

Broads Authority Report

BROADLAND TURF POND SURVEYS 2005 AND ANALYSIS OF DATA 1983-2005

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Broads Authority

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National Park family

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2005 Surveys undertaken in July and August

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CONTENTS

Turf pond survey 2005:

1. Introduction	3
2. Methodology	4
3. Results	5
4. Appendix: Sketch maps Photographs (supplied as separate CD)	28

Analysis of data 1983-2005:

1. Methodology	34
2. Results	35
3. Conclusion	52
4. Appendix 1: Community tables Appendix 2: Data for each pond	53 54

Turf Pond Survey 2005

I. INTRODUCTION

Peat digging within Broadland started in the 9th and 10th centuries. At this time, land levels were much higher than today, which enabled peat to be dug at greater depths than was possible at other times. When the land sunk, these large depressions were filled with water and became the large areas of open water that are characteristic of Broadland. At the end of 19th century, there was a renewed phase of peat digging, but in shallow trenches rather than the earlier method of digging deeper pits. These shallow trenches rapidly filled with water to become turf ponds. It is the shallow turf ponds that were mainly created in the 19th century that are the focus of this survey.

Some turf ponds still support a diverse range of mire communities which include rarities such as Fen Orchid *Liparis loeselii*, but many formerly open areas are being colonised by trees and scrub and some have become carr woodland. The combination of drying out because of the accumulation of plant litter and water abstraction and the cessation of traditional practices of harvesting products such as reed, sedge and mixed fen “litter” is resulting in the degradation of individual turf ponds and the change from an open landscape to one with more frequent trees and woodland.

A programme of turf pond recreation was initiated in 1983, and a monitoring programme was initiated in the same year in order to record the plant colonisation of the new ponds. Vegetation was also recorded in established ponds as part of the same monitoring programme. A selection of both newly created and established ponds are monitored each year. The 2005 surveys were repeats of surveys that were carried out in 1988, 1995 and 1999.

2. METHODOLOGY

The surveys were carried out in July and August.

The following were recorded for each pond:

- **Pond name/number and exact location.** Where possible, the approximate boundary of the original turf pond was recorded using GPS. However, where dangerous conditions prevented this or where significant vegetation damage could occur by walking around the pond, a GPS was used to record the Grid Reference of the central point of the pond. A rough sketch map was made of the larger ponds to show the approximate shape of the pond and its location in relation to where the GPS records were taken.
- **Conductivity and pH**
- **Photograph**
- **A species list** with:
 - **Abundance** values (Domin)
 - **Distribution** across pond (X, Y, or Z)
 - **Presence at various water depths** (A, B or C)

The location of rare species was recorded using GPS.

Distribution: X = under 1m from pond edge
 Y = 1-2m from pond edge
 Z = over 2m from pond edge

Water Depth: A = dry substrate
 B = shallow water up to 0.5m
 C = deep water over 0.5m

Domin Scale: 1 = scarce, cover small
 2 = v. scattered, cover small
 3 = scattered, cover small
 4 = abundant, cover about 5%
 5 = abundant, cover about 20%
 6 = cover 25-33%
 7 = cover 33-50%
 8 = cover 50-75%
 9 = cover above 75%
 10 = cover about 100%

- Any additional notes on observations regarding the distribution of aquatic plant stands geographically, blooms of filamentous algae, deeper areas and their communities, rare insects etc.

3. RESULTS

Pond F1

Photos: F1

This is the southern-most of a series of four small ponds within a stand of tall-herb fen dominated by *Phragmites australis*. Similar to the surrounding fen, Pond F1 consists of tall, dense reed cover, casting considerable shade. Consequently only shade-tolerant species or species of moderate height (such as *Juncus subnodulosus*, *Lythrum salicaria*, *Agrostis stolonifera* and *Galium palustre*) are able to persist in the sward.

Within the water (approximately 10cm deep), *Lemna minor*, *Mentha aquatica* and *Rumex hydrolapathum* showed a scattered distribution. *Calliargon giganteum* was also found towards the centre of the pond but no Charophytes were recorded.

This pond showed signs of encroachment by *Alnus glutinosa*.

In August 2005 the pH was 6.82 and the conductivity was 1371 $\mu\text{S cm}^{-1}$.

Perimeter GPS readings for the pond include:

636640 / 319231

636633 / 319213

636632 / 319207

636644 / 319215

Species:	Distribution:				Water Depth:			Domin Scale
	X	Y	Z	A	B	C		
<i>Agrostis stolonifera</i>	+	+			+		4	
<i>Alnus glutinosa</i>	+				+		2	
<i>Calliargon giganteum</i>		+	+		+		3	
<i>Galium palustre</i>	+	+	+		+		3	
<i>Iris pseudacorus</i>	+				+		1	
<i>Juncus subnodulosus</i>	+	+	+		+		4	
<i>Lemna minor</i>	+	+	+		+		5	
<i>Lysimachia vulgaris</i>	+				+		1	
<i>Lythrum salicaria</i>	+	+			+		2	
<i>Mentha aquatica</i>	+				+		2	
<i>Peucedanum palustre</i>	+	+			+		2	
<i>Phragmites australis</i>	+	+	+		+		9	
<i>Rumex hydrolapathum</i>		+	+		+		1	
<i>Solanum dulcamara</i>	+	+	+		+		1	
<i>Typha angustifolia</i>	+	+	+		+		2	
<i>Typha latifolia</i>	+	+			+		1	
Total no. of species:	16							

Pond F2

This shallow pond is defined by a short step down from the surrounding peat surface. It is connected to other ponds in this linear sequence by shallow bunds: that to the south is most obvious. The general location of the pond is indicated by taller reed growth and its exact extent is suggested by the presence of water, at a reasonably uniform depth of c. 20cm.

Potentilla palustris, *Solanum dulcamara* and *Agrostis stolonifera* are occasional associates of the reed-dominated pond edge and, with other species such as *Peucedanum palustre* and *Oenanthe fistulosa*, are colonists from the surrounding reed fen.

The body of the pond area is occupied by a uniform community of *Phragmites australis* and *Typha angustifolia* over a rather more scattered water-surface cover of *Lemna trisulca*. The moss *Drepanocladus aduncus* is an often obvious if infrequent epiphyte of the basal stems of *Phragmites*.

In August 2005 the pH was 6.97 and the conductivity was 848 μ S cm⁻¹.

A sketch map of the pond is shown in the appendix.

Perimeter GPS readings for the pond include:

636604 / 319223

636626 / 319227

636633 / 319218

636615 / 319215

Species:	Distribution:				Water Depth:			Domin Scale
	X	Y	Z	A	B	C		
<i>Agrostis stolonifera</i>	+				+		2	
<i>Berula erecta</i>		+			+		1	
<i>Drepanocladus aduncus</i>	+	+	+		+		3	
<i>Galium palustre</i>		+			+		2	
<i>Glyceria plicata</i>		+			+		1	
<i>Lemna minor</i>			+		+		1	
<i>Lemna trisulca</i>	+	+	+		+		7	
<i>Lythrum salicaria</i>	+			+	+		1	
<i>Oenanthe fistulosa</i>	+			+	+		1	
<i>Peucedanum palustre</i>	+			+	+		1	
<i>Phragmites australis</i>	+	+	+	+	+		10	
<i>Potentilla palustris</i>	+	+			+		3	
<i>Rubus fruticosus</i> agg.	+			+	+		1	
<i>Solanum dulcamara</i>	+			+	+		2	
<i>Typha angustifolia</i>	+	+	+		+		7	
Total no. of species:	15							

Pond F3

Photos: F3

This is the third in the series of small, shallow ponds at Reedham Marshes and showed the highest level of encroachment by *Alnus glutinosa* (with some *Salix* around the edges also). It has a very similar plant composition to F1, with the additional species *Potentilla palustris* and *Lemna trisulca* in F3. Once again *Phragmites* cover is very dense here and the water depth is approximately 10cm deep.

In August 2005 the pH was 6.98 and the conductivity was 977 μ S cm⁻¹.

Perimeter GPS readings for the pond include:

636613 / 319225

636607 / 319227

636608 / 319215

636612 / 319219

Species:	Distribution:			A	Water Depth:			Domin Scale
	X	Y	Z		B	C		
<i>Alnus glutinosa</i>	+	+			+		2	
<i>Berula erecta</i>		+			+		3	
<i>Iris pseudacorus</i>	+				+		2	
<i>Juncus subnodulosus</i>	+	+	+		+		4	
<i>Lemna minor</i>	+	+	+		+		4	
<i>Lemna trisulca</i>	+	+	+		+		6	
<i>Mentha aquatica</i>	+				+		1	
<i>Phragmites australis</i>	+	+	+		+		9	
<i>Potentilla palustris</i>		+			+		1	
<i>Thelypteris</i>	+				+			
<i>Typha angustifolia</i>	+	+	+		+		3	
<i>Typha latifolia</i>	+	+	+		+		2	
Total no. of species:	11							

Pond II

Photos: II-1, II-2, II-3, II-4, II-5, II-6

This large turf pond has been created from a substantial excavation into peat near, but not connected to, a marginal fen dyke. Construction of the pond produced a large quantity of spoil, which was deposited as a bund along the western side of the pond. The site has steep sides to water level (Zone A), but much of the pond has shallow margins (Zone B) partially covered in tall emergent plants. Zone C is itself partially occupied by emergents, but includes substantial areas of open water.

Zone A. A number of species are restricted to the pond banks. Fen herbs here include *Thelypteris palustris*, *Eupatorium cannabinum* and *Peucedanum palustre*.

Zone B. In shallow water, *Phragmites australis* is dominant in a variable-width belt around much of the pond. It is accompanied by *Juncus subnodulosus* and *Typha angustifolia*; these species form a canopy with less frequent *Cladium mariscus*, *Schoenoplectus lacustris* and *Typha* species. A scattered aquatic component below the canopy is composed of *Utricularia vulgaris* agg.,

Hydrocharis morsus-ranae and blanket weed. The edge of Zone B is sometimes marked by the presence of stoneworts, described in Zone C.

Zone C consists of a large area of open water, the bed of which is usually covered with a thin layer of soft sediment over a hard base. Charophytes are particularly abundant and showed some signs of zoning. *Chara hispida hispida* was one of the most abundant species and tended to have a distribution around the edges of the pond (where water depth was <50cm). *Chara hispida major* also occurred in abundance but at the southern end of the pond, where water depth was between 60 to 100cm and the channel of open water had narrowed. It was generally accompanied by small amounts of *Chara globularis* and rafts of *Utricularia vulgaris* (although *Utricularia* could be found in small amounts across the entire area). *Phragmites australis* and *Typha spp.* also had a scattered distribution across the pond margin.

There was an absence of any aquatic species in the area 637298 / 320468, which seemed to be at the zone most exposed to the prevailing wind and therefore probably received considerable sediment disturbance.

No filamentous algae or aquatic bryophytes were observed.

In August 2005 the pH was 7.78 and the conductivity was 839 μ S cm⁻¹.

Approximate central coordinates for the pond:
637314 / 320459

Species:	Distribution:				Water Depth:		Domin Scale
	X	Y	Z	A	B	C	
<i>Betula sp. sapling</i>	+			+			1
Filamentous algae	+	+			+		3
<i>Cladium mariscus</i>	+	+			+		2
<i>Eupatorium cannabinum</i>	+			+			1
<i>Hydrocharis morsus-ranae</i>	+	+			+		1
<i>Juncus subnodulosus</i>	+	+			+		3
<i>Lonicera periclymenum</i>	+			+			1
<i>Myrica gale</i>	+				+		1
<i>Peucedanum palustre</i>	+			+			1
<i>Phragmites australis</i>	+	+	+	+	+	+	6
<i>Potamogeton coloratus</i>	+	+			+		2
<i>Rosa canina</i>	+			+			1
<i>Rubus caesius</i>	+			+			1
<i>Schoenoplectus lacustris</i>		+			+		1
<i>Solanum dulcamara</i>	+			+	+		1
<i>Thelypteris palustris</i>	+			+			2
<i>Typha angustifolia</i>	+	+	+		+		4
<i>Typha latifolia</i>	+	+			+		2
<i>Utricularia vulgaris</i>	+	+			+		2
Total number of species	19						

Pond J1

This small pond has a scattered upper layer of *Phragmites australis* with occasional *Cladium mariscus* and *Typha angustifolia*. Charophytes are highly dominant within the pond itself, the surface of which is frequently covered with a film of filamentous algae. Species-richness is generally poor but the pond does contain small amounts of *Chara hispida var hispida*.

At the time of the survey, the pond held approximately 20cm depth of water. Beyond the pond margin, *Phragmites* cover thickens considerably and the substrate is moist but not waterlogged.

In August 2005 the pH was 7.82 and the conductivity was 632 μ S cm⁻¹.

Perimeter GPS readings for the pond include:

634080 / 316472
 634078 / 316472
 634074 / 316475
 634070 / 316479
 634073 / 316482
 634077 / 316480
 634079 / 316477
 634079 / 316476

Species:	Distribution:				Water Depth:		Domin Scale
	X	Y	Z	A	B	C	
<i>Chara sp.</i>	+	+			+		8
<i>Phragmites australis</i>	+	+			+		6
<i>Cladium mariscus</i>	+	+			+		4
<i>Filamentous algae</i>	+	+			+		6
<i>Typha angustifolia</i>	+	+			+		2
<i>Juncus subnodulosus</i>	+	+			+		3
<i>Myrica gale</i>	+	+			+		1
<i>Mentha aquatica</i>	+	+			+		1
<i>Chara hispida var hispida</i>	+	+			+		3
Total no. of species:	9						

Pond J2

Photos: J2-1

This is a more-or-less flat bottomed shallow pond with no graded margin. It is dominated by *Cladium mariscus*, amongst which a fen community has developed. This includes primarily *Juncus subnodulosus* and *Carex elata*, but also small amounts of *Peucedanum palustre*, *Lysimachia vulgaris* and *Thelypteris palustris* around the edges of the pond. Underneath the taller fen species, *Utricularia vulgaris* and *Lemna minor* are the only truly aquatic species. Bryophytes, consisting of *Calliargon cuspidatum* and *Eurhynchium praelongum*, were restricted to the edge of the pond.

In August 2005 the pH was 7.05 and the conductivity was 448 μ S cm⁻¹.

Perimeter GPS readings for the pond include:

633920 / 316231

633914 / 316230

633909 / 316239

633924 / 316234

633920 / 316239

633917 / 316247

Species:	Distribution:				Water Depth:		Domin Scale
	X	Y	Z	A	B	C	
<i>Alisma plantago-aquatica</i> .	+				+		1
<i>Calliergonella cuspidata</i>	+				+		2
<i>Carex acutiformis</i>	+	+	+		+		3
<i>Carex elata</i>	+	+	+		+		6
<i>Cladium mariscus</i>	+	+	+		+		9
<i>Eurhynchium praelongum</i>	+				+		2
<i>Hydrocotyle vulgaris</i>	+				+		2
<i>Juncus subnodulosus</i>	+	+	+		+		6
<i>Lemna minor</i>	+				+		3
<i>Lysimachia vulgaris</i>	+				+		2
<i>Peucedanum palustris</i>	+				+		2
<i>Phragmites australis</i>	+	+	+		+		4
<i>Salix sapling</i>	+				+		1
<i>Thelypteris palustris</i>	+				+		2
<i>Utricularia vulgaris</i>	+	+	+		+		6
Total no. of species:	15						

Pond J3

This pond is directly connected with Pond J2 but is noticeably deeper (more than 50cm of water) and consequently has a distinct flora of its own. Here *Phragmites australis* is strongly dominant, amongst which only the moderately tall monocots of *Carex elata*, *Typha latifolia* and *Juncus subnodulosus* are able to persist. There is some scrub encroachment by *Myrica gale* and a small amount of filamentous algae on the surface of the water. *Utricularia vulgaris* is considerably more abundant here than in J2, and is generally accompanied by small amounts of *Potamogeton coloratus*. No bryophytes or Charophytes were recorded.

In August 2005 the pH was 7.32 and the conductivity was 479 μ S cm⁻¹.

Perimeter GPS readings for the pond include:

633918 / 316238

633924 / 316244

633927 / 316243

633930 / 316237

633924 / 316234

633920 / 316239

Species:	Distribution:			Water Depth:			Domin Scale
	X	Y	Z	A	B	C	
Filamentous algae	+	+	+			+	3
<i>Carex elata</i>	+					+	1
<i>Juncus subnodulosus</i>	+	+	+			+	4
<i>Myrica gale</i>	+					+	2
<i>Phragmites australis</i>	+	+	+			+	9
<i>Potamogeton coloratus</i>	+	+	+			+	3
<i>Typha latifolia</i>	+	+	+			+	3
<i>Utricularia vulgaris</i>	+	+	+			+	10
Total no. of species:	8						

Pond J4

Photos: J4-1, J4-2

The pond, originally a small hand-dug area, now appears to have become the corner of the much larger pond J6. The Grid reference was used to locate the same approximate area as was recorded for J4 in 1992. It consists of mainly *Phragmites australis* in the upper tier and Filamentous algae within the water. Very small amounts of the semi-aquatic species *Mentha aquatica* and *Veronica beccabunga* were also present. The vegetation was extremely species poor. No bryophytes or Charophytes were recorded.

In August 2005 the pH was 8.40 and the conductivity was 603µS cm⁻¹.

Central GPS reading for the pond:
633936 / 316370

Species:	Distribution:			Water Depth:			Domin Scale
	X	Y	Z	A	B	C	
Filamentous algae		+	+			+	6
<i>Mentha aquatica</i>	+				+		1
<i>Phragmites australis</i>	+	+				+	6
<i>Typha latifolia</i>			+			+	2
<i>Veronica beccabunga</i>		+				+	2
Total no. of species:	5						

Pond J5

Photos: J5-1, J5-2, J5-3, J5-4, J5-5

Pond J5 is a large body of water, which grades from moderately shallow water on the north-eastern side (approximately 20cm deep), to over 1m deep along its south-western edge. Most of the edge of the pond consists of diverse open fen-meadow vegetation with no one dominant species. Instead, there is a mix of monocots such as *Juncus subnodulosus*, *J. articulatus*, *Carex rostrata*, *C. acutiformis* and *C. elata*, accompanied by herbs of *Lythrum salicaria*, *Eupatorium cannabinum*, *Peucedanum palustre*, *Potamogeton coloratus* and *P. natans*.

In the shallower zone (20cm deep) there are large areas of bare ground with no aquatic or emergent vegetation. However scattered individuals of *Utricularia vulgaris*, *Hippuris vulgaris* and *Potamogeton spp.* do occur here. As the depth of water increases towards the south of the

pond, Charophyte species increase in abundance - mainly *Chara vulgaris globularis*, but also some *Chara hispida var hispida* towards the centre of Pond J5. Filamentous algae was fairly abundant but seemed to be concentrated around the deeper water in the south.

In August 2005 the pH was 8.03 and the conductivity was 482 μ S cm⁻¹.

Perimeter GPS readings for the pond include:

633900 / 316182
633861 / 316208
633841 / 316219
633821 / 316227
633779 / 316255
633809 / 316261
633822 / 316275
633840 / 316291
633873 / 316282
633908 / 316252
633934 / 316211

Species:	Distribution:				Water Depth:			Domin Scale
	X	Y	Z	A	B	C		
<i>Alisma plantago-aquatica</i>	+				+		1	
Aquatic moss			+		+		1	
<i>Berula erecta</i>	+				+		3	
<i>Calystegia sepium</i>	+				+		3	
<i>Carex acutiformis</i>	+				+	+	3	
<i>Carex elata</i>	+				+		3	
<i>Carex paniculata</i>	+				+		2	
<i>Carex pseudocyperus</i>	+	+			+		2	
<i>Carex rostrata</i>	+				+		3	
<i>Chara globularis var vulgata</i>			+		+	+	8	
<i>Chara hispida var. hispida</i>	+	+			+			
<i>Cicuta virosa</i>	+	+			+		2	
<i>Cladium mariscus</i>	+	+			+	+	2	
<i>Eupatorium cannabinum</i>	+				+		3	
Filamentous algae	+	+	+		+	+	4	
<i>Hippuris vulgaris</i>			+		+		2	
<i>Iris pseudacorus</i>	+				+		2	
<i>Juncus articulatus</i>	+	+			+		2	
<i>Juncus subnodulosus</i>	+				+		3	
<i>Lemna minor</i>	+				+		2	
<i>Lysimachia vulgaris</i>	+				+		2	
<i>Lythrum salicaria</i>	+				+		2	
<i>Mentha aquatica</i>	+	+			+		3	
<i>Peucedanum palustre</i>	+				+		2	
<i>Phragmites australis</i>	+	+	+	+	+		3	
<i>Potamogeton coloratus</i>	+				+		2	
<i>Potamogeton natans</i>	+	+	+		+	+	2	
<i>Salix sapling</i>	+				+		2	
<i>Schoenoplectus lacustris</i>	+	+			+		2	
<i>Thelypteris palustris</i>	+				+		3	
<i>Typha latifolia</i>	+		+		+		2	
<i>Utricularia vulgaris</i>	+	+	+		+	+	4	
Total no. of species:	31							

On the northern side of Pond J5, is a narrow, mostly shallow strip of open water (part of the dyke network), which is directly connected to the pond. The vegetation resembles a form of fen-meadow/mire community, dominated by *J. subnodulosus* but including occasional *Cicuta virosa*, *Hydrocotyle vulgaris*, *Lysimachia vulgaris*, *Pedicularis palustris*, *Peucedanum palustre*, *Potamogeton coloratus*, *Ranunculus flammula* and *Utricularia vulgaris*. The water depth ranges between 5cm and 50cm, except in the central part of the ditch channel.

Species:	Distribution:				Water Depth:			Domin Scale
	X	Y	Z	A	B	C		
Filamentous algae		+	+		+		3	
<i>Berula erecta</i>	+	+	+		+		3	
<i>Cicuta virosa</i>		+			+		1	
<i>Hippuris vulgaris</i>		+			+		3	
<i>Hydrocotyle vulgaris</i>		+	+		+		1	
<i>Juncus articulatus</i>	+	+			+		2	
<i>Juncus subnodulosus</i>	+	+	+		+		8	
<i>Lemna minor</i>		+	+		+		2	
<i>Lycopus europeus</i>	+	+	+		+		2	
<i>Lysimachia vulgaris</i>		+			+		2	
<i>Lythrum salicaria</i>	+	+	+		+		2	
<i>Mentha aquatica</i>	+	+	+		+		3	
<i>Pedicularis palustris</i>	+	+	+		+		3	
<i>Peucedanum palustre</i>	+	+	+		+		2	
<i>Phragmites australis</i>	+	+	+		+		4	
<i>Potamogeton coloratus</i>		+	+		+		3	
<i>Ranunculus flammula</i>	+	+	+		+		3	
<i>Rumex hydrolapathum</i>			+		+		1	
<i>Salix cinerea</i>		+	+		+		2	
<i>Scutellaria galericulata</i>		+	+		+		1	
<i>Typha latifolia</i>			+		+		3	
<i>Utricularia vulgaris</i>		+	+		+		3	
Total no. of species:	22							

Pond J6

Photos: J6-1, J6-2, J6-3

This is another large pond with a fairly flat bottom and a depth of water of between 40cm and 60cm. The majority of the bed of the pond is covered with soft sediment and is unvegetated, with the exception of clumps of filamentous algae. Tall emergent species such as *Carex acutiformis*, *C. paniculata*, *Iris pseudacorus*, *Phragmites australis*, *Typha latifolia* and *Schoenoplectus lacustris* skirt the edge of the pond. These species are usually accompanied by small amounts of *Angelica sylvestris*, *Cicuta virosa*, *Juncus subnodulosus* and *Rumex hydrolapathum*. This species combination can also be found on the small islands which occur within Pond J6.

