Meadow Grass ley) and slightly more species-rich than the average with 9 (6-15) species per quadrat.

| Name of meadow and date of survey | NVC | absent constants | low frequency constants | additional constants |
|-----------------------------------|------|------------------|-----------------------------|-------------------------|
| Lower Pells dry 22 June 2016 | MG7b | | <i>Agrostis stolonifera</i> | <i>Ranunculus acris</i> |

Lower Pells rush (TQ379149, Figure 17). Within the fenced off area the lower lying ground was dominated by five species of rush with large patches of Greater Bird's-foot-trefoil (*Lotus uliginosus*), Yorkshire-fog (*Holcus lanatus*), Crested Dog's-tail (*Cynosurus cristatus*), Creeping Buttercup , (*Ranunculus repens*) and Meadow Buttercup (*R. acris*). It was MG10b *Holcus lanatus-Juncus effusus* rush pasture (Yorkshire-fog – Soft Rush pasture), but Hard Rush (*Juncus inflexus*) was rare and it was slightly less species-rich than the average with 14 (9-17) species per sample.

| Name of meadow and date of survey | NVC | absent constants | low frequency constants | additional constants |
|-----------------------------------|-------|------------------|-------------------------|---|
| Lower Pells rush 22 June 2016 | MG10b | | <i>Phleum pratense</i> | <i>Holcus lanatus</i> <i>Ranunculus repens</i> |

In 1838, Lower Pells was pasture (Tithe Survey) and in 1931 it was meadow (Land Utilisation Survey). In 2012 green hay from Hogleg Field, a near-by species-rich field (TQ377151), was spread on Lower Pells which has since been managed by cutting for hay followed by cattle grazing. Lower Pells is currently providing Ecosystem Services 1, 2, 3, 4, 5 and 6.

The fields bordering the next section of the stream, down to the first two fields beyond the railway embankment, were arable in 2014. Deer Park downstream on the west side was surveyed on 22 June 2017. In 1838, it was managed as pasture (Tithe Survey) and in 1831 it was managed as meadow (Land Utilisation Survey). Recently it has been cut for hay with some grazing by cattle and sheep. In 2016 it was grazed by sheep (interview with farm manager 18 January 2017). On the east side of Roman Winterbourne, Comps (known as Twenty Acres in 1838 (Tithe Survey) is bounded by Wickham Stream on the east and is continuous with Stag Run. It was managed as pasture in 1838 (Tithe Survey) and as meadow in 1931 (Land Utilisation Survey). There are plans to plant woodland on the east side of Comps (personal communication with owner). In June 2017 this grassy field had large patches of Red Fescue (*Festuca rubra*) and Creeping Cinquefoil (*Potentilla reptans*), with False Oat-grass (*Arrhenatherum elatius*) and Cock's-foot (*Dactylis glomerata*) in smaller patches and both Common Bent (*Agrostis capillaris*) and Creeping Bent (*A. stolonifera*). MG5a forbs were present, but rare and Grass Vetchling (*Lathyrus nissolia*) was locally frequent.

Deer Park (TQ387154, Figure 17) is roughly triangular in shape and is bounded on the south-east side by Roman Winterbourne. It was surveyed on 22 June 2017. It was largely grassy with flowering False Oat-grass (*Arrhenatherum elatius*), but there were patches of more diverse shorter vegetation on the south-east-facing gentle slope along the stream where we placed our quadrats. Seed heads of Goat's-beard (*Tragopogon pratensis*) were visible scattered across the field. Meadow Brown, Marbled White and Skipper butterflies were flying and Roesel's Bush-crickets were numerous. Deer Park was MG5a but less species-rich than average with 18 (15-21) species per 2 m by 2 m quadrat.

| Name of site and date of survey | NVC | absent constants | low frequency constants | additional constants |
|---------------------------------|------|--|--|---|
| Deer Park 22 June 2017 | MG5a | <i>Cynosurus cristatus</i> <i>Centaurea nigra</i> | <i>Lotus corniculatus</i> <i>Plantago lanceolata</i> <i>Anthoxanthum odoratum</i> <i>Trifolium pratense</i> | <i>Cerastium fontanum</i> <i>Geranium dissectum</i> <i>Taraxacum officinale</i> |

In 1838, Deer Park was managed as pasture (Tithe Survey) and in 1831 it was managed as meadow (Land Utilisation Survey). Recently it has been cut for hay with some grazing by cattle and sheep. In 2016 it was grazed by sheep (interview with farm manager 18 January 2017). It is providing Ecosystem Services 1, 2, 3, 4, 5 and 6.

Stag Run, (TQ390156, Figure 17) was surveyed on 20 May 2015. It was the *Alopecurus pratensis* variant of MG6a (*Lolium perenne-Cynosurus cristatus* grassland, typical sub-community), but was much more species-rich than average with 17 (14-23) species per sample.

| Name of meadow and date of survey | NVC | absent constants | low frequency constants | additional constants |
|-----------------------------------|------|----------------------------|-------------------------|---|
| Stag Run 20 May 2015 | MG6a | <i>Cynosurus cristatus</i> | | <i>Ranunculus repens</i> <i>Geranium dissectum</i> <i>Bromus hordeaceus</i> |

Stag Run was known as Gold Field in 1838 and was arable (Tithe Survey). In 1931 it was managed as meadow (Land Utilisation Survey). Recently it was grazed by cattle until 2010 and since then has been cut for hay and grazed by sheep in the winter (interview with farm manager 18 January 2017). It is currently providing Ecosystem Services 1, 2, 3, 4, 5 and 6.

4.18 Bevern Bridge Reach of Bevern Stream (Figure 18, Table 2)

At the start of Bevern Bridge Reach, opposite the junction with Roman Winterbourne, a small area of Warren down by the stream floods and this part of Warren was managed as meadow in 1838 (Tithe Survey). The adjacent field, Roughs South, also has a streamside strip of grassland which floods (personal communication from owner). A few trees have been planted here under Higher Level Stewardship and the grassy sward contains Common Fleabane (*Pulicaria dysenterica*), Common Ragwort (*Senecio jacobaea*), Bristly Ox-tongue (*Picris echioides*), Smooth Tare and Hairy Tare (*Vicia tetrasperma* and *V. hirsutum*), Creeping Cinquefoil (*Potentilla reptans*), Field Horsetail (*Equisetum arvense*), Dandelion (*Taraxacum officinale*), Glaucous Sedge (*Carex flacca*), Red Fescue (*Festuca rubra*), Common Bird's-foot-trefoil (*Lotus corniculatus*), Meadowsweet (*Filipendula ulmaria*) and Soft Rush

(*Juncus effusus*). The rest of Roughs South has been planted with woodland. On the south side of the Reach, Stag Run (see above) is bounded by Roman Winterbourne on the west side and an area of woodland on the east side. This woodland is mainly Hazel coppice with Ash (*Fraxinus excelsior*) and Oak (*Quercus robur*) and by the stream Field Maple (*Acer campestre*). The ground flora contains Primroses (*Primula vulgaris*) and Bluebells (*Hyacinthoides non-scriptus*). The east side of the wood is bounded by Wickham Stream and is continuous with a narrow strip of woodland which separates Bevern Bridge Reach from the arable fields above. This woodland contains a lot of Ash (*Fraxinus excelsior*) but otherwise has similar tree species. The ground flora has lots of Dog's Mercury (*Mercurialis perennis*). This woodland is providing Ecosystem Services 1,2,5 and 6.

