2052

AN ECOLOGICAL SURVEY OF BRERLEY CLOSE POND, UXBRIDGE

REPORT TO HERPETOFAUNA INTERNATIONAL

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1. INTRODUCTION

This report describes the results of a survey of the plants and invertebrate animals at Brearley Close pond, Uxbridge. It includes maps of the Brearley Close site (showing distribution of the main stands of water plants and positions of trees in the surrounding woodland) as well as preliminary observations of terrestrial insects and birds present. Data on the pond's physical features and water chemistry are also given. The report concludes with an assessment of the conservation value of the pond and gives recommendations for minimising the impact of widening Park Road and for the future management of the pond.

2. BACKGROUND

Brearley Close pond lies in the northern suburbs of Uxbridge (TQ 071847) on a site bounded to the south and east by Brearley Close and to the west by Park Road (B483). To the north lies the more open ground of the Uxbridge Cricket Club.

The pond is approximately 0.25ha (2500 square metres) in area and is separated from Park Road by a small area of mixed oak woodland. The total area of the pond and woodland is about 0.5ha.

The site is underlain by glacial sands and gravels, which in turn overlie the thick impermeable strata of the London Clay.

The projected widening of Park Road on the western margin of the site will mean the destruction of part of the woodland adjacent to the pond but will not impinge upon the pond itself.

3. METHODS

Surveys of the Brearley Close site were carried out on 13 and 14 February 1989 with supplementary visits on 18 and 23 February.

A scale map of the site was prepared from a plane table survey to show:

a) the physical features of the site
b) the extent of the main stands of vegetation within the pond
c) the position of large trees in the surrounding woodland

Wetland plant species (as defined in the Nature Conservancy Council survey card CST OW2 Second Edition) present in or near the pond were recorded, some material being taken back to the laboratory for identification.

The pH, conductivity and alkalinity of the pond were recorded on 13 February. Sampling points are shown in Figure 1. Water samples were returned to the laboratory for phosphate, nitrate and chloride analysis.

Measurements of pond depth were made at 5 metre intervals along

each of the five transects shown in Figure 2. Where the pond was covered by rafts of floating vegetation the depth of the raft was estimated separately. The loose organic material beneath the raft was recorded as sediment. In areas of well established Salix scrub the raft was often appreciably higher than the water level, and in these areas the total depths recorded exaggerated the true depth of the pond.

Aquatic invertebrates were collected from the pond using a standard FBA pattern pond net (mesh size 1mm). Samples were sorted in the field, each site being sampled until no further taxa could be found. Four sites were sampled:

Site 1: leaf litter and sediment.
Site 2: grassy edge, marginal Juncus effusus and Typha latifolia.
Site 3: J. effusus stand.
Site 4: Typha latifolia raft.

Aquatic invertebrates collected were returned to the laboratory for identification. Taxa were identified to species level, except for Diptera, which were identified to family level, and Oligochaeta and smaller Crustacea which were identified to subclass.

Notes of the birds observed at the site were made on 13 and 14 February. Pit fall traps were laid in the woodland for ground beetles on the evening of 13 Feburary and examined the next day. Leaf litter, bark, stones and the floating mat of vegetation were searched for terrestrial insects.

4. RESULTS

4.1 PHYSICAL AND CHEMICAL FEATURES OF THE SITE

The Brearley Close site covers an area of 0.49ha. The pond occupies about half (0.25ha) of the site, its area being defined by a low bank. At the time of the survey water levels were very low. On 13 February standing water in the pond occupied only 0.11ha (ie standing water covered less than half of the pond area).

The results of cores to ascertain whether the pond is clay lined were not available for this report. However the pond is likely to be filled predominantly by ground water, supplemented by surface and near surface run-off from the surrounding area. Water drains into the pond through several culverts from Park Road.

Water and sediment depths are shown in Table 1. Measurements of the total depth (ie water + silt) showed the pond to be deepest in the centre beneath the floating raft of Typha latifolia (reedmace). The maximum total depth recorded was 60cm. However, following a dry winter, water levels were particularly low. Water depths (ie water above silt) were generally less than 25cm, even in the centre of the pond. Normally, when bank-full, the pond would be about 30cm deeper than recorded in this survey.

Sediments averaged about 30cm in thickness with a maximum of 50cms. They were thickest beneath the Typha stand in the centre of the pond and beneath the Salix scrub on the southern margin. The total volume of sediment was estimated (very approximately) to be 700 cubic metres. Even at maximum water levels this at least half fills the pond.

The results of the water chemistry analysis are given in Table 2. The water was slightly acidic, with pH's ranging from 6.2 to 6.9. The total alkalinity ranged from 0.90 to 1.15 m/eq/litre, both values are slightly lower than those commonly observed in ponds in central-southern England (Pond Action, unpublished results). Conductivity readings for the pond at 10cm depth averaged 763.8 micro Siemens/cm slightly above average for central-southern England. Phosphate levels varied from 2.18 to 3.01 mg/l. Nitrate levels varied from 0.49 to 1.32 mg/l. Chloride levels varied from 167.4 to 191.9 mg/l.

The low pH may partly result from the influence of Quaternary sands and gravels which underlie the pond. However, both the low pH and the relatively low alkalinity could reflect seasonal variation. A low percentage temporary hardness is not unusual in ponds at this time of year, and it is difficult to predict whether the pond will retain an acid pH throughout the year.

Chloride concentrations were high, perhaps reflecting an accumulation of salt from the road. Phosphate concentrations were high enough to justify describing the pond as enriched. Nitrate concentrations were low.

4.2 VEGETATION

Species recorded in and around the pond during February 1989 are listed in Table 3a. The main stands of vegetation are shown in Figure 3. A total of 17 wetland plants were recorded.

4.2.1 Trees and scrub

About half the area and over two thirds of the margins of the pond were dominated by Salix scrub (Salix fragilis and Salix cinerea). Areas on the north-east and south-east shores of the pond remained the most open. Where Salix scrub had been established for some years, sediment had built up above the water level. Willows had recently been coppiced along part of the north west margin and in the centre of the pond (see Figure 3). A large two-trunked crack willow dominated the south-west of the pond. A number of small alders grew along the more open south-east margin.

4.2.2 Marginal and emergent plants

At the time of the survey few herbaceous plants were showing. A number of species were identified from the remains of last years growth.

