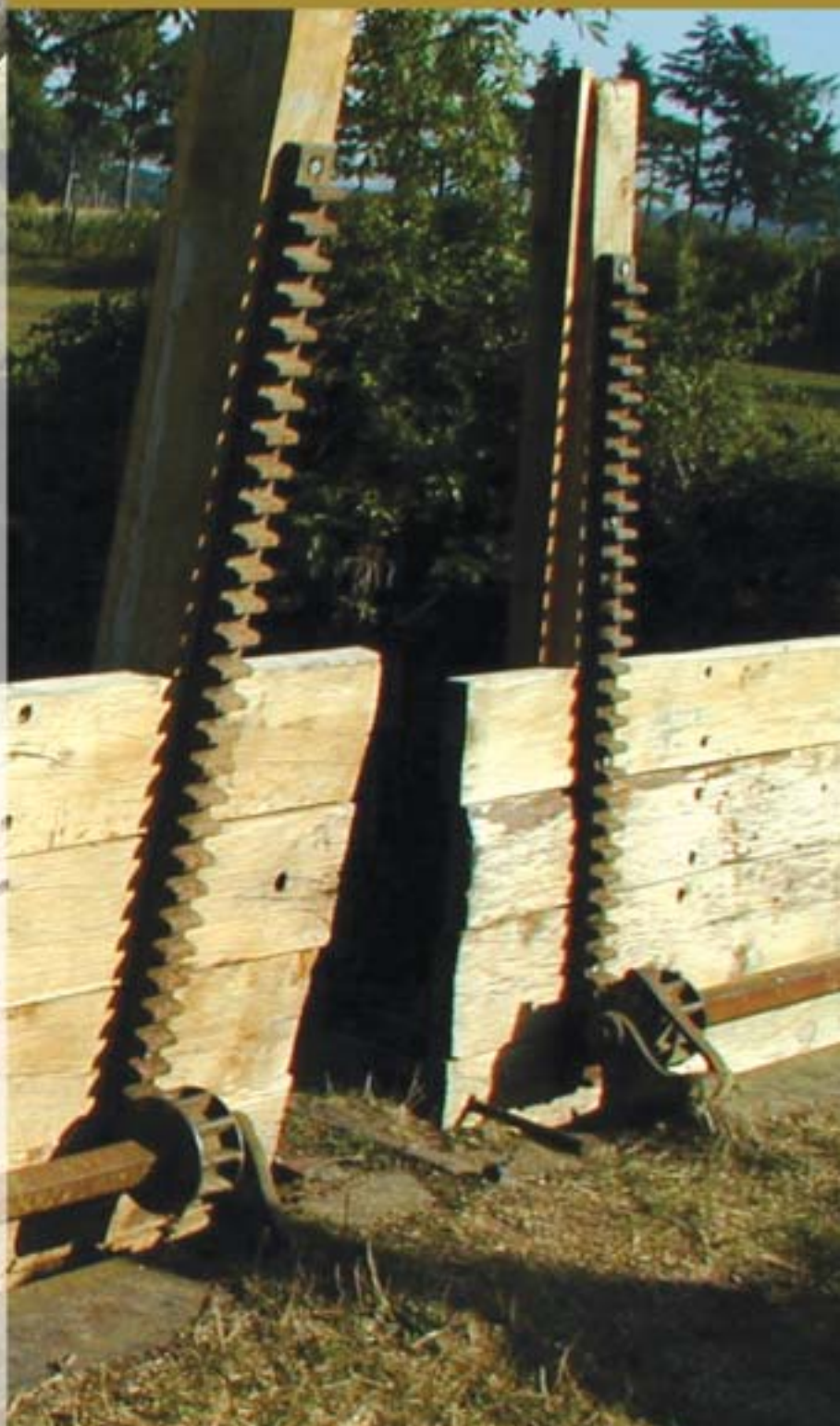
The Conservation of

Water Meadows

Structures



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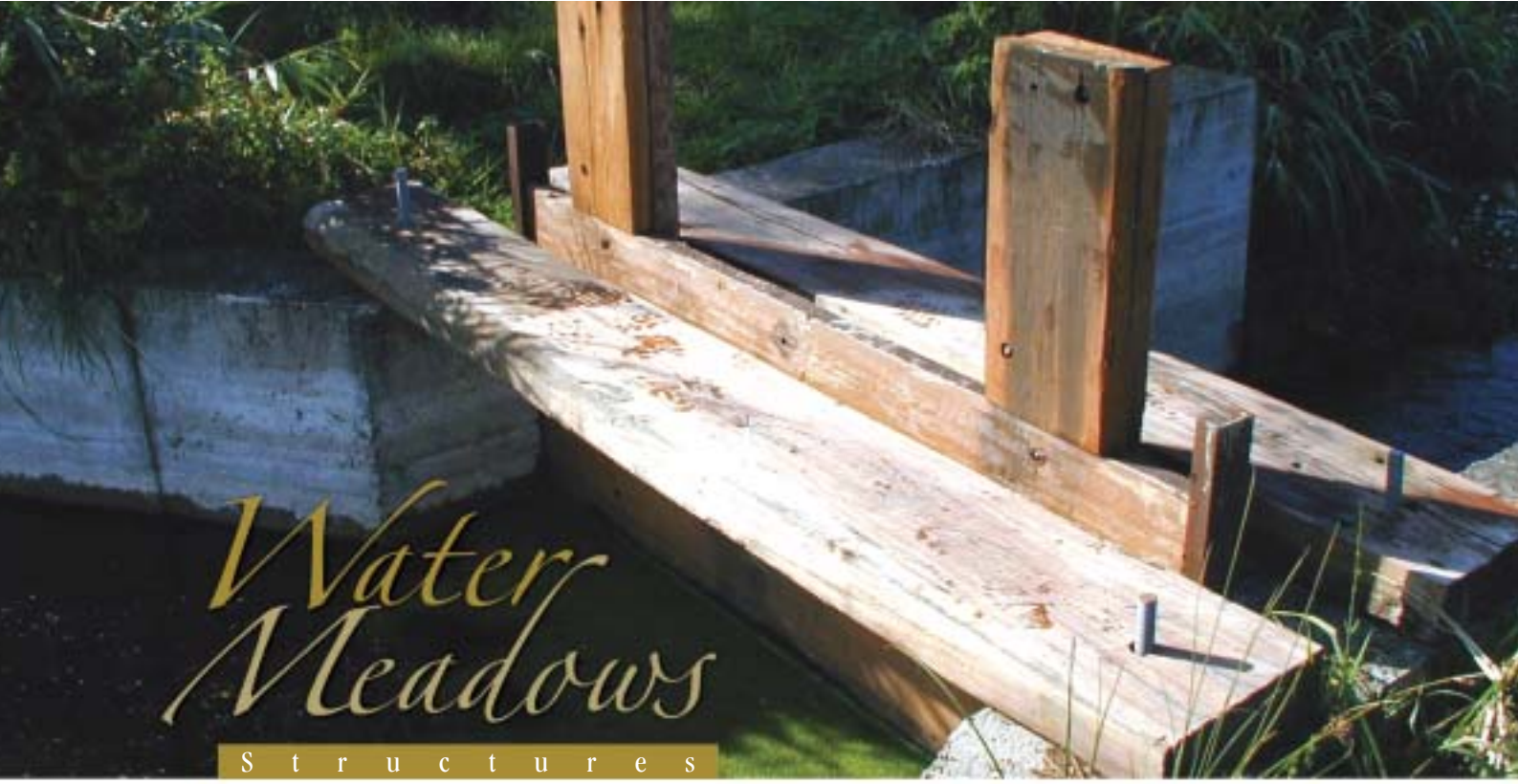

Water Meadows

Structures

Hampshire contains nearly half of all water meadows found in England which makes them of national significance.

Hampshire County Council commissioned an extensive desk-based survey in 1999, and in 2002 published a leaflet which explains the history and development of water meadows and policies which affect their management. This publication is intended to explain further their past function and to look in particular at the conservation of the built structures within them.

