

## Rivers and Wetlands (extract from The State of Nature in Oxfordshire 2017)



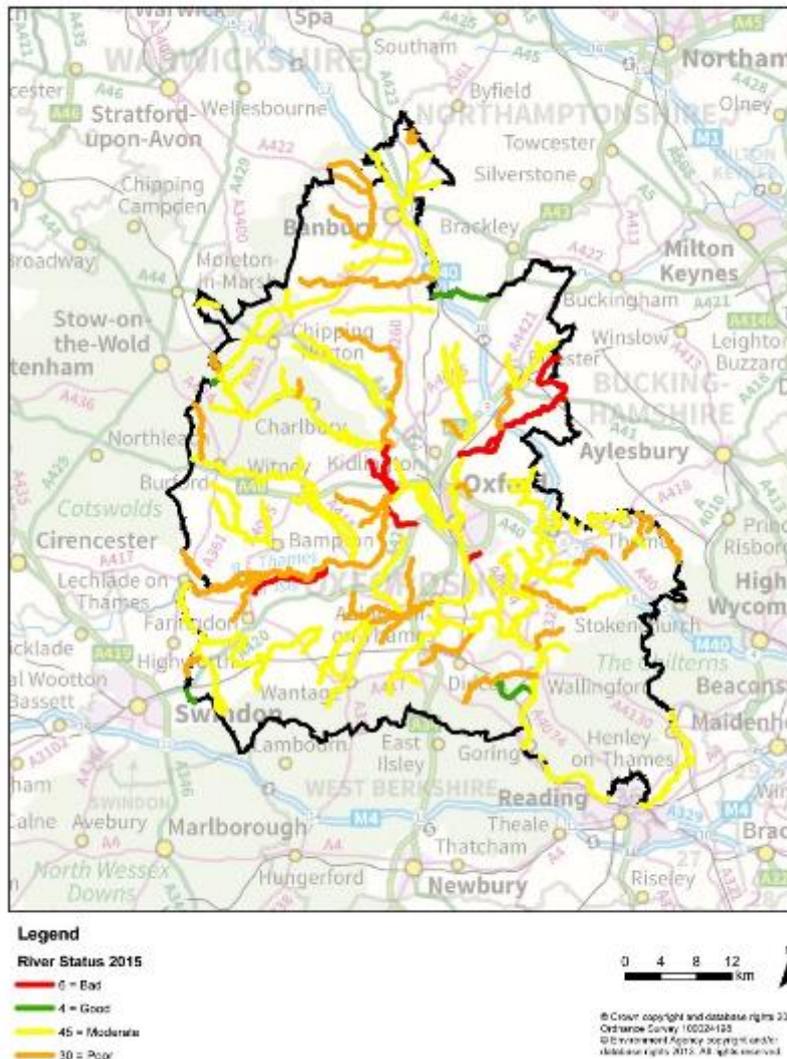
*Otmoor Nature Reserve © Eleanor Bentall /rspsb-images.com*

### Overview

Oxfordshire's landscape is defined by its river network, including eight major rivers (Leach, Windrush, Evenlode, Glyme, Cherwell, Oxon Ray, Ock, and Thames) and many smaller tributaries that flow through the county and into the Thames. Rivers and streams in semi-natural landscapes are typically associated with complexes of wetland habitats including floodplain wetlands, fens, wet grassland, oxbow lakes, permanent and temporary ponds and wet woodland. Along the roughly 73km of River Thames within Oxfordshire the river drops in elevation by around 30 metres over 26 Locks and their associated weirs. Weirs and locks can act as barriers to fish, eels and other species, preventing free movement up and downstream. This river network has been a major determinant of settlement and land use since long before Oxfordshire was created as a county, and continues to be a major influence on both current and future development. For example, the Eco-Bicester masterplan aims to 'Seek a network of open spaces incorporating river corridors and linking not only to existing space within the town but also the wider countryside' (Eco Bicester Strategic Delivery Board, 2010).

Oxfordshire has two canals. The Oxford Canal which is navigable and fully open and the Wiltshire & Berkshire Canal, which is in the early stages of restoration from a derelict state. The Oxford Canal runs from Banbury to Oxford where it connects at two points with the River Thames. At intervals along its course it uses the River Cherwell as the navigational route. The Wiltshire and Berkshire Canal runs from Abingdon to the county border near Shrivenham and will eventually link with the navigable Kennet and Avon Canal at Semington, near Trowbridge. Both canals form linear habitats linking natural or managed wildlife areas.