Marginal emergent vegetation was best developed on the relatively open north-east and south-east sides of the pond. Glyceria fluitans (floating sweet-grass) formed an inner fringe of marginal vegetation, which would be flooded at higher water levels. Slightly drier open ground was dominated by a mixed stand of Juncus effusus (soft rush), Lycopus europaeus (gipsywort), Epilobium hirsutum (great hairy willow-herb) and Alisma plantago-aquatica (water plantain). A single Iris pseudacorus (yellow flag) was found in the shade of the woodland at the south-eastern corner of the pond.

A uniform stand of Typha formed a raft covering about 1/6th of the pond area. The stand became more diverse on the southern margin where Juncus effusus and Lycopus europaeus occurred. Small stands of Typha also occurred around the more open eastern margins of the pond

4.2.3 Submerged and floating leaved plants

At the time of the survey small stands of Callitriche sp. were present in several areas around the open areas of pond margin and amoungst the Typha raft. Two common species of duckweed, Lemna minor and Lemna trisulca were also found. In addition, two turions (overwintering buds) of a submerged plant species were found amongst submerged grasses on the south-east margin of the pond. The turions were grown-on in the laboratory and identified as the uncommon carnivorous plant, Utricularia vulgaris (common bladderwort). This species is of only local occurrence in the South and its presence at Brearley Close is of considerable interest.

4.2.4 Woodland

Woodland surrounds the northern and western margins of the site. The northern woodland is dominated by standards of pedunculate oak (Quercus robur) with a shrub layer of holly (Ilex aquifolius). This gives way southwards to more open mixed woodland composed predominantly of crack willow (Salix fragilis), alder (Alnus glutinosa), hawthorn (Crataegus monogyna), beech (Fagus sylvatica) and sycamore (Acer pseudoplatanus). Figure 4 shows the position of major trees in the woodland. Table 3b lists the tree species present.

4.3 AQUATIC INVERTEBRATES

Forty-five taxa were recorded in the pond, of which just under half were water beetles (see Table 4). No nationally rare or local species were found. The fauna of the pond was dominated numerically by water shrimps (Crangonyx pseudogracilis), the water slater Asellus meridianus, cladocerans and copepods.

19 species of water beetle were found. Almost all were collected in

a small stand of flooded Glyceria fluitans at the south-east margin of the pond. The most abundant water beetle was the medium-sized dytiscid Copelatus haemorrhoidalis, a species common in silty ponds. All other species were scarce, only one or two individuals of each species being found. Most of the water beetles recorded can be found in base rich waters but two are associated with acid conditions. The hydrophilid Helochares punctatus is normally found in acid sandy pools in southern England (R. Angus, personal communication) and the dytiscid Hydroporus erythrocephalus is often found in peat pools, (but can occur in base-rich waters).

All other taxa (flatworms, leeches, snails, mayflies and water bugs) were generally scarce, both in terms of the number of species recorded and in the abundance of those that were found. Only one individual larval dragonfly (Aeshna cyanea), a common species, was found. No damselfly larvae or caddis fly larvae were recorded.

The richest habitat for invertebrates (particularly water beetles) was the grassy margin of the pond where 80% of taxa recorded in the pond were present. In other sampling areas no more than 25% of the taxa recorded in the pond were present. The leaf litter/sediment yielded very few taxa with no water beetles, although Chironomidae (non-biting midge larvae) were most abundant in this location. Stands of Juncus effusus and Typha latifolia were intermediate in the number of taxa found.

4.4 TERRESTRIAL INSECTS

No insects were observed in flight on 13 or 14 February. In the woodland and floating mats of vegetation only Collembola were found. The pit-fall traps caught no adult ground beetles (which hibernate in winter), but they did catch one species of carabid larva (no key yet exists to the larvae) and Collembola (springtails) of the families Poduridae and Onychiuridae.

4.5 BIRDS

During the course of the survey 20 bird species were recorded (see Table 5). Most species were typical of scrub/woodland and the number of species visiting indicates the extent to which birds make us of overgrown ponds. Three species, Mallard (Anas platyrhynchos), Moorhen (Gallinula chloropa) and Siskin (Carduelis spinus), were specifically associated with wetland features of the site.

Birds singing on the site (suggesting that they were holding territory) were blue tit, great tit, dunnock, robin, wren and blackbird. It is possible that the site could also provide breeding territories for summer visitors such as Willow Warbler, Blackcap and Spotted Flycatcher.

5. ASSESSMENT OF THE CONSERVATION VALUE OF THE POND

5.1 VEGETATION

At the time of the survey, a relatively small number of emergent and submerged plant species were recorded at the pond. All, with one notable exception, were common and widespread species. Although it is possible that other species may appear later in the season, the extensive shading of the pond margins and accumulation of thick sediment suggests that the total number of plant species recorded will remain relatively low.

Since the pond seems poor in species it was surprising to find turions of Utricularia vulgaris (Common bladderwort). This species is local in the South, becoming rarer in the North (Clapham et. al. 1987). In the intensively farmed South bladderworts are generally associated with 'high-quality' wetland sites. Within Oxfordshire, for example, the Pond Action group have observed U. vulgaris in only two less disturbed wetland sites. Because of the present condition of the pond the presence of common bladderwort is unexpected.

For this reason the possibility that bladderwort had been introduced to the site must be considered. However, Utricularia spp. are not distributed by at least one of the major wholesale suppliers of water plants in London which suggests that they are not easily available.

Because of the occurrence of common bladderwort the possibility remains that the site may support other rare or local species of aquatic flora (although some could be present only as viable propagules). It is therefore recomended that a brief survey of plants is undertaken at a more favourable time of year (June to August).

5.2 AQUATIC INVERTEBRATES

The composition of aquatic invertebrate communities changes during the course of the year but it is usually possible to find a considerable number of taxa during winter and early spring. Indeed, in some ponds the same number of taxa may be found during winter months as in the summer, (though not necessarily the same taxa). The results of an early spring survey of invertebrates can therefore give a good impression of the general richness of the fauna, but is unlikely to produce a complete species list. Further survey work later in the year would almost certainly lead to the recording of 25-30% more taxa, some of which may be uncommon species.

