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A SURVEY OF THE PLANTS AND AQUATIC MACROINVERTEBRATES OF WOLVERCOTE GREEN POND AND WOLVERCOTE COMMON LARGE POND

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A SURVEY OF THE PLANTS AND AQUATIC MACROINVERTEBRATES OF WOLVERCOTE GREEN POND AND WOLVERCOTE COMMON LARGE POND

1. INTRODUCTION

This report describes the results of a survey of wetland plants and aquatic macroinvertebrates undertaken at two ponds in Wolvercote on 21st July 1988. Additional information is given about amphibians observed at the ponds during visits made in spring 1988, 1989 and 1990. The ponds surveyed were:

Wolvercote Common Large Pond (SP 492097): an "L" shaped pond within the Port Meadow SSSI. One side of the pond runs parallel to Godstow Road, with a narrow arm extending SE across Wolvercote Common towards the railway.

Wolvercote Green Pond (SP 494098) an area of shallow water, overgrown with tall wetland species, located at the northern end of Wolvercote Green.

The nature conservation value of the wetland plant and animal communities within each pond is summarised and a number of general recommendations for the management of the sites are given.

2. METHODS

2.1 AQUATIC MACROINVERTEBRATES

2.1.1 Sampling

At each pond aquatic macroinvertebrates were sampled using a time-limited technique: a three minute period was divided equally between different habitats observed in the pond. Invertebrates within each habitat were collected using vigorous sweeps of a pondnet (Freshwater Biological Association pattern, 1mm square mesh). The habitat samples were pooled. This procedure was repeated 3 times. All samples were returned to the laboratory where macroinvertebrates were removed by hand for identification.

2.1.2 Identification

The following macroinvertebrate groups were identified to species level:

Tricladida	(Flatworms)
Hirudinea	(Leeches)
Gastropoda	(Snails)
Arachnida	(Spiders)
Malacostraca	(Shrimps and Slaters)
Ephemeroptera	(Mayflies)
Heteroptera	(Water Bugs)
Megaloptera	(Alderflies)
Trichoptera	(Caddis-flies)
Coleoptera	(Beetles)

In addition, Lepidoptera (Moths and Butterflies) were identified to genus and Diptera (True Flies) to family level.

2.2 WETLAND PLANTS

A list of the wetland plant species growing within the outer banks of each pond was compiled. Appendix 5 shows the National Pond Survey wetland plant checklist.

Where possible plant species were identified in the field. Specimens which could not be immediatley identified were returned to the laboratory for microscopic examination.

2.3 AMPHIBIANS

Torchlight surveys of amphibians were undertaken at the Wolvercote Common Large Pond in the spring of 1988 and 1989. Wolvercote Common Pond was not included in this survey. A daylight search for amphibians and spawn was made at both ponds during spring 1990.

2.4 FISH

Observations of fish were noted, but no specific survey was undertaken.

2.5 CONSERVATION VALUE

The conservation value of the ponds was assessed on the basis of the number of species recorded and their distribution in Britain (whether common, local or rare).

2.5.1 Number of species

i) Aquatic macroinvertebrates

The species-richness of the aquatic macroinvertebrate community was assessed by comparison with the number of species recorded in 42 ponds selected from the Oxfordshire Pond Survey data-set (Pond Action, unpublished results). It should be noted however that this selection of ponds included a high proportion of ponds of high conservation value.

ii) Wetland plants

The species-richness of the plant community was assessed by comparison with results of the Oxfordshire Pond Survey (Pond Action, unpublished results) and surveys in other regions of Britain. These were: North Leicester, South Leicester, Warwickshire, Wirral, Oose washes, West Lancaster and Cheshire (Bersford and Wade, 1982; Brian et al, 1987; Day et al, 1982).

2.5.2 The distribution of species recorded

Information on the national distribution patterns of the plant and macroinvertebrate species recorded in the Wolvercote ponds was obtained from standard references and personal communications with specialists in selected groups. Species were broadly grouped in one of three categories according to their national distribution: common, local or rare.

2.5.3 Assessment of conservation value

The richness of the pond communities and the number of rare or local species recorded were used to assign overall conservation values to the ponds. The categories were (i) very high, (ii) high, (iii) intermediate or (iv) low nature conservation value. Definitions of these categories are given in Table 1.

It should be noted that the conservation value of the ponds may be **underestimated** because the ponds have only been surveyed in one season (summer). Further surveys, at other times of year, might lead to the recording of 10%-20% more plant species and 30-50% more species of aquatic macroinvertebrate. It is quite possible that further rare or local species could be recorded making it necessary to give the sites a higher nature conservation value.