In August 2005 the pH was 8.12 and the conductivity was 638 μ S cm⁻¹.

Perimeter GPS readings for the pond include:

633908 / 316370
 633885 / 316344
 633861 / 316323
 633850 / 316315
 633824 / 316316

Species:	Distribution:				Water Depth:		Domin Scale
	X	Y	Z	A	B	C	
<i>Alnus glutinosa</i> sapling	+				+		1
<i>Angelica sylvestris</i>	+				+		2
<i>Calamagrostis canescens</i>	+				+		1
<i>Calystegia sepium</i>	+				+		2
<i>Carex acutiformis</i>	+	+			+		3
<i>Carex paniculata</i>	+	+			+		3
<i>Chara vulgaris</i> var <i>vulgaris</i>			+		+		2
<i>Cicuta virosa</i>	+				+		2
<i>Cladium mariscus</i>	+	+			+		2
<i>Eupatorium cannabinum</i>	+				+		2
Filamentous algae		+	+		+	+	3
<i>Filipendula ulmaria</i>	+				+		1
<i>Iris pseudacorus</i>	+				+		2
<i>Juncus subnodulosus</i>	+	+			+		2
<i>Lysimachia vulgaris</i>	+				+		2
<i>Lythrum salicaria</i>	+				+		1
<i>Myrica gale</i>	+				+		2
<i>Phragmites australis</i>	+	+	+		+	+	3
<i>Rumex hydrolapathum</i>	+				+		3
<i>Salix</i> sapling	+				+		2
<i>Schoenoplectus lacustris</i>	+	+			+		2
<i>Thelypteris palustris</i>	+				+		2
<i>Typha latifolia</i>	+	+			+		3
<i>Urtica dioica</i>	+				+		2
<i>Utricularia vulgaris</i>	+				+		1
Total no. of species:	25						

Pond KI

Turf pond KI proved particularly difficult to locate due to the shallow nature of the digging and the uneven surface of the surrounding tall herb fen which also contained small puddles of open water. Consequently Pond KI was only really distinguishable from the surrounding fen by the slightly greater water depth (5-10cm), marginally taller *Phragmites* stems and the greater abundance of aquatic/semi-aquatic species such as *Lemna minor* and the bryophyte *Calliergon giganteum*. In all other respects the vegetation of Pond KI closely resembled its surroundings, consisting of *Phragmites* accompanied by a mix of tall monocots (such as *Cladium mariscus*, *Typha* spp. and *Carex elata*) and herbs such as *Lycopus europaeus*, *Lysimachia vulgaris*, *Lythrum salicaria*, *Peucedanum palustre* and *Rumex hydrolapathum*.

Despite some scrub invasion from *Alnus glutinosa* and *Salix* this represents one of the richer turf ponds in terms of fen species.

In August 2005 the conductivity was 720 μ S cm⁻¹.

Approximate central coordinates for the pond:
636821 / 319897

Species:	Distribution:			A	Water Depth:	C	Domin
	X	Y	Z		B		Scale
<i>Alnus glutinosa</i>		+	+		+		3
<i>Calliergon cuspidatum</i>		+	+		+		4
<i>Calliergon giganteum</i>		+	+		+		3
<i>Calystegia sepium</i>	+				+		1
<i>Carex elata</i>	+				+		3
<i>Cladium mariscus</i>		+	+		+		3
<i>Galium palustre</i>	+	+	+		+		3
<i>Hydrocotyle vulgaris</i>	+				+		2
<i>Juncus subnodulosus</i>	+	+	+		+		4
<i>Lemna minor</i>	+	+	+		+		7
<i>Lycopus europeus</i>	+				+		1
<i>Lysimachia vulgaris</i>	+				+		2
<i>Lythrum salicaria</i>	+	+			+		2
<i>Peucedanum</i>	+				+		2
<i>Phragmites australis</i>	+	+	+		+		10
<i>Rumex hydro</i>		+			+		1
<i>Solanum dulcamara</i>	+	+			+		2
<i>Thelypteris</i>	+	+	+		+		6
<i>Typha angustifolia</i>		+	+		+		4
<i>Typha latifolia</i>	+				+		1
Total no. of species:	20						

Pond LI

Photos: LI-1, LI-2, LI-3, LI-4, LI-5, LI-6, LI-7

The pond is located in the south-west corner of the fen, alongside the marginal dykes. It is fringed with *Phragmites australis* and *Typha angustifolia* swamp stands, with open water covering c.60 per cent of the pond area, notably to the south.

To the west and south, the pond margin is a c.40 cm bluff cut into peat below the embanked spoil: *Salix cinerea* and *Myrica gale* saplings form a dense fringe here, growing from the side and floor of the bluff. *Eupatorium cannabinum* with some *Urtica dioica* marks the upland margin. *Solanum dulcamara* and *Lonicera periclymenum* are restricted to this zone, scrambling through the branches. To the east, the edge of the pond has a gentler slope. The upland margin here is a thick swathe of *Juncus subnodulosus*, bordered by a water track of A4 *Hydrocharis-Stratiotes* vegetation, including *Sium latifolium*, *Berula erecta*, *Ranunculus lingua* and *Hydrocotyle vulgaris*, which gives way to the fringing swamp vegetation. Several species of S24 *Phragmites-Peucedanum* tall-herb fen extend from the water track into the emergent zone along this boundary, notably *Cladium mariscus*, *Juncus subnodulosus* and *Carex elata*. The emergent zone also has a submerged component of *Hydrocharis-Stratiotes* vegetation dominated by *Utricularia vulgaris*, with occasional *Hottonia palustris*. *Potamogeton coloratus* is also common in the northern corner of the pond, with occasional *Schoenoplectus tabernaemontani*.

The centre of the pond was largely devoid of vegetation, with the exception of *Chara globularis*, which was occasionally recorded by grapnel sweeps.

In August 2005, the conductivity was 399 $\mu\text{S cm}^{-1}$ (no pH reading was available).

A sketch map is shown in the appendix.

Perimeter GPS readings for the pond include:

636637 / 320937

636702 / 320966

636660 / 321074

Species:	Distribution:				Water Depth:		Domin Scale
	X	Y	Z	A	B	C	
<i>Berula erecta</i>	+				+		3
<i>Carex elata</i>	+			+			2
<i>Chara globularis</i>			+			+	3
<i>Cladium mariscus</i>	+	+	+	+	+		3
<i>Hottonia palustris</i>		+	+		+		2
<i>Hydrocharis morsus-ranae</i>	+	+			+		2
<i>Hydrocotyle vulgaris</i>	+				+		3
<i>Iris pseudacorus</i>	+	+		+			2
<i>Juncus subnodulosus</i>	+	+	+	+	+		5
<i>Lemna minor</i>	+				+		2
<i>Lonicera periclymenum</i>	+			+			2
<i>Lycopus europaeus</i>	+			+			1
<i>Lysimachia vulgaris</i>	+			+			1
<i>Lythrum salicaria</i>	+	+		+			1
<i>Mentha aquatica</i>	+			+			1
<i>Myrica gale</i>	+			+			3
<i>Oenanthe fistulosa</i>	+			+			2
<i>Peucedanum palustre</i>	+			+			2
<i>Phragmites australis</i>	+	+	+		+		7
<i>Potamogeton coloratus</i>	+	+	+		+	+	4
<i>Ranunculus lingua</i>	+			+	+		3
<i>Salix cinerea</i> sapling	+			+	+		3
<i>Scirpus tabernaemontani</i>			+		+		1
<i>Sium latifolium</i>	+			+			1
<i>Solanum dulcamara</i>	+			+			3
<i>Thelypteris palustris</i>	+			+			1
<i>Typha angustifolia</i>	+	+	+		+		6
<i>Utricularia vulgaris</i>		+	+		+	+	7
Total no. of species:	28						

Pond M1

Photos: M1-1, M1-2, M1-3

This is a large body of water containing a mix of vegetation types. At the western side of the pond (and constituting the main body of the pond) the vegetation consists of *Phragmites australis*, accompanied by a good mix of tall-herb fen species. These include *Calamagrostis canescens*, *Lycopus europaeus*, *Angelica sylvestris*, *Lysimachia vulgaris*, *Sium latifolia* and *Epilobium palustre*. The vegetation sits in approximately 15 to 20cm of water, which contains small amounts of *Utricularia vulgaris*, *Calliergonella cuspidata*, *Lemna minor* and *Amblystegia riparia*. Scattered clumps of *Cladium mariscus* also occur, and increase in frequency towards the north and centre of the pond, where it can become dominant (especially where water depth increases to 20cm).

On the north-eastern edge of Pond M1 there is a gradual separation of the *Phragmites/Cladium* community with *Juncus subnodulosus*, *Dryopteris carthusiana*, *Hydrocotyle vulgaris* and *Calliergonella*

cuspidata to a richer tall herb fen occupying the drier edge of the pond (consisting of *Phragmites*, *Eupatorium cannabinum*, *Peucedanum palustre*, *Thelypteris palustris*, *Cicuta virosa*, *Scutellaria galericulata*, *Berula erecta*, *Potentilla palustris* and *Ranunculus lingua*.)

The easternmost edge of Pond MI was indistinguishable from large areas of fen to the east, which were under water. It is not known whether this eastern area of open water is due to new excavations or floodwater but was not included within the 2005 survey.

In August 2005 the conductivity was 459 μ S cm⁻¹.

Perimeter GPS readings for the pond include:

644754 / 312789
644733 / 312814
644713 / 312826
644752 / 312858
644769 / 312859
644797 / 312868
644812 / 312847
644830 / 312813
644797 / 312790

Species:	Distribution:				Water Depth:			Domin Scale
	X	Y	Z	A	B	C		
<i>Angelica sylvestris</i>	+	+			+		2	
<i>Berula erecta</i>		+	+		+		3	
<i>Brachythecium rutabulum</i>	+			+			1	
<i>Calamagrostis canescens</i>	+	+			+		4	
<i>Calliergon cuspidatum</i>	+	+			+		3	
<i>Cardamine pratensis</i>		+	+		+		2	
<i>Carex acutiformis</i>		+	+		+		3	
<i>Carex elata</i>	+	+	+		+		3	
<i>Carex pseudacorus</i>		+			+		1	
<i>Cladium mariscus</i>		+	+		+		8	
<i>Cicuta virosa</i>		+			+		1	
<i>Dryopteris carthusiana</i>		+		+			2	
<i>Epilobium palustre</i>		+			+		1	
<i>Eupatorium cannabinum</i>	+	+			+		2	
<i>Eurhynchium praelongum</i>	+	+		+			3	
<i>Galium aparine</i>	+			+			1	
<i>Galium palustre</i>	+	+	+		+		2	
<i>Hydrocotyle vulgaris</i>		+			+		2	
<i>Juncus effusus</i>		+			+		1	
<i>Juncus subnodulosus</i>	+	+	+		+		3	
<i>Lemna minor</i>		+	+		+		3	
<i>Leptodictyum riparium</i>		+	+		+		2	
<i>Lycopus europaeus</i>		+	+		+		2	
<i>Lysimachia vulgaris</i>		+			+		1	
<i>Lythrum salicaria</i>	+	+	+		+		2	
<i>Mentha aquatica</i>	+	+	+		+		3	
<i>Peucedanum palustris</i>		+	+	+			2	
<i>Phragmites australis</i>	+	+	+		+		8	
<i>Ranunculus lingua</i>		+	+		+		3	
<i>Rumex hydrolapathum</i>		+	+		+		2	
<i>Scutellaria galericulata</i>		+			+		1	
<i>Sium latifolia</i>		+	+		+		2	
<i>Solanum dulcamara</i>		+			+		2	
<i>Thelypteris palustris</i>		+			+		2	
<i>Typha angustifolia</i>		+			+		2	
<i>Typha latifolia</i>		+	+		+		3	
<i>Utricularia vulgaris</i>		+	+		+		5	
Total no. of species:	37							

Pond M2

Photos: M2-1, M2-2, M2-3

The pond is located on the southern margin of Burgh Common adjacent to the shallow bund that separates the fen from the New Muck Fleet (drain). The pond is no more than a very shallow depression in the peat surface: Photo 1 shows a fringe of *Urtica dioica* at the base of the bund and the visual appearance of the pond as a stand of *Phragmites australis* bed. Although the outline of the edge of the depression can be discerned, the only open area is a recently cleared zone of churned mud and shallow pools (see sketch map and Photo 2) covering c.25 per cent of the originally cleared area. The water was almost entirely less than 3 cm deep at the time of survey, was highly turbid and therefore not sampled.

The vegetation of the uncleared area is dominated by *Phragmites* with a thinly scattered understorey of *Mentha aquatica*, *Agrostis stolonifera* and *Brachytecium rutabulum*. *Typha latifolia* and the pond sedges *Carex riparia* and *C. acutiformis* are often co-dominant: the carices notably in the two 'arms' of the pond (Photo 3).

The open area is fringed by thick, unflowering swathes of *Juncus articulatus*, *Agrostis stolonifera* and *Eleocharis palustris*, with thinly scattered marginals including *Hippuris vulgaris* and *Alisma plantago-aquatica*.

The centre of the pond was largely devoid of vegetation, with the exception of an undetermined *Callitriche* species, and a single sprout of a *Ranunculus* subgenus *Batrachium*.

In August 2005 the pH and conductivity were not recorded due to no open water being present.

A sketch map is shown in the appendix.

Approximate central coordinates for the pond:
644200 / 312460

Species:	Distribution:				Water Depth:		Domin Scale
	X	Y	Z	A	B	C	
<i>Agrostis stolonifera</i>	+	+	+	+			4
<i>Alisma plantago-aquatica</i>			+	+	+		3
<i>Brachythecium rutabulum</i>	+	+	+	+			4
<i>Calliergonella cuspidata</i>			+	+			3
<i>Callitriche</i> spp.			+	+	+		4
<i>Carex acutiformis</i>	+	+	+	+			4
<i>Carex pseudocyperus</i>			+	+			1
<i>Carex riparia</i>	+	+	+	+			5
<i>Eleocharis palustris</i>			+	+			4
<i>Epilobium palustre</i>		+	+	+	+		3
<i>Glyceria</i> spp.			+	+			2
<i>Hippuris vulgaris</i>			+	+	+		3
<i>Juncus articulatus</i>		+	+	+	+		4
<i>Juncus effusus</i>		+		+			3
<i>Lemna minuta</i>			+	+	+		2
<i>Mentha aquatica</i>	+	+	+	+	+		3
<i>Phragmites australis</i>	+	+	+	+			8
<i>Polygonum lapathifolium</i> seedling			+	+			2
<i>Ranunculus</i> subgenus <i>Batrachium</i> (2)			+		+		1
<i>Solanum dulcamara</i>	+	+		+			2
<i>Sonchus arvensis</i>			+	+			1
<i>Typha angustifolia</i>			+	+	+		2
<i>Typha latifolia</i>	+	+	+	+			5
<i>Veronica</i> section <i>Beccabunga</i> (1)			+	+			3
Total no. of species:	24						

Pond O2

Photos: O2-1, O2-2, O2-3

This small, rectangular pond is located near the river, and shares a spoil bund with Horning O3.

Three vegetation zones are evident:

Zone A: The disturbed peat forming the bund is colonised by *Urtica dioica* and *Eupatorium cannabinum* with Reed *Phragmites australis*. At a lower elevation in the water, the reed grows with *Typha latifolia*.

Zone B: The open water is largely occupied by dense growths of a submerged form of the pondweed *Potamogeton pusillus*. This species is reduced to only a few strands beneath the fringing swamp canopy.

Zone C: Much of the pond fringe is dominated by Reed, with associates *Carex acutiformis* and *Berula erecta* in the shallow water.

In August 2005 the pH was 7.71 and the conductivity was 1428µS cm⁻¹.

A sketch map of the pond is shown in the appendix.

Approximate central co-ordinates for the pond:

635240 / 316190

Species:	Distribution:				Water Depth:			Domin Scale
	X	Y	Z	A	B	C		
<i>Berula erecta</i>		+			+		2	
<i>Calystegia sepium</i>		+			+		2	
<i>Carex acutiformis</i>	+	+			+		3	
<i>Carex pseudocyperus</i>	+	+			+		1	
<i>Eupatorium cannabinum</i>	+			+			3	
<i>Juncus subnodulosus</i>	+	+		+	+		4	
<i>Mentha aquatica</i>		+		+			2	
<i>Oenanthe fistulosa</i>	+			+			1	
<i>Phragmites australis</i>	+	+	+	+	+		6	
<i>Potamogeton pusillus</i>			+		+	+	8	
<i>Typha latifolia</i>	+		+		+		2	
<i>Urtica dioica</i>	+			+			4	
Total no. of species:	12							

Pond O3

Photos: O3-1, O3-2, O3-3, O3-4

This turf pond is somewhat larger than Horning O1. The eastern margin includes the spoil bank, with its characteristic margin flora of *Urtica dioica* and *Eupatorium cannabinum* with reed *Phragmites australis*. Below the bank in the southern corner, *Juncus subnodulosus* dominates a small stand of fen meadow species that extends as a thin hover into the open water. Beyond this stand, and surrounding the rest of the pond, reed swamp with some *Typha latifolia* is ubiquitous. In one small area on the eastern margin, *Typha angustifolia* extends out into deeper water. No deep water aquatics are recorded.

In August 2005 the pH was 7.63 and the conductivity was 1314µS cm⁻¹.

A sketch map of the pond is shown in the appendix.

Approximate central coordinates for the pond:
635200 / 316180

Species:	Distribution:				Water Depth:		Domin Scale
	X	Y	Z	A	B	C	
<i>Alnus glutinosa</i>	+			+			2
<i>Berula erecta</i>	+	+			+		2
Filamentous algae			+		+		2
<i>Carex diandra</i>			+		+		1
<i>Carex elata</i>			+		+		1
<i>Eupatorium cannabinum</i>	+			+			1
<i>Galium palustre</i>	+				+		1
<i>Hydrocotyle vulgaris</i>	+				+		2
<i>Juncus effusus</i>	+				+		1
<i>Juncus subnodulosus</i>	+	+	+		+		7
<i>Lemna minor</i>	+	+	+		+		4
<i>Lycopus europaeus</i>	+	+			+		1
<i>Lysimachia vulgaris</i>	+				+		1
<i>Lythrum salicaria</i>	+	+	+		+		2
<i>Mentha aquatica</i>	+	+	+	+	+		2
<i>Phragmites australis</i>	+	+	+	+	+		7
<i>Rumex hydrolapathum</i>		+	+	+	+		1
<i>Samolus valerandi</i>	+				+		1
<i>Schoenoplectus lacustris</i>			+		+		1
<i>Sium latifolium</i>		+	+		+		1
<i>Thelypteris palustris</i>	+				+		1
<i>Typha angustifolia</i>			+		+	+	4
<i>Typha latifolia</i>	+	+	+		+		4
<i>Urtica dioica</i>	+			+			1
Total no. of species:	24						

Pond O4

Photos: O4-1, O4-2, O4-3

This narrow, rectangular pond remains well-defined by its original cut profile and spoil bank (to the east), but is now covered by reed *Phragmites australis*, with scattered *Typha angustifolia*, which forms a dense swamp over patches of *Lemna minor* on the shallow (15-20 cm) water surface. The reed extends to the margin and into the surrounding vegetation. The edge of the pond is marked by a thin fringe of young *Myrica gale* bushes. On the bund margin, this species gives way to an *Urtica dioica* – *Eupatorium cannabinum* stand on the slopes of the bund. To the west, it is associated with a group of tall-herb fen species, including *Calamagrostis canescens*, *Carex acutiformis* and *Thelypteris palustris*, which extend from the peat surface into the margins of the turf pond.

In August 2005 the pH was 7.43 and the conductivity was 726 μ S cm⁻¹.

A sketch map of the pond is shown in the appendix.

Perimeter GPS readings for the pond include:

634969 / 316271 (eastern edge)

634959 / 316281 (western edge)

Species:	Distribution:				Water Depth:	C	Domin
	X	Y	Z	A	B		Scale
<i>Agrostis stolonifera</i>	+			+			1
<i>Calamagrostis canescens</i>	+			+			2
<i>Calystegia sepium</i>	+	+		+	+		2
<i>Carex acutiformis</i>		+	+		+		3
<i>Eupatorium cannabinum</i>	+			+			2
<i>Juncus subnodulosus</i>		+	+		+		3
<i>Lemna minor</i>		+	+		+		6
<i>Lysimachia vulgaris</i>	+			+			1
<i>Myrica gale</i>	+			+			2
<i>Phragmites australis</i>	+	+	+	+	+		10
<i>Solanum dulcamara</i>		+			+		1
<i>Thelypteris palustris</i>	+	+		+			2
<i>Typha angustifolia</i>			+			+	2
<i>Urtica dioica</i>	+			+			3
Total no. of species:	14						

Pond O5

Photos: O5-1, O5-2, O5-3, O5-4

From the spoil bank shared with Horning O4, this pond is largely occupied by a stand of reed *Phragmites australis*. To the west, *Juncus subnodulosus* and *Ceratophyllum demersum* are notable associates; to the north a narrow fringe of *Cladium mariscus* marks the pond edge; elsewhere, the reed is accompanied by submerged *Utricularia vulgaris sensu lato*. This swamp is extended towards the centre of the pond by scattered reed stems, and partly fringed by small blanket weed masses at the time of survey. In the deepest area, some 40 cm depth, the stoneworts *Chara species* and *C. species* were recorded as numerous individual plants.

In August 2005 the pH was 7.69 and the conductivity was 735µS cm⁻¹.

A sketch map of the pond is shown in the appendix.

