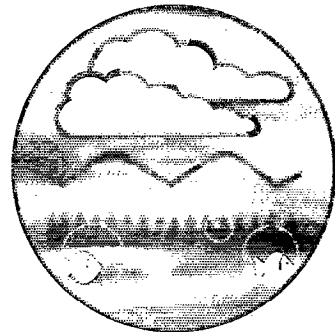
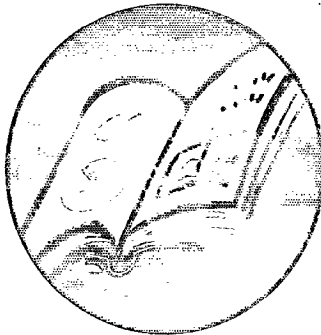
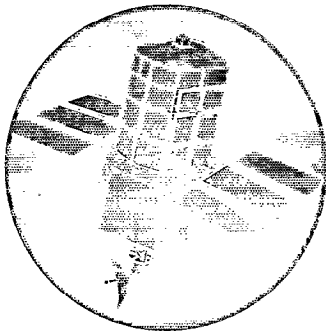


Evaluation of the Effectiveness of the Water Fringe Option Scheme on Environment Quality



Research and Development
Technical Report
W165



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Evaluation of the Effectiveness of the Water Fringe Option Scheme on Environmental Quality

Technical Report W165

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Rio House
Waterside Drive
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Bristol BS32 4UD

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Fax: 01454 624409

HO-04/98-B-BCQR

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Statement of use

This report provides information about the Water Fringe Option Scheme and similar schemes with regard to their effectiveness for protecting the water environment, in order to assist the Environment Agency to contribute to the forthcoming reviews of these schemes.

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EXECUTIVE SUMMARY

RPS Clouston (RPS) was instructed by the Environment Agency on 19th August 1997 to evaluate the Ministry of Agriculture Fisheries and Food's pilot scheme, the Water Fringe Option Scheme (WFOS), and how the scheme fulfils the Agency's duties and objectives. The appraisal of the WFOS involved three interactive stages: Stage I being a detailed literature review using external and internal libraries; Stage II involved discussions and meetings with appropriate Government bodies and NGOs; and Stage III involved field visits to selected pilot areas.

The Water Fringe Option Scheme is a component of the Habitat Scheme and was launched in 1994. Its objective is to encourage farmers to enhance and protect the wildlife habitat value of watercourses and adjacent land. It has been piloted in six areas in England each with specific pressures within the catchment.

Under the WFOS farmers may enter eligible land into three management options: withdraw strips of land from agricultural production for 20 years (Option 1); alter the existing management to extensive grassland management for 10 years (Option 2); or raise water levels on land entered into Option 1 or Option 2. Management prescriptions under these options are set at a national level and are inflexible in terms of addressing local concerns or targeting critical areas. Uptake of the scheme by region and option has varied and a number of influencing factors have been identified including: the different time period for the binding agreement under Option 1 and 2; the method of calculating payment rates and the type of agriculture taking place in the pilot area.

In terms of fulfilling the Agency's objectives, the extensification options available under the WFOS may benefit the Agency, in particular improving water quality and the water fringe habitat. However, significant changes in water quality would require substantial areas of land along the main channel and headwaters to be entered into the scheme. The potential for increased biodiversity of wetland fringes is unclear as different species will gain different benefits from the options. Consultation between the Agency and other organisations is essential to target the location of WFOS sites and ensure their appropriate management.

Generally, water quality is not included in the primary objectives of other agri-environment schemes. However these schemes do contain a range of management prescriptions which have the potential to reduce water pollution from agricultural sources. Proposals have been made to incorporate elements of the WFOS into the Countryside Stewardship Scheme (CSS). This may lead to a change in its design and management, and remove the limitations of the WFOS which have impaired its overall success.

Key Words

Agri-Environment Scheme, Water Fringe Option Scheme (WFOS), Habitat Scheme, Countryside Stewardship Scheme (CSS), Ministry of Agriculture, Fisheries and Food (MAFF), Environment Agency (Agency), Diffuse Pollution, Water Quality, Flood Defence and Water Resources.

1. INTRODUCTION

1.1 Background

RPS Clouston (RPS) was instructed on the 19th August 1997 by the Environment Agency to evaluate the Ministry of Agriculture Fisheries and Food (MAFF) water fringe element of the Habitat Scheme known as the Water Fringe Option Scheme (WFOS). The evaluation sought to identify how WFOS fulfils the Agency's duties and objectives. This section provides a background to the study.

