KNEPP CASTLE ESTATE

RIVER ADUR & WETLAND RESTORATION PROJECT

Project synopsis

The Knepp Castle Estate is one of very few places in England managed on natural process principles. Unlike many nature reserves, this privately owned estate allows natural or naturalistic processes to determine outcomes and management objectives on its former farmland, known as the Wildland Project. An important component of the Wildland project is the River Restoration Project which physically began in 2011 and aims to regenerate a degraded wetland system through restoration of meanders and reintegration of floodplains. Benefits to the Knepp Estate and the wider landscape are flood storage for downstream, fisheries improvements and multiple improvements in biodiversity.

Introduction

The Knepp Castle Estate lies to the south of Horsham, West Sussex. Its long history has resulted in a number of features of archaeological, cultural and geological interest, including the remains of the original 11th century castle. The Estate now extends to a total of 1,416ha and lies within the Low Weald Natural Area and has a heavy clay soil. It is traversed by the River Adur and some of its tributaries and contains Kneppmill Pond - a hammer pond constructed for nearby iron workings prior to 1568. There are two Sites of Nature Conservation Interest (SNCI) on the Estate.

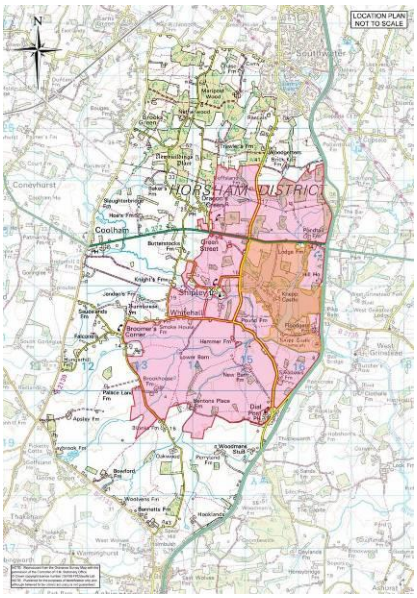

Figure 1 Aerial image of the River Adur showing canalised course and old meanders and map showing Knepp Estate boundary

The Wildland Project

The transition from intensive agriculture to naturalistic grazing started in 2002 with the restoration of the estate's parkland through DEFRA's Countryside Stewardship. This model of arable reversion was considered so successful that the project was extended in 2005 and again in 2009, and with each subsequent extension of the land holding within the project, a more hands-off approach was taken in the management.

Large herbivores graze each of the three enclosures (longhorn cattle, Exmoor ponies, fallow deer and tamworth pigs) drive the succession of habitat.

This re-wilding scheme aims to explore an ecological alternative to intensive farming on marginal lowland in Britain. Through natural processes Knepp hopes to see the redevelopment of a mosaic of habitats resulting in improvements in biodiversity and biological continuity as well as linked 'ecosystem service' benefits.

Restoration of the River Adur

The Knepp Estate, in conjunction with the Environment Agency, Natural England and the River Restoration Centre, has also embarked upon the 're-wilding' of the stretch of the River Adur that crosses the estate together with two of its main tributaries. This £300,000 river restoration is a key component of the Wildland Project. It involves re-

naturalising a 2.2km stretch of the River Adur itself as far as possible to its original course before canalisation, enabling the Adur floodplain to resume its natural function.

The river restoration will complement other wetland work on the estate, which includes floodplain meadow restoration, floodplain woodland planting and a 10 year strategy to restore ponds. This latter project forms part of the Million Ponds Project, a national initiative led by Pond Conservation, which aims to reverse a century of loss and decline in British freshwater habitats.

The floodplain of the River Adur is set in a gently rounded valley. Tributaries, known as lags, cross the floodplain to flow into the River Adur, one of the largest rivers in West Sussex. The Lay Brook and the Lancing Brook are the two main tributaries of the Adur that lie within the Knepp Estate. The clay nature of the catchment results in the deposition of much fine sediment in the main river and adjacent ponds. The natural form of the river in this part of the lowland England is flat and silty, with steep clay banks and marginal vegetation, but centuries of management have resulted in a river channel very different from the natural state.