Perimeter GPS readings for the pond include:

634988 / 616269 (eastern edge)

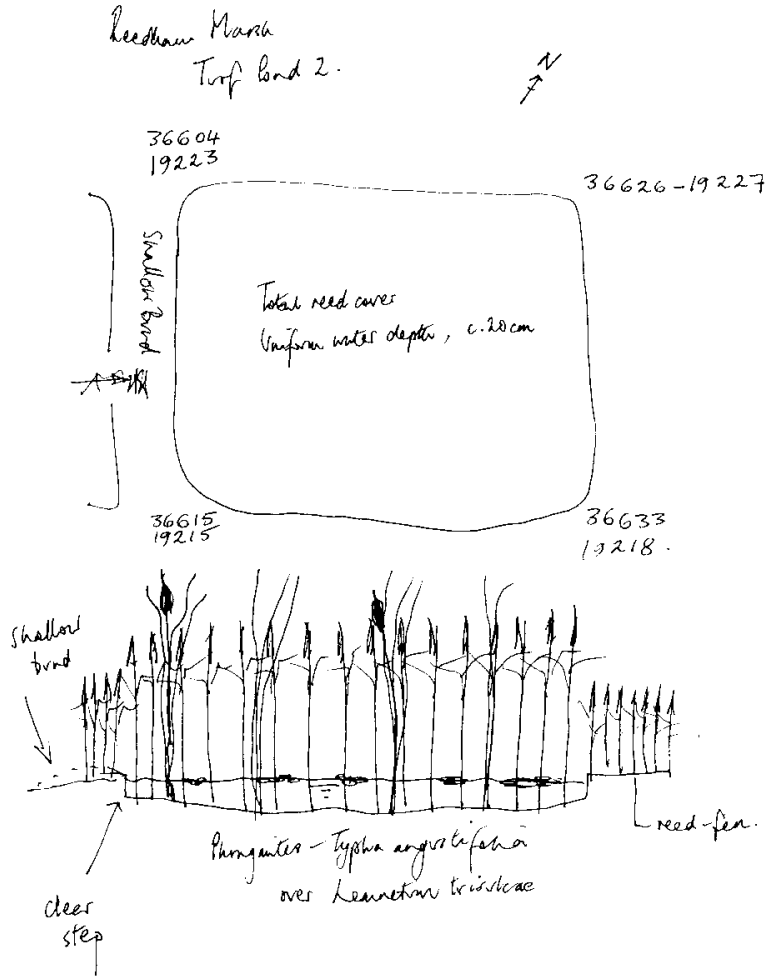
634969 / 316271 (western edge)

Species:	Distribution:			Water Depth:			Domin Scale
	X	Y	Z	A	B	C	
<i>Filamentous algae</i>			+		+	+	4
<i>Calamagrostis canescens</i>	+			+			1
<i>Calystegia sepium</i>	+			+			1
<i>Ceratophyllum demersum</i>		+	+		+		2
<i>Chara aculeolata</i>			+		+	+	2
<i>Chara virgata</i>			+		+		3
<i>Cladium mariscus</i>	+	+		+			1
<i>Eupatorium cannabinum</i>	+			+			2
<i>Juncus subnodulosus</i>	+	+		+	+		3
<i>Lemna minor</i>		+	+		+		3
<i>Lysimachia vulgaris</i>	+			+			1
<i>Myrica gale</i>	+			+			2
<i>Phragmites australis</i>	+			+			7
<i>Thelypteris palustris</i>	+			+			1
<i>Utricularia vulgaris</i>		+			+		4
Total no. of species:	15						

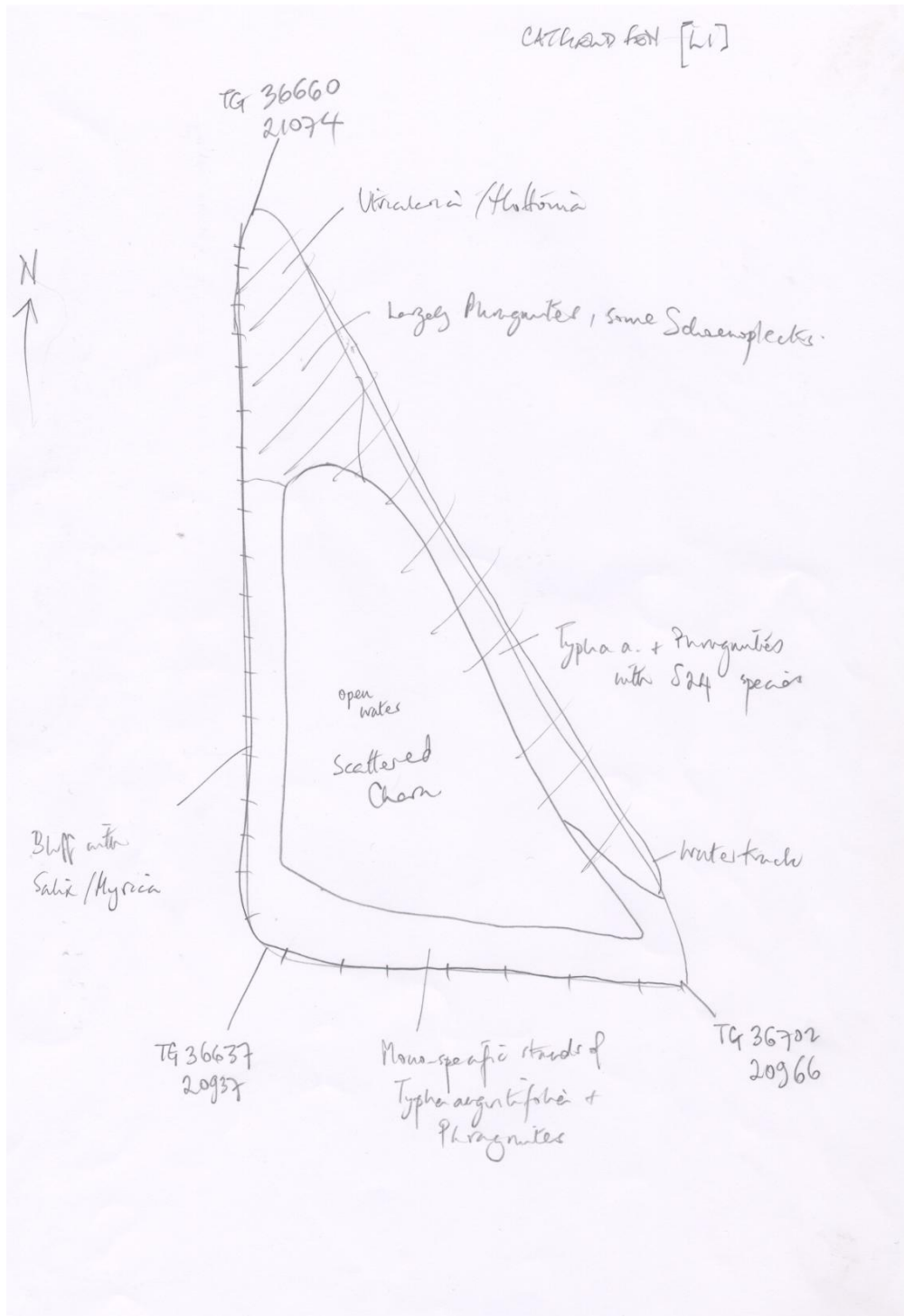
APPENDIX

Sketch Maps

Pond F2

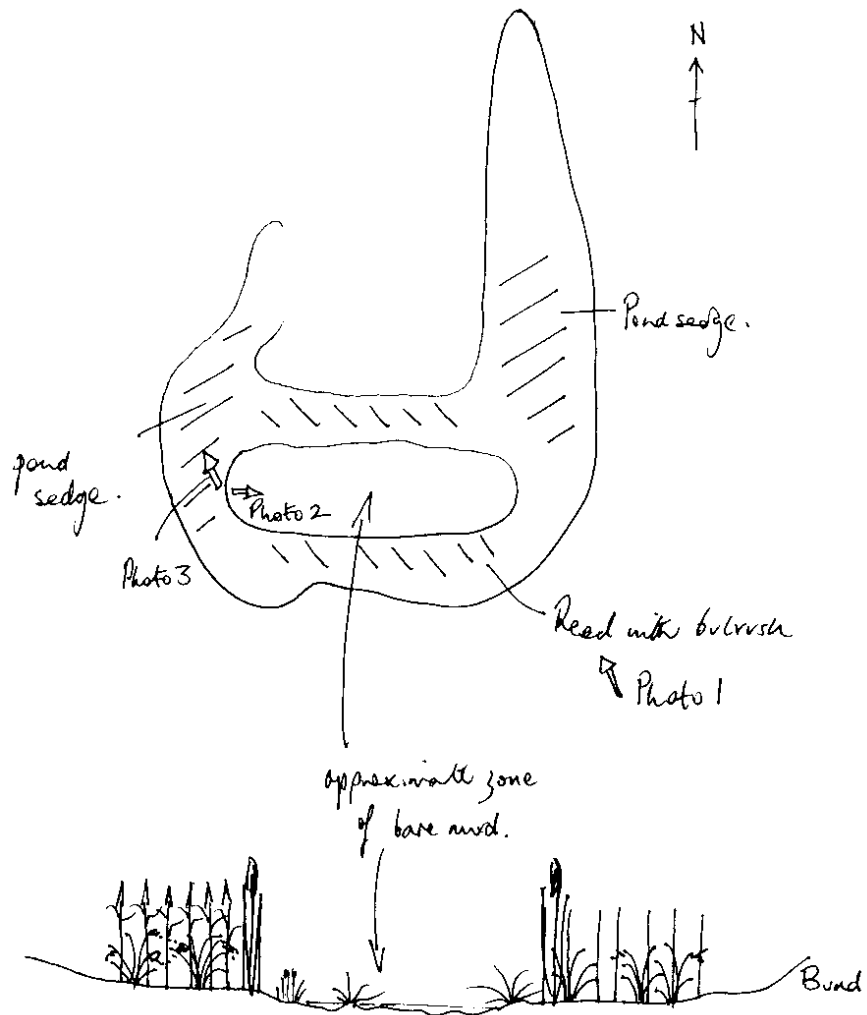


Pond LI

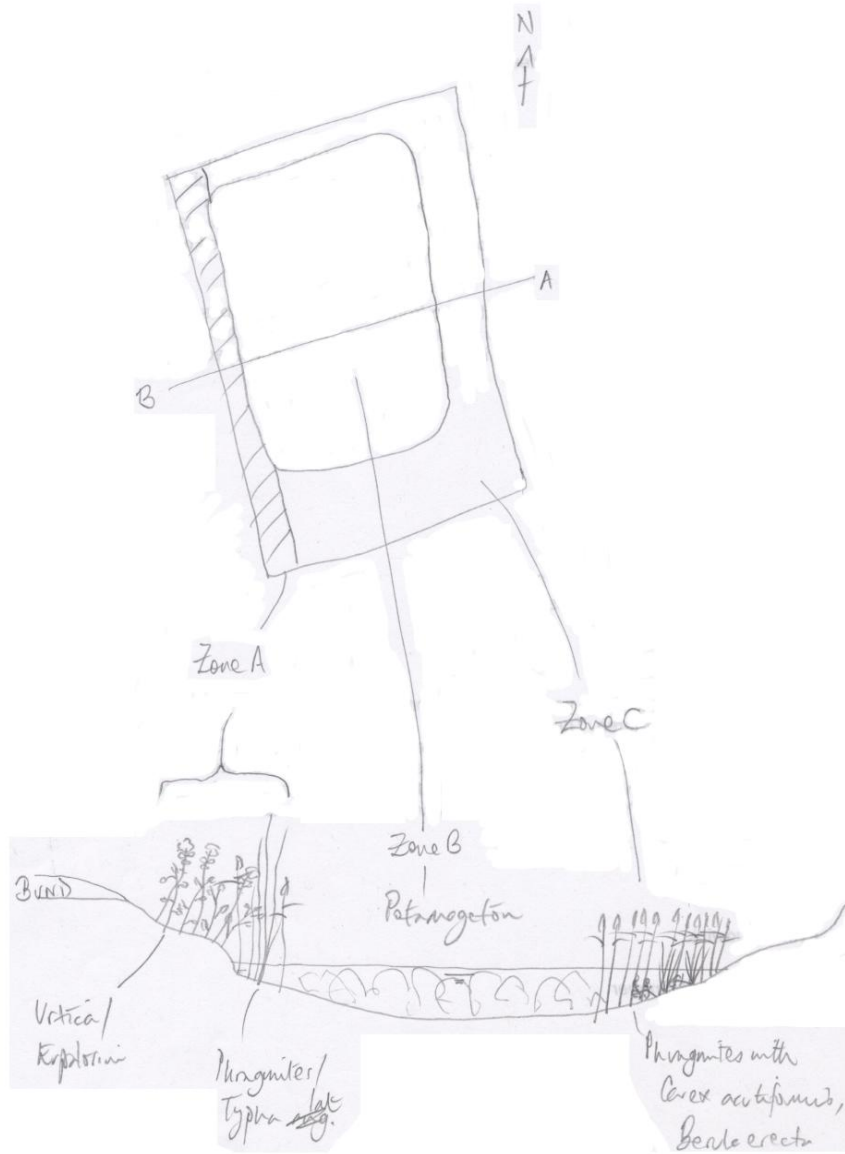


Pond M2

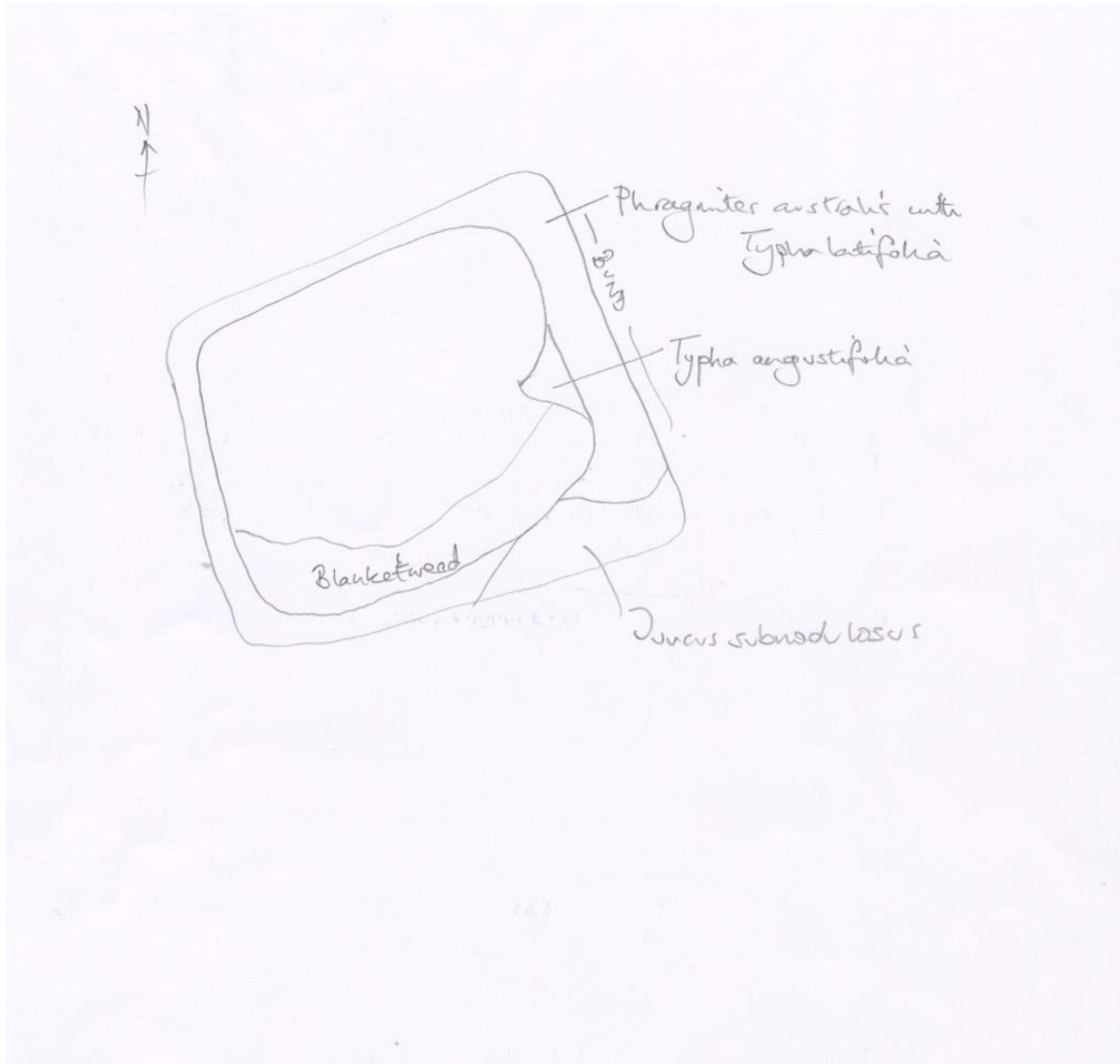
Brygh Coleson
Truf Pond M2.



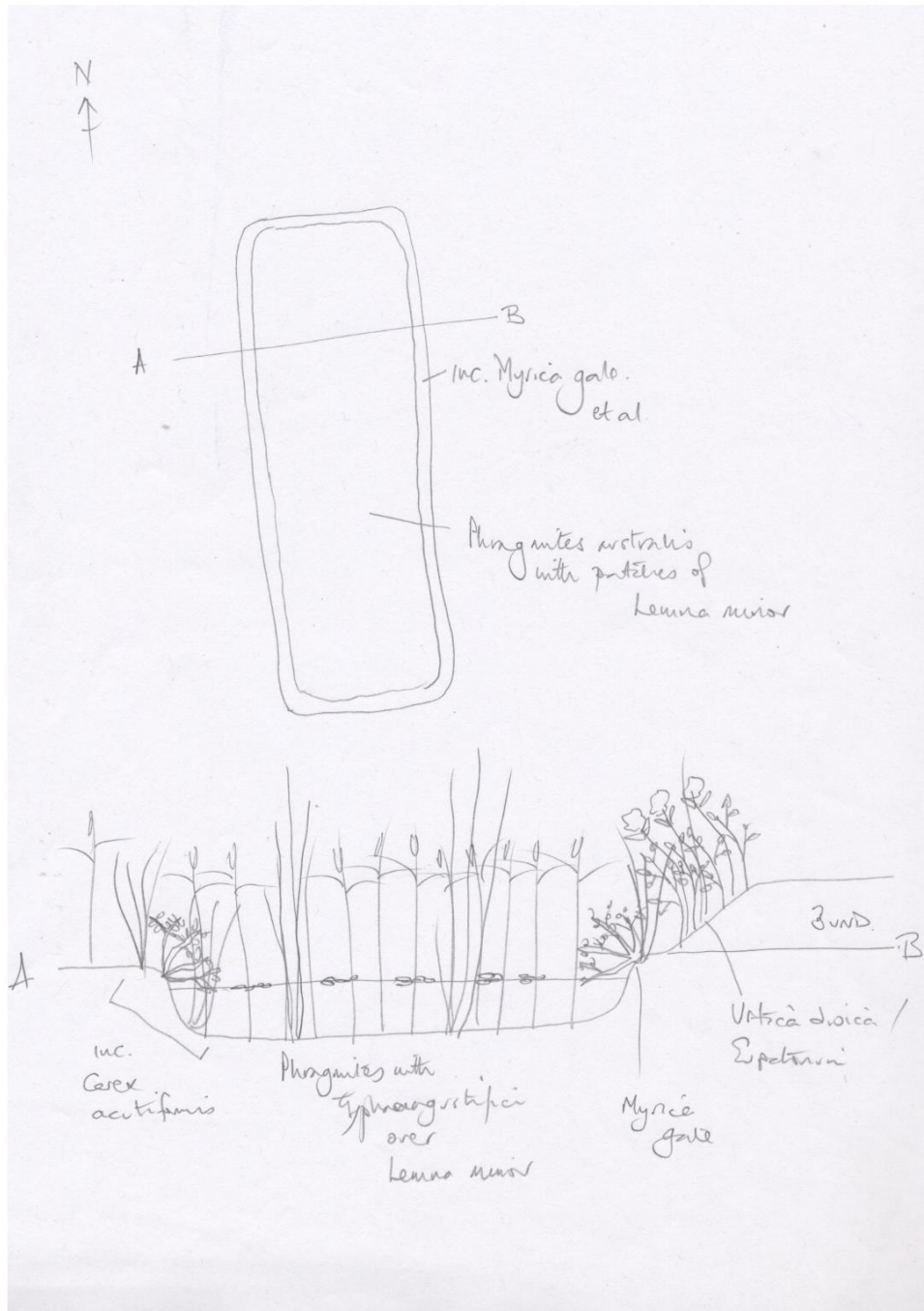
Pond O2



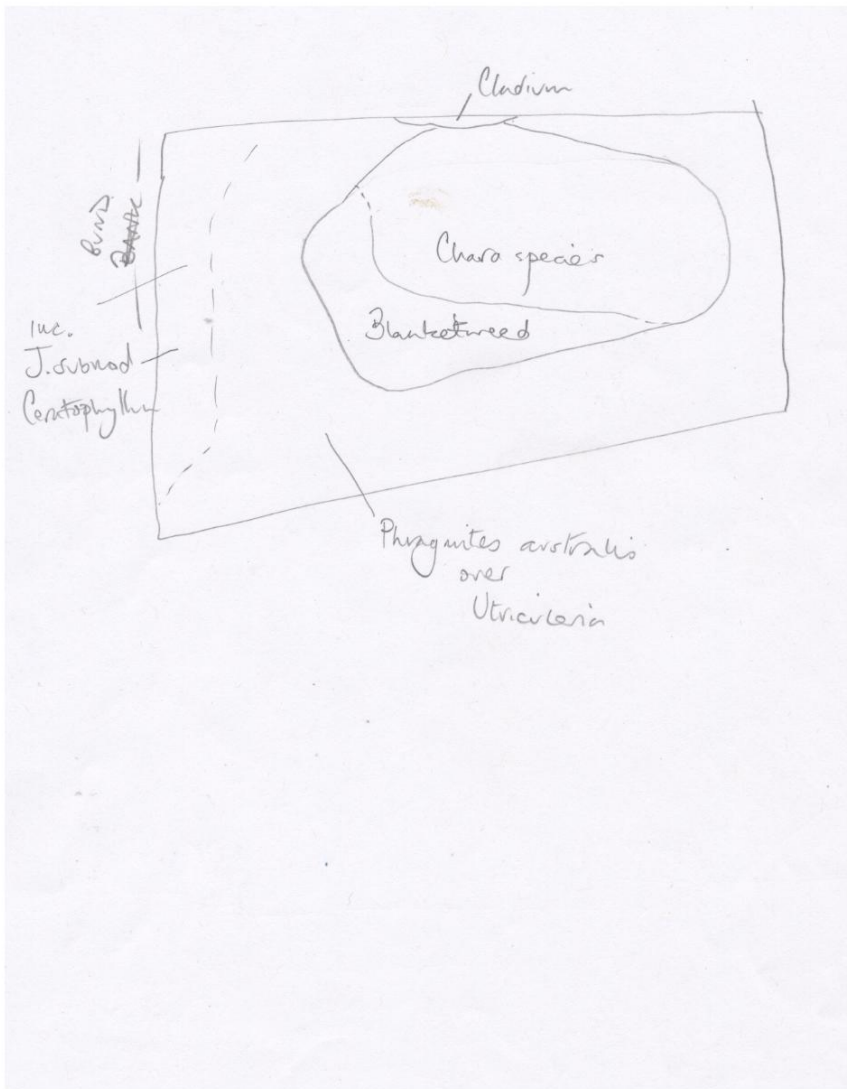
Pond O3



Pond O4



Pond O5



Analysis of Data 1983-2005

I. METHODOLOGY

Because of the large number of pond survey results to be analysed, hand sorting was not practicable, therefore the Ordination package TWINSpan (Two-way Indicator Species Analysis) was used initially in order to characterise the vegetation communities that were present in the turf ponds.