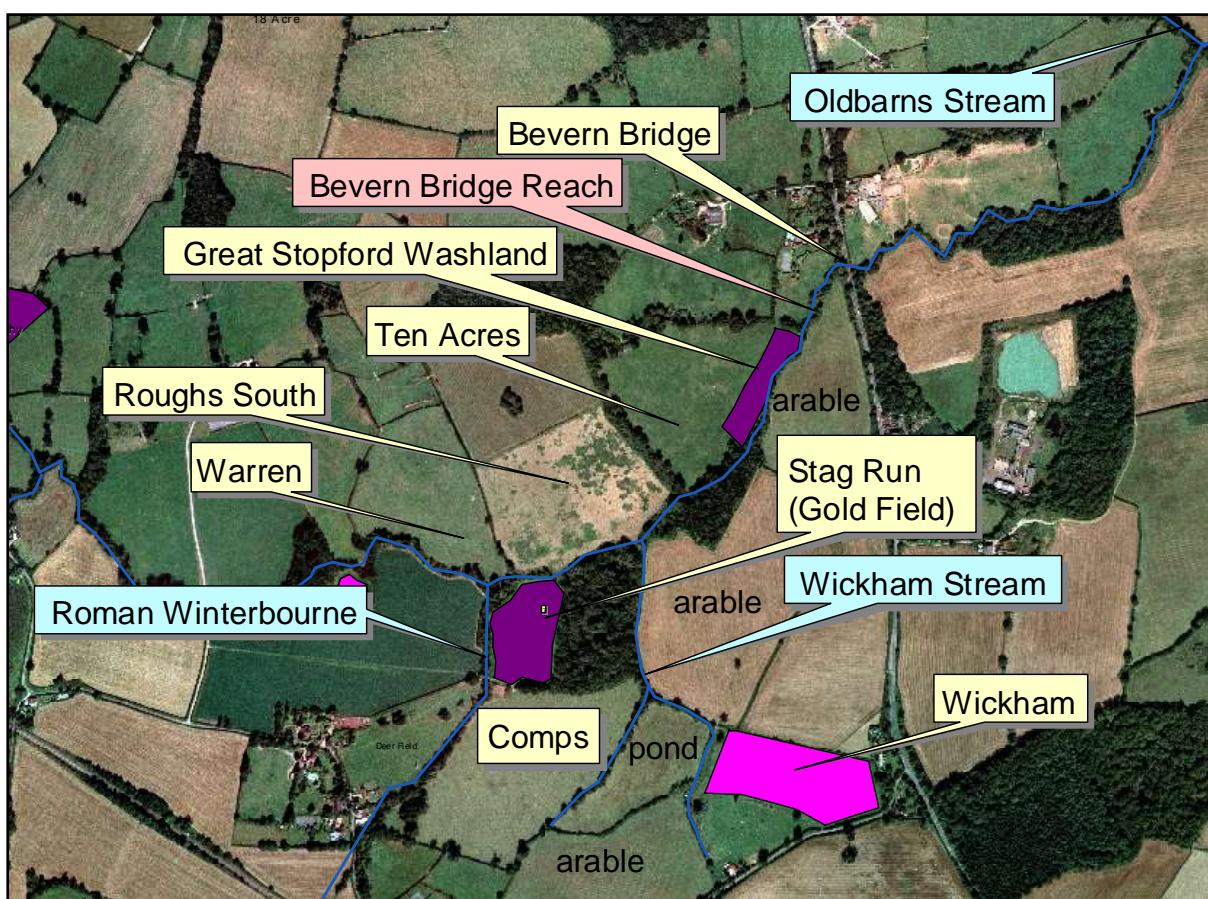


Figure 18. Bevern Bridge Reach and Wickham Stream.

4.19 Wickham Stream (Figure 18, Table 2)

This stream is a very short tributary which drains Wickham and the adjacent arable field.

Wickham (TQ 394153, Figure 18) is the northern part of what is now a large field divided by a ghost hedge. It was surveyed on 22 June 2017. There were large patches of False Oat-grass (*Arrhenatherum elatius*) and Creeping Thistle (*Cirsium arvense*), but in other places the sward was more diverse and MG5a. However, with only 16 (9-22) species per 2 m by 2 m quadrat it was considerably less species-rich than the average. A Common Spotted-orchid (*Dactylorhiza fuchsii*) was found in flower. Marble White and Meadow Brown butterflies were flying.

The field looked unmanaged with tree seedlings that were more than one year old and a thick thatch. There was no sign of recent grazing; and last year's dead flower heads were present on the Crested Dog's-tail (*Cynosurus cristatus*). It has not been ploughed for over 100 years and is not allowed to be cut until August to allow it to re-seed itself. Recently it has not been touched at all (interview with farm manager 18 January 2017). In 1838 Wickham was arable (Tithe Survey) and in 1932 meadow (Land Utilisation Survey). Wickham is providing Ecosystem Services 1, 2, 5 and 6. It would be more species-rich if it was cut for hay again and the aftermath grazed by cattle. It would then be providing Ecosystem Services 3 and 4 again too.

| Name of site and date of survey | NVC | absent constants | low frequency constants | additional constants |
|---------------------------------|------|------------------|---|---|
| Wickham 22 June 2017 | MG5a | | <i>Festuca rubra</i> <i>Cynosurus cristatus</i> <i>Lotus corniculatus</i> <i>Plantago lanceolata</i> <i>Trifolium repens</i> <i>Centaurea nigra</i> <i>Agrostis capillaris</i> <i>Trifolium pratense</i> | <i>Agrostis stolonifera</i> <i>Rumex acetosa</i> <i>Cerastium fontanum</i> <i>Cirsium arvense</i> <i>Vicia tetraspernum</i> |

Downstream on the north bank of Bevern Bridge Reach, Ten Acres and Great Stopford are now one field and were being grazed by a pack of semi-wild horses when we visited on 18 May 2016. The horses have now gone. We surveyed the washland strip of Great Stopford, which has not been ploughed within living memory. The rest of the field was re-seeded in 1966, but has not been ploughed since then (personal communication from elderly tenant farmer, 24 September 2015). Ten Acres was arable in 1838 and Great Stopford was meadow (Tithe Survey). In 1931 they were both meadow (Land Utilisation Survey).

