1.0 INTRODUCTION

1.1 Chris Blandford Associates has been commissioned to undertake ecological surveys of Kneppmill Pond, part of the Knepp Castle Estate, in order to advise on proposed future dredging work of this waterbody. Kneppmill Pond forms part of a Site of Nature Conservation Importance (SNCI) and although dredging work is required to maintain much of the ecological interest, a balanced programme of clearance is required. Sensitive areas of significant value are to be protected from the dredging activities while those communities that can respond positively to dredging will be selectively removed over a phased programme to allow the wetland communities to maintain their status and ecological value within the site.

Background

1.2 Kneppmill Pond was constructed as an enormous hammer pond for the nearby iron workings but its date of formation is obscure. It is, however, clearly ancient in origin and can be dated at least before 1568, i.e. over 400 years old. At one time it was reputed to be the largest artificial waterbody in southern England. This has allowed a varied wetland vegetation to establish over the centuries, and with siltation and natural succession this has led to a progressive reduction in the area of open water. In 1754 the area of open water covered approximately 80 acres, and today it measures approximately 29 acres, i.e. a reduction of some 64% over the last 250 years. Similarly the longest dimension of open water has shrunk from 1950m in 1754 to 1000m (49% less) today.

2.0 METHODOLOGY

Desk Study Assessment

2.1 A Desk Study has been undertaken within an enlarged Study Area of approximately 2.5km around the Kneppmill Pond perimeter, as shown on Figure 1. The object of the study is to identify relevant background ecological information on the site, in terms of habitats and species, to identify potential ecological constraints and guide the survey methodology. Organisations and consultees for the Desktop Study have included the following:

- English Nature;
- Environment Agency;
- West Sussex County Council;
- Sussex Biodiversity Records Centre; and
- Sussex Ornithological Society.

2.2 Although the Sussex Amphibian and Reptile Group were contacted they did not respond within the consultation period, and background information was instead gathered from the *Sussex Amphibian and Reptile Group Millenium Report* (Sussex Amphibian and Reptile Group, 2000). The Sussex Biodiversity Action Plan (BAP) is currently being. Relevant habitats and species from the UK BAP (HMSO, 1994) are therefore discussed.

Survey Methodology

2.3 Kneppmill Pond was subjected to a Phase I survey (Nature Conservancy Council, 1990), and targeted Phase II surveys of the woodland and wetland habitats using the National Vegetation Classification or NVC (Rodwell, 1991 *et seq*.) to define the communities. Quadrats of each habitat type were recorded within each of the principle habitats/features, and a list of macrophytes made, see Table 2. All plants have been identified to species level, wherever possible, based on the nomenclature of Stace (1997). A measure of the cover of each species has been undertaken using the DOMIN Scale as explained on Table 2.

2.4 ***Great crested newt*** - the methodology was based on the English Nature (2000) guidance using three of the following four survey techniques - egg searches, bottle trapping, sweep netting and torchlight searches - over four survey visits. As part of this guidance, Griffiths and Roper (1997) recommend bottle traps be laid every 2m. At the recommendation of DEFRA instead of surveying the whole of the pond, sample areas totalling approximately 200m perimeter length were surveyed. The areas surveyed were those regarded as being most suitable breeding habitat for great crested newt.

2.5 ***Bird survey*** - A method based on the standard Common Birds Census (CBC) technique was employed (Gilbert *et al*. 1998). In total four site visits were made on 14 May, 27 May, 5 June and 20 June 2002 respectively. Visits on 27 May and 5 June were made between 0500 and 1030 hours; and on 14 May and 20 June between 1000 to 1230 hours. On each visit the full perimeter of the pond was walked and an effort was made to get to within 100m of the pond margin although in some areas, particularly at the northern and southern end of the pond, this proved difficult.

2.6 The position of each bird seen or heard was marked accurately on a map, particular importance being placed on the location of individuals of the same species that could be heard or seen simultaneously and those showing signs of holding territory or breeding. All registrations were then transferred to a 'master' map and the number of breeding pairs determined. In general, clusters of sightings represent the location of a territory holding pair and this can be used to determine population size although it is acknowledged that this involves some subjectivity.

2.7 Additional information used to determine the presence of breeding birds include the discovery of an occupied nest, finding eggshells within a territory of the species concerned, recently fledged birds or adult birds collecting food or nest material.

2.8 Although four visits are not normally considered a sufficient number of visits to record absolute population size, the linear nature of the area surveyed meant that an above average efficiency was attained. The survey is therefore considered to represent an accurate population census of Kneppmill Pond in 2002.

3.0 RESULTS

Desk Study Assessment

3.1 There are no designated sites of international or national importance within the Extended Study Area.

Sites of County Importance

3.2 There are five SNCIs within the extended Study Area, as shown on Figure 2 (as provided by the Sussex Biodiversity Records Centre), including Kneppmill Pond itself, these being:

- *Kneppmill Pond, the River Adur and Lancing Brook* SNCI, Shipley;
- *Horsham Common, Alder Copse, Coate's Furzefield and Constable's Furze* SNCI, Southwater - approximately 1km to the north;
- *Walden Close Meadows* SNCI, Cowfold - approximately 2.5km to the east;
- *The Downs Link, Nutham Wood and Greatsteads Farm Meadow* SNCI, Copsale - approximately 1.75km to the north-east; and
- *Hooklands Farm Meadow* SNCI, Ashington – approximately 2.75km to the south.

3.3 *Kneppmill Pond, the River Adur and Lancing Brook* SNCI includes the Application site, see Appendix 1. The citation describes Kneppmill Pond as being a large area of open water with well-developed marginal vegetation and tall fen, supporting large numbers of wintering wildfowl and breeding birds. The River Adur and its tributary Lancing Brook, are recognised as having diverse emergent and aquatic vegetation, including locally uncommon species.

3.4 *Horsham Common, Alder Copse, Coate's Furzefield and Constable's Furze* SNCI is a diverse woodland complex that includes semi-natural woodland, semi-mature oak plantation, young broad-leaved plantation, conifer plantation, streams and a small herb rich meadow. Noteworthy plants in the woodland include wild daffodil *Narcissus pseudonarcissus* and early purple orchid *Orchis mascula*, while the grassland contains dyers greenweed *Genista tinctoria.* It supports a rich bird community and uncommon butterflies such as purple hairstreak *Quercusia quercus*, silver-washed fritillary *Argynnis paphia* and white admiral *Ladoga camilla*.

3.5 *Walden Close Meadows* SNCI consists of two species rich meadows with uncommon species such as adder's-tongue *Ophioglossum vulgatum* and sneezewort *Achillea ptarmica* present. They are also noted for their invertebrate importance.

3.6 *The Downs Link, Nutham Wood and Greatsteeds Farm Meadow* SNCI consists of a range of habitats including a small herb rich meadow, scrub along a disused railway line and ancient semi-natural woodland. Nutham Wood is noted for its very rich ground flora, with uncommon species such as toothwort *Lathraea squamaria*. The herb rich meadow contains four species of orchid, including green winged orchid *Orchis morio* and fragrant orchid *Gymnadenia conopsea.* The disused railway supports a colony of the localised brown hairstreak butterfly *Thecla betulae*.