TABLE 1. PROVISIONAL SYSTEM FOR ASSESSING THE NATURE CONSERVATION VALUE OF AQUATIC MACROINVERTEBRATE AND PLANT COMMUNITIES

CONSERVATION VALUE	DESCRIPTION OF TYPE OF COMMUNITY
VERY HIGH	Supporting a rich community of wetland plants and macroinvertebrate species, including local and rare species. Note that some sites with rare species may be relatively species-poor. Sites in this category are likely either to be Sites of Special Scientific Interest in their own right, or within larger SSSI's.
HIGH	Supporting a rich community of common wetland plant and macroinvertebrate species. A number of local species present. No rare species. Could include sites on SSSI's or sites of local nature conservation value.
INTERMEDIATE	Supporting plant and macroinvertebrate communities with a near average diversity of common species. No rare species, very few or no uncommon species.
LOW	Supporting a low diversity of common species. No rare or uncommon species.

3. WOLVERCOTE COMMON MAIN POND

3.1 SURVEY RESULTS

3.1.1 Aquatic macroinvertebrates

49 aquatic macroinvertebrate species were recorded in the Wolvercote Common Main Pond (see Appendix 1). This is considerably above the average recorded in a selected group of ponds (42) in Oxfordshire including a high proportion of sites of high nature conservation value (Pond Action, unpublished results: average number of species recorded in one season = 35, range = 11-57). One local species, the lesser water boatman Corixa panzeri, was recorded.

The aquatic macroinvertebrate community was distinguished by a rich snail fauna. 14 snail species were recorded (see Appendix 1) including, (with the exception of exclusively riverine species) almost all our common, native freshwater snail species. This was amongst the highest number of snails recorded by PA in an Oxfordshire pond. The leech community was similarly diverse: 8 species were recorded (2 or 3 would be more be typical for Oxfordshire). The rich leech fauna may partly reflect the profusion of snails, which form part of the diet of many species of leech.

PA's results (unpublished) suggest that snail and leech rich comunities often occur at long-established ponds or ponds with links to long established wetlands. At the Wolvercote site this may reflect the age of the pond, its semi-permanant link with Wolvercote lake, and flood connections to local ditch and river systems.

Although only one uncommon macroinvertebrate species was recorded at the pond, other local or rare species might be found if further surveys were carried out in different seasons (see Section 2.5.3). In this context it should be noted that, in the past, two nationally rare aquatic macroinvertebrates have been recorded in the Wolvercote/Port Meadow area and may still be present there. The valve snail Valvata macrostoma was recorded from a marsh drain in Port Meadow in 1956 (M.P. Kerney, British Museum, pers. comm.); and the shiny ramshorn snail Segmentina nitida, which is "under serious threat in Britain", was last recorded in Oxfordshire in "a lake at Wolvercote" (ibid., pers. comm.).

3.1.2 Wetland plants

The pond had a rich wetland flora with 34 species recorded (see Appendix 3). This is considerably above the average for ponds in other areas of lowland Britain. Results of pond surveys in eight regions gave an overall average of 9 [range of averages 2-16] species per pond (see section 2.5.1). In Oxfordshire (where preliminary analysis of OPS data gives an average of 13 species) Wolvercote Common Main Pond supported the greatest (=) number of species recorded in this selected group of

sites. This was equal to the number of species found in Fowl's Pill on Otmoor.

The diversity of aquatic plants (submerged and floating-leaved species) was also high. 13 aquatic species were found, which was the highest number recorded in the preliminary analysis of OPS data. The average number of aquatic species per pond in the OPS is currently only 3 and it is unlikely that this will increase significantly with futher data.

Wolvercote Common Main Pond also supported 5 local plant species. These included three aquatic species, opposite-leaved pondweed (Groenlandia densa) and horned pondweed (Zannichellia palustris), great duckweed (Lemna polyrhiza) and two marginal species, tubular water-dropwort (Oenanthe fistulosa and great bittercress Cardamine amara).

It should also be mentioned that several rare or local wetland species recorded from Port Meadow could be present around the margins of the pond. These are creeping marshwort (Apium repens), mudwort (Limosella aquatica), round-fruited rush (Juncus compressus) and marsh arrowgrass and (Triglochin palustris).

3.1.3 Amphibians

Toads were sighted at the pond in very large numbers (several hundred), suggesting that the pond may be an important local breeding site. A few (5 or 6) frogs were also recorded. No newts were observed either as adults or as eggs.

3.1.4 Fish

Pike (up to approximately 1m in length) were recorded in the pond during both daytime and night-time visits.