With the exception of water beetles, the invertebrate fauna of the Brearley Close pond was species-poor. This reflected the neglected

state of the pond, with a) margins dominated by extensive stands of Salix spp. (and the consequent supression of marginal and submerged plants), b) development of an extensive mat of Typha c) large accumulations of sediment. All three factors commonly reduce invertebrate diversity (and in some cases abundance) in ponds.

In contrast to the other groups of invertebrates, the number of water beetles species recorded was similar to that found in many well maintained ponds in south-central England (Biggs, 1988 and Pond Action, unpublished results). The presence of this moderately diverse water beetle community in the Brearley Close pond was the result of the existence of two small areas of flooded grassy margins in the south-east and north-east corners of the pond. Grassy margins are particularly attractive to water beetles and almost all the beetle species found, were recorded in these two small areas of the pond.

Although the water of the pond was slightly acid at the time of the survey and is located on sands and gravels which are probably base-poor, there was little evidence that the macro-invertebrate community was typical of acid water. Only two of the species found, both water beetles, are associated with base-poor conditions. However, it is possible that a community associated with more acid conditions was once present in the pond.

5.3 THE SIGNIFICANCE OF UNCOMMON SPECIES

Uncommon species, whilst worthy of conservation in their own right, are also important as indicators of long-established undisturbed sites, with communities which cannot be recreated. The occurrence of great crested newts and bladderwort in the neglected and nutrient enriched Brearley Close pond suggests that the pond may once have supported a considerably more diverse community (including a number of uncommon species) than is now evident.

5.4 TERRESTRIAL FAUNA AND FLORA

Further survey work is required to make an assessment of the conservation value of the terrestrial fauna and flora of the site.

5.5 SUMMARY OF CONSERVATION INTEREST

5.5.1 General value of site for nature conservation

Although Brearley Close pond is neglected it retains considerable interest and potential for wildlife conservation. The pond supports uncommon species which indicate that the site is of particular importance for nature conservation. The persistence of these species also suggests that the site may previously have supported a community of greater diversity with a number of uncommon species present. Management may lead to the reappearance of some of these species.

5.5.2 Conservation value of pond areas

The principal areas of the pond and their conservation value are listed below.

(i)	Salix scrub	Salix scrub is extensively shading the margins of the pond and increasing leaf litter inputs. The substrate beneath the Salix is poor in aquatic invertebrates but provides feeding and breeding cover for birds and insects.
(ii)	Typha stand	A floating mat of Typha is encroaching on the pond. It provides a generally poor habitat for aquatic plant and animal species although probably provides feeding/breeding cover for moorhens (and other species?).
(iii)	Grassy margins	Grassy margins provide good invertebrate habitat, especially for water beetles. This habitat currently supports the most diverse invertebrate community in the pond and undoubtedly provides spawning areas for amphibians.
(iv)	Sediment	Sediments are greatly reducing the depth and area of pond. The accumulations of sediment is restricting plant diversity (especially submerged species) and reducing invertebrate diversity (and possibly also abundance).

6. MANAGEMENT OF THE POND

6.1 INTRODUCTION

Management is required not only to maintain uncommon species but also to provide the conditions required for the re-establishment of a species-rich community. It is possible that some species, particularly water plants, may also be present as viable propagules in the sediment.

Management of the pond can be divided into two categories:

i) minimising the environmental impact of the road during and after widening.

ii) active site management (eg dredging of pond, cutting back of encroaching vegetation)

6.2 MINIMISING THE ENVIRONMENTAL IMPACT OF THE ROAD

In order to minimise the environmental impact of the road, the following potentially damaging factors should be controlled.

i) physical damage to pond site during construction of the road.

ii) oil spillage whilst construction machinery is on site.

iii) run-off from the road carrying oils, chemicals (especially salt), suspended solids and toxins from vehicle exhausts.

iv) increased dumping of litter and rubbish and the danger of fly tipping because of increased visibility of the pond.

v) increased human disturbance to the pond area.

Factors (i) and (ii) can be dealt with by careful instruction of site workers. Factor (iii) is to be dealt with by construction of a wall alongside the site and by re-routing of surface water runoff. Periodic monitoring should be instated to measure the success of this approach (see Section 6.5.2ii). Factor (iv) must be dealt with by making unauthorised vehicular access to the site difficult and by regular removal of litter (perhaps by local residents). Factor (v) should be controlled by regulating access to the site and by vegetation management (see Section 6.3v).

6.3 ACTIVE MANAGEMENT OF THE POND

The main aims of active management should be to:

i) maintain (preferably strengthening) populations of specially protected or uncommon species (ie great crested newts, common bladderwort).

ii) increase variation in vegetation structure at the margins of the pond and provide conditions suitable for a greater variety of water plants.

iii) maintain/create conditions suitable for diverse invertebrate and amphibian communities.

iv) retain an area of undisturbed Salix scrub, sediment and marginal vegetation from which re-colonisation of dredged areas can occur; this area also to provide shrubs and mature trees for the site and to provide a barrier restricting access to the north-east side of the pond.

v) involve the local community, particularly residents of Brearley Close, in general maintainance and resposibility for the Pond. Assuming that they can also be kept well-informed about the site it may be possible to involve them in some decision-making.

The practical management of the site for aquatic plant and invertebrate species is discussed below. Specific management for amphibians is not considered.

6.4 PRACTICAL PROCEDURES REQUIRED TO ACHIEVE MANAGEMENT AIMS

6.4.1 Introduction

A considerable amount of management work is required, including the dredging out of most of the accumulated pond sediments and removal of encroaching Salix scrub, particularly on the south and west sides of the pond.

It is recommended that, during management, the pond is divided into two areas: i) an actively managed 'Cleared Area' ii) an undisturbed 'Refuge Area' (See Figure 5).

6.4.2 Refuge area

A Refuge Area should be established around the northern and eastern margins of the pond and left undisturbed during dredging and clearing. It is particularly important to retain the eastern margin as a refuge from which plants and animals can recolonise the pond. This area supports floating sweet-grass which provided the most valuable habitat for aquatic invertebrates. Common bladderwort propagules were also found in this area.

The area of Salix scrub in the north-east corner of the pond should be retained in order to provide cover for birds and insects. Some of the scrub should be brought under coppice/pollard management but otherwise left relatively undisturbed.