3.7 *Hooklands Farm Meadow* SNCI is described as an excellent example of unimproved damp grassland. The species rich sward contains uncommon plant species such as saw-wort *Serratula tinctoria* and dyers greenweed. A stream and overgrown pond are present within the meadow. A second isolated pond lies away from the meadow. This has been included as part of the SNCI as it contains the Nationally Scarce three-lobed crowfoot *Ranunculus tripartitus*.

3.8 None of the SNCI's within the extended Study Area appear to contain similar habitats to Kneppmill Pond, although *Horsham Common, Alder Copse, Coate's Furzefield and Constable's Furze* SNCI and *Hooklands Farm Meadow* SNCI contain streams and ponds on a smaller scale and lower quality.

Ancient Woodlands

3.9 Ancient Woodlands are usually defined as woodlands thought to have been in existence since at least AD 1600 and are considered to be particularly valuable if largely composed of native, non-planted trees and shrubs. Ancient Woodland is a nationally important resource but has no statutory designation within the UK.

3.10 None of the woodlands within the vicinity of Kneppmill Pond are classified as Ancient Semi-Natural Woodland in the provisional *Inventory of West Sussex's Ancient Woodlands*. There are, however, several areas of semi-natural ancient woodland or replanted ancient woodland within the extended Study Area – the nearest being approximately 200m west of Knepp Castle itself, a second area

approximately 1km from the northern tip of Kneppmill pond (near the junction of the A24 and A272) and Park Covert approximately 1.2km to the east. Other areas are located further away from the site, will not be affected by the Proposed scheme and are therefore not referred to within this report.

Records of Uncommon and/or Protected Species

3.11 Information on species recorded within the extended Study Area has been derived from the Sussex Biodiversity Records Centre. Only records that could pertain to the range of habitats identified at Kneppmill Pond have been reviewed.

3.12 ***Flora*** **-** Three Nationally Scarce plant species have been recorded within the extended Study Area. These are:

- three-lobed crowfoot, recorded in 1997 from Hooklands Farm Meadow SNCI,
- broad-leaved spurge *Euphorbia platyphyllos*, recorded in 1999 approximately 2.2km to the east; and
- greater broomrape *Orobanche rapum-genistae*, recorded in 1994 approximately 2.2km to the east of Kneppmill pond.

Of these, only three-lobed crowfoot has potential to occur in and around Kneppmill Pond.

3.13 ***Mammals*** **-** Both otter *Lutra lutra* and water vole *Arvicola terrestris* have been recorded within the extended Study Area. Otter are fully protected under the European Habitats Directive (92/43/EEC) and the Wildlife and Countryside Act 1981 (as amended). Water voles are protected by Schedule 5 of the Wildlife and Countryside Act 1981, but only in respect of Section 9(4), which protects the vole's shelter or burrow system but does not protect the voles themselves. Both species are UK Biodiversity Action Plan (BAP) 1 Priority Species. The records of these animals within the extended Study Area are shown below:

- *Otter* recorded in 1995 at Grid Ref. TQ152210 on the River Adur approximately 400m to the south-east of Kneppmill Pond.
- *Water vole* recorded in 1990 at Grid Ref. TQ179191 on a tributary of the River Adur approximately 2km to the south-east of Kneppmill Pond.

3.14 There are records of three species of bat within the Extended Study area and recent records for up to four species from the Estate. The latter include both pipistrelle species, *Pipistrellus pipistrellus* and *P. pygmaeus*, Daubenton's *Myotis daubentonii* and possibly a further unidentified *Myotis* bat. In addition, dormouse *Muscardinus avellanarius* has also been recorded nearby between 1989 and 1990 from the *Horsham Common, Alder Copse, Coate's Furzefield and Constable's Furze* SNCI approximately 1km to the north.

3.15 ***Amphibians*** - Great crested newt *Triturus cristatus* have been recorded in the extended Study Area, the closest location being at Renches Wood approximately 1.5km to the north-west. The most recent record at this site was in 1991. Other records are in 1994 at Tuckmans Farm approximately 2km to the north east and in 1993 at Well Land Farm approximately 2.5km to the east. The Millennium Report indicates that smooth newt *T. vulgaris,* palmate newt .*T. helveticus,* common frog *Rana temporaria* and common toad *Bufo bufo* are also present within the extended Study Area.

3.16 A detailed survey of all ponds within the Knepp Castle Estate, with the exception of Kneppmill Pond, was undertaken in 1991. This recorded common frog, palmate newt and low numbers of common toad.

3.17 ***Reptiles*** - There are records of two species of reptile - grass snake *Natrix natrix* and slow worm *Anguis fragalis* - within the extended Study Area, including Kneppmill Pond. No other reptile species are indicated as being present by the Sussex Amphibian and Reptile Group Millennium Report (2000). However, in a recent report on Knepp Castle Deer Park (2000) this refers to additional records for common lizard *Lacerta vivipara* and adder *Vipera berus*.

3.18 ***Birds*** – Approximately 122 species have been recorded from Knepp Castle Estate, and the numbers of breeding and wintering wildfowl make this a site of County importance. Breeding species include heron *Ardea cinerea* (up to 15 pairs), great crested grebe *Podiceps crsistatus* (up to six pairs) and little grebe *Tachybaptus ruficollis* (single pair). Over-wintering wildfowl reflect the context of Kneppmill Pond in the vicinity of Pulborough Marshes and the River Adur. The site can also be viewed as a stepping-stone for local movement as well as for long range migratory species. Species of interest include widgeon *Anas penelope* (in excess of 200), teal *A. crecca* (up to 200) and pochard *Aythya farina* (over 60), as well as gadwell *Anas*

strepera and shoveler *A. clypeata*. Bewick swan *Cygnus columbianus* occasionally move onto the Pond from the nearby River Adur.

3.19 Other species of interest associated with the Estate are nightingale *Luscinia megarhynchos* associated with the woodlands, barn owl *Tyto alba* foraging over the field margins and peregrine falcon *Falco peregrinus*. There is also a report of hobby *Falco subbuteo* breeding in a nearby woodland at Greenstreet.

3.20 ***Fish*** – Kneppmill Pond contains a commercial carp fishery, and as such is drained down every three to four years when an average of 10,000lbs of carp are removed. In addition a haul of 1.5 tonnes of eel is present. The fishery also includes roach, rudd, tench and bream. Pike are thought to be absent.