Great Stopford Washland (TQ394160, Figure 18) was surveyed on 18 May 2016. Sweet Vernal-grass (*Anthoxanthum odoratum*) was absent from quadrats, although present in the field, and we concluded that the grassland was the *Alopecurus pratensis* variant of MG6a (*Lolium perenne-Cynosurus cristatus* grassland, typical sub-community). It was much more species-rich than average with 18 (13-22) species per sample. Oxeye Daisy (*Leucanthemum vulgare*) was frequent and two other species characteristic of MG5a, Common Bird's-foot-trefoil (*Lotus corniculatus*) and Meadow Vetchling (*Lathyrus pratensis*), were present, but at low frequencies. This washland is providing Ecosystem Services 1, 2, 5, 6, 7, 8 and 9.

| Name of meadow and date of survey | NVC | absent constants | low frequency constants | additional constants |
|--|------|--|-------------------------|---|
| Great Stopford Washland 18 May 2016 | MG6a | <i>Cynosurus cristatus</i> <i>Festuca rubra</i> | <i>Lolium perenne</i> | <i>Ranunculus acris</i> <i>Ranunculus repens</i> |

Downstream from Bevern Bridge the south side is mainly arable and on the north side there is a chicken farm and then a horse paddock extending down to the confluence with Oldbarns Stream (16 October 2015 walk).

4.20 Oldbarns Stream (Figure 19, Table 2)

Oldbarns Stream rises in a pond in the north-west corner of a well-grazed grassy field and flows east along the hedge-line before turning south down the long eastern side of this field. At Oldbarns Farm it turns sharply east and runs to the south of the farm buildings, past a pony paddock and into the western arm of Swan Wood. Downstream from Swan Wood to the confluence with the main Bevern has not been walked.

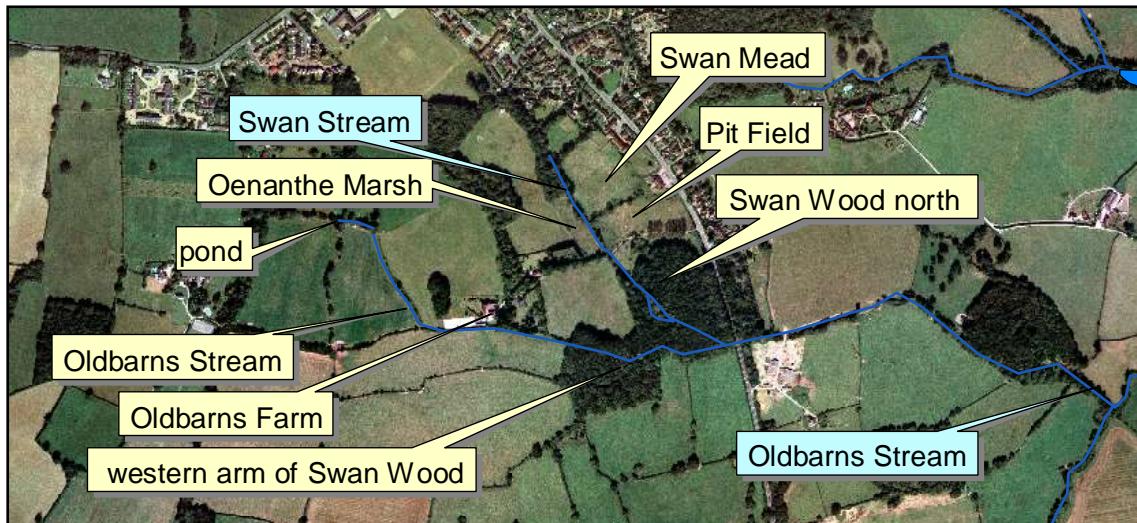


Figure 19. Oldbarns Stream.

Western arm of Swan Wood (TQ 392167, Figure 19) was visited on 2 March 2016. It has Ash (*Fraxinus excelsior*), Pedunculate Oak (*Quercus robur*) and Hazel (*Corylus avellana*) in the canopy with thickets of Blackthorn (*Prunus spinosa*). Near the western boundary there were lots of Bluebells (*Hyacinthoides non-scripta*) and Moschatel (*Adoxa moschatellina*) in the ground flora, but then the streamside flattens out into a wet area with Ramsons (*Allium ursinum*) and Hemlock Water-dropwort (*Oenanthe crocata*). The stream then runs along the southern edge of the wood where it borders pasture. Here there were many fallen trees making a tangled mass of branches over the stream. The streamside bryophytes included *Thamnobryum alopecurum*, *Atrichum undulatum*, *Thuidium tamariscinum*, *Eurhynchium striatum* and lots of *Pellia endiviifolia*. Swan Wood is providing Ecosystem Services 1, 2, 5, 6, 7, 8 and 9.

4.21 Swan Stream (Figure 19, Table 2)

This tributary rises in woodland to the north of Swan Mead and flows south through a narrow band of woodland along the western boundary of Swan Mead and into a dense marsh of Hemlock Water-dropwort (labelled as Oenanthe Marsh). The stream flows under the public footpath and into the northern part of Swan Wood to join Oldbarns Stream at the eastern end of the wood.

Swan Mead (TQ392171, Figure 19). Swan Mead was surveyed on 8 June 2016. The sloping part of the field was degraded MG5a with only 17 (10-22) species per sample and is probably in transition to MG1 *Arrhenatherum elatius* grassland (False Oat-grass grassland) as a result of poor management. It is cut twice a year, but the arisings are not picked up and

it is not grazed. In 1838 (Tithe Survey) and in 1931 (Land Utilisation Survey), it was meadow. Swan Mead is providing Ecosystem Services 1, 2, 5 and 6.

| Name of meadow and date of survey | NVC | absent constants | low frequency constants | additional constants |
|-----------------------------------|------|--|---|--|
| Swan Mead slope 8 June 2016 | MG5a | <i>Cynosurus cristatus</i> <i>Agrostis capillaris</i> <i>Anthoxanthum odoratum</i> | <i>Festuca rubra</i> <i>Lotus corniculatus</i> <i>Plantago lanceolata</i> <i>Dactylis glomerata</i> <i>Centaurea nigra</i> <i>Trifolium pratense</i> | <i>Glechoma hederacea</i> <i>Poa trivialis</i> <i>Rumex obtusifolius</i> |

The washland at the bottom of the slope was also surveyed on 8 June 2016. It was MG10b *Holcus lanatus-Juncus effusus* rush pasture (Yorkshire-fog – Soft Rush pasture), but with 14 (11-18) species per sample was slightly less species-rich than the average. It was also cut twice a year and the risings left on the ground, but there was evidence of some grazing by rabbits. Swan Mead washland is providing Ecosystem Services 1, 2, 5, 6, 7, 8 and 9.

| Name of meadow and date of survey | NVC | absent constants | low frequency constants | additional constants |
|-----------------------------------|-------|------------------|--|--|
| Swan Mead washland 8 June 2016 | MG10b | | <i>Juncus inflexus</i> <i>Carex hirta</i> | <i>Rumex obtusifolius</i> <i>Alopecurus pratensis</i> |

Pit Field (TQ392170, Figure 19). The species present in this adjacent meadow were recorded on 8 June 2016, but the meadow was not surveyed because it was very similar to the slope in Swan Mead and was managed in the same way. This field was not recorded in the Tithe Survey, but was being managed as meadow in 1931 (Land Utilisation Survey).

