PRELIMINARY ECOLOGICAL APPRAISAL & BIODIVERSITY ENHANCEMENT PLAN

at

Queensgate Campus
Huddersfield
West Yorkshire
HD1 3DH

Client:
University of Huddersfield

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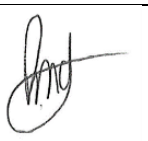
Quality Assurance

Version	**Desktop Survey Completed:**		**Site Surveyed:**		**Report Completed:**		**Reviewed:**	
	Date	Name	Date	Name	Date	Name	Date	Name
Enhancement	29/12/21	Poppy McDermott	03/12/2021	Poppy McDermott	03/12/2021	Poppy McDermott	03/12/2021	Poppy McDermott

This report has been prepared and provided in accordance with the *British Standard 42020: Biodiversity – Code of practice for planning and development 2018* and the *CIEEM's Code of Professional Conduct.*

Risk Assessment Completed	
Bio-security Procedure Completed	
Lone Worker Procedure Completed	

Summary

JCA Limited has been commissioned by the **University of Huddersfield** to undertake a Preliminary Ecological Appraisal (PEA) and to create a biodiversity enhancement plan of the site, **Queensgate Campus.** The site is located at Ordnance Survey (OS) National Grid Reference SE 14800 16276 with nearby postcode HD1 3DH.

The report includes a desk study and an extended Phase 1 survey, which were undertaken to assess the potential for protected habitats and species presence on site, and to advise the client of the opportunities present for biodiversity enhancement.

Recommendations for biodiversity enhancement opportunities have been summarised in Table 1 on the following page and are explained in further detail throughout the report.

Table 1: Summary of relevant biodiversity potential of each habitat onsite and enhancement recommendations.

Receptor	Current levels of biodiversity potential	Further details (Page Number)	Suggested biodiversity enhancement (Page Number)	Subsequent levels of biodiversity potential
Buildings				
Birds	Low	20	N/A	Low
Bats	Not assessed	20	N/A	Not assessed
Scrub				
Flora	Low	21	• Refer to page 29. • Cutting scrub to encourage re-growth. • Cutting in a rotation and in small patches to create a mosaic in the landscape. • Cut between September and January to avoid breeding bird season. • Planting tall herbs and grasses along the edge and wildflowers to encourage more biodiversity. • Placing fauna boxes in areas of scrub such as hedgehog houses and insect hotels. • Planting more scrub in areas suggested.	High
Invertebrates	Moderate	21		High
Hedgehogs	Moderate	21		High
Birds	Low	21		High
Bats	Low	21		High
Badgers	Low	21		Moderate
Intact Hedges				
Flora*	Low	22	• Refer to page 29. • Aim on campus to increase ecological connectivity and ecological value of the hedgerows. This can be done by increased hedgerow planting and management to develop species rich hedgerows. • Following hedgerow planting guidance and planting list.	Moderate
Invertebrates	Low	22		High
Hedgehogs	Low	22		Moderate
Birds	Low	22		High

Bats	None (neg)	22	• Hedgerows should be cut only once every two to three years, not annually.	Moderate
Running water				
Flora*	Low	22	• Refer to page 30. • Any maintenance or enhancement works which is deemed to affect the canal, needs to be approved by the Canal & River Trust • Planting scrub or hedgerow borders along the canal to reduce the litter blowing into the canal. • Maintenance may include dredging and weed cutting in the area of the canal opposite the Charles Sikes building • Also, the removal of Himalayan Balsam, with permission from the Canal & River Trust.	Low
Invertebrates	Moderate	22		Low
Amphibians	Low	22		Low
Birds	Moderate	22		Moderate
Bats	Moderate	22		Moderate
Fish	Not assessed	22	N/A	Not assessed
Scattered Trees				
Flora*	Moderate	20	• Refer to page 30. • Encouraged for this campus that tree planting is more widespread, possibly through the creation of a volunteer planting scheme through the university. • Trees should be planted with ecological connectivity in mind, planting lines of trees and trees adjacent to other habitats such as the canal and wildflower meadows. • Tree planting could be focused on the north section of the site adjacent to Sir John Ramsden Court, making this into a small 'woodland patch' with scrub and increased tree planting, • Tree planting could also increase along either side of the canal, filling in the gaps along the canal border where trees aren't present. • Referring to the JCA arboricultural report ensure all necessary arboriculturist advice on management is followed. • Where trees are necessarily removed, there should be a policy encouraged of replacing two for one.	High
Invertebrates	Low	20		Moderate
Birds	Low	20		High
Bats	Low	20		High

			• Putting up bat and bird boxes on the suggested trees in the faunal box plan.	
Introduced Shrub				
Flora*	Moderate	21	• Refer to page 31. • Using the planting lists provided and ensuring all planters are soil planters, removing any artificial lining, will increase their biodiversity potential. • All plants selected are either native or non- native but are chosen for a specific ecological purpose such as extending the flowering season. • Using planters as an insect hub placing insect boxes adjacent or within them.	High
Invertebrates	Low	21		High
Birds	Low	21		High
Bats	Low	21		High
Amenity Grassland				
Flora*	Low	22 & 23	• Refer to page 26. • It is recommended as many patches of amenity grassland as possible are converted to species rich grassland or wildflower meadows • The species chosen for this grassland are all nectar and pollen rich, and so will attract insects such as bees and butterflies • It is recommended that the seed mix WFG2 from the website Germinal (https://germinal.co.uk/) is used. • A two-cut management approach should be used for suppressing coarse grasses and encouraging wildflowers. • No fertiliser or pesticides should be used.	High
Invertebrates	Low	22 & 23		High
Hedgehogs	Low	22 & 23		Moderate
Potential Key *Flora is measured on the number of native plant species present (1- none, 2-low, 3- moderate 4 or above high)				

Contents

1. Introduction

1.1 Background

1.1.1 The purpose of the report is to establish a baseline of ecological information present on Queensgate Campus, by providing a detailed description of the habitats present on site and an assessment of their current ecological value. This can then be used to create a biodiversity enhancement plan with recommendations on how to increase biodiversity onsite.

1.2 Ecological context

1.3.1 The site is located at Ordnance Survey (OS) National Grid Reference SE 14800 16276, with nearby postcode HD1 3DH. The campus is situated in Huddersfield town centre with limited greenspace, and is bordered to the north, west and south by commercial and residential buildings. To the east, the landscape becomes less developed and there are patches of woodland and green spaces. There is also the Huddersfield Narrow Canal which runs through the centre of the campus and the River Colne which runs along the east side of the campus.

1.3.2 The survey area is estimated at 11 hectares within the grounds of Huddersfield Queensgate campus.

1.4 Aims and Objectives

1.5.1 The objectives of this report are:

- To identify the habitats present onsite.
- To note the presence of, or potential for, any protected or notable species onsite.
- To outline potential enhancement options, as appropriate for the creation of a biodiversity enhancement plan.

In order to achieve the outlined objectives, a desktop study and a field survey of the site were conducted.

1.5.2 The aim of the desktop study is to conduct a review of the environmental records for the surrounding area, to obtain existing information on

statutory and non-statutory designated sites of nature conservation interest, and to determine the presence of protected and notable habitats and species within the site's recent history.

1.5.3 The aim of the field survey is to conduct an Extended Phase 1 Habitat survey of the site, recording the present habitat types and dominant vegetation, including any invasive species.

- During this survey, evidence of protected or notable fauna and habitats or habitats capable of supporting protected or notable fauna were assessed and recorded. Locations of any features constituting ecological interest and vegetation recorded on and around the development are included in an accompanying Phase 1 Habitat Map (Appendix 1).

- This report and the maps within are supported by photographic evidence (Appendix 3) and information regarding current legislation (Appendix 6).

2. Methodology

1.6 Desktop Study

2.1.1 The desktop study involved conducting database searches for statutory and non-statutory designated sites within a 2km radius of the site. The baseline conditions are based on a review of existing available information including:

- MAGIC (Multi-Agency Geographical Information for the Countryside) website (to identify statutory designated sites and EPS licences).
- Ordnance Survey mapping (to identify potentially notable habitats including ponds).
- Aerial photography (to identify potentially notable habitats).
- Data search for records of protected/notable species on and within 2km of the site within the last ten years (exempting bat roosts, of which all records are included) obtained from West Yorkshire Ecology, the local environmental records centre for Huddersfield, along with information for non-statutory wildlife sites.

2.1.2 The records were checked against species listed as priority species under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 and the Kirkless Biodiversity Action Plan, (LBAP, KBAP) to ensure any recommendations of biodiversity enhancement onsite, contribute to regional and national biodiversity objectives.

2.2 Field Survey

2.3.1 A Phase 1 survey of the site was conducted on the 3rd November 2021. All areas of the site were investigated and areas around the site where access was permitted. The habitats were also assessed for their potential to support legally protected or notable species in accordance with Chartered Institute of Ecology and Environmental Management (CIEEM) guidelines. The field survey included:

2.3.2 Mapping of the vegetation and habitat types present within the site in accordance with the categories specified for a Phase 1 Vegetation and Habitat Survey (Joint Nature Conservation Committee, 2010).