3.21 ***Invertebrates*** – The Knepp Castle Estate contains an exceptionally rich butterfly fauna with no less than 32 species recorded (74%) of the 43 species known in the County, although some of these species have not been observed in recent years. There are also records for 18 species of odonata (dragonflies and damselflies) in and around the Knepp Castle Estate, of which many are regarded as nationally uncommon. Within the extended Study Area a further five species have been recorded, therefore suggesting an overall resource of 23 species. Those uncommon odonata recorded from Kneppmill Pond are highlighted below:

Table 1 - Uncommon Odonata recorded from Kneppmill Pond

Scientific Name	Common Name	Status	Date of Record
Brachytron pratense	Hairy dragonfly	Nationally Scarce	1995
Coenagrion pulchellum	Variable damselfly	Nationally Scarce	1988
Cordulia aenea	Downy emerald	Nationally Scarce	1988
Sympetrum sanguineum	Ruddy darter	Nationally Scarce	1988, 1993

Botanical Survey Results

3.22 The Phase I Habitat Survey and additional NVC surveys identified a number of community types. The distribution of these is shown on Figure 1. Quadrat data for each of the community types is given in Table 2 and the descriptions of the communities are given below.

Wetland Communities

A8a *Nuphur lutea* community

3.23 This open water community is dominated by yellow water lily *Nuphur lutea.* A sample of this community type is represented by Quadrat Q9. At Kneppmill Pond, the typical sub-community is present in which all other species are absent. This community is typical of deep, still or slow moving, mesotrophic or eutrophic water in lowland areas. It is largely confined to the south of Britain.

3.24 At Kneppmill Pond, this community is present around the inflow to the pond beyond and alongside marginal vegetation. There are also large areas at the southern end of the pond, close to the dam. These areas spread eastwards, almost entirely choking the eastern branch of the pond. It should be noted that the extent and cover of yellow water lily visually changes over the season, dependant on the variation in depth and water levels.

***S6 Carex riparia* Swamp**

3.25 This is a marginal community dominated by greater pond sedge *Carex riparia*. At Knepp Mill Pond it is restricted to one small area adjacent to the southern side of the eastern branch of the pond. It is usually floristically species poor, with scattered additional species such as reed canary grass *Phalaris arundinacea* and greater reedmace *Typha latifolia.* At Kneppmill Pond, associated species with greater pond sedge are hemlock water dropwort *Oenanthe crocata* and greater reedmace. Typical conditions are usually wet or waterlogged mesotrophic to eutrophic circum-neutral mineral soils in lowland areas. This community is restricted to the lowlands of England and Wales.

3.26 A sample of this community type is represented by Quadrat Q13.

***Carex acuta* Swamp**

3.27 Stands dominated by slender tufted sedge *Carex acuta* are not recognised as a separate NVC type due to their scarcity. They are usually associated with a surrounding fen or swamp type. At Knepp Mill Pond, slender tufted sedge is widely distributed around the margins of the main body of water, usually growing in standing water and is sufficiently dominant in some areas to be mapped (see Figure 1). It is present within stands of S12 (see below), both greater reedmace and

lesser reedmace *Typha angustifolia* being associates, along with other sedge species. Slender tufted sedge is associated with the margins of sluggish or standing mesotrophic to eutrophic waters throughout lowland England, Wales and Southern Scotland.

3.28 This area was deemed too small to sample by quadrat analysis.

S8 *Schoenoplectus* (*Scirpus) lacustris* Swamp

3.29 The S8a sub-community can be identified as a virtually pure stand of common club-rush *Schoenoplectus lacustris* (formerly recognised as *Scirpus lacustris* ssp. *lacustris*). It typically occurs in deeper water away from other marginal vegetation, often up to 1.5m depth, in oligotrophic or eutrophic lowland sites. At Kneppmill Pond, a thin band of this community demarcates the waterside edge of the marginal fringe of vegetation. At Kneppmill Pond it has few associates, although in places the S13 swamp lies adjacent the community and therefore occasional mixing with lesser reedmace occurs. This sub-community is represented by Quadrat Q14.

3.30 A large stand of S8 swamp is also present within an area of sallow scrub to the north of the main open water. This area is more diverse, with associated species including sweet flag, branched bur-reed *Sparganium erectum* and common water plantain *Alisma plantago-aquatica.* This community has affinities with the S8b *Sparganium erectum* sub-community, and is shown by Quadrat Q2.

S11 *Carex vesicaria* Swamp

3.31 Bladder sedge *Carex vesicaria* is widespread in the marginal areas surrounding Kneppmill Pond, usually being located in shallow standing water and often as patches amongst S12 swamp. There are few small areas, however, where this species forms a continuous sward – (i) the largest of these is located on the north side of the eastern branch off the main body of water and a sample is shown as Quadrat Q11 and (ii) smaller patches occur amongst the marginal vegetation fringing the western boundary of the main body of water.

3.32 The larger area may be attributed to the S11b *Mentha aquatica* sub-community. A variety of small herbs are present as associates including water mint *Mentha aquatica* and marsh bedstraw *Galium palustre.* The smaller area is floristically species poor, with bladder sedge being the only species present. This has more affinity with the *Carex vesicaria* sub-community and was not sampled due to its

small size. Both sub-communities are typical of open water transitions on mesotrophic substrates. The S11b sub-community is typical of drier areas, however, with a water table of between 0.1m below and 0.2m above ground level, i.e. as a transition community into terrestrial vegetation. By contrast, the S11a sub-community is typically found in standing water of up to 0.4m depth.

3.33 S11 swamp is a nationally uncommon community that is mostly recorded from Scotland

S12 *Typha latifolia* Swamp

3.34 The majority of the marginal vegetation surrounding Knepp Mill Pond is S12 *Typha latifolia* swamp. This community is always dominated by greater reedmace. Around the inflow to the pond, virtually pure stands are present in fairly deep water and may be attributed to the S12a *Typha latifolia* sub-community, as shown by Quadrat Q12.

3.35 A band of S12 swamp is also present around much of the margin of the main pond. Here, however, it is far more diverse, with a wide range of other species as shown by Quadrat Q16. The most frequent of these are common club-rush, sweet flag *Acorus calamus*, branched bur-reed and reed canary grass. Sweet flag and common club-rush are a feature of the S12b *Mentha aquatica* sub-community, however, this could also represent transition community towards the S15 *Acorus calamus* swamp. Sweet flag is an introduced species that will invade natural swamp and marginal vegetation.

3.36 This swamp community is characteristic of standing or slow moving, mesotrophic to eutrophic, circum-neutral to basic water over a silty substrate. It is frequent around suitable lowland water bodies and tolerates a wide range of water depths. One uncommon species present within this community of Kneppmill Pond is greater spearwort *Ranunculus lingua*, which is present at the northern end of the pond as a marginal strip on both the east and west sides.

S13 *Typha angustifolia* Swamp

3.37 Lesser reedmace *Typha angustifolia* dominates this swamp community, as shown by Quadrat Q10. At Kneppmill Pond a strip of this community runs through the marginal vegetation surrounding the main pond, sandwiched between the S8a and S12b swamp communities. At Kneppmill Pond the stands are typically

homogeneous, with only occasional individuals of other species. The proximity of greater reedmace adjacent to this community is a relatively uncommon feature as lesser reedmace and greater reedmace rarely occur together.

3.38 This community is commonly found in standing or slow moving, neutral to basic, lowland waters over silty substrates, as found at Kneppmill Pond. This swamp has a scattered distribution in England, the strongholds being the south-east and Midlands.