The remaining area of the pond forms the 'Cleared Area' which is discussed below (see also Figure 5)

6.4.3 Dredging

Ideally dredging and clearance should be done in stages (the effects of dredging on wildlife in ponds are little understood) and removal of sediments should be staggered over several years, to allow recolonisation of the site from this substrate.

If dredging over 3 years is possible:

Year 1: remove (winch) Salix around south and west margins. Dredge sediments from northern 1/3 of pond.

Year 2: dredge sediments from middle 1/3 of pond.

Year 3: dredge sediments from southern 1/3 of pond.

However, since it is probable that heavy machinery will be available only during the road widening scheme it seems likey that dredging and major clearance will have to take place in Year 1.

For this reason it will be particularly important to protect the eastern margins of the pond to provide a source of recolonising plants and animals.

6.4.4 Removal of Typha raft

Removal of 85% of the Typha stand is recommended retaining 15% on the north-west margin. If possible replant part of the mixed Typha/Juncus effusus stand from the southern part of main raft. Removed vegetation should be left on the bank for at least 2 days to enable some of the invertebrates within raft to return to the pond.

6.4.5 Additional management recommendations

The following guidelines should be followed during renovation.

- Work should be done from the western side of the pond wherever possible. In general, the eastern margin should be free from disturbance, particularly by heavy machinery.

- If the pond is lined, particular care must be taken not to damage the lining. However, in view of local geology, the pond is more likely to be fed predominanly by the water table (results of the test borings were not available when these comments were written).

- Within the Cleared Area all sediments should be dredged from the pond and all Salix scrub within the pond boundary removed. The large double trunked crack willow on the south-west bank should be retained.

- Dredged sediment should not be dumped on site. Depending on the dumping site it may be necessary to analyse sediments for contaminants (especially heavy metals such as Lead).

- Wherever possible shallow, gently shelving margins should be retained.

- Remove yellow flag prior to dredging and transplant to a similar situation on the north-east of the pond just in the shade of the Salix scrub.

- Following clearance/dredging pond margins should be left to recolonise naturally, relying on plant propagules on site. The margins should not be sown with wildflower mixtures.

- To prevent competition with Utricularia there should be no introductions of submerged ('oxygenating') aquatic plants.

- Fish should not be introduced to the pond.

- Access to the pond for machinery should be maintained.

- Access to the northern end of the pond should be restricted by retaining the area of Salix scrub to make casual access to this part of the pond difficult. In general, viewing of the pond only to be encouraged from to the hard path in the south-east corner.

6.5 FUTURE MANAGEMENT

A management plan for the pond should be prepared. This should include recommendations about the management of the physical and chemical environment of the pond (eg water chemistry and sediment accumulation) and plant and animal populations. It should also include recommendations about access and educational use. The management plan should include details of the management needed to maintain populations of protected and uncommon species.

The main areas that should be dealt with by the management plan are listed below. The management plan should include details of sufficient survey work and monitoring to ensure that the success of site management can be reviewed.

6.5.1 Management plan

The management plan should make recommendations on:

(i) The establishment of a cycle of sediment removal. Maintenance of areas with different depths of accumulated silt (ie areas with no, slight and considerable accumulations of silt).

(ii) The introduction of a Salix coppicing/pollarding cycle for the Refuge Area.

(iii) The retention of some older crack willows.

(iv) The prevention of futher encroachment by Salix scrub.

(v) Maintainenance of the diversity of vegetation structure on the wet margins of the pond (providing habitats for invertebrates and areas suitable for colonisation by less robust marginal plants).

(vi) The management of Typha and other emergent species capable of forming dense monospecific stands.

6.5.2 Monitoring and further survey work

The managment plan should also describe futher survey/monitoring work required:

(i) Further surveys during the spring or summer of:

- aquatic plants and animals (particulaly to check for the occurrence of uncommon species.

- terrestrial plants and invertebrates (to determine the range of species present and identify those with limited powers of dispersal which may require rescue and transfer to other sites).

(ii) Monitoring, and reviewing at an agreed time, the success of measures designed to minimise impact of road widening:

- water quality (particularly sodium, chloride and heavy metals) to assess the effectiveness of any barrier system employed to isolate the pond from the road.

(iii) Monitoring to assess the effect of management work on aquatic plant, invertebrate and amphibian populations.

7. REFERENCES

Biggs, J. (1988). A preliminary assessment of the use of multivariate techniques (TWINSPAN & DECORANA) in the interpretation of pond survey data. Unpublished Report for the World Wide Fund for Nature.

Clapham, A. R., Tutin, T. G. and Moore, D. M. (1987). Flora of the British Isles. Cambridge University Press, Cambridge.

TABLE 1. WATER, SEDIMENT AND RAFT DEPTHS FOR BREARLEY CLOSE POND

See Figure 2 for location of sampling sites.

SITE	RAFT DEPTH (cm.)	WATER DEPTH (cm.)	SEDIMENT DEPTH (cm.)	TOTAL DEPTH (cm.)
1			30	30
2			22	22
3		10	18	28
4			20	20
5			40	40
6			30	30
7	20		30	50
8	20		30	50
9	10		50	60
10		30	25	55
11		22	18	40
12			30	30
13			35	35
14	25		35	60
15	10		50	60
16		35	15	50
17		15	20	35
18		15	20	35
19		20	20	40
20			50	50
21			45	45
22		15	30	45
23			25	25
24		3	37	40
25		20	20	40
26	50		30	80
26	45		15	60
27		10	30	45

TABLE 2. WATER CHEMISTRY OF BREARLEY CLOSE POND

SITE	DESCRIPTION	DEPTH (cm.)	TEMP. ('C.)	pH	ALKALINITY m/eq/l	CONDUCTIVITY (micro Siemens/cm.)	CHLORIDE (mg/l)	PHOSPHATE (mg/l)	NITRATE (mg/l)
a)	Open water	10	5.8	6.2	-	740	-	-	-
b)	Open water	10	5.5	6.4	-	784	-	-	-
c)	Open water at edge of Typha	10	5.2	6.9	1.12	775	190.9 191.9	3.01 2.75	0.49 0.40
d)	Open water	10	6.0	6.8	-	740	-	-	-
e)	Open water at a break in the raft of Typha	10	5.5	-	0.90	780	167.4 174.7	2.59 2.18	0.89 0.86
		25	5.5	-	-	910	-	-	-
		35	5.5	-	-	980	-	-	-
		45	5.5	-	-	1020	-	-	-
f)	Below Typha raft	35	5.3	-	-	-	-	-	-
g)	Adjacent to grassy margin	10	-	-	1.12	-	184.6 -	2.62 2.52	1.30 1.32

