

A survey of four ponds on Skipwith Common, 2016

A report for the Freshwater Habitats Trust



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1. Introduction

Skipwith Common has been identified as a Flagship Pond site by the Freshwater Habitats Trust due to its exceptional importance for freshwater biodiversity. The Common is a 293 hectare Site of Special Scientific Interest (SSSI) in the Vale of York, designated as an extensive example of lowland heathland. It is also designated as a Special Area of Conservation (SAC) for its wet and dry heath features. There are numerous ponds and pools on Skipwith Common, many probably originating as peat cuttings, sand pits and flax retting pits. Several have been created more recently for conservation purposes. Ecological information on these ponds is limited.

This survey assessed three ponds (Pucker Pool, Line Pond and Runway (Pillwort) Pond) in detail with a brief assessment of a fourth (King Rudding Pond). The first three ponds were sampled in spring to obtain a representative list of aquatic macro-invertebrates (many 'fen' species are most readily collected in spring). All meso-habitats within each pond were sampled using a long-handled net until no further taxa could be recognised in the net. All four ponds were then surveyed in early summer using the PSYM, the standard methodology for assessing the ecological quality of ponds (Environment Agency, 2002).

PSYM (**P**redictive **S**ystem for **M**ultimetrics) uses six 'metrics' (measurements) representing important indicators of ecological quality. The three botanical metrics are:

- diversity of emergent and submerged plant species
- the number of uncommon species
- Trophic Ranking Score (TRS, an indication of nutrient status based on selected plant species)

The three invertebrate family-level metrics are:

- Average Score Per Taxon (ASPT, an estimation of biological water quality based on the sensitivity of different invertebrate families to organic enrichment)
- diversity of dragonfly, damselfly and alderfly families
- diversity of water beetle families

Environmental data obtained for each pond include: surface area, altitude, grid reference, water pH, presence/absence of inflows, substrate composition, degree of shade, accessibility to livestock and cover of emergent vegetation.

The PSYM software compares the observed data with values predicted from a large reference dataset of undegraded ponds. PSYM predicts how a high quality pond with similar attributes *should* score for each metric, and compares the predictions with the survey results. The scores for individual metrics are combined to produce an Index of Biotic Integrity (IBI), which provides an overall indication of the ecological quality of the pond. Ponds can then be categorised as Very Poor, Poor, Medium and Good. PSYM results are provided in Appendix 1 and summarised briefly for the relevant ponds in section 2 below.

2. The ponds surveyed

Pucker Pool (SE 661 367)

Pucker Pool is located in the south-east sector of the Common, where conditions appear to be less acidic than in the centre. A water sample collected on 19th April produced a pH reading of 5.78 with electrical conductivity of 50 $\mu\text{S}/\text{cm}^{-1}$. Two samples collected on 6th June gave pH readings of 6.21 and 6.36 with conductivity values of 180 and 90 $\mu\text{S}/\text{cm}^{-1}$. These measurements suggest mildly acidic conditions with low levels of dissolved minerals.



The majority of the pond is dominated by Bog Pondweed *Potamogeton polygonifolius*, which has increased in recent years. Species growing amongst the pondweed include Lesser Marshwort *Apium inundatum* and Pond Water-crowfoot *Ranunculus peltatus*. The margins support stands of Sharp-flowered Rush *Juncus acutiflorus* and Soft Rush *J. effusus* as well as low-growing mixtures of small herbs and bryophytes. The latter include Flat-topped Bog-moss *Sphagnum fallax*, Spiky Bog-moss *S. squarrosum* and, more locally, Pointed Spear-moss *Calliergonella cuspidata* and Kneiff's Hook-moss *Drepanocladus aduncus*.

A total of 65 aquatic macro-invertebrate taxa were identified during this survey with species of conservation concern including: Mud Snail; the diving beetles *Agabus labiatus*, *A. uliginosus* and *Hygrotus decoratus*; the scavenger water beetles *Hydrochus brevis*, *Helochares punctatus* and *Chaetarthria simillima*; the long-toed water beetle *Dryops auriculatus*; and the caddis-fly *Trichostegia minor*. Forty-two taxa were collected in the PSYM sample on 6th June.

PSYM assessment produced an Index of Biotic Integrity of 89%, placing Teal Pond within the top category for ecological quality. It scored highly on all metrics except for diversity of damselfly/dragonfly/alderfly families, which were poorly represented in the PSYM sample. Diversity of wetland plants and representation of uncommon plant species was notably higher than predicted, emphasising the botanical quality of this water body.

Runway Pond (Pillwort Pond) (SE 647 374)

This pond was excavated in the late 20th century in one of the WWII runway embayments in the north-west sector of the Common. It has changed considerably during the past 25 years, becoming more silty and shaded. The more open area adjoining the track has patchy stands of Greater Reedmace *Typha latifolia*, Yellow Flag *Iris pseudacorus* and Sweet Flag *Acorus calamus*. To the west, the pond forms a loop around a small island; this area is heavily shaded by overhanging Alder, birch and willow. To the south, a shallow, linear depression parallel to the track forms a seasonal extension to the pond supporting grass mats and low emergent vegetation such as Jointed Rush *Juncus articulatus*, Lesser Spearwort *Ranunculus flammula* and Creeping Jenny *Lysimachia nummularia*. Pillwort *Pilularia globulifera* was recorded from this pond in the 1990s but there do not appear to be any more recent records.



A water sample collected on 21st April produced a pH reading of 7.09 with electrical conductivity of 240 $\mu\text{S}/\text{cm}^{-1}$.

A third invertebrate sample was collected from Runway Pond on 15th June so that sampling effort was comparable to the NPS survey of the same pond in 1990. A total of 80 aquatic macro-invertebrate taxa were identified including three species of conservation concern: the diving beetles *Acilius canaliculatus* and *Hydroporus neglectus* and the scavenger water beetle *Helochares punctatus*. Thirty taxa were collected in the PSYM sample on 26th May.