S28 *Phalaris arundinacea* Tall-herb Fen

3.39 Several areas on the margins of Kneppmill Pond are dominated by this community in which reed canary grass is a constant species. A large area of this community is present to the north of the inflow to the pond, with sallow scrub fringing its west and north boundaries. Further areas of S28 tall-herb fen are present on the western fringes of the main pond, within S12 swamp. Few other species are associated with S28 tall-herb fen, although scattered greater reedmace and sweet flag occur sporadically throughout.

3.40 Although standing water was present at the time of survey, the water level must drop during the summer months within this community, as reed canary grass will not tolerate permanently waterlogged conditions. This is reflected by its position on the terrestrial edge of marginal vegetation.

3.41 Typical conditions for this community are the margins of fluctuating circum-neutral and mesotrophic to eutrophic waters, in both still and flowing conditions. Quadrat Q4 provides a sample of this community.

***Oenanthe crocata* Swamp**

3.42 Several areas are dominated by a thick sward of hemlock water dropwort *Oenanthe crocata*. The largest of these fringes alder carr in the north east of the site, however, several smaller areas are also present on the eastern fringes of the pond.

3.43 None of these areas are submerged. Hemlock water dropwort is the overwhelming dominant to the exclusion of most other species. Analysis of data taken from this area has proved inconclusive, see Quadrat Q7. There are no NVC types that are dominated by hemlock water dropwort, although this plant is present in many swamp NVC types.

Woodland Communities

W1 *Salix cinerea - Galium palustre* Carr

3.44 W1 carr woodland is dominated by sallow *Salix cinerea*. Sallow scrub has spread along the northern margins of Kneppmill Pond and through the centre of the swamp north of the pond. Extensive areas of this habitat are also present along the eastern arm of the pond. A dense tangle of bushes has formed in areas of standing water and along the waterlogged margins of the pond. Deep shade cast by the sallow canopy results in a poor ground layer, with much bare ground and occasional individuals of species such as skullcap *Scutellaria galericulata*, marsh bedstraw and yellow flag *Iris pseudacorus*. Apart from sallow, other species occur rarely in the canopy, such as alder *Alnus glutinosa,* white willow *Salix alba* and crack willow *S. fragilis.* Quadrat Q1 provides a sample of this community.

3.45 This type of woodland is typical of wet mineral soils on the margins of standing or slow moving open water in the lowlands. It occurs in scattered locations throughout lowland Britain.

W6 *Alnus glutinosa - Urtica dioica* Woodland

3.46 There are two main areas of W6 woodland present. The first of these comprises much of the northern area of the site, through which the stream that enters Kneppmill Pond meanders. The second area lies north of the eastern branch of the Pond.

3.47 In the northern area, mature and unaltered alder woodland is present only in a small stand bordering the A272. Dominant cover by alder is a feature of the typical W6a sub-community, as shown by Quadrat Q5.

3.48 To the south of this stand, the alders have been cleared and planted with poplars, and these are now mature trees. However, many of these poplars have fallen and alder is reinvading the area. The ground flora throughout the northern area remains typical of W6 alder woodland. Nettle dominates the woodland floor, along with scattered individuals of species such as meadowsweet *Filipendula ulmaria* and cleavers *Galium aparine.* Where trees have fallen, ruderal species such as spear thistle *Cirsium vulgare* and chickweed *Stellaria media* have invaded the bare ground. Some parts of this area are flooded, especially where the poplars have fallen, ripping holes in the soil surface. However, the standing water is regarded as

temporary as nettle beds will not grow in permanently flooded areas. Large quantities of willow are also present where the poplars have been planted. This is a feature of the W6b *Salix fragilis* sub-community. In this sub-community, alder is only present as scattered individuals and crack willow dominates the canopy, as shown by Quadrat Q15. In wetter conditions still further south, this community then grades into W1 willow carr, with much sallow, as shown by Quadrat Q3.

3.49 The second area of W6 alder woodland to the north of the eastern arm of the pond has affinities with the typical sub-community, as demonstrated by Quadrat Q8. At the time of surveying, this area was still flooded. Much bare leaf litter and silt was evident, along with a range of species occurring as scattered individuals. These included yellow flag and yellow loosestrife *Lysimachia vulgaris*. Nettle was abundant in the drier areas, whilst the flooded areas supported common water starwort *Callitriche stagnalis*. Alder dominates the canopy along with some sallow scrub. This community then grades into W1 willow carr towards the pond.

3.50 W6 alder woodland is recognised as a community of eutrophic moist soils where silt has been deposited, such as on floodplains. This is reflected by its occurrence along the stream at Kneppmill Pond. Nationally this community is of widespread but local occurrence through the lowlands.

W8 *Fraxinus excelsior - Acer campestre - Mercurialis perennis* Woodland

3.51 This type of woodland is restricted to the fringes of Kneppmill Pond, on the clay soils that lie above the regularly flooding areas. The main stand is present in the north west of the site, where it extends from the A272 southwards.

3.52 The woodland is floristically rather species poor. Apart from ash *Fraxinus excelsior*, there are extensive areas of wych elm *Ulmus glabra*. The ground flora contains abundant dog's mercury *Mercurialis perennis*, ground ivy *Glechoma hederacea* and bluebell *Hyacinthoides non-scripta*. This would suggest that this is the W8b *Primula vulgaris - Glechoma hederacea* sub-community, and Quadrat Q6 provides a sample.

3.53 W8 woodland is typical of calcareous mull soils in the lowlands of southern England. There are a range of ancient woodland indicators present including early purple orchid *Orchis mascula*, which together suggest that the stands present on site of are considerable age.

W10 - *Quercus robur - Pteridiuim aquilinum - Rubus fruticosus* Woodland

3.54 The typical W10 sub-community is present on the fringes of Kneppmill Pond, above the regularly flooded area. Pedunculate oak *Quercus* robur dominates the canopy, with bramble *Rubus fruticosus* and hawthorn *Crataegus monogyna* in the understorey. Ancient woodland indicators such as bluebell, early purple orchid and yellow archangel *Lamiastum galeobdolon* are present in this community at Kneppmill Pond.

3.55 This woodland type is typical of base poor brown soils throughout lowland southern Britain. It was not sampled by quadrat analysis as it is not affected by the restoration proposals.

Amphibian Survey Results

3.56 Four species of amphibian were confirmed within Kneppmill Pond, these being smooth newt *Triturus vulgaris*, palmate newt *T. helveticus*, common frog *Rana temporaria* and a green frog (unconfirmed, but reported as edible frog *Rana esculenta*). A summary of the results is shown in Table 3. Of these, only smooth newt is confirmed as breeding in 2002. Large numbers of green frogs were observed on the bankside particularly at Location 1 along the western shore of Kneppmill Pond.

3.57 There were no signs of any great crested newt life stages encountered during the survey, despite searches of the main pond and isolated waterbodies where fish predation is likely to be low or absent.