3.2 CONSERVATION ASSESSMENT

The high species diversity and the presence of at least 6 local species suggest that the pond is, at minimum, of high nature conservation value (see Section 2.5.3 and Table 1). The richness of the aquatic flora is of particular note. Overall this pond is likley to be within the top 1%-2% of ponds in Oxfordshire in terms of its nature conservation value.

3.3 GENERAL MANAGEMENT RECOMMENDATIONS

Pond Actions survey work provides a preliminary indication of the conservation value of the pond. However sites of high/very high value require further survey work in order that sufficient information is available for adequate management recommendations to be given. This survey work should include detailed observations of the distribution of rare or local species, a phase of monitoring prior to any management work and a review of site records and history.

In this report, therefore, only general management guidelines are given. However potential problems are highlighted to help preserve the nature conservation value of the site.

3.3.1 The present management regime

i) The traditional management of the site, has undoubtedly contributed towards the richness of the pond for plants and macroinvertebrates. In particular, grazing has kept invasive wetland emergents, such as reed sweet-grass (Glyceria maxima), in check, enabling the retention of areas of open water and creating a more open sward structure suitable for a wide range of aquatic and marginal species.

In order to maintain the nature conservation value of the site it is therefore important that the traditional grazing management of the site is maintained. However, it may be necessary to consider some reduction in the intensity of grazing on the site.

ii) The present combination of semi-permanent open water areas at the road end of the site, and of marsh areas in the south-east arm, both contribute to the diversity of the habitat and the richness of the wildlife. The link with the Wolvercote Lakes is also likely to be an important factor in shaping the pond community, particularly as it affects the recolonisation of the site after periods of drought.

It is therefore important that the general structure of the site is retained. In particular large scale clearance/ dredging of the south-east arm, with its rich flora, should be avoided.

3.3.2 ACTIVE SITE MANAGEMENT

Because of the high conservation value of the site, active management of the pond (eg digging-out) should ideally be undertaken only after thorough survey and monitoring work. This should aim to establish where management is necessary and how it can best be undertaken without detrimental effects.

If in practice, constraints of time, manpower or money restrict the amount of survey and monitoring work that can be undertaken, some

"preventative" management may be desirable.

The most likely need for such work will be to prevent the loss of aquatic plants. From the survey work done these appear to be both the most vulnerable group at the site and the group which contribute most to its conservation value.

The main causes of losses of aquatic plants are likley to be:

i) Deterioration of water quality in the pond.

This may be caused by the polluting effect of urban/road runoff (Gower 1980) from the surrounding area. The routing of urban runoff into ponds should generally be avoided. Urban runoff may cause eutrophification (which is known to affect adversly the diversity of aquatic species), and may carry silt, heavy metals, oil and salt into the pond.

If possible road and urban runoff should be routed away from the pond, if this has not already been done.

ii) Decreasing water levels in the pond.

At the Wolvercote site this is likely to be caused by cattle/horses poaching the banks and filling in the pond, or possibly, in the longer term, by more extensive periods of drying out due to lowering of the water table. Short periods of drying out, or drying in some parts of the pond, are not necessarily detrimental.

Small scale dredging or deepening of the pond could be undertaken to counteract any decreases in water depth. This should initially be only undertaken in 1-2 sections of the pond (approximately 5-6m long and 30-50cms deep). Hand tools should be used. Autumn is likely to be the most suitable time of year, because water levels are at their lowest and damage to plant and animal communities is likely to be minimised.

A thorough survey of the area (especially those areas to be worked on) needs to be undertaken prior to any management work, in order that localised stands of uncommon plants are not destroyed by this work.

Post-management monitoring of the deepened areas is also essential in order to assess the beneficial or detrimental effects of any managment work. Results from the monitoring should be used to determine the course of any future work, but whatever the result, it is recommended that digging-out is undertaken in relatively small units, over a number of years to enable new areas to recolonise. It is also recommended that some areas of the pond are left untouched.

5. WOLVERCOTE GREEN POND

5.1 SURVEY RESULTS

5.1.1 Aquatic Macroinvertebrates

28 species of macroinvertebrate were recorded in the Wolvercote Green pond (see Appendix 2). This is a little below the average of 35 for ponds in Oxfordshire (see also Section 2.5.1). No rare or local species were recorded. In contrast to the Wolvercote Common Main Pond the invertebrate community was dominated by beetle species.

The relatively low diversity of the fauna is likely to be a reflection of the shallow, temporary nature of the pond and the dominance of tall emergent plants, which reduce habitat diversity at the site.

5.1.2 Wetland Plants

16 species of wetland plants were recorded in the Wolvercote Green pond. This is above average for ponds in lowland Britain (9 species: see Sections 2.5.1), and just above Pond Action's average for Oxfordshire (13 species).