In addition to the TWINSpan analysis, which separates data based on the similarity of floristic compositions between samples, the data was also analysed using CANOCO, an ordination software package that uses Detrended Correspondence Analysis (DCA) to illustrate the degree of spread or overlap between divisions in graphical form.

Using these two approaches allows the validity of the outputs from TWINSpan to be checked against the distribution of clusters of samples in the CANOCO diagram. If a division in TWINSpan has strongly distinctive plant assemblages, those samples should appear on the CANOCO diagram in a cluster along the ordination axes. In contrast, where the distribution of samples show considerable spread or overlap with other TWINSpan divisions, this would need to be amalgamated into one single community or divided via a means other than TWINSpan ordination (e.g. hand-sorting).

Initially, no clear patterns emerged in the distribution of TWINSpan divisions along the CANOCO ordination axes. This was found to be the result of two limitations in the data:

1. Several of the groups of plant were not identified down to species level (e.g. Bryophytes, Carex sp. and Juncus sp.) in the early surveys.
2. The data was in the presence/absence form for all surveys prior to 1994, after which DOMIN values were recorded. As TWINSpan typically uses the abundance of species as well as species presence to divide samples, the absence of this type of data considerably limits the effectiveness of the divisions.

It was found that many of the initial separations in the first run of TWINSpan had been based on this generic data, therefore to counteract this; the data was re-run through TWINSpan, this time omitting all generic data.

The CANOCO diagrams, based on the revised TWINSpan outputs were then re-assessed and clusters emerged that were associated with sites. A number of other variables were also investigated to identify whether the distribution of samples within the divisions diagram was related to, for example, site location age of pond or method of excavation.

In the final stage, the original data was then re-organised so that samples from same site for the age range 0-10 yrs from the same site, and age range 11+ yrs from the same site were grouped together. The data was then hand-sorted into distinctive communities using the TWINSpan and CANOCO results as a guide.

I.1 Limitations of data

The following factors limited the scope of the analysis:

- Few ponds have been surveyed in the later years of succession
- There were a limited number of surveys for some ponds

- DOMIN values were absent in many cases – which made separating vegetation data into communities more difficult
- Some vegetation data from the early years of the surveys was “lumped” into genera – e.g. *Carex sp.*, Bryophytes.
- There were a limited number of pH and conductivity readings, which prevented using these variables in the detailed analysis.

2. RESULTS

Of the 38 ponds surveyed over a period of 22 years, 4 aquatic and 19 marginal communities were identified. The locations of the ponds are shown in figures 7a and 7b.

Community descriptions (based on TWINSPAN, CANOCO and hand-sorting techniques) are given below. Floristic tables for each community can be found in appendix 1.

2.1 Aquatic Communities

Community A is species-poor with few scarce species. The constants are Charophytes and Filamentous algae with *Lemna minor* occurring frequently. *Potamogeton coloratus* and *Utricularia minor* occur occasionally. This community is by far the most frequent, and has been recorded at Broad Fen Dilham, How Hill, Hands Marsh, Irstead Poors Fen, Burgh Common, Horning and Woodbastwick. The community usually appears 1-2 years following creation and can persist for up to 16 years.

Community B This community is characterised by a high incidence of scarce species including *Najas marina*, *Hydrocharis morsus-ranae*, *Lemna minor*, *Potamogeton coloratus* and *Utricularia vulgaris* are all constant. The community only occurs in four samples taken from pond L1 at Catfield Fen 0-10 years following its creation.

Community C is species-poor with *Persicaria amphibia* always present and *Chara globularis* usually present. No other species occur in this community. It is present at East Ruston (all ponds).

Community D The constants are Filamentous algae and *Lemna minor*, which, together with the frequent occurrence of *Lemna trisulca* indicate eutrophic conditions. The only scarce species that occurs in this community is *Apium inundatum*. The community was recorded at Broad Fen Dilham, How Hill, Hands Marsh and Horning, occurring in ponds between the first year and 11 years following their creation.

2.2 Marginal / emergent communities

Table 1. Frequencies of species in each community.

Species	Marginal Community																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Agro sto	5	3	4	5	5	5		4	4					5					
Alis pla						3								3					
Alnu glu				5	4	3			4					3					
Anag ten	3			5		3							5						
Ange syl				4													4		
Bald ran	4					3													
Beru ere				4	4				4							4		3	
Betu pub				5		3													
Bryophyte	4	4	5	5	4	5		3		3				5		3	5		
Cala can		3	3		3														
Call sp														3					
Call cor						3													
Call cus						3													
Calt pal				3															
Caly sep															5			3	
Care pse					3	3								5		3	4		
Care vir					4								5						
Card pra	3			5	4	3								5					
Care acu														3	5		4		5
Care ela					4	5							5	5		4			
Care las														3					
Care pan					3								5		5				
Care rip		3				3								5					
Care ros																			4
Carex sp	5	5	5	5	3	3		5		5		3	5						
Charo sp	4	3	5	5	5	3		3		3	4	3		5		4			4
Cicu vir															5				
Cirs pal					3														
Clad mar			5	5							3				5				
Dact sp				4															
Eleo mul	5			5															
Epil sp				5		3								4			4		
Epip pal				5															
Equi pal										4									
Eupa can				5	5			4						5	5	5		4	4
Fila alga	5	5	4	4	5	5		5				3		5	5	4			3
Fili ulm		3		3	3						4								
Gali pal	4	3	5	5	4	5		5	4					5	5		4	4	
Gali uli														5					
Holc lan					5														
Hott pal																	3		
Hydr mor																5			
Hydr vul	4		5	5	4	5				4				5	5		4	4	
Hype tet					3														

Iris pse						3		4									5		
Junc art						5	3										4	3	4
Junc bul						3													
Junc eff																			4
Junc sp	5	4	5	5	5	5		5		5	4	3	5	4			3	4	5
Junc sub						5	3			4		3	5	4	5	5	4	5	4
Lemn min	4	4	5	4	5	5		5						5		5			4
Lemn tri			3				3			4				4		4			
Lych flo						5	3												
Lyco eur						5	3	3						5	5		3	4	5
Lysi vul							3			4				5	4	5	3		3
Lyth sal	4	4	3	4	5	5				4					5	5	5	4	
Ment aqu	4	3	4	5	5	5				4	3			5	4		4	5	4
Myos lax	4					4	5								5				
Myri gal						4								5					
Naja mar																			3
Oena fis						4				3									
Oena lac																			3
Parn pal						5	4												
Pedi pal						5	3												
Pers amp																			3
Peuc pal						5	3	3		3	4				5				4
Phra aus	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Pota col	5	3					3						5		5	4		5	
Pota nat											4								3
Pota pus																			3
Pote pal	4	4				3		5		4	4								
Ranu fla	5					5	5	3									3	4	
Ranu lin						3	3										3	3	4
Ranu rep						3													
Ranu scl							3										4		
Rume con							5												
Rume hyd							3	3		3									4
Sali rep							3												
Sali sp						3	5	4	3								3	5	3
Samo val							5	5	3										
Scho lac																			5
Scho nig							5	3											
Scho tab							5	3											3
Sium lat																			3
Sola dulc								3		3	4						3		4
Spar eme																			3
Spar ere																			3
Succ pra							4												
Thel pal							3												3
Trif rep							3												
Typh ang										5	5								4
Typh lat							4	5	3										4
Urti dio																			3
Utri vul											5	4							4

Utri min	5	3
Vale dio	4	3

5 = 80-100% frequency
 4 = 60-80% frequency
 3 = 40-60% frequency
 2 = 20-40% frequency
 1 = 0-20% frequency

Community 1: This community occurs in ponds A1, A2, C1, C2 and H1 at Broad Fen in years 1-9. All of these ponds except H1 were excavated in peat. The total number of species ranges from 11 to 39.

Constants: *Agrostis stolonifera*, *Carex sp.*, *Eleocharis multicaulis*, *Juncus sp.*, *Phragmites australis*, and *Ranunculus flammula*.

Baldellia ranunculoides, *Galium palustre*, *Hydrocotyle vulgaris*, *Lythrum salicaria*, *Mentha aquatica*, *Myosotis laxa* and *Potentilla palustris* are also present at a very high frequency.

One of the notable characteristics of the community is the high occurrence of scarce species including *Baldellia ranunculoides*, *Eleocharis multicaulis*, *Hypericum elodes*, *Pedicularis palustris* and *Sium latifolium*.

Community 2: All samples are from ponds at Broad Fen (A2, A3, A4, B, C1, D, H1). Ponds A2, A3, A4, B and C1 were excavated in peat. Ponds D and H were created on the sites of old broads. The age range is 1-10 years. The total number of species ranges from 5 to 29.

Constants: *Carex sp.* (probably *C. riparia*) and *Phragmites australis*.

Juncus sp., *Lythrum salicaria* and *Potentilla palustris* occur at a very high frequency. There are a few records of scarce species, including *Baldellia ranunculoides*.

Community 3: All samples are from ponds at Broad Fen (A2, B, D, E, H3). Pond A2 and B were cut into peat. D, E and H3 were created on the sites of old broads. The age range is 1-10 years. The total number of species ranges from 5 to 29. Aquatic community A always occurs with this marginal/emergent community.

Constants: *Carex sp.*, *Cladium mariscus*, *Galium palustre*, *Hydrocotyle vulgaris*, *Juncus sp.* and *Phragmites australis*.

Agrostis stolonifera and *Mentha aquatica* occur at a very high frequency.

Three scarce species were occasionally recorded – *Baldellia ranunculoides*, *Eleocharis multicaulis* and *Pedicularis palustris*.

Aquatic community A is strongly associated with this community, occurring in all but one of the ponds at the times of the surveys.

Community 4: A distinctive and species-rich community (42-47 species), which occurs at pond H1 at Broad Fen between 5 and 9 years following its creation.

Constants: *Agrostis stolonifera*, *Alnus glutinosa*, *Anagallis tenella*, *Betula pubescens*, *Cardamine pratensis*, *Carex sp.*, *Cladium mariscus*, *Eleocharis multicaulis*, *Epilobium sp.*, *Epipactis palustris*, *Eupatorium cannabinum*, *Galium palustre*, *Hydrocotyle vulgaris*, *Juncus sp.*, *Lychnis flos-cuculi*, *Lycopus europaeus*, *Mentha aquatica*, *Parnassia palustris*, *Pedicularis palustris*, *Peucedanum palustre*, *Phragmites australis*, *Ranunculus flammula*, *Salix cinerea*, *Samolus valerandi*, *Schoenoplectus tabernaemontani* and *Schoenus nigricans*.

Aquatic community A always occurs with this community.

Community 5: Occurs at Broad Fen (H2, H4, H5) 1-5 years following the ponds' creation. All of these ponds were machine excavated on the sites of old broads. Total species range: 16-49
 Constants: *Agrostis stolonifera*, *Eupatorium cannabinum*, *Juncus articulatus*, *Juncus subnodulosus*, *Holcus lanatus*, *Lythrum salicaria*, *Mentha aquatica*, *Phragmites australis*, *Samolus valerandi* and *Typha latifolia*.

High frequency: *Alnus glutinosa*, *Berula erecta*, *Cardamine pratensis*, *Carex elata*, *Carex viridula*, *Galium palustre*, *Hydrocotyle vulgaris*, *Parnassia palustris* and *Salix cinerea*.

Occasional scarce species: *Baldellia ranunculoides*, *Carex appropinquata*, *Pedicularis palustris*, and *Utricularia minor*.

Aquatic community A is strongly associated with this community, occurring in all but one of the ponds at times of the surveys.

Community 6: This community is confined to two ponds at Broad Fen (A1 and C1) in samples taken from the ponds at 11 and 15 years following their creation. Both ponds were hand dug into peat.

Constants: *Agrostis stolonifera*, *Carex elata*, *Galium palustre*, *Hydrocotyle vulgaris*, *Juncus sp.*, *Lythrum salicaria*, *Mentha aquatica*, *Myosotis laxa*, *Phragmites australis*, *Potentilla palustris*.

Occasional scarce species: *Baldellia ranunculoides*.

Community 7: This community is present in just one pond (B) at Broad fen 11 years after it was created. The community is a monoculture of *Phragmites australis*.

Community 8: Occurs at How Hill (F1, F2, F3, F4), between 1 and 9 years following the ponds' creation. All of these ponds were created by a combination of hand digging and machine excavation on the sites of old cuttings. Total species range: 12-30.

Constants: *Carex sp.*, *Galium palustre*, *Juncus sp.*, *Phragmites australis*, *Schoenoplectus tabernaemontani*, *Typha angustifolia*.

High frequency: *Agrostis stolonifera*, *Eupatorium cannabinum*, *Lysimachia vulgaris*, *Potentilla palustris*.

Occasional scarce species: *Sium latifolium*.

Community 9: Occurs at How Hill (F1, F2, F3) between 19 and 20 years following the ponds' creation. Total species range: 11-16. All of these ponds were created by a combination of hand digging and machine excavation on the sites of old cuttings. Constants: *Phragmites australis*, *Typha angustifolia*.

High frequency: *Agrostis stolonifera*, *Alnus glutinosa*, *Berula erecta*, *Galium palustre*, *Iris pseudacorus*, *Juncus subnodulosus*, *Lythrum salicaria*, *Mentha aquatica*, *Peucedanum palustre*, *Potentilla palustris*, *Solanum dulcamara*, *Typha latifolia*.

Community 10: Occurs at Hands marsh (G) from 1 to 9 years following the pond's creation.

Total species range: 8-22

Constants: *Carex sp.*, *Juncus sp.*, *Phragmites australis*.

High frequency: *Hydrocotyle vulgaris*, *Equisetum palustre*.

Occasional scarce species: *Carex lasiocarpa*, *Pedicularis palustris*.

Community 11: Occurs at Irstead Poor's Fen (I), 0-13 years following the pond's creation.

Total species range: 8-21.

Constants: *Phragmites australis*.

High frequency: *Juncus subnodulosus*, *Typha angustifolia*, *Typha latifolia*.

Aquatic community A always occurs with this community.

Community 12: Occurs at Woodbastwick (J1, J3, J4) in 1 to 17 year-old ponds. Total species range: 2-15.

Constants: *Phragmites australis*.

High frequency: *Carex sp.*, *Juncus subnodulosus*.

Community 13: Occurs at Woodbastwick in pond J2 at 2 and 4 years old. All were hand-dug into either peat or old cuttings. Total species range: 25-26

Constants: *Anagallis tenella*, *Carex elata*, *Carex panicea*, *Carex viridula*, *Eupatorium cannabinum*, *Galium palustre*, *Galium uliginosum*, *Hydrocotyle vulgaris*, *Juncus subnodulosus*, *Lycopus europaeus*, *Lysimachia vulgaris*, *Mentha aquatica*, *Myrica gale*, *Peucedanum palustre*, *Phragmites australis*.

Community 14: A species-rich community that occurs at ponds J5 and J6 at Woodbastwick between 0 and 4 following their creation. Both ponds were machine-excavated. The pH was 8.5 in 1993 in pond J5 and 8.4 in pond J6 in 1994. Total species range: 36-48

Constants: *Agrostis stolonifera*, *Cardamine pratensis*, *Carex acutiformis*, *Carex elata*, *Carex pseudocyperus*, *Carex riparia*, *Eupatorium cannabinum*, *Galium palustre*, *Hydrocotyle vulgaris*, *Lycopus europaeus*, *Lythrum salicaria*, *Myosotis laxa*, *Phragmites australis*, *Typha latifolia*.

High frequency: *Epilobium hirsutum*, *Juncus articulatus*, *Juncus subnodulosus*, *Lysimachia vulgaris*, *Mentha aquatica*, *Ranunculus sceleratus*.

Occasional scarce species: *Carex lasiocarpa*, *Cicuta virosa*, *Eleocharis multicaulis*, *Pedicularis palustris*, *Sium latifolium*.

Aquatic community A is strongly associated with this community, occurring in all but one of the ponds at the times of the surveys.

Community 15: Occurs at Woodbastwick in pond J5 12 years following its creation and J6 at 11 years old. Both ponds were machine excavated. The pH was 8.05 in 1993 in pond J5 and 8.12 in pond J6 in 1994. Total species range: 25-31

Constants: *Calystegia sepium*, *Carex acutiformis*, *Carex panicea*, *Cicuta virosa*, *Cladium mariscus*, *Eupatorium cannabinum*, *Iris pseudacorus*, *Juncus subnodulosus*, *Lysimachia vulgaris*, *Lythrum salicaria*, *Phragmites australis*, *Salix sp.*, *Schoenoplectus lacustris*, *Thelypteris palustris*, *Typha latifolia*.

Aquatic community A always occurs with this community.

Community 16: Occurs in pond L1 at Catfield 0-10 years following its creation. Total species range: 21-31

Constants: *Juncus subnodulosus*, *Lythrum salicaria*, *Phragmites australis*, *Typha angustifolia*.

Aquatic community B always occurs with this marginal/emergent community and does not occur elsewhere.

Community 17: Occurs at Burgh Common (M1, M2) between 1 and 9 years following the ponds' creation. Total species range: 24-37. Both ponds were machine-excavated in clay.

Constants: *Mentha aquatica*, *Phragmites australis*, *Typha latifolia*.

Occasional scarce species: *Cicuta virosa*, *Sium latifolium*.

Community 18: Occurs at Horning (O1, O2, O3, O4). The ages of the ponds when the surveys were undertaken are unknown. The pH ranges from 6.8 to 7.7. Total species range: 11-24

Constants: *Juncus subnodulosus*, *Phragmites australis*.

High frequency: *Eupatorium cannabinum*.

Occasional scarce species: *Carex diandra*, *Sium latifolium*.

Community 19: Occurs at East Ruston (NW, SE and Valley Fen). All three ponds had a pH of 6.98 at the time of the surveys. The ages of the ponds when the surveys were undertaken are unknown. Total species range: 10-12

Constants: *Carex acutiformis*, *Lycopus europaeus*, *Persicaria amphibia*, *Phragmites australis*, *Sparganium erectum*, *Typha latifolia*.

High frequency: *Carex rostrata*, *Juncus effusus*, *Juncus subnodulosus*, *Mentha aquatica*.

Aquatic community C always occurs with this marginal/emergent community and does not occur elsewhere.

Figure 2 shows the distribution of these communities along the ordination axes. Figure 3 shows the distribution of plant species along the same axes.

2.3 Successional pathways

Appendix 2 displays the data on a site by site basis and in chronological order. Summaries are given below.

A1 Broad Fen, Dilham

Initial colonisation of the pond was slow, with only three species appearing in the first few months following creation. Species diversity increased between years 1 and 9 to a peak of 37 and declined by year 11 to 27 species. Both the marginal and aquatic communities were indeterminate in the first few months following creation, but marginal/emergent Community 1 became established in year 1 and remained until year 11, to be replaced by Community 6. The aquatic communities were indeterminate until year 2, when community A became established. This was superseded by Community D in year 8, which remained until year 11 when the last survey was undertaken.

Potamogeton coloratus and *Eleocharis multicaulis* followed the same pattern of appearing one year after the pond's creation and disappearing by year 11.

Apium inundatum was present between years 7 and 9 and *Baldellia ranunculoides* appeared in year 2 and was present until year 8, but subsequently disappeared.

Apium inundatum, *Baldellia ranunculoides*, *Eleocharis multicaulis* and *Potamogeton coloratus* were all absent prior to the pond's excavation.

A2 Broad Fen, Dilham

The number of species present in the pond remained fairly low throughout the period when the surveys were undertaken. In year 1 there were 8 species with numbers gradually increasing to a maximum of 17 in year 9. The marginal/emergent community varied throughout the period of study – it was indeterminate in years 1 and 2, was Community 2 in year 5, Community 1 in year 6 when *Eleocharis multicaulis* appeared, reverted to Community 2 in year 7 and then became Community 3 in year 9. At this point *Phragmites australis* was the most dominant species and was present at 51-75% cover (no data is available for the level of cover in earlier years).

Potamogeton coloratus appeared in year 2 and remained until year 7. *Eleocharis multicaulis* was only present in year 6.

Eleocharis multicaulis and *Potamogeton coloratus* were absent before the pond's excavation.

A3 Broad Fen, Dilham

Only one survey was undertaken at this pond, in year 8, therefore successional trends cannot be analysed. 11 species were recorded during the survey, which were consistent with marginal/emergent Community 2 and aquatic Community A. No scarce species were recorded.

A4 Broad Fen, Dilham

Only one survey was undertaken at this pond, in year 7, therefore successional trends cannot be analysed. 10 species were recorded during the survey, which were consistent with marginal/emergent Community 2 and aquatic Community A. No scarce species were recorded.

B Broad Fen, Dilham

Initial colonisation of the pond was slow, with only six species appearing in the first few months following creation. Species diversity increased rapidly over the following 2 years to a peak of 29 which then gradually declined until year 11 when the pond was dominated by a monoculture of *Phragmites australis*. The marginal/emergent community was indeterminate in the first few months following creation, was Community 2 in year 1, changed to Community 3 by year 2, reverted to Community 2 between years 4 and 9 and then became Community 7 at year 11.

The aquatic flora quickly became established as Community D, which remained until year 9, when the community was indeterminate, it remained indeterminate in year 11.

Potamogeton coloratus and *Baldellia ranunculoides* followed the same pattern of appearing two years after the pond's creation and disappearing by year 7.

Baldellia ranunculoides and *Potamogeton coloratus* were absent before the pond's excavation.

C1 Broad Fen, Dilham

Surveys were not undertaken at this site until year 2, so the pattern of early succession is unknown. Species diversity increased from 12 in year 2 to 22 in year 5, it then declined in years 8-10, but increased again in year 15, when it reached a peak of 25 species. The marginal/emergent vegetation changed from Community 2 in year 2 to Community 1 between years 3 and 9; it then reverted to Community 2 in year 10 and eventually Community 6 in year 15. Aquatic Community A was present each time the pond was surveyed.

Potamogeton coloratus was present in year 2, but *Baldellia ranunculoides* and *Eleocharis multicaulis* did not appear until year 3. *Baldellia ranunculoides* and *Eleocharis multicaulis* persisted until year 9 and were not recorded again. *Potamogeton coloratus* was still present by year 15

Baldellia ranunculoides, *Eleocharis multicaulis* and *Potamogeton coloratus* were absent before the pond's excavation.

C2 Broad Fen, Dilham

Only one survey was undertaken at this pond, in year 2, therefore successional trends cannot be analysed. 39 species were recorded during the survey, including *Apium inundatum*, *Potamogeton coloratus*, *Baldellia ranunculoides* and *Eleocharis multicaulis*. The vegetation was consistent with marginal/emergent Community 1 and aquatic Community A.