PSYM assessment produced an Index of Biotic Integrity of 89%, placing Runway Pond within the top category for ecological quality. It scored highly on all metrics except for diversity of damselfly/dragonfly/alderfly families, which were poorly represented by in the PSYM sample.

Line Pond (SE 664 380)

This pond is located close to Skipwith village, on the site of a cluster of historic flax retting ('line') pits. These pits were shown on the first OS 6" map (extract below), surveyed in the 1840s, and were used to soak flax stems to separate-out the fibre used to manufacture linen.



The pond was re-excavated about five years ago but has become rapidly overgrown with willows. The remaining open areas around its margins support plants tolerant of acidic and nutrient-poor waters such as Flat-topped Bog-moss, Common Hair-cap Moss *Polytrichum commune*, Velvet Bent *Agrostis canina* and Marsh Pennywort *Hydrocotyle vulgaris*. A water sample collected on 21st April produced a pH reading of 4.77 with electrical conductivity of 150 $\mu\text{S}/\text{cm}^{-1}$.

A total of 28 aquatic macro-invertebrate taxa were identified during this survey with species of conservation concern including the diving beetles *Hydroporus neglectus* and *Hygrotus decoratus*; the scavenger water beetle *Helochares punctatus*; and the caddis-fly *Trichostegia minor*. Twenty-four taxa were collected in the PSYM sample on 6th June.

PSYM assessment produced an Index of Biotic Integrity of 50%, placing Line Pond on the borderline between Poor and Moderate ecological quality. It scored well for trophic status (TRS) and biological water quality (ASPT), moderately for diversity of submerged and emergent plant species and poorly for diversity of water beetle families. There were null scores for representation of uncommon wetland plants and Odonata.

King Rudding Pond (SE 644 373)

This shallow, silty pond has a surface area of around 200 m² and adjoins the King Rudding Lane King Rudding at the western edge of the Common. It is well-used by livestock, with moderately poached margins and no tall emergent vegetation. Aquatic vegetation comprises Broad-leaved Pondweed, Pond Water-crowfoot *Ranunculus peltatus* and Common Water-crowfoot *R. aquatilis*. Trailing grasses (Flote grass *Glyceria fluitans*, Marsh Foxtail *Alopecurus geniculatus* and Creeping Bent *Agrostis stolonifera*) grow in the margins. A water sample collected on 15th June produced a pH reading of 8.29 with electrical conductivity of 310 $\mu\text{S}/\text{cm}^{-1}$.



The invertebrate sample produced 30 taxa. None of these were species of conservation concern but there were a number of local species such as Emperor Dragonfly *Anax imperator* and the algivorous water beetle *Halipus heydeni*.

PSYM assessment produced an Index of Biotic Integrity of 94%, placing the King Rudding Pond within the top category for ecological quality. It scored highly on all metrics except for diversity of damselfly/dragonfly/alderfly families, which were represented by fewer taxa than predicted in the PSYM sample.

3. Results

3.1 Invertebrates

One hundred and twenty aquatic macro-invertebrate taxa were recorded during this survey (Appendix 2). Raw data have been provided in spreadsheet format. As is typical for shallow lowland ponds, water beetles (Coleoptera) made up more than half the taxa recorded (57%) (Figure 1).

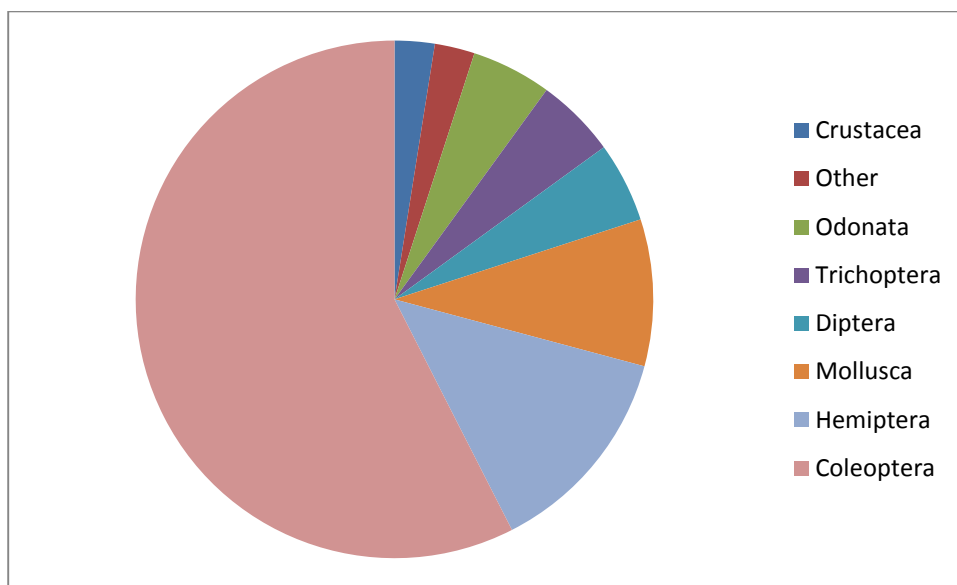


Figure 1: taxonomic composition of the aquatic macro-invertebrate fauna in four ponds at Skipwith Common sampled by hand-netting

3.2 Vertebrates

Several adult Smooth Newts, a pair of Palmate Newts and a single Great Crested Newt larva were netted in Runway Pond on 26th May. By 15th June, Great Crested Newt larvae were quite numerous and modest numbers of Common Frog tadpoles were also netted. Great Crested and Smooth/Palmate Newt tadpoles were plentiful in the King Rudding Pond on this date.

Nine-spined Sticklebacks and adult Smooth Newts were found in Pucker Pool along with Smooth/Palmate Newt and Common Frog tadpoles.