2.3.3 Assessing the current habitats and their biodiversity potential, noting any notable features which have the potential to support protected and/or notable species. Specifically noting those listed under the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019, the Wildlife & Countryside Act (WCA) 1981 (as amended), including those given a higher level of legal protection under the NERC Act 2006 and Countryside & Rights of Way (CRoW) Act 2000, and those listed on the LBAP. The following species were considered:

- Invertebrates (including white-clawed crayfish *Austropotamobius pallipes*).
- Great crested newt *Triturus cristatus* freshwater habitat potential within 500m of the site.
- Reptile habitat within the site.
- Nesting and foraging habitat for birds within the site.
- Bat roost potential and foraging habitat within the site.
- Badger *Meles meles* setts within 30m of the site, where accessible.
- Otters *Lutra lutra* and suitable habitat within 30m of the site, where accessible.
- Water vole *Arvicola amphibius* habitat within 20m of the site, where accessible.
- Other notable species.
- Invasive species.

2.4 Survey Constraints

2.5.1 The optimum time of year for completing the field survey is between April and September, as many plant species have a seasonal expression in spring and summer only. The survey was undertaken on the 3rd November outside of this optimum period. But given the information collected on the site including the species records and the site location, it can be concluded the plant species results found onsite would not significantly differ.

2.5.2 The weather at the time of the survey, and in the days previous, had been dry and sunny, having little effect on field signs that could be present.

3. Desk Study Results

2.6 Statutory Designated Sites

3.1.1 The MAGIC website revealed no internationally designated sites within 2km of the site.

3.1.2 The MAGIC website revealed one nationally designated site within 2km of the site. The site is the Local Nature Reserve (LNR) Gledholt Woods and is a mixture of mature woodland and rough meadow. The woodland supports a variety of wildlife including white-clawed Crayfish *Austropotamobius pallipes*. Gledholt Woods is located 1397m from the site boundary.

3.2 Non-statutory Designated Sites

3.3.1 Records received from WYES revealed four non-statutory designated sites within 2km of the site, detailed in Table 2 below.

Table 2: Non-statutory designated sites within 2km of the site, returned from WYES.

Site Name	Distance (m) from Site	Reasons for Designation
Huddersfield Narrow Canal	Onsite	The canals are designated as Local Wildlife sites because they provide excellent opportunities for people to see a wide variety of wildlife. Wildlife present here includes kingfishers Alcedo atthis and an otter spraint. Both of which are protected under the Wildlife and Countryside Act.
Sir John Ramsden Canal	50 m	No information given.
Gledholt Woods	1397m	Gledholt Woods is also designated as a Local Wildlife Site. Gledholt Woods is a mixture of mature woodland and rough meadow. The woodland supports a variety of wildlife including white-clawed Crayfish *Austropotamobius pallipes.*
Longley Plantation	1440 m	Longley Plantation is designated as a Local Wildlife Site. It is a mixture of neutral and acid

		grassland with scattered trees and scrub and small blocks of woodland.
Key: SINC – Site of Interest for Nature Conservation LWS – Local Wildlife Site		

3.4 Protected and Notable Species

3.1.1 Records of Protected and Notable Species

Within the grounds of the University of Huddersfield there are recognised areas suitable to support protected and/or notable species. The species listed in Table 3 below have been recorded on or within 2km of the University estate within the last 10 years (excluding bat roost records for which all historical records are noted). These species are legally protected under UK and European Law and are considered rare and/or threatened.

Table 3: Protected or notable species records received from WYES.

Priority species	Designation	Latest Record	Number of records	Nearest distance to the site
Flora				
Bluebell *Hyacinthoides non-scripta*	WCA Sch 8	2015	4	1552 m
Invertebrates				
White-clawed crayfish *Austropotamobius pallipes*	WCA Sch 5, UKBAP, WYBAP	2011	1	1720 m
Fish				
Sea trout *Salmo- trutta*	UKBAP, WYBAP, KBAP	2015	4	1170 m
Amphibians				
No Records Received				
Reptiles				
No Records Received				
Bird species				
Swift *Apus apus*	WYBAP	2012	1	1733 m
Goldfinch *Carduelis carduelis*	KBAP	2018	1	1702 m
Peregrine Falcon *Falco peregrinus*	WCA Sch 1, WYBAP, KBAP	2016	2	689 m
House sparrow *Passer domesticus*	UKBAP, WYBAP, KBAP	2018	1	1702 m

Dunnock *Prunella modularis*	UKBAP, WYBAP, KBAP	2018	1	1702 m
Bullfinch *Pyrrhula pyrrhula*	UKBAP, WYBAP, KBAP	2018	1	1702 m
Bat Field Records				
Daubenton's bat *Myotis daubentonii*	EPS WCA Sch 5 LBAP	2012	1	1179 m
Leisler's bat *Nyctalus leisleri*	EPS WCA Sch 5 LBAP	2015	3	1425 m
Noctule bat *Nyctalus noctula*	EPS WCA Sch 5 S41 LBAP	2016	3	998 m
Pipistrelle *Pipistrellus*	EPS WCA Sch 5 S41 KBAP	2017	26	179 m
Soprano pipistrelle *Pipistrellus pygmaeus*	EPS WCA Sch 5 S41 LBAP	2014	2	1160 m
Bat Roost records				
Common pipistrelle *Pipistrellus pipistrellus*	EPS WCA Sch 5 S41 KBAP	2007	2	1117 m
Unidentified bat *Vespertilionidae*	EPS WCA Sch 5 S41 KBAP	2008	13	515 m
Badgers				
Badger *Meles meles*	WCA Sch 6 Badgers Act	N/A	1 **(Sett)**	1700 m
Otters (*Lutra Lutra*)				
No Records Received				
Water Voles (*Arvicola amphibius*)				
No Records Received				
Brown Hare				
Brown Hare *Lepus europaeus*	KBAP, UKBAP, S41	2012	1	1262 m

Key:
EPS: European Protected Species: Species listed under the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019.

WCA: Wildlife & Countryside Act 1981 (as amended)
S41: Section 41 of the NERC Act 2006
LBAP: Local Biodiversity Action Plan
KBAP: Kirkless Biodiversity Action Plan

3.5 Invasive Species Records

3.4.1. The species in Table 4 below are listed under Schedule 9 of the Wildlife & Countryside Act 1981 (as amended).

Table: 4 Invasive species records received from WYES.

Invasive Species	Latest Record	Number of records	Nearest distance from site (m)
Himalayan Cotoneaster *Cotoneaster simonsii*	2018	1	1702 m
Indian Balsam *Impatiens glandulifera*	2013	4	253 m
Yellow archangel *Lamiastrum galeobdolon*	2015	1	1448 m
Rhodondendron *Rhododendron ponticum*	2018	1	1702 m
Japense rose *Rosa rugosa*	2018	1	1702 m
Canadian Waterweed *Elodea canadensis*	2011	1	253 m
Japnese knotweed *Fallopia japonica*	2018	12	117 m
Giant hogweed *Heracleum mantegazzianum*	2016	1	462 m

4. Field Survey Results

3.6 Habitats

4.1.1 A Phase 1 habitat map illustrating the findings of the habitat survey is shown in Appendix 1. The following habitats were recorded within the site boundary:

- Scrub
- Buildings
- Scattered trees
- Running water
- Intact hedge
- Introduced shrub

The following sections provide an overview of the habitats recorded on the site during the survey. Photographs are provided in Appendix 3.

4.1.2 Scrub

Scrub is found in the centre of the site as the ground layer in the 'woodland walk' area. The scrub found here is dense and the species include, bramble *Rubus fruticosus*, fern *Polypodiophyta* sp, nettle *Urtica dioica*, doc *Rumex* sp, sedge *Carex* sp , ivy *Hedera helix,* snowberry *Symphoricarpos* sp, Himalayan blackberry *Rubus armeniacus* and huckleberry *Ericaceae* sp. This habitat showed signs of vegetation clearance, as it has a large pile of vegetation cuttings in the centre. This is currently being used to attract insects and hedgehogs.

4.1.3 Scattered trees

The trees on campus range in maturity and ecological value. The JCA arboricultural team found 83 trees with the majority being scattered across the university and 14 of them classed as being a group. The tree species found included London plane *Platanus × acerifolia*, rowan *Sorbus subg. Sorbus*, field maple *Acer campestre* , ash *Fraxinus* sp, Norway maple *Acer platanoides*, red oak *Quercus rubra*, columnar cherry *Prunus Amanogawa*, leopold sycamore Acer Pseudoplantanus, hornbeam *Carpinus* sp*,* dawyck *beech Fagus sylvatica*, sycamore *Acer pseudoplatanus*, apple *Malus domestica*, wild cherry *prunus avium*, Himalayan birch *Betula utilis*, box elder *Acer negundo*, lime *Tilia x europaea*, bird cherry *prunus padus*, winter flowering cherry *Prunus subhirtella*, silver birch *betula pendula*, weeping willow *Salix babylonica*, stag's horn

sumach *Rhus typhina*, , common oak *Quercus robur*, hawthorn *Crataegus* sp, crack willow *Salix* × *fragilis*, alder *Alnus glutinosa* and goat willow *Salix caprea*,

The main patch of trees to note are present in the central areas of campus on the canal bank and adjacent to it, including scattered trees within the 'woodland walk' area.

The remaining trees are isolated and scattered and currently suggest more ornamental purposes. There is therefore the potential for an increase in their ecological value.

4.1.4 Running water

On campus there are two water courses. The Huddersfield Narrow Canal runs through the centre of campus from northeast to southwest and the River Colne runs along the east side of the campus. Both these habitats provide a high level of ecological connectivity and value across the site. Many of the plant species found bordering the canal could not be surveyed due to health and safety constraints, however, most of these were scrub species with little ecological value. The species identified were rosebay willowherb *Chamaenerion angustifolium*, ivy *Hedera helix*, fern *Polypodiophyta* sp, cypress *Cupressaceae* sp and Himalayan balsam *Impatiens glandulifera*.