> *"Water meadows are an important feature of Hampshire's historic landscape."*

A water meadow is an area of pasture within a river valley which is deliberately flooded to encourage the growth of grass, the water deposits nutrient encouraging better grass growth and enables early production of animal fodder and an increased number of hay crops per year.

Water meadows were formed in river valleys throughout Hampshire – those of the Avon, Test, Itchen, Meon, Wey, Loddon and Wallington. They have typically survived as earthwork features in the landscape and will invariably also contain built structures such as sluices, hatches, weirs, bridges and aquaducts.

Most water meadow systems are located on alluvial soils of the floodplain, or the adjacent terraces.

This valley bottom design is termed 'bedwork' where water is directed from a main river, often via a canal or 'main carrier' through control structures (weirs, hatches, sluices etc) into channels tapered so as to spill down the sides of specially constructed ridges, called 'panes'.

The type of structure and method of construction used will depend on the age of the water meadow and its location and thus the availability of local materials. Because by their very nature water meadows are usually located in inaccessible areas the use of local materials simplified the construction process, reducing problems of transportation. Although water meadows and their structures were expensive for landowners and farmers to construct and labour intensive to operate and maintain, there is evidence that they could increase the rental value of a meadow by up to four fold or more.

Water meadows were generally abandoned between 1918 and 1960, being in particular decline due to changing agricultural practices during and after the Second World War. Results of the recent survey commissioned by Hampshire County Council show that:

- Only 4% of water meadows in Hampshire are classified as 'well preserved'
- 40% of water meadows originally recorded in Hampshire have been destroyed. (Subsequent field surveys reveal that more water meadows structures still exist on the ground).

- Between 1970 and 1996 the condition of over a third of Hampshire's water meadows has deteriorated.

The desk-based survey used information gathered from maps and aerial photographs and though highlighting the loss of water meadows over the past 30 years does not record the type and frequency of different structures. For example, the systems along the River Wey are now largely tree covered which prevents easy analysis by aerial photography.

The decline in water meadows has resulted in many of the built structures being destroyed, hidden from view, covered by vegetation or in a near derelict condition.

Water meadows often lie within designated areas for nature conservation such as Special Areas of Conservation (SACs), Sites of Special Scientific Interest (SSSIs). The numerous designations and initiatives secure the nature conservation interest of many water meadows, but few have protection for reasons of historic interest. Very few structures in Hampshire are listed under the Planning (Historic Buildings and Conservation Areas) Act 1990, or are designated Scheduled Ancient Monuments. This may be appropriate to apply to particular structures of known historic importance but it is probably inappropriate for the majority of historic structures to be found within water meadows.

It is, however, important to recognise the intrinsic historic and archaeological interest of these structures if water meadows are not to become merely wetland sites of ecological value which ignore their historic agricultural function and archaeological and landscape value.

This leaflet is intended to provide general advice on the appropriate conservation approach to water meadows structures. The approach will clearly depend on individual site circumstances and other factors but some principles may be laid down.

The level of intervention will vary from 'doing nothing' to full scale restoration, but it is likely that management which promotes awareness of the existence of structures, their location and type and measures to prevent deterioration is an appropriate approach. In some cases burying structures which are not to be used might be comtemplated.

It is useful to show how a typical water meadow was operated to explain how the different structures functioned. (See centre pages).

The sluice was used to direct the river from its natural course. In early structures, timber boards were placed by hand into slotted channels in stone or brickwork to control the flow of water. Normally termed 'hatches' these can vary in size from 7, across a main river to a small single 'bunny' hatch, the size of a spade.

In later structures these boards were raised or lowered mechanically using a variety of iron and timber devices often using a rack and pinion system derived from watermill technology.

The ironwork for such devices was typically produced by local foundries and manufacturers which had traditionally provided machinery for use in watermills. An example on the River Avon was made by Armfields with factories at Bickton near Fordingbridge and at Ringwood. Many examples date between 1880-1910.