D Broad Fen, Dilham

Initial colonisation of the pond was slow, with only seven species appearing in the first few months following creation. Species diversity increased over the following 2 years to a peak of 22 which then declined to 9 species in year 6 and increased to 11 in years 7 to 10. The marginal/emergent vegetation was an indeterminate community in the first few months following creation, was Community 3 in years 1 and 2, changed to Community 2 by year 3 and then reverted to Community 3 between years 6 and 10. The aquatic flora was initially an indeterminate community, but then developed into Community A, which remained until year 10. *Utricularia minor* did not appear until year 8 and was still present in year 10. *Eleocharis multicaulis* appeared was recorded once, in year 7.

Eleocharis multicaulis and *Utricularia minor* were absent before the pond's excavation.

E Broad Fen, Dilham

Initial colonisation of the pond was slow, with only seven species appearing in the first few months following creation. Species diversity increased over the following 2 years to a peak of 24 which then declined to 14 species in year 6 and then increased to 19 in year 10. The marginal/emergent community was indeterminate in the first few months following creation, and then developed into Community 3 and remained as this community during all subsequent years. The aquatic flora was initially indeterminate, but then became established as Community A, which remained until year 10.

Utricularia minor did not appear until year 8 and was still present in year 10. It had been absent before the pond's excavation.

F1 How Hill Nature Reserve

Species diversity was relatively high one year following the pond's creation, at 17 species, but in subsequent years, the number of species fell gradually to 13 species in year 7, and then increased to 17 in year 9 and 16 in year 20.

The marginal/emergent community was Community 8 from year 1 to year 9, but by year 20 had changed to Community 9. The aquatic flora was initially indeterminate, but then became established as Community A, and remained as this up to and including year 9. By year 20 the community had once again become indeterminate.

No scarce species were recorded.

F2 How Hill Nature Reserve

Surveys were only undertaken in years 6, 9, 10 and 21, so the pattern of succession in the early years cannot be commented on. From year 6, the total number of species rose from 12 in year 6 to a peak of 18 in year 10 and then declined to 15 by year 21.

The marginal/emergent community was Community 8 from year 6 to year 10, but by year 21 had changed to Community 9. The aquatic flora was initially indeterminate, then became established as Community A in years 9 and 10, then by year 21 the community had once again become indeterminate.

No scarce species were recorded.

F3 How Hill Nature Reserve

Surveys were only undertaken in years 6, 7, 8 and 19, so the pattern of succession in the early years cannot be commented on. From year 6, the total number of species rose from 22 in year 6 to a peak of 30 in year 8 and then declined to 11 by year 19.

The marginal/emergent community was Community 8 from year 6 to year 8, but by year 19 had changed to Community 9. The aquatic flora was indeterminate in years 6 and 7, became Community D in year 8, then by year 19 the community had once again become indeterminate.

No scarce species were recorded.

F4 How Hill Nature Reserve

Only one survey was undertaken at this pond, in year 8, therefore successional trends cannot be analysed. 14 species were recorded during the survey, with *Phragmites australis* being the most frequent species (76-90% cover). The vegetation was consistent with marginal/emergent Community 8 and aquatic Community D.

G Hands Marsh Sutton

Initial colonisation of the pond was fairly rapid, with 11 species appearing in the first year following creation. Species diversity then declined over the next few years to a low of 8 in year 4, followed by a gradual increase to 11 in year 7 and a peak of 22 species in year 9.

Marginal/emergent Community 10 was present each time the pond was surveyed. The aquatic flora quickly became established and was initially Community D, subsequently, it changed to Community A from year 2 to year 5 and from year 6 to year 9 the community was indeterminate.

Potamogeton coloratus appeared 5 years after the pond's creation and had disappeared by year 7. It had been absent before the pond's excavation.

H1 Broad Fen, Dilham

Initial colonisation of the pond was fairly rapid, with 20 species appearing in the first year after creation. Species diversity increased rapidly over the following 5 years to a peak of 47 in year 6, which then gradually declined until year 9 when the total number of species was 42. The

marginal/emergent community was Community 2 in year 1, developed into Community 1 by year 2 and became Community 4 between years 5 and 9. The aquatic flora quickly became established as Community A, which was still present in year 9.

Eleocharis multicaulis appeared in year 2 and was still present in year 9. *Utricularia minor* was present every year the pond was surveyed.

Eleocharis multicaulis and *Utricularia minor* were absent before the pond's excavation.

H2 Broad Fen, Dilham

Only one survey was undertaken at this pond, in year 5, therefore successional trends cannot be analysed. 16 species were recorded during the survey, with *Chara hispida* being the most frequent (51-75% cover). The vegetation was consistent with marginal/emergent Community 5 and aquatic Community A.

Utricularia minor was absent prior to the pond's excavation.

H3 Broad Fen, Dilham

Only one survey was undertaken at this pond, in year 7, therefore successional trends cannot be analysed. 22 species were recorded during the survey, including *Utricularia minor*, *Anagallis tenella*, *Cladium mariscus*, *Pedicularis palustris* and *Schoenus nigricans*. The vegetation was consistent with marginal/emergent Community 3 and aquatic Community A.

Utricularia minor was absent prior to the pond's excavation.

H4 Broad Fen, Dilham

Initial colonisation of the pond was very rapid, with 49 species appearing in the first year after creation. Species diversity then gradually declined until year 5 when the total number of species was 34. The marginal/emergent community was Community 5 and the aquatic community was Community A in each year that surveys were undertaken.

Baldellia ranunculoides was only present in year 2, *Parnassia palustris* was present from year 1 to year 4 and *Utricularia minor* was present in years 4 and 5. *Parnassia palustris* was absent before the pond's excavation.

H5 Broad Fen, Dilham

Initial colonisation of the pond was very rapid, with 37 species appearing in the first year after creation. Species diversity then increased to 49 in year 2. Unfortunately no further surveys were conducted at this pond.

The marginal/emergent vegetation was Community 5 and the aquatic community was Community A in each year that surveys were undertaken.

Parnassia palustris and *Utricularia minor* were present in year 2.

I1 Irstead Poors Fen Catfield

Initial colonisation of the pond was slow, with only eight species appearing in the first few months following its creation. Species diversity increased over the following 2 years to a peak of 21 which then declined to 7 species in year 11 and then increased to 19 in year 13.

Marginal/emergent Community 11 and aquatic Community A were present each time the pond was surveyed. *Potamogeton coloratus* appeared in the initial few months following the ponds creation and was still present 13 years later. It had been absent before the pond's excavation.

J1 Woodbastwick Marshes

Initial colonisation of the pond was slow, with only two species appearing in the first few months following its creation. Species diversity increased over the following 2 years to a peak of 9. A total of 9 species were also present 17 years following the ponds creation, but no data was

collected in the intervening years, so no conclusions can be reached about the overall patterns of succession. In the initial period following the creation, both the marginal/emergent community and the aquatic community were indeterminate. In year 2, the marginal emergent community was Community 12 and the aquatic community was Community A. Both were still present in year 17.

J2 Woodbastwick Marshes

Surveys were only undertaken in years 2, 4 and 17, so the pattern of succession cannot be commented on. In year 2, the total number of species was 26. Numbers declined in year 4 to 25 and in year 17 the total number of species was 15.

The marginal/emergent community was Community 13 in years 2 and 4, but by year 17 had changed to Community 12. The aquatic flora was indeterminate in all the years that surveys had been undertaken.

Potamogeton coloratus was present in years 2 and 4, but was absent by year 17. *Carex lasiocarpa* was only recorded once, in year 2. Neither species was recorded prior to the excavation of the pond.

J3 Woodbastwick Marshes

Surveys were only undertaken in years 1, 3 and 16, so the pattern of succession cannot be commented on. In year 1, the total number of species was 2. Numbers increased to 5 in year 3 and 8 in year 16.

The marginal/emergent community was Community 12 in all years. The aquatic flora was an indeterminate community in year 1, and was Community A in years 3 and 16.

Potamogeton coloratus was present in year 16.

J4 Woodbastwick Marshes

Surveys were only undertaken in years 1 and 14, so the pattern of succession cannot be commented on. In year 1, the total number of species was 4. Numbers increased to 5 in year 14.

The marginal/emergent community was Community 12 in both years. The aquatic flora was Community A in year 1, and was indeterminate in year 14.

Potamogeton coloratus was present in year 16.

J5 Woodbastwick Marshes

Initial colonisation of the pond was very rapid, with 42 species appearing in the first year following creation. Species diversity then declined to 36 in year 2, increased in year 4, then declined to 31 in year 12. The marginal/emergent community was Community 14 in years 1, 2 and 4 and was Community 15 at year 12. The aquatic community was Community A in each year that surveys were undertaken.

Potamogeton coloratus was present in year 1, disappeared in year 2, and then reappeared in year 4. It was still present in year 12. *Carex lasiocarpa* was present in years 1 and 2 but was subsequently absent. *Eleocharis multicaulis* was recorded once, in year 4.

Potamogeton coloratus was absent before the pond's excavation.

J6 Woodbastwick Marshes

Initial colonisation of the pond was very rapid, with 41 species appearing in the first few months following creation. Species diversity then increased to 48 in year 2, and then declined to 25 in year 11. The marginal/emergent community was Community 14 in years 0, 1 and 3 and Community 15 at year 11. The aquatic community was Community A in each year that surveys were undertaken.

Potamogeton coloratus was present in years 1 and 2, and was subsequently absent. *Najas marina* was recorded once, in year 1 and *Eleocharis multicaulis* was also recorded just once, in year 3.

K1 Sharp Street Fen

Only one survey was undertaken at this pond, in year 2005 (age of pond unknown), therefore successional trends cannot be analysed. 20 species were recorded during the survey, with *Phragmites australis* being the most frequent species (91-100% cover). Both the marginal/emergent and the aquatic community were indeterminate.

L1 Catfield Fen

Initial colonisation of the pond was fairly rapid, with 21 species appearing in the first year following creation. Species diversity then increased to 31 in year 2, and then declined to 26 in year 3. By year 11 the total had increased marginally, to 28. The marginal/emergent community was Community 16 and the aquatic community was Community B in each year that surveys were undertaken.

Hydrocharis morsus-ranae and *Potamogeton coloratus* was present each year and *Najas marina* was present in years 2 and 3.

M1 Burgh Common

Surveys were only undertaken in years 1 and 9, so the pattern of succession cannot be commented on. In year 1, the total number of species was 27 and was 37 in year 9. The marginal/emergent community was Community 17 in both years. The aquatic flora was Community A in year 1, and was indeterminate in year 9.

Potamogeton coloratus was present in year 1 and *Cicuta virosa* was present in year 9.

M2 Burgh Common

Only one survey was undertaken at this pond, in 2005 (age of pond unknown), therefore successional trends cannot be analysed. 24 species were recorded during the survey, with *Phragmites australis* being the most frequent species (51-75% cover). The marginal/emergent community was Community 17 and the aquatic community was Community A.

O1 Horning Marsh Farm

Only one survey was undertaken at this pond, in 2003 (age of pond unknown), therefore successional trends cannot be analysed. 11 species were recorded during the survey, with *Phragmites australis* being the most frequent species (34-50% cover). The marginal/emergent community was Community 18 and the aquatic community was Community D.

O2 Horning Marsh Farm

Only one survey was undertaken at this pond, in 2005 (age of pond unknown), therefore successional trends cannot be analysed. 12 species were recorded during the survey, with *Potamogeton pusillus* being the most frequent species (51-75% cover). The marginal/emergent community was Community 18 and the aquatic community was indeterminate.

O3 Horning Marsh Farm

Only one survey was undertaken at this pond, in 2005 (age of pond unknown), therefore successional trends cannot be analysed. 24 species were recorded during the survey, with *Juncus subnodulosus* and *Phragmites australis* being the most frequent species (34-50% cover). The marginal/emergent community was Community 18 and the aquatic community was Community D.

O4 Horning Marsh Farm

Only one survey was undertaken at this pond, in 2005 (age of pond unknown), therefore successional trends cannot be analysed. 14 species were recorded during the survey, with *Phragmites australis* being the most frequent species (91-100% cover). The marginal/emergent community was Community 18 and the aquatic community was indeterminate.

O5 Horning Marsh Farm

Only one survey was undertaken at this pond, in 2005 (age of pond unknown), therefore successional trends cannot be analysed. 15 species were recorded during the survey, with *Phragmites australis* being the most frequent species (34-50% cover). The marginal/emergent community was Community 18 and the aquatic community was Community A.

East Ruston – North West Pond

Only one survey was undertaken at this pond, in 2003 (age of pond unknown), therefore successional trends cannot be analysed. 10 species were recorded during the survey, with *Phragmites australis* being the most frequent species (51-75% cover). The marginal/emergent community was Community 19 and the aquatic community was Community C. These two communities always occur together and are exclusive to East Ruston.

East Ruston – South East Pond

Only one survey was undertaken at this pond, in 2003 (age of pond unknown), therefore successional trends cannot be analysed. 12 species were recorded during the survey, with *Phragmites australis* being the most frequent species (51-75% cover). The marginal/emergent community was Community 19 and the aquatic community was Community C. These two communities always occur together and are exclusive to East Ruston.

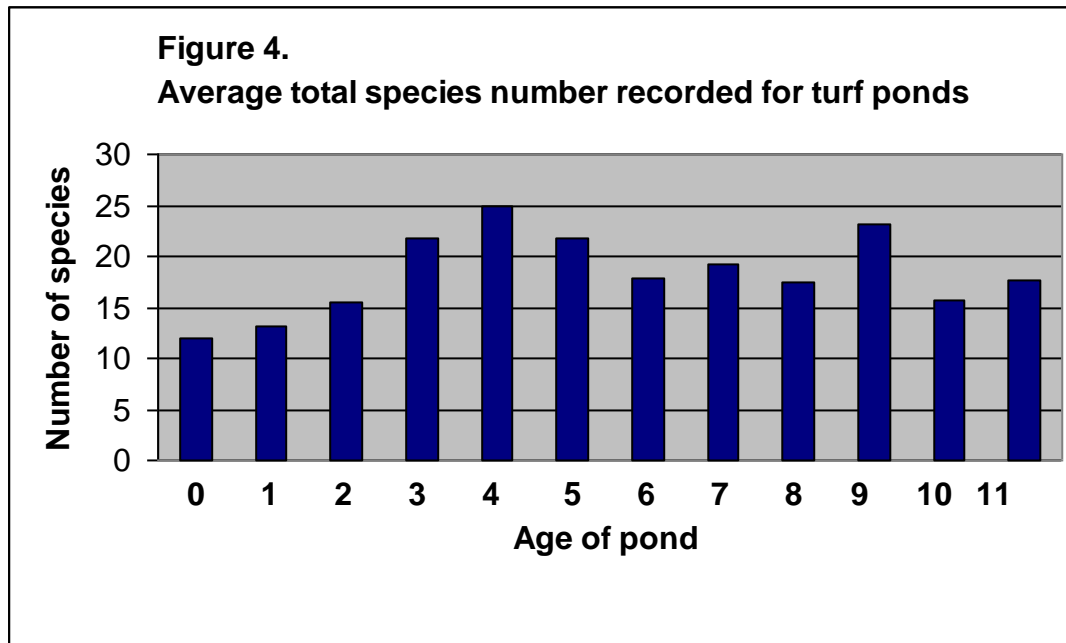
East Ruston – Valley Fen

Only one survey was undertaken at this pond, in 2003 (age of pond unknown), therefore successional trends cannot be analysed. 12 species were recorded during the survey, with *Phragmites australis* being the most frequent species (34-50% cover). The marginal/emergent community was Community 19 and the aquatic community was Community C. These two communities always occur together and are exclusive to East Ruston.

2.4 Overall trends

2.4.1 Species diversity

The average number of species for all ponds surveyed increased from 12 in year 0 to 25 in year 4, this was followed by several years between years 5 and 9 when the total number varied between 17.5 and 23.2, then the number declined slightly in years 10 and 11. Too few ponds were surveyed after 12 years since excavation to derive any meaningful data – in most cases there is only one example of ponds between the ages of 12 and 21.



2.4.2 Communities

The type of marginal/emergent communities found in turf ponds was found to be strongly site-specific, for example communities 1, 2, 3, 4, 5, 6 and 7 are only found at Broad Fen, Dilham and communities 8 and 9 are only found at How Hill (See figure 5). Some aquatic communities such as community A occur at several sites, others are more site-specific, for example community C, which only occurs at Catfield Fen.

In the first few months of succession of a new pond there was often a fairly haphazard collection of species, such that it was impossible to find any patterns in the vegetation and hence not possible to describe these collections of plants as communities. By year 2 however, definite marginal/emergent communities had developed. Many ponds continued to retain the community that had established in the first two years. This was the case in the majority (76.5%) of ponds for which there were four or more year's data (A1, C1, E, F1, F2, F3, G, H4, I1, J1, J5, J6 and L1). In many of these ponds (A1, C1, F1, F2, F3, J5, J6,) the type of community changed in later years (from year 10 onwards), but in four ponds the same community persisted beyond 10 years: in pond E the same community was still present in year 10, in pond L1, the same community was still present in year 11, in pond I1 the same community was still present in year 13 and in J1 the same community was still present in year 17.

In the CANOCO diagram (figure 6), the strongest associations were between two age ranges (0-10yrs and 11+ yrs) and individual sites.

2.4.3 Scarce species

Apium inundatum

There were four records for this scarce marginal plant – in pond A1 in years 7, 8 and 9 and pond C2 in year 1, so no clear patterns of succession could be surmised. It did, however, only occur with emergent/marginal community 1.

Baldellia ranunculoides

This plant was recorded in ponds A1, B, C1, C2 and H4 at Broad Fen, Dilham. It appeared in these ponds between year 2 and 4 and did not persist beyond year 9. It was most strongly associated with community 1, but sometimes occurred with communities 2, 3 and 5.

Carex appropinquata

There was only one record for this sedge – at pond H4 (Broad Fen Dilham) in year 4. It occurred in community 5.

Carex diandra

There was only one record for this sedge – at pond O3 (Horning Marsh Farm) in 2005, the age of the pond was unknown. It occurred in community 18.

Carex lasiocarpa

This sedge was recorded in three separate ponds – once in G (Hands Marsh Sutton), once in J2 (Woodbastwick) and twice in J5 (Woodbastwick)

The pattern of succession is unclear from the data – at Hands Marsh all *Carex* species were recorded generically until year 9, so it is possible that it occurred here from year 1 onwards, and not just in year 9. In the two Woodbastwick ponds, *C. lasiocarpa* only occurred in the first two years following the creation of the ponds, and then disappeared.

There was no association with any particular marginal/emergent community.

Cicuta virosa

This plant was recorded in three separate ponds – once in M1 (Burgh Common), once in J6 (Woodbastwick) and three times in J5 (Woodbastwick)

There was no clear pattern of succession, nor any association with any particular marginal/emergent community.

Eleocharis multicaulis

There were numerous records at Broad Fen, where it occurred in ponds A1, A2, C1, C2, D and H1 from 1 to 10 years following their creation. There were also records from Woodbastwick, where it occurred in J5 in year 4 and J6 in year 3. At Broad Fen, *E. multicaulis* is a constant in communities 1 and 4, and at Woodbastwick it always occurs in community 14.

Hypericum elodes

Although more frequent elsewhere, this plant is scarce in Norfolk. It was only recorded in two turf ponds, which are both at Broad Fen – A1 in years 3,4,7,8 and 9, and C2 in year 1. There are too few records to determine general successional pathways.

In both ponds it only occurs with community 1.

Najas marina

There were just three records of this scarce aquatic plant – at Woodbastwick in pond J6 1 year after it was created, and at Catfield in pond L1 in years 1 and 2. At Woodbastwick it was associated with marginal/emergent community 14 and aquatic community A, and at Catfield it was associated with marginal/emergent community 16 and aquatic community B.

Parnassia palustris

This plant was only recorded from ponds at Broad Fen, Dilham (H1, H4 and H5). It appeared in year 1 in ponds H4 and H5, but not until year 5 in pond H1. There is not enough information to assess the length of time it may persist. In pond H1 it occurred with community 4 and in ponds H4 and H5 it occurred with community 5.

In all except one case, *Parnassia palustris* occurred alongside *Pedicularis palustris*.

Pedicularis palustris

Pedicularis palustris was fairly widespread, occurring at nine ponds at three separate sites. It appeared between 1 and 7 years following the ponds creation, but did not persist beyond 9 years. It was associated with communities 1, 3, 5, 10 and 14.

Potamogeton coloratus

Potamogeton coloratus was very widespread, occurring at 14 ponds at six separate sites. It could appear any time between the first few months following creation and 16 years later. So there was no clear pattern in either when it first appears or how long it persists. It was most strongly associated with aquatic community A, but it did occasionally occur with communities B and D, and was occasionally recorded in indeterminate communities.

Sium latifolium

This plant was also widespread, occurring at six ponds at six separate sites. From the limited number of records, it can be surmised that it tends to appear in the early stages of succession and can persist for up to 11 years.

There was no association with any particular marginal/emergent community.

Utricularia minor

Although it was recorded in seven different ponds, all except one were at the same site (Broad Fen) – the other site was Hands Marsh. There was no clear pattern of succession. At Broad Fen *Utricularia minor* invariably occurred with community A and at Hands marsh it occurred with an indeterminate aquatic community.

3. CONCLUSION

The following trends could be surmised from the turf pond data:

- The strongest influence on the type of marginal/emergent community that developed in a pond was the surrounding vegetation – the same community types occurred in ponds at the same site.
- Once a marginal/emergent community was established, it usually persisted until 10 years after the ponds creation.
- There was not much variation in the type of aquatic communities that developed in ponds, suggesting a limited spread of plant propagules from the surrounding area.
- Average species diversity increased gradually until year 4, it then fluctuated slightly until year 9 and subsequently declined, but there was insufficient data to determine trends beyond year 11.
- The ponds with the greatest species diversity were H4 at Broad Fen Dilham, which supported 49 species in year 1 and H5, also at Broad Fen, Dilham, which supported 49 species in year 2.
- The pond with the lowest species diversity was B at Broad Fen Dilham, which supported 1 species in year 11.
- The pond with the greatest number of scarce species was J5 at Woodbastwick Marshes, where 6 scarce species were recorded over a period of several years.
- Marginal/emergent communities 1 and 14 had the highest proportion of scarce species (7) and aquatic community A had the highest proportion of scarce species (4)

The data gathered to date therefore shows that ponds which are created close to communities of high conservation value tend to develop more diverse communities with greater numbers of scarce species. The communities that develop tend to be derived from the seed/propagule source of their immediate surroundings. Once established, pond communities at particular sites do not tend to resemble communities of similar aged ponds at other sites.

Appendix I Community tables

NB: P denotes peat substrate, H denotes hand excavation, E denotes machine excavation, I denotes species presence.

Appendix 2: Data recorded for each pond.

√ = species present

Number = DOMIN value

A1 Broad Fen, Dilham

Date of creation: 1983

Max depth: 0.3m.

