





Biodiversity Enhancement Plan for the Exeter Campuses



Final: October 2011

Foreword

The recently published Natural Environment White Paper states that natural environment needs to be placed at the heart of decision making at all levels. Too often we take for granted the goods and services that a healthy natural environment provides for us.

Biodiversity represents the building blocks, the foundation, for the ecosystem services that we all rely on in our everyday lives such as clean water, clean air, flood mitigation, recreation, and landscape - all contributing to our health and well being. We have however failed to meet our biodiversity targets that followed the Rio Earth Summit – to simply halt the decline in biodiversity.

Devon Wildlife Trust welcomes this ambitious Biodiversity Enhancement Plan that clearly recognises the importance of biodiversity in this urban environment. Approximately 80% of our population reside in urban areas. Huge losses in quality and quantity of urban greenspace has occurred – for example the present extent of allotments only account for 10% of peak levels and over 10,000 playing fields have been sold (between 1979 and 1997).

Exeter is located in a key strategic location, supporting important green space and the crucial linkages through the city and beyond – often to sites recognised for their international importance to conservation (Exe Estuary Special Protection Area for example). The University, as a major landowner, can directly influence the quantity and quality of greenspace in the City and also the provision of habitat for threatened species. As important, is its role in research, as an educator, inspiring students and fostering a more integrated approach to conservation.

We hope that the partnerships set-up within the University are able to fully integrate biodiversity enhancement throughout all activities and look forward to working with the University and other partners in the City through the Exeter Wild City project to ensure a healthy and wildlife-rich future.

Peter Burgess
Conservation Advocacy Manager
Devon Wildlife Trust

Executive Summary

The University of Exeter estate within Exeter comprises of 153 Ha of grounds under management (100 Ha gardens, 31 Ha sport grounds, and 22 Ha wider countryside). There are two main campuses in the city, the Streatham campus and the smaller St Luke's campus, and alongside these the University also manages sports pitches at Duckes Meadow, grounds and residences in the Duryard Valley, and the grounds of several student residences across the city. The University of Exeter therefore has an important part to play in conserving the natural heritage of Exeter – not only does it own a significant area of land within the city where conserving and enhancing biodiversity can make a real difference, but it also plays a key role in furthering understanding about the crucial importance of biodiversity and ecosystem delivery. Through implementing visible biodiversity enhancement initiatives within the campus grounds the University is in an excellent position to promote positive biodiversity action to students, staff and the wider community.

The importance of biodiversity was formally recognised on a global scale in 1992 when 153 nations signed the Convention on Biodiversity at the Earth Summit in Rio de Janeiro. Biodiversity was then defined as 'the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems'. Biodiversity enhancement encompasses the conservation and enhancement of wildlife and habitats, and entails active measures to increase the biodiversity interest of a targeted area.

The University is proud of the contribution its estate makes to the richness and connectivity of the overall biodiversity network of Exeter, and is committed to safeguarding and enhancing this by its land management and development practices. The University of Exeter aims 'to protect, preserve and enhance biodiversity on sites that the University manages or owns' (Environmental Sustainability Strategy 2010-2015). This Biodiversity Enhancement Plan sets out the how the University can achieve this aim through proposing a series of recommended biodiversity enhancement measures for the eight main habitats found across the University's Exeter estate.

The recommendations made in this plan build upon existing good practice; the University has already produced a Biodiversity Statement and a Campus Biodiversity Management Principles for Grounds/Estates, and the University's Birds and Bees Campaign was launched in recognition of the United Nations Decade for Biodiversity. The successful implementation of the recommendations made in the Biodiversity Enhancement Plan will:

- Re-create, restore and successfully reconnect high quality habitats across the University's grounds, linking into the wider biodiversity network across the city of Exeter
- Provide opportunities for students, staff and the local community to engage with biodiversity through, for example, volunteering opportunities
- Ensure that the Exeter campuses are ecologically diverse and inspiring places to visit, helping people to enjoy the natural environment
- Enhance the opportunities for using the University's grounds as a 'Living Laboratory', promoting biodiversity within the curriculum
- Increase the opportunities to work in partnership to enhance the biodiversity of Exeter

Four locations have been identified as priority target sites for biodiversity enhancement, selected because they contain the largest areas of land with capacity for significant biodiversity enhancement. They are the Streatham Campus, the St Luke's Campus, the Duryard Valley and Thomas Hall area, and Duckes Meadow. Within these four priority sites eight different habitats can be found - amenity grassland and planting, buildings and the built environment, hedgerows, scattered trees, scrub, semi-improved grassland, wetland, and woodland. Each habitat has been considered in turn in the Biodiversity Enhancement Plan, with details of the habitat and its occurrence across the campuses, alongside a summary of the current management employed. Prioritised enhancement recommendations follow, suggesting how existing management can be changed or new management introduced in order to enhance biodiversity. Every recommendation has been given a priority category so that associated targets dates can be set.

Priority 1 recommendations include:

- Amenity grassland management plan to be drafted and adopted
- Installation of bird and bat boxes and development of a box management plan
- Hedgerow management plan to be drafted and adopted
- Creation of viable corridors between wetland areas
- Reduction of excessive woodland shading on the banks of wetland areas
- Protection of trees during construction work
- Non-intervention to allow trees to mature
- Clearance of laurel and rhododendron from woodland areas
- Retention of standing deadwood and creation of deadwood piles
- Establishment of a management regime of woodland thinning
- Introduction of scrub management
- Semi-improved grassland management plan to drafted and adopted

Priority 2 recommendations include:

- Mitigation of lighting impacts on bats
- Construction of woodpiles
- Incorporation of new wetlands and SUDS into future developments
- Improvement of the nature conservation value of fish stocked ponds
- Planting a traditional orchard
- Creation of zones of wildflowers and native shrubs adjacent to woodland

Priority 3 recommendations include:

- Consideration of green roofs in new developments
- Creation of green walls
- Construction of artificial habitats
- Enhancement of suitable wetland areas for otters
- Planting new areas of woodland to connect existing woodland section.

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1 Biodiversity Enhancement at the University of Exeter

1.1 Introduction

The University of Exeter aims ‘to protect, preserve and enhance biodiversity on sites that the University manages or owns’ (Environmental Sustainability Strategy 2010-2015). This Biodiversity Enhancement Plan sets out the how the University will achieve this through proposing a series of recommended biodiversity enhancement measures for the eight main habitats found across the University’s Exeter estate.

The successful implementation of the recommendations made in the Biodiversity Enhancement Plan will:

- Re-create, restore and successfully reconnect high quality habitats across the University’s grounds, linking into the wider biodiversity network across the city of Exeter
- Provide opportunities for students, staff and the local community to engage with biodiversity through, for example, volunteering opportunities
- Ensure that the Exeter campuses are ecologically diverse and inspiring places to visit, helping people to enjoy the natural environment
- Enhance the opportunities for using the University’s grounds as a ‘Living Laboratory’, promoting biodiversity within the curriculum
- Increase the opportunities to work in partnership to enhance the biodiversity of the city of Exeter

The Biodiversity Enhancement Plan will be adopted by the Grounds team to ensure that biodiversity enhancement measures form an integral part of grounds management and by the Estate Development team to ensure that the plan is formally consulted during the design stage of all new developments at the University. Responsibility for this will lie with the Director of Grounds, Iain Park, and the Director of Estate Development, Hugh McCann. The Biodiversity Enhancement Plan will be reviewed annually in June as part of the Sustainability Action Plan, and will include consultation to see which recommendations have been accomplished, assess where there have been barriers and challenges to delivery and to decide on which actions to implement during the following year.

1.2 The University of Exeter

The University of Exeter estate within the city of Exeter comprises of 153 Ha of grounds under management (100Ha gardens, 31 Ha sport grounds, and 22 ha wider countryside). There are two main campuses – the Streatham campus and the smaller St Luke’s campus. Alongside these the University also manages sports pitches at Duckes Meadow by the River Exe, grounds and residences in the Duryard Valley, and the grounds of several student residences across the city.

The University of Exeter has an important part to play in conserving the natural heritage of Exeter – not only does it own a significant area of land within the city where conserving and enhancing biodiversity can make a real difference, but it also plays a key role in furthering understanding about the crucial importance of biodiversity and ecosystem delivery. Through

implementing visible biodiversity enhancement initiatives within the campus grounds, the University is in an excellent position to promote positive biodiversity action to students, staff and the wider community.

As a feature of the University of Exeter's Strategic Plan '2015: Our Vision, Our Strategy' states that one of the key characteristics of the University is its 'uniquely attractive living and learning environments'; the BEP will ensure that the University's grounds in Exeter are diverse and interesting places to visit which make an important contribution to the richness and connectivity of the biodiversity network of Exeter so that the grounds continue to be recognised as being amongst the best in the UK. The University has already produced a Biodiversity Statement and a Campus Biodiversity Management Principles for Grounds/Estates (see Appendix A), and the production of this Biodiversity Enhancement Plan is part of the continuation of the University's Birds and Bees Campaign which was launched in recognition of the UN Decade of Biodiversity (2011-2020).

1.3 The Biodiversity of Exeter

The importance of biodiversity was formally recognised on a global scale in 1992 when 153 nations signed the Convention on Biodiversity at the Earth Summit in Rio de Janeiro. Biodiversity was then defined as 'the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems'.

Exeter is a city of high nature conservation value. The River Exe flows through the city, and the Exe estuary is of global importance to a range of wildlife, particularly birds, and this significance is reflected in its' designation as a Special Protection Area (SPA), a Site of Special Scientific Interest (SSSI) and a Ramsar site. To the north of the city Stoke Woods is an area of ancient semi-natural woodland recognised by its designation as a SSSI. Exeter sits within the Devon Redlands Landscape Character Area. Within the city urban wildlife thrives, and the following notable habitats can be found:

- flower rich meadows
- rivers, streams and canals
- Exe estuary
- ponds and lakes
- reed beds
- flood plains
- deciduous woodland
- wet woodland
- scrub
- ancient hedgerows
- mixed farming
- gardens
- parks
- allotments
- quarries and cuttings
- built environment

The Exeter Biodiversity Network consists of statutory and non-statutory sites and countryside features which represent important wildlife habitats and also act as wildlife corridors linking habitats together. These include areas of species-rich semi-improved grassland, hedgerows and hedgebanks, significant areas of scrub, semi-natural or plantation broadleaved woodland and wetlands, which all act as wildlife stepping stones and contribute to the movement of species within the Exeter landscape. The Exeter Biodiversity Reference Map, recently developed by the

Exeter Wild City partnership between Devon Wildlife Trust and Exeter City Council, is a reference tool providing information on the biodiversity network in Exeter; green space within the Exeter boundary has been divided into three categories according to biodiversity value and the Biodiversity Reference Map illustrates this network (a copy of the Exeter Biodiversity Reference Map can be found in Appendix B). In relation to the University's estate, land classified as Habitat of Principal Importance can be found in the two fields in the Duryard Valley designated as County Wildlife Sites. The Streatham campus contains some areas which support wildlife-rich assemblages assigned Greenspace A, notably Taddiford Brook County Wildlife Site and land to the east of Higher Hoopern House. The majority of the central section of the Streatham campus, the formal grounds of Thomas Hall and the land at Duckes Meadow have been assigned as areas of Greenspace B, defined as areas which support a less rich wildlife assemblage than the Greenspace A category and have often been heavily modified through agricultural improvement or woodland planting.

The enhancement of existing habitats, extension of key habitats and improvement of the connectivity of habitats within Exeter will enable wildlife populations to be more robust and better able to withstand change.

1.4 Biodiversity Objectives and Targets

The Environmental Sustainability Strategy 2010-2015 states that the University of Exeter aims 'to protect, preserve and enhance biodiversity on sites that the University manages or owns'. In order to achieve this aim the following objectives and targets have been devised:

Objective 1. Take positive practical action to conserve and enhance biodiversity on sites that the University manages or owns

Targets:

- All Priority 1 recommendations in the Biodiversity Enhancement Plan to be implemented by 2013.
- All priority 2 recommendations in the Biodiversity Enhancement Plan to be implemented by 2014.
- All priority 3 recommendations in the Biodiversity Enhancement Plan to be implemented by 2015.