3.3 Wetland plants

A total of 60 wetland plant species were recorded from the four ponds (Appendix 3). Raw data have been provided in spreadsheet format. Pucker Pool supports the most diverse flora with 35 species compared to 30 for Runway Pond and only 13 for Line Pond.

4. Species of conservation concern

4.1 Invertebrates

MOLLUSCA

Omphiscola glabra (Lymnaeidae), Mud Snail

GB status: Nationally Scarce; NERC Act Section 41 Species of Principal Importance

A distinctively elongate pond snail, closely associated with pools and pond margins in agriculturally-unimproved habitats, typically on historic Commons. This species has declined massively, though significant populations persist in a few regions such as the New Forest and Humberhead Levels/Vale of York. There are post-1999 records from 47 hectads in Great Britain (Seddon *et al*, 2014).



Its remnant distribution implies that Mud Snail is much more sedentary than most of the Lymnaeidae. It avoids water bodies supporting a rich variety of aquatic molluscs, preferring those which dry out in summer or are poor in nutrients (e.g. Kerney, 1999) though the oft-repeated claim that this is a calcifuge species is misleading. This is a well-established species in Teal Pond, occurring also in more seasonal pools in the adjoining area.

COLEOPTERA

Agabus labiatus (Dytiscidae), a diving beetle

GB status: Near Threatened

This species is associated with seasonal pools in fens and heaths, occurring in both acidic and neutral waters. Six out of seven recent Yorkshire sites are remnants of pre-Enclosure common land. Despite discoveries of previously unknown populations, it has disappeared from some historic sites including Strensall Common, Askham Bog and Thorne Moors. Its British distribution is wide but fragmented and declining, and *A. labiatus* has apparently been lost from some regions (Foster, 2010a; Foster *et al.*, 2016). A large and important population occurs in the south-east sector of Skipwith Common, and it was found in good numbers on both visits to Pucker Pool.

Agabus uliginosus (Dytiscidae), a diving beetle

GB status: Near Threatened

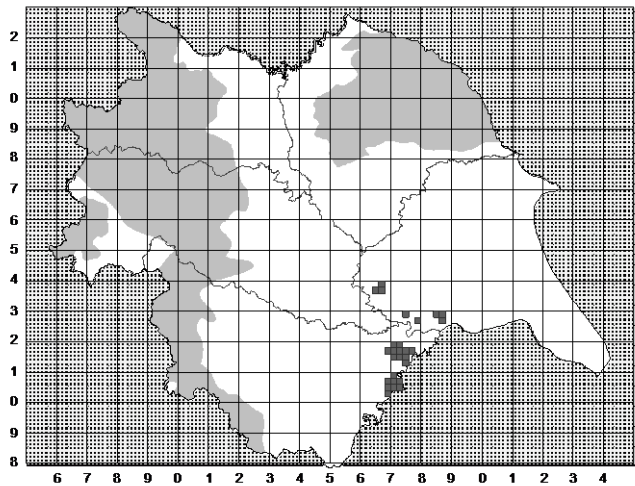
This mid-sized diving beetle occurs in seasonal pools in fens, old woodland, unimproved grassland and the margins of lowland heaths. It has a national stronghold in the Vale of York and Humberhead Levels. Our populations have matt-coloured females of the *dispar* form. *Agabus uliginosus* is very scarce outside its centres in the Humber basin and East Anglia. It is listed as Near Threatened due to the fragility of its habitats and localised contractions in range

(Foster, 2010). It occurs with *A. labiatus* in the south-eastern part of Skipwith Common; during the present survey, one was collected from Pucker Pool on 19th April.

Acilius canaliculatus (Dytiscidae), a diving beetle

GB status: Nationally Scarce

A single male specimen of this large, broad-bodied diving beetle was caught in Runway Pond on 21st April. *Acilius canaliculatus* has a national stronghold on the Humberhead Peatlands, where it is abundant in acidic, oligotrophic water. Elsewhere in Yorkshire, there are well-established populations on Skipwith Common and in base-rich borrow pits and clay pits at Oxmardyke/Broomfleet on the former Walling Fen. *Acilius canaliculatus* has a fragmented distribution in England with centres in Kent/Sussex, the Shropshire Meres, Cheshire Plain and Lake District as well as the Humberhead Peatlands. It has a wider distribution in Scotland and appears to be increasing overall (Foster *et al.*, 2016). It appears to have been first recorded at Skipwith Common in 1967 (Aubrook, 1970)¹.



Above: *Acilius canaliculatus* (adult female) with map of records for Watsonian Yorkshire plotted at tetrad (2 x 2 km square) resolution.

Hydroporus neglectus (Dytiscidae), a diving beetle

GB status: Nationally Scarce

This very small dytiscid is local in bogs, fens and richly-vegetated pond margins in the central plain of Yorkshire. It tolerates shaded conditions. *Hydroporus neglectus* has a very patchy distribution in England, reaching its northern limit in North Yorkshire. It was found at Runway Pond and Line Pond in May.

¹ The YNU database records that it was found to be “common” by Jeremy Flint, implying that it was well-established.

Hygrotus decoratus (Dytiscidae), a diving beetle

GB status: Nationally Scarce

This tiny but attractively-marked diving beetle is very local amongst fen vegetation in the shallow margins of ponds, peat cuttings or ditches. Its main centres in Yorkshire are in and around Strensall and Skipwith Commons and parts of Thorne Moors. Outside our region, it occurs mainly in south-east England, East Anglia and Cheshire (Foster & Friday, 2011). During this survey, *H. decoratus* was recorded from Line Pond and Pucker Pool.

Hydrochus brevis (Hydrochidae), a scavenger water beetle

GB status: Vulnerable

This species has a wide but extremely fragmented distribution in old fens, with strong populations largely confined to the Norfolk Broads and Breckland (Foster, 2010). *Hydrochus brevis* has been known from Skipwith Common since 1949 (YNU records). There is only one other recent Yorkshire location (a single specimen from a pond at Copmanthorpe near York in 2004). However, it has been reported as a fossil from at least ten sites in Yorkshire, from late glacial to Roman era deposits, indicating that it was once more widespread.