### 2015 WFD Status for Oxfordshire Rivers



There have been great improvements in water quality over recent decades, but there are still significant pressures: **Ecological status of waterbodies in Oxfordshire as defined under the European Water Framework Directive (WFD) September 2016:**

- 101 waterbodies fully or partly in the county:
- 5% at Good Status
- 55.5 % at Moderate Status
- 32.5 % at Poor Status
- 7 % at Bad Status

Groundwater provides 40% of our water supply, and at least 50% of groundwater used for public supply is showing significant long-term deterioration in quality through elevated nitrate levels as a result of the legacy of agricultural fertiliser use.

Rivers and freshwater

habitats have recently undergone an increase in activity to control pollution, manage habitats and protect against threats. The Environment Agency, conservation charities, anglers, action groups and the wider community are delivering hands-on river conservation, and promoting campaigns to raise public and political awareness. Initiatives based on citizen participation in monitoring (like the Thames Water-Blitz and FreshWater Watch) have shown that data acquired are complementary to Environment Agency data. Such initiatives help to generate knowledge around small streams and still water environments which are frequently overlooked at a larger scale, but are often key clean water habitats (such as in Freshwater Habitats Trust's 'Clean Water for Wildlife' survey). There have also been advances at policy level for example, the development of the Catchment Based Approach (Defra, 2013) and the recent changes to the Water Act 2014 (Defra, 2014) which will effectively enable water company over-abstraction to be more comprehensively addressed.

### Oxfordshire's Wetlands Headlines

- Between 1900 and 1998, water voles *Arvicola amphibius* suffered a 95% reduction in their range in the UK. Targeted conservation action in Oxfordshire has resulted in a three-fold increase in their Local Key Areas.

- The banning of toxic chemicals, improvements in water quality and legal protection have all helped to bring otters back to the Thames catchment, including in urban rivers.
- After an absence of about 200 years, bittern *Botaurus stellaris* and marsh harrier *Circus aeruginosus* have returned to breed in the new reedbed at RSPB's Otmoor reserve.
- Oxfordshire hosts a complex of calcareous species-rich fens that forms the largest remaining group of such habitats outside East Anglia and North Wales.
- Oxfordshire holds the major UK population of the rare fen violet *Viola persicifolia*, which is found at only three sites in the country.
- 15 invasive non-native species of most concern to the environment agency are found in Oxfordshire, including the demon shrimp *Dikerogammarus haemobaphes*.
- Reedbeds were once a common habitat in the low-lying areas of Oxfordshire, but today no large remnants remain.
- Once complete, the gravel pit restoration at Gill Mill in the Lower Windrush Valley will deliver one of the largest connected priority wildlife habitats in Southern England.

### The State of Wetland Nature

Oxfordshire has a range of wetland habitat types of great importance for a range of plant and animal species, with waterside habitats providing some of the richest environments for wildlife. Unfortunately, many wetland habitats are in a degraded state due to a lack of appropriate management, historical dredging that has disconnected rivers from their floodplain habitat, pollution and habitat loss through sand and gravel extraction, urban and industrial development (Rothero et al, 2016).

At a national level, slightly more freshwater species have declined than increased over recent decades (Burns *et al.* 2013). Currently we have no readily accessible data demonstrating local population trends apart from that relating to species with targeted projects to aid their recovery, such as the water vole *Arvicola amphibius*. At a national level water voles have suffered a 95% decline in range since 1900. Concerns over the rapidly declining species in 1998 led to the development of a water vole recovery programme in Oxfordshire, headed by BBOWT. During the period 2008 to 2016, against the backdrop of a national decline, the total water vole Local Key Areas in Oxfordshire increased more than three-fold from 137 to 433km<sup>2</sup> (see case studies).