Objective 2. Raise the awareness of biodiversity amongst students, staff and the local community

Objective 3. Enhance the opportunities for using the University's grounds as a 'Living Laboratory' to promote biodiversity within the curriculum and the local community

Objectives 2 and 3 fit with the principle of the campus as a Living Laboratory project, which provides innovative opportunities to inspire the formal curriculum and go beyond the theoretical topics that need to be 'covered' in lectures. The idea is that the campus serves as a community based living laboratory for identifying, evaluating and assessing indicators of progress toward greater sustainability. The Birds and Bees Campaign is an example of a project

where campus staff, academics, students and stakeholders are collaborating to enhance biodiversity on the campus.

An Action Plan will be produced by August 2011 to address Objectives 2 and 3. The plan will include mapping the Living Laboratory activities already taking place on the Exeter campuses, identifying gaps in the biodiversity data held by the University in order to devise a list of topics for potential student projects, and developing opportunities to promote the use of the campus by the local community for biodiversity related activities. The Living Laboratory project will play a key role in monitoring the change in biodiversity that takes place as a result of the implementation of the recommendations made in this Biodiversity Enhancement Plan.

2 Guiding Documents

2.1 Biodiversity Action Plans

A Biodiversity Action Plan (BAP) is a document which sets out a plan to restore key habitats and species. In the UK BAP's have been produced at national, regional, county and local levels, and these provide a useful source of information on the prioritisation of habitats and species.

'The Nature of Devon: A Biodiversity Action Plan' takes the objectives and targets of the national UK BAP and translates them to the context of the county of Devon. A Biodiversity Action Plan for Exeter was published by Exeter City Council in 2005, and draws on the Devon County BAP to provide a focus for the practical actions that are required to achieve successful conservation of selected species and habitats in Exeter. The table below lists the habitats and species selected for inclusion within the Exeter BAP:

Reason for inclusion	Habitat / Species	
Habitats and species in the Devon BAP that are also present and significant in Exeter	Atlantic Salmon Barn owl Cirl bunting Dormouse Great green bush cricket Otter	Flower-rich meadows and pastures Quarries and cuttings Species-rich hedges Wet willow woodland Woodlark
Habitats that are important parts of the natural landscape character of Exeter and which, in turn, support a myriad of animals and plants	Agricultural land (pasture and arable) Allotments Built environment Canal Deciduous woodland Gardens	Parks Ponds and lakes Reed beds Rivers, streams and riparian habitats Wet meadows
Iconic urban species or those that particularly enhance people's quality of life	Bats Bumble bees Butterflies Dragonflies Frog House martin House sparrow Peregrine	Rook Skylark Song thrush Swift Tawny owl Toad Veteran trees
Previously recorded species now extinct in Exeter	Red kite Pied flycatcher	Water vole

2.2 Green Infrastructure Strategy for Exeter and East Devon

The Green Infrastructure Strategy for Exeter and East Devon (2009) aims to enhance biodiversity through 'protecting, enhancing and linking existing and future habitats to raise ecological value

and species persistence across the area in urban and rural locations'. Within this strategy, the University grounds have been identified as areas belonging to the 'Historic Parkland Enhancement Scheme'. This scheme seeks to enhance registered and remnant parkland landscapes, which are recognised as historic and cultural elements of the landscape. The lead on this scheme is Devon County Council, and suggested areas for future investment and enhancement include:

- establishing management regimes and projects to raise biodiversity interest and habitat value;
- low key conservation ideas including reinstating lost or degraded views and vistas, replanting ageing avenues or trees where they are inappropriate species or in decline;
- preserving features of intrinsic historic value;
- considering opportunities to make contemporary contribution to the evolution of the designed landscape.

2.3 The Environmental Association for Universities and Colleges.

'Biodiversity on Campus: An EAUC Practical Guide' published by The Environmental Association for Universities and Colleges is a practical guide aimed at Further and Higher Education institutions in the UK. The guide looks at how biodiversity fits into environmental management agendas, and contains advices on biodiversity enhancement and biodiversity initiatives through three sections on 'Institutional Context', 'Practical Management' and 'Further Information'.

2.4 The Institute of Environmental Management and Assessment Best Practice Series

'The Business of Biodiversity: A guide to its management in organisations' from the Best Practice Series published by The Institute of Environmental Management and Assessment (2007) has been used to inform the structure of this Biodiversity Enhancement Plan.

2.5 Existing Surveys and Biodiversity Management Plans

Several reports and surveys have already been carried out on the University's Exeter campuses. One of the purposes of this Biodiversity Enhancement Plan is to draw together these existing sources of information and recommendations to create one overarching document. Details of these documents can be found in Appendix C, and include a Phase 1 Habitat Survey of the Streatham Campus and an Extended Phase 1 Habitat Survey and Habitat Creation and Management Plan Report on the Duryard Valley.

3 Priority Sites for Biodiversity Enhancement at the University of Exeter

The University of Exeter owns sites and buildings across the city, however the scope of this report is limited in the number of sites it can address and therefore four locations have been identified as priority target sites for biodiversity enhancement. They are:

- Streatham Campus
- St Luke's Campus
- Duryard Valley and Thomas Hall area
- Duckes Meadow

These four sites were selected because they contain the largest areas of land with capacity for significant biodiversity enhancement. However, many of the recommended enhancement measures are transferable to the University's remaining properties and grounds, which are primarily halls of residences.

The following pages provide an overview of these four priority sites and the habitats and species found within them.

3.1 Streatham Campus

The Streatham campus is the University's largest site in Exeter and covers 113 hectares built around a country estate overlooking the city. A large proportion of the grounds were laid out by the firm Veitch, well known nurserymen and plant collectors, during the 19th century. The grounds feature a registered botanic garden with many exotic trees and shrubs including the national collection of *Azara*, a South American evergreen plant, and also the wild conifer collection in association with the Royal Botanic Garden, Edinburgh. In 2009 the UK's most significant collection of *Heuchera* plants was re-homed at the University of Exeter.

The campus is based on bedrock geology of interbedded mudstones and sandstones of Carboniferous age (the Crackington Formation). The soils are clayloam, which are slightly acidic with a pH of 5.5 to 6.5. In terms of hydrology, Taddiford Brook watercourse is located at the southern boundary of the campus and the campus lies within its' catchment area. A series of ponds and watercourses are located in the Hoopern and Taddiford Valleys and The Plantation area.

3.1.1 Important Sites and Habitats

Taddiford Brook County Wildlife Site lies within University grounds on the Streatham campus, and is described as 'semi-improved neutral grassland, broadleaved woodland, marsh and ponds, flush and stream'. Duryard Valley Park County Wildlife Site and Belvedere Meadows Local Nature Reserve border the northern boundary of the campus.

A habitat map of the campus can be found in Appendix E. A survey in 2007 identified 16 different habitat types on the campus:

- Amenity grassland
- Bare ground
- Buildings
- Hedgerows
- Introduced shrubs
- Running water
- Scattered trees
- Scrub
- Semi-improved acid grassland
- Semi-improved neutral grassland
- Semi-improved neutral grassland (poor)
- Standing water
- Swamp
- Tall ruderal
- Woodland (plantations)
- Woodland (semi-natural)

3.1.2 *Important Species*

Plants

Devon Biodiversity Records Centre records indicate that there are a variety of notable plants on the campus, including the Nationally Rare species box in Taddiford Brook CWS, and the Nationally Scarce species of fringed water-lily (the Plantation) and cornflower (northern fields). Several Devon Notable Species can also be found on the campus, including corky-fruited water-dropwort, royal fern, hornwort, white water lily, fringed water lily, greater pond sedge, spiked water-milfoil, common club rush, flowering rush, cyperus sedge, ivy broomrape, wild service tree, corncockle, water fern, and galingale.

Invertebrates

There are records of the legally protected marsh fritillary, which is a UK and Devon BAP species, on the campus, as well as 21 UK BAP Priority Species, four Nationally Notable species, one Nationally Important Dragonfly species, and three locally declining invertebrate species (see appendix D).

Amphibians and Reptiles

Surveying in 2010 identified slow worms and surveying in 2008 found grass snakes. Older records indicate that common toad and common lizard have also been recorded in the campus grounds. All are UK BAP Priority Species.

Birds

Since 2008 the University has undertaken an annual bird survey on campus. In 2010 there were records of four RSPB red listed species (song thrush, house sparrow, herring gull, and starling), and records of eight RSPB amber list species (bullfinch, dunnock, green woodpecker, grey wagtail, lesser black-backed gull, little egret, mallard, mistle thrush, and swallow).

Mammals

There are records of badgers and bats within the campus, which are legally protected and priority species in the Exeter BAP. Other records of notable species include hazel dormouse and hedgehogs.

3.2 St Luke's Campus

The St Luke's campus is located to the east of Exeter city centre, just over a mile away from the Streatham Campus. The campus is smaller than the Streatham campus and covers 4.7 hectares,

and has a collegiate atmosphere with a lawn quadrangle surrounded by teaching buildings and student residences.

The campus is based on a superficial geology of quaternary river terrace deposits, and bedrock geology of Permian Breccia (the Alphington Breccia formation). Part of the campus lies within the St Leonard's Conservation Area, an area of special architectural and historic interest.

There are no designated sites of protected conservation value within the campus grounds, and Devon Biodiversity Records Centre has no records of any legally protected species within the campus grounds. There were 6 records of legally protected species within 300m of the St Luke's campus - two hedgehogs, one bat, and three records of Japanese Knotweed.

3.3 Duckes Meadow

The University maintains high quality grass sports pitches at Duckes Meadow, which is located alongside the River Exe. The ground has nine football and four rugby pitches as well as lacrosse pitches, covering approximately 12.9 hectares. Duckes Meadow is held freehold by the University but is subject to a number of covenants and encumbrances, the principal of which relate to rights of way as well as a public footpath.

The Countess Weir County Wildlife Site borders Duckes Meadow, encompassing the River Exe to the south and the Mill Race stream to the northeast. Further afield, the Exe Estuary Site of Special Scientific Interest, Special Protection Area and RAMSAR site lies 1km south east of Duckes Meadow and an RSPB reserve lies 1km to the south. The fields are based on a superficial geology of alluvium and bedrock geology of Permian Breccias (the Alphington Breccia formation).

3.4 Duryard Valley and Thomas Hall area

The land surrounding the Duryard Halls of Residence and Thomas Hall covers approximately 14 hectares. Duryard Halls sit on the north facing hillside, and new residential buildings have recently been developed here. Thomas Hall sits to the north of the Duryard Halls within gardens - the building is currently derelict but there are development plans in place for the future. A small brook runs from east to west in the valley.

The bedrock geology under the site is the Crackington Formation (interbedded mudstones and sandstones). In some areas there are no overlying superficial deposits, in some areas it is overlain by Head deposits (sand with clay and gravel), and in some areas it is overlain by River terrace deposits (sand and gravel).

3.4.1 *Important Sites and Habitats*

There are no statutory sites within the site or within 1km of the site. There are eight non-statutory sites within 1km of the site - four County Wildlife Sites (CWS), three Local Wildlife Sites, and one potential County Wildlife Site. The two large fields directly east of the Duryard residences and Thomas Hall are located within the Duryard Valley Park County Wildlife Site, and

are classified within the Exeter Biodiversity Reference Map as a Habitat of Principal Importance, designated for its' importance as a core part of the Exeter ecological network. Thomas Hall and its grounds are classified as Greenspace B areas.

In terms of the habitats found on the site, a survey in 2008 identified 13 different habitat types:

- Amenity Grassland
- Buildings
- Hedgerows
- Introduced Shrub
- Marshy grassland
- Running water
- Scattered trees
- Scrub
- Semi-improved Grassland
- Tall ruderal
- Wet woodland
- Woodland (broadleaved)
- Woodland (mixed)

3.4.2 *Important Species*

Devon Biodiversity Records Centre records indicate that there are a variety of notable species within 1km of the site. These include badger, otter, slowworm, marsh fritillary, grass snake, dormouse, pipistrelle bat, and brown long-eared bat. There were also records for Japanese knotweed.

3.5 All other sites in Exeter managed by the University

The University of Exeter owns or manages many residences and academic buildings across the city. Due to the small size of these individual sites no research has been carried out into the particular habitats and species which can be found in or around them, however there will be enhancement measures within this plan that will apply to these sites.