A feasibility report produced by the River Restoration Centre (RRC) in 2006 identified the aims, opportunities, scoping feasibility and constraints involved with the river and floodplain restoration. In 2009, the Environment Agency produced a scoping consultation document. The well-founded project began in the summer of 2011.

The overall objective is the restoration of the stretch of the River Adur crossing Knepp from a canalised widened waterway to a more natural riverine system with natural meanders and the integration of the surrounding floodplain water meadows. The river restoration work will complement the more general re-wilding of the Estate, resulting in an increase in improvements to flood risk management, landscape and wetland biodiversity. An increase in morphological diversity through physical restoration will support an increased population of key species, which will then encourage colonisation by wading and nesting birds, insects, amphibians, aquatic and semi-aquatic vegetation and riverine trees such as the black poplar. Predicted increases in insect diversity and abundance will benefit bats and other insectivores, significant indicators of improvements in habitat quality and diversity.

The restoration of the channel and floodplain has had to incorporate the wider catchment objectives for the Adur system and Knepp Castle Estate re-wilding programme. The project has to function within site constraints and demonstrate the opportunities for landscape, biological, ecological, morphological and hydraulic enhancements. The Knepp Estate holds only two designated sites of conservation, (SNCIs), some County Geological Sites (COGS) and English Heritage features. This project therefore provides an opportunity to explore the benefits of re-wilding and restoration with minimum constraints to works.

For further information on the Knepp Estate Conservation and Restoration Projects and feasibility study of the River Adur please refer to www.knepp.co.uk.

Baseline Ecological Information

Prior to the start of the restoration, baseline ecological surveys were carried out along the watercourses and floodplain of the River Adur, Lancing Brook and tributaries as part of the Wildland Project monitoring strategy produced in 2006, itself a product of baseline surveys carried out in 2005:

2005: Wetland & aquatic Coleoptera & molluscs; Odonata; moths; aquatic & bankside vascular plants (summer); vegetation survey NVC (Phase 2 & belt transect survey; bat survey; water vole & water shrew survey.
2007: Aquatic & bankside vascular plants (spring)
2009: Bat survey of foraging use of River Adur, Lancing Brook and floodplains and to locate nursery roosts of species foraging in the river restoration site.
2010: First repeat of floodplain belt transect survey

Together with additional data held by Sussex Biodiversity Record Centre, the results of these surveys amount to a significant level of knowledge on the biodiversity of the project area prior to restoration. The importance of much of the data will only become apparent over time, as changes in vegetation structure and the distribution and abundance of more common species can be mapped. Changes driven by natural processes may be slow and also depend to an extent on species resources in the wider adjacent countryside as well as dispersal rates of species. But benefits are already apparent. Scrub is developing over formerly intensive arable land. Berry-rich hedgerows are

widening, supporting a wide variety of breeding and overwintering birds. Lapwings are starting to breed on the wet grassland. It is now known that there are 13 species of bat foraging over the river corridor and other parts of the estate, with 6 species confirmed as breeding in a bat survey carried out in 2009 by F.Greenaway. Its connectivity with the wider countryside has been demonstrated both by the abundance and diversity of overwintering wetland birds and also by one of our rarest bats, the barbastelle. In 2008, a female barbastelle was radio-tracked commuting from the breeding site at The Mens SAC to forage over the wet floodplain grassland at Knepp.