Size: 40 square metres.

Age of pond/date of survey

	0	1	2	3	4	7	8	9	11
	1983	1984	1985	1986	1987	1990	1991	1992	1994
Aquatic species									
Charophytes			√	√	√	√			
Filamentous algae		√	√	√	√	√		√	1
<i>Lemna minor</i>				√	√	√	√	√	3
<i>Lemna trisulca</i>								√	3
<i>Persicaria amphibia</i>					√		√	√	2
<i>Potamogeton coloratus</i>		√	√	√	√	√	√	√	
<i>Potamogeton natans</i>			√	√	√				
Marginal /emergent species									
<i>Agrostis stolonifera</i>									5
<i>Alisma plantago-aquatica</i>				√					
<i>Alnus glutinosa</i>							√		1
<i>Anagallis tenella</i>			√	√	√	√	√	√	
<i>Apium inundatum</i>						√	√	√	
<i>Baldellia ranunculoides</i>			√	√	√	√	√		
<i>Betula pubescens</i>								√	1
<i>Calamagrostis canescens</i>						√			
<i>Calliergon cordifolium</i>									√
<i>Calliergonella cuspidata</i>									√
<i>Caltha palustris</i>					√				
<i>Cardamine pratensis</i>	√			√	√	√	√	√	1
<i>Carex sp.</i>		√	√	√	√	√	√	√	
<i>Carex elata</i>									5
<i>Carex pseudocyperus</i>									3
<i>Carex riparia</i>									1
<i>Cirsium dissectum</i>							√		
<i>Eleocharis multicaulis</i>		√	√	√	√	√	√	√	
<i>Epilobium palustre</i>					√				1
<i>Epilobium parviflorum</i>								√	
<i>Equisetum fluviatile</i>		√	√	√	√				
<i>Equisetum palustre</i>				√	√		√	√	
<i>Eupatorium cannabinum</i>						√		√	
<i>Galium palustre</i>		√		√	√	√	√	√	3

<i>Hydrocotyle vulgaris</i>				✓	✓	✓	✓	✓	2
<i>Hypericum elodes</i>				✓	✓	✓	✓	✓	
<i>Impatiens capensis</i>							✓	✓	
<i>Iris pseudacorus</i>				✓	✓				1
<i>Juncus sp.</i>	✓	✓	✓	✓	✓	✓	✓	✓	
<i>Juncus effusus</i>									1
<i>Juncus subnodulosus</i>									8
<i>Lycopus europaeus</i>						✓	✓	✓	
<i>Lysimachia vulgaris</i>				✓	✓		✓	✓	2
<i>Lythrum salicaria</i>			✓	✓	✓	✓	✓	✓	3
<i>Mentha aquatica</i>			✓	✓	✓	✓	✓	✓	1
<i>Myosotis laxa</i>		✓	✓	✓			✓	✓	1
<i>Oenanthe fistulosa</i>					✓				
<i>Pedicularis palustris</i>					✓		✓	✓	
<i>Peucedanum palustre</i>						✓	✓	✓	
<i>Phragmites australis</i>		✓	✓	✓	✓	✓	✓	✓	5
<i>Potentilla palustris</i>	✓		✓	✓	✓	✓	✓	✓	4
<i>Ranunculus flammula</i>		✓	✓	✓	✓	✓	✓	✓	
<i>Ranunculus lingua</i>						✓			
<i>Rumex hydrolapathum</i>								✓	1
<i>Salix cinerea</i>								✓	1
<i>Salix fragilis</i>								✓	
<i>Samolus valerandi</i>				✓	✓	✓		✓	
<i>Solanum dulcamara</i>								✓	2
<i>Stellaria palustris</i>							✓	✓	
<i>Triglochin palustris</i>						✓			
<i>Veronica beccabunga</i>							✓		
<i>Veronica scutellaria</i>						✓			
Total number of species	3	11	18	28	31	30	31	37	27
Marginal/emergent community	Indet	1	1	1	1	1	1	1	6
Aquatic community	Indet	Indet	A	A	A	A	D	D	D

A2 Broad Fen, Dilham

Date of creation: 1985

Max depth: 0.7m

Size: 150 square metres

Age of pond/date of survey

	1	2	5	6	7	9
	1986	1987	1990	1991	1992	1994
Aquatic species						
Charophytes		√	√	√	√	2
Filamentous algae	√	√	√	√	√	4
<i>Lemna minor</i>	√	√	√	√	√	3
<i>Lemna trisulca</i>			√	√	√	3
<i>Persicaria amphibia</i>	√	√				2
<i>Potamogeton coloratus</i>		√	√	√	√	
<i>Potamogeton natans</i>		√	√	√	√	3
Marginal /emergent species						
<i>Calliergon cordifolium</i>						3
<i>Cardamine pratensis</i>		√				
<i>Carex</i> sp.			√	√	√	
<i>Carex elata</i>						3
<i>Carex pseudocyperus</i>						4
<i>Cladium mariscus</i>						2
<i>Eleocharis multicaulis</i>				√		
<i>Eriophorum angustifolium</i>	√					
<i>Hydrocotyle vulgaris</i>	√					2
<i>Juncus</i> sp.	√	√	√	√	√	
<i>Juncus subnodulosus</i>						3
<i>Lythrum salicaria</i>					√	2
<i>Mentha aquatica</i>	√			√	√	
<i>Myosotis laxa</i>				√	√	
<i>Peucedanum palustre</i>	√					
<i>Phragmites australis</i>			√	√	√	8
<i>Potentilla palustris</i>		√	√			2
<i>Ranunculus flammula</i>				√		
<i>Ranunculus lingua</i>		√		√		
<i>Samolus valerandi</i>					√	
Total number of species	8	11	11	16	15	17
Marginal/emergent community	Indet	Indet	2	1	2	3
Aquatic community	D	A	A	A	A	A

A3 Broad Fen, Dilham

Date of creation: 1986

Max depth: 0.6m

Size: 50 square metres

Age of pond/
date of survey

	8
	1994
Aquatic species	
Charophytes	4
Filamentous algae	4
<i>Lemna minor</i>	2
<i>Lemna trisulca</i>	2
<i>Potamogeton coloratus</i>	2
Marginal /emergent species	
<i>Calliergon cordifolium</i>	3
<i>Carex elata</i>	2
<i>Carex pseudocyperus</i>	3
<i>Phragmites australis</i>	6
<i>Potentilla palustris</i>	3
<i>Salix cinerea</i>	1
Total number of species	11
Marginal/emergent community	2
Aquatic community	A

A4 Broad Fen, Dilham

Date of creation: 1987

Max depth: 0.7m

Size: 120 square metres

Age of pond/
date of survey

	7
	1994
Aquatic species	
Charophytes	6
Filamentous algae	5
<i>Potamogeton coloratus</i>	1
Marginal /emergent species	
<i>Calliergon cordifolium</i>	3
<i>Carex pseudocyperus</i>	3
<i>Carex riparia</i>	1
<i>Drepanocladus sp.</i>	3
<i>Hydrocotyle vulgaris</i>	2
<i>Juncus subnodulosus</i>	2
<i>Phragmites australis</i>	4
<i>Potentilla palustris</i>	3
<i>Typha latifolia</i>	3
Total number of species	10
Marginal/emergent community	2
Aquatic community	A

B Broad Fen, Dilham

Date of creation: 1983

Max depth: 0.5m,

Size: 800 square metres

Age of pond/date of survey

	0	1	2	3	4	7	8	9	11
	1983	1984	1985	1986	1987	1990	1991	1992	1994
Aquatic species									
<i>Elodea canadensis</i>			✓	✓					
Filamentous algae	✓	✓	✓	✓	✓	✓	✓	✓	
<i>Lemna minor</i>	✓	✓	✓	✓	✓	✓	✓		
<i>Lemna trisulca</i>	✓	✓	✓	✓	✓	✓	✓		
<i>Potamogeton coloratus</i>			✓	✓	✓				
<i>Potamogeton obtusifolius</i>	✓		✓	✓	✓				
Marginal /emergent species									
<i>Alisma plantago-aquatica</i>				✓					
<i>Baldellia ranunculoides</i>			✓	✓	✓				
<i>Calamagrostis canescens</i>		✓	✓	✓	✓	✓	✓		
<i>Caltha palustris</i>		✓	✓						

<i>Cardamine pratensis</i>			✓						
<i>Carex</i> sp.		✓	✓	✓	✓	✓	✓	✓	
<i>Cladium mariscus</i>			✓						
<i>Epilobium hirsutum</i>			✓						
<i>Equisetum palustre</i>			✓	✓	✓				
<i>Filipendula ulmaria</i>		✓	✓	✓	✓				
<i>Galium palustre</i>		✓	✓	✓	✓				
<i>Hydrocotyle vulgaris</i>			✓	✓					
<i>Impatiens capensis</i>							✓		
<i>Iris pseudacorus</i>		✓	✓	✓	✓				
<i>Juncus</i> sp.		✓	✓	✓	✓	✓			
<i>Lycopus europaeus</i>		✓	✓	✓	✓				
<i>Lysimachia vulgaris</i>		✓		✓	✓	✓			
<i>Lythrum salicaria</i>			✓	✓	✓	✓	✓	✓	
<i>Mentha aquatica</i>		✓	✓	✓	✓				
<i>Myosotis laxa</i>		✓	✓	✓	✓				
<i>Oenanthe fistulosa</i>			✓	✓	✓				
<i>Peucedanum palustre</i>		✓		✓	✓				
<i>Phragmites australis</i>	✓	✓	✓	✓	✓	✓	✓	✓	10
<i>Potentilla palustris</i>	✓	✓	✓	✓	✓	✓	✓	✓	
<i>Ranunculus flammula</i>		✓	✓	✓	✓				
<i>Salix</i> sp.				✓	✓				
<i>Solanum dulcamara</i>						✓			
<i>Sparganium</i> sp.					✓				
Total number of species	6	18	29	29	27	12	10	5	1
Marginal/emergent community	Indet	2	3	2	2	2	2	2	7
Aquatic community	D	D	D	D	D	D	D	Indet	Indet

CI Broad Fen, Dilham

Date of creation: 1982

Max depth: 0.5m,

Size: 100 square metres

	Age of pond/date of survey							
	2 1984	3 1985	4 1986	5 1987	8 1990	9 1991	10 1992	15 1997
Aquatic species								
Charophytes	✓	✓	✓	✓	✓		✓	6
Filamentous algae	✓	✓	✓	✓	✓	✓	✓	4
<i>Lemna minor</i>		✓		✓	✓	✓	✓	3
<i>Lemna trisulca</i>				✓				
<i>Potamogeton coloratus</i>	✓	✓	✓	✓	✓			2
<i>Potamogeton natans</i>				✓				
Marginal /emergent species								
<i>Agrostis stolonifera</i>	✓		✓		✓	✓	✓	4
<i>Alisma plantago-aquatica</i>								1
<i>Anagallis tenella</i>								2
<i>Baldellia ranunculoides</i>		✓	✓	✓		✓		1
<i>Cardamine pratensis</i>					✓	✓		
<i>Carex</i> sp.	✓	✓	✓	✓	✓	✓	✓	
<i>Carex elata</i>								3
<i>Eleocharis multicaulis</i>		✓	✓	✓	✓	✓		
<i>Filipendula ulmaria</i>	✓	✓	✓					
<i>Galium palustre</i>	✓		✓	✓	✓	✓		1
<i>Hydrocotyle vulgaris</i>				✓	✓	✓		2
<i>Impatiens capensis</i>			✓	✓	✓	✓	✓	
<i>Iris pseudacorus</i>	✓			✓				
<i>Juncus</i> sp.	✓	✓	✓	✓	✓	✓	✓	
<i>Juncus articulatus</i>								3
<i>Juncus bulbosus</i>								2
<i>Juncus subnodulosus</i>								3
<i>Lychnis flos-cuculi</i>			✓					
<i>Lycopus europaeus</i>		✓	✓					1
<i>Lysimachia vulgaris</i>				✓				
<i>Lythrum salicaria</i>	✓	✓	✓			✓	✓	1
<i>Mentha aquatica</i>				✓				3
<i>Myosotis laxa</i>		✓	✓			✓		1
<i>Pedicularis palustris</i>		✓		✓				
<i>Peucedanum palustre</i>				✓		✓	✓	1
<i>Phragmites australis</i>	✓	✓	✓	✓	✓	✓	✓	5
<i>Potentilla palustris</i>				✓	✓	✓	✓	1
<i>Ranunculus flammula</i>	✓	✓	✓	✓		✓		3
<i>Salix cinerea</i>							✓	

<i>Samolus valerandi</i>				√				3
<i>Solanum dulcamara</i>							√	
<i>Typha latifolia</i>								1
Total number of species	12	16	17	22	15	18	15	25
Marginal/emergent community	2	1	1	1	1	1	2	6
Aquatic community	A	A	A	A	A	A	A	A

C2 Broad Fen, Dilham

Date of creation: 1995

Max depth: 1m

Size: 10000 square metres

	Age of pond/ date of survey
	2
	1997
Aquatic species	
Charophytes	8
Filamentous algae	5
<i>Lemna minor</i>	1
<i>Potamogeton coloratus</i>	3
Marginal /emergent species	
<i>Agrostis stolonifera</i>	2
<i>Anagallis tenella</i>	2
<i>Apium inundatum</i>	1
<i>Baldellia ranunculoides</i>	3
<i>Calamagrostis canescens</i>	1
<i>Calliergon cordifolium</i>	7
<i>Calliergonella cuspidata</i>	3
<i>Calliergon giganteum</i>	1
<i>Carex elata</i>	3
<i>Carex pseudocyperus</i>	1
<i>Carex viridula</i>	2
<i>Eleocharis multicaulis</i>	2
<i>Eupatorium cannabinum</i>	1
<i>Galium palustre</i>	1
<i>Hydrocotyle vulgaris</i>	1
<i>Hypericum elodes</i>	1
<i>Juncus articulatus</i>	7
<i>Juncus bufonis</i>	1
<i>Juncus subnodulosus</i>	7
<i>Lycopus europaeus</i>	1
<i>Lythrum salicaria</i>	2
<i>Mentha aquatica</i>	4
<i>Myosotis laxa</i>	2
<i>Myosotis scorpioides</i>	1
<i>Oenanthe fistulosa</i>	1
<i>Phragmites australis</i>	5
<i>Potentilla palustris</i>	1
<i>Ranunculus flammula</i>	4
<i>Rumex hydrolapathum</i>	1
<i>Samolus valerandi</i>	5
<i>Scutellaria galericulata</i>	1

<i>Sium latifolium</i>	1
<i>Typha latifolia</i>	2
Total number of species	39
Marginal/emergent community	1
Aquatic community	A

D Broad Fen, Dilham

Date of creation: 1984

Max depth: 0.3m

Size: 200 square metres

Age of pond/date of survey

	0	1	2	3	6	7	8	10
	1984	1985	1986	1987	1990	1991	1992	1994
Aquatic species								
Charophytes		√	√	√	√	√	√	5
Filamentous algae		√	√	√	√	√		
<i>Lemna minor</i>		√	√	√	√	√	√	
<i>Utricularia minor</i>							√	3
Marginal /emergent species								
<i>Agrostis stolonifera</i>								1
<i>Alnus glutinosa</i>			√					
<i>Calamagrostis canescens</i>	√		√			√		
<i>Calliergonella cuspidata</i>								2
<i>Cardamine pratensis</i>		√	√	√				
<i>Carex</i> sp.		√	√	√	√	√	√	
<i>Cirsium palustre</i>		√	√					
<i>Cladium mariscus</i>		√	√		√	√	√	2
<i>Eleocharis multicaulis</i>						√		
<i>Eupatorium cannabinum</i>	√	√	√					
<i>Filipendula ulmaria</i>	√			√				
<i>Galium palustre</i>		√	√	√			√	1
<i>Hydrocotyle vulgaris</i>		√	√	√		√		1
<i>Juncus</i> sp.	√	√	√	√	√	√	√	
<i>Juncus subnodulosus</i>								3
<i>Lycopus europaeus</i>		√	√	√				
<i>Lythrum salicaria</i>	√			√	√			2
<i>Mentha aquatica</i>			√	√			√	
<i>Myosotis laxa</i>			√					
<i>Myrica gale</i>					√	√	√	2
<i>Phragmites australis</i>	√	√	√	√	√	√	√	4
<i>Ranunculus lingua</i>			√	√				
<i>Salix</i> sp.	√		√					
<i>Solanum dulcamara</i>							√	
<i>Valeriana dioica</i>		√	√					
Total number of species	7	16	22	16	9	11	11	11
Marginal/emergent community	Indet	3	3	2	3	3	3	3
Aquatic community	Indet	A	A	A	A	A	A	A

E Broad Fen, Dilham

Date of creation: 1984

Max depth: 0.5m

Size: 150 square metres

Age of pond/date of survey

	0	1	2	3	6	7	8	10
	1984	1985	1986	1987	1990	1991	1992	1994
Aquatic species								
Charophytes		✓	✓	✓	✓	✓	✓	8
Filamentous algae	✓	✓	✓	✓	✓			1
<i>Lemna minor</i>		✓	✓	✓	✓	✓	✓	2
<i>Utricularia minor</i>							✓	3
Marginal /emergent species								
<i>Agrostis stolonifera</i>								3
<i>Betula pubescens</i>			✓					
<i>Calamagrostis canescens</i>	✓	✓		✓	✓	✓		
<i>Calliergon cordifolium</i>								2
<i>Caltha palustris</i>			✓				✓	
<i>Cardamine pratensis</i>		✓	✓				✓	
<i>Carex</i> sp.		✓	✓	✓	✓	✓	✓	
<i>Carex pseudocyperus</i>								2
<i>Cladium mariscus</i>	✓	✓	✓	✓	✓	✓	✓	3
<i>Epilobium hirsutum</i>			✓					
<i>Eupatorium cannabinum</i>		✓	✓					
<i>Filipendula ulmaria</i>			✓		✓	✓	✓	1
<i>Galium palustre</i>		✓	✓	✓	✓	✓	✓	2
<i>Hydrocotyle vulgaris</i>		✓	✓	✓		✓	✓	2
<i>Juncus</i> sp.	✓	✓	✓	✓	✓	✓	✓	
<i>Juncus articulatus</i>								1
<i>Juncus subnodulosus</i>								4
<i>Lycopus europaeus</i>		✓				✓		
<i>Lythrum salicaria</i>	✓	✓		✓		✓	✓	2
<i>Mentha aquatica</i>		✓	✓	✓		✓	✓	2
<i>Oenanthe fistulosa</i>			✓					
<i>Pedicularis palustris</i>		✓		✓		✓		
<i>Peucedanum palustre</i>	✓	✓	✓	✓				
<i>Phragmites australis</i>		✓	✓	✓	✓	✓	✓	8
<i>Ranunculus flammula</i>		✓	✓	✓				
<i>Ranunculus lingua</i>			✓	✓				
<i>Salix</i> sp.	✓	✓	✓	✓	✓	✓	✓	
<i>Salix repens</i>								2
<i>Samolus valerandi</i>						✓		
<i>Thelypteris palustris</i>		✓	✓	✓	✓	✓	✓	3

<i>Valeriana dioica</i>		√	√	√				
Total number of species	7	23	24	21	14	18	18	19
Marginal/emergent community	Indet	3	3	3	3	3	3	3
Aquatic community	Indet	A	A	A	A	A	A	A

FI How Hill Nature Reserve

Date of creation: 1985,

Max depth: 0.75m

Size: 130 square metres

Age of pond/date of survey

	1	2	5	6	7	9	20
	1986	1987	1990	1991	1992	1994	2005
Aquatic species							
Charophytes		✓	✓	✓	✓	8	
Filamentous algae	✓	✓	✓	✓	✓	5	
<i>Lemna minor</i>							5
Marginal /emergent species							
<i>Agrostis stolonifera</i>						6	
<i>Alnus glutinosa</i>					✓		2
<i>Calliergon giganteum</i>							3
<i>Cardamine pratensis</i>	✓	✓					
<i>Carex sp.</i>	✓	✓	✓	✓			
<i>Cirsium palustre</i>				✓	✓		
<i>Eupatorium cannabinum</i>	✓	✓	✓	✓	✓		
<i>Galium palustre</i>	✓	✓	✓	✓	✓	3	3
<i>Iris pseudacorus</i>							1
<i>Juncus sp.</i>	✓	✓	✓		✓		
<i>Juncus subnodulosus</i>						1	4
<i>Lysimachia vulgaris</i>	✓	✓	✓		✓	3	1
<i>Lythrum salicaria</i>	✓	✓	✓		✓	2	2
<i>Mentha aquatica</i>						1	2
<i>Oenanthe fistulosa</i>	✓	✓			✓	2	
<i>Peucedanum palustre</i>			✓	✓			2
<i>Phragmites australis</i>	✓	✓	✓	✓	✓	8	9
<i>Potentilla palustris</i>				✓		3	
<i>Ranunculus flammula</i>	✓						
<i>Rumex hydrolapathum</i>						2	1
<i>Salix sp.</i>	✓	✓					
<i>Schoenoplectus tabernaemontani</i>	✓	✓	✓	✓	✓	3	
<i>Solanum dulcamara</i>						2	1
<i>Typha angustifolia</i>	✓	✓	✓	✓	✓	5	2
<i>Typha latifolia</i>							1
Total number of species	17	16	14	13	13	17	16
Marginal/emergent community	8	8	8	8	8	8	9
Aquatic community	Indet	A	A	A	A	A	Indet

F2 How Hill Nature Reserve

Date of creation: 1986

Max depth: 1.0m

Size: 250 square metres

	Age of pond/date of survey			
	6	9	10	21
	1992	1993	1994	2005
Aquatic species				
Charophytes	√	√		
Filamentous algae	√	√	5	
<i>Lemna minor</i>				1
<i>Lemna trisulca</i>				7
Marginal /emergent species				
<i>Agrostis stolonifera</i>			3	
<i>Alnus glutinosa</i>			2	
<i>Berula erecta</i>		√		1
<i>Carex</i> sp.	√	√		
<i>Carex riparia</i>			1	
<i>Drepanocladus aduncus</i>				3
<i>Eupatorium cannabinum</i>			2	
<i>Galium palustre</i>			2	2
<i>Glyceria plicata</i>				1
<i>Juncus</i> sp.	√	√		
<i>Juncus subnodulosus</i>			3	
<i>Lysimachia vulgaris</i>			2	1
<i>Lythrum salicaria</i>	√	√		
<i>Mentha aquatica</i>		√		
<i>Myosotis laxa</i>			2	
<i>Oenanthe fistulosa</i>				1
<i>Peucedanum palustre</i>			1	1
<i>Phragmites australis</i>	√	√	8	10
<i>Potentilla palustris</i>	√	√	1	3
<i>Rumex hydrolapathum</i>		√	2	
<i>Schoenoplectus tabernaemontani</i>	√	√	3	
<i>Solanum dulcamara</i>	√	√		2
<i>Thelypteris palustris</i>			3	
<i>Typha angustifolia</i>	√	√	6	7
<i>Typha latifolia</i>	√	√	2	
Total number of species	12	14	18	15
Marginal/emergent community	8	8	8	9
Aquatic community	Indet	A	A	Indet