Helochares punctatus (Hydrophilidae), a scavenger water beetle

GB status: Nationally Scarce

Although listed as Nationally Scarce by Foster (2010), *H. punctatus* is a localised rather than rare beetle, mostly associated with acidic bog-pools at low to moderate elevations but sometimes occurring in base-rich ponds. During this survey, it was found in Line Pond, Runway Pond and Pucker Pool.

Chaetarthria simillima (Hydrophilidae), a scavenger water beetle

GB status: Nationally Scarce

This tiny, rotund beetle has only recently been only recently distinguished from *C. seminulum* (Vorst & Cuppen, 2003) and subsequently confirmed as British (Levey, 2005). It is uncommon in seepages or pools in the uplands with scattered records from lowland fens and mossy pond margins. Male specimens were collected from moss at the edge of Pucker Pool.

Dryops auriculatus (Dryopidae), a long-toed water beetle

GB status: Near Threatened

Dryops are mid-sized, very hairy, dark brown amphibious beetles. Although difficult to identify, the British species have been rather well-studied and show distinctive patterns of distribution (Foster, 1995). Only two of the seven British *Dryops* are at all widespread, the others being rare or scarce habitat-specialists. *Dryops auriculatus* is a beetle of heath and fen pools found from North Yorkshire southwards. It is, according to Foster (2010), "largely

confined to natural habitats". Specimens were collected from Teal Pond on 19th April and 6th June. A large population occurs in the south-eastern sector of Skipwith Common, where it co-exists with the relatively common *D. luridus*. The only other site in Yorkshire for *D. auriculatus* is Crossley's Pond on Strensall Common, although there is an historic record from Askham Bog.

Bagous limosus (Curculionidae), an aquatic weevil

GB status: Nationally Scarce

Bagous is a genus of aquatic/wetland weevils, all of which tend to be rare and elusive. The adults and larvae of *B. limosus* feed on pondweeds (*Potamogeton* spp.) One specimen was collected from Pucker Pool on 6th June, where Bog Pondweed must be the host plant. There are two previous records for Skipwith Common (including one from Pucker Pool).

TRICHOPTERA

Trichostegia minor (Phryganeidae), a caddis-fly

GB status: Nationally Scarce

A local caddis of pools rich in leaf litter which dry out in summer. It has been recorded from 98 ten km squares in Britain since 1980 (Wallace, in prep), so only narrowly qualifies for Nationally Scarce status. Larvae were collected from Line Pond and Pucker Pool.

4.2 Plants

Species considered here include vascular plants meriting Red List² or Near Threatened status in England (Stroh *et al*, 2014³). No mosses, liverworts or stoneworts of conservation concern were recorded during the survey.

***Apium inundatum*, Lesser Marshwort**

English status: Vulnerable

This delicate aquatic umbellifer occurs in modest amounts in Teal Pond, although it may be struggling to compete with the mat of Bog Pondweed. It is a plant of clean, low-nutrient waters which was formerly widespread in the Vale of York but is now known from only two or three locations. Its English range contracted by 49% during the second half of the 20th

² **Red List** species are those categorised as Regionally Extinct, Critically Endangered, Endangered or Vulnerable in relevant inventories. **Near Threatened** plants are mainly those undergoing significant declines in distribution which are not yet at risk but liable to become so if present trends continue.

³ The recently-published vascular plant Red List for England provides a more relevant basis for conservation assessment than previous inventories covering the whole of Great Britain as many species which have stable populations in Scotland are threatened in lowland England.

century (Stroh *et al.*, 2014). Lesser Marshwort seems to be particularly sensitive to nutrient-enrichment.

***Carex echinata*, Star Sedge**

English status: Near Threatened

This small sedge remains frequent in flushes of varying trophic status in the uplands but has undergone a protracted decline in the lowlands (Preston *et al.*, 2002). It is found locally around the edges of Pucker Pool.

***Eriophorum angustifolium*, Common Cotton-grass**

English status: Vulnerable

Common Cotton-grass is a classic example of a plant which remains locally-abundant in the uplands of northern and western Britain but has declined seriously in the agricultural lowlands: it underwent a 33% decline in its English distribution during the second half of the 20th century (Stroh *et al.*, 2014). Cotton-grass occurs sparsely at the edge of Pucker Pool.

***Hydrocotyle vulgaris*, Marsh Pennywort**

English status: Near Threatened

A humble plant of short vegetation in water margins and wet fens which, like many species of less fertile wetlands, is undergoing a long-term decline in distribution in England. It can be found at the edges of Pucker Pool, Line Pond and the King Rudding Pond.

***Hypericum elodes*, Marsh St John's Wort**

English status: Near Threatened

Patches of this distinctive bog plant can be found in several places at the margins of Pucker Pool. Marsh St John's Wort underwent a 24% decline in distribution in England during the latter half of the last century (Stroh *et al.*, 2014). This species is threatened by the drainage and deterioration of peatland habitats.

***Potentilla erecta*, Tormentil**

English status: Near Threatened

Another common upland species which is restricted to a diminishing number of unimproved grasslands, heaths and fens in the lowlands. Recorded from the edge of the Line Pond.

***Ranunculus flammula*, Lesser Spearwort**

English status: Vulnerable

Although still widespread and locally frequent, Lesser Spearwort underwent a 32% decline in distribution in England during the latter half of the last century (Stroh *et al.*, 2014). It was found at Pucker Pool and Runway Pond.

***Veronica scutellata*, Marsh Speedwell**

English status: Near Threatened

A moderately declining species of water-margins on poorer soils, Marsh Speedwell is occasional at Pucker Pool.