To date, 50 UK Priority BAP species have been recorded (Table 1) on the Knepp Estate including 26 bird species, 5 bat species, water vole, European eel, grass snake, great crested newt and slow worm. In addition over 60 invertebrate species of conservation importance have been recorded. Most of the recorded BAP species either have already, or will benefit from the Wildland Project, contributing to UKBAP targets. Those likely to benefit from the river restoration in particular are water vole, barbastelle bat, soprano pipistrelle bat, northern lapwing, common toad, great crested newt, common eel and tubular water dropwort, with benefits also probable with respect to grass snake and slow worm. The anticipated increase in the diversity and abundance of invertebrates will benefit most of the fauna on the estate, either directly or indirectly.

The River Restoration Project is contributing to the Black Poplar Species Action Plan in association with the Sussex Biodiversity Partnership and Wakehurst Place, with the planting of cuttings, saplings and transplants over three years. This complements the substantial riparian planting that took place in 2007. This work with the Forestry Commission and volunteers, constituted one of the largest riparian woodland planting efforts in the country. Following restoration the site has the potential to contribute to multiple UK HAPs, providing a rich mosaic of wetland habitats.


Figure 2 Riparian woodland planting with volunteers in the upper reaches of the River Adur


Figure 3 Aerial photo showing edge of SAM site, weir and canalised river course with old meanders visible (left), longhorn cattle and Exmoor ponies grazing and drinking in re-wetted area near to the Knepp Castle remains

Table 1 Recorded BAP species on the Knepp Estate *
Many of these species are additionally protected under UK and European Laws

Bats			
Barbastelle	Bechstein's bat	Noctule	Soprano pipistrelle
Brown-long eared bat			
Birds			
Greater white-fronted goose	Yellow wagtail	Greater Scaup	Hedge accentor
Common Scotor	Song thrush	Grey Partridge	Common grasshopper warbler
Northern Lapwing	Spotted flycatcher	Herring gull	Willow Tit
European turtle dove	Marsh Tit	Common cuckoo	Common Starling
Eurasian wryneck	House sparrow	Lesser-spotted woodpecker	Common Linnet
Woodlark	Lesser Redpoll	Skylark	Common Bullfinch
Yellowhammer	Reed Bunting		
Butterfly/Moth			
Brown Hairstreak	White admiral	Small blue	Blood vein
Cinnabar	Small square-spot	Centre-barred sallow	Mouse moth
Rosy rustic			
Herptile			
Great crested newt	Common toad	Slow worm	Grass snake
Rodent			
Water vole	Hazel dormouse		

Others: Stag beetle, European eel, a lichen (Anaptychia ciliaris ciliaris) and Tubular water dropwort

Project Objectives

Throughout the project Knepp has worked with the following objectives:

- **River and floodplain restoration**

Restore to favourable condition the stretch of the river Adur within the Knepp estate.
Establish greater connectivity between floodplain and river through modification of ditches and sluices.

- **Sustainability and ecosystem services**

Develop a sustainable riverine system of favourable condition with well-connected floodplain meadows.
Offer a variety of invaluable ecosystem services including flood alleviation, recreation and biodiversity as well as the more abstract spiritual / religious services.

- **Community and education**

Organise events, open days and tours for local community groups, schools and conservation specialists to raise awareness of the river restoration project.
Encourage fishing groups and local visitors to the restoration area.

- **Monitoring**

Implement a comprehensive and usable monitoring scheme to monitor the results of restoration efforts and natural driven processes at the landscape scale.

River and Floodplain Restoration

The main aim of the river restoration is to enhance the channel and floodplain habitat diversity by physical manipulation of channel platform, bed levels and flow patterns with a particular emphasis on reconnecting the

floodplain to the river channel. This will overcome issues outlined in the RRC feasibility report in which a strategic work plan was developed to address:

- Over-sized and realigned route with loss of original planform
- Weir structures affecting landscape, hydrology and fish movement
- Flooding issues and high maintenance for Environment Agency
- Floodplain function loss, lack of in channel, marginal, bankside and floodplain habitat diversity

In response to which a number of specific aims were identified:

Geological & Hydrological

- Increase naturalness of landscape, habitat, frequency of large woody debris (LWD) based physical habitats
- Increased physical habitat diversity in river channel through manipulation of spatial structure achieved by LWD, modification of grazing regimes and increase in frequency and duration of fluvial flooding.
- Increase channel sinuosity and reduce channel cross-section area to match characteristics of adjacent semi-natural reaches
- Create a variable cross-section form with bank angles reflecting bend curvature in the first instance followed by adjustment in the post-construction phase
- Develop a mixed sandy silt substrate with intermittent LWD and vegetation
- Demonstrate appropriate restoration techniques
- Mitigation against flood damage from increased frequency or depth of flooding and minimised flooding extent and duration
- Protection for floodplain properties and infrastructure

Ecological

- Increased diversity of riverine and floodplain habitats
- Enhancement for species of conservation importance while considering wider ecological and landscape impacts
- A monitoring strategy that links floodplain, hydro-morphology and habitat enhancement
- Develop a succession of wet floodplain habitats with some wet woodland, sustained by a mixture of flush and flood hydrology of which black poplar could become a key component.
- Enable free passage for sea trout and increase passage of coarse fish species
- Free passage for eels to Kneppmill Pond
- Develop a wooded riparian margin, affording shading along the newly constructed channel

Phase 1

Re-profiling

In 2011 works commenced to create approximately 1750m of new channel or convert old channel (where retained) to more appropriate dimensions. The re-meandering involved carving a new course through dry ground, away from problems of flowing water and fluctuating levels (fig 4). The course follows the old visible meanders where they cross the present course, and old channels will continue to provide a refuge for fish and act as a sheltering backwater in floods. Large woody debris and curled fencing was introduced to encourage natural riverine physical habitats and processes.

Figure 4 Re-creating natural meanders and re-profiling the river Adur channel and introduction of LWD

River restoration may cause some disturbance during the restoration, however all activities involved in the restoration are carried out in consideration of the priority BAP species and habitats on site. Minimal disturbance is achieved through correct planning, timing and executing of works.

Blocked ditches and culverts

Ditch networks formerly conveyed surface water to river and brooks thereby draining the grazing land. Modification of ditches through blocking increases surface water as a result of flooding and retention of precipitation across the site while the heavy clay soil further limits infiltration. Previous work carried out upstream of the current restoration site provides examples of restoration potential; a ditch blocked twenty years ago has resulted in wet woodland and ideal floodplain habitat, (fig 5) demonstrating the possibility for retaining surface water, encouraging rush dominated pasture and providing feeding habitat for wading birds (fig 6). In 2008 work carried out with volunteers and the OART blocked culverts resulting in successful re-wetting of the floodplain and a ford across a farm road which longhorn cattle use as a drinking hole.

Figure 5 Development of wetland and riparian woodland twenty years after ditch blockage

Figure 6 Re-wetted floodplain and wet woodland as a result of blocked culverts

Pond restoration

Considerable work has been carried out to improve wider wetland habitat on the estate, including the restoration and creation of ponds. The Ouse and Adur Rivers Trust (OART) along with volunteers considerably improved the condition a number of degraded ponds through removal of willow and other scrub, thereby improving habitat for great crested newt and ground nesting birds (fig 7). This work is particularly important in areas where the grazing animals are excluded and will not drive natural processes.

Figure 7 Pond restoration work with volunteers from the Ouse and Adur Rivers Trust in 2010

Eel easement works

Two projects carried out by the OART and Defra addressed the issue of restricted eel easement at the outfall of Kneppmill Pond and the old eel rack house. Knepp mill pond comprises excellent habitat for eels however migration is currently hindered by the weir at Floodgate Farm. Work was carried out to encourage water flow from the pond, thereby enhancing connectivity between Knepp mill pond and the River Adur. In July 2011 eel mats were installed underneath the old eel rack house downstream of Knepp mill pond.