4 Recommended Biodiversity Enhancement Measures

4.1 Amenity Grassland and Amenity Planting

Overview:

Amenity grassland and planting comprises intensively managed and regularly mown grasslands, such as lawns and playing fields, and planted flower beds. It is the prevalent form of open land use across the Exeter campuses, and can be found at the Streatham, St Luke's, Duckes Meadow and Duryard Valley sites. Amenity grassland and planting generally has limited wildlife value because of its intensive management and the restricted variety of plant species and vegetation structure.

Current Management:

- Grass is principally cut on a 5 to 10 day cutting cycle during the growing season (typically February to November). The grass is mainly cylinder cut, and the frequency of cut allows the grass to be kept between 25mm and 50mm throughout the main areas of the estate.
- Bark mulch is used on planted beds as a weed suppressant to reduce pesticide dependency.
- No pure peat products are used as a soil enhancer.
- Double planted ornamental flower beds are planted September/October and April/May each year and maintained in accordance with best industry practice. The maintenance will include periodic watering depending on the season.
- Hoeing and non-residual *Glyphosate* weedkiller is used to deal with weed growth.

Biodiversity Enhancement Recommendations:

Priority 1. Amenity grassland management plan to be drafted and adopted in consultation with the grounds departments. The management plan should include, but not be limited to the following recommendations:

- a. Less intensive management of the margins of amenity grassland
- b. Recreation of wildflower rich areas
- c. Planting bulbs and wildflower plugs

Less intensive management of the margins of amenity grassland alongside woodland, hedgerows and scrub areas

Where amenity grassland borders woodland, hedgerows and scrub areas, a less rigorous mowing regime should be used to create buffer strips which will improve biodiversity value through enabling plants to flower and seed. These areas should be cut annually at the end of the flower season (July 31st), and over sowing of wildflower seed should be used for sward enhancement.

Recreate flower rich areas through reseedling

Short amenity grassland can be enhanced by over sowing flower species which are tolerant of frequent mowing and trampling, providing cover for invertebrates and nectar sources for insects. The following herbaceous wildflower species are suitable for seeding or over sowing into amenity grassland:

- Birdsfoot trefoil (*Lotus corniculatus*)
- Common cats ear (*Hypochoeris radicata*)
- Daisy (*Bellis perennis*)
- Goat's-beard (*Tragopogon pratensis* agg.)
- Ribwort plantain (*Plantago lanceolata*)
- Selfheal (*Prunella vulgaris*)
- Yarrow (*Achillea millefolium*)
- Lady's bedstraw (*Galium verum*)
- Autumn hawkbit (*Leontodon autumnalis*)
- Black medick (*Medicago lupulina*)
- Salad burnet (*Sanquisorba minor*)

Plant bulbs and wildflower plugs within amenity grassland areas

Spring flowering bulbs and plugs of nectar rich flowering plants should be embedded into amenity grassland to increase the biodiversity and amenity value of the grassland and to provide early sources of nectar for insects.



Spring flowers at St Luke's campus

Suitable bulbs include:

- Snake's head fritillary (*Fritillaria meleagris*)
- Ramsons (*Allium ursinum*)
- Snowdrop (*Galanthus nivalis*)
- Primrose (*Primula vulgaris*)
- Bluebell (*Hyacinthoides non-scriptus*)
- Wild daffodil (*Narcissus pseudonarcissus*)
- Lesser celandine (*Ranunculus ficaria*)

Suitable wildflower plugs include:

- Birdsfoot trefoil (*Lotus corniculatus*)
- Common cats ear (*Hypochoeris radicata*)
- Daisy (*Bellis perennis*)
- Goat's-beard (*Tragopogon pratensis* agg.)
- Ribwort plantain (*Plantago lanceolata*)
- Selfheal (*Prunella vulgaris*)
- Yarrow (*Achillea millefolium*)
- Lady's bedstraw (*Galium verum*)
- Autumn hawkbit (*Leontodon autumnalis*)
- Black medick (*Medicago lupulina*)
- Salad burnet (*Sanquisorba minor*)

Before planting, the surrounding grass should be cut to 5cm and the cuttings removed. Plug planting in the autumn is recommended, as this allows time for the roots of the plug plants to establish over winter which will give the plants a greater chance of competing with the existing sward in spring. Spring planting is possible but there is higher risk of failure due to drought, and the newly planted plug plants should be checked regularly for signs of drought stress and watered if required. The surrounding grassland must be kept short in the first spring and early summer after planting to prevent the plug plants from becoming shaded out, and any cuttings should be removed. The plants should then be allowed to flower and set seed before cutting takes place again, which may require an eight week period of reduced cutting during spring and summer.

4.2 Buildings and the Built Environment

Overview:

The Streatham, St Luke's and Duryard sites all contain a significant number of buildings. The two main ways in which buildings can support wildlife are through the installation of nesting boxes for birds and bats and the creation of green roofs and walls. These enhancements can be retrofitted onto existing buildings, but in the future the potential for biodiversity enhancement should be considered right from the outset of the design and planning process for new developments. Opportunities for biodiversity enhancement within the vicinity of buildings include the construction of woodpiles and artificial habitats.

Current Management:

- Bird and bat boxes located across the campuses, but no formal management
- Habitat piles are created with some green waste products
- Some deadwood left in situ
- Natural green walls

Biodiversity Enhancement Recommendations:

Priority	Recommendation
1	Installation of bird and bat boxes and development of a management plan
2	Mitigation of lighting impacts on bats
2	Construction of woodpiles
3	Consideration of green roofs in new developments
3	Creation of green walls
3	Construction of artificial habitats

Install bird and bat boxes and draft and adopt a management plan

A number of bird and bat species rely on the availability of suitable nesting opportunities within buildings; however modern building designs often exclude these spaces. Bird and bat boxes provide additional nesting locations and can be fitted onto existing buildings and trees or built into the fabric of new buildings. Bat boxes are known to be used by 11 of the UK's 14 resident bat species and bird boxes are used by more than 60 species of birds. Opportunities for the installation of boxes across the campus include:

- Installation of internal bird boxes at soffits/eaves level for the common swift, house sparrow and starling
- Creation of purpose built ledges for swallows, and the installation of pre-cast nest cups for swallows and house martins
- Installation of appropriate nest boxes for owls, kestrels, and garden birds
- Creation of space in walls or behind cladding for crevice dwelling bats, installation of access points for roof-void dwelling bats, or the installation of bat boxes.

A bird and bat box plan should be drafted and adopted to show the location of all boxes across the Exeter sites and to plan box maintenance. The majority of bird boxes need to be cleaned once a year, two or three weeks after any nestlings have fledged (October-November); old nests should be removed and the box should be washed with warm soapy water. Bat boxes also need to be cleaned annually to ensure they do not become colonised by other species. A check of all bat and bird boxes should take place to ensure they are securely attached to their tree or wall.

Mitigation of lighting impacts on bats

Bat roosts and access points should not be directly illuminated and any necessary nearby lighting should avoid these areas as light disturbs bat roosts and can lead to a roost being abandoned. Light will also affect the emergence times of bats, potentially reducing their foraging time and affecting their feeding behaviour. To reduce the impact of lighting on bat foraging and commuting, low or high pressure sodium lamps should be used instead of mercury or metal halide lamps, the light should be directed to the intended areas using hoods and shields to reduce light spill, and low level lighting should be used where possible. Lighting times could also be restricted to provide periods of dark or lower level lighting, and lighting in areas of particular sensitivity such as river corridors, woodland edges and hedgerows should be avoided where possible.



Bird and bat boxes in the Duryard Valley

The report 'Bats and Lighting in the UK' by the Bat Conservation Trust, should be consulted to reduce the impact of lighting on bats in both existing areas and in future developments.

Construct woodpiles

Dead and decaying wood are of great value to wildlife, especially insects, fungi, mosses and lichens, and in turn help to provide a food source for birds and other small mammals. Woody cuttings and larger pieces of wood should be used to create woodpiles, which are best located in direct contact with the ground in a shaded area.

Consideration of green roofs in the design of new developments (with additional potential for retrofitting onto existing buildings)

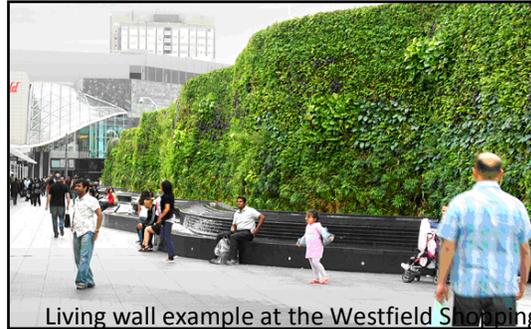
Green roofs can enhance the biodiversity value of built areas through replacing some of the habitat lost at ground level through the presence of vegetation on the roof. They can be installed on most roof types, and can also be retrofitted onto existing roofs providing the building is able to structurally support the saturated weight of a green roof.

In terms of their biodiversity value, green roofs provide green links across the built environment and support a range of different species - well designed green roofs can even provide a habitat for ground nesting birds.

Alongside the biodiversity benefits, green roofs are visually attractive and provide heat and noise insulation, and are often included in sustainable drainage systems design because they intercept rainfall and reduce run-off rates. Further details on green roofs can be found in the 2007 CIRIA 'Building Greener' report (CIRIA C644), which provides guidance on the use of green roofs, green walls and complementary features on buildings.

Create green walls on buildings

Green walls are walls with vegetation growing on them, enhancing otherwise featureless areas of bare wall. They can be large scale engineered green walls or more natural green walls, such as brick or stone built walls which have been colonised by lichens, mosses, ferns and flowering plants. Green walls are important as they mimic natural rock faces, providing habitats for several groups including birds and small mammals. Alongside the biodiversity benefits, green walls also have the potential to reduce energy consumption through providing shading during the summer and insulation during the winter, and can also form part of a Sustainable Urban Drainage System. Combining green walls with green roofs provides a route for wildlife between habitats at ground and roof level. There are two main opportunities for developing green walls at the University – the inclusion of large scale engineered green walls in new building design and the development of smaller scale green walls on existing buildings.



Living wall example at the Westfield Shopping Centre in London (www.aecom.com)

Engineered Green Walls

Engineered green walls, or ‘vertical gardening’, provide an impressive visual impact whilst providing a living vertical habitat with biodiversity value. They tend to be either designed as a large structure attached to a wall containing a variety of planted species and an irrigation system which provides the plants with water and nutrients, or as a hanging wall at the top of a building where plants are allowed to hang down from suspended planters, entailing no direct contact between the plants and the wall. Guidance on green wall design should be sought from the 2007 CIRIA ‘Building Greener’ report (CIRIA C644) which provides excellent guidance on the use of green roofs, green walls and complementary features on buildings.

Climbing Plants and Fruit Espaliers

On a smaller scale, green walls can also be created on existing buildings by growing climbing plants against a section of trellis work to train the plant. Climbing plants are likely to require pruning to ensure that they do not have an adverse affect on the condition of windows and guttering (although this can be controlled to a certain degree by carefully considering where to site the plants at the outset). Fruits trees such as apples and pears can also be used to form a green wall by training them as espaliers.



Green wall example at St Luke's

Construct artificial habitats

Building a habitat tower in a level, sheltered and discrete location would provide shelter for invertebrates and pollinators and feeding places for insects, amphibians, reptiles and small animals. The most suitable location for a habitat tower is beside a wall or tree, or a miniature tower could be located within a shrub bed in order to increase its' wildlife value. The construction of a habitat tower is a great opportunity to get volunteers involved.

Habitat towers can be built to any size - a simple way of building one is to secure together up to seven old wooden pallets on top of each other on a level base, or to build a similar structure using available materials. The gaps between the pallets can then be filled with materials in which invertebrates can shelter, such as small rock piles, old wood, twigs, tiles, pine cones, bamboo canes, dead seed heads or terracotta pots. The top of the tower should be covered with a layer of bark or dead wood.

4.3 Hedgerows

Overview:

Hedgerows are important for wildlife as they provide a suitable habitat and food source for many different species, link different habitat areas, and act as corridors for flight for bats, birds and butterflies. Devon has an estimated 53,000km of hedgerows remaining, more than any other county in the UK, and ancient and species-rich hedgerows are a UK Biodiversity Action Plan Priority habitat. The traditional Devon hedge is a 'hedgebank' which consists of an earth wall faced with turf or stone, with woody shrubs on top. Hedgerows can be found on all four of the University's priority sites.