The main section flowing through the centre of the site showed little signs of pollution, build-up of litter, or a build-up of debris. However, two areas flowing off the main section showed signs of a major reduction in water quality. This was due to a build-up of litter and aquatic vegetation and debris. These were located in a tributary section of the canal in front of the Schwann building (see target note, 2) and another section located in the east section of campus adjacent to the health centre. This section had become so densely overgrown with pendulous sedge *Carex pendula*; it is transitioning into a stagnant water habitat. Due to health and safety constraints this could not be fully surveyed, however there were signs of Himalayan balsam on the bank side and tree sapling growth (see target note, 1).

4.1.5 Amenity grassland

Due to the university being situated in a town centre the amount of greenspace on campus is relatively small. The main areas of green space are the patches of amenity grassland across the site. These are species poor and mainly consist of perennial rye grass *Lolium perenne*. The isolated nature of these patches means they are providing little ecological connectivity across the site.

4.1.6 Introduced shrub

Introduced shrub made up most of the vegetation content of this site. Introduced shrub is found as a variety of species in soil, wood chipping and slate planters and plant beds across the campus. The species found in the planters and plant beds across the site can be found in appendix 2.

4.1.7 Intact hedge

Across the site there are numerous hedges. These hedges are mostly to an ornamental standard and fall into the category of species poor hedges. The hedge species in the northeast area of the site adjacent to Wakefield Road include cherry laurel *Prunus laurocerasus* and drooping sedge *Carex pendula*. The hedge species found in front of the university entrance include beech *Fagus* sp, thorny olive *Elaeagnus pungens*, winter creeper *Euonymus fortune*, Siberian dogwood *Cornus alba*, common box *Buxus sempervirens.* The other sections of hedge making up the ornamental planting were found scattered across the site and included the same species.

4.1.8 Buildings

The site mainly consists of buildings owned by Huddersfield University. These had a variety of structure and building material. Many of the buildings were relatively new, such as the technology building in the centre of the site and the main reception areas in the north section of the site. Many buildings kept their historical structure, these were mainly present along the canal front in the west section of the site.

5. Assessing the Potential for Biodiversity

3.7 Designated Sites

5.1.1 Statutory designated sites

The only statutory site within 2km is Gledholt Wood which is designated as a Local Nature reserve. Due to the location of the site and the fragmented landscape between the two sites, there is little opportunity for reciprocal biodiversity enhancement. Therefore, the potential for biodiversity from this habitat is not relevant to the report.

5.1.2 Non-statutory designated sites

There are four non statutory sites within 2km of the site area. Due to two of these sites being positioned a far distance from the site and separated by fragmented urbanised landscape, there is little potential for reciprocal biodiversity enhancement. The remaining two canals, which are designated as Local Wildlife sites, are found either on campus or adjacent to campus. These have a high potential for reciprocal biodiversity enhancement as they are in a position which means any management conducted on the canal onsite will benefit the biodiversity offsite.

5.2 Habitats

5.2.1 Buildings

As mentioned in section 4.1.8 most of the university campus consists of built-up areas with various university buildings. However, it is possible for buildings to be utilised by various species and, as a result, have their own biodiversity potential. The buildings noted with the most biodiversity potential are found along the canal. These buildings are made from stone, and although a full bat roosting potential survey was not relevant for this report, these buildings would be noted to have high bat roosting potential. Bats have a high potential to roost in the gaps in brick work and loose tiles on roof spaces and as they are in close vicinity to high quality habitat of the canal, this increases the possibility of this.

Another building to note is the Journalism & Media building which currently has five wooden bird boxes fitted on the outside of the building. This increases the buildings biodiversity potential, as it encourages bird species onsite and provides nesting areas for birds.

However, the majority of buildings onsite have a negligible biodiversity potential and are not encouraging protected or notable fauna and flora species to the campus.

5.2.2 Scattered trees

There are various tree species listed in section 4.1.3 providing various levels of biodiversity potential across the site. Trees in general increase an areas biodiversity potential as they are classed as “keystone structures” for biodiversity. They offer shelter and food source for various species, they provide steppingstones and ecological connectivity between landscapes, and enhance and provide ecosystem services such as increasing air quality. Certain features and species of trees can provide more biodiversity potential than others.

The trees bordering the canal are noted to have high biodiversity potential. These trees are mainly groups of mature willow species and have high levels of bat and bird roosting potential. This is due to their position in relation to the canal and their large crown size and signs of crevices in the stems which bats may utilise. The tree line adjacent to the river is providing the potential for a good commuting corridor for bats to utilise.

Another area of trees with high biodiversity potential is the group of trees found in the centre of campus on the west side of the Huddersfield Narrow canal. This is being referred to as the ‘woodland walk’ by the university. Although this is not meeting the habitat requirements to be a woodland, this dense patch of trees with a dense scrub ground layer is creating a unique patch of habitat and is mimicking the ecological benefits a woodland on campus would produce. These include habitats for hedgehogs and small mammals to nest, and a variety of trees for foraging and shelter uses. This area is deemed important for the campus to increase its urban diversity and is providing ecological connectivity to the adjacent canal habitat.

The other trees found on site are generally isolated and lacking maturity. As these trees increase in maturity, they will become utilised further by bird species. In addition, there is scope for increased tree planting, as there is relatively little for the size of the area being surveyed.

5.2.3 Scrub

The dense scrub onsite provides high biodiversity potential as it provides ecological connectivity for commuting and hibernating mammals, especially hedgehogs. It also supports many bird species as a nesting area. Bats will often use scrub for foraging and due to how close this is to the canal; it is helping create a wildlife corridor. This habitat is also a listed as a priority habitat in the

Kirklees Biodiversity Action Plan, so any methods to increase the extent of scrub or quality of species within the scrub area will help contribute towards local biodiversity objectives. It does, however, have the potential to be more species rich and provide further foraging opportunities under correct management.

5.2.4 Introduced shrub

Across the site generally the main diversity of flora species is found as introduced shrub species in planters and plant beds. These species are a mixture of native and non-native plant species with varying levels of biodiversity value and potential. Planters and plant beds have the potential to provide high levels of biodiversity especially for insect species and pollinator species encouraging these to the area. In turn, this encourages other species which feed off insects to the area further increasing biodiversity. However, the planters onsite varied in their biodiversity potential due to the plant species chosen and low levels of maintenance present in some areas. There is scope for improvement to these with a planting scheme and continued maintenance, ensuring plants are being chosen for an ecological purpose.

5.2.5 Running water

Overall, the canal was assessed as being in a relatively good condition from a walkover preliminary assessment. The canal is a focal point of biodiversity and helps link together fragmented areas formed from urbanisation. The Huddersfield Narrow canal is designated as a Local Wildlife site, which further demonstrates its ecological value. Wildlife recorded along the canal includes otters and a kingfisher. The canal could provide habitats for a number of protected species and Kirklees BAP species including sea trout, which is a KBAP species, and has been found in the Narrow canal. In addition, white-clawed crayfish may inhabit the canal especially if it is kept in a clean and good condition. They are also a KBAP and UKBAP species.

As previously identified in section 4.1.4, a number of areas within the canal have lower biodiversity potential due to a lack of management. One section of the canal has become so densely overgrown with vegetation it is stagnant. Although this may seem an unlikely way of providing biodiversity, this patch of the canal provides a different type of aquatic habitat which amphibians, such as Great Crested Newts, may inhabit or could be managed and enhanced to produce a habitat which Great crested newts could utilise. The canal is providing a great opportunity for the university to use in enhancing biodiversity and also for wildlife education purposes.

5.2.6 Intact hedge

The hedges across campus are generally small and isolated, lacking species diversity. Currently they will have little ecological value for species such as nesting and foraging birds. The university has the potential to improve the hedges found on site, therefore improving their biodiversity potential. Hedgerows are a Kirkless and UK priority habitat, so any improvement or development of this habitat will also be meeting national and local objectives. The hedges onsite have the potential to be improved to provide connectivity between the habitats onsite and also for ornamental purposes, to increase the campus aesthetic and provide a screen to the roads and urbanisation surrounding the campus.

5.2.7 Amenity grassland

The campus is mainly providing areas of green space via patches of amenity grassland. These grassland areas currently have low biodiversity potential as they have both low species diversity and ecological connectivity and are essentially being used for ornamental purposes. However, there is the potential for using these grassland patches to increase floral diversity and create a mosaic of habitats across the campus.

6 Biodiversity enhancement onsite

6.1 Purpose of Suggested Enhancement

6.1.1 A Biodiversity Enhancement plan has been requested for **Queensgate Campus,** by Huddersfield University. This Enhancement Plan proposes actions to deliver biodiversity gain onsite, which will help the university contribute towards local and national objectives for environmental development such as in the UK Biodiversity Framework and the Kirklees Biodiversity Action Plan.

6.1.2 This Biodiversity Enhancement is aligned with the context of these documents. Considering any objectives that the University can contribute to, in a series of enhancement measures across the site.

6.2 Local Biodiversity Action Plan

6.2.1 If possible, JCA Ltd aim to incorporate Local Biodiversity Action Plan (LBAP) habitats within our enhancement plans. We also aim to attract and support LBAP species, through either directly planting LBAP floral species, or creating habitats that will attract these species. The LBAP that covers Queensgate Campus is the Kirklees BAP.