The diverted river was fed into a man-made 'carrier' channel which would have smaller sluices – 'hatches' to control the flow of water. These were typically of stone or brick construction depending on age and locally available materials. Where bricks were used they invariably came from local brickworks to reduce transportation problems.
Hatches contained smaller timber boards running in vertical grooves and were hand operated, sometimes using iron brackets to enable levers to assist the operation.
The hatches were used to divert water from the main carrier into a network of channels within the water meadow to control the irrigation. The main carrier could be used to supply water to further sections of meadows.

- The river is damned by the **sluice** or hatch or weir and diverted into the **carrier**.
- A **hatch** is opened to let water into the carrier. The hatch is closed when the carrier is not in use to prevent the system from silting up.
- Water from the carrier is let into the water meadow by a subsidiary hatch and is held up by the **stop** and overflows into each part of the meadow in succession.
  The carriers run along the top of **ridges**, water flowing down the side of the ridge into the **drain** and back to the river. The aim was to achieve a steady flow at a depth through the root mat and stems of the grass sward no greater than 25mm (1 inch).
- In some cases water was directed over the river via **aqueducts** to supply meadows on the other side of a water course, drain or river.
- On many water meadows **bridges** were constructed to enable easier foot and cart access across channels. These may be simple stone slab 'clapper' bridges or more elaborate brick arched structures on later examples. Even later 20th century concrete structures were also used.

The resultant historic landscape form which we now see evident in Hampshire's water meadows is a reflection of these early man-made earthworks and water controls.

Vegetation growth

Some general principles can be applied.

Historic sites are often heavily overgrown with vegetation and can form important habitats for a variety of wildlife. When gaining access to undertake inspection or repairs care must be taken not to disturb vegetation or wildlife unnecessarily.

Structures of stone or brick in a damp environment will naturally attract moss and lichen growth, and in some cases grass where there is a thin soil covering. Their presence is not likely to cause damage to the structure and may be important ecologically and should not be removed. It is, however, important where practical to cut back excessive vegetation if there is a danger that a structure may become overgrown and completely obscured. If the water meadows are regularly grazed then this will usually be the most appropriate method of control.

Larger shrubs and tree growth where root systems are causing damage to brick and stone structures have to be dealt with on an individual site basis with relevant ecological and arboricultural advice. In some circumstances the careful removal of a tree which is causing damage to an otherwise sound brick structure will cause little impact to the landscape or ecological quality of the site. Where a structure has reached the point of dereliction requiring extensive rebuilding, the correct approach may be to consolidate the sound existing structure but accept the loss of some part with vegetation retained but controlled to prevent further damage. The water meadow system can still operate with little loss of historic material.

Trees or shrubs should be cut back to as close to the structure as possible and the root system left to decay in situ. Physical removal will usually result in structural damage. In certain circumstances it may be necessary to treat the stump locally with a suitable biocide to accelerate the process.

Chemical control is best avoided if possible, but in all cases any use of chemicals must take into account safety and potential pollution of the water course. DEFRA and the Environment Agency should be consulted.

Masonry repairs

The conservation of masonry structures should be that of the minimum intervention necessary to consolidate the structure. Cracks and missing bricks need not be a problem unless there is a danger of collapse or they are causing water to be trapped and likely to accelerate decay. It is important not to 'over-restore' historic structures and to use materials compatible with the stone or brickwork.

Mortars should be lime based and weaker than the masonry. Use of hard cement based mortars should be avoided since they will result in accelerated decay of surrounding masonry.

Where new bricks are to be used in rebuilding they should be compatible with the existing brickwork in texture and colour and used in less conspicuous areas where possible, using salvaged bricks for example in the upper courses.