Current Management:

In some areas of the estate the frequency of hedgerow cutting is dependent upon health and safety requirements and the requirements of the Road Traffic Act 1988. In other areas, hedgerows are generally cut twice a year.

Biodiversity Enhancement Recommendations:

Priority 1. Hedgerow management plan to be drafted and adopted in consultation with the grounds departments. The management plan should include, but not be limited to the following recommendations:

- a. Preserve existing hedgerows where possible
- b. Leave a 4m buffer strip beside hedgerows
- c. Amend the hedgerow cutting regime to at least a biennial cut to favour biodiversity
- d. Restore gaps in hedgerows using traditional management methods
- e. Plant new hedgerows in the landscaping of future developments

Preserve existing hedgerows where possible

Newly-created hedges often do not have the same biodiversity value as long-established hedgerows, and so any existing hedgerows on University grounds should be maintained and enhanced wherever possible. Important hedgerows are afforded protection under the Hedgerows Regulations 1997, which make it against the law to remove or destroy certain hedgerows without permission from the local planning authority.

Leave a 4m buffer strip beside hedgerows

A buffer strip of grassland on both sides of a hedgerow can further enhance its biodiversity value. The ideal width of this area is 4 metres measured from the centre of the hedge - this area should be left uncut and no fertilisers or herbicides should be used unless necessary to control injurious weeds.

If the buffer strip is wide enough, its management should be split into two halves. The half closest to the hedgerow should only be cut once every few years, which will encourage tussocky grass, and the other half furthest from the hedge should be cut annually after July.

Amend the existing hedgerow cutting regime to a biennial cut to favour biodiversity

Hedges need to be managed to maintain dense vigorous growth, which is of benefit to many birds and wildlife and helps ensure that low growing plants such as violets and primroses are not lost due to over shading. It is recommended that where health and safety restrictions allow, hedgerows are cut every other year with adjacent lengths of hedges being cut in different years. This is beneficial as most tree and shrub flowers are produced on year old wood which would be removed by an annual cutting regime, and a hedgerow maintained on a biennial cut will be able support more wildlife (Natural England suggest that for every year a hedgerow is left uncut it will gain two species of breeding bird).

The best time to cut a hedgerow is during January and February, as this is outside the bird nesting season and after most of the berries in a hedge have been eaten. The Hedgerow Regulations 1997 state that a hedge must not be cut between March 1st and July 31st, unless for reasons of public safety. If a hedgerow must be cut annually, efforts should be made to cut the hedgerow at a higher height than the previous year.

Restore gaps within hedgerows using traditional management methods

In areas where a hedge is becoming thin or there are gaps, restoration should be implemented to restore the hedgerow. Hedge laying or steeping is a method used to repair a gappy hedge, and is particularly useful when a hedge becomes thin at the base. The base of shrubs in a hedge are cut and pegged down so that they are parallel to the top of the hedge - they will then sprout new growth which will thicken and restore the gaps in the hedge. Coppicing can also be used, which involves cutting a shrub back to its base and allowing it to regrow, or new hedge trees can be planted to replace any diminished areas.

Further guidance on traditional hedgerow management should be sought from the Devon Hedge Group, Hedgelinek, or Natural England.

Plant new Devon hedges in the landscaping of future developments

Creating Devon hedgebanks around new developments would help to maintain wildlife links as well as reduce the visual impact of a new development. They should be positioned in a location where they will fill a break in an existing hedgerow network or where they will join up areas of scrub, shrubs, trees, wildflower rich grassland and wetland habitats. Historical maps should be consulted to see if historical hedgerows could be reinstated, and the following plants are hedge species common to Devon which should be used when creating a new hedge:

Main species:	Additional species:	On acidic soils:	On lime rich soils:
Hawthorn	Crab apple	Guelder-rose	Guelder-rose
Blackthorn	Wild Service	Alder buckthorn	Alder buckthorn
Hazel	Ash (fast growing)	Rowan	Rowan
Oak	Willow (fast growing)		
Holly	Alder (on wet sites)		

A recommended source of advice on hedgerow restoration is the Natural England Technical Information Note TIN039, entitled 'Devon field boundaries: restoration standards for agri-environment schemes'.

4.4 Scattered Trees

Overview:

'Scattered trees' defines any area of trees where the cover of trees is less than 30%. Almost 10,000 trees can be found on University land, ranging from native, non-native, rare and exotic trees, and these contribute to the wider woodland network in Exeter. They are typically found within amenity grassland and landscaped areas, and the University of Exeter is the custodian of two Arboretums near Reed Hall and Birks Bank and a 'wild Conifer collection' in association with the Royal Botanic Garden Edinburgh. Due to the position of many of these trees close to roads, footpaths, buildings and other public access areas, safety is of utmost importance when considering their management.

Current Management:

- The trees on campus were subject to a detailed condition survey in 2009 - the results of this survey are held by the Director of Grounds and help to guide management decisions
- The University has its own arborists and trained grounds staff which inspect the trees to identify priority works annually and implement a programme of felling, pruning and replacement planting as deemed necessary between October and March each year
- Trees are inspected both visually and using a Picus machine
- Sanitation felling of diseased trees is undertaken if an outbreak of Dutch Elm disease, fire blight or Amilaria is found
- A one metre weed free circle is cultivated around the base of young trees to prevent new growth and competition for nutrients.

Biodiversity Enhancement Recommendations:

Priority	Recommendation
1	Protect trees during construction work
1	Non-intervention to allow trees to mature
2	Plant a traditional orchard

Protect trees during construction work

Trees should be protected during any construction work on the University site, and guidance is given in the 'BS 5837:2005 Trees in relation to construction' document. A protected zone should be placed around trees, formed of a robust fenced off area in order to eliminate tree damage during development works (the size of this zone is dependent on the spread of the crown and the height of the tree).

Non-intervention to allow trees to mature

Where public safety restrictions allow, management of scattered trees should be one of non intervention where the trees are allowed to mature. Arboricultural surveys should be used to direct any necessary pruning and thinning requirements. Where possible, dead trees should be left standing as these provide habitat for hole nesting birds, tree roosting bats, invertebrates and fungi.

Plant a traditional orchard

Traditional orchards are a priority habitat in the UK BAP. Traditional orchards differ from other wooded habitats in that they are predominantly composed of domestic fruit and nut species, and they differ from intensively managed orchards in that pesticides and inorganic fertilizers are not applied and mowing is infrequent. Traditional orchards feature a variety of different habitats, such as a grassland floor, fruit trees, hedgerow boundaries, wetland areas and fallen deadwood, and as a result support a wide array of species and are excellent for enhancing biodiversity.

There are several suitable locations on the Streatham campus for an orchard, particularly on the semi-improved fields on the eastern side of the campus which already host hedgerows and nearby wetland areas which form integral parts of an orchard.

4.5 Scrub

Overview:

Scrub is defined as vegetation dominated by locally native shrubs which are usually less than 5m in height, and includes species such as hawthorn, blackthorn, bramble, elder, and gorse. It is an intermediate habitat usually located between herbaceous vegetation on open ground and woodland, and develops where there is limited management. Scrub itself is not a protected habitat but it does support many UK BAP species and provides a valuable habitat for birds, mammals and invertebrates. However, it can encroach onto habitats such as species rich grasslands and can make sites look untidy and unmanaged. If left unmanaged scrub will develop into woodland. Small parcels of scrub can be found in the Duryard Valley site and on the Streatham campus.

Current Management:

There is no set management in place for scrub.

Biodiversity Enhancement Recommendations:

Priority	Recommendation
1	Introduce scrub management
1	Continue no intervention routine management of the scrub area at the top of the Hoopern Valley

Introduce scrub management

The most appropriate management is to retain small amounts of scrub amongst other habitat types.

On the Streatham campus, scrub only forms small areas and does not have a detrimental effect on any other habitat types – in this instance infrequent flailing of the scrub is the only management required. Cutting stops excessive shrub growth and should be used to create a variety of sward heights across the scrub including leaving some areas uncut. Cutting should not take place during the bird breeding season (March to July) to avoid disturbance to nesting birds.



Bramble encroachment in the Duryard Valley

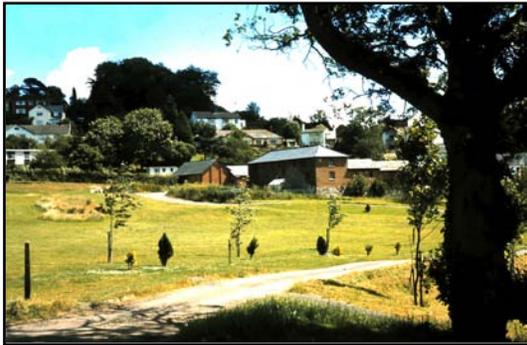
On the Duryard site, however, scrub is encroaching onto the semi-improved grassland fields and management needs to be introduced to remove most of the scrub so that the condition of the grassland can be improved. Some of the scrub should be retained as it provides shelter for the badger setts in this area, and the management of this area is considered further in the section

on semi-improved grassland management.

No intervention routine management policy for the scrub area at the top of the Hoopern Valley

In 1979 mowing ceased on half of the grass area at the top of the Hoopern Valley near the Wolfson Laboratory and the unmown area has undergone natural succession over the past 32 years to form a mature shrubby woodland copse.

This area is a unique site on the Streatham campus and is also one of the few sites found in the UK for natural regeneration with a known start date. This area should therefore be unmanaged where possible to allow the natural succession to continue.



1975 Photo: An example of the mown area found adjacent to the experimental plot.



1987 Photo: Shrubs have started to establish and plant species diversity was close to its highest.

4.6 Semi-Improved Grasslands

Overview:

Semi-improved grasslands are grasslands which have been modified by artificial means, such as the use of fertilisers, intensive grazing, or alterations to the natural drainage pattern, and as a consequence contain a less diverse range of species.

There are two fields of semi improved grassland on the Duryard site which form part of the Duryard Valley Park County Wildlife Site, designated as a whole for its' un-improved, semi-improved neutral grassland, scrub and woodland. The Streatham campus also contains two areas of semi-improved grassland – the grassland found in the Taddiford Brook CWS, and a smaller area of grassland in the north east corner of the campus near Higher Hoopern Farm.

Current Management:

The semi-improved grassland fields on the Streatham campus are let to local farmers - the Taddiford Brook County Wildlife Site is leased on an annual basis as a grazing let, and grazing is permitted throughout the annual tenancy. In the Duryard Valley, the fields are leased to a local farmer on an annual basis as an arable let.

Biodiversity Enhancement Recommendations:

1. Semi-improved grassland management plan to be drafted and adopted by the grounds departments. The management plan should include, but not be limited to the following recommendations:
 - a. Reduce scrub encroachment on semi-improved grassland
 - b. Introduce sward enhancement measures on the semi-improved grassland in the Duryard Valley
 - c. Modify the existing grazing regime to promote the floral diversity of the semi-improved grassland in the Taddiforde Brook County Wildlife Site

Reduce scrub encroachment onto semi-improved grassland

Scrub encroachment onto semi-improved grassland needs to be managed in order to prevent scrub from becoming a dominant feature of the grassland and eradicating grassland of nature conservation interest.

One area where scrub is a particular problem is in the north facing field in the Duryard Valley. This semi-improved grassland is bordered by broadleaved woodland to the south and north and contains a small area of wet woodland in the south east corner which connects to the brook in the valley via an area of marshy grassland. It has potential to be of greater conservation value, however brambles are significantly encroaching onto the grassland and need to be controlled.

The scrub on this field should be cleared and removed from the grassland over a two year period. To increase the chances of the bramble clearance being successful, during the winter months the stems of unwanted large bramble bushes should be cut as close to the base as possible. The main clearance of bramble should then be undertaken outside of the badger breeding season (1st December and 30th June), and the cut brambles should be removed from the site.

Some pockets of scrub should be left on the site as it supports a range of night flying insects which in turn provides valuable foraging potential for bats and other species.

Badger setts are known to be located within this area, and these are protected under the Protection of Badgers Act 1992. Guidance should be sought from Natural England in advance of any works which may cause disturbance to these setts. In addition to this, checks should also be undertaken for any other protected and important species present in the field, such as dormice and the brown hairstreak butterfly.