TABLE 3a WETLAND PLANTS (AS DEFINED BY NCC SURVEY SHEET, CST OW2) RECORDED AT BREARLEY CLOSE POND (13-23 Februrary 1989)

Alisma plantago-aquatica	(Water plantain)
Alnus glutinosa	(Alder)
Callitriche (probably) stagnalis	(Water starwort)
Epilobium hirsutum	(Great hairy willowherb)
Glyceria fluitans	(Sweet-grass)
Iris pseudacorus	(Yellow flag)
Juncus effusus	(Soft rush)
Juncus acutus/acutiflorus	(Jointed/sharp-flowered rush, a single dead plant from last year)
Lemna minor	(Common duckweed)
Lemna trisulca	(Ivy-laved duckweed)
Lycopus europaeus	(Gipsywort)
Ranunculus sceleratus	(Celery-leaved buttercup)
Salix cinerea	(Common sallow)
Salix fragilis	(Crack willow)
Solanum dulcamara	(Bittersweet)
Typha latifolia	(Reedmace)
Urtica dioica	(Stinging nettle)
Utricularia vulgaris	(Common bladderwort)

TABLE 3b TREES AND SHRUBS RECORDED IN THE WOODLAND

Acer pseudoplatanus	(Sycamore)
Alnus glutinosa	(Alder)
Crataegus monogyna	(Common hawthorn)
Fagus sylvatica	(Beech)
Ilex aquifolium	(Holly)
Platanus (probably acerifolia)	(Plane)
Quercus robur	(Pedunculate oak)
Salix fragilis	(Crack willow)
Sambucus nigra	(Elder)

TABLE 4. MACRO-INVERTEBRATE TAXA RECORDED IN BREARLEY CLOSE POND (13/2/89)

	Site 1	Site 2	Site 3	Site 4
TRICLADIDA				
Dendrocoelum lacteum		+		
ANNELIDA				
Oligochaeta		+	+	+
Erpobdella testacea		+		
MOLLUSCA				
Planorbis planorbis			+	+
Planorbis crista		C		
CRUSTACEA				
Copepoda	+	C		
Cladocera	+	C		
Ostracoda	+	C		
Asellus meridianus	+	C		+
Crangonyx pseudogracilis	+	C	+	+
COLLEMBOLA				
Podura aquatica		+		
Isotoma palustris			+	
Isotoma sp.		+		+
EPHEMEROPTERA				
Cloeon dipterum	+			
Caenidae	+			
ODONATA				
Aeshna cyanea		+		
HEMIPTERA				
Notonecta glauca		+		
Corixa punctata		+		
Hesperocorixa sahlbergi		+	+	
COLEOPTERA				
Agabus nebulosus		+		
Agabus bipustulatus		+		
Copelatus haemorrhoidalis		C	+	
Enochrus testaceus		+		+
Helochares punctatus		+		
Suphrodytes dorsalis		+		
Noterus clavicornis		+		
Cymbiodytes marginella		+		
Anacaena limbata		+	+	
Hygrotus inaequalis		+		+
Hydroporus erythrocephalus		+		
Hydroporus planus		+		

TABLE 4. MACRO-INVERTEBRATE TAXA RECORDED IN BREARLEY CLOSE POND (13/2/89)

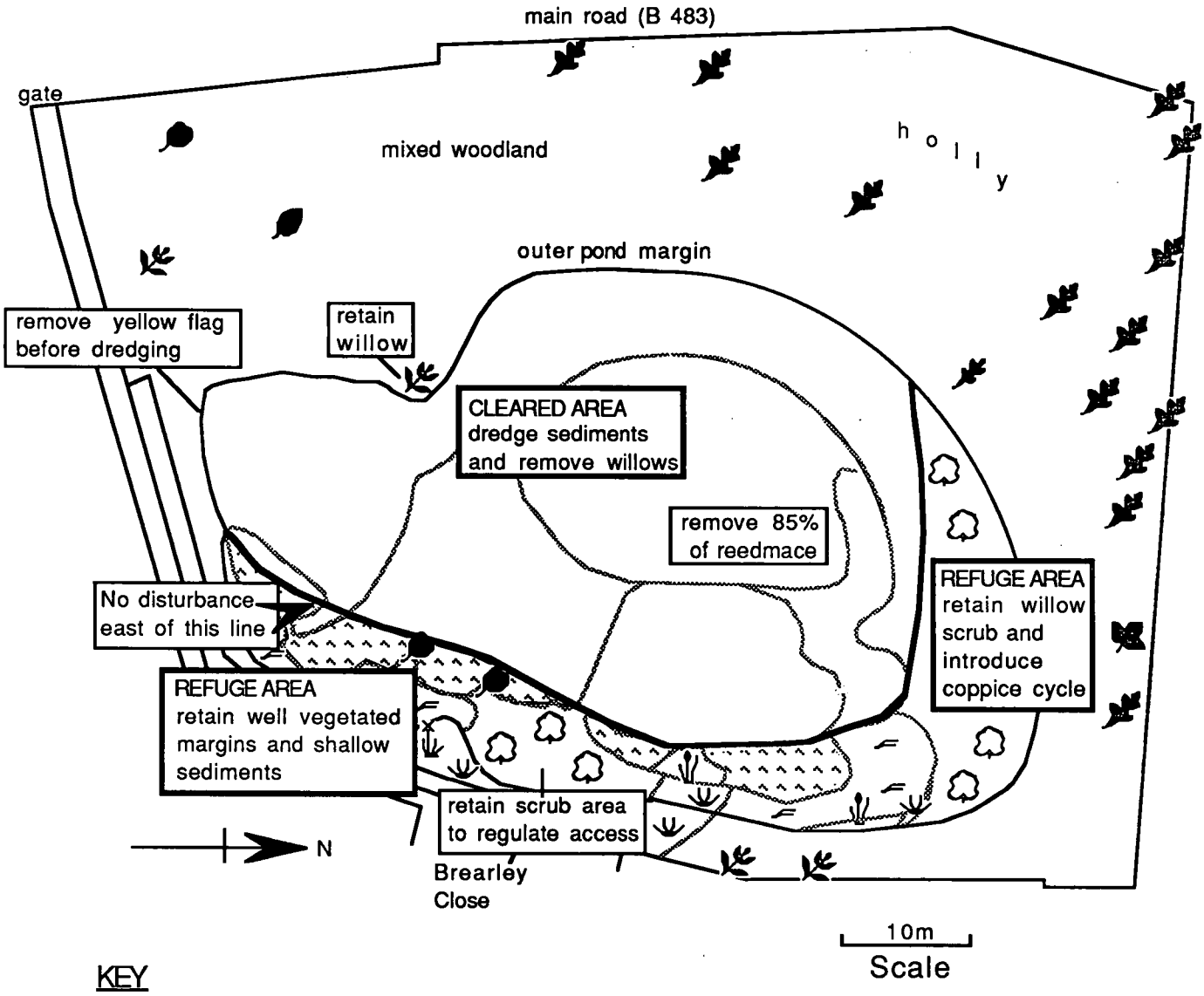
	Site 1	Site 2	Site 3	Site 4
Hydroporus angustatus		+	+	
Hydroporus striola		+		
Hydroporus palustris		+		
Colymbetes fuscus		+		
Haliplus ruficollis		+		
Hydrobius fuscipes			+	
Helophorus minutus			+	
DIPTERA				
Ptychopteridae		+		
Chaoboridae		+		+
Tipulidae		+		
Dixidae	+	+	+	+
Chironomidae	+	C	+	+
Ceratopogonidae				+
Culicidae			+	
Taxa found	9	37	13	11
Species identified	3	27	9	5