6.2.2 The habitats listed within the Kirklees BAP are;

- Scrub
- Other Semi- Natural grassland (Wet/rush pasture and rough grassland)
- Riverine

6.2.3 Kirkless council have issued the following species action plans (Kirklees Biodiversity Action Plan):

Table 1: Birds

Common name	Scientific Name	Common name	Scientific Name
Common Bullfinch	*Pyrrhula pyrrhula*	Common Grasshopper Warbler	*Locustella naevia*

Common Linnet	*Linaria cannabina*	Common Starling	*Sturnus vulgaris*
Eurasian Curlew	*Numenius arquata*	Corn Bunting	*Emberiza calandra*
Eurasian Tree Sparrow	*Passer montanus*	European Turtle Dove	*Streptopelia turtur*
Grey Partridge	*Perdix perdix*	Hawfinch	*C. coccothraustes*
Sky Lark	*Alauda arvensis*	Hedge Accentor	*Prunella modularis*
House Sparrow	*Passer domesticus*	Northern Lapwing	*Vanellus vanellus*
Song Thrush	*Turdus philomelos*	Reed Bunting	*Emberiza schoeniclus*
Red Grouse	*Lagopus lagopus scotica*	Ring Ouzel	*Turdus torquatus*
Tree Pipit	*Anthus trivialis*	Twite	*L. flavirostris*
Willow Tit	*Poecile montanus*	Wood Warbler	*Phylloscopus sibilatrix*
Yellow Wagtail	*Motacilla flava*	Yellowhammer	*Emberiza citrinella*
Spotted Flycatcher	*Muscicapa striata*		

Table 2: Invertebrate

Common name	Scientific name	Common name	Scientific name
Northern Wood Ant	*Formica lugubris*	White Letter-Hairstreak	*Satyrium w-album*

Table 3: Fish

Common name	Scientific name
Atlantic Salmon	*Salmo salar*

Table 4: Reptile & Amphibian

Common name	Scientific name	Common name	Scientific name

Comon Lizard	*Zootoca vivipara*	Common Toad	*Bufo bufo*
Great Crested Newt	*Triturus cristatus*		

Table 5: Terrestrial Mammals

Common name	Scientific name	Common name	Scientific name
Brown hare	*Lepus europaeus*	Brown Long-eared Bat	*Plecotus auritus*
Mountain Hare	*Lepus timidus*	Noctule	*Nyctalus noctula*
Soprano Pipistrelle	*Pipistrellus pygmaeus*	Otter	*Lutrinae*
Water vole	*Arvicola amphibius*	West European Hedgehog	*Erinaceus europaeus*

Table 6: Flora

Common name	Scientific name	Common name	Scientific name
Changing Forget-me-not	*Myosotis discolor*	Ivy Leaved Bellflower	*Wahlenbergia hederacea*
Early Marsh Orchid	*Dactylorhiza incarnata*	Marsh Helleborine	*Epipactis palustris*
Flowering Rush	*B. umbellatus*	Slender Cudweed	*Gnaphalium exilifolium*
Fragrant Agrimony	*Agrimonia procera*	Bog Asphodel	*Narthecium ossifragum,*
Broad Helleborine	*Epipactis helleborine*	Common Centaury	*Centaurium erythraea*
Cowberry	*Lingonberry*	Dyer's Greenweed	*Genista tinctoria*
Goldilocks	*Galatella linosyris*	Moscahatel	*Adoxa moschatellina*
Pyramidal Orchid	*Anacamptis pyramidalis*	Narrow-leaved Water Plantain	*Alisma gramineum*
Round-leaved Sundew	*Drosera rotundifolia,*	*Royal Fern*	*Osmunda regalis*
Spindle Tree	*Euonymus europaeus*	*Twayblade*	*Eggleaf twayblade*

7 Habitat Creation

7.1.1 Most of the habitats on site are of low conservation value. As a result, there is scope to greatly enhance the universities value for wildlife

7.1.2 Based off the information presented in the baseline assessment of the Phase 1 survey, it is recommended that the following habitats should be either enhanced or have further creation onsite.

- Wildflower meadow creation/species rich grassland patches
- Hedgerow enhancement/creation
- Scrub planting/enhancement
- Planting native broad-leaved trees
- Native wildflowers/ plant bed enhancement
- Narrow canal management
- Increasing variety and number of faunal boxes

7.2 Grassland Planting

7.2.1 It is recommended as many patches of amenity grassland as possible are converted to species rich grassland or wildflower meadows. Grassland is classed as being species rich if it has:

- More than 15 species per square metre
- More than 30% clover cover of wildflowers and sedges
- Less than 10% cover of white clover and perennial rye grass

7.2.2 Species Selection: The species chosen for this grassland are all nectar and pollen rich, and so will attract insects such as bees and butterflies. The grasses are visually attractive, and many are the host plant of butterfly species. It is hoped that the insects that are attracted to the site will then provide a food source for larger animals, thus encouraging species such as bats and birds to the site.

7.2.3 Species specifications: A list of the recommended species can be seen below in Table 7. It is recommended the planting mix WFG2 Flowering meadow mix from the site, Germinal is used for this. This mix combines

the UK native wildflowers and selected non-native species with ecological value to produce a grassland meadow mixture with 80% grasses suitable for all soil types.

Table 7: List of wildflower grassland mix.

Common name	Scientific Name	%	Common name	Scientific Name	%
Purple Coneflower	*(Echinacea)*	1.0%	Corncockle	*(Agrostemma githago)*	2.0%
Cornflower	*(Centaurea cyanus)*	1.5%	Shasta Daisy	*(Leucanthemum x superbum)*	2.5%
Foxglove	*(Digitalis purpurea)*	0.3%	Smooth Blue Aster	*(Symphyotrichum laeve)*	0.2%
Rudbeckia	*(Rudbeckia hirta)*	0.5%	Oxeye Sunflower	*(Heliopsis helianthoides)*	2.5%
Ribwort Plantain	*(Plantago lanceolata)*	0.5%	Corn Poppy	*(Papaver rhoeas)*	2.0%
Corn Chamomile	*(Anthemis arvensis)*	2.0%	Lance-leaved Coreopsis	*(Coreopsis lanceolata)*	1.0%
Salad Burnet	*(Sanguisorba minor)*	1.0%	Birdsfoot Trefoil	*(Lotus corniculatus)*	1.0%
Common Vetch	*(Vicia sativa)*	0.3%	Yellow Prairie Coneflower	*(Ratibida pinnata)*	0.5%
Yarrow	*(Achilles millefolium)*	1.0%	Calendula Art Shades	*(Calendula art shades)*	0.2%
Sheeps Fescue	*(Festuca Ovina)*	35.0%	Slender Creeping Red Fescue	*(Festuca rubra litoralis)*	24.0%
Crested Dogstail	*(Cynosurus cristatus)*	7.5%	Tall Oat-grass	*(Arrhenatherum elatus)*	6.5%
Chewings Fescue	*(Festuca rubra commutata)*	5.0%	Browntop Bent	*(Agrostis capillaris)*	1.0%
Tufted Hair Grass	*(Deschampsia cespitosa)*	1.0%			

7.2.4 Planting Implementation: When creating wildflower grasslands begin with a nutrient-poor base and then manage the land correctly. Species-rich grasslands require much less management than amenity grassland.

7.2.5 Sowing: The seed mix should be sown during early autumn (late August/ September). The seeds should be sown sparsely, at a rate of 2 to 5 grams per square metre.

7.2.6 Management: A two-cut management approach is ideal for suppressing coarse grasses and encouraging wildflowers. The grassland should be cut only twice a year; once in the spring (between early March and early April) and once in the autumn (between late June and the end of August).

7.2.7 Lawn height should not exceed 150 mm and should be cut to a height of 10mm-50 mm. The approach prevents wildflowers such as clovers and dandelions from being out competed by grass species.

7.2.8 No fertiliser or pesticides should be used, and all grass clippings should be removed and composted elsewhere.

7.2.9 A neat border of grass kept constantly short can be maintained around lawn edges to have a neater appearance.

7.3 Hedgerow Planting

7.3.1 The current quality of hedgerows found across the site are relatively species poor. It should be an aim on campus to increase ecological connectivity and ecological value of the hedgerows. This can be done by increased hedgerow planting and management to develop species rich hedgerows.

7.3.2 Species Selection: The species have been selected for their hardiness, amenity value and their value to local wildlife, either in the form of flowers, berries, seeds or shelter. Species that are poisonous such as Spindle have been avoided.

7.3.3 Shrub Specifications: The following table details the specification for the newly planted shrubs.

Table 8: Mixed native hedgerow planting at 30cm spacing double staggered lines.

Botanical Name	Common Name	Size at Purchase	Numbers required (Approx.)
Crataegus monogyna	hawthorn	Whip	(55%)
Rosa canina	dog rose	Whip	(10%)
Viburnum lantana	wayfaring tree	Whip	(10%)
Viburnum opulus	guelder-rose	Whip	(10%)
Lonicera periclymenum	honeysuckle	Whip	(10%)

Ilex aquifolium	Holly	Whip	(5%)
		Total	(100%)

7.3.4 Planting: Should be carried out during the dormancy period for deciduous species (November to February).

7.3.5 Positioning: Whips within the hedgerow should be planted in two staggered lines, **30cm** apart, and distributed evenly.