Tall emergent species were well represented at the site, (see Appendix 4) with quite extensive stands of reed sweet-grass (Glyceria maxima) and great pond-sedge (Carex riparia). A stand of bulrush (Typha latifolia) occupied the area of deepest water near the centre of the pond. The submerged and floating-leaved flora was represented by only one species, ivy-leaved duckweed (Lemna trisulca). No rare or local plant species were recorded.

Domination by tall emergent plants is typical of overgrown, ungrazed ponds. However, the emergent flora in the Wolvercote Green pond was richer than that commonly encountered in overgrown ponds.

5.1.3 Amphibians

Pond Action did not undertake amphibian survey work at the pond in 1988 or 1989, but during a daytime visit in spring 1990 six clumps of frogspawn were observed near the south-east side of the bulrush stand. No toads or newts were observed during this visit. Because the pond is shallow and overgrown it is very unlikely that it provides an important breeding site for amphibian species.

5.2 CONSERVATION VALUE

Although the pond site is now almost dry for considerable periods of the year, the area still supports a wetland community of average species richness for Oxfordshire. Overall it is best classified as of moderate conservation value (see Section 2.5.3 and Table 1)

5.3 MANAGEMENT OF THE SITE

5.3.1 Site potential

The pond area retains considerable potential for nature conservation because:

i) Part of the pond's immediate surrounds are still under low intensity landuse.

ii) The pond still retains a moderate conservation value.

iii) The pond is in close proximity of a number of high quality neighbouring wetlands. Uncommon species present in these areas may colonise the Wolvercote Green site.

iv) The pond sediments may themselves contain a seed bank of wetland species which may reappear following management of the pond.

5.3.2 General recommendations

Because of the relativly high potential of the site, plans for management of the pond are strongly supported.

The recommendations given here aim to retain the best existing features of the pond, whilst enhancing the potential of the pond within the context of surrrounding wetlands.

Overall it is advised that the central area of the pond site is dug out to form an open waterbody of 15-30m diameter. The areas of the marsh/wetland and scrub that surround the waterbody should be retained almost untouched.

It is recommended that, if possible, the completed pond should be fed mainly by groundwater and that links to larger waterbodies (eg the Oxford Canal) are avoided. This will provide a different water regime to that prevailing in neighbouring ponds, encouraging a different (and complementary) plant and animal community to develope.

To increase the diversify of habitats on the site further, a second smaller pond (5-8m diameter) could be dug within the sedge beds at the western side of the site.

5.3.3 Management

Precise details of the management of the pond will of course depend upon the money and manpower available. The following should therefore be used as general guidelines.

i) Open water area

Dig out an area of ground (15-30m diameter) from the wettest area of the pond. This is located relatively centrally, and encompasses the stand of bulrush. Most of the bulrush should be removed to reduce subsequent management work. This is unlikely to greatly reduce the conservation value of the site since bulrush is extremely invasive and is one of the few wetland plants increasing in abundance nationally, probably at the expense of other less aggressive species (Grime et al, 1988). Some bulrush could be retained to maintain habitat diversity (and for public enjoyment), but regular management will be required in order to keep this very invasive species in check.

The depth to which the new pond should be dug depends partly on the level of the water table. A maximum depth of 1-1.5m below the level of the summer water table is suggested. If water level information is not available, it is suggested that a small number of trenches are dug on the site to investigate water levels during the summer and early autumn period.

The shape of the pond is unlikely to be critical to most species using the site. However in principle, irregular shapes may increase species diversity and abundance, since they increase the length of bank (which supports the most diverse community of many ponds).

It is advised that the margins of the pond are excavated to include a mixture of shallow and steeply shelving banks. Shallow banks will enable marginal plants to colonise extensively, whereas steeper banks will help to restrict encroachment by emergent plants. This will increase habitat diversity and minimise the amount of vegetation management needed at the site.

The timing of any excavation work is unlikely to be critical from the point of view of wildlife, but may be easiest in late summer or autumn when water levels are at their lowest.

It should be noted that when disposing of spoil from the pond, care must be taken not to dump material in any sensitive areas adjacent to the site.

Following pond excavation we would advise that the pond is left to recolonise naturally and is not stocked with plants or amphibian spawn. All are present in the area and will colonise the site. It is recommended that fish, in particular, are not introduced since they will probably reduced the abundance of amphibian larvae and aquatic invertebrates.

ii) The pond surrounds

The two small areas of willow scrub on the margins of the pond area should be retained to provide cover for amphibians and birds

(especially warblers and reed buntings). Re-coppicing of the large willow might be considered (although it may now be too old). Coppicing in stages (making sure the tree does not become unbalanced), might also be considered.