Water vole, *Arvicola amphibius* © Jo Cartmell



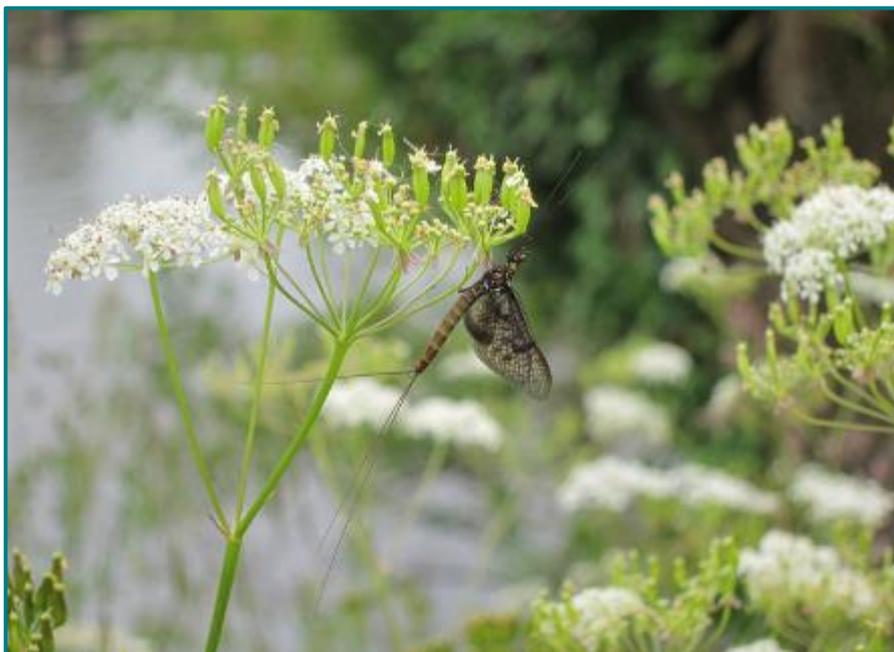
Otter, *Lutra lutra* © Ben Andrew/rspb-images.com

A certain amount can be inferred about the status of a few habitats and species from national datasets, and the Water Framework Directive (WFD) status (a measure of physical, chemical and biological parameters) tells us something about the ecological status of our rivers. Generally, our rivers are very much cleaner than they were 30 years ago, which has aided the recovery of generalist species such as otter *Lutra lutra*, but those species that require a higher standard of water quality are still suffering declines in many places.

In 1998 otters were regarded as a rare species, on the edge of its range in Oxfordshire, but increasing in number. Otters are now widespread across the county and can be seen in urban as well as rural areas. The cessation of use of certain toxic agricultural chemicals, improvements in water quality and legal protection, has over the years resulted in the number of sites with evidence of otters [in the Thames catchment] increasing from 0% in 1984-86, 2% in 1991-1994, 8% in 2000-02, to 53% in 2009-10 (Scholey, pers. Comm.).

### Rivers and Flowing Water

The wildlife our rivers support is influenced by their form, underlying geology, flow patterns and the quality of water that feeds them, as run-off (from fields or urban areas) or groundwater. The county's varied geology results in a wide range of river habitats, from fast flowing chalk streams to sluggish, deep main rivers. There is an estimated 1265 km of main river and 637 km of non-main river. Several streams arising from chalk aquifers such as the Letcombe Brook, Chalgrove Brook and Ewelme Stream support characteristic species such as brown trout *Salmo trutta*, bullhead *Cottus gobio* and other species dependant on clear, fast flowing water and gravel substrates. Chalk streams are a globally rare habitat, with only 161 in the UK. Ewelme Cress Beds, which Ewelme Stream runs through on its way to the Thames, is a Local Nature Reserve (LNR) and County Wildlife Site. Letcombe Brook, a tributary of the river Ock, runs through the 7.5Ha Letcombe Valley nature reserve.



Mayfly © Hilary Phillips

Nutrient-poor rivers of upland areas support sparse vegetation and insects such as stoneflies *Plecoptera*, mayflies *Ephemera* and caddisflies *Trichoptera*, which are hunted by brown trout *Salmo trutta* and birds such as white-throated dipper *Cinclus cinclus*. In contrast the lower reaches of our rivers tend to be nutrient-rich and more sluggish in their flows, and plant diversity increases providing more cover