7.3.6 Management: Hedgerows should be cut only once every two to three years, not annually. Cutting annually will prevent hedgerow species from flowering and fruiting, thus reducing their wildlife benefit. The best time to cut hedgerows is during late winter.

7.4 Scrub

7.4.1 Summary: Scrub is an essential habitat for increasing biodiversity at Huddersfield University. It is also a KBAP species, so enhancement and maintenance will be helping meet local environmental objectives. In order to improve the scrub areas found on site, especially the large patch named as the 'woodland walk', focus needs to be on its management and enhancement.

7.4.2 Management: Cutting most species of scrub encourages re-growth and is useful for maintenance and restoration.

7.4.3 Cut areas of scrub in a rotation, aiming to retain all ages. Scrub typically matures in 15 years, so cut 1/15 every year or 1/5 every third year. Ensure cutting is done in small patches in the landscape, to help create a mosaic of vegetation structure.

7.4.4 Try to cut between September and February, to avoid the bird breeding season. Leaving berry-bearing scrub cutting until after December, so birds and mammals can eat the berries throughout winter.

7.4.5 Tall herbs and grasses can be planted along the edge of scrub, to offer shelter for small mammals, nest sites for bird and help create ecotones between habitats onsite.

7.4.6 Planting wildflower species can further increase invertebrate populations present further enhancing the biodiversity in scrub areas. Species such as common vetch *Vicia sativa,* betony *Stachys officinalis*, wood *sage Teucrium scorodonia*, common tufted vetch Vicia sativa, hedge bedstraw Centaurea nigra, common yarrow *Achillea millefolium* could be planted.

7.4.7 Planting: Scrub growth could be encouraged bordering the canal adjacent to the Haslet building, and adjacent to the Sir Johns Ramsden building, to create another 'woodland walk' area on campus.

Scrub management should also be considered bordering the canal adjacent to the Health Centre. A dense and unmanaged patch of scrub including Himalayan balsam, has become overgrown affecting the quality of the canal and would benefit from a cutting regime and replanting to remove this invasive species.

7.5 Tree planting

7.5.1 Summary: Trees are an essential element to a university town campus as they provide ecological connectivity and increase biodiversity without taking up too much space. It is encouraged for this campus that tree planting is more widespread, possibly through the creation of a volunteer planting scheme through the university.

7.5.2 Positioning: Trees should be planted with ecological connectivity in mind, planting lines of trees and trees adjacent to other habitats such as the canal and wildflower meadows to make the university more ecologically connected.

7.5.3 Tree planting could be focused on the north section of the site adjacent to Sir John Ramsden Court, making this into a small 'woodland patch' with scrub and increased tree planting. Tree planting could also increase along either side of the canal, filling in the gaps along the canal border where trees aren't present, helping to create a tree corridor and commuting corridor for bird and bat species. Tree planting should be considered in all amenity grassland spaces to help create this network of connectivity across the site.

7.5.4 Species Selection: The chosen species are all native to Britain. These species have attractive autumnal colours, berries, flowers, interesting bark and leaves and as such, the site should be attractive throughout the seasons for both residents and wildlife. The species selected have a range of life expectancies in order to provide the site with long term tree

cover. Poisonous species have been avoided, as have species which commonly drop branches.

Table: 9 Recommended native deciduous trees to include

Botanical Name	Common Name
Betula pendula	Silver Birch
Malus sylvestris	Crab apple
Prunus padus	Bird cherry
Prunus domestica 'Merryweather'	merry weather damson
Sorbus aucuparia	Rowan

7.5.5 Management: Referring to the JCA arboricultural report ensure all necessary arboriculturist advice on management is followed.

7.5.6 Where trees are necessarily removed, there should be a policy encouraged of replacing two for one; replacement trees are the same species as those felled or species more suitable to the ecological profile of the area.

7.5.7 After completing any future tree works such as pruning or felling, all dead wood must be retained on site and created into log piles in suitable and sheltered positions. This will then provide habitat for flora and fauna such as fungus and invertebrates.

7.6 Planters and Plant beds

7.6.1 Summary: Across campus there are many planters and plant beds. These plant beds are lacking a planting scheme or management which would significantly raise the biodiversity potential they currently have. Using the planting lists provided below and ensuring all planters are soil planters, removing any artificial lining, will increase their biodiversity potential. All plants selected below are either native or non- native but are chosen for a specific ecological purpose such as extending the flowering season. The plants chosen range in colour, and petal size, ensuring the maximum benefits are provided for a range of pollinator species.

The following species are native herbaceous perennials unless stated otherwise:

Table 10: List for small to medium sized planters and flower beds

Common name	Scientific Name	Common name	Scientific Name
common harebell	*Campanula rotundifolia*	common foxglove	*Digitalis purpurea*
Marsh Helleborine	*Epipactis palustris (Protected and KBAP)*	cornflower	*Centaurea cyanus*
wood avens	*Geum urbanum*	common harebell	*Campanula rotundifolia*
cornflower	*Centaurea cyanus*	common foxglove	*Digitalis purpurea*
marsh Helleborine	*Epipactis palustris* (KBAP species)	horseshoe vetch	*Hippocrepis comosa*
native bluebell	*Hyacinthoides non-scripta* (Protected and KBAP species)	ox-eye daisy	*Leucanthemum vulgare*
bird's foot trefoil	*Lotus corniculatus*	wood forget-me-not	*Myosotis sylvatica*
common poppy	*Papaver rhoeas*	tormentil	*Potentilla erecta*
creeping cinquefoil	*Potentilla reptans*	common cowslip	*Primula veris*
primrose	*Primula vulgaris*	selfheal	*Prunella vulgaris*
meadow buttercup	*Ranunculus acris*	creeping buttercup	*Ranunculus repens*
red campion	*Silene dioic*	white campion	*Silene latifolia subsp. alba*
greater stitchwort	*Stellaria holostea*	wild thyme	*Thymus polytrichus*
red clover	*Trifolium pratense*	germander speedwell	*Veronica chamaedrys*
common vetch	*Vicia sativa*	common tufted vetch	*Vicia cracca*
ivy Leaved Bellflower	*Wahlenbergia hederacea* (KBAP species)		

Table 11*: Flora for large, ground planters (e.g., to replace current wood chipping & slate planters).

Common name	Scientific Name	Common name	Scientific Name
common yarrow	*Achillea millefolium*	Pyramidal Orchid	*Anacamptis pyramidalis (KBAP species)*
cornflower	*Centaurea cyanus*	common knapweed	*Centaurea nigra*
common dogwood	*Cornus sanguinea*	common hawthorn	*Crataegus monogyna*
common broom	*Cytisus scoparius*	Early Marsh Orchid	*Dactylorhiza incarnat (KBAP)*

common foxglove	*Digitalis purpurea*	alder buckthorn	*Frangula alnus*
hedge bedstraw	*Galium mollugo*	Dyer's Greenweed	*Genista tinctoria (KBAP)*
cow parsnip	*Heracleum sphondylium*	orpine	*Hydrotelephium telephium*
common holly	*Ilex aquifolium*	common honeysuckle	*Lonicera periclymenum*
Crab apple	*Malus sylvestris*	changing forget-me-not	*Myosotis discolor (KBAP)*
Cotton thistle	*Onopordum acanthium*	wild cherry	*Prunus avium*
bird cherry	*Prunus padus*		

7.7 Huddersfield Narrow Canal

7.7.1 Summary: The Huddersfield Narrow canal is the main foraging habitat on the campus, and as mentioned is an important feature for biodiversity. Any maintenance or enhancement works which is deemed to affect the canal, needs to be approved by the Canal & River Trust. The Canal & River Trust has a number of volunteer schemes aiming at increasing biodiversity along their canals.

7.7.2 A focus for the university is reducing the litter that blows into the canal. A method to reduce this, is planting scrub or hedgerow borders along the canal which would also increase biodiversity on campus.

7.7.3 As mentioned in section 5.2.5, the canal area adjacent to the Health Centre is now stagnant water due to overgrown vegetation. The first step for enhancing this area is establishing what species are present, most importantly, excluding Great Crested Newts. If Great Crested Newts can be excluded, maintenance may include dredging and weed cutting in this area of the canal. However, management and enhancement decisions regarding the canal area must be agreed with the Canal & River Trust, with the aim of working collectively to increase biodiversity along the canal.

7.8 Faunal boxes

7.8.1 Summary: Faunal boxes should be placed in various places across the campus to increase biodiversity. The focus should be on placing bird boxes on as many trees as possible and bat boxes on the trees bordering the canal, as that is the most likely area bats will use to forage. Insect

hotels should be placed in areas of dense scrub, which is mainly the 'woodland walk' area for the time being. However, should a wildflower meadow planting scheme be developed, insect hotels should be placed in those areas. Hedgehog houses should be placed in scrub areas and any other areas of dense vegetation onsite.

Bird Boxes (All chosen from the nhbs website)

7.8.2 Vivara Pro Barcelona Box: This box has been chosen as they are manufactured using WoodStone and will not rot away or deteriorate. These open nest boxes are suitable for wrens *Troglodytidae*, robins *Erithacus rubecula*, spotted flycatchers *Muscicapa striata*, pied and grey wagtails *Motacilla* sp, song thrushes *Turdus philomelos* and blackbirds *Turdus merula*.

7.8.3 Vivara Pro Seville 32mm WoodStone Nest Box: This box has been chosen as it made out of the durable Woodstone material. This has a smaller entrance hole making it suitable for many species such as blue tits *Cyanistes caeruleus* and tree and house sparrows *Passeridae* sp.

