3. Environmental Information

This section provides a summary of the current habitat at Castle Lake and the flora and fauna recorded at the site.

3.1 Physical

The underlying geology of Castle Lake is solid, Permian magnesian limestone. Soil types are predominantly light, magnesian limestone and till. Castle Lake, as a water body on limestone, is a comparatively rare habitat. As Durkin has underlined with regard to magnesian limestone habitat, 'the porous nature of the limestone reduces the likelihood of ponds and marshes forming on its surface. Only the presence of glacial boulder clay here and there creates a waterproof liner for wetlands. Consequently, ponds are very scarce on the limestone, and most are in old clay pits. They often have a richer flora than ponds on the coal measures. Particularly important are "flushes", which are grasslands on sloping banks, with calcareous water trickling downhill' (Durham Wildlife Trust, 2007).

3.2 Habitat & Structure

Durham Bird Club has developed Castle Lake to attract a wide range of bird species with the addition of breeding islands, scrapes, wet ditches, reed beds and hedgerow systems. The surrounding pasture is primarily grazed throughout the year with fields also cut for silage, although in within the last 20 years, these fields have also been cultivated for cereal and root vegetable production. Some fields, for example 'Castle Field' to the north of the site, also include areas of exposed limestone rock because of historical quarrying activities and the existence of ruined buildings. This provides suitable habitat for specialist flora associated with magnesian limestone. The old 'deer park' wall, albeit in need of substantial restoration, neatly surrounds the land tenure. This ancient wall is full of nooks and crannies amongst the crumbling masonry, offering an interesting habitat for invertebrates, small mammals and birds, interspersed with scattered scrub and individual hawthorn. A modern sewage water treatment works serving Bishop Middleham is now situated in the central north-west corner, and amongst the water treatment facilities are cut grassland and occasional shrubs. A butterfly and dragonfly survey of this site in 2010 concluded that the sewage treatment works had little environmental value, especially with regards to botanical interest, owing to the mown grassland of the main operational zone and the heavy grazing taking place in the site's redundant area (Eales, 2010).


Deer Park Wall (south end and north side) demonstrates the completeness of this structure and its poor condition, but also it's potential as a micro-habitat (Fred Milton)

The north of the lake is shallow with peat formation. Lowland peat bog is a rare and increasingly threatened habitat. The shallow basin formed by Castle Field and quarrying activity allied to poor water drainage provided ideal conditions for peat formation, as plant decay is slowed leading to layers of decomposing plant material. In addition, this boggy habitat may also have been supplemented by humus sediment from a sewage works that previously operated in this area from the early twentieth-century (now superseded by the current works).

A surviving small ruined brick building in situ may be a remnant of this plant. The shallow character of the north end of the lake allows extensive bare mud areas to develop in the autumn. This provides a rich feeding area and is especially attractive to feeding birds, although constant grazing has denuded this boggy area of flora of importance. The central section of the lake is deepest with a maximum depth of 1.5m. To the south, the lake is more of a gravel substrate with recently a planted Phragmites reed bed on the western edge. Areas of fencing have been erected to remove grazing pressure to develop marginal vegetation.

There is also a small pond to the west of the lake, separated by a causeway, and was formed by previous quarrying activity. This additional pond is attractive to small numbers of wildfowl and wading birds.


Castle Lake - looking southeast towards Sedgefield from the bird hide and from Castle Field. Emphasises extensive muddy margins of lake, May 2017 (Fred Milton)

Ariel view of Castle Lake – outline area of site boundary clearly defined (Google Map)

3.3 Biological – Flora (Lake Area)

Tree cover around the lake is minimal, with sporadic Crack Willow (S*alix fragilis*) shrubs only of note.

The boundary hedges of the surrounding fields predominantly consist of Hawthorn (*Crataegus monogyna*), Dog Rose (*Rosa canina*) and Bramble (*Rubus fruticosus*), with also occasional Oak (*Quercus robur*), Ash (*Fraxinus excelsior*), and Sycamore (*Acer pseudoplatanus*). Notably, many of the hedge-lines are shown on the Ordinance Survey map of 1888, thus indicating their longevity, and also that possibly of some of their tree-species, indeed the Foumarts Lane access route and field boundaries is lined by numerous mature trees, including Beech (*Fagus sylvatica*) and, notably several Hornbeam (*Carpinus betulus*), a relatively scarce species in Northern England.