It is always best to plan any work involving mortar repairs when there is little risk of frost. It may be necessary to temporarily dam sections of a water course to allow access to undertake repairs. Licences may be needed for the restoration of structures or work in a

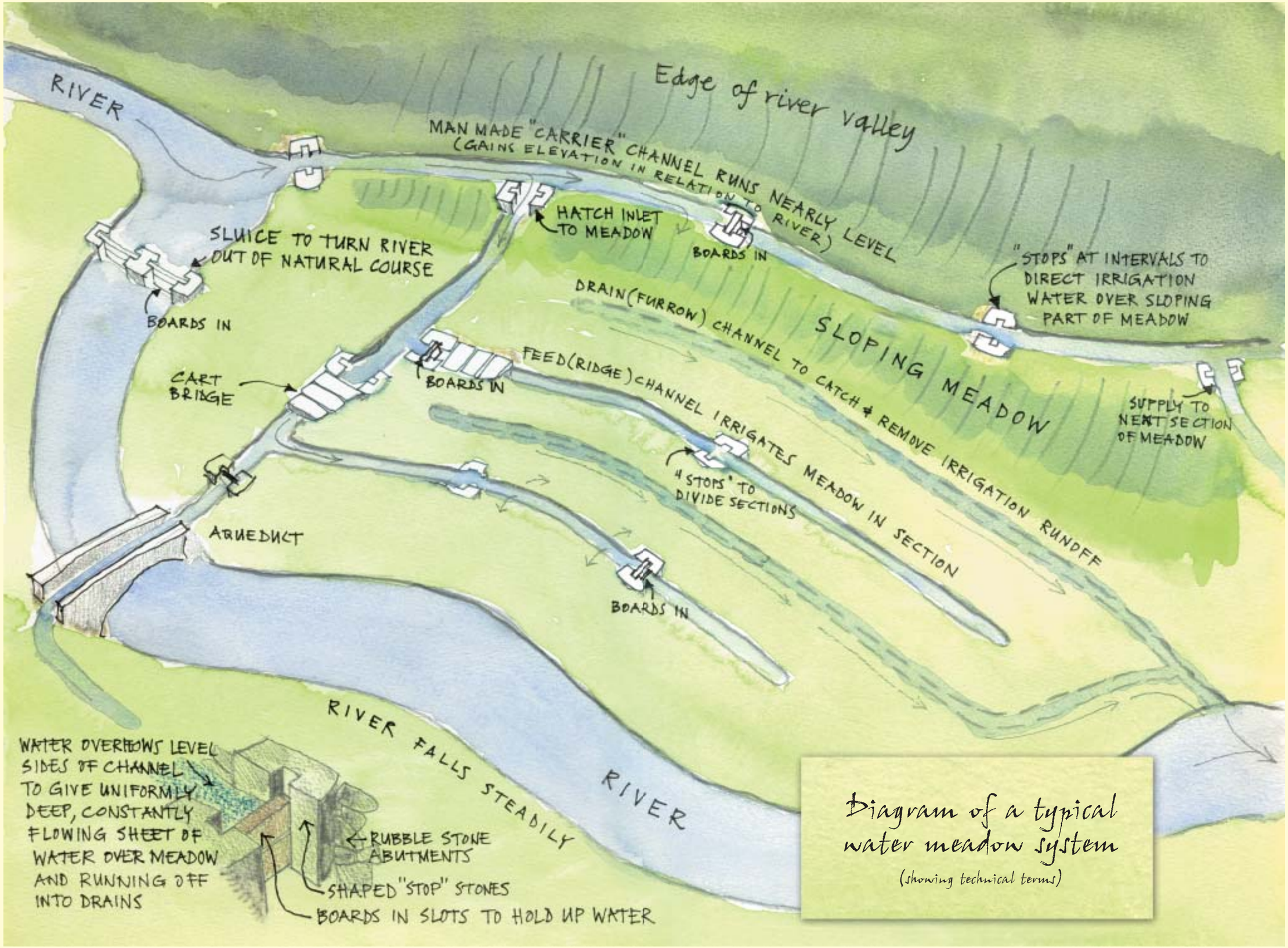

Diagram of a typical water meadow system

(showing technical terms)

river, so **The Environment Agency must be consulted at the earliest possible stage because of a potential impact on the ecology and hydrology of the river system.**

Given the likely damp environment of masonry within water meadows the use of hydraulic limes for repair and repointing is appropriate. These will offer a faster setting time than lime putty mortars but will still be compatible with historic masonry allowing for moisture migration and flexibility. Traditional lime putty mortars may be used for such locations as bridge parapets. Repointing should only be undertaken where the joints in brick or stone are badly eroded. A rule of thumb is if it is easy to rake out using hand tools to a depth of at least three times the joint width.