The stands of wetland vegetation around the pond should be retained in their existing state. They will provide a habitat for birds, amphibians and terrestrial invertebrates.

iii) Programme of work following excavation

A programme of regular (twice a year) light management should be maintained in order to prevent domination of the pond by emergent species, particularly bulrush.

Scrub should also be prevented from excessive encroachment into the stands of emergent plants or the pond.

REFERENCES

Beresford, J.E. and Wade, P.M. (1982). Field Ponds in north Leicestshire: their characteristics, aquatic flora and decline. Trans. Leicester & Philosophical Soc **76**: 25-34.

Brian, A. D., Price, P. S., Redwood, B.C. and Wheeler, E. (1987). The flora of the marl-pits (ponds) in one Cheshire parish. Watsonia, **16**:417-426.

Day, P., Deadman,A.J., Greenwood, B. W. and Greenwood, E. F. (1982). A floristic appraisal of marl pits in parts of north-western England and northern Wales. Watsonia, **14**:153-165.

Grime, J.P., Hodgson J.G., Hunt, (1988) Comparative Plant Ecology. Unwin Hyman.

Henderson-Sellers, B. and Markland, H. R. (1987). Decaying Lakes. John Wiley & Sons.

APPENDIX 1: AQUATIC MACROINVERTEBRATES FOUND IN WOLVERCOTE COMMON MAIN POND(21 JULY 1988)

TRICLADIDA (FLATWORMS)

Dugesia lugubris
Polycelis nigra/tenuis

HIRUDINEA (LEECHES)

Erpobdella octoculata
Erpobdella testacea
Glossiphonia complanata
Glossiphonia heteroclita
Haemopis sanguisuga (Horse Leech)
Helobdella stagnalis
Piscicola geometra
Theromyzon tessulatum

GASTROPODA (SNAILS)

Bithynia tentaculata (The Bithynia)
Lymnaea palustris (Marsh Snail)
Lymnaea peregra (Wandering Snail)
Lymnaea stagnalis (Great Pond Snail)
Physa fontinalis (Bladder Snail)
Planorbis albus (White Ramshorn)
Planorbis carinatus (Keeled Ramshorn)
Planorbis contortus (Button Ramshorn)
Planorbarius corneus (Great Ramshorn)
Planorbis crista (Nautilus Ramshorn)
Planorbis planorbis (The Ramshorn)
Planorbis vortex (Whirlpool Ramshorn)
Valvata cristata (Flat Valve Snail)
Valvata piscinalis (Valve Snail)

ARACHNIDA (SPIDERS)

Argyroneta aquatica (Water Spider)

MALACOSTRACA (SHRIMPS AND SLATERS)

Asellus aquaticus (a water slater or hog louse)
Crangonyx pseudogracilis (a freshwater shrimp)

EPHEMEROPTERA (MAYFLIES)

Cloeon dipterum (Pond Olive)

HETEROPTERA (WATER BUGS)

Corixidae (Lesser Waterboatmen)

Corixa panzeri*
Hesperocorixa linnei
Hesperocorixa sahlbergi
Sigara distincta
Sigara dorsalis
Sigara fossarum

Notonectidae (Greater Waterboatmen)

Notonecta glauca

MEGALOPTERA (ALDERFLIES)

Sialis lutaria

TRICHOPTERA (CADDIS FLIES)

Triaenodes bicolor

LEPIDOPTERA (MOTHS)

Nymphula sp. (China-mark Moth)

COLEOPTERA (BEETLES)

Coelambus impressopunctatus
Colymbetes fuscus
Haliplus ruficollis
Haliplus immaculatus
Helophorus brevipalpis
Helophorus grandis
Hydroporus palustris
Hygrobia hermanni (Screech Beetle)
Hygrotus inaequalis
Hyphydrus ovatus
Limnebius papposus
Noterus clavicornis

DIPTERA (TRUE FLIES)

Ceratopogonidae (Biting Midges)
Chironomidae (Plumed Gnats, Bloodworms)
Culicidae (Mosquitoes and Gnats)
Stratiomyidae (Soldier-flies)
Tipulidae (Crane-flies, Daddy long-legs)

N.B. Common (English) names have been given where possible, but in the case of many invertebrates only a Latin name exists.

* Local species are marked with an asterisk.

Welw. Common Pond.

16/5/93.