The small areas of marshland on the fringes of the lake and its numerous islands support a range of aquatic and marginal species. These include: Meadowsweet (*Filipendula ulmaria*), Greater Willowherb *(Epilobium hirsutum*), Watermint (*Mentha aquatica),* Ladies Smock (*Cardamine*

pratensis), Northern Marsh Orchid (*Dactylorhiza purpurella*), Common Spotted Orchid (*Dactylorhiza fuchsii*), Brooklime (*Veronica beccabunga*), Water Forget-me-not (*Myosotis scorpioides*), Water Avens *(Geum rivale),* Great Burnet *(Sanguisorba officinalis*), Jointed Rush (*Juncus articulatus*), Greater Spearwort (*Ranunculus lingua*), Lesser Spearwort (*Ranunculus flammula*), Valerian (*Valeriana officinalis*), Cattail (*Typha latifolia*) and Pondweed (*Potamogeton spp*).

The drier areas around the lake support a wide range of species dominated by Speedwell (*Veronica spp.*), as well as Thistle (*Cirsium spp.*), St John's Wort (*Hypericum spp.*) and Cowslip (*Primula veris*). A field survey to assess the condition of lowland fen habitat in the Durham Magnesian Limestone Natural Area was carried out in September 2007, and included Castle Lake, its swampy fringes and also some surrounding wetland habitat (referred to as Bishop Middleham Deer Park Lake in the report). Forty-six plant species were recorded as being present, with at least 30 plant species as being present, with Mare's-tail (*Hippuris vulgaris*) and Pink-Water Speedwell (*Veronica catenata*) thought to be particularly dominant around the fringes of the lake and swamp areas at the north end. The report made no comment of any significant flora recorded.

The field survey concluded that in 2007, Castle Lake was thought to be 'in early stages of development and it will become more diverse', and that 'vegetation is sparse and developing, but includes some marginal *Hippuris* swamp'. The management recommendation for the site was to 'maintain grazing to lake margins and continue to allow water levels to fluctuate' (Durham Magnesian Limestone Fen Inventory, 2008).

However, as Eales (2010) recorded, heavy grazing can have a detrimental effect. That carried out within the redundant operational zone of the sewage treatment facility had produced an area of negligible botanical interest.

Reed beds in the south-west corner of Castle Lake (John Olley) Castle Lake, looking north – highlights grasslands surrounding the lake, and the comparative lack of vegetated lake shore (Neil Fawcett)

3.4 Biological – Flora (Surrounding Grassland and Pasture)

A comprehensive inventory semi-natural grasslands carried out during the summer of 2006 (Stobbs & Durkin, 2007) of the Sedgefield area included several sites around Bishop Middleham, including Bishop Middleham Castle Field. This was identified as a particularly rich grassland habitat that supported a wide range of significant flora.

The field is particularly noteworthy as 'it consists of dry and generally calcareous grassland with the better flora coinciding with areas of stone originating from the Castle foundations there are some steep gradients within the field which, together with the grazing regime, have helped to keep the grassland generally short'. Recommended management of Castle Field suggested that the current grazing regime was 'satisfactory' and that there should be no variation to this.

Fieldwork surveys of a small field north of Castle Field in 2006 observed it to be 'a rather neglected field which is ungrazed at the present time. The only species of interest is Crosswort (*Cruciata laevipes*)', but that the 'flora of this field would be helped by the adoption of an appropriate grazing regime. Outside, but adjacent to the 'Castle Lake' site, surveys were carried out on a number of other fields, although they were, from a botanical perspective, found to be of 'no interest' (Stobbs & Durkin, 2007).

Given the ability of new plants to appear via windborne seeds, it is noteworthy that a number of other fields and sites near to Castle Lake are of great botanical interest, particularly for magnesian limestone grassland species. These include areas adjacent to the former Bishop Middleham pit workings and the Bishop Middleham Quarry Nature Reserve, a SSSI currently managed by Durham Wildlife Trust for its nationally recognised plant life and large numbers of butterfly species.