The lime mortar should be packed well into the joint and the joint left recessed so that the repointing does not accentuate the width of the joint. A stiff brush can be used to tamp the mortar to produce a textured finish, exposing the aggregate and assisting in the weathering of the overall masonry repair.

Where rebuilding is involved it is important to carefully record by drawings and/or photographs and notes the existing structure.

Timber repairs

Inevitably, given the damp environment, the timber used in water control mechanisms is prone to decay. Where possible, surviving sound timber should be salvaged and re-used. Otherwise appropriate new timber of the same dimension should be used in repair. Traditionally, locally available hardwoods such as elm and oak were used in these structures and these are suitable for restoration work. The timber should be seasoned to lessen the possibility of warping and cracking but timber salvaged from outside the site should not be used and will be difficult to work with. Fixing methods should be reproduced where practical and any metal fittings salvaged from existing structures re-used.

Metalwork

Metalwork used in historic water control mechanisms are invariably of cast iron. Cast iron is strong in compression but weak in tension and brittle, so great care must be taken when handling and working on such machinery. It has good resistance to fire and corrosion and so is capable of long-term survival in wet and damp locations. The cast iron fittings found in water meadow structures are often the most important items to conserve since they were often manufactured locally and are difficult and costly to replace.

Towards the end of the 19th century mild steel had become more widely available. This has advantages of being easy to cast, roll or fabricate but is much more prone to corrosion. It is easier and cheaper to replace than cast iron.

When iron or steel corrodes within a masonry structure the expansion effect can cause considerable disruption so it is important to prevent water penetration where such as a situation occurs. Cast iron mechanisms used in sluices are usually attached to timber

sections with nuts and bolts and conservation is relatively straightforward with replacement of rotten timber sections being the most common situation. It is important to carefully record the way the mechanism is constructed before dismantling takes place. This is particularly important when reconstruction is likely to be delayed. The record photographs/drawings and notes should be carefully stored for future use.

The location of all structures and photographs, drawings and notes should be kept safely for future land management. It would also be helpful if a copy was went to the County Council (Landscape Planning and Heritage Group, Environment Department) to enhance the historic environment archive.

Site observations

Where structures are in a reasonably sound and stable condition they should be repaired in situ. There may be circumstances, typically where timber and iron sluice structures are encountered, where there is a real danger to persons or that important items are irretrievably damaged or lost. In such situations, after thorough recording has taken place, the structure should be carefully dismantled and the parts stored safely. This should be the principle whether or not restoration is proposed in the short term. It is important that a record is lodged containing details of the date, location, items stored and record photographs/drawings and notes.

This sluice structure on the River Avon has deteriorated badly. Further delay of the horizontal timber support will result in loss of the cast iron lifting mechanism into the water. In such a situation, after recording, the structure should be carefully dismantled and stored. Timber sections which are sound should be retained. The replacement of the timber components is relatively straightforward but the cast iron components are both difficult and costly to replace.

A shallow arched bridge across water meadows in the Avon Valley. This structure is mostly solid but needs some consolidation to prevent further decay. Loose bricks should be carefully removed and retained for repair purposes. A lime mortar should be used to repoint/repair areas where water can be trapped at exposed parts of the structure. The moss, lichen and grass on the brickwork is not excessive and can be left.

In the same meadow, a brick and concrete structure. Apart from consolidation of loose masonry this requires little attention.

In some situations a vulnerable structure may be protected by simple land management measures. For example, the relocation of a field gate to prevent vehicle damage or provision of simple timber posts to warn of the position of low inconspicuous features.