7.8.4 3S Schwegler Starling Nest Box: This box has been chosen as it is a durable box with the aim of attracting starlings to the campus. Starlings are a KBAP species and are widespread throughout Kirklees, so there is a high chance they will be found on campus. Not only will the 3S nest box attract starlings, but it is also likely to provide overnight shelter for great spotted *Dendrocopos major*, middle spotted *Dendrocopos medius* and lesser spotted woodpeckers *Dryobates minor*.

7.8.5 Positioning: The boxes should face between north and east, thus avoiding strong sunlight and the wettest winds and should be put up during the autumn.

7.8.6 For tit species, sparrows or starling's, boxes should be fixed two to four metres up a tree or a wall. The boxes have been chosen to encourage these species, with specific focus on encouraging willow tits which are a KBAP species.

7.8.7 House sparrows *Passer domesticus* and starlings *Sturnidae* will readily use nest boxes placed high up under the eaves. Although it is not currently in the university plans to place bird/bat boxes on buildings, this should be considered in the future to encourage specific species which have adapted to using buildings, such as the ones mentioned.

7.8.8 Boxes should be attached with either a nylon bolt or with wire around the trunk or branch.

Bat Boxes

7.8.9 Summary: All British bat species are protected by UK legislation. This is in response to the declines experienced by many bat species over the past century. The cause of the decline could be linked to a number of factors, including habitat loss, pesticide over-use, habitat fragmentation, loss of roost sites and roost disturbance.

7.8.10 There are a wide range of different bat boxes available, including both internal and external designs. External designs include the traditional wooden and woodcrete boxes. Internal designs include boxes that can be built into the walls, with a front that mimics the brickwork of the building, essentially becoming invisible. Other roost opportunities include cutting slots into soffit boxes, using bat bricks that lead into cavity walls and using lifted tiles to allow access into the loft.

7.8.11 Positioning: Bat Boxes should be positioned at least 4m high, with their front facing north, southwest or southeast (as recommended by the BCT). It is recommended one of each bat box is placed on each tree. This will allow each box to gain a different amount of warmth from the sun, creating a range of different environmental conditions for bats to choose from. The selected boxes should be constructed of woodcrete or similar in order increase their life expectancy. A range of different designs should be selected in order to increase the likelihood of bats roosting within the site (see appendix 4).

7.8.12 Bat boxes onsite should mostly be positioned on trees bordering the canal. This is deemed the most likely area bats will be using currently to forage, so it is most beneficial to place boxes near this habitat. Three species of bat are included in the KBAP species list, making their encouragement to campus even more vital for meeting local biodiversity objectives.

Insect boxes

7.8.13 Summary: Insects are the primary food source for many of the rare or protected animals that regularly visit gardens. Thus, encouraging insects into a site will then attract their predators, such as birds and bats.

7.8.14 Many insect species will hibernate over winter in their adult state, such as butterflies, ladybirds and lacewings. In nature, these insects would

hibernate within features such as leaf litter or other plant debris. However, gardeners tend to over-maintain their gardens, often tidying these features away in the autumn and reducing habitat available for invertebrate species to hibernate in.

7.8.15 Positioning: It is recommended as additional habitat is created such as the wildflower meadows, and pollinator friendly planters, insect boxes and houses should be placed within or adjacent to this habitat. The nhbs website has many good examples of insect houses and hotels and placing a variety of these across campus will increase biodiversity and can be used for educational purposes.

Hedgehog Shelters

7.8.16 Summary: Hedgehog numbers have declined by 90% over the past 50 years due to a number of factors including habitat loss, fragmentation and parasites. Providing shelter and a means of dispersal in gardens will encourage hedgehogs to visit the site and utilise the natural space.

7.8.17 Positioning: Hedgehog shelters should be situated in a quiet corner of a patch of grassland, preferably under vegetation. The entrance should not face North or Northeast to avoid prevailing winds. Place inside the shelter dried leaves or hay for bedding.

7.8.18 Hedgehog shelters should be positioned in areas which have high scrub or vegetation density. If scrub planting occurs in any additional areas on campus, hedgehog shelters should be placed in this habitat.

7.8.19 As new developments in the future continue across the campus, walls and fences may be erected, this blocking hedgehog dispersal. A simple solution is to create a 13x13cm access hole at ground level into fences in each garden to allow hedgehogs to freely move between green spaces (Bunnell 2014).

7.9 Lighting Scheme

7.9.1 Lighting: Lighting is most likely a requirement on campus due to safety reasons. Where possible, the levels of light on site should be as low as safety permits. Lighting columns height near hedgerows or trees should be kept to a minimum as this reduces the ecological impact. Where lighting can be directed downwards at a more acute angle, taller columns can be used. Please refer to the Bat Conservation Trust's Bats and Lighting in the UK (2009).

8 Management and Monitoring

8.1.1 A system of surveying and monitoring will allow the University to both monitor progress against goals of campus wide biodiversity increase included in this report, and report on contributions it has made to the local, regional, and national BAPs. Some surveys do not need to be conducted by professionals and can be carried out by students in related fields of study and used as opportunities to develop employability skills.

8.1.2 It is recommended that a full management plan is created to inform people what is required on site to maintain biodiversity. The management plan should include who, how and when specific surveys will be undertaken such as bird, bat, invertebrate and hedgehog surveys.

8.1.3 It also is essential to monitor the progress of flora diversity being introduced onto campus. This can be done by ensuring in the management plan, a count of the number of trees planted or hedgerows grown/managed should be recorded.

8.1.4 Another important feature to include in the management plan should be the maintenance regime of planters, plant beds, scrub, and grassland areas. The regime should include a weeding and cutting regime. This ensures maintenance is being conducted in the correct manor to encourage biodiversity.

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Surveys and mitigation plans: protected species - Detailed guidance (2015) *Gov.uk*. Available at: https://www.gov.uk/guidance/surveys-and-mitigation-plans-protected-species

Within this detailed guidance on surveys and mitigation information is available on the following protected species:

- Bats
- Natterjack toads
- Otters
- Reptiles
- Water voles
- White-clawed crayfish
- Wild birds
- Hazel dormice
- Great crested newts
- Badgers

Wildlife licences: when you need to apply - Detailed guidance (2014) *Gov.uk*. Available at: https://www.gov.uk/guidance/wildlife-licences

Within this detailed guidance on licensing information is available on licences for the following protected species:

- Bats
- Natterjack toads
- Otters
- Reptiles
- Water voles
- White-clawed crayfish
- Wild birds
- Hazel dormice
- Great crested newts
- Badgers

As well as:

- Non-native Bumblebee species
- Deer
- Freshwater fish
- Invertebrates
- Mink, coypu, muskrat and grey squirrel
- Plants

Species Specific Information:

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Appendices

Appendix 1: Phase 1 Habitat Map

Phase 1 Map Huddersfield University 17145b

- Target note
- Intact Species Poor Hedge
- Introduced Shrub
- Scattered Trees
- Running Water
- Amenity Grassland
- Scrub
- Buildings

Appendix 2: Planters Species List

Common name	Scientific Name	Planter/Plant bed
Goatsbeard (herbaceous perennial)	*Aruncus dioicus*	Planter
Chinese astibile (herbaceous perennial)	*Astilbe chinensis*	Planter
Herb Robert (herbaceous biennial)	*Geranium robertianum*	Planter
Common yew	*Taxus baccata*	Planter
Turkey corn (herbaceous perennial)	*Dicentra cucullaria*	Planter
Flame of the woods	*Ixora coccinea*	Planter
Dwarf lilyturf (herbaceous perennial)	*Ophiopogon japonicus*	Planter
Himalayan blackberry	*Rubus armeniacus*	Plant bed
Autumn olive	*Elaeagnus umbellata*	Plant bed
Common hawthorn	*Crataegus monogyna*	Plant bed
Red elderberry	*Sambucus racemosa*	Plant bed
American elm	*Ulmus glabra*	Plant bed
Field maple	*Acer campestre*	Plant bed
Winterberry	*Ilex verticillata*	Plant bed
Holly	*Ilex* sp.	Plant bed
Wintercreeper	*Euonymus fortunei*	Plant bed
Red bistort (herbaceous perennial)	*Persicaria amplexicaulis*	Plant bed
Sedge	*Carex* sp.	Plant bed
Common dogwood	*Cornus sanguinea*	Plant bed
Osier	*Salix viminalis*	Plant bed
Buddleia	*Buddleja davidii*	Plant bed
Garden thyme	*Thymus vulgaris*	Plant bed
Cherry laurel	*Prunus laurocerasus*	Plant bed
New Zealand flax	*Phormium tenax*	Planter