Fieldwork carried out by Stobbs and Durkin (2007) recorded the following species within Castle Field:

Magnesian Limestone flora:
Yarrow (*Achillea millefolium*)
Daisy (*Bellis perrenis*)
Quaking Grass (*Briza media*)
Harebell (*Campanula rotundfolia*)
Shepheds purse (*Capsella bursa-pastoris*)
Musk Thistle (*Carduus nutans*)
Fern Grass (*Catapodium rigidum*)
Common Mouse ear (*Cerastium fontanum*)

Creeping Thistle (*Cirsium arvense*)
Pignut (*Conopodium majus*)
Crosswort (*Cruciata laevipes*)
Crested dogs tail (*Cynosurus cristatus*)
Cocks-foot (*Dactylis glomerata*)
Sheep's fescue (*Festuca ovina*)
Lady's bedstraw (*Galium verum*)
Doves-foot cranesbill (*Geranium molle*)
Autumnal hawkbit (*Leontodon autumnalis*)
Fairy flax (*Linum catharticum*)
Perennial rye grass (*Lolium perenne*)
Birds foot trefoil (*Lotus corniculatuus*)
Pineapple weed (*Matricaria discoidea*)
Black medic (*Medicago lupulina*)
Common restharrow (*Ononis repens*)
Redshank (*Persicaria maculosa*)
Timothy (*Phleum pratense*)
Mouse ear-hawkweed (*Pilosella officinarum*)
Ribwort plantain (*Plantago lanceolata*)
Greater plantain (*Plantago major*)
Hoary plantain (*Plantago media*)
Rough meadow grass (*Poa trivialis*)
Tormentil (*Potentilla erecta*)
Creeping cinquefoil (*Pontentilla raptans*)
Selfheal (*Prunella vulgaris*)
Meadow buttercup (*Ranunculus acris*)
Common sorrel (*Rumex acetosa*)
Salad burnet (*Sanguisorba minor*)
Prickly sow thistle (*Sonchus asper*)
Dandelion (*Taraxacum aggregate*)
Wild thyme (*Thymus polytrichus*)
Red clover (*Trifolium pratense*)
White clover (*Trifolium rapens*)
Stinging nettle (*Urtica dioica*)
Heath speedwell (*Veronica officinallis*)

Other flora noted across the Castle Lake site include important broad-leaved herbs with Common Bird's-foot-trefoil (*Lotus corniculatus*), Hare Bell (*Campanula rotundifolia)*, Cowslip (*Primula veris)*, Salad Burnet (*Sanguisorba minor)* and Wild Thyme (*Thymus polytrichus)* all prominent.

Less common species include Common Milkwort (*Polygala vulgaris)*, Common Dog Violet (*Viola riviniana)*, Wild Carrot (*Daucus carota)* and Musk Thistle (*Carduus nutans*). The more heavily grazed pasture holds predominantly Creeping Thistle (*Cirsium arvense*), Spear Thistle (*Cirsium vulgare*), Black Knapweed (*Centaurea nigra*), Common Daisy (*Bellis perennis*), Dandelion (*Taraxacum officinale*) and Dock (*Rumex patientia*).

Musk Thistle (Julie Hogg) and Hare Bell, a magnesian limestone specialist (John Olley), Castle Field – illustrates earthworks of Bishop Middleham Castle, previous quarrying activity and exposed magnesian limestone (Fred Milton).

3.6 Invertebrates

Damselflies and Dragonflies:
Common Blue (*Enallagma cyathigerum*)
Large Red Damselfly (*Pyrrhosoma nymphula*)
Blue-tailed Damselfly (*Ischnura elegans*)
Common Sympetrum (*Sympetrum striolatum*)
Common Aeshna (*Aeshna juncea*).
Four-spotted Chaser (*Libellula quadrimaculata*)
Common Darter (*Sympetrum striolatum*)

Given the wet habitat of Castle Lake and the availability of multiple shallow pools, it is noted there is definitely under recording of species of damselflies and dragonflies.