Phase 2

Phase two of the project planned for 2012 involves the remaining downstream stretch of the River Adur. Restoration to a more natural river channel (fig 8) and linking of the floodplain will continue downstream. The proposed works respond to the following aims:

- Retain the current channel capacity at high flows
- Create a low flow channel by reshaping one bank
- Undertake excavation work on the floodplain to create scrapes which will form the wetland habitats
- Prevent an increase in flood depths at Tenchford Bridge or to the A24
- Resolve the problem of low flows during the summer

- Allow the removal of the weirs while increasing the wetness of the floodplain.

Re-profiling of the river channel will result in an unimpeded flowing watercourse during the summer and high flow relief channel in the winter. The removal of the weir close to the A24 provides a sustainable solution with minimal future management needs and greatly improved fish passage (fig 9). These works would require the replacement of a public right of way if access structures are removed and a raised walkway to be rebuilt over the floodplain (fig 8).

Figure 8 Raised walkway to be rebuilt on PROW (left), meanders and LWD upstream showing some of the natural forms of the river Adur

Figure 9 Canalised widened river Adur course; weir to be removed or modified to ease fish and eel movement

Sustainability and Ecosystem Services

Wetlands deliver a disproportionate amount of benefits; the restoration of a functioning and well-connected riverine and floodplain system at Knepp offers the potential for accumulative improvements to flood alleviation, biodiversity and human wellbeing as well as the delivery of important services including water supply, water purification, fishing, recreation and tourism.

The feasibility report identified that natural processes of debris accumulation and decomposition, channel migration, vegetation colonisation and succession and variability in flow regime will sustain a natural river system post-restoration. The restoration project will provide multiple benefits to the riverine ecosystem, related habitats and offer ecosystem services to the surrounding landscape and community as well as providing a high quality example at the national scale.

Improvements in the population status of many of the breeding waders and other birds that use the river and floodplain area are dependent on the improvement of habitat. Condition has been unfavourable due to poor watercourse quality and low water levels. The river restoration will enhance the estate as a significant site for wetland winter migrants, the importance of which is enhanced by its proximity to Amberley Wildbrooks and Pulborough Wildbrooks SSSIs, both within the Arun Valley RAMSAR site. The species recorded on the estate include many species of conservation interest in addition to BAP species, including Amber List species such as little grebe, little egret, common snipe, Eurasian woodcock, common redshank and grey wagtail.

Landscape character will be maintained through vegetation management via-grazing, the floodplain will be open to grazing animals. Eventual vegetation will depend largely on preference of various grazers for floodplain vegetation as opposed to that of drier woodland, parkland and arable reversion across the remainder of the estate. The development of floodplain woodland though desirable is uncertain due to grazing pressures from large herbivores. The possible community types are as follows:

- **Floodplain woodland**: woodland will occur spontaneously, given proximity of seed source, if grazing pressure is low
- **Swamp communities**: where surface water is retained beyond May. If grazing pressure is moderate, sedges will predominate over reeds.
- **Grassland communities**: high grazing pressure is likely to maintain grassland communities irrespective of hydrological scenario

Community and education

The scheme will inform and highlight the potential for future wetland restoration projects elsewhere and will continue to be high profile through the involvement with numerous conservation and environmental bodies. Public involvement through television features on programmes such as Countryfile (fig 10) promotes the project to a national level.

Figure 10 Filming Countryfile at Knepp

The Knepp Estate has a varied programme of events and visits to the estate. From 2009 to 2011 visitor numbers rose and now average about 500 per year in 20 -30 groups. Groups vary from local schools to charities (list of stakeholders and visitors appendix 1). Since 2007 the Estate has offered tours with a bespoke personnel carrying trailer (fig 12) and regularly hosts visits to landowners and governmental agencies to inform, share and consider the future for Knepp and other potential wildland areas in the UK.