Bird Survey Results

3.58 A total of 10 bird species associated with wetland habitats were recorded during the 2002 survey. Table 4 details the number of pairs of each species holding territory around Kneppmill Pond whilst their relative distribution is shown on Figure 2. The most abundant species was reed warbler *Acrocephalus scirpaceus* with 33 pairs. The only species recorded on site that is recognised as being of high conservation concern in the UK (RSPB, 1996 = Red List) is reed bunting *Emberiza schoeniclus* with four pairs. This species is also priority UK BAP species. One pair of pochard bred raising four young, the species is defined as a Rare Breeding Bird (as defined

by the British Birds Rare Breeding Birds panel). The species is described as a local breeding species in Sussex.

3.59 A heronry is present in the south-eastern corner of the pond, in a woodland area known as the Bow, but the present survey was not able to provide information regarding this years numbers as the vegetation was too dense at the beginning of the survey and nests could not be seen. However, up to 10 fledged young were present around the pond margin on 20 June indicating successful breeding. Previous counts peaked at 16 pairs in 1995 representing approximately 8% of the total Sussex breeding population of 200 pairs.

3.60 Figure 2 shows that 26 (44%) of all territories are distributed along the western fringe of the pond and that 15 (25%) are distributed along the eastern fringe of the pond. This is probably as a result of the wider strip of fen vegetation with a more varied structure and species composition (based on casual observations) along the western fringe of the pond. Furthermore, a total of 18 (54%) of all reed warbler territories are located along this fringe. Table 4 shows the species and numbers of breeding pairs at Kneppmill Pond in 2002, in decreasing order of abundance.

Table 4 – Wetland breeding bird territories at Kneppmill Pond in 2002

Species	**Number of territories**
Reed warbler	33
Moorhen	6
Coot	5
Reed bunting	4
Mallard	3
Water rail	3
Great crested grebe	2
Tufted duck	1
Pochard	1
Mandarin duck	1
Total	**59**

Incidental Species

3.61 Whilst no reptile survey was undertaken in 2002, a large female grass snake was observed on the 22nd May, while a juvenile grass snake and one dead adult slow worm were found on 23rd May.

3.62 Odonata were also recorded in 2002, all of which have been recorded in previous years, and are shown on Table 5 below:

Table 5 – Odonata records for Kneppmill Pond in 2002

Common Name	Scientific Name	Status
Large Red Damselfly	*Pyrrhosoma nymphula*	Abundant
White-legged Damselfly	*Platycnemis pennipes*	Occasional
Common Blue Damselfly	*Enallagma cyathigerum*	Abundant
Azure Damselfly	*Coenagrion puella*	Abundant
Variable Damselfly	*Coenagrion pulchellum*	Occasional
Blue-tailed Damselfly	*Ischnura elegans*	Frequent
Red-eyed Damselfly	*Erythromma najas*	Frequent
Hairy Dragonfly	*Brachytron pratense*	Occasional
Emperor Dragonfly	*Anax imperator*	Frequent
Broad-bodied Chaser	*Libellula depressa*	Frequent
Black-tailed Skimmer	*Orthetrum cancellatum*	Occasional

4.0 EVALUATION

4.1 Kneppmill Pond is clearly of considerable nature conservation value as defined by (i) vegetation communities, (ii) breeding birds, (iii) wintering birds and (iv) odonata. The SNCI designation acknowledges the County importance of (i) to (iii) and notes the odonata value due to the presence of variable damselfly and ruddy darter. The 2002 survey has defined the importance of the vegetation communities in terms of their NVC type and relative status and distribution within vicinity of the Pond; the relative status and distribution of wetland breeding birds about the Pond; and confirmed the likely absence of great crested newt from the Pond. These results are discussed below, in order to evaluate the most important areas of Kneppmill Pond.

Low Weald Natural Area

4.2 English Nature note that wetland habitats are an important component of the Low Weald landscape, and recognise standing open water and wet woodland as being Key Nature Conservation Features of Local Significance. Other large ecologically valuable waterbodies in the Natural Area include St. Leonards Park Ponds, Shillinglee Lake and Vann Lake.

4.3 Kneppmill Pond is also of considerable value as it contains 'Eutrotrophic Standing Freshwater' and 'Fen' communities – both recognised as Priority Habitats by the UK BAP and County BAP. The Sussex BAP (Working Draft, 2002) has a Habitat Action Plan (or HAP) for all standing freshwater defined as '*the open water zone which may contain submerged, free floating or floating-leaved vegetation, and also water fringe vegetation and adjacent land*'. Larger bodies of freshwater (over 1ha in size) are thought to cover about 2200ha of Sussex, therefore Kneppmill Pond at approximately 12ha forms less than 0.5% of the County resource.

Wetland Vegetation

4.4 A total of 12 NVC communities (or stand types) was recorded in the vicinity of Kneppmill Pond. These form a hydrological zonation from terrestrial communities, through seasonally flooded damp and wet marginal communities, into emergent and aquatic communities. The Kneppmill Pond resource is listed below in order of increasingly wet conditions and the approximate area of each community is provided:

NVC Community or Stand Type	Area
W10 Oak Woodland	N/A (as not relevant)
W6 Alder Woodland	4.56ha
	(2.92ha is W6a, 1.64ha is W6b)
W1 Willow Carr	2.60ha
Oenanthe crocata Swamp	0.32ha
S28 *Phalaris arundinacea* Tall-herb Fen	1.29ha
S13 *Typha angustifolia* Swamp	0.23ha
S12 *Typha latifolia* Swamp	1.79ha
	(0.74ha is S12a, 1.05ha is S12b)
S11 *Carex vesicaria* Swamp	0.16ha
S8 *Schoenoplectus* (*Scirpus) lacustris* Swamp	0.86ha
Carex acuta Swamp	<0.1ha
S6 Carex riparia Swamp	<0.1ha
A8a *Nuphur lutea* Beds	N/A (too variable)

4.5 The most uncommon wetland community of those identified is though to be S11 *Carex vesicaria* swamp as this is relatively scarce in England. It tends to occur in localised patches at the periphery of lowland ponds, as found here, but the relative proportion of the Kneppmill Pond resource in comparison with other sites in Sussex is not known. In terms of rare plants, none of the communities are regarded as significant with the exception of S12 *Typha latifolia* swamp. Stands of the Nationally Local greater spearwort were found associated with this community at the northern end of the Pond.

4.6 In terms of distribution of the wetland communities, it is useful to group these by virtue of their abundance and location about the Pond:

(i) Five relatively widespread communities: A8a beds, S8 swamp, S12 swamp, S13 swamp and W1 willow carr.

(ii) Three relatively localised communities at the waterside edge:

- S6 swamp – restricted to the southern side of the eastern arm of Pond;
- S11 swamp – mostly restricted to (i) the northern side of the eastern arm of the Pond and (ii) small patches along the western side of the Pond; and

- *Carex acuta* swamp – mainly restricted to the western side of the pond.

(iii) Three relatively localised communities mostly set back from open water: S28 tall-herb fen (only found to the north), *Oenanthe crocata* swamp and W6 alder woodland (mainly to the north and at the east end of the eastern arm of the Pond).

4.7 This would suggest that the most important area of Kneppmill Pond in terms of vegetation communities is the eastern arm, by virtue of the occurrence of the two localised communities, of which S11 appears to be the most uncommon community. In addition, the eastern arm and western side of the Pond would appear to contain all of the wetland communities.