Lepidoptera:
Small White (*Pieris rapae*)
Large White (*Pieris brassicae*)
Green Veined White (*Pieris napi*)
Meadow Brown (*Maniola jurtina*)
Ringlet (*Aphantopus hyperantus*)
Speckled Wood (*Pararge aegeria*)
Red Admiral (*Vanessa atalanta*)
Painted Lady (*Vanessa cardui*)
Small Tortoiseshell (*Aglais urticae*)
Wall Brown (*Lassiomatta megera*)
Comma (*Polygonia c-album*)
Common Blue (*Polymattus icarus*)
Small Skipper (*Thymelicus sylvestris*)
Large Skipper (*Ochlodes sylvanus*)
Peacock (*Aglais io*)
Small Copper (*Lycaena phlaeas*)
Orange Tip (*Anthocharis cardamines*)

UK butterflies have undergone significant declines since the mid-1970s; indeed, 76% of the UK's resident and common migrants butterfly species have decreased in abundance over the past 40 years, with species on farmland recording a 57% decline in the period 1990-2014 (Fox *et al,* 2015).

Butterflies are under-recorded at Castle Lake, especially given the presence of magnesian limestone grassland habitat; this is highly attractive to several butterfly species, including some

scarce species, as shown by the wide variety of butterflies, including Northern Brown Argus (*Aricia artaxerxes*), recorded at nearby Bishop Middleham Quarry SSSI to the north of Castle Lake. Those butterfly species recorded at Castle Lake are relatively common species, with no significant records or numbers of note recorded. Despite the rather negative assessment of the ecological value of the adjacent sewage treatment works, nine species of butterfly were recorded during the course of a 2010 survey, although there was no evidence of any breeding taking place owing to the rather sparse and monoculture herbage (Eales, 2010).

Common Blue (John Olley)

3.7 Amphibians

Smooth Newt (*Triturus vulgaris*)
Common Frog (*Rana temporaria*)
Common Toad (*Bufo bufo*).

3.8 Mammals

Roe Deer (*Capreolus capreolus*)
Water Vole (*Arvicola amphibius)*
Brown Rat (*rattus norvigicus*)
Mole (*Talpa europaea*)
Eurasian Hedgehog (*Erinaceus europaeus*)
Rabbit (*Oryctolagus cuniculus*)
Brown Hare (*Lepus europeus*)
Fox (Vulpes vulpes)
Badger (*Meles meles*)
Stoat (*Mustela erminea*)

Weasel (*Mustela nivalis*)
Brown Long-eared Bat (*Plecotus auritus)*
Daubenton's Bat (*Myotis daubentonii)*
Noctule Bat (*Nyctalus noctula)*
Common Pipstrelle Bat (*Pipistrellus pipistrellus)*

Mammals are under-recorded at Castle Lake: for example, notable by their absence are any formal records of any species of mouse, vole or shrew, which, given the habitat and regular sightings of birds of prey and owls, are undoubtedly present in some numbers.

It is highly likely that Otter (*Lutra lutra)* is also present, given the size of water body, availability of food, and the nearby Still drain and River Skerne watercourses. Water Vole is probably the most significant mammal species recorded, with individuals noted in the lake and also the River Skerne. The population of Water Voles has undergone rapid decline, due to habitat destruction, the intensification of agriculture, water pollution and the spread of the introduced American Mink (*Neovison vison).*

Recent surveys suggested a loss of 67.5% of occupied sites and 88% of the remaining population in only seven years (Battersby, 2005). Therefore, any records at Castle Lake are important. Three species of bat have been definitely recorded at Castle Lake, although it is unlikely that any breed or roost there, given the lack of suitable locations.

Bishop Middleham village offers ideal bat roosting/breeding habitat, and an active Noctule roost was noted at a farm to the north of village in 2002, although the roost site was later destroyed by high winds. Interestingly, archaeological records also suggest the presence of Wolves (*Canis lupus*) at Bishop Middleham with bones thought to be this species found in an excavated cave, and most certainly to be dated as pre-medieval or earlier It is also believed that the species of deer kept in the deer park, were Fallow Deer **(***Dama dama*). This species is still housed in the deer parks at Raby Castle and Whitworth Park (Coult, 2012).

Roe Deer, October 2015 (Neil Fawcett)