Despite a functioning sea trout run the river is known to be poor for fishing. Riverine improvements offer potential for a fisheries resource with salmonids. As the river returns to a more natural state and natural processes resume, Knepp plans to reinstate the fishing club and create a community fishing area, hold wetland seminars and continue to run educational tours with a focus on wetland ecosystems. These will supplement a wetland day run by the Sussex Wildlife Trust, a watchtower bird hide and an additional public footpath through the river restoration site.

Figure 11 Knepp Volunteer day (left) and an advisory group safari led by Sir Charles Burrell


Figure 12 Safari trailer with visitor group, Wildland Carp day with the local community

Monitoring

The Wildland project has been monitored since 2005 in accordance with the Monitoring Strategy, resulting in a considerable amount of data on habitats and species and focussing on the River Adur, its floodplain and main tributaries. A comparison of post-restoration monitoring with the baseline ecology will enable an informative evaluation of the restoration project, set as it is within the Wildland project as a whole. The opportunities that this presents will make a highly valuable contribution to our knowledge of ecosystem function and services. Future monitoring of the river restoration area will be incorporated into the next phase of the Wildland project monitoring.

Various hydrological scenarios are expected to develop in the first 10 years of the project due to varying degrees of grazing and browsing pressure, ranging from open vegetation and bare mud to willow carr with alder invading. Vegetation and habitat development will depend on physical differences of the floodplain and corresponding climate soil and water conditions

Once the initial restoration and redirecting of the channel is completed natural processes will inform the development of the wetland system, subsequently aerial and species surveys will assess the relative success and biological impact. The following key indicators of habitat improvement will be monitored:

- Changes in structure and composition of aquatic and wetland vegetation
- The population size of the breeding roost of Soprano pipistrelle
- The male: female ratio of Soprano pipistrelles
- Water vole population
- Black poplar establishment
- European eel population

Summary

As a privately owned estate Knepp would normally gain revenue through intensive agriculture involving drainage and herbicide and pesticide application. The owner with support from governmental bodies and conservation NGOs is developing Knepp as a nationally important test site for the reversion of arable land and the development of an ecologically sensitive approach to land management. The wider project is pioneering in its approach and the river restoration forms a key component, both of which are well beyond the normal remit of the organisation.

The restoration work carried out at Knepp constitutes a case study for example to the rest of Britain and the EU. Research is available to the public and is shared with the Sussex Biodiversity Report and the River Restoration Centre as well as other governmental bodies involved with the Wildland Project. Over time as wetland habitat diversity improves to the benefit of flora and fauna this part of the estate may be used as a demonstration of what river restoration and low level grazing on floodplain grassland can achieve.

Appendix 1

Knepp Wildland Project - Stakeholders

Financial Supporters	
Natural England	Countryside Stewardship, Environmental Stewardship
Rural Payments Agency	Single Farm Payment
Countryside Agency	Feasibility Report
Sussex Wildlife Trust	Baseline Survey and ongoing monitoring
Environment Agency	River Restoration
Otters & Rivers Project	Monitoring
Forestry Commission	Short rotation forestry trial
RSPB	Cattle GPS Tracking system
Steering Group	
This group was formed early in the re wilding projects life.	
Buckland, Paul	Environmental Archaeology academic
Butler, Jill	Woodland Trust Conservation Officer
Crawley, Mick	Plant Ecology Department of Biological Sciences, Imperial College
Emrich, Jason	Knepp Estate Land Agent
Fowkes, Bruce	RSPB
Fuller, Rob	BTO, Director of Science (Ecological Change)
Goldberg, Emma	Forestry and Woodland Officer, Natural England
Goriup, Paul	Fieldfare International Ecological Development plc
Green, Ted	Ancient Tree Forum
Greenaway, Theresa	Retired Survey & Research Officer Sussex Biodiversity Record Centre
Heard, Matthew	Head of Biodiversity & Conservation Management Group NERC
Kampf, Hans	Executive Director Large Herbivore Foundation
Kirby, Keith	Natural England
Lavender, Jason	Joint Director High weald AONB Unit
Miller, Sophie	SJM Ecology
Oates, Matthew	National Trust Nature Conservation Adviser
Seymour, James	South East Regional Land Management Programme Manager, Natural England
Smith, Julian	Trustee to the Knepp Castle Estate
Smith, Ken	Retired from the RSPB as head of Aquatic Research
Spencer, Jonathan	Senior Ecologist Forestry Commission
Toe, Patrick	Stockman Knepp Castle Estate
van de Vlasakker, Joep	Flaxfield Nature
Vera, Frans	Grazing Ecology and Forest History
Whitbread, Tony	Chief Executive Sussex Wildlife Trust