4.8 Further areas requiring some measure of protection are the eastern and western sides at the northern end of the pond, where stands of greater spearwort are present.

Breeding Birds

4.9 All bird species identified during the 2002 survey have previously bred at Kneppmill Pond on a regular basis and the number of pairs recorded mostly represent average numbers. The most notable exception is that previous surveys have suggested that up to 12 pairs of reed warbler *Acrocephalus scirpaceus* breed at the site but during the present survey 33 males held territory. This might suggest an increase in the population due to changing habitat features, but is more likely to reflect targeted survey effort.

4.10 Reed bunting is notable as four breeding territories were noted in 2002. This species is not listed within Schedule 1 of the Wildlife and Countryside Act 1981 and/or on Annex 1 of the 1979 Directive on the Conservation of Wild Birds 79/409/EEC. However, it is a species recognised as being of high conservation concern in the UK, and although within Sussex it is described as a common breeding bird there is no information available on trends in the county.

4.11 Water rail *Rallus aquaticus* is also regarded as notable at Kneppmill Pond, as three territories were confirmed. This is a localised but widespread species that is often unrecorded as it is relatively difficult to detect other than by its distinctive call. Three territories would confirm this site as an important breeding habitat for water

rail. The territories were located (i) in the south-western corner of the Pond, (ii) in the northern end of the Pond and (iii) in tall-herb fen to the north of the Pond.

4.12 The numbers of great crested grebe breeding on the Pond peaked at six in 1996 but the recorded success rate was low with only three pairs raising young. The numbers recorded during the present survey might suggest a decline at the site however both pairs raised two young.

4.13 The importance of the established heronry at the Pond is already known, and breeding activity is centred within oak woodland known as The Bow.

4.14 Several species that have previously bred were not recorded during the present survey. These include little grebe (peak of two pairs in 1997), mute swan *Cygnus olor* (regular breeder, peak of two pairs in 1990), grey wagtail *Motacilla cinerea* (usually a single pair breeds) and sedge warbler *Acrocephalus schoenobaenus* (only breeding records are two pairs in 1983 and three pairs in 1986). At the same time, additional species were noted such as Canada goose *Branta canadensis* (recorded as breeding, but numbers not counted) and a pair of kingfisher *Alcedo atthis* were seen on every survey visit and almost certainly nested in the area. The latter of significant importance as this is a fully protected Schedule 1 species under the Wildlife and Countryside Act 1981 and amendments.

4.15 If the distribution of breeding bird territories in 2002 is examined, see Figure 2, this indicates that the single most important area of Kneppmill Pond is the western side (marginal/emergent fringe) where 26 (44%) of all territories are present, including 18 (54%) of all reed warbler territories and one water rail territory.

4.16 In 2002, important habitat areas (excluding the heronry within The Bow) for the more significant wetland breeding species were as follows:

- reed warbler – S12 swamp along the western and eastern sides of the Pond;
- reed bunting – probably S12 swamp along the western and eastern sides of the Pond, and S28 tall-herb fen to the north of the Pond; and
- water rail – S12 swamp in the south-eastern corner and northern end of the Pond, and S28 tall-herb fen to the north of the Pond.

4.17 It should be noted that as the results are based only on 2002, and the relative importance of these habitat areas is likely to change between years. However, the important conclusions that can be drawn from the breeding bird survey, are that sufficient areas of S12 *Typha latifolia* swamp should be retained at all times to maximise the numbers of important wetland species, and that any management of the western fringe should ideally be gradual over time or be of limited extent.

Addressing Siltation within the Pond

4.18 The SNCI citation for Kneppmill Pond suggests that the site is '*too complex to give detailed management recommendations*' but that the management aims should be to '*maintain the variety and quality of the habitats by preventing the contamination or drying-up of the waterbody*' and '*maintain open water in the lake*'. Knepp Castle Estate accord with these aims and, in addition to sensitively increasing the area of open water, would seek to extend the open water into the silted northern end. As historical mapping clearly demonstrates that the Pond suffers from a pattern of siltation that has progressively choked the northern end, this aim would be regarded as highly appropriate.

4.19 Ultimately the management of Kneppmill Pond is a large scale issue and can only be achieved with long term management commitment. The siltation of the Pond has been a major concern for some time, but there has been little significant work undertaken to date to halt this problem other than (i) limited dredging work in 1939 and (ii) the current management operation by periodic cutting back of the marginal vegetation. Neither of these actions are likely to have had any significant impact on the scale of siltation occurring at Kneppmill Pond.

4.20 If no significant change is made to address the siltation issue at Kneppmill Pond this waterbody will ultimately become completely choked with wetland vegetation, although this process may yet take many decades to achieve. Although this would still retain a significant ecological value, the process of siltation and drying out will proceed unless man-made intervention through dredging occurs. The inherent value of the SNCI at this point is likely to diminish as the open water interest will decline (as wintering birds and wildfowl), piscivorous birds will decline (as herons and grebes) and habitat diversity will decline. The optimum value of the Pond is therefore regarded as a balance between open water, encroaching emergent vegetation and stabilised marginal wetland vegetation. For this reason, dredging

work is regarded as an inevitable part of the management of Kneppmill Pond, and the present opportunity to address the siltation issue will begin the need for sensitive overall management over time.

4.21 The process of siltation within Kneppmill Pond is likely to be due to three main reasons. The first is the extreme age of the pond. The second is the stream that feeds the Pond from the north. Silt-laden water entering the northern end of the waterbody will mostly deposit suspended sediments at the point where it enters the Pond, due to the suddenly slowing of water velocity. The source of this silt is likely to have arisen from (i) soils washed off agricultural land to the north of the site, (ii) urban areas such as Southwater and additional road infrastructure within the catchment while (iii) periodical spates of heavy rainfall may contributed important historic siltation events. The third problem is likely to be due to the slow movement of water through the Pond as, relative to the size the Pond, the volume of water entering via the stream is small. There is therefore little ability to flush the Pond and so remove sediment and vegetation accumulations. To address the siltation process it is therefore recommended that the strategy is aimed at both the stream feed and the Pond.

Appropriate Areas for Dredging

4.22 Based on the results of the 2002 surveys, the most appropriate area to initiate dredging work is shown on Figure 3. Given that the dredging work will require considerable time and that a prolonged draw-down period will stress the wetland habitats, it is proposed that to dredge approximately one sixth of this area every three years, i.e. in Years One, Four, Seven, Ten, Thirteen and Sixteen. This should allow sufficient recovery time for the wetland flora and fauna.

4.23 The sequential dredging should approximate to the programme set out below:

- *Main Pond* – Deepen centre of pond to create a central core area of deep water, as shown on Figure 3. Given that this is a major undertaking, and sustained disturbance over time is likely to be more damaging than a single large scale operation, this work should be undertaken in a single phase over winter (Yeas Four and Ten).