Swan Wood north (TQ 393168, Figure 19) has Ash (*Fraxinus excelsior*) and Pedunculate Oak (*Quercus robur*) in the canopy and Dog's Mercury (*Mercurialis perennis*), Moschatel (*Adoxa moschatellina*), Bluebell (*Hyacinthoides non-scripta*), Primrose (*Primula vulgaris*), Lord-and-ladies (*Arum maculatum*), Lesser Celandine (*Ranunculus ficaria*), Hart's-tongue (*Phyllitis scolopendrium*), and Early-purple Orchid (*Orchis mascula*) in the ground flora. Bryophytes included *Thamnobryum alopecurum*, *Plagiommium undulatum*, *Cirriphyllum piliferum*, *Atrichum undulatum* and *Mnium hornum*, with *Pellia endiviifolia*, *Lunularia cruciata*, *Conocephalum conicum* and *Plagiochila asplenoides*. The stream has a muddy bottom and flows into a large wet area which is probably the remains of a pond. Shortly before the confluence with Oldbarns Stream the bottom of Swan Stream is gravelly. Swan Wood is providing Ecosystem Services 1, 2, 5, 6, 7, 8 and 9.

4.22 Beachy Wood Stream (Figure 20, Table 2)

This stream rises in the south-west part of Beachy Wood and flows northward along the western edge of the wood. Beachy Wood is surrounded by arable fields. The stream continues northward through a narrow shaw, which is continuous with Beachy Wood and then along the eastern boundary of cattle-grazed pasture before joining the main Bevorn Stream. Only this narrow band separates the stream from arable fields. Run-off and the amount of sediment, metaldehyde, and nutrients entering the stream would be greatly reduced by converting these fields to permanent grass or by extending the woodland.

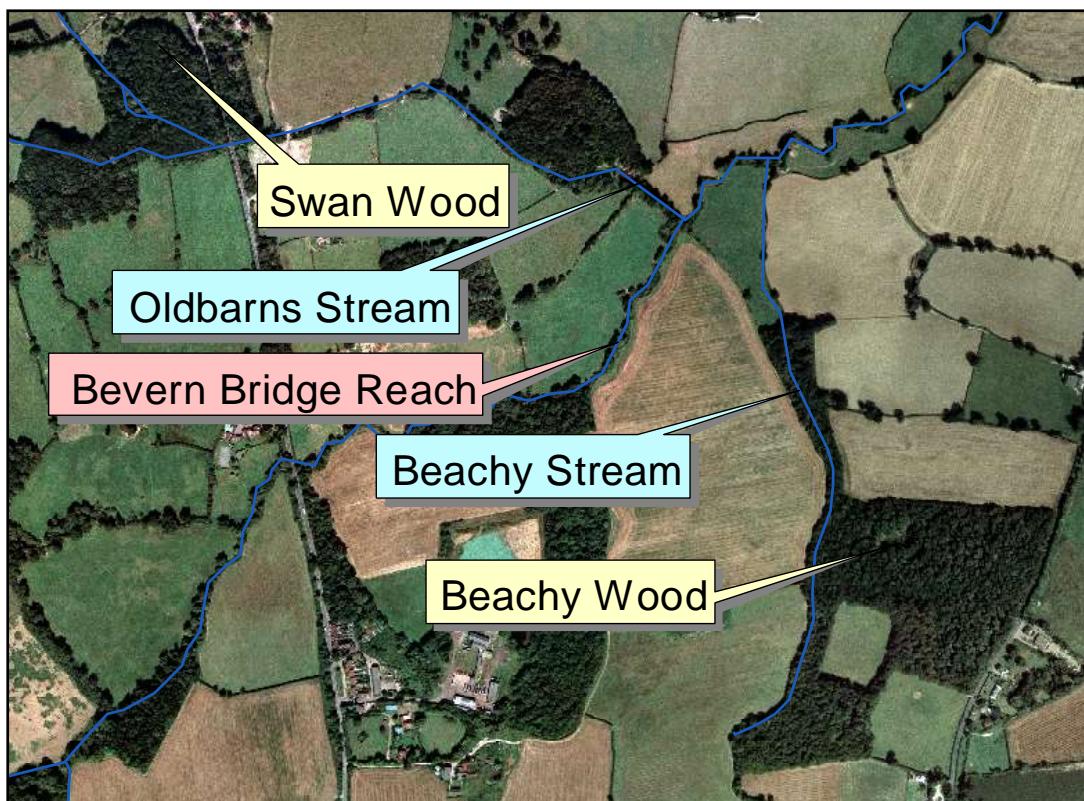


Figure 20. Beachy Stream.

Beachy Wood (TQ 404161, Figure 20) was surveyed on 27 April 2017. It lacked the expected Constants *Atrichum undulatum* and Ash (*Fraxinus excelsior*), but could be assigned to Group 3A (Table 1, pp. 9–11). The calcicole *Pellia endiviifolia* replaced *P. epiphylla*, which is characteristic of more acidic environments. There were four debris dams in the length of stream surveyed and these were holding the water back to a depth of 30 cm, 30 cm, 50 cm and 60 cm. Beachy Wood is providing Ecosystem Services 1, 2, 5 and 6, which is particularly important in the context of the surrounding arable land.

| Name of Wood and date of survey | Group | absent discriminators | low frequency discriminators | additional constants |
|---------------------------------|-------|--|--|--|
| Beachy Wood 27 April 2017 | 3A | <i>Lamiastrum galeobdolon</i> <i>Chrysosplenium oppositifolium</i> <i>Deschampsia cespitosa</i> <i>Conocephalum conicum</i> | <i>Dryopteris affinis</i> <i>Hypnum cupressiforme</i> | <i>Hypnum andoi</i> <i>Adoxa moschatellina</i> <i>Anthriscus sylvestris</i> <i>Galium aparine</i> <i>Mercurialis perennis</i> <i>Rumex obtusifolius</i> <i>Silene dioica</i> <i>Urtica dioica</i> |

4.23 Balneath Stream (Figure 21, Table 2)

This stream rises in Kiln Wood to the north-west of Balneath Manor and flows east through Balneath Manor grounds and along a blackthorn thicket to an area of wet woodland. Two small streams, which rise in Starvecrow Wood, flow south to join Balneath Stream at the western end of this woodland. A large part of the woodland floods to form a pond held back by a weir at the eastern end. Fields on both sides have been re-seeded with Perennial Rye

Grass. The fields to the north were part of Balneath Wood until the late 1970s when a large area of woodland was cleared.