for coarse fish species, the predominant fish community within Oxfordshire. Our most common coarse fish species include roach *Rutilus rutilus*, chub *Leuciscus cephalus* and perch *Perca fluviatilis*. Less common species through, for example, decline or lack of suitable habitat include barbel *Barbus barbus*, grayling *Thymallus thymallus*, eel *Anguilla Anguilla*, ruffe *Gymnocephalus cernuus*, lampreys *Lampetra sp.* and rudd *Scardinius erythrophthalmus*. The zander *Sander lucioperca* and, to some degree, the common carp *Cyprinus carpio*, are also less common, being non-native species, though now naturalised in the UK (EA *per comm.*, 2017). Barbel, *Barbus barbus* appeared to have declined significantly on the Thames and its tributaries in Oxfordshire throughout the 90's, but has recently been re-appearing along some river stretches. Numbers are still very low though and habitat enhancements, along with stocking of juvenile fish, are still carried out by the EA as part of a strategy to bolster stocks. The River Thames between Iffley and Benson has been surveyed for fish annually since 1994. Trends from here appear to show a slight decrease in density of the roach *Rutilus rutilus* population, however this is offset by a slight increase in their biomass. This is reinforced by the length frequency data collected, which appears to show a trend of increasing average size within the surveyed individuals for each year – over 25mm the period 1994 to 2012 (EA *per comm.*, 2017).

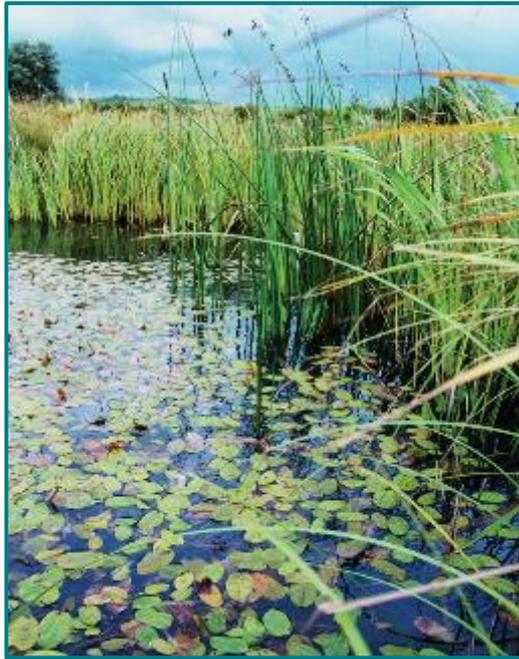
The length of the River Thames in Oxfordshire is one of the few strongholds of the common club-tail dragonfly *Gomphus vulgatissimus*, probably the nationally most important species of dragonfly occurring in the county (Tompkins, 2016; Brownett, 1996). Other Priority freshwater and riparian specialists include water vole *Arvicola amphibius*, Thames ram's horn snail *Gyraulus (Gyraulus) acronicus*, depressed river mussel *Pseudanodonta complanata*, our native white clawed crayfish *Austropotamobius pallipes* (rapidly declining in 1998 and now very rare), Daubenton's bat *Myotis daubentonii* and soprano pipistrelle bat *Pipistrellus pygmaeus*. Kingfishers *Alcedo atthis*, that most iconic of river birds that hunts along slow moving or still waters, is now Amber listed because of their unfavourable conservation status in Europe. The River Ray floodplain is a stronghold for the rare true fox-sedge *Carex vulpina* (Feber, 2013)



Common club-tail dragonfly, *Gomphus vulgatissimus* © Stephen Burch

Invasive non-native species have a major impact on freshwater biodiversity (Millennium Ecosystem Assessment, 2005). Thirty-eight of the 135 invasive non-native species listed by the EA (Environment Agency, 2016) are found in Oxfordshire. These include 15 species of most concern to the EA, such as the demon shrimp *Dikerogammarus haemobaphes*. Prior to 1990, invasive American signal crayfish *Pacifastacus leniusculus* were recorded at only three locations in the Upper Thames, and large populations of the native white-clawed crayfish *Austropotamobius pallipes* were present throughout the area. By 2000 signal crayfish had spread to the majority of water-courses, and white-clawed crayfish were increasingly restricted to upstream locations, tributaries, or remnant populations encroached by enclosing signal crayfish populations (Moorhouse, 2015). In September 2016, the EA surveyed eight small Oxfordshire watercourses which have had white-clawed crayfish records in the last 15 years. Of the eight surveyed, only one was found to have evidence of white-clawed crayfish. Three of the sites had no evidence of either species of crayfish.