5. Changes to Runway Pond

Runway Pond was surveyed intensively over three visits in 1990 as part of the National Pond Survey (NPS) (Freshwater Habitats Trust, unpublished data). Only 15% of the pond was directly shaded compared to around 60% now. This is due to maturation of Alders around the western 'loop' of the pond: in 1990, the tree canopy was much further back from the bank and the 'loop' supported extensive beds of Broad-leaved Pondweed as well as a well-developed fringe of emergent vegetation. The pond bed was composed of sand (30%), gravel (30%), pebbles (25%) and stone blocks (15%), whereas now it is entirely silt.

In 1990, mean pH was 7.1 (measurements ranged seasonally from 6.6 to 8.1) and electrical conductivity averaged $360 \mu\text{S}/\text{cm}^{-1}$ (range = 312-440). The single water sample collected in 2016 gave a very similar pH (7.09) and rather lower conductivity ($240 \mu\text{S}/\text{cm}^{-1}$); the decrease in conductivity probably reflects the diminished influence of minerals from the wartime concrete, now buried beneath silt. It would be unwise to infer much from such limited data, but these measurements do not suggest significant change in water chemistry.

The plant list for 1990 included a few species no longer present such as Common Club-rush *Schoenoplectus lacustris*, Yellow Loosestrife *Lysimachia vulgaris* and, most interestingly, Pillwort. A sketch map accompanying the 1990 survey shows that Pillwort grew along the eastern margin of the pond (adjoining the runway) but also along the northern shore of the 'loop'. A small amount of Sweet Flag was present, showing that this is not a recent introduction. Broad-leaved Pondweed was more abundant and there were submerged beds of Nuttall's Waterweed *Elodea nuttallii* (an invasive non-native plant). Diversity of wetland plants has not declined (26 species in 1990 compared to 30 in 2016).

In the NPS data, 105 aquatic macro-invertebrate taxa were recorded over three visits⁴, compared to 80 in 2016. In 1990, 57 water beetle species were found compared to 43 in 2016. However, the composition and 'quality' of the assemblage has not changed greatly and most of the species found in 1990 have been recorded by the author from Runway Pond since 2004. One noteworthy loss has been the small diving beetle *Porhydrus lineatus*, last found in May 2008; this species has declined rapidly in Yorkshire during the past 25 years for no obvious reason (author's unpublished data), though it is not considered threatened in Britain as a whole. Its apparent disappearance from Runway Pond is probably the result of a wider regional population decline rather than any site-specific factor.

⁴ Three taxa considered to be possible mis-identifications in the NPS data have been disregarded.

The most significant change amongst the water beetles is the decline in algivorous water beetles of the genus *Haliphus*. These were well-represented in 1990, when seven species were collected; in 2016 only *H. ruficollis*, the most ubiquitous member of the genus, was present. As *Haliphus* are characteristic of habitats with patchy submerged vegetation over an exposed mineral substrate, this change reflects increased siltation and the loss of submerged macrophytes. The reduced diversity of Corixid bugs reflects a similar trend, as do changes in the water snail fauna. Some of the caddis found in 1990 favour exposed mineral substrates whereas those found in 2016 are often associated with leaf-litter ponds.

There have been modest reductions in diversity of mollusc species (nine in 1990 compared to six in 2016), water bugs (16 compared to 12) and caddis-flies (seven down to five). Six leech species were recorded in 1990 but none in 2016, though the reason for that is unclear.

The NPS data suggests greater structural diversity and complexity in 1990, including submerged weed beds (now absent apart from a trace amount of *Chara* sp.), open water over a firm substrate (now replaced by deep, soft silt over the majority of the pond) and some hard surfaces.

Representation of rarer invertebrates has not changed much and the three species of conservation concern recorded in 1990 (the water beetles *Acilius canaliculatus*, *Hydroporus neglectus* and *Helochaeres punctatus*)⁵ were also collected in 2016.

It is evident that Runway Pond has become much more silted since 1990 with an increased homogenisation of the pond bed, a reduction in meso-habitat diversity and probably a loss of vegetation complexity. In the author's experience, this change has accelerated since the turn of the century. Sources of sediment including inwash from surrounding habitats, leaf fall from increasingly mature woodland around the pond and decomposition of vegetation within the water body. However, it is possible that mining subsidence has been a contributory factor.

6. Implications for conservation management

Line Pond has undergone rapid colonisation by Grey Sallow *Salix cinerea* and Downy Birch *Betula pubescens* scrub since it was re-excavated. Grazing pressure in this area appears to be negligible. Extensive scrub clearance with herbicide treatment of cut stumps is needed to restore its wildlife value but this will only be sustainable if grazing pressure can be increased. Its flora and fauna is probably comparable to other acidic woodland ponds on Skipwith Common so it is not a priority in terms of resources. However, the results of this survey do show that re-excavation of ponds without adequate long-term management is of questionable value.

Pucker Pool is amongst the best ponds in lowland Yorkshire for wildlife. It supports exceptional assemblages of plants and invertebrates including seven plants and ten

⁵ Account has been taken of changes in conservation status designations.

invertebrates of conservation concern. Some individual species such as Lesser Marshwort and the diving beetle *Agabus labiatus* probably have their strongest populations in the Vale of York in this pond and it is likely to be the most important site in northern England for the scavenger water beetle *Hydrochus brevis*. It supports most of the species found in the wider area of 'transitional fen' habitat in the south-east sector of the Common, where conditions are less acidic than in the interior of the SSSI. This results from natural variation in soil and groundwater conditions rather than any 'edge effect', because Riccall Common to the west was only converted to arable in the late 19th century: before that, Pucker Pool was closer to the centre of the pre-Enclosure common!