Three gills run in narrow strips of woodland across the cleared area: Gill A and Gill B rise in woodland along Balneath Lane and Gill C in a pond at the south end of a small unmanaged field (Figure 21). The gills were walked on 16 November 2016. Sheep had free access to Gill C from the adjacent field and fences were not sufficiently well maintained to keep sheep and cattle out of the other gills. The ground flora was not as rich as expected and ferns were surprisingly rare. However, there was a lovely range of tree and shrub species: Hornbeam (*Carpinus betulus*), Sessile Oak (*Quercus petraea*), Pedunculate Oak (*Quercus robur*), Birch (*Betula* species), Wild Service Tree (*Sorbus torminalis*), Hazel (*Corylus avellana*), Ash (*Fraxinus excelsior*), Crab Apple (*Malus sylvestris*), Field Maple (*Acer campestre*), Common Hawthorn (*Crataegus monogyna*), Guelder Rose (*Viburnum opulus*), Spindle (*Euonymus europaeus*), Wild Privet (*Ligustrum vulgare*), Dogwood (*Cornus sanguinea*), Blackthorn (*Prunus spinosa*) and a large quantity of Aspen (*Populus tremula*) along the field boundaries. The three Gill Constant bryophytes (Table 1, pp. 9–11) were present and *Thamnobryum alopecurum*, *Plagiomnium undulatum*, *Hypnum cupressiforme* and *Fissidens taxifolius*, but the other characteristic species used in Table 1 were absent. These strips of woodland are providing Ecosystem Services 1, 2, 5 and 6.

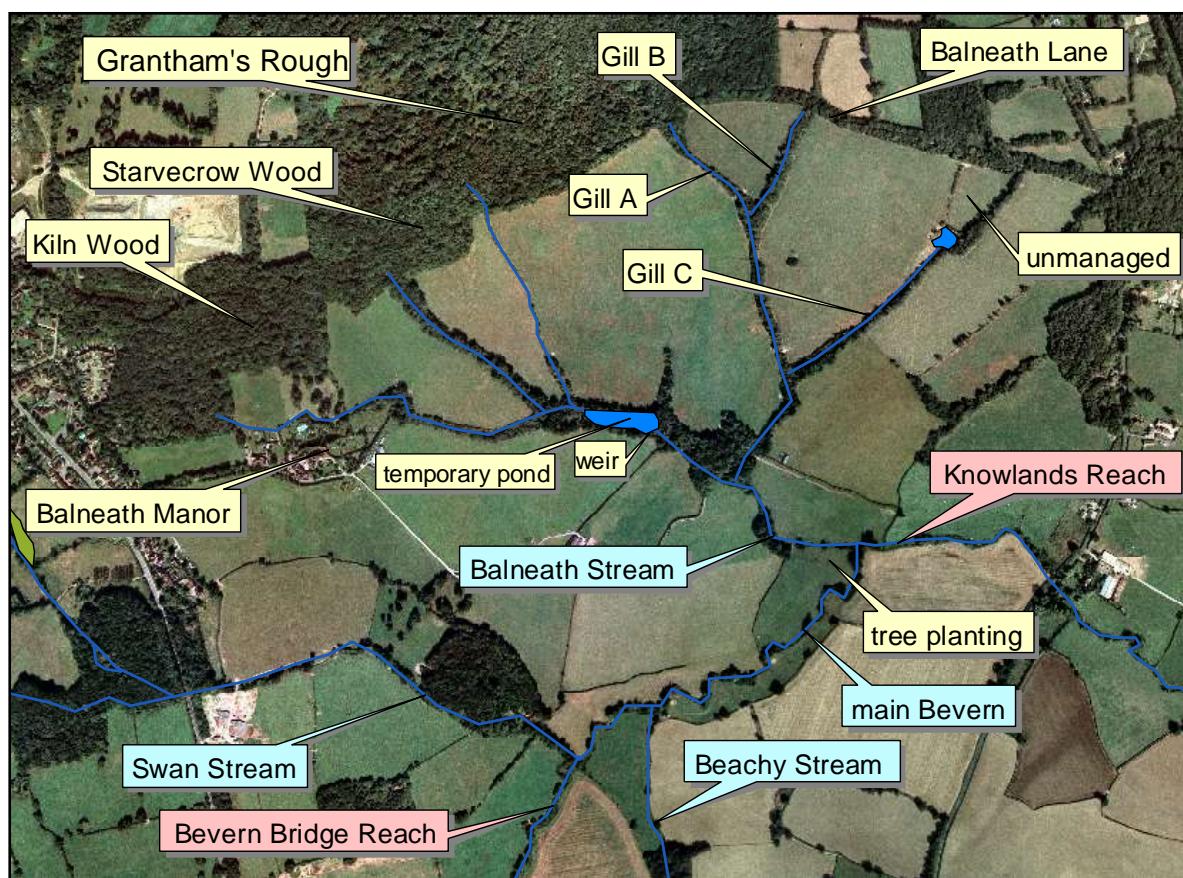


Figure 21. Balneath Stream.

4.24 Knowlands Reach of Bevorn Stream (Figure 22, Table 2)

The fields on the south side of Knowlands Reach down to the railway embankment are mainly arable. The north side, which was walked on 8 October 2015, had a series of meadows containing more permanent grassland. The most species-rich of these, Downsview, was surveyed on 19 May 2016 in two parts: the slope and the less species-rich bottom which looked as though it flooded.