This tree is causing damage to an otherwise quite sound brick sluice structure. Roots are growing into the brickwork and will result in localised collapse. In this situation, given the life expectancy of the tree, its relatively low ecological and landscape value in an area with many more trees of better quality the decision might be to carefully remove it. It is usually best not to attempt to physically remove the stump or root system but to stabilise the surrounding brickwork and regularly monitor the site to check on further deterioration.

In this example, it might be argued that this mature oak is of such importance in ecological and landscape terms that it must be retained. Some loss of the historic brick structure at its base may be incurred but without affecting the operation of the water meadow system.

The small brick hatch is at the point where unless repairs are carried out soon there is danger of extensive collapse. Rebuilding using salvaged materials is required, though only the top five courses on the left need repair. The salvaged bricks should be used on the most conspicuous parts when rebuilding. The metal channel which the boards run on can be retained if not too corroded. New metal work should be galvanised to reduce future corrosion and risk of rust expansion and masonry damage.

This three arch sluice structure has been carefully repointed with lime mortar and vegetation controlled. The lichen and moss growth is not harmful to the structure and should not be removed – it may have ecological importance and is visually attractive.

Another early water-meadow structure constructed from local stone. The grass has been controlled to ensure that the feature is exposed and can be protected against accidental damage.

This stone hatch shows the grooves for the insertion of sluice boards. Grass kept under control to prevent the structure becoming overgrown and hidden from view.

This brick constructed bridge/sluice is in generally good condition, requiring only localised repointing in lime mortar where joints are deeply eroded.

This vegetation should be carefully removed. If allowed to grow, its root system could cause significant damage to the brick parapet.

Sluice repaired using new timber boards and metal-work salvaged from the original structure.

New concrete structure used where repair or restoration was not possible. The date of the new structure should be recorded. This will depend on local site details - a

simple inscription or discrete non-corrosive plaque would be appropriate.

Salvaged timber and ironwork used in conjunction with new timber. Existing brickwork repaired and reinstated.

Smaller sluice board with original metal fixing mechanism. Boards raised and lowered manually without mechanised assistance.

Cast iron mechanism rescued and salvaged for storage/re-use. It is important to record the original location of these structures.

Brick aqueduct which has become overgrown. Careful cutting back of vegetation required and consolidation of the masonry.

New sluice boards in position. Some brick repair required to sides of channel at lower levels.

A new concrete/brick structure in this restored water meadow system retains the important tree.

Rebuilt structure using salvaged bricks and new metal sluice boards.

Clearly, the management of ditches and channels is an integral part of the water meadow system. **The Environment Agency has produced an advisory leaflet on Ditch Management.** Channels should not be cleared to more than their original dimension (depth and width).

Acknowledgments

Kathy Stearne, DEFRA and Green Mark International
Kevin Stubbs, Centre for the Conservation of the Built Environment
Adrian Bird, River Wey Trust

Contacts

DEFRA Rural Development Service
Government Offices, Coley Park,
Reading, RG1 6DE
Tel. 0118 939 2347

Environment Agency
Colvedene Court, Wessex Business Park,
Winchester SO21 1WP
Tel. 01962 713267

Hampshire Wildlife Trust
Woodside House, Woodside Road,
Eastleigh, SO50 9ET
Tel. 023 8068 8931

Hampshire Farming and Wildlife Advisory Group
Block B, 98 Epsom Road,
Guildford, GU1 2LD
Tel. 01483 404255

English Nature
1 Southampton Road, Lyndhurst,
Hampshire SO43 7BU
Tel. 023 8028 3944

English Heritage (SE Region)
Eastgate Court, 195-205 High Street,
Guildford, GU1 3EH
Tel. 01483 252000

River Wey Trust
12 London Road, Liphook,
Hampshire GU30 7AN
Tel. 01428 722162

Centre for the Conservation of the Built Environment
Bursledon Brickworks Trust,
Coal Park Lane, Swanwick,
SO 31 7GW
Tel. 01489 576248

Landscape Planning and Heritage Group
Environment Department,
Hampshire County Council,
The Castle, Winchester,
SO 23 8UD
Tel. 01962 846832

Written by Mike Clark with Landscape Planning & Heritage, Environment Department

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