C = taxa were abundant. + = taxa present but not abundant.

TABLE 5. BIRD RECORDED AT BREARLEY CLOSE POND ON 13-14 FEBRUARY 1989

Blackbird
Redwing
Mistle thrush
Song thrush
Dunnock
Blue tit
Great tit
Long-tailed tit
Mallard
Magpie
Moorhen
Pied wagtail
Robin
Starling
Wren
Chaffinch
Goldfinch
Greenfinch
Siskin
Woodpigeon

Figure 5 Brearley Close Pond - Management



KEY

Main Vegetation Stands

- Floating reedsweet grass
- Soft Rush
- Reedmace
- Soft rush and tall herb community
- willow carr
- boundary of vegetation stands
- boundary between Cleared and Refuge Areas

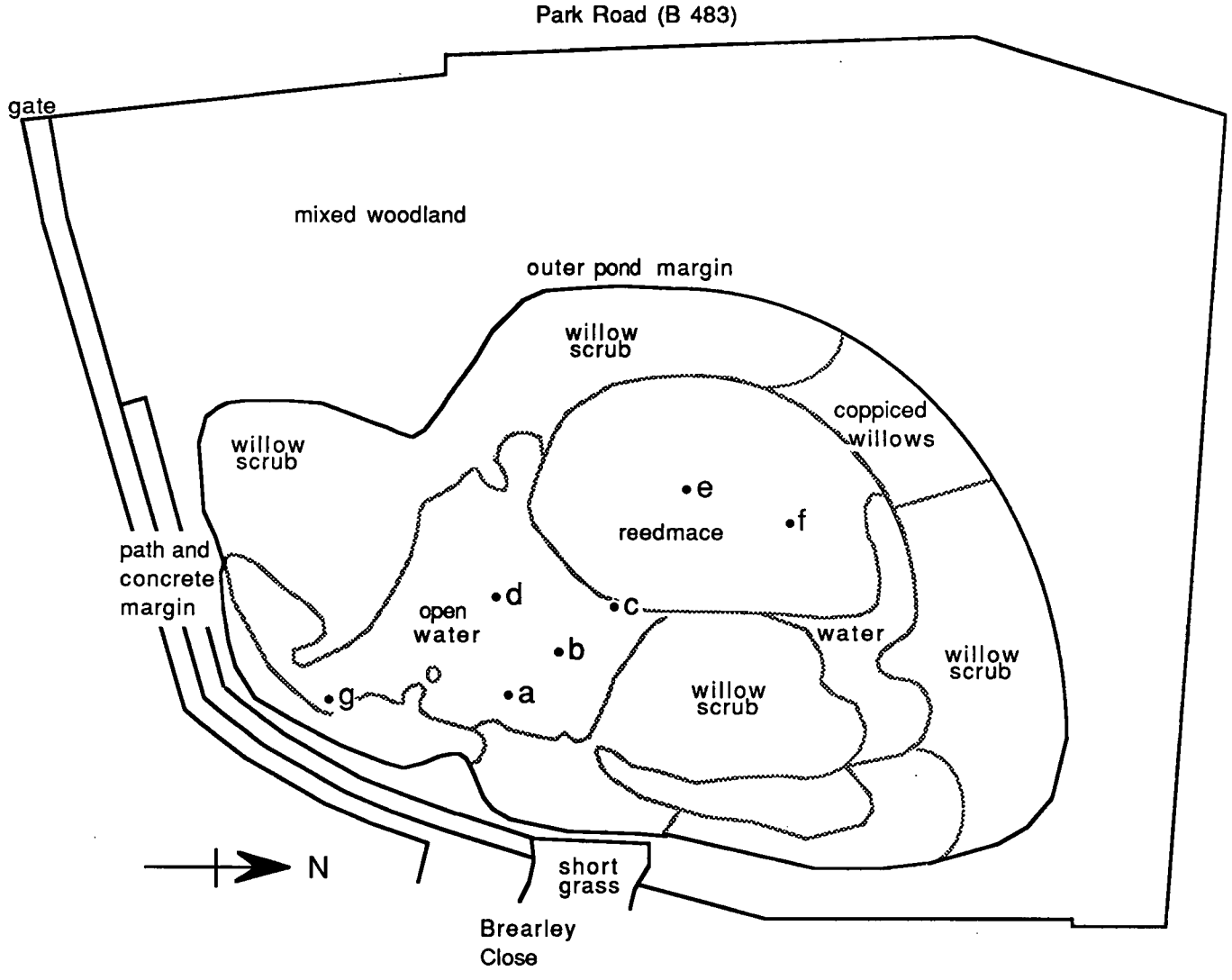
Trees

(over 1m circumference at breast height)