Downsview Slope (TQ 411171, Figure 22) was MG6b (*Lolium perenne-Cynosurus cristatus* grassland, *Anthoxanthum odoratum* sub-community) and slightly more species-rich than average with 15 (11-17) per sample. This grassland is providing Ecosystem Services 1, 2, 5 and 6.

| Name of meadow and date of survey | NVC | absent constants | low frequency constants | additional constants |
|-----------------------------------|------|--|--|---|
| Downsview slope 19 May 2016 | MG6b | <i>Cynosurus cristatus</i> <i>Festuca rubra</i> | <i>Trifolium repens</i> <i>Cerastium fontanum</i> | <i>Geranium dissectum</i> <i>Poa trivialis</i> <i>Rumex acetosa</i> |

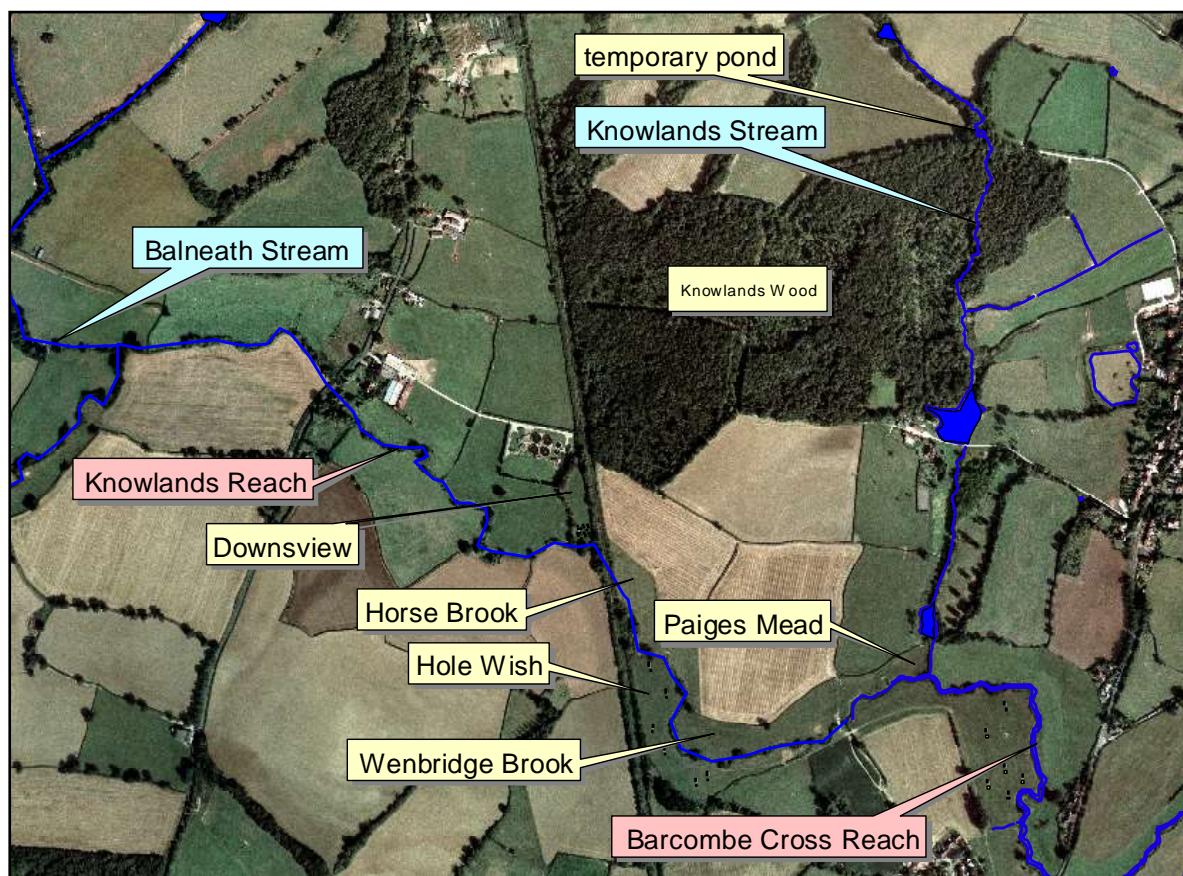


Figure 22. Knowlands Reach and Knowlands Stream.

Downsview Bottom (TQ 410170, Figure 22) was MG7d *Lolium perenne-Alopecurus pratensis* ley (Perennial Rye Grass–Meadow Foxtail ley), but was considerably more species-rich than average with 13 (11-15) per sample. Downsview was meadow in both 1839 (Tithe Survey) and 1931 (Land Utilisation Survey).

| Name of meadow and date of survey | NVC | absent constants | low frequency constants | additional constants |
|-----------------------------------|------|------------------|-------------------------|--|
| Downsview bottom 19 May 2016 | MG7d | | | <i>Poa trivialis</i> <i>Ranunculus acris</i> <i>Rumex acetosa</i> <i>Holcus lanatus</i> <i>Ranunculus repens</i> <i>Bromus hordeaceus</i> |

Downstream from the railway embankment, the stream is bordered by permanent grassland. Horse Brook, Hole Wish, and Wenbridge Brook have never been ploughed and flood briefly about four times a year (oral history interview with John and Hedley Cornwell, 21 August 2013). They were cut for hay or silage and then grazed by cattle. Paiges Mead was ploughed and grew cereal, but was then returned to grass and has remained grass for more than 20 years. In the past, the grassland was fertilised, but this has not happened since 1998 when the farm entered Stewardship. When we walked on 15 March 2012 they looked as though they were still quite fertile, but this could be the result of nutrient-rich floodwaters.

Hole Wish (TQ416164, Figure 22) was surveyed on 31 May 2012. Cattle had been grazing, but not too hard. It was MG7d *Lolium perenne-Alopecurus pratensis* ley (Perennial Rye Grass–Meadow Foxtail ley), but considerably more species-rich than average with 13 (9-15) species per 2 m by 2 m sample.

| Name of meadow and date of survey | NVC | absent constants | low frequency constants | additional constants |
|-----------------------------------|------|------------------|-------------------------|--|
| Hole Wish 31 May 2012 | MG7d | | | <i>Poa trivialis</i> <i>Agrostis stolonifera</i> <i>Holcus lanatus</i> |

There was also a spring-fed wet corner with additional species such as Meadowsweet (*Filipendula ulmaria*), Marsh Bedstraw (*Galium palustre*), Tufted Forget-me-not (*Myosotis laxa*), Floating Sweet Grass (*Glyceria fluitans*), Bog Stitchwort (*Stellaria alsine*), Reed Canary-grass (*Phalaris arundinacea*) and Marsh Foxtail (*Alopecurus geniculatus*). And the ditch along the hedge bordering the south-east side of the washland contained Gipsywort (*Lycopus europaeus*). Hole Wish was meadow in both 1841 (Tithe Survey) and 1931 (Land Utilisation Survey). It floods completely and is providing Ecosystem Services 1, 2, 3, 5, 6, 7, 8 and 9.

4.25 Knowlands Stream (Figure 22, Table 2)

This tributary rises in a pond, which was covered in Parrot's-feather (*Myriophyllum aquaticum*) when we visited on 8 October 2015. From here it flows south in the hedge between two grassy fields before entering Knowlands Wood. The fields were in cereal production until 6 years ago, but are now grazed by sheep and sometimes cattle. Lime and slurry are spread. Just inside the wood there is a depression where water spills out to make a temporary pond after heavy rain.