Sward enhancement on the semi-improved grassland on the Duryard site

Sward enhancement refers to management techniques which aim to increase the botanical diversity of species poor grassland. The suitability of the grassland for sward enhancement needs to be assessed through carrying out soil analysis to determine the soil nutrient status. Once the nutrient status has been ascertained, a suitable sward enhancement management scheme can then be devised.

One potential management option is the introduction of a formal cutting regime where the grassland is treated as a hay meadow. During the 1st and 2nd years after any necessary scrub clearance has taken place, cuts should take place twice per year - once in the early spring and once in early August (all cuttings should be removed from the site and composted). From year 3 onward there should be just one cut a year, taking place after the bird breeding season and after desirable plant species have set seed (the exact date will vary year by year but on average cutting should take place between late June and late July, and once in every five years a late cut in late August or September should take place to support late flowering species).

The marshy grassland and wet woodland areas on the east side of the Duryard site should be omitted from the cutting regime and an area of long grass should be maintained around the margins of the field to provide cover for small animals and less mobile species. As the fields are used by local walkers, access paths through the grassland should be mowed to provide designated routes through the field (cuttings should again be removed from the site). To ensure that the grassland management is successful, the sward composition should be assessed before and after the enhancement measures are undertaken.

It may also be necessary to introduce wildflowers to the site; the four main techniques used to do this are:

- i. Over sowing with wildflower/grass seed
- ii. Slot seeding with wildflower/grass seed
- iii. Spreading species rich green hay
- iv. Plug planting

The most appropriate technique for the Duryard site depends on a number of factors including the seed source, the machinery available and the overall management plan, and several of the techniques could be trialled to see which works best.

An additional consideration is the sowing of yellow rattle (*Rhinanthus minor*) before the introduction of wildflowers to increase their chance of becoming established. Yellow rattle parasitizes the dominant grass species which host it, reducing their biomass and the competition for any wildflowers introduced into the grassland. Yellow rattle can be introduced by over sowing, slot seeding or the spreading of green hay, and is particularly suited to sites which have a significant cover of competitive species such as perennial rye-grass, Yorkshire fog and white clover, are very productive, or have soils which have a Phosphorus Index of 2. Further guidance on the sowing of yellow rattle should be sought from the Natural England Technical Information Note TIN060 'The use of yellow rattle to facilitate grassland diversification'.

Modify the grazing regime in the Taddiford Brook CWS to promote the floral diversity of the grassland

Taddiford Brook County Wildlife Site is designated for its' semi-improved neutral grassland, broadleaved woodland, marsh and ponds, flush and stream. The fields are currently leased to a local farmer on an annual basis as a grazing let, and grazing is permitted throughout the annual tenancy. Grazing is of benefit to the grassland as it allows less competitive species to establish as the grazing helps to reduce the dominant plant species. Other benefits include the creation of areas of bare ground and structural diversity in the vegetation due to trampling. Many invertebrates are also dependent on the dung that livestock produce.

The overall diversity of the grassland could be further increased by altering the cattle grazing regime to allow a wider floral diversity. This would consist of grazing from mid-April until October/November, with higher stocking rates in the spring and summer and lower stocking rates in the autumn as grass growth declines. Earlier or later grazing in wet weather may poach the pasture and allow creeping thistle or nettles to invade.

4.7 Wetland

Overview:

Wetland includes all standing water, such as lakes, ponds, pools and canals, and all running water, such as rivers and streams. Canals, ponds, lakes, rivers, streams and riparian habitats are all priority habitats in the Exeter Biodiversity Action Plan.

On the Streatham campus there are the ponds near Reed Hall, the Forum project, the Taddiford Valley and the Hoopern Valley, there is a stream running through Taddiford Brook in the County Wildlife Site, a pond and stream are located in the Plantation area, and a small pond and bog is located by the Peter Chalk building. On the Duryard site there is a brook which runs through the woodland in the valley, and on the St Luke's campus there is an ornamental pond in the garden by Staff House.

Current Management:

- Ponds and water courses on campus are cleaned annually to remove surface debris. Every 3 to 5 years they are drained or lowered to prevent build-up of rotting material. Pumps and fountains are used to agitate ponds, introducing oxygen to sustain pond life and reduce the build-up of weed and algae problems.
- Streams on campus are managed with a one metre buffer strip along the margins where mowing and weedkiller use is prohibited.

Biodiversity Enhancement Recommendations:

Priority	Recommendation
1	Create viable corridors between wetland areas
1	Reduce excessive woodland shading on the banks of wetland areas
1	Improve the condition of the ponds in the Taddiford Brook County Wildlife Site
2	Incorporate new wetland creation and Sustainable Urban Drainage Systems (SUDS) into the design of future developments
2	Improve the nature conservation value of fish stocked ponds
2	Monitor the water quality of wetland areas
3	Enhance suitable wetland areas for otters

Create viable corridors between wetland areas

Increasing the width and diversity of the marginal vegetation strips along the edges of ponds and waterways will help to create viable corridors for wetland species. These corridors can be created by establishing a one metre buffer strip around the perimeter of a wetland area, which can then be linked to other such areas in order to create a network of safe routes for wetland species to move between.

Reduce excessive woodland shading on the banks of wetland areas

Excessive shading from woodland on the bank of a wetland area can result in limited marginal vegetation development. One particular wetland that has been identified as an area that would benefit from reduced woodland shading is the shallow moderate flowing brook which runs through the Duryard Valley. Increased light levels reaching this brook, achieved through reducing the shading from adjacent woodland habitats through woodland thinning, would enhance marginal floral species and in turn increase the connectivity of the brook to adjacent land. The marginal habitats should be managed on a rotational basis with no more than 30% of the brook margin thinned in one year, and preferably with adjacent bank sides not being managed within the same year.

Improve the condition of the ponds in the Taddiford Brook County Wildlife Site

There are a series of three ponds in Taddiford Brook which are almost completely covered with aquatic vegetation. The ponds would benefit from clearance of some of the vegetation and silt removal to create larger areas of open water. This work should be carried out with care so as not to remove all the vegetation around the ponds, but instead to create small areas of open water with associated marginal vegetation around the fringes. Locating piles of rocks and logs around the margins of the ponds would also create refuges for amphibians.

Incorporate new wetland creation and Sustainable Urban Drainage Systems (SUDS) into the design of future developments

The aim of SUDS is to mimic natural drainage systems in the engineering design of new drainage structures, for example through the use of permeable surfaces and wetland areas. This assists in reducing the urbanisation of river catchment areas which takes place when using the customary practice of routing water through a pipe to a watercourse. The inclusion of wetland areas into future developments would help to replicate many natural hydrological functions, such as smoothing flows, storing and purifying water, supporting wildlife and fish, and maintaining traditional landscapes.

Successful SUDS design entails early consideration during the design stage of new developments and advice should be sought from a SUDS drainage expert. SUDS should be a key consideration when designing the building in East Park, an area outlined for development in the University Masterplan published in 2010, as any development here will need to take account of the importance of the surrounding wetland areas as wildlife corridors.

Improve the nature conservation value of the fish stocked pond in the grounds of Reed Hall

The fish pond at Reed Hall is a man-made brick and puddle clay construction and is home to stocked ornamental fish and wildfowl. Fish stocked ponds often have reduced biodiversity value compared to other ponds because the fish tend to cause silt disturbance resulting in reduced light levels, excessive algae growth takes place due to the additional nutrients added from fish excrement, and the fish can eat submerged water plants and smaller animals. Significant improvements have recently been made, but to further enhance the biodiversity value of the pond, an area could be segregated from the fish using netting and the leaf litter should be dredged annually.

Monitor the water quality of wetland areas

The quality of water in a wetland affects its nature conservation value and in terms of ponds, the best wildlife ponds have clean water with low levels of pollutants. Buffer strips should be established to shield wetland areas against surface run off which may contain organic matter and chemicals, and rubbish inspections should take place on a regular basis and any necessary rubbish removal instigated.

On the Streatham campus, the quality of the wetland found in the Plantation area has recently been questioned. An investigation into this should take place to see if there is a water quality issue that is preventing the area from supporting a wider range of flora and fauna.

Improve the condition of the ponds in the Taddiford Brook County Wildlife Site

The three ponds in the valley need to be cleared out to provide an increased area of open water habitat. This should be carried out with care, so as not to remove all the vegetation around the ponds – these communities are diverse and contain two Devon Notable sedges – but rather to create small areas of open water with associated marginal vegetation around the fringes. This work is important as the ponds are a key feature in the designation of the site as a County Wildlife Site, and so if their interest is lost it may impact upon the designation.

Enhance suitable wetland areas for otters

A recent survey by Devon Biodiversity Records Centre's Operation Otter confirmed that otters use the brook which runs through the Duryard Valley. Although the Taddiford Brook looks suitable for otters, a recent survey found no evidence of otters using the brook and the culvert at the western end of the brook is the most likely barrier.

The feasibility of installing passes, ledges and steps into existing culverts for otters to use should be explored through consultation with the Environment Agency and Local Authorities.

4.8 Woodland

Overview:

The woodland found on the University sites across Exeter fall into four main categories: planted broadleaved woodland, planted coniferous woodland, planted mixed woodland, and semi-natural woodland. Any area where the cover of trees is less than 30% is classified as 'scattered trees'.

On the Streatham campus there is a significant amount of woodland which forms a network running throughout the campus - the Taddiford Brook County Wildlife Site contains woodland on the valley sides and along the brook itself, and the other main areas of woodland are near Reed Hall and along the Hoopern Valley and Taddiford Valley on the eastern side of the campus. Semi-natural woodland can be found north west of the Streatham campus at Grassway Wood. At the Duryard site, there is a large area of broadleaved woodland which runs through the valley and forms a relatively wide area of woodland between the Duryard residences and Thomas Hall. Broadleaved woodland also forms pockets on the sides of the semi-improved grassland fields, and there is an area of mixed woodland alongside Thomas Hall. At Duckes Meadow, there is thin a belt of woodland surrounding the sports pitches.

Current Management:

There is no set management of the woodland areas, other than that detailed for individual trees in the 'Scattered Trees' section.

Biodiversity Enhancement Recommendations:

Priority	Recommendation
1	Clear laurel and rhododendron from woodland to allow the development of woodland ground flora
1	Retain standing deadwood and create deadwood piles
1	Establish a management regime of rotational woodland thinning
2	Create zones of native shrubs and wildflower grassland adjacent to woodland
3	Plant new woodland areas to connect existing woodland sections

Clear laurel and rhododendron from woodland

In some areas of woodland, notably in the Duryard Valley, the woodland understory has become dominated by laurel and rhododendron. In such areas, laurel and rhododendron should be cleared to allow the regeneration of woodland and the development of woodland ground flora.

The removal of the laurel and rhododendron needs to take place gradually through the introduction of a thinning regime. The Forestry Commission produced a practice guide in 2006 entitled 'Managing and Controlling Invasive Rhododendron' and the guidance in this document should be used to produce a management plan before any control work is undertaken, as the method used to control rhododendron depends on factors such as the size and accessibility of the shrub. Particular caution must be exercised if herbicides are to be used on the laurel and rhododendron in the Duryard Valley, as herbicides can be harmful to aquatic life and there is a brook which runs through the woodland. Guidance should be sought from the Environment Agency before the start of any operations if herbicides are to be used near a watercourse. Once the removal of the laurel and rhododendron has taken place, it may take some time before the natural regeneration of the woodland floor takes place because the rhododendron plant leaves a toxin in the soil which suppresses the germination of other plant species.

Badger setts are known to be located within the Duryard site and these are protected under the Protection of Badgers Act 1992. Guidance should be sought from Natural England in advance of any works which may cause disturbance to these setts. In addition to this, checks should also be undertaken for any other protected and important species present in the woodland area.

Retain standing deadwood and create deadwood piles

Where it is safe to do so, standing deadwood trees should be retained as they will provide habitats for bats, birds, invertebrates and fungi. Any wood resulting from woodland thinning can be used to create woodpiles which provide habitat for a wide range of species.

Draft and adopt a management regime of rotational woodland thinning

Rotational woodland thinning would enhance the shrub and ground flora layers in woodland by increasing light levels and encouraging regeneration. The increased light levels will promote the return of woodland ground flora which are most likely still present in the seedbank, which in turn would support a range of species and particularly enhance the invertebrate population.