- *Eastern and Western Sides* – Re-profile the Pond margin to between 1 in 3 and 1 in 6 gradients. In places, the bed should be lowered to 2m below average water level to slow plant re-colonisation. Based on the areas proposed this work, see Figure 3, this would involve the loss of approximately half the marginal swamp communities. However, this work would not impact upon the more uncommon swamp communities (Year Thirteen).

- *Northern End* – extend pond area by 300m length retaining 5m to 8m wide belts of S12a and S13 swamp communities, and peripheral belt of S28 tall-herb fen of between 10 and 15m. Overall width of new open water to be between 35m and 50m. Given that this is a major undertaking, and sustained disturbance over time is likely to be more damaging than a single large scale operation, this work should be undertaken in a single phase over winter in first season (Year One).

- *Eastern Arm* – Excavate a central open channel in the western half of the Arm, see Figure 3 (Year Sixteen).

4.24 The strategy outlined in para 4.22 above should help to minimise disturbance to the overall Pond during dredging operations, and ensure that the loss of breeding bird territories both within each year and between years is reduced. By spreading out the activities as outlined, this should result in the area of open water being extended significantly, establish a cycle of re-colonising marginal and emergent vegetation and still retain substantial blocks of each surrounding wetland swamp community type.

4.25 The extension of the northern end of Kneppmill Pond would result in an increase of approximately 1.2ha of open water (c. 3 acres),

Stream Improvements

4.26 To ensure that the stream does not deliver substantial quantities of silt-laden water into the Pond, either over time or during flood events, it is proposed that a new sluice should be constructed across the stream near its inlet to the Estate (location yet to be selected). This would be used regulate inputs to the Pond, with the bulk of

floodwater during the winter months to be diverted into a new side channel along the western side of the Pond.

4.27 To allow the pond to be dredged during the first season of work (Year One), it is recommended that the side channel is excavated along the western margin of the Pond, linking with the feeder stream from its point of entry into the Estate, and its outfall beside Kneppmill House along Castle Lane. This should be located as shown on Figure 3, and include a new on-line pond. The pond would also act as a receptor site for some of the more interesting swamp communities cleared from Kneppmill Pond. It is recommended that the new drainage ditch should otherwise be of similar width and depth to the incoming stream, and should be fitted with sluices at either end. Additional constraints to consider in selecting the line of drainage ditch at various locations are shown on Figure 3.

Clearance of Scrub

4.28 Further opening up of the waterbody can be achieved by introducing cyclical clearance of the peripheral wet woodland communities. Presently these encircle the northern end of the Pond, and the entire eastern arm. While large scale clearance would be totally inappropriate, clearance in the areas shown on Figure 3 would encourage re-growth in the underlying swamp and tall-herb fen communities. It would also contribute to improving the aesthetic appearance of the Pond, another objective of the Knepp Castle Estate.

4.29 Two areas are proposed for the clearance work, and material should be cut and removed from site either by burning or chip/blow into trailers. To reduce regrowth, all cut stems should be treated with a systemic herbicide such as glyphosate. As wet woodland regenerates quickly and herbicidal control in never 100% effective, this action should serve to prevent vigorous regrowth.

Clearance of Poplar

4.30 A plantation of poplar was established in the area of Pondtail Rew beneath which W8b alder woodland is present and/or regenerating. Much of the poplar stand has toppled over. Clearance of the poplar stand is recommended as it is non-native and does not significantly contribute to the ecological value of the area, while the underlying alder woodland is the appropriate wetland community and should

therefore be promoted. The most cost effective technique for removing the poplar is by cut and clear, followed by the treatment of all cut stumps using Garlon 4 in diesel. The cut stump should be suitably prepared for treatment by cross cuts to increase the contact surface. Follow up spot treatment with this herbicide may be required, over at least the following year.

4.31 In an effort to reduce costs and provide ecological habitats of value, a high proportion of the cordwood should be retained within the swamp as fallen timber or stacked at the pond periphery in cords. It would be important to ensure that this timber would not be released during flooding and therefore pose a threat to the integrity of the downstream sluices. The remainder should be removed for sale/firewood, as appropriate, while the brashings should be chipped and sprayed into the surrounding swamp.

5.0 PROPOSED DREDGING WORK WITHIN KNEPPMILL POND

5.1 Based on trial excavations the underlying silt is thought to be mostly mineral in composition, and depth to perhaps average 1.5m (up to 2m at the southern end). However, this is conjecture based on limited survey evidence. It is proposed that the arisings from the dredging work are used to create a new landform along the eastern boundary of the estate, to improve site containment from the A24 trunk road. This would be stored by constructing an encircling bank using inert material, in which settlement lagoons can be created for the deposition of the wet silts. This feature would be subsequently capped with inert fill and planted up with a woodland/scrub mosaic.

5.2 Consideration required for the storage area is (i) the need for haul routes, (ii) the need for an external containment ditch to capture silt-laden run-off and (iii) to isolate from existing drainage system in this area to prevent blockages occurring.

5.3 The proposed methodology for the dredging of the main body of the Pond would be as follows:

1. Closure of the sluice across the stream at the Pond inlet, so opening the new bypass drain along the western side of the Pond;

2. Opening the sluice gate near Kneppmill House and draining down the Pond.

3. Access dredging machine(s) into Pond to be achieved via locations shown on Figure 3, consider use of temporary haul routes for lorries removing spoil (such as duck boards etc.) away from the Pond. Material to be excavated according to its composition and depth.

5.4 It is assumed the dredging work would require teams consisting of an excavator and a number of Moxie-type dumper trucks, the number required being dependant on the turn-around period between the silt storage area and the Pond. It is also possible that a bulldozer could facilitate this process.

5.5 A proportion of the material excavated from the better quality swamp communities should be retained and placed into the new receptor pond proposed along the western side of Kneppmill Pond.

5.6 Haulage routes can be strengthened using duck boarding or temporary handstanding laid over geotextile sheeting. Low-lying areas and gradients should be considered for this treatment.

5.7 The restoration work proposed in this report is based on major dredging and clearance work to be carried out over the next sixteen years. It is important to ensure that the restoration proposals are achieving their goal, in maintaining the current ecological interest and providing opportunities for the re-establishment of wetland vegetation. The dredging process itself should also be scrutinised to gain insight on the most efficient and cost effective ways of undertaking this work. The success of the dredging exercise and feedback on problems and solutions would therefore require a Monitoring Programme to inform on the long term restoration of the Pond for which a number of decades is recommended to reduce impacts on this immensely diverse and ecological valuable Sussex site.

5.8 Monitoring work over the sixteen year period should include vegetation surveys to ensure that the floristic species richness and size of the respective wetland communities is maintained, supplemented with bird surveys to assess habitat diversity and Odonata surveys (dragonflies and damselflies) to assess biological water quality. By using these organisms as surrogates of quality, this provides a simple means for monitoring the ecological success of the restoration proposals.

5.9 The proposed restoration of Kneppmill Pond should ensure that this waterbody and its small wetland habitat retain their SNCI status and continue to be of major ecological importance with West Sussex.