- Pedunculate Oak
- Crack Willow
- Beech
- Alder
- Plane
- pond margin

Figure 1 Location of Water Chemistry Sampling Sites

(See Table 2 for results)



KEY

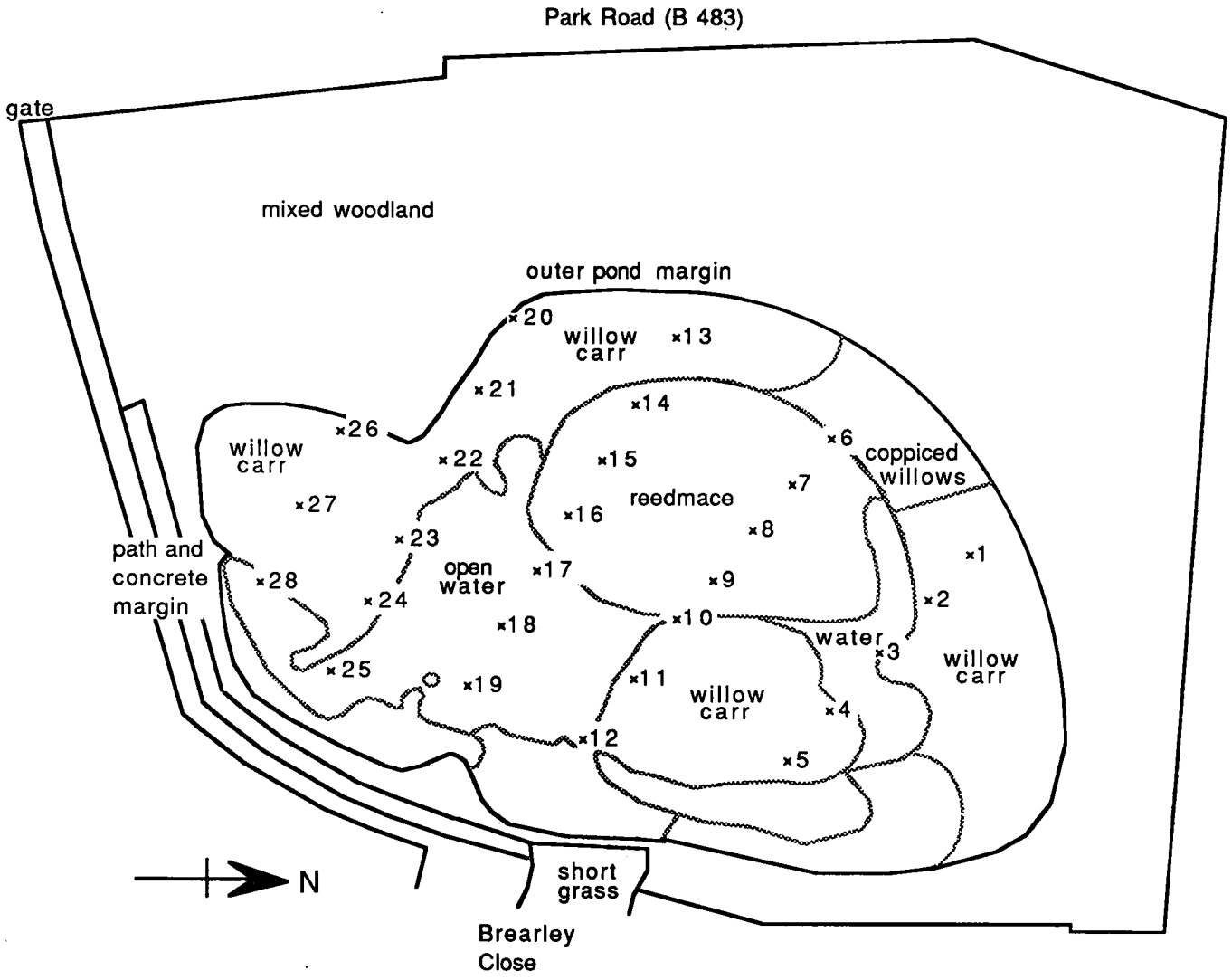
- Water chemistry sampling site (see table 2 for results)
- Limit of major vegetation stands
- Pond margin

Scale 10m

1cm = 5m

Figure 2 Location of silt and water depth measurements

(See Table 1 for results)



KEY

× site of depth measurements (see Table 1for results)