Pucker Pool can be considered to be in excellent condition though it has altered considerably in recent years due to changes in grazing management. About 15 years ago, Common Reed covered much of the pond but restoration of extensive livestock grazing has reduced reed cover dramatically. More recent dead-hedging of the pond to exclude livestock has probably led to the current domination of Bog Pondweed. There may be some benefit to removing dead hedging from part of the pond margin to allow livestock to break-up the pondweed carpet, which should benefit smaller plants such as Lesser Marshwort. However, the mossy edge of Pucker Pool is of special value for both aquatic and terrestrial invertebrates so it is important that this does not become excessively trampled. Therefore monitoring is important.

Runway Pond has evidently become increasingly silty in recent years, as described in section 5 above. An immediate priority should be to reduce shading by overhanging trees in order to allow emergent and aquatic vegetation to increase. The recent practice of removing Greater Reedmace is unlikely to provide any biodiversity benefit. A more radical option would be to remove soft sediment from a portion of the pond in order to re-create early successional conditions. This is not normally an appropriate option for ponds of high biodiversity value but in this instance deterioration is clearly linked to silt accumulation. It is possible that sediment removal could encourage regeneration of Pillwort spores; alternatively, if suitable conditions can be re-created, translocation from Strensall Common might be considered. Another option might be to excavate a new pond on the runways to create conditions similar to those which existed in 1990. Constraints relating to wartime archaeology and SSSI/SAC status would obviously need to be assessed.

7. References

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APPENDIX 1: PSYM RESULTS

<i>Site details</i>				
Site name	Line Pond	Pucker Pool	King Rudding Pond	Runway Pond (AKA Pillwort Pond)
Survey date	26-May-16	06-Jun-16	15-Jun-16	26-May-16
Grid reference	SE 664 380	SE 661 367	SE 644 373	SE 647 374
<i>Plant metrics</i>				
No. of submerged + marginal plant species (not including floating leaved)	13	30	13	25
Number of uncommon plant species	0	6	4	4
Trophic Ranking Score (TRS)	5.925	5.983333333	8.666666667	8.325
<i>Invertebrates metrics</i>				
ASPT	6	5.066666667	4.769230769	4.5
Odonata + Megaloptera (OM) families	0	1	2	1
Coleoptera families	2	4	4	3
<i>Environmental variables</i>				
Altitude (m)	9	9	10	10
Easting	4664	4661	4644	4647
Northing	4380	4367	4373	4374
Shade (%)	80	5	10	60
Inflow (0/1)	0	0	0	0
Grazing (%)	0	0	100	25
pH	4.77	5.78	8.29	7.09
Emergent plant cover (%)	25	20	15	30
Base clay (1-3)	1	1	3	3
Base sand, gravel, cobbles (1-3)	1	1	1	1
Base peat (1-3)	3	3	1	1
Base rock (1-3)	1	1	1	1
Area (m ²)	190	950	200	990
Results				
Submerged + marginal plant species				
Predicted (SM)	18.4	21.8	16.1	21.3
Actual (SM)	13	30	13	25
EQI (SM)	0.71	1.37	0.81	1.17
IBI (SM)	2	3	3	3
Uncommon plant species				
Predicted (U)	4.1	4.6	2.7	3.7
Actual (U)	0	6	4	4
EQI (U)	0.00	1.31	1.48	1.08
IBI (U)	0	3	3	3
Trophic Ranking Score (TRS)				

Predicted (TRS)	8.68	7.84	8.38	8.56
Actual (TRS)	5.93	5.98	8.67	8.33
EQI (TRS)	0.68	0.76	1.03	0.97
IBI (TRS)	3	3	3	3
ASPT				
Predicted (ASPT)	4.98	5.33	5.10	5.11
Actual (ASPT)	6.00	5.07	4.77	4.50
EQI (ASPT)	1.20	0.95	0.93	0.88
IBI (ASPT)	3	3	3	3
Odonata + Megaloptera (OM) families				
Predicted (OM)	2.58	3.65	3.30	3.42
Actual (OM)	0	1	2	1
EQI (OM)	0.00	0.27	0.61	0.29
IBI (OM)	0	1	2	1
Coleoptera families				
Predicted (CO)	4.03	3.81	3.74	3.77
Actual (CO)	2	4	4	3
EQI (CO)	0.50	1.05	1.07	0.80
IBI (CO)	1	3	3	3
Sum of Individual Metrics	9	16	17	16
Index of Biotic Integrity (%)	50%	89%	94%	89%
PSYM quality category (IBI >75%=Good, 51-75%=Moderate, 25-50%=Poor, <25%=V Poor)	Poor	Good	Good	Good
Is this a Priority Pond? (Good quality category)	No	Yes	Yes	Yes

Appendix 2: aquatic macro-invertebrates recorded during this survey

Taxon	English name	Family	Order
<i>Crangonyx pseudogracilis</i>	an amphipod shrimp	Crangonyctidae	Amphipoda
<i>Pisidium</i> sp.	a pea-mussel	Sphaeriidae	Bivalvia
<i>Bagous limosus</i>	an aquatic weevil	Curculionidae	Coleoptera
<i>Dryops auriculatus</i>	a long-toed water beetle	Dryopidae	Coleoptera
<i>Dryops luridus</i>	a long-toed water beetle	Dryopidae	Coleoptera
<i>Acilius canaliculatus</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Acilius sulcatus</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Agabus affinis</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Agabus bipustulatus</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Agabus congener</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Agabus labiatus</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Agabus labiatus</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Agabus sturmii</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Agabus uliginosus</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Agabus unguicularis</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Anacaena globulus</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Colymbetes fuscus</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Dytiscus marginalis</i>	Great Diving Beetle	Dytiscidae	Coleoptera
<i>Dytiscus semisulcatus</i>	a great diving beetle	Dytiscidae	Coleoptera
<i>Graptodytes granularis</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Hydroporus angustatus</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Hydroporus erythrocephalus</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Hydroporus figuratus</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Hydroporus gyllenhalii</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Hydroporus neglectus</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Hydroporus palustris</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Hydroporus planus</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Hydroporus pubescens</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Hydroporus striola</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Hydroporus tessellatus</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Hydroporus tristis</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Hygrotus decoratus</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Hygrotus impressopunctatus</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Hygrotus inaequalis</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Hyphydrus ovatus</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Ilybius aenescens</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Ilybius ater</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Ilybius fuliginosus</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Ilybius guttiger</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Ilybius montanus</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Liopteris haemorrhoidalis</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Rhantus grapii</i>	a diving beetle	Dytiscidae	Coleoptera