6.0 REFERENCES

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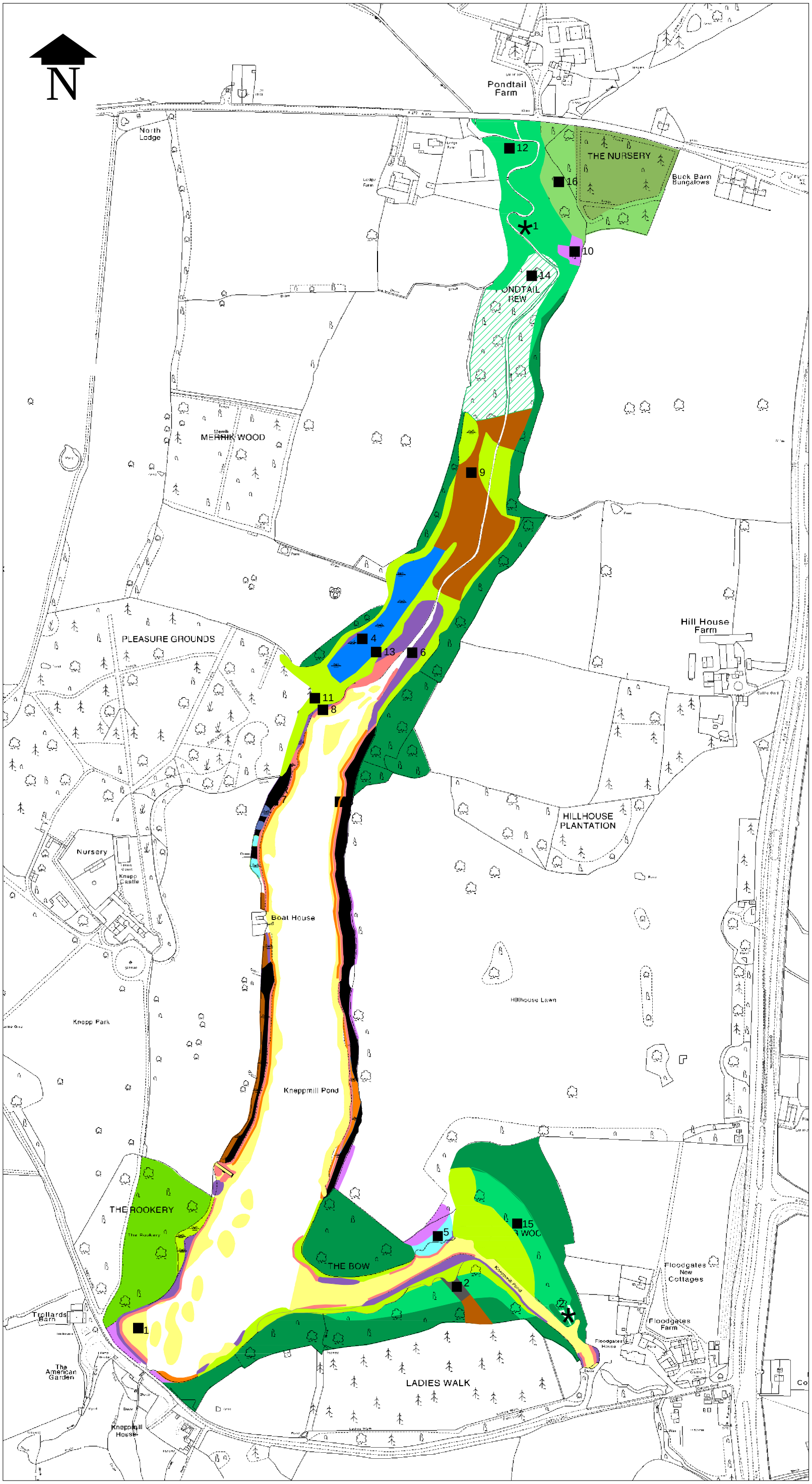

Key

- A8a *Nuphar lutea* community - species poor sub - community
- S6 *Carex riparia* swamp
- S8a *Scirpus lacustris* ssp *lacustris* swamp, *Scirpus lacustris* ssp *lacustis* sub - community
- S8b *Scirpus lacustris* ssp *lacustris* swamp, Sparganium erectrum sub - community
- S11a *Carex vesicaria* swamp, *Carex vesicaria* sub - community
- S11b *Carex vesicaria* swam *Mentha aquatica* sub - community
- *Carex acuta* community
- S12a *Typha latifolia* swamp *Typha latifolia* sub - community
- S12b *Typha latifolia* swamp *Mentha aquatica* sub - community
- S13 *Typha angustifolia* swamp
- S28 *Phalaris arundinacea* tall-herb fen
- *Oenanthe crocata* community
- W1 *Salix cinerea - Galium palustre* woodland
- W6a *Alnus glutinosa - Urtica dioica* woodland, typical sub - community
- W6b *Alnus glutinosa - Urtic dioica* woodland, *Salix fragilis* sub - community
- W8b *Fraxinus excelsior - Acer campestre - Mercuriali perennis* woodland *Primula vulgaris - Glechoma hederacea* sub-community
- W10a *Quercus robur - Pteridium aquilinum - Rubus fruticosus* woodland, typical sub - community
- Broad-leaved plantation
- Coniferous plantation
- *1 Area planted with poplar except for small stand by road.
- *2 Island of W10 dominated by *Rhododendron ponticum*
- R Stand of *Ranunculus lingua*
- ■1 Quadrat

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Project title
Knepp Castle Estate

Drawing title
FIGURE 1
National Vegetation Communities

Scale	Drawn	Date
1:5000	LCG	July 2002
	Approved APL	

Drawing No **1086501** Revision

CAD Filename
G:Projects/1086501/CBA Drawings/1086501-NVC.dwg

N

Pondtail Farm

North Lodge

THE NURSERY

Buck Barn Bungalows

Retain area of rush pasture

PONDTAIL FEN

Proposed new pond (Receptor site A)

Poplar to be cleared in this area (Cardwood to be stacked and brashings chipped)

Proposed new drain

MERRIKWOOD

Machine Access

Tree clearance along ditch line

Dredging work proposed in Year One

Hill House Farm

PLEASURE GROUNDS

Machine Access

Ditch line to be carefully selected re watercrossing and colonies of devils-bit scabious

Willow carr to clear in Year Two

Willow carr to clear in Year Four

Proposed new pond (Receptor site A)

HILLHOUSE PLANTATION

Nursery

Knepp Castle

Boat House

Hillhouse Lawn

Knepp Park

Kneppmill Pond

Machine Access

Willow carr to clear in Year Three

Machine Access

THE ROOKERY

The Rookery

THE BOW

Floodgates New Cottages

Floodgates Farm

Floodgates House

Trollards Barn

Willow carr to clear in Year Four

The American Garden

LADIES WALK

Kneppmill House

Key

- Former Lake March Habitat
- Estate's Proposal for Long-Term Open Water through Dredging
- Undredged Open Water Liable to silt up

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Project title

Knepp Castle Estate

Drawing title

FIGURE 3

Proposed restoration projects - 10 years

Scale	Drawn	Date
1:5000	Bvl	March 2003
	Approved	

Drawing No **1086501** Revision

CAD Filename