Flat.
- Poly tenu
- Poly nigr ✓
- ~~Duge~~
- Duge lugu ✓

(3)

Leech
- Erpo test ✓
- Glos comp ✓
- Pisc geom ✓
- Helo stag ✓
- Erpo oct ✓
- (Thea biss) ✓

(6)

Mule
- Asel aqua ✓
- Cra pseu ✓

(2)

Snails
- Anis vort ✓
- Bath cont ✓
- B. tent ✓
- Lymn palu ✓
- Plan plan ✓
- Plan cont ✓
- Bleak.
- Phys fonk ✓
- Lymn stag ✓
- Lymn pere ✓
- Plan corn ✓
- Aero lacu
- Valv cris ✓
- Gyra albu ✓

(14)

Mayf
- Cloe dipt ✓
- Caen robu

(2)

Odon
- Lthe dipr
- Isch eleg
- Enal cyat

(3)

Hete
- Plea leac
- Nepa cine
- Hesp stag
- Sigo dist ✓
- Sigo dors ✓
- Hesp linn ✓

(6)

Tric
- Thia buc ✓
- Lein luna
- Lein vitt

(3)

Coleo.
- Note clav ✓
- Halo lin
- Hyph ovat
- Hygr ovo ✓
- Laccp min
- Hali rufi ✓

(6)

Spha lacu

30

49

45

Tot.

88 = 49

93 = 45

$\Sigma = \underline{64}$

Cj = 0.47

Invertebrate richness guide

Flatworms: Flat and gliding smoothly over the surface. Three common families told apart mainly by colour and eyes.

Dendrocoelidae. White. To 25mm.

Polycelidae. Brown/black, many tiny eyes To 12mm

Dugesiidae. Grey/brown. Two white eyes. To 15mm

True worms. Often red. Many segments. Move with a writhing action

Leeches: Move by pulling themselves forward with their front sucker, or 'looping'. Separate by colour (green, red, white), shape (rather flattened, tubular) and by movement (looping or pulling)

Snails: Many species in several combinations. With or without a trap -door. Coiled or flat. Left or right handed.

Valve snails. Flat or coiled. Very circular opening.

Bithyniids. Spired with an obvious

Pond snails. Spired and with no

Bladder snails. The only left-handed water

APPENDIX 2: AQUATIC MACROINVERTEBRATES FOUND AT WOLVERCOTE GREEN POND (21 JULY 1988)

HIRUDINEA (LEECHES)

Erpobdella testacea
Helobdella stagnalis

GASTROPODA (SNAILS)

Lymnaea palustris (Marsh Snail)
Lymnaea peregra (Wandering Snail)
Planorbis contortus (Button Ramshorn)
Planorbis planorbis (The Ramshorn)

MALACOSTRACA (SHRIMPS AND SLATERS)

Asellus aquaticus (a water slater or hog louse)
Crangonyx pseudogracilis (a freshwater shrimp)

HETEROPTERA (WATER BUGS)

Hesperocorixa sahlbergi (a lesser waterboatman)
Corixid nymphs

LEPIDOPTERA (MOTHS AND BUTTERFLIES)

Nymphula sp. (China-mark Moth)

COLEOPTERA (BEETLES)

Agabus bipustulatus
Anacaena limbata
Cercyon sternalis
Copelatus haemorrhoidalis
Helophorus brevipalpis
Hydrobius fuscipes
Hydroporus angustatus
Hydroporus erythrocephalus
Hydroporus palustris
Hydroporus planus
Hydroporus pubescens
Ilybius quadriguttatus
Haliplid larvae
Dytiscid larvae

DIPTERA (TRUE FLIES)

Chironomidae (Plumed gnats, Bloodworms)
Culicidae (Mosquitoes and Gnats)
Stratiomyidae (Soldier-flies)
Tabanidae (Horseflies)

APPENDIX 3: WETLAND PLANTS RECORDED IN WOLVERCOTE COMMON MAIN POND (21 JULY 1988)

SUBMERGED

Callitriche hamulata (Intermediate Water-starwort)
Callitriche obtusanglia (Blunt-fruited Water-starwort)
Callitriche stagnalis (Common Water-starwort)
Ceratophyllum demersum (Rigid Hornwort)
Chara sp. (Stonewort)
Elodea canadensis (Canadian Waterweed)
Elodea nuttallii (Nuttall's Waterweed)
Groenlandia densa (Opposite-leaved Pondweed)*
Lemna trisulca (Ivy-leaved Duckweed)
Potamogeton crispus (Curled Pondweed)
Zannichellia palustris (Horned Pondweed)*

FLOATING

Glyceria fluitans (Floating Sweet-grass)
Lemna minor (Common Duckweed)
Lemna polyrhiza (Greater Duckweed)*