<i>Rhantus suturalis</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Rhantus suturellus</i>	a diving beetle	Dytiscidae	Coleoptera
<i>Gyrinus substriatus</i>	Common Whirligig	Gyrinidae	Coleoptera
<i>Haliplus heydeni</i>	an algivorous water beetle	Haliplidae	Coleoptera
<i>Haliplus ruficollis</i>	an algivorous water beetle	Haliplidae	Coleoptera
<i>Helophorus aequalis</i>	a scavenger water beetle	Helophoridae	Coleoptera
<i>Helophorus brevipalpis</i>	a scavenger water beetle	Helophoridae	Coleoptera
<i>Helophorus grandis</i>	a scavenger water beetle	Helophoridae	Coleoptera
<i>Helophorus griseus/minutus</i>	a scavenger water beetle	Helophoridae	Coleoptera
<i>Helophorus obscurus</i>	a scavenger water beetle	Helophoridae	Coleoptera
<i>Hydrochus brevis</i>	a scavenger water beetle	Hydrochidae	Coleoptera
<i>Anacaena globulus</i>	a scavenger water beetle	Hydrophilidae	Coleoptera
<i>Anacaena limbata</i>	a scavenger water beetle	Hydrophilidae	Coleoptera
<i>Anacaena lutescens</i>	a scavenger water beetle	Hydrophilidae	Coleoptera
<i>Cercyon convexiusculus</i>	a scavenger water beetle	Hydrophilidae	Coleoptera
<i>Chaetarthria simillima</i>	a scavenger water beetle	Hydrophilidae	Coleoptera
<i>Coelostoma orbiculare</i>	a scavenger water beetle	Hydrophilidae	Coleoptera
<i>Cymbiodyta marginellus</i>	a scavenger water beetle	Hydrophilidae	Coleoptera
<i>Enochrus affinis</i>	a scavenger water beetle	Hydrophilidae	Coleoptera
<i>Enochrus affinis</i>	a scavenger water beetle	Hydrophilidae	Coleoptera
<i>Enochrus coarctatus</i>	a scavenger water beetle	Hydrophilidae	Coleoptera
<i>Enochrus ochropterus</i>	a scavenger water beetle	Hydrophilidae	Coleoptera
<i>Helochares lividus</i>	a scavenger water beetle	Hydrophilidae	Coleoptera
<i>Helochares punctatus</i>	a scavenger water beetle	Hydrophilidae	Coleoptera
<i>Hydrobius fuscipes</i>	a scavenger water beetle	Hydrophilidae	Coleoptera
<i>Hydrobius subrotundus</i>	a scavenger water beetle	Hydrophilidae	Coleoptera
<i>Laccobius bipunctatus</i>	a scavenger water beetle	Hydrophilidae	Coleoptera
<i>Noterus clavicornis</i>	a burrowing water beetle	Noteridae	Coleoptera
<i>Contacyphon variabilis</i>	a marsh beetle	Scirtidae	Coleoptera
Chaoboridae	phantom midge larvae	Chaoboridae	Diptera
Chironomidae indet	non-biting midge larvae	Chironomidae	Diptera
<i>Chironomus</i> sp.	non-biting midge larvae	Chironomidae	Diptera
Culicidae indet	mosquito larvae & pupae	Culicidae	Diptera
Dixidae	meniscus midge larvae	Dixidae	Diptera
Tipuloidea	a crane fly larva	Tipuloidea	Diptera
<i>Cloeon dipterum</i>	Pond Olive mayfly	Baetidae	Ephemeroptera
<i>Lymnaea stagnalis</i>	Greater Pond Snail	Lymnaeidae	Gastropoda
<i>Omphiscola glabra</i>	Mud Snail	Lymnaeidae	Gastropoda
<i>Radix balthica</i>	Wandering Snail	Lymnaeidae	Gastropoda
<i>Stagnicola palustris</i> agg.	Marsh Pond Snail	Lymnaeidae	Gastropoda
<i>Aplexa hypnorum</i>	Moss Bladder Snail	Physidae	Gastropoda
<i>Anisus leucostoma</i>	White-lipped Ramshorn snail	Planorbidae	Gastropoda
<i>Bathymphalus contortus</i>	Twisted Ramshorn snail	Planorbidae	Gastropoda
<i>Hippeutis complanata</i>	Flat Ramshorn snail	Planorbidae	Gastropoda