The management regime should address individual areas of woodland, as some areas will need limited intervention allowing trees to mature and maintain a good canopy, whilst other woodland areas will require a more intensive thinning regime to control the more aggressive species. Rotational thinning is recommended instead of complete thinning because this will open up areas of woodland in rotation, reduce the impact of erosion, and maintain cover for the existing wildlife in these areas. Woodland thinning should take place during January and early February, allowing mammals and birds to forage over the autumn and winter but still avoiding the bird nesting season.

Create zones of native shrubs and wildflower grassland adjacent to woodland

Structuring woodland areas with a margin of native shrubs to provide cover and food for nesting birds, small mammals, insects and other invertebrates, and an outer zone of wildflower grassland to support smaller animals, bees, butterflies and other insects, will enhance the biodiversity of existing woodland areas. This structure would also act as a buffer zone around the woodland, protecting the interior woodland from disturbance and linking it more effectively to surrounding habitats.

Suitable native shrubs for planting around the margins of woodland include:

- Dogwood (*Cornus sanguinea*)
- Elder (*Sambucus nigra*)
- Hawthorn (*Crataegus monogyna*)
- Rowan (*Sorbus aucuparia*)
- Wild cherry (*Prunus avium*)
- Field maple (*Acer campestre*)
- Blackthorn (*Prunus spinosa*)
- Hazel (*Corylus avellana*)
- Dog rose (*Rosa canina*)
- Holly (*Ilex aquifolium*)
- Silver birch (*Betula pendula*)

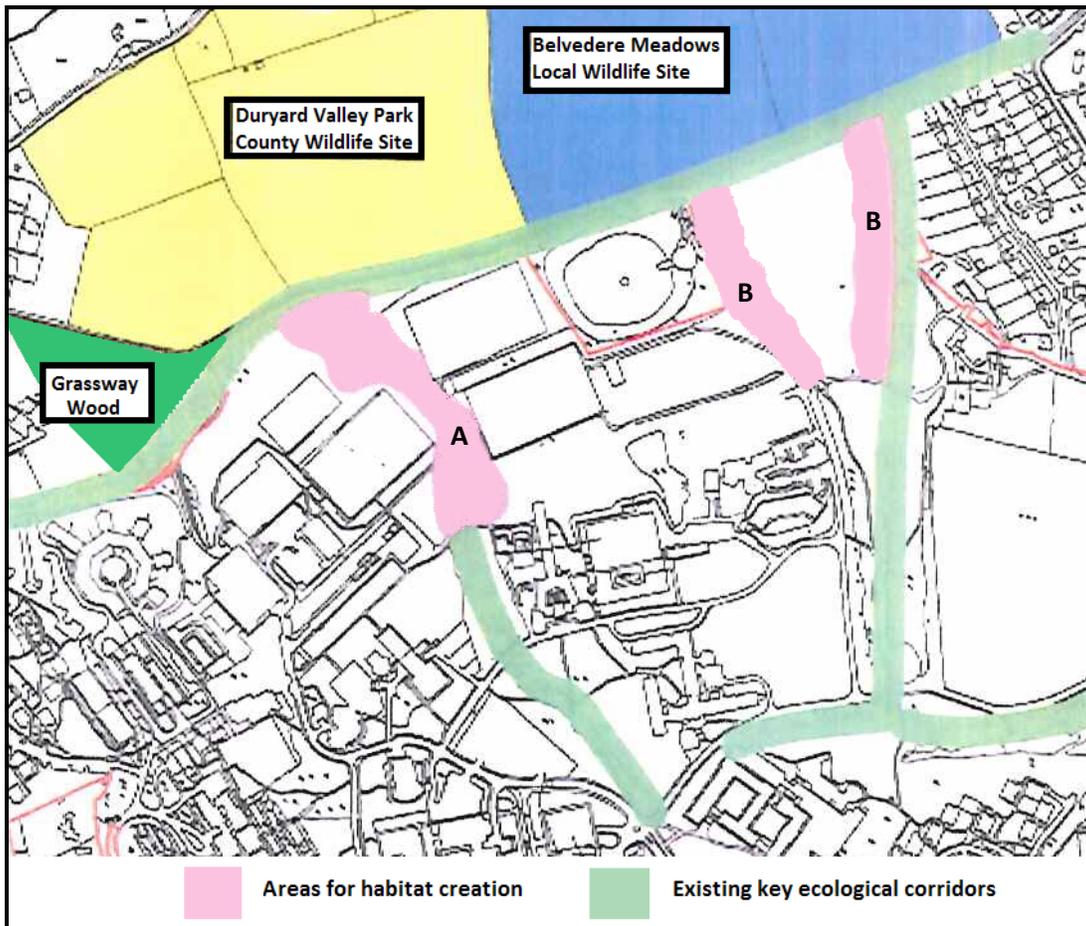
Suitable wildflowers for planting as an outer zone include:

- Birdsfoot trefoil (*Lotus corniculatus*)
- Common cats ear (*Hypochoeris radicata*)
- Daisy (*Bellis perennis*)
- Goat's-beard (*Tragopogon pratensis* agg.)
- Ribwort plantain (*Plantago lanceolata*)
- Selfheal (*Prunella vulgaris*)
- Yarrow (*Achillea millefolium*)
- Lady's bedstraw (*Galium verum*)
- Autumn hawkbit (*Leontodon autumnalis*)
- Black medick (*Medicago lupulina*)
- Salad burnet (*Sanquisorba minor*)

Plant new woodland areas to connect existing woodland sections

Woodland contributes to the biodiversity network of the Exeter campuses by providing corridors and potential habitat for birds, bats, hazel dormice, invertebrates, badgers and reptiles. On the Streatham campus two areas have been identified as areas where habitat creation would enhance the overall network of the site by linking existing woodland areas to the wildlife sites immediately north of the campus. These areas are:

- A. The land between the tennis courts and rugby pitches, in order to connect Grassway Wood and Duryard Valley Park with the woodland in the Plantation area
- B. The land north of the ponds in the Taddiford Valley, in order to connect the Taddiford Valley to the Belvedere Meadows Wildlife Site



(Map of areas for future woodland planting (adapted from 2007 LDA Design report)).

A new belt of native trees and shrubs at these locations would enhance the overall ecological network of the Streatham campus, and the new planting should be structured with a central area of native trees surrounded by a marginal area of native shrubs, bordered by wildflower grassland.

5 Summary of Actions

Priority 1 Recommendations - to be implemented by 2013.	
Amenity Grassland	Amenity grassland management plan to be drafted and adopted in consultation with the grounds departments
Buildings and Built Environment	Installation of bird and bat boxes and development of a box management plan
Hedgerows	Hedgerow management plan to be drafted and adopted in consultation with the grounds departments
Wetland	Create viable corridors between wetland areas
	Reduce excessive woodland shading on the banks of wetland areas
	Improve the condition of the ponds in the Taddiford Brook County Wildlife Site
Scattered trees	Protect trees during construction work
	Non-intervention to allow trees to mature
Woodland	Clear laurel and rhododendron from woodland to allow the development of woodland ground flora
	Retain standing deadwood and create deadwood piles
	Establish a management regime of rotational woodland thinning
Scrub	Introduce scrub management
Semi-improved grassland	Semi-improved grassland management plan to be drafted and adopted by the grounds departments
Priority 2 Recommendations - to be implemented by 2014.	
Buildings and Built Environment	Mitigation of lighting impacts on bats
	Construction of woodpiles
Wetland	Incorporate new wetland creation and Sustainable Urban Drainage Systems (SUDS) into the design of future developments
	Improve the nature conservation value of fish stocked ponds
	Monitor the water quality of wetland areas
Scattered trees	Plant a traditional orchard
Woodland	Create zones of native shrubs and wildflower grassland adjacent to woodland
Priority 3 Recommendations - to be implemented by 2015.	
Buildings and Built Environment	Consideration of green roofs in new developments
	Creation of green walls
	Construction of artificial habitats
Wetland	Enhance suitable wetland areas for otters
Woodland	Plant new woodland areas to connect existing woodland sections

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7 Appendices

Appendix A – University of Exeter Biodiversity Statement and Campus Biodiversity Management Principles for Grounds/Estates

Appendix B – Exeter Biodiversity Reference Map

Appendix C – Existing surveys and biodiversity management plans for the University of Exeter

Appendix D – DBRC invertebrate records for the Streatham Campus

Appendix E – Habitat map of the Streatham and Duryard Valley sites showing six key habitats

Appendix A

University of Exeter Biodiversity Statement

and

University of Exeter Campus Biodiversity Management Principles for Grounds/Estates

UNIVERSITY OF EXETER

BIODIVERSITY STATEMENT

As a feature of the University of Exeter's Strategic Plan 2007-2011, the University is committed to 'offering a high quality, campus based living and learning environment which is welcoming and inclusive'. As part of this it holds as one of its values 'to be responsible, sustainable and ethical, meeting the needs of the present and leaving a better environment for future generations'.

Biodiversity refers to the biological diversity of our planet. It includes all living Organisms and the diverse habitats they live and thrive in, often referred to as Ecosystems. The interactions of these components ensures the continuation of life. The most important elements for healthy biodiversity are air, water and light, in differing levels. In principle these determine the health and vitality of an Ecosystem.

The University is in a position to actively protect and enhance biodiversity in areas that are owned / managed by the organisation. Through this Biodiversity Policy, which applies to the Streatham and St Luke's campuses, the University of Exeter:

- recognises the importance of contact with nature for staff, students and visitors to their sites and will take positive action to conserve and enhance biodiversity on sites that the University manages or owns, where local conditions allow;
- will ensure that biodiversity is considered in all major redevelopments and is addressed through the master plan process;
- will comply with all applicable legal requirements and other requirements to which the University subscribes relating to biodiversity and habitat management
- will identify opportunities to raise the awareness of Biodiversity and sustainable practices outlined in the Guiding Operational Principles;
- recognises the value of Biodiversity and sustainable practices to both formal and informal learning about open spaces and their associated wild flora and fauna and will seek to identify opportunities to support curricular and extracurricular activities relating to it;
- will report annually on performance

Iain Park
Director of Grounds
18 June 2010

UNIVERSITY OF EXETER

CAMPUS BIODIVERSITY MANAGEMENT

PRINCIPLES FOR GROUNDS/ESTATES

1. As far as is practical, preserve and enhance existing valuable habitats.

Action :

All known habitats to be recorded and mapped. Habitats to be surveyed annually and all species recorded.

2. Identify specialist treatments/protection measures for vulnerable species. E.g. protection around known badger sites.
3. Erect interpretive signboards in proximity to valuable habitats to explain species present, management techniques employed, and value of habitats.
4. Review management techniques annually to reduce the use of residual pesticides and increase the use of non-residual and biological/non-chemical control techniques, e.g. use of bark mulch and natural predators.
5. Preserve the current policy of putting ZERO GREEN WASTE to reduce our contribution to landfill and resulting Greenhouse gases.
6. Introduce sympathetic management techniques to leave 'eco-strips' near streams and watercourses, around woodland edges, and create wildflower meadows, to stimulate natural habitats.
7. No non-urgent tree felling works to be carried out on trees during the bird nesting season (March-September) to protect nesting sites. Essential hedge maintenance will only be carried out after checking hedges to make sure nesting birds will not be disturbed by the proposed activity.
8. Habitat piles will be left in appropriate areas to provide sources of food, shelter and hibernation sites.

9. Bird and Bat boxes will be erected at suitable locations throughout the campus and monitored annually.

10. All new and replacement planting schemes will use a variety of plants, trees and shrubs, with varying growth patterns and flowering times to encourage year round animal, bird and insect activity.

Conclusion

The Biodiversity Management principles shall be reviewed annually to determine their impact on the number and range of species, recorded on campus, through survey, observation and web cam info. The review will also compare actions and observations against relevant legislation.