EMERGENT

Alisma plantago-aquatica (Common Water-plantain)
Apium nodiflorum (Fool's Water-cress)
Cardamine amara (Large Bitter-cress)*
Eleocharis palustris (Common Spike-rush)
Epilobium hirsutum (Great Willowherb)
Equisetum palustre (Marsh Horsetail)
Filipendula ulmaria (Meadowsweet)
Glyceria maxima (Reed Sweet-grass)
Juncus articulatus (Jointed Rush)
Lythrum salicaria (Purple Loosestrife)
Mentha aquatica (Water Mint)
Nasturtium officinale (Water-cress)
Myosotis laxa subsp.caespitosa (Tufted Forget-me-not)
Myosotis scorpioides (Water Forget-me-not)
Oenanthe fistulosa (Tubular Water-dropwort)*
Phalaris arundinacea (Reed Canary-grass)
Rumex hydrolapathum (Water Dock)
Sparganium erectum (Branched Bur-reed)
Typha latifolia (Bulrush)
Urtica dioica (Common Nettle)
Veronica beccabunga (Brooklime)

* Local species are marked with an asterisk.

APPENDIX 4: WETLAND PLANTS RECORDED AT WOLVERCOTE GREEN POND (21 JULY 1988)

SUBMERGED

Lemna trisulca (Ivy-leaved Duckweed)

MARGINAL

Carex riparia (Great pond-sedge)
Cirsium palustre (Marsh Thistle)
Epilobium hirsutum (Great Willowherb)
Filipendula ulmaria (Meadowsweet)
Glyceria maxima (Reed Sweet-grass)
Iris pseudacorus (Yellow Iris)
Juncus inflexus (Hard Rush)
Lycopus europaeus (Gipsywort)
Lythrum salicaria (Purple-loosestrife)
Mentha aquatica (Water Mint)
Polygonum amphibium (Amphibious Bistort)
Rumex hydrolapathum (Water Dock)
Scrophularia auriculata (Water Figwort)
Solanum dulcamara (Bittersweet)
Sparganium erectum (Branched Bur-reed)
Typha latifolia (Bulrush)

APPENDIX 5. NATIONAL POND SURVEY- Wetland Plant List

SUBMERGED, FLOATING AND EMERGENT PLANTS

Acorus calamus
Agrostis stolonifera
Alisma lanceolatum
Alisma plantago-aquatica
Apium inundatum
Apium nodiflorum
Aponogeton distachyos
Azolla filiculoides
Baldellia ranunculoides
Berula erecta
Butomus umbellatus
Callitriche hamulata
Callitriche hermaphroditica
Callitriche obtusangula
Callitriche platycarpa
Callitriche stagnalis
Callitriche truncata
Callitriche sp. (undetermined)
Caltha palustris
Cardamine amara
Carex acuta
Carex acutiformis
Carex elata
Carex lasiocarpa
Carex nigra
Carex paniculata
Carex pseudocyperus
Carex riparia
Carex rostrata
Carex vesicaria
Catabrosa aquatica
Ceratophyllum demersum
Ceratophyllum submersum
Cicuta virosa
Cladium mariscus
Crassula helmsii
Egeria densa
Elatine hexandra
Eleocharis acicularis
Eleocharis palustris
Eleogiton fluitans
Elodea canadensis
Elodea nuttallii
Equisetum fluviatile
Equisetum palustre
Eriophorum angustifolium
Glyceria declinata
Glyceria fluitans
Glyceria maxima
Glyceria plicata
Glyceria sp. (fine leaved)
Groenlandia densa
Hippuris vulgaris
Hottonia palustris
Hydrocharis morsus-ranae
Hydrocotyle vulgaris
Iris pseudacorus
Isoetes lacustris
Isolepis setacea
Juncus bulbosus
Juncus effusus
Lagarosiphon major
Lemna gibba
Lemna minuscula
Lemna minor
Lemna trisulca
Lemna polyrhiza
Littorella uniflora
Lobelia dortmanna
Lythrum portula
Mentha aquatica
Menyanthes trifoliata
Myosotis laxa
Myosotis scorpioides
Myosotis secunda
Myosoton aquaticum
Myriophyllum alterniflorum
Myriophyllum spicatum
Myriophyllum verticillatum
Nasturtium microphyllum
Nasturtium officinale
Nuphar lutea
Nymphaea alba
Nymphoides peltata
Oenanthe aquatica
Oenanthe fistulosa
Oenanthe fluviatilis
Phalaris arundinacea
Phragmites australis
Pilularia globulifera
Polygonum amphibium
Polygonum hydropiper
Potamogeton alpinus
Potamogeton berchtoldii
Potamogeton coloratus
Potamogeton crispus
Potamogeton friesii
Potamogeton gramineus
Potamogeton lucens
Potamogeton natans
Potamogeton obtusifolius
Potamogeton pectinatus
Potamogeton polygonifolius
Potamogeton praelongus
Potamogeton pusillus
Potamogeton trichoides
Potamogeton hybrid(s)
Potentilla palustris
Ranunculus aquatilis
Ranunculus baudotii
Ranunculus circinatus
Ranunculus flammula
Ranunculus fluitans
Ranunculus hederaceus
Ranunculus omiophyllus
Ranunculus peltatus
Ranunculus penicillatus
Ranunculus sceleratus
Ranunculus trichophyllus
Rorippa amphibia
Rumex hydrolapathum
Sagittaria sagittifolia
Schoenoplectus lacustris
ssp lacustris
ssp tabernaemontani
Sparganium angustifolium
Sparganium emersum
Sparganium erectum
Sparganium minimum
Stratiotes aloides
Subularia aquatica
Typha angustifolia
Typha latifolia
Utricularia australis
Utricularia intermedia
Utricularia vulgaris
Veronica anagallis-aquatica
Veronica beccabunga
Veronica catenata
Veronica scutellata
Wolffia arriza
Zannichellia palustris