Knowlands Wood (Figure 22) was walked 8 October 2015. It consists of mainly overgrown hornbeam coppice with some Pedunculate Oak (*Quercus robus*), and an understorey of Spindle (*Euonymus europaeus*), Hazel (*Corylus avellana*) and Common Hawthorn (*Crataegus*

monogyna). Field Maple (*Acer campestre*) occurs along the field edge with Elder (*Sambucus nigra*) and Holly (*Ilex aquifolium*) and, at the northern end, Blackthorn (*Prunus spinosa*) with Alder (*Alnus glutinosa*) by the temporary pond. Ground flora contained Bluebell (*Hyacinthoides non-scripta*), Primrose (*Primula vulgaris*) and Dog's Mercury (*Mercurialis perennis*), but no Wood Sorrel (*Oxalis acetosella*). Hart's-tongue (*Phyllitis scolopendrium*), Bracken (*Pteridium aquilinum*), Male-fern *Dryopteris filix-mas* and Scaly Male-fern (*D. affinis*) were present, but no Broad Buckler-fern (*Dryopteris dilatata*). *Pellia endiviifolia* was present rather than *P. epiphylla*, but other Gill Constant bryophytes (Table 1, pp. 9–11) were present.

Downstream from the wood, the stream enters a large pond and then flows south through wet grassland with Yellow Iris (*Iris pseudacorus*), Branched Bur-reed (*Sparganium erecta*), Water Mint (*Mentha aquatica*), Soft Rush (*Juncus effusus*), Hard Rush (*J. inflexus*), Creeping Buttercup (*Ranunculus repens*) and Wild Teasel (*Dipsacus fullonum*). There is a small pond before the stream flows past the east side of Paiges Mead to join the main Bevern.

4.26 Barcombe Cross Reach (Figure 23, Table 2)

Roundabout Field (TQ422163, Figure 23) was surveyed on 19 May 2016. It was MG7d *Lolium perenne-Alopecurus pratensis* ley (Perennial Rye Grass–Meadow Foxtail ley) and slightly more species-rich than average with 10 (8-12) species per sample.

| Name of meadow and date of survey | NVC | absent constants | low frequency constants | additional constants |
|-----------------------------------|------|------------------|-------------------------|---|
| Roundabout 19 May 2016 | MG7d | | | <i>Poa trivialis</i> <i>Cardamine pratensis</i> <i>Holcus lanatus</i> <i>Ranunculus repens</i> |

Roundabout field has never been ploughed and has not been fertilised since 1998. It floods briefly about 4 times a year (oral history interview with John and Hedley Cornwell, 21 August 2013). It is cut for hay or silage and then grazed by cattle, but it is too wet to leave the cattle on for long. It is providing Ecosystem Services 1, 2, 3, 4, 5, 6, 7, 8, and 9. Roundabout was meadow in both 1841 (Tithe Survey) and 1931 (Land Utilisation Survey).

4.27 Camays Reach (Figure 23, Table 2)

This reach was walked on 7 March 2014. The grassy fields flood regularly and had been flooded prior to our visit. Mostly they lacked broad-leaved hay-meadow plants except for one hummock at the upstream end, which rose above the floodplain and had MG5 forbs on the top out of reach of the nutrient-rich floodwaters. Downstream from the point where the stream turns sharply east, the fields on the north side had been grazed by horses, but the new owner intends to graze with cattle. The downstream end of Chilly Wood Brook was surveyed on 21 May 2014. The fields on the west side had been grazed by cattle. The downstream end of Horse Brooks was surveyed on 21 May 2014.

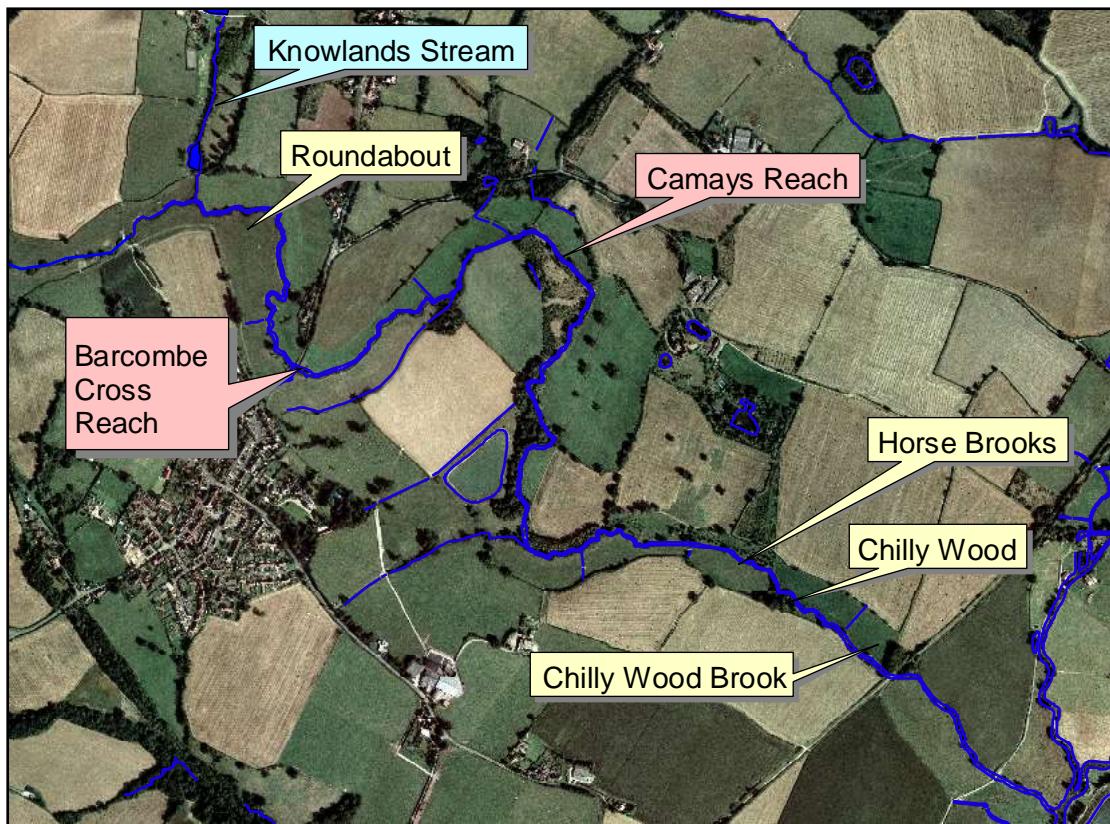


Figure 23. Barcombe Cross and Camays Reach.