Appendix B

Exeter Biodiversity Reference Map

Exeter Biodiversity Reference Map

Information Layers:

The Biodiversity Reference Map developed by the Exeter Wild City partnership indicates where Habitats of Principal importance are found in Exeter. The Government is required to publish a list of Habitats of Principal Importance for the purpose of conserving biodiversity in England, by Section 41 of the Natural Environment and Rural Communities Act 2006. This list is compiled from, and is the same as, the UK Biodiversity Action Plan Priority Habitats which are found in England. Some of these Habitats of Principal Importance may be also formally designated as:

- Special Protection Areas (SPA) – these sites are strictly protected and classified in accordance with Article 4 of the EC Birds Directive 1979.
- Sites of Special Scientific Interest (SSSI) – these sites are designated under the Wildlife and Countryside Act 1981 and represent the Country's very best wildlife and geological sites.
- County Wildlife Sites (CWS) – this is a non-statutory designation for sites of county significance for wildlife or geology. Positive management of CWS is encouraged and development affecting them is controlled by Local Plan policies

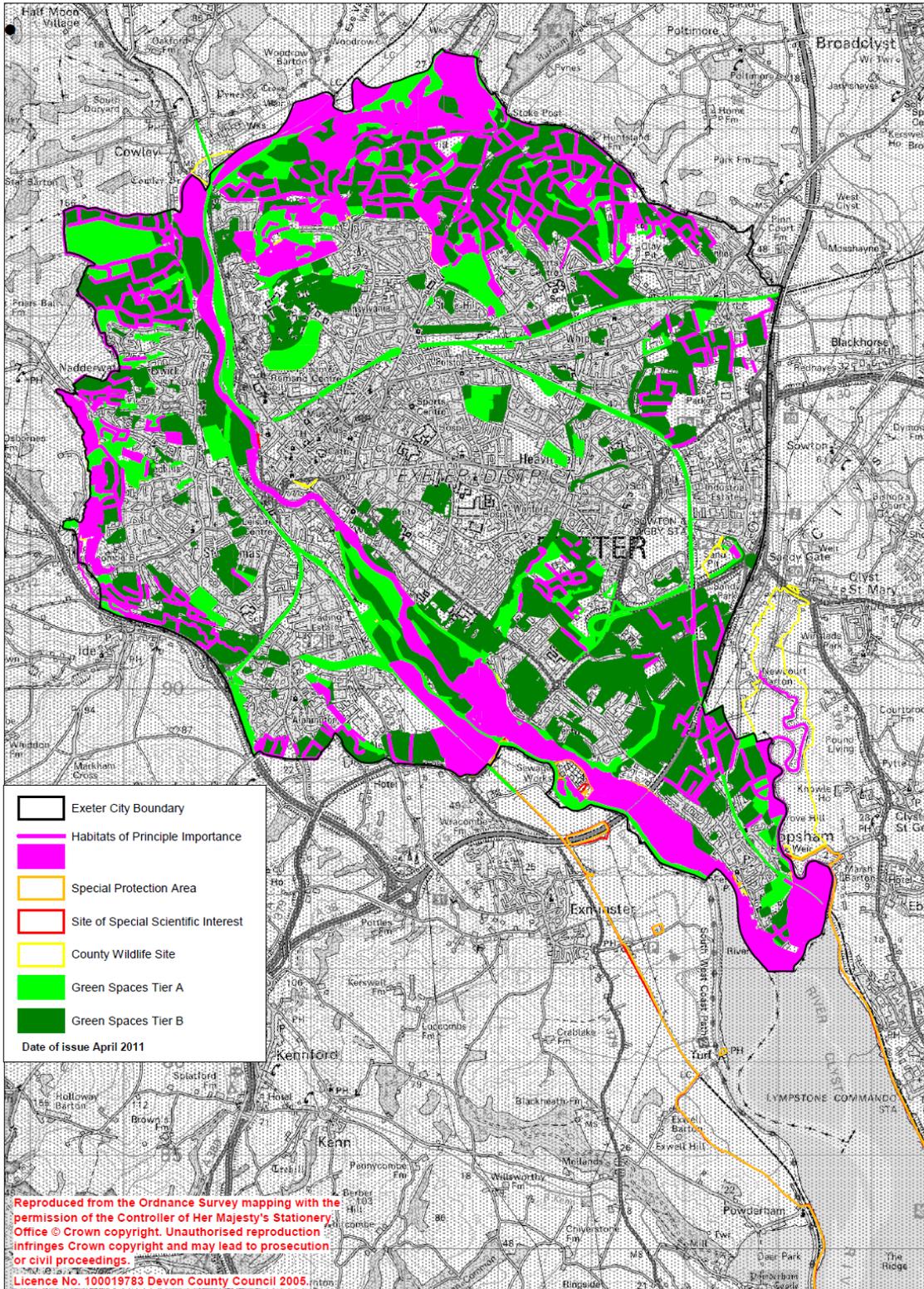
The remaining green space (not HPI) has been assigned to one of two categories:

Greenspace A - These areas support wildlife-rich assemblages that do not meet the HPI criteria.

Greenspace B - These areas support a less rich wildlife assemblage than the Greenspace A category and have often been heavily modified through agricultural improvement or woodland planting.



Exeter Biodiversity Reference Map (April 2011)



Appendix C

Existing surveys and biodiversity management plans for the University of Exeter

Existing Surveys and Biodiversity Management Plans for the University

Several reports and surveys have already been carried out on the Exeter campuses. One of the purposes of this Biodiversity Enhancement Plan is to draw together these existing sources of information and recommendations and to create one overarching document.

Phase 1 Habitat Survey of the Streatham Campus (2007)

A Biodiversity Enhancement Plan cannot be produced without knowledge of the nature of the existing habitats on the campus, and a Phase 1 Habitat Survey is the principal method of providing this information and provides a clearly defined baseline for monitoring change.

The survey involves a site visit to survey the land in order to classify the vegetation according to approximately 90 specified habitat types. The end product of a Phase 1 Habitat Survey is a map which uses standardised colour codes to show the distribution of different habitats, a series of 'target notes' highlighting areas of particular interest, and a descriptive and interpretive report. Surveys are carried out in accordance with the Joint Nature Conservancy Council Handbook for Phase 1 Habitat Survey.

In 2007 LDA Design produced a report on ecological design inputs to the University landscape strategy. The Extended Phase 1 Habitat survey identified 16 habitats within the Streatham campus. The value of these different habitats were calculated using the standardised framework developed by the Institute of Ecology and Environmental Management, which identifies the level of biodiversity value using a geographical classification system which goes from 'international' down to 'sub-parish' value, and are show in Table 7.1.

Table 7.1 Phase 1 habitat survey results for the Streatham campus, showing the value and description of each habitat type found (adapted from LDA Design report, 2007).

Habitat	Ecological Valuation	Description
Designated Site of Nature Conservation Value		
Taddiford Brook CWS	County	Extensive area of diverse grassland, wetland and woodland habitat.
Habitats found within the campus boundary <i>excluding Taddiford Brook CWS</i>		
Amenity grassland	Sub-parish	Common species-poor habitat, but provides foraging habitat for badgers and widespread birds.
Bare ground and hardstanding	Negligible	Limited potential for faunal species.
Buildings	Unknown	Common habitat with potential for bird nesting and bat roosting. A valuation would depend on the presence and status of bat roosts.
Hedgerows (species poor)	Sub-parish	Few associated plants and limited value to faunal species.
Hedgerows (species poor with trees)	Parish	Wildlife corridor, including a wide range of native shrubs and ground flora species. Assigned value based on the presence of mature hedgerow trees.

Habitat	Ecological Valuation	Description
Introduced shrubs	Sub-parish	Unnatural common habitat, providing nesting and foraging habitat for birds and potential flight-lines and foraging habitat for bats.
Running water	District	Wildlife corridor, and likely to support a wide range of invertebrates. Potential foraging area for grass snakes. Marginal woodland and trees present.
Semi improved neutral and acid grassland	Parish	Supports a range of typical plant species and provided potential habitat for invertebrates, reptiles, and birds. Foraging habitat for badgers.
Semi improved grassland (poor)	Sub-parish	Recently establish species poor habitat, suitable foraging habitat for badgers.
Scrub	Sub-parish	Common species poor habitat, but contributes to the habitat mosaic by providing habitat for birds, reptiles and invertebrates.
Scattered trees	District	Mature scattered trees, providing potential habitat for notable invertebrates, bats and birds. Some trees may qualify for veteran status.
Standing water	District	Extensive network of ponds, supporting notable plants and providing habitat for invertebrates, amphibians, foraging bats and grass snake.
Swamp	Parish	Contributes to the wetland habitat mosaic, and provides potential foraging habitat for grass snake.
Tall ruderal	Sub-parish	Common species poor habitat, providing habitat for reptiles. Limited extent.
Woodland (planted and semi natural)	District	Long established woodland, providing potential habitats for notable invertebrates and birds, bats, hazel dormouse, badger and reptiles.

Duryard Valley Extended Phase 1 Habitat Survey and Habitat Creation and Management Plan Report

In 2008 Devon Wildlife Consultants produced a report detailing the results of an Extended Phase 1 Habitat Survey and a Habitat Creation and Management Plan for an area of land within the Duryard Valley in Exeter, which included the University of Exeter's Duryard Halls of Residence and St Thomas Hall.

The Habitat Creation and Management Plan was written to incorporate the habitats considered to be, or potentially to be, the most ecologically valuable on site. These habitats were identified as grasslands, hedgerows, parkland with scattered trees, running water, and woodland areas. The plan also made provision for enhancing the habitat for wildlife, paying particular attention to badger, bat species, birds, invertebrates, reptile species, and small mammals including dormouse. The recommended management measures are highlighted in Table 1.2.

Table 1.2 Summary of the management objectives recommended in the Duryard Valley Extended Phase 1 Habitat Survey and Habitat Creation and Management Plan.

Habitat/Species	Management Objectives
Amenity grassland	Encourage use of the habitat by a diverse range of invertebrate species, and introduce a number of native floral bulb species
Semi-improved grassland	Introduce/maintain cattle grazing at a low stocking density
Hedgebanks	Establish a cutting regime to maintain the hedgebanks
Scattered trees	Allow for the development of scattered trees as a habitat type within the site, provide nesting/roosting opportunities for bird/bat species, and provide habitat for invertebrates
Running water	Increase light levels to the brook and allow for the natural processes of deposition and erosion associated with the water flow
Woodland	Establish a management regime of rotational woodland thinning to enhance the woodland shrub and ground flora layers, and to establish a management regime to remove/thin laurel and rhododendron from certain areas of the woodland.
Introduced shrubs	Encourage dense growth to provide nesting habitat for bird species, and encourage growth of wildlife attracting shrub species
Bird and bat species	Maintain and monitor the number of bird and bat boxes
Vegetation piles	To create and maintain features which provide habitat for invertebrates, small mammals, and to create hibernation sites which may also be utilised by reptiles.
Noxious weeds	To control all noxious weeds from the site as defined by the Weed Act 1959 before any seed develop or germinate
Invasive exotic weeds	To prevent any further establishment of invasive exotic species within the site

Forum Project Ecological Management Plan

In 2010 an Ecological Management Plan (EMP) for the Exeter Forum project development was produced by EAD Ltd, prepared as part of BREEAM Accreditation for the site. The aim of the EMP was to maintain and where possible enhance the ecological value of the site, with reference to the UK, Devon and Exeter Biodiversity Action Plans. Ecological objectives and management prescriptions were specified for pre-construction, construction and post-construction phases. The post construction prescription from this report will be included in this Biodiversity Enhancement Plan, and this is detailed in Table 1.3.

Table 1.3 Summary of the Forum Project post construction ecological management prescription.

Management Action	Timing
<i>Year 1</i>	
Watering newly planted trees/shrubs and checking stakes, ties and guards	Weekly
Trimming hedgerow to 60cm tall	December to February
Mowing of grassland and removal of arisings. Weed management	April, July and September

by hand pulling or spot-treatment of glyphophosphate	
Check and clearance of ponds and wetlands	Weekly
<i>Years 2 to 5</i>	
Hedgerow trimming	Annually, between December and February
Removal of non-native species and rubbish from the pond. Removal of vegetation to leave 30-40% open water habitat	Annually, between November and January, as necessary
Mowing of wildflower grassland and removal of arisings	Annually, April and September
Cleaning out bird and bat boxes	Annually, between November and January

Streatham Campus Master Plan Framework

The Streatham Campus Master Plan was adopted by Exeter City Council in December 2010. This document shows future development sites and includes a statement that future development will have an impact on the current layout and natural amenities of the estate, but we will seek to ensure impact will be minimised or offset as part of the development process.