## Ponds



Pinkhill Pond © Pascale Nicolet

Oxfordshire has an outstanding pond resource with a wide range of pond types, which support some of our rarest and most vulnerable aquatic plants and animals as well as providing an important stronghold for amphibians. Since the 1980's numbers of common toad *Bufo bufo* in the UK has fallen by more than two-thirds, with the south-east of England suffering the greatest declines. Oxfordshire currently has five widespread and one rare / localised species of amphibian; the widespread species include the common frog *Rana temporaria*, common toad *Bufo bufo*, smooth or common newt *Lissotriton vulgaris*, palmate newt *Lissotriton helveticus* and great crested newt *Triturus cristatus*. The rare / localised species is the natterjack toad *Bufo calamita*. With its specialist habitat requirements, the natterjack toad has always been rare in the county, found only in the Oxfordshire Heights (D'Ayala, 2016). This species went extinct in the twentieth century but was more recently re-

introduced into the county by Amphibian and Reptile Conservation (ARC) as part of national programme and survives at the [private] re-introduction site.

Little Wittenham is one of three Oxfordshire Flagship pond sites (<http://freshwaterhabitats.org.uk/projects/flagship/>) and is of European Importance, designated as a Special Area of Conservation (SAC) as a result of the resident population of great crested newt *Lissotriton vulgaris*. High quality ponds are generally located in sites managed for nature conservation, like the fen ponds at BBOWT's Cothill Fen NNR (part of the Cothill Fen SAC), the woodland ponds at Wytham Woods, ponds at Otmoor SSSI and the Pinkhill Meadows pond complex at Farmoor. The county's numerous village ponds are often degraded by pollution, but they can provide important habitats for plants and animals less sensitive to poor water quality, such as grass snakes *Natrix natrix*, Daubenton's bats *Myotis daubentonii* and a range of water birds.

## Fens, Reedbed and Marshes

Species rich calcareous fens have declined dramatically over the past century (JNCC, 2015) largely due to land drainage and agricultural intensification and now, like ponds, are largely confined to designated sites and nature reserves. Cothill Fen SAC (JNCC, 2016) is the largest surviving example of alkaline fen in central England. The loss of the waterlogged, anaerobic conditions of these habitats has resulted in a decline in the rate at which they capture and store carbon, and in the case of some fens this activity has even been reversed (Alonso, 2012). Urban fen sites in particular, such as the Lye Valley in Oxford, are under threat from hydrological change resulting from development pressures (Webb, 2016).



Grass-of-Parnassus, *Parnassia palustris*  
© Susan Erskine

Fens hold a disproportionately high number of rare plant species considering the current, tiny area of the county they occupy (Oxfordshire Flora Group, 2014). Twenty-two of our rare plant species can be found at Lye Valley for example, including the grass-of-Parnassus *Parnassia palustris*. Three dragonfly species that are very scarce in the county are found only in the calcareous fen habitat at the Cothill complex of reserves (Dry Sandford Pit, Cothill Fen NNR and Parsonage Moor). These are the keeled skimmer *Orthetrum coerulescens*, southern damselfly *Coenagrion mercuriale*, and small red damselfly *Ceriagrion tenellum*. The southern damselfly, considered to be rapidly increasing in



Female clubbed general, *Stratiomys chamaeleon* © Judy Webb

1998, still only exists in low numbers in isolated populations. Also found at this site are some extremely rare, endangered soldier flies (all RDB1 or RDB2 (Falk, 2005)) including the clubbed general *Stratiomys chamaeleon* (recently listed as Critically Endangered), orange-horned green colonel *Odontomyia angulata* and silver colonel *Odontomyia argentata* (Porter, 1991 & 2011) and with many other rare flies. Both the clubbed general and the scarce forest horsefly *Hybomitra solstitialis* (Critically Endangered) were recently listed by NE along

with 44 other flies among species 'most likely to be lost from England by 2020'. Other rare species associated with local fen habitat, and vulnerable to degradation of the habitat, include water penny beetles *Eubria palustris*, the locally scarce whorl snail *Vertigo antivertigo*, the nationally rare *Perforatella rubiginosa* (Gregory, 2000), fen violet *Viola persicifolia* and greater water parsnip, *Sium latifolium*. The status of all these species in the county is hence very vulnerable.