Algae:
Chara sp.
Nitella sp.
Tolypella sp.
Entermorpha sp
Filamentous
planktonic

Bryophytes:
Fontinalis antipyretica
Riccia fluitans
Ricciocarpus natans
Sphagnum sp.

OTHER WETLAND PLANTS

Alopecurus geniculatus
Anagallis tenella
Andromeda polifolia
Angelica archangelica
Angelica sylvestris
Barbarea intermedia
Barbarea stricta
Barbarea vulgaris
Bidens cernua
Bidens tripartita
Blysmus compressus
Calamagrostis canescens
Calamagrostis epigejos
Cardamine pratensis
Carex curta
Carex demissa
Carex diandra
Carex disticha
Carex flacca
Carex hostiana
Carex laevigata
Carex lepidocarpa
Carex limosa
Carex otrubae
Carex panicea
Carex pendula
Carex pulicaris
Carex spicata
Cirsium dissectum
Cirsium palustre
Conium maculatum
Crepis paludosa
Cyperus longulus
Dactylorhiza fuchsii
Dactylorhiza incarnata
Dactylorhiza majalis:
D. majalis ssp. praetermissa
D. majalis ssp. purpurella
Deschampsia caespitosa
Drosera rotundifolia
Eleocharis multicaulis
Eleocharis quinqueflora
Eleocharis uniglumis
Epilobium adenocaulon
Epilobium hirsutum
Epilobium nerteroides
Epilobium obscurum
Epilobium palustre
Epilobium parviflorum
Epilobium tetragonum
Epipactis palustris
Erica tetralix
Eriophorum latifolium
Eriophorum vaginatum
Eupatorium cannabinum
Filipendula ulmaria
Frangula alnus
Gallium boreale
Galium palustre
Galium uliginosum
Geum rivale
Hypericum elodes
Hypericum tetrapterum
Impatiens capensis
Impatiens glandulifera
Impatiens noli-tangere
Isolepis cernua
Juncus acutiflorus
Juncus articulatus
Juncus bufonis
Juncus compressus
Juncus conglomeratus
Juncus inflexus
Juncus subnodulosus
Achillea ptarmica
Alnus glutinosa
Alopecurus aequalis
Lotus uliginosus
Lycopus europaeus
Lysimachia nummularia
Lysimachia vulgaris
Lythrum salicaria
Mimulus guttatus
Mimulus luteus
Molinia caerulea
Montia fontana
Myrica gale
Narthecium ossifragum
Oenanthe crocata
Oenanthe lachenalii
Osmunda regalis
Parnassia palustris
Pedicularis palustris
Petasites hybridus
Pinguicula vulgaris
Polygonum lapathifolium
Polygonum persicaria
Potentilla erecta
Pulicaria dysenterica
Ranunculus lingua
Rhynchospora alba
Rorippa palustris
Rorippa sylvestris
Rumex maritimus
Rumex palustris
Sagina procumbens
Salix sp.
Schoenus nigricans
Tricophorum cespitosum
Scrophularia auriculata
Scutellaria galericulata
Senecio aquaticus
Senecio fluviatilis
Sium latifolium
Solanum dulcamara
Stachys palustris
Stellaria alsine
Stellaria palustris
Symphytum officinale
Thalictrum flavum
Thelypteris palustris
Tofieldia pusilla
Triglochin palustris
Urtica dioica
Valeriana dioica
Viola palustris