The plan identified habitats to retain and areas for habitat creation, as shown in Figure 1.1. Habitats considered to be a priority for retention are:

- Taddiford Brook County Wildlife Site (also known as the Hoopern Valley);
- woodland and scattered trees;
- semi improved neutral and acid grassland;
- standing and running water and swamp;
- hedgerows with trees.

The recommendation for improving diversity is planting native species with a central zone of trees and shrubs, a margin of native shrubs and an outer zone of infrequently managed wildflower grassland. The overall objective for the site is to ensure a series of linked open green spaces ('stepping stones') that can provide continuity of habitat through the site from north to south, linking the Local and County Wildlife Sites in the north to the Taddiford Brook County Wildlife Site in the south.

Alongside the areas identified in the master plan for habitat conservation and creation, it is also important to keep in mind the overall plan so that the recommended biodiversity enhancement measures do not conflict with the future plans for the site. In view of this, a map of the master plan is shown in Figure 1.2.

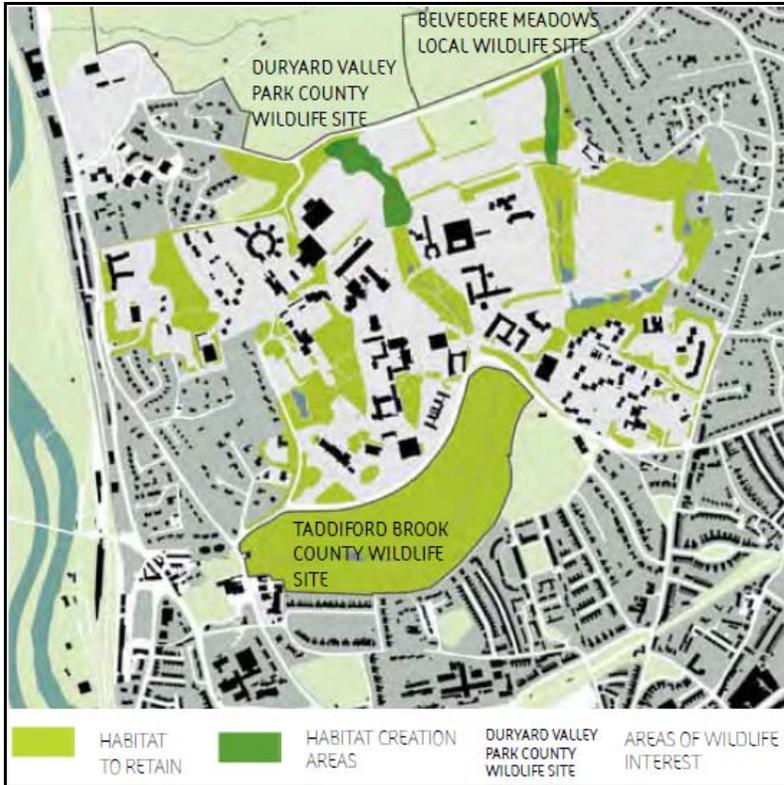


Figure 1.1 Streatham campus master plan map, indicating the areas where habitats are to be retained or created.

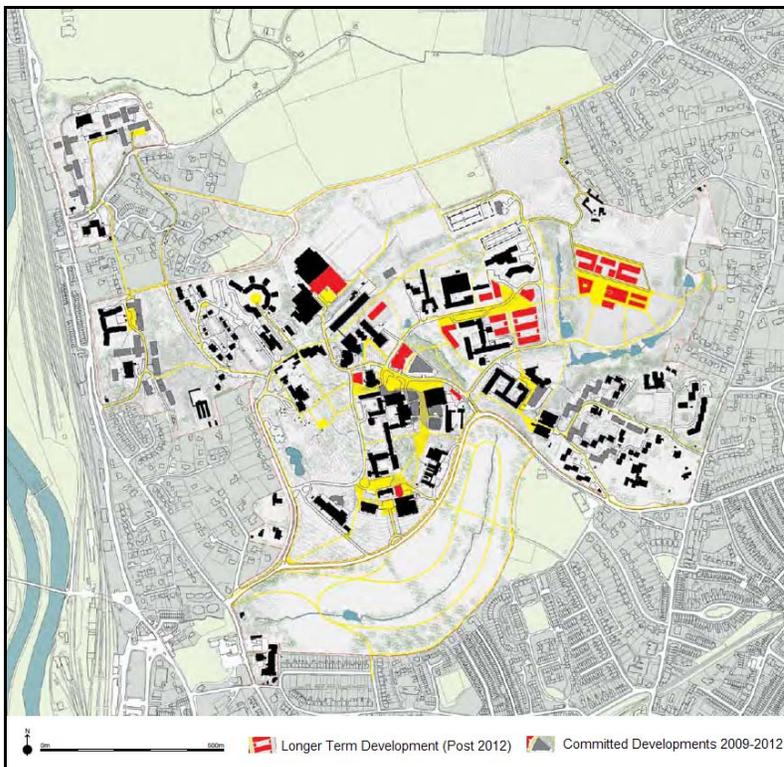


Figure 1.2 Streatham campus Master Plan map, indicating areas of committed and longer term developments.

Appendix D

DBRC Invertebrate Records for the Streatham Campus

Legally protected & notable Invertebrate Species within 300 metres of University of Exeter (2010) Enq 4921

ID	Common Name	Scientific Name	Location	Date	Grid Reference	UK protection	International protection	Status
1.	White-Legged Damselfly	Platycnemis pennipes	Sidings Field	2007	SX908940			Nb; KeyD (N)
2.	Small Phoenix	Ecliptopera silaceata	Reed Hall University, Exeter	1959	SX910940	NERC 41		UKBAP (P)
3.	Wall Brown	Lasiommata megera		1990	SX915945	NERC 41		UKBAP (P)
4.	Brown Hairstreak	Thecla betulae	Duryard, Exeter	1998	SX915945	WCA 5 (S); NERC 41		UKBAP (P); Nb
5.	Dingy Skipper	Erynnis tages	Duryard Valley Park	1994	SX917947	NERC 41		UKBAP (P); Decline
6.	Lackey	Malacosoma neustria	Duryard Valley Park	1998	SX917947	NERC 41		UKBAP (P)
7.	Dot Moth	Melanchra persicariae	Duryard Valley Park	1998	SX917947	NERC 41		UKBAP (P)
8.	Shoulder-Striped Wainscot	Mythimna comma	Duryard Valley Park	1998	SX917947	NERC 41		UKBAP (P)
9.	Mottled Rustic	Caradrina morpheus	Duryard Valley Park	1998	SX917947	NERC 41		UKBAP (P)
10	Wall Brown	Lasiommata megera		1992	SX917947	NERC 41		UKBAP (P)
11	Purple Hairstreak	Quercusia quercus	DURYARD VALLEY, EXETER	1992	SX917947			Decline
12	Purple Hairstreak	Quercusia quercus	Duryard Valley Park	1993	SX917947			Decline
13	White Admiral	Ladoga camilla	Duryard Valley Park	1994	SX917947	NERC 41		Decline
14	Brown Argus	Aricia agestis	DURYARD VALLEY	1994	SX918946			Decline

ID	Common Name	Scientific Name	Location	Date	Grid Reference	UK protection	International protection	Status
15	Small Heath	<i>Coenonympha pamphilus</i>		1994	SX918946	NERC 41		UKBAP (P)
16	Grizzled Skipper	<i>Pyrgus malvae</i>	DURYARD VALLEY	1994	SX918946	NERC 41		UKBAP (P); Decline
17	White Admiral	<i>Ladoga camilla</i>	DURYARD VALLEY	1994-1997	SX918948	NERC 41		Decline
18	Dingy Skipper	<i>Erynnis tages</i>	DURYARD VALLEY	1994-1999	SX9194	NERC 41		UKBAP (P); Decline
19	Marsh Fritillary	<i>Eurodryas aurinia</i>	DURYARD VALLEY	1992	SX919947	WCA 5; NERC 41	EC IIa; Bern II (GB reservation)	UKBAP (P); DBAP; Nb
20	Brown Hairstreak	<i>Thecla betulae</i>	DURYARD MEADOW	1996	SX920946	WCA 5 (S); NERC 41		UKBAP (P); Nb
21	Dingy Skipper	<i>Erynnis tages</i>	DURYARD MEADOW	1996-1999	SX920946	NERC 41		UKBAP (P); Decline
22	Rosy Minor	<i>Mesoligia literosa</i>	Belvidere Meadows LNR	1997	SX920947	NERC 41		UKBAP (P)
23	Sallow	<i>Xanthia icteritia</i>	Belvidere Meadows LNR	1997	SX920947	NERC 41		UKBAP (P)
24	Small Phoenix	<i>Ecliptopera silaceata</i>	Belvidere Meadows LNR	1997	SX920947	NERC 41		UKBAP (P)
25	Shoulder-Striped Wainscot	<i>Mythimna comma</i>	Belvidere Meadows LNR	1997	SX920947	NERC 41		UKBAP (P)
26	Mottled Rustic	<i>Caradrina morpheus</i>	Belvidere Meadows LNR	1997	SX920947	NERC 41		UKBAP (P)
27	Dark-Barred Twin-Spot Carpet	<i>Xanthorhoe ferrugata</i>	Belvidere Meadows LNR	1997	SX920947	NERC 41		UKBAP (P)
28	Rustic	<i>Hoplodrina blanda</i>	Belvidere Meadows LNR	1997	SX920947	NERC 41		UKBAP (P)
29	Buff Ermine	<i>Spilosoma luteum</i>	Belvidere Meadows LNR	1997	SX920947	NERC 41		UKBAP (P)

ID	Common Name	Scientific Name	Location	Date	Grid Reference	UK protection	International protection	Status
30	Wasp Spider	Argiope bruennichi	Belvidere Road (Belvidere Meadows)	2006	SX920947			Na
31	Long-Winged Conehead	Conocephalus discolor	Belvidere Road (Belvidere Meadows)	2006	SX920947			Na
32	Small Square-Spot	Diarsia rubi	Belvidere Meadows LNR	1997	SX920947	NERC 41		UKBAP (P)
33	Cloaked Carpet	Euphyia biangulata	Belvidere Meadows LNR	1997	SX920947			Nb
34	Lackey	Malacosoma neustria	Belvidere Meadows LNR	1997	SX920947	NERC 41		UKBAP (P)
35	Jersey Tiger	Euplagia quadripunctaria	Belvidere Meadows LNR	1997	SX920947			Nb
36	Dingy Skipper	Erynnis tages	DURYARD VALLEY	1995	SX921946	NERC 41		UKBAP (P); Decline

UKBAP(P) **UK Priority Species (Short and Middle Lists - UK Biodiversity steering Group Report 1995)** i.e. species that are globally threatened and rapidly declining in the UK (by more than 50% in the last 25 years). Has a Species Action Plan.

DBAP **Devon Biodiversity Action Plan species:** these have been identified as species of key conservation concern in Devon.

Devon Notable Species: Selected species recorded from over 50 2km squares in the Atlas of Devon Flora 1984 (R.B. Ivimey-Cook, Department of Biological Sciences, The University of Exeter).

DN1 **Devon Notable¹:** 1-25 2 km squares in Atlas of Devon Flora 1984.

DN2 **Devon Notable²:** 26-50 2 km squares in Atlas of Devon Flora 1984.

DN3 **Devon Notable³:** Selected species recorded from over 50 2 km squares in Atlas of Devon Flora 1984.

DR **Devon Rarity:** native species recorded from 3 or fewer localities within Devon.

Nb **Nationally Notable B:** known from 100 or fewer 10km squares. Taken from the Invertebrate Site Register.

Decline Substantial local decline in Devon

KeyD (N) **Nationally Important Key Dragonfly Species:** those which have been recorded in less than 10% of 10km squares in Britain. Those occurring in Devon are White-legged damselfly (*Platycnemis pennipes*) Scarce blue-tailed damselfly (*Ischnura pumilio*) Small red damselfly (*Ceragrion tenellum*) Hairy dragonfly (*Brachytron pratense*) Downy emerald (*Cordulia aenea*) and Keeled skimmer (*Orthetrum coerulescens*).

Appendix E

Habitat map of the Streatham and Duryard Valley sites showing six key habitats