Reedbeds were once a common habitat in the low-lying areas of Oxfordshire but no large remnants remain today. Otmoor currently has the only sizeable reedbed at 22ha although small areas of reed do occur, fringing gravel pit lakes (such as the Cassington complex) and river channels. They are among the most important habitats for birds in the UK, and three amber listed Birds of Conservation Concern can now be seen in Oxfordshire's reedbeds:

bittern *Botaurus stellaris* (regarded

as extinct in Oxfordshire in 1998), marsh harrier *Circus aeruginosus* (considered extinct at the end of the 19<sup>th</sup> century) and common crane *Grus grus*. Common cranes were once a widespread breeding species in the UK, before hunting and habitat loss drove them to extinction around the 1600's. All



Common crane, *Grus grus* © Mike Pollard

three species have very recently started or attempted breeding at RSPB's Otmoor reserve, highlighting the importance of both large areas of reedbed and good habitat management.

Reedbed habitat also provides roosting and feeding sites for migratory species and several raptors including the marsh harrier *Circus aeruginosus*. Along with the 31ha reedbed currently found in Oxfordshire (TVERC 2016) there are smaller areas of sedge beds, one of the largest being **Error! Reference source not found.** near the river Cherwell; also Cholsey Marsh, Minster Lovell Marsh and Jubilee Fields at Wootton.

## Causes of Change

The ecology of rivers and other waterbodies in Oxfordshire is impacted by a range of issues, a measure of which is reflected in their status under the European Water Framework Directive (WFD). Many of our rivers have been heavily modified through historic dredging, canalisation and impoundment by weirs and other structures. This has led to considerable reduction in the variety of habitats available for a range of species, and prevented the river connecting to its floodplain in all but the most severe of flood events, restricting the extent and quality of associated wetland habitat. To date at least twenty fish passes exist with a minimum twelve more planned for the future, encompassing the main rivers and some smaller tributaries.

Our rivers also suffer from nutrient pollution and in some locations, low flows caused by abstraction, although many of our rivers receive much of their flow back via sewage treatment works. Although much has been done to address many of these impacts over the last two decades, some of these pressures will be exacerbated by climate change.

Lack of good, appropriate management has led to a number of Oxfordshire's freshwater habitats, including calcareous fens, losing value for the more specialist wetland plants and animals. At some sites they have degraded to primarily wet woodland or solid reed bed, for example: SSSIs Weston fen, Spartum Fen and Barrow Farm Fen (Webb, 2016). Sydlings Cope fen has lost a great number of species, very few of which are returning despite improved grazing



Small red-eyed damselfly, *Erythromma viridulum* © Stephen Burch

and scrub removal. One of the very few currently known sites in the county for small red-eyed damselfly *Erythromma viridulum* is at Shellingford Pit, near Stanford-in-the-Vale. This small site is not actively managed and is severely threatened by recent decreases in water level (Burch, 2016). Cothill fen ponds no longer support the range of rare stoneworts they once did, with recent searches failing to find *Chara contraria* and *Chara fragilis*, although small quantities of the uncommon *Chara hispida* and *Chara virgata* were found (Webb, 2013). Many of these impacts are difficult to either quantify (Rothero et al, 2016) or address.

Targeted conservation action, including enhanced management techniques, is taking place for some species in the county and has been demonstrated to benefit some of our iconic wetland species. For example, at a national level water voles *Arvicola amphibius* suffered a 95% reduction in their range

between 1900 and 1998, with continued declines since then. In Oxfordshire BBOWT developed a water vole recovery programme in 1998 and during the period 2008 to 2016, against the backdrop of a national decline, the total water vole Local Key Areas in Oxfordshire increased more than three-fold from 137 to 433km<sup>2</sup>. Habitat restoration to improve water quality and for natural flood management, alongside efforts such as the reintroduction and protection of the scarce greater water-parsnip *Sium latifolium* by local specialist groups, demonstrates further positive change. Regarded as having a stable population in 1998 the greater water-parsnip has more recently suffered a huge decline, being susceptible to grazing and shading of the fens and wet ditches it favours.