F3 How Hill Nature Reserve

Date of creation: 1986

Max depth: 0.5m

Size: 200 square metres

	Age of pond/date of survey			
	6 1992	7 1993	8 1994	19 2005
Aquatic species				
Filamentous algae	√	√	1	
<i>Lemna minor</i>			1	4
<i>Lemna trisulca</i>				6
Marginal /emergent species				
<i>Agrostis stolonifera</i>			4	
<i>Alnus glutinosa</i>	√	√	3	2
<i>Apium nodiflorum</i>			1	
<i>Berula erecta</i>	√		1	3
<i>Betula pubescens</i>		√	3	
<i>Calamagrostis canescens</i>		√	2	
<i>Cardamine pratensis</i>		√		
<i>Carex sp.</i>	√	√		
<i>Carex pseudocyperus</i>			1	
<i>Carex riparia</i>			1	
<i>Cirsium palustre</i>	√	√		
<i>Epilobium hirsutum</i>	√			
<i>Eupatorium cannabinum</i>	√	√	2	
<i>Filipendula ulmaria</i>			1	
<i>Galium palustre</i>	√	√	3	
<i>Hydrocotyle vulgaris</i>		√		
<i>Iris pseudacorus</i>	√	√		2
<i>Juncus sp.</i>	√	√		
<i>Juncus subnodulosus</i>			3	4
<i>Lycopus europaeus</i>		√	1	
<i>Lysimachia vulgaris</i>		√	3	
<i>Lythrum salicaria</i>	√	√	2	
<i>Mentha aquatica</i>	√	√	3	1
<i>Myosotis laxa</i>			2	
<i>Oenanthe fistulosa</i>	√		1	
<i>Peucedanum palustre</i>	√	√	3	
<i>Phragmites australis</i>	√	√	7	9
<i>Potentilla palustris</i>	√		1	1
<i>Rumex hydrolapathum</i>	√	√	3	
<i>Salix cinerea</i>		√	3	
<i>Schoenoplectus tabernaemontani</i>	√	√	4	
<i>Scutellaria galericulata</i>			2	

<i>Sium latifolium</i>		√		
<i>Solanum dulcamara</i>	√	√	2	
<i>Stellaria palustris</i>				
<i>Thelypteris palustris</i>	√	√	1	√
<i>Typha angustifolia</i>	√	√	8	3
<i>Typha latifolia</i>				2
Total number of species	22	26	30	11
Marginal/emergent community	8	8	8	9
Aquatic community	Indet	Indet	D	Indet

F4 How Hill Nature Reserve

Date of creation: 1986

Max depth: 0.75m

Size: 150 square metres

Age of pond/ date of survey

	8
	1994
Aquatic species	
Filamentous algae	9
<i>Lemna minor</i>	5
Marginal /emergent species	
<i>Agrostis stolonifera</i>	5
<i>Carex riparia</i>	5
<i>Galium palustre</i>	2
<i>Juncus sp.</i>	7
<i>Myosotis laxa</i>	2
<i>Phragmites australis</i>	9
<i>Potentilla palustris</i>	3
<i>Solanum dulcamara</i>	3
<i>Typha angustifolia</i>	3
<i>Typha latifolia</i>	3
Total number of species	14
Marginal/emergent community	8
Aquatic community	D

G Hands Marsh Sutton

Date of creation: 1985

Max depth: 0.45m

Size: 80 square metres

Age of pond/date of survey

	1	2	4	5	6	7	9
	1986	1987	1989	1990	1991	1992	1994
Aquatic species							
Charophytes		√	√	√			
Filamentous algae	√	√					
<i>Potamogeton coloratus</i>				√	√		
<i>Potamogeton natans</i>		√	√	√		√	2
<i>Utricularia</i> sp.	√	√	√	√	√	√	4
Marginal /emergent species							
<i>Agrostis stolonifera</i>							3
<i>Calamagrostis canescens</i>						√	
<i>Calliergon</i> sp.							2
<i>Caltha palustris</i>							2
<i>Campylium stellatum</i>							2
<i>Carex</i> sp.	√	√	√	√	√	√	
<i>Carex elata</i>							3
<i>Carex lasiocarpa</i>							8
<i>Equisetum palustre</i>	√	√	√	√	√		
<i>Eupatorium cannabinum</i>	√						
<i>Filipendula ulmaria</i>	√					√	
<i>Galium palustre</i>							1
<i>Hydrocotyle vulgaris</i>	√			√	√	√	3
<i>Juncus</i> sp.	√	√	√	√	√	√	√
<i>Juncus articulatus</i>							3
<i>Juncus bulbosus</i>							3
<i>Juncus subnodulosus</i>							6
<i>Lycopus europaeus</i>			√				
<i>Lysimachia vulgaris</i>				√			3
<i>Mentha aquatica</i>	√				√	√	2
<i>Molinia caerulea</i>							2
<i>Pedicularis palustris</i>						√	2
<i>Peucedanum palustre</i>							1
<i>Phragmites australis</i>	√	√	√	√	√	√	3
<i>Ranunculus flammula</i>		√					2
<i>Ranunculus lingua</i>							2
<i>Riccardia multifida</i>							2
<i>Schoenoplectus tabernaemontani</i>							1
<i>Sparganium</i> sp.		√			√		
<i>Typha angustifolia</i>						√	

<i>Valeriana dioica</i>							
Total number of species	11	10	8	10	10	11	22
Marginal/emergent community	10	10	10	10	10	10	10
Aquatic community	D	A	A	A	Indet	Indet	Indet

HI Broad Fen Dilham

Date of creation: 1985

Max depth: 2m

Size: 400 square metres

	Age of pond/date of survey					
	1 1986	2 1987	5 1990	6 1991	7 1992	9 1994
Aquatic species						
Charophytes	✓	✓	✓	✓	✓	8
Filamentous algae	✓	✓	✓	✓		3
<i>Lemna minor</i>	✓	✓		✓	✓	2
<i>Utricularia minor</i>	✓	✓	✓	✓	✓	4
Marginal /emergent species						
<i>Agrostis stolonifera</i>						1
<i>Alnus glutinosa</i>			✓	✓	✓	✓
<i>Anagallis tenella</i>			✓	✓	✓	✓
<i>Angelica sylvestris</i>			✓	✓	✓	
<i>Berula erecta</i>				✓	✓	✓
<i>Betula pubescens</i>	✓		✓	✓	✓	✓
<i>Calamagrostis canescens</i>	✓					
<i>Caltha palustris</i>			✓	✓		
<i>Cardamine pratensis</i>		✓	✓	✓	✓	✓
<i>Carex</i> sp.	✓	✓	✓	✓	✓	✓
<i>Carex riparia</i>						
<i>Cladium mariscus</i>			✓	✓	✓	✓
<i>Dactylorhiza</i> sp.			✓	✓	✓	
<i>Eleocharis multicaulis</i>		✓	✓	✓	✓	✓
<i>Epilobium</i> sp.	✓		✓	✓	✓	✓
<i>Epipactis palustris</i>			✓	✓	✓	✓
<i>Eupatorium cannabinum</i>			✓	✓	✓	✓
<i>Filipendula ulmaria</i>	✓		✓	✓		
<i>Galium palustre</i>		✓	✓	✓	✓	✓
<i>Hydrocotyle vulgaris</i>	✓	✓	✓	✓	✓	✓
<i>Hypericum tetrapterum</i>			✓			
<i>Impatiens capensis</i>			✓			
<i>Juncus</i> sp.	✓	✓	✓	✓	✓	✓
<i>Lychnis flos-cuculi</i>			✓	✓	✓	✓
<i>Lycopus europaeus</i>			✓	✓	✓	✓
<i>Lysimachia vulgaris</i>	✓					
<i>Lythrum salicaria</i>	✓	✓		✓	✓	✓
<i>Mentha aquatica</i>	✓	✓	✓	✓	✓	✓
<i>Molinia caerulea</i>						✓
<i>Myosotis laxa</i>			✓	✓	✓	
<i>Myrica gale</i>	✓	✓	✓		✓	✓

<i>Oenanthe fistulosa</i>		✓		✓	✓	✓
<i>Parnassia palustris</i>			✓	✓	✓	✓
<i>Pedicularis palustris</i>		✓	✓	✓	✓	✓
<i>Peucedanum palustre</i>	✓	✓	✓	✓	✓	✓
<i>Phragmites australis</i>	✓	✓	✓	✓	✓	✓
<i>Potentilla palustris</i>			✓	✓		
<i>Pulicaria dysenterica</i>					✓	
<i>Ranunculus flammula</i>		✓	✓	✓	✓	✓
<i>Ranunculus lingua</i>				✓	✓	
<i>Rumex hydrolapathum</i>						
<i>Salix cinerea</i>		✓	✓	✓	✓	✓
<i>Salix repens</i>			✓			✓
<i>Samolus valerandi</i>			✓	✓	✓	✓
Total number of species	20	22	46	47	43	42
Marginal/emergent community	2	1	4	4	4	4
Aquatic community	A	A	A	A	A	A

H2 Broad Fen Dilham

Date of creation: 1987

Max depth: 2m

Size: 180 square metres

Age of pond/
date of survey

	5
	1992
Aquatic species	
<i>Chara hispida</i>	8
<i>Utricularia minor</i>	3
Marginal /emergent species	
<i>Agrostis stolonifera</i>	1
<i>Calliergonella cuspidata</i>	1
<i>Carex pseudocyperus</i>	2
<i>Eupatorium cannabinum</i>	1
<i>Juncus articulatus</i>	1
<i>Juncus subnodulosus</i>	3
<i>Lythrum salicaria</i>	1
<i>Mentha aquatica</i>	1
<i>Phragmites australis</i>	3
<i>Potentilla palustris</i>	1
<i>Samolus valerandi</i>	2
<i>Schoenoplectus tabernaemontani</i>	1
<i>Solanum dulcamara</i>	1
<i>Typha latifolia</i>	3
Total number of species	16
Marginal/emergent community	5
Aquatic community	A

H3 Broad Fen Dilham

Date of creation: 1985

Max depth: 1m

Size: 275 square metres

Age of pond/
date of survey

	7
	1992
Aquatic species	
Charophytes	✓
<i>Utricularia minor</i>	✓
Marginal /emergent species	
<i>Agrostis stolonifera</i>	✓
<i>Anagallis tenella</i>	✓
<i>Carex</i> sp.	✓
<i>Cladium mariscus</i>	✓
<i>Galium palustre</i>	✓
<i>Hydrocotyle vulgaris</i>	✓
<i>Juncus</i> sp.	✓
<i>Lycopus europaeus</i>	✓
<i>Lysimachia vulgaris</i>	✓
<i>Mentha aquatica</i>	✓
<i>Myrica gale</i>	✓
<i>Pedicularis palustris</i>	✓
<i>Phragmites australis</i>	✓
<i>Ranunculus flammula</i>	✓
<i>Salix</i> sp.	✓
<i>Samolus valerandi</i>	✓
<i>Schoenus nigricans</i>	✓
<i>Thelypteris palustris</i>	✓
<i>Typha latifolia</i>	✓
Total number of species	22
Marginal/emergent community	3
Aquatic community	A

H4 Broad Fen Dilham

Date of creation: 1992

Max depth: 0.8m

Size: 500 square metres

Age of pond/date of survey

	1	2	4	5
	1993	1994	1996	1997
Aquatic species				
Charophytes	6	8	7	7
Filamentous algae	5	7	5	5
<i>Lemna minor</i>	4	4	2	3
<i>Utricularia minor</i>			2	3
Marginal /emergent species				
<i>Agrostis stolonifera</i>	4	4	3	2
<i>Alnus glutinosa</i>		3	1	1
<i>Anagallis tenella</i>	3	2	1	
<i>Baldellia ranunculoides</i>			1	
<i>Berula erecta</i>		1	1	1
<i>Betula pubescens</i>	2		1	
<i>Bryum pseudotriquetrum</i>		1		
<i>Calamagrostis canescens</i>				1
<i>Calliergonella cuspidata</i>		5		
<i>Cardamine pratensis</i>	2	1	1	
<i>Carex appropinquata</i>			1	
<i>Carex elata</i>	1	2	1	3
<i>Carex panicea</i>	2	3	3	
<i>Carex pseudocyperus</i>	2		1	3
<i>Carex viridula</i>	3	5	4	3
<i>Cirsium arvense</i>	√	1		
<i>Cirsium palustre</i>	1		1	
<i>Cirsium vulgare</i>		1		
<i>Dryopteris carthusiana</i>	1			
<i>Eleocharis sp.</i>	3	2		
<i>Epilobium hirsutum</i>	2			1
<i>Epilobium palustre</i>	1			
<i>Epilobium parviflorum</i>	3	3	1	
<i>Eupatorium cannabinum</i>	2	3	2	1
<i>Filipendula ulmaria</i>		1		1
<i>Galium palustre</i>	2		2	1
<i>Holcus lanatus</i>	3	4	3	3
<i>Hydrocotyle vulgaris</i>	3	3	2	1
<i>Hypericum tetrapterum</i>	1	2		
<i>Juncus articulatus</i>	4	3	2	3
<i>Juncus subnodulosus</i>	5	6	8	6
<i>Lychnis flos-cuculi</i>	1	1	1	

<i>Lycopus europaeus</i>	1	1	1	
<i>Lythrum salicaria</i>	3	2	1	1
<i>Mentha aquatica</i>	3	3	1	2
<i>Molinia caerulea</i>	√	2		
<i>Myrica gale</i>		2		
<i>Oenanthe fistulosa</i>				1
<i>Parnassia palustris</i>	2	3	1	
<i>Pedicularis palustris</i>	1	2	3	
<i>Persicaria lapathifolia</i>	1			
<i>Persicaria maculosa</i>	1			
<i>Peucedanum palustre</i>	1	1		1
<i>Phragmites australis</i>	3	3	3	4
<i>Poa annua</i>	2			
<i>Pohlia nutans</i>		1		
<i>Potentilla palustris</i>				1
<i>Ranunculus flammula</i>	2	2	1	1
<i>Ranunculus lingua</i>			1	1
<i>Ranunculus sceleratus</i>	1		1	1
<i>Rumex conglomeratus</i>	1		1	
<i>Rumex hydrolapathum</i>			1	1
<i>Sagina procumbens</i>	1	2		
<i>Salix cinerea</i>	1	2	1	1
<i>Salix repens</i>	1			
<i>Samolus valerandi</i>	2	4	1	1
<i>Schoenus nigricans</i>		4	3	3
<i>Schoenoplectus tabernaemontani</i>		2	2	2
<i>Sonchus sp.</i>	1			
<i>Stellaria alsine</i>		2		
<i>Triglochin palustris</i>	1			
<i>Typha latifolia</i>	1	2	2	3
<i>Urtica dioica</i>	1			
<i>Valeriana dioica</i>	2	2	1	
<i>Valeriana officinalis</i>	1			
Total number of species	49	45	43	34
Marginal/emergent community	5	5	5	5
Aquatic community	A	A	A	A

H5 Broad Fen Dilham

Date of creation: 1995

Max depth: 0.4m

Size: 7000 square metres

Age of pond/date of survey

	1	2
	1996	1997
Aquatic species		
<i>Callitriche</i> sp.	1	
Charophytes		3
Filamentous algae	3	4
<i>Lemna minor</i>	3	3
<i>Lemna trisulca</i>		1
<i>Utricularia minor</i>		2
Marginal /emergent species		
<i>Agrostis stolonifera</i>	4	4
<i>Alisma plantago- aquatica</i>	1	1
<i>Alnus glutinosa</i>		1
<i>Berula erecta</i>	2	2
<i>Calamagrostis canescens</i>	1	1
<i>Cardamine pratensis</i>	1	1
<i>Carex</i> sp.	2	3
<i>Carex elata</i>	1	
<i>Carex viridula</i>		3
<i>Cirsium palustre</i>	1	1
<i>Cirsium vulgare</i>		1
<i>Epilobium</i> sp.	3	1
<i>Eupatorium cannabinum</i>		1
<i>Festuca</i> sp.		1
<i>Filipendula ulmaria</i>		1
<i>Galium palustre</i>	1	1
<i>Holcus lanatus</i>	3	2
<i>Hydrocotyle vulgaris</i>		1
<i>Hypericum tetrapterum</i>		1
<i>Juncus articulatus</i>	1	3
<i>Juncus subnodulosus</i>	5	6
<i>Lychnis flos-cuculi</i>		1
<i>Lycopus europaeus</i>	1	
<i>Lysimachia vulgaris</i>		1
<i>Lythrum salicaria</i>	2	1
<i>Mentha aquatica</i>	1	2
<i>Myosotis laxa</i>	2	
<i>Myosotis scorpioides</i>	1	1
<i>Oenanthe fistulosa</i>		1
<i>Parnassia palustris</i>		2

<i>Pedicularis palustris</i>		1
<i>Persicaria maculosa</i>	1	
<i>Peucedanum palustre</i>		1
<i>Phalaris arundinacea</i>	2	
<i>Phragmites australis</i>	3	1
<i>Ranunculus flammula</i>	2	3
<i>Ranunculus lingua</i>		1
<i>Ranunculus repens</i>	1	
<i>Ranunculus sceleratus</i>	2	
<i>Rorippa palustris</i>	1	
<i>Rumex conglomeratus</i>		1
<i>Rumex hydrolapathum</i>		1
<i>Salix cinerea</i>		1
<i>Samolus valerandi</i>	1	1
<i>Schoenus nigricans</i>		3
<i>Schoenoplectus tabernaemontani</i>		1
<i>Scutellaria galericulata</i>		1
<i>Solanum dulcamara</i>	1	
<i>Sparganium emersum</i>	1	
<i>Stellaria alsine</i>	1	
<i>Triglochin palustris</i>		1
<i>Tussilago farfara</i>	1	
<i>Typha latifolia</i>	2	4
<i>Urtica dioica</i>	1	1
<i>Valeriana dioica</i>		1
<i>Veronica catenata</i>	2	1
Total number of species	37	49
Marginal/emergent community	5	5
Aquatic community	A	A

II Irstead Poors Fen Catfield

Date of creation: 1992

Max depth: 1m,

Size: 4000 square metres

Age of pond/date of survey

	0	1	2	11	13
	1992	1993	1994	2003	2005
Aquatic species					
Charophytes	√	√	9		
<i>Chara hispida</i>				3	
<i>Chara pedunculata</i>				4	
Filamentous algae		√	5	3	3
<i>Hydrocharis morsus-ranae</i>					1
<i>Lemna minor</i>	√				
<i>Potamogeton coloratus</i>	√	√	3	1	2
<i>Potamogeton natans</i>		√	1		
<i>Utricularia vulgaris</i>		√	2	6	2
<i>Zannichellia palustris</i>		√	3		
Marginal /emergent species					
<i>Berula erecta</i>			1		
<i>Betula sp.</i>					1
<i>Carex elata</i>			2		
<i>Cladium mariscus</i>		√	1		2
<i>Eupatorium cannabinum</i>					1
<i>Holcus lanatus</i>			1		
<i>Hydrocharis morsus-ranae</i>					1
<i>Hydrocotyle vulgaris</i>		√			
<i>Juncus articulatus</i>		√	2		
<i>Juncus subnodulosus</i>	√	√	3		3
<i>Lonicera periclymenum</i>					1
<i>Lythrum salicaria</i>			1		
<i>Mentha aquatica</i>			2		
<i>Myrica gale</i>					1
<i>Oenanthe lachenalii</i>			1		
<i>Peucedanum palustre</i>					1
<i>Phragmites australis</i>	√	√	3	7	6
<i>Rosa canina</i>					1
<i>Rubus caesius</i>					1
<i>Samolus valerandi</i>			1		
<i>Schoenoplectus lacustris</i>					1
<i>Schoenoplectus tabernaemontani</i>			2		
<i>Solanum dulcamara</i>					1
<i>Sparganium emersum</i>	√	√			
<i>Sparganium erectum</i>			1		

<i>Thelypteris palustris</i>					2
<i>Typha angustifolia</i>		√	2	5	4
<i>Typha latifolia</i>	√	√	3		2
Total number of species	8	14	21	7	19
Marginal/emergent community	11	11	11	11	11
Aquatic community	A	A	A	A	A

J1 Woodbastwick Marshes

Date of creation: 1988,

Max depth: 0.25m

Size: 196 square metres

Age of pond/date of survey

	1	2	4	17
	1989	1990	1992	2005
Aquatic species				
<i>Callitriche</i> sp.		√	√	
Charophytes	√	√	√	8
Filamentous algae			√	6
<i>Ranunculus (Batrachium)</i>		√		
Marginal /emergent species				
<i>Agrostis stolonifera</i>		√	√	
<i>Carex</i> sp.		√		
<i>Cladium mariscus</i>				4
<i>Epilobium parviflorum</i>		√		
<i>Hydrocotyle vulgaris</i>			√	
<i>Juncus subnodulosus</i>		√	√	3
<i>Lysimachia vulgaris</i>			√	
<i>Mentha aquatica</i>				1
<i>Myrica gale</i>			√	1
<i>Phragmites australis</i>		√	√	6
<i>Typha angustifolia</i>				2
Total number of species	2	8	9	9
Marginal/emergent community	Indet	12	12	12
Aquatic community	Indet	A	A	A

J2 Woodbastwick Marshes

Date of creation: 1988

Max depth: 0.24m

Size: 110 square metres

Age of pond/date of survey

	2	4	17
	1990	1992	2005
Aquatic species			
<i>Lemna minor</i>			3
<i>Potamogeton coloratus</i>	√	√	
<i>Utricularia vulgaris</i>			6
Marginal /emergent species			
<i>Agrostis stolonifera</i>		√	
<i>Alisma plantago-aquatica</i>			1
<i>Anagallis tenella</i>	√	√	
<i>Calliergonella cuspidata</i>			2
<i>Carex</i> sp.		√	
<i>Carex acutiformis</i>			3
<i>Carex elata</i>	√	√	6
<i>Carex lasiocarpa</i>	√		
<i>Carex panicea</i>	√	√	
<i>Carex viridula</i>	√	√	
<i>Chenopodium album</i>	√		
<i>Cirsium dissectum</i>	√		
<i>Cladium mariscus</i>		√	9
<i>Epilobium parviflorum</i>	√		
<i>Eupatorium cannabinum</i>	√	√	
<i>Eurhynchium praelongum</i>			2
<i>Galium palustre</i>	√	√	
<i>Galium uliginosum</i>	√	√	
<i>Hydrocotyle vulgaris</i>	√	√	2
<i>Juncus</i> sp.	√		
<i>Juncus acutiflorus</i>	√	√	
<i>Juncus articulatus</i>		√	
<i>Juncus effusus</i>		√	
<i>Juncus subnodulosus</i>	√	√	6
<i>Lycopus europaeus</i>	√	√	
<i>Lysimachia vulgaris</i>	√	√	2
<i>Mentha aquatica</i>	√	√	
<i>Molinia caerulea</i>	√		
<i>Myrica gale</i>	√	√	
<i>Peucedanum palustre</i>	√	√	2
<i>Phragmites australis</i>	√	√	4
<i>Ranunculus flammula</i>		√	