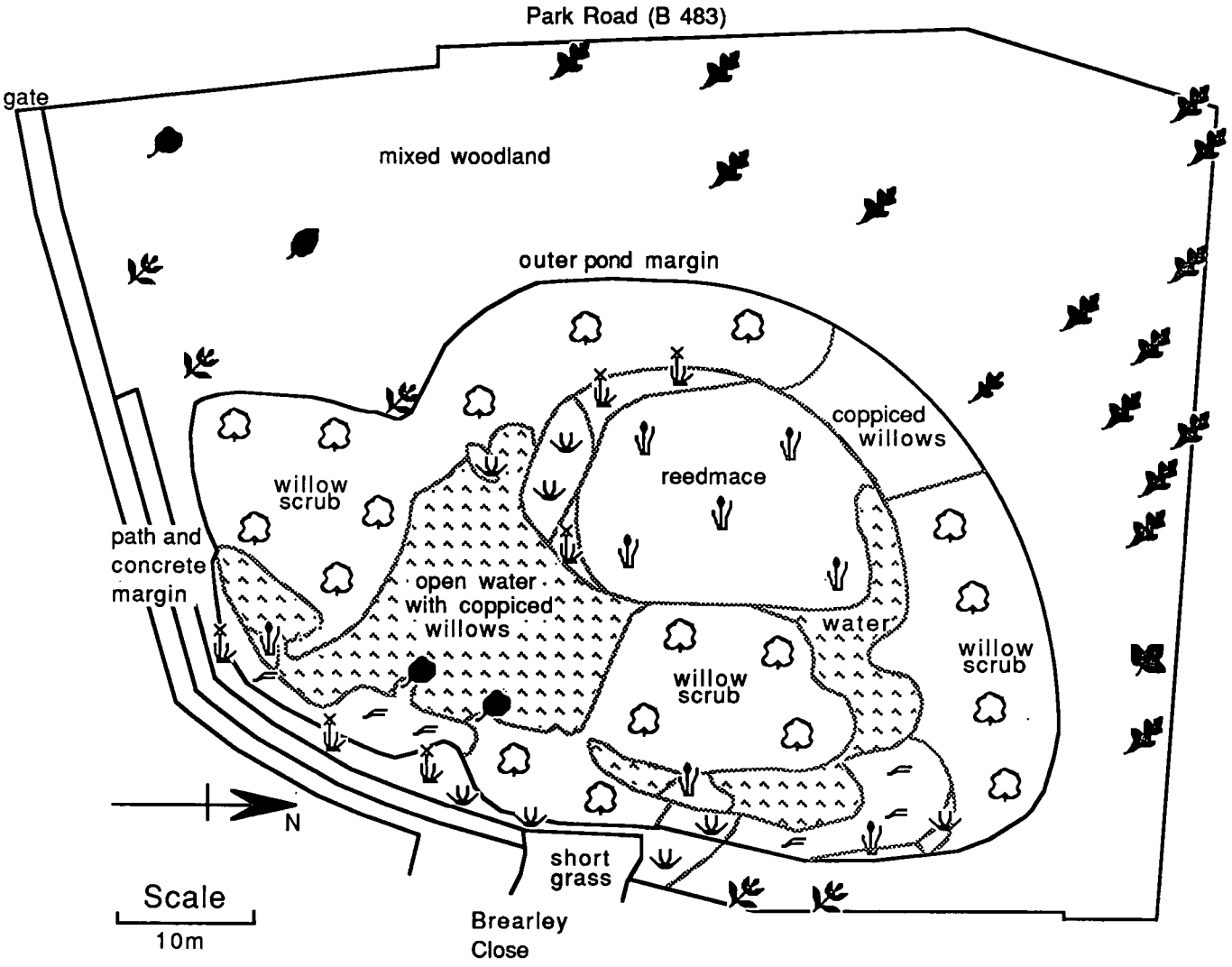
Limit of major vegetation stands

Pond margin

Scale 10m

1cm = 5m

Figure 3 Brearley Close Pond - Vegetation Stands



KEY

Main Vegetation Stands

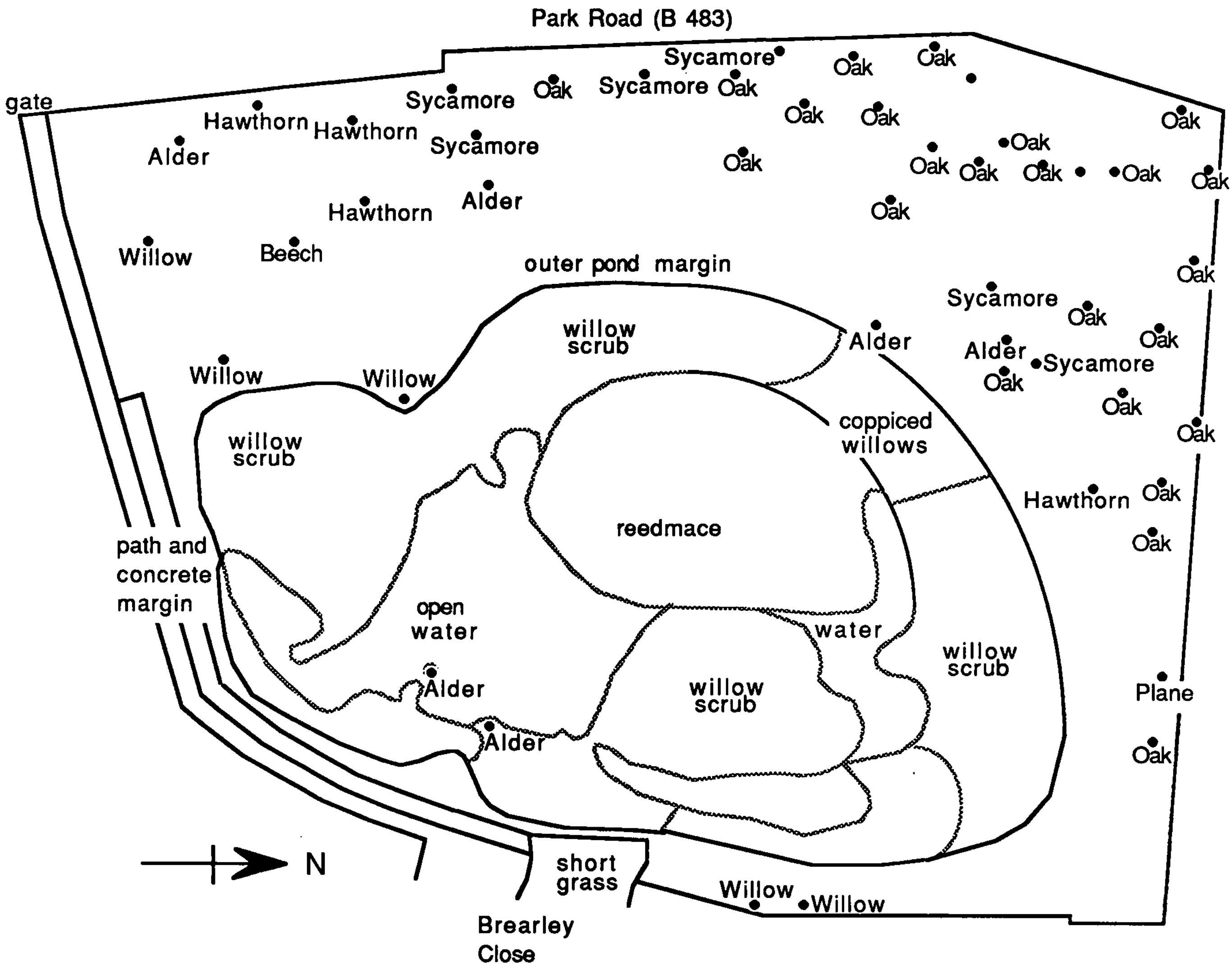
- Floating reedsweet grass
- Soft Rush
- Reedmace
- Soft rush and tall herb community
- Willow scrub
- boundary of vegetation stands

Trees

(over 1m circumference at breast height)

- Pedunculate Oak
- Crack Willow
- Beech
- Alder
- Plane
- pond margin

Figure 4 Location of Main Woodland Trees



KEY

- • Major trees
- ~~~ Limit of major vegetation stands
- — Pond margin

Scale 10m

1cm = 5m