<i>Planorbarius corneus</i>	Great Ramshorn Snail	Planorbidae	Gastropoda
<i>Planorbis planorbis</i>	Margined Ramshorn snail	Planorbidae	Gastropoda
<i>Corixa punctata</i>	a lesser water-boatman	Corixidae	Hemiptera
<i>Hesperocorixa castanea</i>	a lesser water-boatman	Corixidae	Hemiptera
<i>Hesperocorixa sahlbergi</i>	a lesser water-boatman	Corixidae	Hemiptera
<i>Sigara dorsalis</i>	a lesser water-boatman	Corixidae	Hemiptera
<i>Sigara lateralis</i>	a lesser water-boatman	Corixidae	Hemiptera
<i>Sigara scotti</i>	a lesser water-boatman	Corixidae	Hemiptera
<i>Sigara semistriata</i>	a lesser water-boatman	Corixidae	Hemiptera
<i>Gerris lacustris</i>	Common Pondskater	Gerridae	Hemiptera
<i>Gerris thoracicus</i>	a pond-skater	Gerridae	Hemiptera
<i>Hebrus ruficeps</i>	Sphagnum Bug	Hebridae	Hemiptera
<i>Hydrometra stagnorum</i>	Water-measurer	Hydrometridae	Hemiptera
<i>Ilyocoris cimicoides</i>	Saucer Bug	Naucoridae	Hemiptera
<i>Nepa cinerea</i>	Water Scorpion	Nepidae	Hemiptera
<i>Notonecta glauca</i>	Common Backswimmer	Notonectidae	Hemiptera
<i>Microvelia reticulata</i>	a pygmy water-cricket	Veliidae	Hemiptera
<i>Velia caprai</i>	Water Cricket	Veliidae	Hemiptera
<i>Asellus aquaticus</i>	Water Hoglouse	Asellidae	Isopoda
<i>Proasellus meridianus</i>	a water hoglouse	Asellidae	Isopoda
<i>Aeshna cyanea</i>	Southern Hawker dragonfly	Aeshnidae	Odonata
<i>Anax imperator</i>	Emperor Dragonfly	Aeshnidae	Odonata
<i>Coenagrion puella</i>	Azure Damselfly	Coenagrionidae	Odonata
<i>Enallagma cyathigerum</i>	Common Blue Damselfly	Coenagrionidae	Odonata
<i>Orthetrum cancellatum</i>	Broad-bodied Chaser	Libellulidae	Odonata
<i>Sympetrum danae</i>	Black Darter	Libellulidae	Odonata
Oligochaeta	a worm	Oligochaeta	Oligochaeta
<i>Nemoura cinerea</i>	a stonefly	Nemouridae	Plecoptera
<i>Glyptotaelius pellucidus</i>	a caddis-fly	Limnephilidae	Trichoptera
<i>Limnephilus ?marmoratus</i>	a caddis-fly	Limnephilidae	Trichoptera
<i>Limnephilus flavicornis</i>	a caddis-fly	Limnephilidae	Trichoptera
<i>Limnephilus stigma</i>	a caddis-fly	Limnephilidae	Trichoptera
<i>Limnephilus vittatus</i>	a caddis-fly	Limnephilidae	Trichoptera
<i>Trichostegia minor</i>	a caddis-fly	Phryganeidae	Trichoptera

Appendix 2: wetland plants recorded during this survey

SPECIES	ENGLISH NAME
<i>Acorus calamus</i>	sweet flag
<i>Agrostis canina</i>	velvet bent
<i>Agrostis stolonifera</i>	creeping bent
<i>Alisma plantago-aquatica</i>	common water plantain
<i>Alopecurus geniculatus</i>	marsh foxtail
<i>Apium inundatum</i>	lesser marshwort
<i>Aulacomnium palustre</i>	bog bead-moss
<i>Calamagrostis canescens</i>	purple small-reed
<i>Calliergonella cuspidata</i>	pointed spear-moss
<i>Callitriche</i> sp.	a water-starwort
<i>Cardamine pratensis</i>	lady's smock
<i>Carex echinata</i>	star sedge
<i>Carex nigra</i>	common sedge
<i>Carex otrubae</i>	false fox sedge
<i>Carex panicea</i>	carnation sedge
<i>Carex remota</i>	remote sedge
<i>Chara</i> sp. (indet)	a stonewort ⁶
<i>Cirsium palustre</i>	marsh thistle
<i>Eleocharis palustris</i>	common spike-rush
<i>Epilobium hirsutum</i>	greater willowherb
<i>Epilobium palustre</i>	marsh willowherb
<i>Epilobium</i> sp. (other, non-flowering)	a willowherb
<i>Equisetum palustre</i>	marsh horsetail
<i>Eriophorum angustifolium</i>	common cotton-grass
<i>Galium palustre</i>	common marsh bedstraw
<i>Glyceria fluitans</i>	flote-grass
<i>Hydrocotyle vulgaris</i>	marsh pennywort
<i>Hypericum elodes</i>	marsh st John's-wort
<i>Iris pseudacorus</i>	yellow flag
<i>Juncus acutiflorus</i>	sharp-flowered rush
<i>Juncus articulatus</i>	jointed rush
<i>Juncus buffonius</i>	toad rush
<i>Juncus bulbosus</i>	bulbous rush
<i>Juncus conglomeratus</i>	compact rush
<i>Juncus effusus</i>	soft rush
<i>Juncus inflexus</i>	hard rush
<i>Lemna minor</i>	common duckweed
<i>Lemna trisulca</i>	ivy-leaved duckweed
<i>Lysimachia nummularia</i>	creeping jenny
<i>Lythrum portula</i>	water purslane
<i>Mentha aquatica</i>	water mint
<i>Molinia caerulea</i>	purple moor-grass

⁶ Material from Runway Pond in poor condition, possibly *C. virgata*

<i>Myosotis laxa</i>	tufted forget-me-not
<i>Myosotis scorpioides</i>	water forget-me-not
<i>Persicaria amphibia</i>	amphibious bistort
<i>Phragmites australis</i>	common reed
<i>Polytrichum commune</i>	common haircap moss
<i>Potamogeton natans</i>	broad-leaved pondweed
<i>Potamogeton polygonifolius</i>	bog pondweed
<i>Ranunculus aquatilis</i>	common water-crowfoot
<i>Ranunculus flammula</i>	lesser spearwort
<i>Ranunculus peltatus</i>	pond water-crowfoot
<i>Ranunculus trichophyllus</i>	thread-leaved water-crowfoot
<i>Riccia fluitans</i>	floating crystalwort
<i>Solanum dulcamara</i>	woody nightshade
<i>Sphagnum fallax</i>	flat-topped bog-moss
<i>Sphagnum squarrosum</i>	spiky bog-moss
<i>Typha latifolia</i>	greater reedmace
<i>Veronica catenata</i>	pink water-speedwell
<i>Veronica scutellata</i>	marsh speedwell