Gray rupturewort (herbaceous perennial)	*Herniaria incana*	Planter
Red valerian (herbaceous perennial)	*Centranthus ruber*	Planter
Ash	*Fraxinus excelsior*	Planter
Lavender	*Lavandula* sp.	Planter
Perennial pea (herbaceous perennial)	*Lathyrus latifolius*	Planter
Sow thistle (herbaceous perennial)	*Sonchus* sp.	Planter
Candle larkspur (herbaceous perennial)	*Delphinium elatum*	Planter
Cypress	*Cupressus* sp.	Planter
Plum	*Prunus domestica*	Planter
Japanese skimmia	*Skimmia japonica*	Plant bed
Meadow cranesbill (herbaceous perennial)	*Geranium pratense*	Plant bed
Bloody cranesbill (herbaceous perennial)	*Geranium sanguineum*	Plant bed
Woodbalm	*Lepechinia calycina*	Plant bed
Japanese meadowsweet	*Spiraea japonica*	Plant bed
Bentgrass (perennial grass)	*Agrostis*	Plant bed
Firecracker bush	*Russelia equisetiformis*	Plant bed
Ribwort plantain (herbaceous perennial)	*Plantago lanceolata*	Plant bed
Common box	*Buxus sempervirens*	Plant bed
Pale smartweed (herbaceous annual)	*Persicaria lapathifolia*	Plant bed
Red hot poker	*Kniphofia uvaria*	Plant bed
Wormwood (herbaceous perennial)	*Artemisia absinthium*	Planter
Fleabane (herbaceous perennial)	*Pulicaria dysenterica*	Planter
Common zinnia (herbaceous annual)	*Zinnia elegans*	Planter
Ti (evergreen)	*Cordyline fruticosa*	Planter
Fuchsia	*Fuchsia* sp.	Planter

Flowering tobacco (herbaceous perennial)	*Nicotiana alata*	Planter
Callery pear	*Pyrus calleryana*	Planter
Large white petunia (herbaceous annual)	*Petunia axillaris*	Planter
Poppy anemone (herbaceous perennial)	*Anemone coronaria*	Planter
Scarlet monkeyflower	*Erythranthe cardinalis*	Planter
African lily (perennial bulb)	*Agapanthus africanus*	Planter
Lavender cotton	*Santolina chamaecyparissus*	Planter

Appendix 3: Photographic Evidence

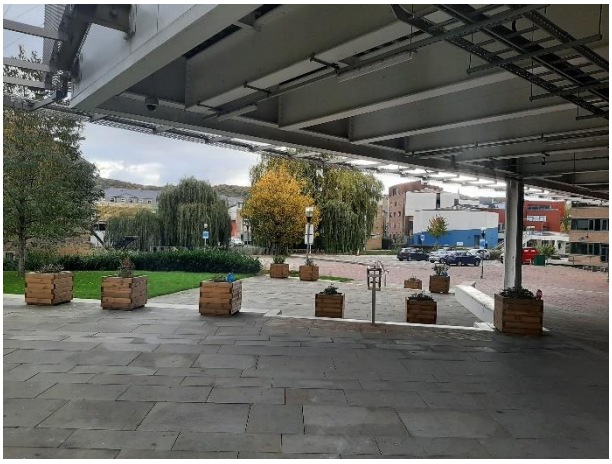


Photo 1: Planters at the Wakefield Road entrance north of the site.

Photo 2: Slate planters in the east section of the site.

Photo 3: Scattered trees in front of the Charles Sikes building

Photo 4: Planters outside the main reception building.

Photo 5: More planters outside the main building.

Photo 6: Narrow canal.

Photo 7: Another view of the narrow canal.

Photo 8: Area of the canal opposite the school of business which is overgrown and contains Himalayan balsam.

Photo 9: The 'woodland walk' area which is dense scrub and scattered trees.

Photo 10: Intact species poor hedge found at the front of the university.

Photo 11: More planters found across the site.

Photo 12: Planters, scattered trees, and amenity grassland at the university entrance.

Appendix 4: Faunal box information

Bat Box	Description	Details
	**1FD Schwegler Bat Box** The Schwegler 1FD has been developed specifically for smaller bats as both the interior and the type and size of the entrance hole match the requirements of smaller species. It features a special layout inside the domed roof, an increased interior height, and two grooved internal wooden front panels with precise spacing between them. This model has proved highly effective as a nursing area. The front panel can be removed for cleaning and inspection.	Material: Schwegler wood-concrete, galvanised steel hanger * Diameter: 16cm * Height: 36cm * Weight: 4.8kg
	**2F Schwegler Bat Box** It is ideal as a starter box to see if there are bats in your area or to provide much needed secure roosting space. It has been designed as a summer roosting space for bats and has a simple entrance hole at the front. The 2F is manufactured from long-lasting Woodcrete, which is a blend of wood, concrete and clay which will not rot, leak, crack or warp, and will last for at least 20 - 25 years, making it suitable for long-term mitigation projects. The 2F bat box can be sited on a tree or building and is best positioned at a height of between 3 to 6 metres in an open sunny position.	Height: 33cm * Diameter: 16cm * Weight: 4kg * Material: Schwegler Woodcrete * Colour: Black with grey front panel * Supplied with: Hanger and aluminium tree-friendly nail

Bird Box	Description	Details
	**<u>Vivara Pro Barcelona Box</u>** Nest boxes are manufactured from WoodStone which is a mix of concrete and FSC certified wood fibres. Unlike a traditional wooden nest box, these boxes will not rot away or deteriorate and are guaranteed for 10 years. The best height for your nest box is between 1.5m and 3m high, and open nest boxes should be sited in undergrowth such as ivy to provide cover for the nest. These nest boxes have a removable front panel for easy cleaning.	Width: 19cm * Height: 24cm * Length: 17.5cm * Entrance hole: Open
	**<u>Vivara Pro Seville 32mm WoodStone Nest Box</u>** Attractive nest boxes are manufactured from WoodStone which is a mix of concrete and FSC certified wood fibres. Unlike a traditional wooden nest box, these boxes will not rot away or deteriorate and are guaranteed for 10 years. The best height for your nest box is between 1.5m and 3m high, and should be sited higher if your area has a particularly high cat population. These nest boxes have a removable front panel for easy cleaning.	Entrance hole diameter: 32mm * Width: 20cm * Height: 31cm * Length: 20cm * Weight: 6.9kg

	**3S Schwegler Starling Nest Box** Because of the relatively large entrance hole (45mm diameter), the interior is well lit which encourages occupation. The large diameter nesting chamber (140mm) also helps to encourage occupation.	External dimensions: 28 x 19 x 20cm * Entrance hole diameter: 45mm * Nesting chamber diameter: 14cm * Weight: 4.4kg

Insect Hotels	Description	Details
	**National Trust Apex Insect House** National Trust Apex Insect House is an ideal addition to any wildlife friendly garden. With a variety of shelter types, it offers a perfect habitat for important invertebrates such as lacewings, ladybirds, and even some butterflies. Simply hang the house less than two meters from the ground or place in a sheltered position amongst vegetation and watch for the arrival of its first occupants.	Dimensions: 11cm x 26cm x 28cm
	**Bug Box Kit** The flat pack kit comes supplied with fixings and instructions included. All you need to assemble the box is a Phillips screwdriver and a pin hammer. The pre-cut wooden panels are constructed of FSC exterior grade plywood, and the whole box can be	Material: FSC Certified Exterior Grade European Birch Plywood * Height: 23cm * Width: 13cm * Depth: 15cm * Weight: 900g

	painted to produce a unique, personalised insect hotel.	

Hedgehog shelters	Description	Details
	**<u>Hedgehog House</u>** Underneath the textured brushwood finish there is a sturdy steel frame covered with a waterproof felt lining. The wooden entrance door is manufactured from FSC wood and forms a short predator defence tunnel, small enough to deter access by dogs or badgers. The edges of the house can be pegged down using tent pegs to provide extra security. To encourage hedgehogs to use the house, place it in a quiet corner of the garden and cover with leaves for extra camouflage.	Dimensions: (H) 210 x (W) 380 x (D) 490mm Weight: 1.9kg Material: Steel frame, waterproof felt roof, brushwood exterior, FSC wooden door (painted brown), rattan edge

Appendix 5: Glossary

Activity surveys - are used to assess the level of bat activity at a site. This can be done either by using equipment such as an AnaBat device, or manually walking around a site with a heterodyne detector, documenting the number of bat passes and interceptions.

Dawn surveys - begin around 2 hours before and up to sunrise when bats are returning to their roosts from foraging, and swarming behaviour can be seen close to roost entrances.

Dusk surveys - begin around 30 minutes before sunset and up to 2 hours afterwards. These are done in order to see bats emerging from their roost sites at night.

Echolocation – is a system similar to sonar that allows bats to travel and forage even in total darkness. Bats make a call and then listen to the returning echoes in order to build up a map of their surrounding area. This allows bats to gauge the identity and distance of an object by how long the echo takes to return to them.

Habitat - the ecological or environmental area that is inhabited by a particular species of animal, plant or other type of organism.

Hibernation - is a state of inactivity and metabolic depression characterized by lower body temperature, slower breathing, and lower metabolic rate. Hibernating animals conserve energy, especially during winter when food is short, tapping energy reserves, i.e. body fat, at a slow rate.

Hibernacula - typically consist of underground sites, such as caves and cellars, which remain relatively cold and humid. Bats will hibernate to conserve energy over the winter months when falling temperatures cause a drop in the abundance of insects. These will typically be colonised around November to around March.

Insectivorous – is when an organism feeds exclusively on insects.

Nocturnal - a behaviour characterized by being active during the night and sleeping during the day.

Maternity roosts – colonised around late May early June and consist of mature females and their young. These roosts need to be warm and quiet, and are used up until around August, with females typically leaving first and then the young.

Mating roosts – mating begins around late October to November. Males of most species use special mating calls to attract females. These can include purrs, clicks and buzzing.

Roost – a site where bats live during the day, rear young and hibernate. These can be in man made structures, such as buildings, bridges, tunnels, cellars and mines, or natural features such as mature trees and caves.