Visitor Groups to the Knepp Estate 2011

Shoreham Dist Ornithological Society	Davison High School
Shipley Cubs	Shipley School
Country Trust/Marshlands Primary	SWT wild about wetlands course
CIWEM	Horsham Food festival 1
Shipley Scouts	Horsham Food festival 2
Open Farm Sunday	South Downs Rangers
Sompting Abbotts School	Tianjin Institute
Shipley School	Shipley with Jim Seymour
SWT Members Event	Handcross Park School
Friends of Hollingbury & Burstead Woods	Handcross Park School
Ferring Conservation Group	Shipley Whole School
	Hadlow College

Naturalisation of Streams Brooks and Ditches on Knepp **Meters**

Naturalisation of Pondtail New pond and stream dam	206	
Naturalisation of Pondtail drians blocked	96	
Naturalisation of Pondtail stream	506	
Naturalisation of ditches Lancing Brook by New Barn Farm phase 1	222	
Naturalisation of ditches Lancing Brook by New Barn Farm phase 2	408	
Naturalisation of ditches to the splash Lancing Brook	520	
Naturalisation of Laybrook Hammer pond	664	
Naturalisation of Laybrook Scrapes Brookhouse	607	
Naturalisation of top end of Laybrook Brookhouse	286	
Naturalisation of Spring wood Stream and Pond	250	
Naturalisation of Spring wood Stream in river Adur Floodplain	236	
Naturalisation of Spring wood Stream in river Adur Floodplain south	387	
Naturalisation of Oakland Lagg	450	
Naturalisation of Lay Brook Lagg	364	
	5,202	
Detail on River Adur		
Naturalisation of River Adur Phase 1 from Capps Bridge to Lancing Brook	1,123	done
Naturalisation of River Adur Phase 2 from Tenchford to A24	1,507	to do
Naturalisation of River Adur Phase 3 scrapes		to do
	2,630	

Ponds Restored or constructed in the last 20 years

Restored Pond Renches 1
Restored Pond Renches 2
Restored Pond Renches 3
Restored Pond Little North Chruch Farm North
Restored Pond Jockie's Cops Chruch Farm North
Restored Pond Chruch Farm North
Restored Pond Windmill Lagg CFS
Restored Pond Church Farm South
Restored Pond Lower Barn
Restored Pond Oakland Lagg
Restored Pond Sunt Farm
Restored Pond Brookhouse
Restored Pond Brookhouse small
Restored Pond Splash
Restored Hammer
Restored New Barn Farm
Restored Tumbledown
Restored Matches
Restored Coate's Furzefield
Restored Goffslands
Restored Pondtail Ford
Restored Pondtail Pond Lagg

The Larger Brooks, Streams and Rivers on Knepp	
River Adur	3,871
Lancing Brook	2,675
Lay Brook	3,510
Pondtail Stream from the North	6,032
Pondtail Stream from the West	666
Horsham Common Streat from the North	538
Horsham Common Streat from the East	1,033
Warf Stream	799
Windmill Stream	669
Spring Wood Stream	1,115
	20,908

Appendix 3 Map showing open water in and around the Knepp Estate and 2km buffer around river Adur restoration site