<i>Sagina procumbens</i>	√		
<i>Salix</i> sp.			1
<i>Salix cinerea</i>	√		
<i>Salix repens</i>		√	
<i>Schoenus nigricans</i>		√	
<i>Thelypteris palustris</i>			6
Total number of species	26	25	15
Marginal/emergent community	13	13	12
Aquatic community	Indet	Indet	Indet

J3 Woodbastwick Marshes

Date of creation: 1989

Max depth: 0.49m

Size: 110 square metres

	Age of pond/date of survey		
	1 1990	3 1992	16 2005
Aquatic species			
Charophytes		√	
Filamentous algae		√	3
<i>Potamogeton coloratus</i>			3
<i>Utricularia vulgaris</i>			10
Marginal /emergent species			
<i>Carex</i> sp.	√		
<i>Carex elata</i>			1
<i>Carex rostrata</i>		√	
<i>Hydrocotyle vulgaris</i>		√	
<i>Juncus subnodulosus</i>			4
<i>Myrica gale</i>			2
<i>Phragmites australis</i>	√	√	9
<i>Typha latifolia</i>			3
Total number of species	2	5	8
Marginal/emergent community	12	12	12
Aquatic community	Indet	A	A

J4 Woodbastwick Marshes

Date of creation: 1991

Max depth: 0.8m

Size: 230 square metres

Age of pond/ date of survey

	1	14
	1992	2005
Aquatic species		
Charophytes	√	
Filamentous algae	√	6
Marginal /emergent species		
<i>Mentha aquatica</i>		1
<i>Phragmites australis</i>	√	6
<i>Typha latifolia</i>		2
<i>Veronica beccabunga</i>		2
Total number of species	4	5
Marginal/emergent community	12	12
Aquatic community	A	Indet

J5 Woodbastwick Marshes

Date of creation: 1993

Max depth: 1m

Size: 12000 square metres

Age of pond/date of survey

	1	2	4	12
	1994	1995	1997	2005
Aquatic species				
<i>Callitriche sp.</i>	1		1	
<i>Chara globularis var virgata</i>				8
<i>Chara hispida</i>	3	8	5	√
<i>Chara vulgaris</i>	3			
Filamentous algae	7	3	4	
<i>Hippuris vulgaris</i>	1		1	2
<i>Lemna minor</i>	1	2	2	2
<i>Lemna trisulca</i>			2	
<i>Potamogeton coloratus</i>	4		3	2
<i>Potamogeton friesii</i>	1			
<i>Potamogeton natans</i>				2
<i>Potamogeton pusillus</i>			4	
<i>Utricularia vulgaris</i>			2	4
Marginal /emergent species				
<i>Agrostis stolonifera</i>	3	2	3	
<i>Alisma plantago- aquatica</i>	1	1	2	1
<i>Berula erecta</i>				3

<i>Caltha palustris</i>			1	
<i>Calystegia sepium</i>				3
<i>Cardamine pratensis</i>	1	1	1	
<i>Carex acutiformis</i>		2	1	3
<i>Carex elata</i>	1	2		3
<i>Carex lasiocarpa</i>	2	1		
<i>Carex paniculata</i>				2
<i>Carex pseudocyperus</i>	1	1	2	2
<i>Carex riparia</i>	1	1	2	
<i>Carex rostrata</i>			3	3
<i>Cicuta virosa</i>	1	1		2
<i>Cirsium palustre</i>		1		
<i>Cladium mariscus</i>				2
<i>Eleocharis multicaulis</i>			3	
<i>Epilobium sp.</i>	1	2	1	
<i>Equisetum fluviatile</i>		1		
<i>Eupatorium cannabinum</i>		1	1	3
<i>Galium palustre</i>	1	1		
<i>Holcus lanatus</i>	1			
<i>Hydrocotyle vulgaris</i>	1	1	2	
<i>Iris pseudacorus</i>	1	1		2
<i>Juncus acutiflorus hybrid</i>		1		
<i>Juncus articulatus</i>	3	3	3	2
<i>Juncus subnodulosus</i>	3	3	5	3
<i>Lycopus europaeus</i>	1	1	1	
<i>Lysimachia vulgaris</i>	1	1		2
<i>Lythrum salicaria</i>	2	1	1	2
<i>Mentha aquatica</i>	1	1	2	3
<i>Molinia caerulea</i>	1			
<i>Myosotis laxa</i>		1	1	
<i>Myrica gale</i>	1			
<i>Oenanthe lachenalii</i>	1			
<i>Pedicularis palustris</i>		1		
<i>Persicaria sp.</i>	1			
<i>Peucedanum palustre</i>	1	1		2
<i>Phragmites australis</i>	3	4	5	3
<i>Potentilla palustris</i>	1		1	
<i>Ranunculus flammula</i>	1	1	2	
<i>Ranunculus lingua</i>	1		1	
<i>Ranunculus sceleratus</i>	1	1	1	
<i>Salix sp.</i>				2
<i>Schoenoplectus lacustris</i>				2
<i>Schoenoplectus tabernaemontani</i>			2	
<i>Sium latifolium</i>	1	1		
<i>Solanum dulcamara</i>		1	1	
<i>Sparganium erectum</i>			1	

<i>Thelypteris palustris</i>	1			3
<i>Tussilago farfara</i>	1			
<i>Typha latifolia</i>	1	3	3	2
Total number of species	42	36	40	31
Marginal/emergent community	14	14	14	15
Aquatic community	A	A	A	A

J6 Woodbastwick Marshes

Date of creation: 1994

Max depth: 1.5m

Size: 11000 square metres

Age of pond/date of survey

	0	1	3	11
	1994	1995	1997	2005
Aquatic species				
<i>Callitriche</i> sp.	1			
<i>Ceratophyllum demersum</i>			3	
<i>Chara vulgaris</i>	1	7		2
Filamentous algae	1	4	4	3
<i>Lemna minor</i>	1			
<i>Lemna trisulca</i>	1	2	3	
<i>Najas marina</i>		1		
<i>Potamogeton coloratus</i>		1	1	
<i>Utricularia vulgaris</i>	1	7	8	1
Marginal /emergent species				
<i>Agrostis stolonifera</i>	2	3	3	
<i>Alnus glutinosa</i>	1	1	1	1
<i>Angelica sylvestris</i>				2
<i>Apium nodiflorum</i>	1	1		
<i>Berula erecta</i>		1	1	
<i>Betula pubescens</i>	1		1	
<i>Bidens cernua</i>			2	
<i>Calamagrostis canescens</i>				1
<i>Calystegia sepium</i>				2
<i>Cardamine pratensis</i>	1	1		
<i>Carex acutiformis</i>		1		3
<i>Carex elata</i>	1	1	1	
<i>Carex panicea</i>	1			
<i>Carex paniculata</i>				3
<i>Carex pseudocyperus</i>	1	3	2	
<i>Carex riparia</i>	1		2	
<i>Carex viridula</i>	1			
<i>Chenopodium rubrum</i>		1	1	
<i>Cicuta virosa</i>				2
<i>Cirsium</i> sp.	1		1	

<i>Cladium mariscus</i>				2
<i>Conyza canadensis</i>		1		
<i>Eleocharis multicaulis</i>			2	
<i>Epilobium hirsutum.</i>	1	2	2	
<i>Epilobium parviflorum</i>	1	3		
<i>Eupatorium cannabinum</i>	1	1	2	2
<i>Filipendula ulmaria</i>				1
<i>Galium palustre</i>	1	1	1	
<i>Gnaphalium uliginosum</i>		1		
<i>Glyceria fluitans</i>	1			
<i>Holcus lanatus</i>	1			
<i>Hydrocotyle vulgaris</i>	1	2		
<i>Hypericum tetrapterum</i>		1	1	
<i>Iris pseudacorus</i>				2
<i>Juncus sp.</i>	3	4	4	
<i>Juncus subnodulosus</i>				2
<i>Lychnis flos-cuculi</i>		1		
<i>Lycopus europaeus</i>	2	2	2	
<i>Lysimachia vulgaris</i>	1	1		2
<i>Lythrum salicaria</i>	2	1	1	1
<i>Mentha aquatica</i>	2			
<i>Myosotis laxa</i>	1	1	1	
<i>Myrica gale</i>				2
<i>Oenanthe lachenalii</i>		1	1	
<i>Phragmites australis</i>	3	3	3	3
<i>Plantago media</i>			1	
<i>Poa sp.</i>	1	1	1	
<i>Polygonum aviculare</i>		1		
<i>Prunella vulgaris</i>		1		
<i>Ranunculus lingua</i>	1			
<i>Ranunculus sceleratus</i>			1	
<i>Rorippa palustris</i>		1		
<i>Rumex conglomeratus</i>		1	1	
<i>Rumex hydrolapathum</i>	1	1		3
<i>Sagina nodosa</i>		1		
<i>Sagina procumbens</i>		1		
<i>Salix sp.</i>				2
<i>Salix cinerea</i>	1	1	1	
<i>Salix fragilis</i>			1	
<i>Schoenoplectus lacustris</i>				2
<i>Schoenoplectus tabernaemontani</i>		1	1	
<i>Scutellaria galericulata</i>		1		
<i>Solanum dulcamara</i>	1			
<i>Tripleurospermum inodorum</i>		1		
<i>Thelypteris palustris</i>	1	1		2
<i>Typha latifolia</i>	1	3	3	3

<i>Urtica dioica</i>				2
Total number of species	41	48	36	25
Marginal/emergent community	14	14	14	15
Aquatic community	A	A	A	A

KI Sharp Street Fen

Date of survey

	2005
Aquatic species	
<i>Lemna minor</i>	7
Marginal /emergent species	
<i>Alnus glutinosa</i>	3
<i>Calliergon giganteum</i>	3
<i>Calliergonella cuspidata</i>	4
<i>Calystegia sepium</i>	1
<i>Carex elata</i>	3
<i>Cladium mariscus</i>	3
<i>Galium palustre</i>	3
<i>Hydrocotyle vulgaris</i>	2
<i>Juncus subnodulosus</i>	4
<i>Lycopus europaeus</i>	1
<i>Lysimachia vulgaris</i>	2
<i>Lythrum salicaria</i>	2
<i>Peucedanum palustre</i>	2
<i>Phragmites australis</i>	10
<i>Rumex hydrolapathum</i>	1
<i>Solanum dulcamara</i>	2
<i>Thelypteris palustris</i>	6
<i>Typha angustifolia</i>	4
<i>Typha latifolia</i>	1
Total number of species	20
Marginal/emergent community	Indet
Aquatic community	Indet

LI Catfield Fen

Date of creation: 1994

Max depth: 1.5m

Size: 3750 square metres

Age of pond/date of survey

	1	2	3	11
	1995	1996	1997	2005
Aquatic species				
Charophytes	3	3	8	3
Filamentous algae	5	5	4	
<i>Hottonia palustris</i>		1		2
<i>Hydrocharis morsus-ranae</i>	1	2	2	2
<i>Lemna minor</i>	2	3	1	2
<i>Lemna trisulca</i>	1	2	1	
<i>Najas marina</i>		1	1	
<i>Potamogeton coloratus</i>	1	2	3	4
<i>Potamogeton natans</i>		1	3	
<i>Potamogeton pusillus</i>		3	2	
<i>Utricularia vulgaris</i>	3	7	6	7
Marginal /emergent species				
<i>Berula erecta</i>		2	2	3
<i>Carex elata</i>		1	1	2
<i>Carex pseudocyperus</i>		1	1	
<i>Cladium mariscus</i>				3
<i>Eleocharis sp.</i>	1			
<i>Galium palustre</i>	1	2	1	
<i>Hydrocotyle vulgaris</i>	1	1		3
<i>Iris pseudacorus</i>				2
<i>Juncus articulatus</i>		4	4	
<i>Juncus effusus</i>				
<i>Juncus subnodulosus</i>	4	3	4	5
<i>Lonicera periclymenum</i>				2
<i>Lycopus europaeus</i>		1		1
<i>Lysimachia vulgaris</i>			1	1
<i>Lythrum salicaria</i>	2	2	1	1
<i>Mentha aquatica</i>		1	2	1
<i>Myosotis laxa</i>			2	
<i>Myrica gale</i>				3
<i>Oenanthe fistulosa</i>				2
<i>Peucedanum palustre</i>				2
<i>Phragmites australis</i>	3	3	4	7
<i>Ranunculus flammula</i>	1	1	2	
<i>Ranunculus lingua</i>		1		3
<i>Rumex hydrolapathum</i>		1		
<i>Salix cinerea</i>	1			3

<i>Samolus valerandi</i>			1	
<i>Schoenoplectus tabernaemontani</i>				1
<i>Schoenus nigricans</i>	3			
<i>Sium latifolium</i>		2		1
<i>Solanum dulcamara</i>				3
<i>Sparganium emersum</i>	2	2		
<i>Sparganium erectum</i>	2	2		
<i>Thelypteris palustris</i>	1			1
<i>Typha angustifolia</i>	3	2	1	6
<i>Typha latifolia</i>	2	3	3	
Total number of species	21	31	26	28
Marginal/emergent community	16	16	16	16
Aquatic community	B	B	B	B

MI Burgh Common

Date of creation: 1996

Max depth: 1.5m

Size: 3500 square metres.

Age of pond/ date of survey

	1	9
	1997	2005
Aquatic species		
Charophytes	6	
Filamentous algae	4	
<i>Lemna minor</i>		3
<i>Potamogeton coloratus</i>	2	
<i>Utricularia vulgaris</i>		5
Marginal /emergent species		
<i>Angelica sylvestris</i>	1	2
<i>Berula erecta</i>		3
<i>Brachythecium rutabulum</i>		1
<i>Calamagrostis canescens</i>		4
<i>Calliergonella cuspidata</i>		3
<i>Cardamine pratensis</i>		2
<i>Carex</i> sp.	3	
<i>Carex acutiformis</i>		3
<i>Carex elata</i>		3
<i>Carex pseudocyperus</i>		1
<i>Cicuta virosa</i>		1
<i>Cirsium palustre</i>	1	
<i>Cladium mariscus</i>		8
<i>Dryopteris carthusiana</i>		2
<i>Epilobium hirsutum</i>	1	
<i>Epilobium palustre</i>		1

<i>Eupatorium cannabinum</i>	1	2
<i>Eurhynchium praelongum</i>		3
<i>Galium aparine</i>		1
<i>Galium palustre</i>	2	2
<i>Hydrocotyle vulgaris</i>	1	2
<i>Iris pseudacorus</i>	1	
<i>Juncus sp.</i>	6	
<i>Juncus effusus</i>		1
<i>Juncus subnodulosus</i>		3
<i>Leptodictyum riparium</i>		2
<i>Lycopus europaeus</i>	1	2
<i>Lysimachia vulgaris</i>		1
<i>Lythrum salicaria</i>	2	2
<i>Mentha aquatica</i>	3	3
<i>Peucedanum palustre</i>	1	2
<i>Phragmites australis</i>	5	8
<i>Ranunculus flammula</i>	3	
<i>Ranunculus lingua</i>	1	3
<i>Rumex hydrolapathum</i>	1	2
<i>Salix cinerea</i>	1	
<i>Samolus valerandi</i>	1	
<i>Scutellaria galericulata</i>		1
<i>Sium latifolium</i>	1	2
<i>Solanum dulcamara</i>		2
<i>Sparganium emersum</i>	3	
<i>Thelypteris palustris</i>	1	2
<i>Typha angustifolia</i>		2
<i>Typha latifolia</i>	3	3
Total number of species	27	37
Marginal/emergent community	17	17
Aquatic community	A	Indet

M2 Burgh Common

Date of survey

	2005
Aquatic species	
<i>Callitriche</i> sp.	4
<i>Hippuris vulgaris</i>	3
<i>Lemna minuta</i>	2
<i>Ranunculus (Batrachium)</i>	1
Marginal /emergent species	
<i>Agrostis stolonifera</i>	4
<i>Alisma plantago- aquatica</i>	3
<i>Brachythecium rutabulum</i>	4
<i>Calliergonella cuspidata</i>	3
<i>Carex acutiformis</i>	4
<i>Carex pseudocyperus</i>	1
<i>Carex riparia</i>	5
<i>Eleocharis palustris</i>	4
<i>Epilobium palustre</i>	3
<i>Glyceria</i> sp.	2
<i>Juncus articulatus</i>	4
<i>Juncus effusus</i>	3
<i>Mentha aquatica</i>	3
<i>Phragmites australis</i>	8
<i>Polygonum lapathifolium</i>	2
<i>Solanum dulcamara</i>	2
<i>Sonchus arvensis</i>	1
<i>Typha angustifolia</i>	2
<i>Typha latifolia</i>	5
<i>Veronica beccabunga</i>	3
Total number of species	24
Marginal/emergent community	17
Aquatic community	A

OI Horning Marsh Farm

Date of survey

	2003
Aquatic species	
Filamentous algae	7
<i>Lemna minor</i>	2
<i>Lemna polyrhiza</i>	1
<i>Zannichellia palustris</i>	1
Marginal /emergent species	
<i>Berula erecta</i>	2
<i>Carex riparia</i>	4
<i>Juncus subnodulosus</i>	4
<i>Phragmites australis</i>	7
<i>Typha angustifolia</i>	4
<i>Typha latifolia</i>	1
Total number of species	11
Marginal/emergent community	18
Aquatic community	D

O2 Horning Marsh Farm

Date of survey

	2005
Aquatic species	
<i>Potamogeton pusillus</i>	8
Marginal /emergent species	
<i>Berula erecta</i>	2
<i>Calystegia sepium</i>	2
<i>Carex acutiformis</i>	3
<i>Carex pseudocyperus</i>	1
<i>Eupatorium cannabinum</i>	3
<i>Juncus subnodulosus</i>	4
<i>Mentha aquatica</i>	2
<i>Oenanthe fistulosa</i>	1
<i>Phragmites australis</i>	6
<i>Typha latifolia</i>	2
<i>Urtica dioica</i>	4
Total number of species	12
Marginal/emergent community	18
Aquatic community	Indet

O3 Horning Marsh Farm

Date of survey

	2005
Aquatic species	
Filamentous algae	2
<i>Lemna minor</i>	4
Marginal /emergent species	
<i>Alnus glutinosa</i>	2
<i>Berula erecta</i>	2
<i>Carex diandra</i>	1
<i>Carex elata</i>	1
<i>Eupatorium cannabinum</i>	1
<i>Galium palustre</i>	1
<i>Hydrocotyle vulgaris</i>	2
<i>Juncus effusus</i>	1
<i>Juncus subnodulosus</i>	7
<i>Lycopus europaeus</i>	1
<i>Lysimachia vulgaris</i>	1
<i>Lythrum salicaria</i>	2
<i>Mentha aquatica</i>	2
<i>Phragmites australis</i>	7
<i>Rumex hydrolapathum</i>	1
<i>Samolus valerandi</i>	1
<i>Schoenoplectus lacustris</i>	1
<i>Sium latifolium</i>	1
<i>Thelypteris palustris</i>	1
<i>Typha angustifolia</i>	4
<i>Typha latifolia</i>	4
<i>Urtica dioica</i>	1
Total number of species	24
Marginal/emergent community	18
Aquatic community	D

O4 Horning Marsh Farm

Date of survey

	2005
Aquatic species	
<i>Lemna minor</i>	6
Marginal /emergent species	
<i>Agrostis stolonifera</i>	1
<i>Calamagrostis canescens</i>	2
<i>Calystegia sepium</i>	2
<i>Carex acutiformis</i>	3
<i>Eupatorium cannabinum</i>	2
<i>Juncus subnodulosus</i>	3
<i>Lysimachia vulgaris</i>	1
<i>Myrica gale</i>	2
<i>Phragmites australis</i>	10
<i>Solanum dulcamara</i>	1
<i>Thelypteris palustris</i>	2
<i>Typha angustifolia</i>	2
<i>Urtica dioica</i>	3
Total number of species	14
Marginal/emergent community	18
Aquatic community	Indet

O5 Horning Marsh Farm

Date of survey

	2005
Aquatic species	
<i>Ceratophyllum demersum</i>	2
<i>Chara aculeata</i>	2
<i>Chara virgata</i>	3
Filamentous algae	4
<i>Lemna minor</i>	3
<i>Utricularia vulgaris</i>	4
Marginal /emergent species	
<i>Calamagrostis canescens</i>	1
<i>Calystegia sepium</i>	1
<i>Cladium mariscus</i>	1
<i>Eupatorium cannabinum</i>	2
<i>Juncus subnodulosus</i>	3
<i>Lysimachia vulgaris</i>	1
<i>Myrica gale</i>	2
<i>Phragmites australis</i>	7
<i>Thelypteris palustris</i>	1
Total number of species	15
Marginal/emergent community	18
Aquatic community	A

East Ruston – North West Pond

Date of survey

	2003
Aquatic species	
<i>Chara globularis</i>	1
<i>Persicaria amphibia</i>	1
Marginal /emergent species	
<i>Carex acutiformis</i>	5
<i>Carex rostrata</i>	2
<i>Juncus subnodulosus</i>	3
<i>Lycopus europaeus</i>	1
<i>Mentha aquatica</i>	1
<i>Phragmites australis</i>	8
<i>Sparganium erectum</i>	1
<i>Typha latifolia</i>	5
Total number of species	10
Marginal/emergent community	19
Aquatic community	C

East Ruston – South East Pond

Date of survey

	2003
Aquatic species	
<i>Chara globularis</i>	1
<i>Persicaria amphibia</i>	2
Marginal /emergent species	
<i>Carex acutiformis</i>	5
<i>Carex rostrata</i>	1
<i>Juncus effusus</i>	1
<i>Juncus subnodulosus</i>	4
<i>Lycopus europaeus</i>	1
<i>Menyanthes trifoliata</i>	2
<i>Phragmites australis</i>	8
<i>Schoenoplectus lacustris</i>	2
<i>Sparganium erectum</i>	1
<i>Typha latifolia</i>	6
Total number of species	12
Marginal/emergent community	19
Aquatic community	C

East Ruston – Valley Fen

Date of survey

	2003
Aquatic species	
<i>Persicaria amphibia</i>	2
Marginal /emergent species	
<i>Carex acutiformis/riparia.</i>	2
<i>Crassula helmsii</i>	3
<i>Iris pseudacorus</i>	1
<i>Juncus articulatus</i>	1
<i>Juncus effusus</i>	5
<i>Lycopus europaeus</i>	2
<i>Mentha aquatica</i>	2
<i>Myosotis scorpioides</i>	1
<i>Persicaria amphibia</i>	3
<i>Phragmites australis</i>	7
<i>Potentilla palustris</i>	
<i>Sparganium erectum</i>	2
<i>Typha latifolia</i>	2
Total number of species	12
Marginal/emergent community	19
Aquatic community	C