There have been some positive changes in our freshwater resource in recent years, such as an increase in gravel pit lakes restored for nature (see Gill Mill case study) and a range of river and wetland creation projects presenting new opportunities for water quality and wetland species. Work at the RSPB's Otmoor reserve to increase reedbed habitat has also brought common cranes *Grus grus*, marsh harriers *Circus aeruginosus* and bitterns *Botaurus stellaris* back to the area. Landowners, farmers, businesses, conservation organisations and government bodies are coming together in Catchment Partnerships to improve the ecological quality and flow, and biodiversity of our freshwater systems. For example, in the Evenlode catchment, where farmers and landowners are working with a partnership of the Evenlode Catchment Partnership, the EA and West Oxfordshire District Council (WODC) to deliver the first demonstration project for Natural Flood Management in the Thames river basin (see case studies).

## Case Studies

### ***Pinkhill Meadow Flagship Pond Site***

The Pinkhill Meadow pond complex was created in 1990/91 through a collaboration between Thames Water, The Environment Agency and Freshwater Habitats Trust, to demonstrate new advances in pond design and creation for freshwater wildlife. The site is located between Farmoor Reservoir and the River Thames, and now sits adjacent to two smaller pond complexes that were created much later: Shrike Meadow is about 10 years old, and the Buckthorn Meadow pond complex created in 2011. The Pinkhill wetland area is relatively small, only 3.2 hectares, but it includes some 40 permanent, semi-permanent and seasonal ponds, ranging from less than 1 m<sup>2</sup> to 0.75 hectare in surface area. A wide drawdown zone was created around many of the ponds with extensive microtopography to mimic natural floodplain wetland mosaics (Figure below).



*Pinkhill Meadow soon after excavations © Alistair Driver*

Plant and invertebrate monitoring at Pinkhill, showed that the site rapidly became exceptionally species rich (Williams et al, 2008). After 7 years, approximately 20% of all UK wetland plant and macroinvertebrate species had colonised the complex. This included eight invertebrate species and one plant species, clustered stonewort *Tolypella glomerata*, that are Nationally Scarce in the UK. The site also supported three breeding species of wading bird and was used by an additional 54 species of waders, waterfowl and other wetland birds - all through natural colonisation. Further monitoring showed that from 7 to 18 years, the Pinkhill pond complex

had on average continued to accumulate one species of wetland plant and one species of macroinvertebrate every year. A pond quality assessment showed that the four ponds surveyed in more detail over a 20-year period had become Priority habitat just a few years after creation (Figure below, from Williams et al, 2009).

So why is the Pinkhill wetland mosaic so diverse? The design and the location are both very important of course, but the key ingredient is clean water. The ponds are fed by surface water draining semi-natural catchments or groundwater and infrequent flooding from the nutrient-enriched River Thames.

The Pinkhill Meadow pond mosaic was to be the inspiration for the [Million Ponds Project](#) – a 50-year national partnership initiative which began in 2008 and aims to create clean water ponds for freshwater wildlife. Oxfordshire has been a focal point for pond creation with some 100 ponds created over the past 8 years, including 30 small ponds near Pinkhill at Buckthorn Meadow, a site that also supports the Nationally Scarce Clustered Stonewort. Many of these new ponds are now being studied as part of a PhD research project – there is still much to learn about what makes a good wildlife pond. Indeed, the Pinkhill plant and invertebrate monitoring dataset is almost certainly unique in Europe.

As a result of the monitoring work at Pinkhill, in 2008 the site was recognised by the Pond Biodiversity Action Plan steering group as one of 70 Flagship Sites representing the most important Priority Pond sites in the UK. As part of the [People, Ponds and Water](#) project, with funding from the Heritage Lottery Fund (HLF) and TOE2, Freshwater Habitats Trust is now working in collaboration with Thames Water to involve the local community in the monitoring and management of the site, to ensure that the Pinkhill pond complex and the other wetlands around it, remain full of wildlife in the future, and continue to provide an inspiration for the creation of clean water ponds, both in Oxfordshire and further afield.

*Williams P, Whitfield M and J Biggs (2008). How can we make new ponds biodiverse? A case study monitored over 7 years Hydrobiologia 597:137–148.*

<https://www.wildoxfordshire.org.uk/stateofnature/>

*Pond Conservation (2009). Pinkhill Meadow wetland creation scheme: Ecological survey of an 18-year-old pond complex. Freshwater Habitats Trust, Oxford.*

For more information see <http://freshwaterhabitats.org.uk/a-pick-me-up-for-pinkhill-meadow/>