Roosts in buildings – many types of buildings will be used by bats. The most likely sites are agricultural buildings (e.g. farmhouses and barns), buildings with exposed wooden beams (greater than 20cm thick), buildings with weather boarding and/or hanging tiles, and buildings close to woodland and/or water.

Roosts in trees – these are typically in mature trees with deep sheltered cracks, under loose sections of bark, or in woodpecker holes.

Species – a group of organisms in which all members can interbreed and produce viable offspring.

Summer roosts (non-breeding) - these are generally occupied by groups of males and immature females during the summer, and are usually only occupied for a short period before the group moves to another location.

Swarming – a behaviour exhibited by bats returning to their roost sites at dawn. Bats can be seen repeatedly flying to and from the roost entrance, making it much easier for consultants to identify where roosts are on a building or structure.

Temporary/Transitory roosts – These are used after hibernation (March – April) before mature females disperse to maternity roosts and male/immature females colonise summer (non-breeding) roosts. Similarly, temporary roosts form before hibernation (August -October).

Underground Roosts – these are typically used during the winter and can be mines, caves, tunnels or cellars.

Appendix 6: Protected Species Information

The following species are fully protected in UK law, under the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019:

- All UK bat species
- Dormouse
- Great Crested Newt and Natterjack Toad
- Large Blue Butterfly
- Otter
- Pine Marten
- Polecat
- Scottish Wild Cat
- Smooth Snake and Sand Lizard
- Various aquatic and plant species

These species are afforded the highest protection in the UK. Under this protection it is an offence to; deliberately capture, injure or kill any wild animal of a European protected species; deliberately disturb wild animal of any such species; deliberately take or destroy the eggs of such an animal, or damage or destroy a breeding site or resting place of such an animal.

In addition to this it is an offence to be in possession of, or to control, transport, sell or exchange, or to offer for sale or exchange, a European Protected species.

The following species are protected under UK law, such as the Wildlife and Countryside Act 1981 (as amended):

- Badger
- Nesting birds
- Red Squirrel
- Reptiles (Adder, Common lizard, Grass snake, Slow worm)
- Water Vole
- White Clawed Crayfish
- Various bird species i.e. Barn Owl
- Various plant species

Therefore under this protection it is an offence to; kill, injure or take any of the above species.

Nesting birds are only protected during the breeding season whilst on their nest. In addition to the adults being protected, the eggs, young and nest itself whilst in use are protected.

The Wildlife and Countryside Act 1981 also contains measures to prevent the establishment of non-native species which may be detrimental to native wildlife, prohibiting the release of animals and planting of plants listed in Schedule 9 in England and Wales (e.g. Japanese Knotweed and Himalayan Balsam).

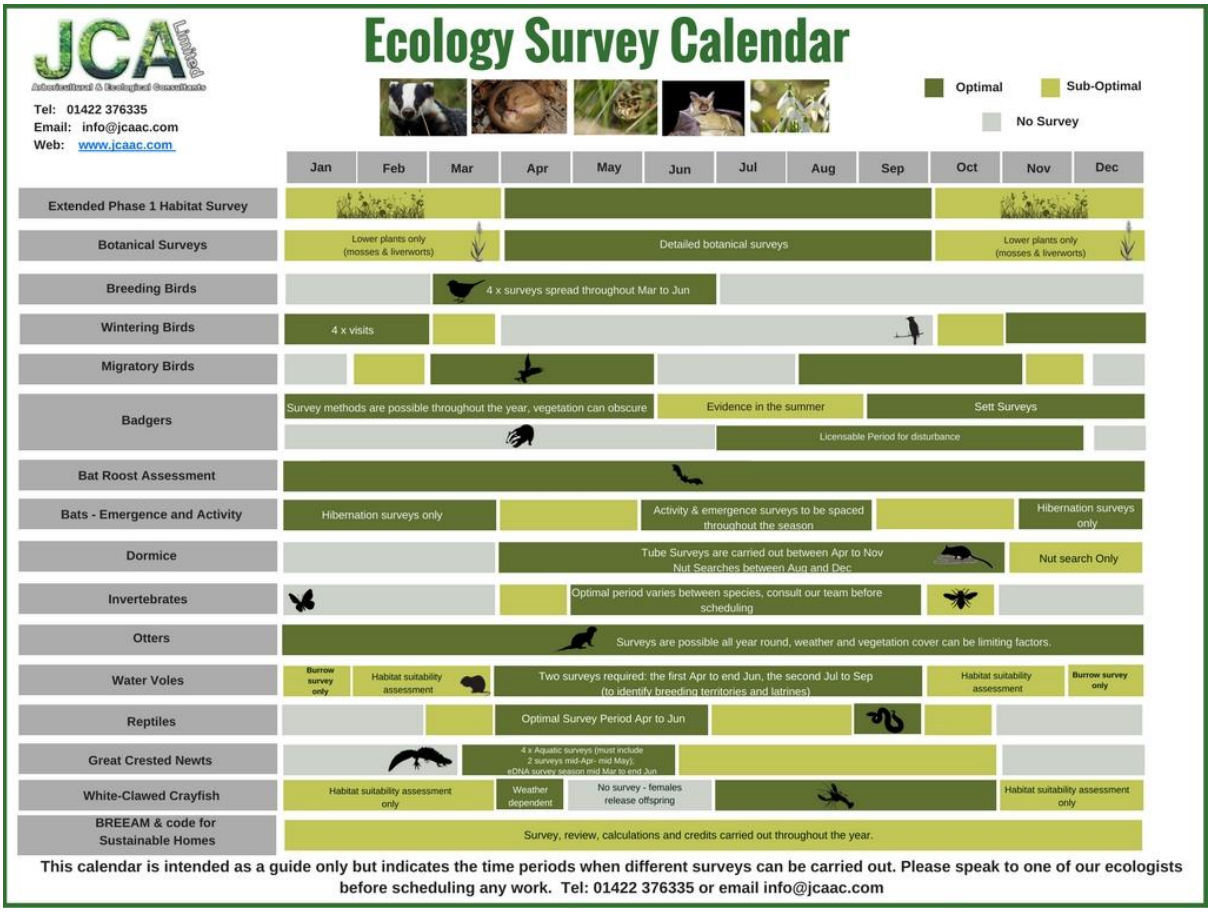
Badgers are protected under The Protection of Badgers Act 1992. Under this legislation it is an offence to; take, injure, kill, or cruelly ill-treat a badger; interfere with a badger sett; sell or possess a live badger; or mark or ring a badger.

The following habitat types are protected under UK Law:

- Habitats that are used by protected species
- Habitats that fall within designated sites
- Hedgerows
- Individual trees/woods can be protected under Tree Preservation Orders

Appendix 7: Survey Calendar

Figure 2: Survey calendar for protected species and habitat surveys.



Appendix 8: Author Qualifications

Adam West, Principal Ecologist

BSc (Hons) Animal and Wildlife Management.

Adam joined JCA to lead the expanding ecology department. Having returned to education as a mature student, Adam studied Countryside Management for two years before undertaking a Batchelor's degree, for which he was awarded First Class Honours. Adam has many years' experience in ecological consultancy, working on projects ranging from individual planning applications to national infrastructure projects. Adam holds a Natural England Level 1 great crested newt survey class licence, a Natural England Level 2 bat survey class licence (and the Scottish and Welsh equivalents) and a CSCS card.

Poppy McDermott, Graduate Ecologist

BSc (Hons) Ecology and Conservation

Poppy joined JCA after completing her degree for three years at Nottingham Trent University in Ecology and Conservation. She has gained practical experience in protected species surveying and report writing whilst at university and is hoping to further develop these skills and consultancy experience whilst at JCA.

The Information and advice which we have prepared and provided is true and has been prepared and provided in accordance with the CIEEM's Code of Professional Conduct. We confirm that the opinions expressed are our true and bona fide opinions.

Signed

.....

Poppy McDermott *Student CIEEM member*

02/12/2021

Reviewed by

.....

Adam West

03/12/2021

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ECOLOGICAL SERVICES

Ecological Pre-Planning Services

- Phase 1 Habitat Surveys
- Great Crested Newt eDNA Sampling
- Protected species: Bat, Wintering and Nesting Bird, Badger, Amphibian, Otter, Water Vole, White-Clawed Crayfish, Dormice and Reptile Surveys.
- Preparation for Environmental Impact Assessment (EIA)
- Invasive Species Surveys
- Code for Sustainable Homes
- Butterfly & Insect Surveys

Ecological Post-Planning Services

- Biodiversity Enhancement Plans
- Protected Species Mitigation
- Ecological Management (Bat and Bird box installation and inspection)
- Planting Schemes
- Monitoring of bird or bat boxes.

ARBORICULTURAL SERVICES

Guidance for Architects & Developers

- British Standard 5837 Surveys
- Arboricultural Implications Assessments (AIA)
- Arboricultural Method Statements (AMS)

Advice for Engineers, Loss Adjusters and Insurers

- Tree Surveys for Subsidence
- Heave Assessment
- Tree Root Identification

Advice for Local Authorities and Social Housing

- Tree Safety Surveys
- Specialist Decay Detection
- Landscape and Orchard Design

Tree Advice for the Legal Profession

- Subsidence Litigation
- Personal Injury and Accident Investigation
- Expert Witness, Planning Inquiries and Appeals

Veteran Tree Management

- Ancient Woodland Management
- Veteran Tree Management

Tree Health and Pest and Disease Management

- Pest and Disease Surveys
- Tree Health Checks
- Disease Mitigation and Control

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