Horse Brooks (TQ432151, Figure 23). This washland was the *Alopecurus pratensis* variant of MG6a (*Lolium perenne*-*Cynosurus cristatus* grassland, typical sub-community), but much more species-rich than the average with 16 (13-20) species per sample. Horse Brooks was meadow in both 1841 (Tithe Survey) and 1931 (Land Utilisation Survey). It is providing Ecosystem Services 1, 2, 3, 5, 6, 7, 8 and 9.

| Name of meadow and date of survey | NVC | absent constants | low frequency constants | additional constants |
|-----------------------------------|-----------------|------------------|---|---|
| Horse Brooks 21 May 2014 | MG6a Al prat | | <i>Cynosurus cristatus</i> <i>Trifolium repens</i> | <i>Poa trivialis</i> <i>Ranunculus acris</i> <i>Ranunculus bulbosus</i> |

Chilly Wood Brook (TQ432157, Figure 23). This washland was MG7d *Lolium perenne*-*Alopecurus pratensis* ley (Perennial Rye Grass-Meadow Foxtail ley) and about average species richness with 10 (8-13) species per sample. Chilly Wood Brook was meadow in 1841 (Tithe Survey) and was not recorded in the Land Utilisation Survey of 1931. It is providing Ecosystem Services 1, 2, 5, 6, 7, 8 and 9 – and under new management will provide Ecosystem Service 3 as well.

| Name of meadow and date of survey | NVC | absent constants | low frequency constants | additional constants |
|-----------------------------------|------|------------------|-------------------------|----------------------|
| Chilly Wood Brook | MG7d | | <i>Rumex acetosa</i> | <i>Poa trivialis</i> |

5 Conclusions from our research

The Bevvern catchment contains a large amount of arable land growing both cereal crops and short-term grass ley, so there is enormous scope for converting arable fields into permanent grassland, particularly close to the water course. Most of the wheat and maize is grown to feed animals kept indoors. Maize is a particularly unfortunate choice of crop because of the harmful chemicals used in its production and the bare soil left over winter following harvesting leading to severe run-off of sediment and chemicals into the water course. Plumpton College land, lying near the head of the catchment, provides a wonderful opportunity for the college to show-case progressive farming techniques: producing pasture-fed meat and dairy products rather than growing maize to feed to animals kept indoors. Such progressive farming is essential if we are to feed the world in 2050 (United Nations Food and Agriculture SOL-m) as well as producing more healthy food (Pasture-for-life website).

5.1 Converting short-term grass ley to permanent grassland

We have identified the following fields that had short-term grass ley in 2015:

Field F p.16

Moore Racehorse Trust fields, p. 17

Cattle Field TQ344158, p. 17

Field D TQ344162, p. 17

Fields on North Barnes Stream downstream from Plumpton Green, p. 21

Middleton Park, p. 25, Figure 11

Sandpits, p. 25, Figure 11

Series of grass leys along lower part of Plumpton Mill Stream, p. 29

Re-seeded grass leys along Highbridge Reach, p. 30

Re-seeded grass leys along upper part of North Hall Stream, p. 30

Re-seeded grass leys surrounding Balneath Gills, p. 42

5.2 Converting cereal fields to permanent grassland

We have identified the following fields which grew cereal crops in 2015:

Arable Field TQ342157, p. 17

Wales Croft, Spring Field, Summer Field, Church Leg, Pages Croft, Figure 10, p. 22,

Sheepwash, Figure 11, p. 25

Terrace and Lamberts, Figure 11 (p. 25), p. 26

Middleton, Figure 11 (p. 25), p. 26

Osiers, Figure 11 (p. 25)

Jubilee, Figure 11 (p. 25)

Dentures, Figure 12 (p. 27), p. 28

Arable fields bordering Roman Winterbourne, p. 36

Arable field downstream from Wickham, Figure 18, p. 38

Arable fields surrounding Beachy Wood, p. 41

5.3 Hedgerow planting combined with species-rich grassland

Another strategy for reducing the pollution caused by the arable fields identified in 5.2 above would be to sow strips of species-rich grassland along the stream-sides and then to

plant hedges to separate these small fields from the adjacent arable fields. This would be particularly effective where large arable fields border the stream system. For example:
Spring Field and Wales Croft, Figure 10, p. 22
Summer Field and Pages Croft, Figure 10, p. 22
Osiers, Jubilee, West Slope, Sandpits, Figure 11, p. 25

5.4 Tree planting

Another strategy for reducing the pollution caused by the arable fields identified in 5.2 above would be to plant woodland shaws along the stream system. Again this would be particularly effective where large arable fields border the stream system. For example:
Spring Field and Wales Croft, Figure 10, p. 22
Summer Field and Pages Croft, Figure 10, p. 22
Osiers, Jubilee, West Slope, Sandpits, Figure 11, p. 25

Tree planting would also be beneficial along the margins of the arable fields adjacent to Beachy Wood, particularly along the narrow band of woodland extending northwards and along the western side of the wood (p. 41). The northern extension of the wood could perhaps be continued northwards right up to the main Bevern.

5.5 Debris dams

Three of the five sections of stream surveyed in Beachy Wood contained at least one natural debris dam, which was increasing habitat diversity as well as retaining run-off. Two of the five sections of stream surveyed in Sheepwash Wood also contained a natural debris dam. The part played by these natural features in preventing run-off needs to be recognised together with the ecological importance of retaining upstream woodland.

5.6 Species-rich meadows

Our studies have been directed particularly towards remaining areas of species-rich grassland along the Bevern. Such sites are vital for the range of ecosystem services that they provide, including those relating to flood alleviation and maintaining water quality. This applies especially to those which are washlands, but also to grassland on the slopes above the water course. Every encouragement should be given to the landowners of such sites to continue managing the sites appropriately. Such sites should not be used for tree planting. We have identified the following species-rich meadows:

Street Green Field, p. 19
Godley Meadow and adjacent meadow at TQ350157, p. 19
The Severals and Sheepwash, pp. 22, 23
Stem Field, p. 27
South Mead, p. 28
Ditchy C, p. 32
Pipers Brook, p. 34
Deer Park, p. 37
Wickham, p. 38

We have also identified the following areas of permanent grassland with some wildflower interest:

Field A (TQ333145), p. 15
Stoneywish camping field, Golf course southern streamside and Field E TQ345164, p. 16

Kiln Meadow, p. 18
The Plot, p. 23
Little Wales West, p. 24
The Lag, p. 27
Pondtail, p. 28
Five Acres, pp. 28-29
Ditchy A and B, p. 32
Blacksmiths A, B and C, p. 33
Lower Pells, p. 36
Stag Run, p. 37
Great Stopford washland, p. 39
Swan Mead, p. 40
Downsview, p. 44
Hole Wish, p. 45
Roundabout Field, p. 46
Chilly Wood Brook, p. 47
Horse Brooks, p. 47
With appropriate management of hay cut followed by aftermath grazing by cattle or sheep these sites could become more species-rich.

6 References

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