1.1.1 MAFF Duties and the WFOS

'MAFF is responsible for balancing the needs of the farming community with its wider duty to conserve the nations natural resources and by protecting the environment from pollution by agriculture' (MAFF 1995^a).

The Government fulfils its requirement to protect the environment through policies, legislation, education and through its agri-environment schemes, principally Environmental Sensitive Areas (ESA) and the Countryside Stewardship Scheme (CSS). In addition to these, there are a number of schemes targeting specific environments or objectives, these include Nitrate Sensitive Areas (NSA), and the pilot Moorland, Countryside Access and Habitat Schemes. The latter includes, as a component, the Water Fringe Option Scheme (WFOS).

The Habitat Scheme was launched as a pilot scheme in 1994 and was aimed at *'creating or enhancing certain valuable habitats by taking land out of agricultural production, or introducing extensive grazing, and managing it for the benefit of wildlife. The scheme targets three types of habitat:*

- i) *water fringes in six designated areas;*
- ii) *farmland previously in the Five Year Set-Aside Scheme; and*
- iii) *coastal saltmarsh' (MAFF's Website)¹.*

All the components of the Habitat Scheme will be reviewed in 1998/99 along with the other pilot schemes, namely the Countryside Access and Moorland Schemes. The Habitat Scheme is voluntary and a payment is made to off-set any reduction in productivity. The water fringe option of the Habitat Scheme is voluntary and aims to de-intensify farming on the water fringe. A payment is made to off set any productivity lost. The purpose of the scheme is *'to protect and enhance wildlife value of the waterside habitats and of the watercourses and lake themselves by taking adjacent agricultural land out of production' (MAFF 1994^a).* Payments to the farmers under the water fringe element of the Habitat Scheme are currently running at some £250,000 per

¹ address <http://www.maff.gov.uk/environsch/hs.htm>

year ². Approximately half of this amount has been paid by the European Commission.

The scheme is piloted in six areas of England: the Yorkshire Derwent and Rye System in the Vale of Pickering; Swanside Beck and Ings Beck with their feeder streams (both tributaries of the River Ribble) in Lancashire; Fenmere, Crosemere, Berrington and Bretton Pools in Shropshire (referred to as the Shropshire Meres in this report); the River Beult in Kent; the Upper Avon, Wylde, Nadder and tributaries in Wiltshire; and Slapton Ley and its catchment in Devon.

The future of the pilot scheme is uncertain and depends upon the results of the Government's review later this year.

1.1.2 The Environment Agency's Duties

The Agency was established by the Environment Act 1995 which stated its principle aim in '*discharging its functions the Agency is required so to protect or enhance the environment, taken as a whole, as to make the contribution that Ministers consider appropriate towards achieving sustainable development*' (HMSO 1995).

The Agency conducts a range of activities in order to fulfil its principle aim. These can be summarised as *pollution prevention and control* (Integrated Pollution Control, Radioactive Substances, Water Quality and Waste Regulation) and *management of the water environment* (Water Resources, Flood Defence, Fisheries, Conservation, Navigation and Recreation) (Environment Agency 1996). Environmental monitoring and surveillance of the environment is conducted across all the mediums in support of the duties discussed above. Many of the activities have implications on its other functions, for example, the removal of shrubs and vegetation in flood defence management conflicts with the management of habitats for nature conservation in the riparian zone.

The Agency is a statutory member in the consultation process of the pilot schemes when they come under review in 1998/99. By examining how the WFOS interacts, facilitates or hinders the Agency in fulfilling its objectives and duties, this report aims to provide comment and observations upon which the Agency may formulate its conclusions and opinions prior to the consultation process.

It should be noted that the comments expressed in this report are only the views of the authors and are not necessarily those of the Agency.

² Data provided by Bryan Symes MAFF Conservation & Rural Development Division.

1.2 Report Structure

The report is structured to provide an easy interpretation of the scheme and to allow cross reference between chapters and interpretation of the findings. Chapter 2 of the report identifies the methodology adopted in evaluating the WFOS. Chapter 3 examines the WFOS with respect to: design; management and implementation; uptake; and monitoring. Chapter 3 also provides comments on any noted environmental improvements brought about through the scheme. Chapter 4 examines how the WFOS may interact with the Agency's duties. Chapter 5 examines the differences between other agri-environment measures and the WFOS, in particular drawing upon any evidence of improvement concerning the water fringe environment. Chapter 6 discusses the merits and disadvantages of the scheme with respect to the Agency and concludes how it may be modified to fulfil better the Agency's objectives.

2. METHODOLOGY

2.1 General

This section identifies the general methodology adopted in identifying and assessing data sources, key contacts and site visits. The appraisal of the WFOS involved a number of key steps. The steps were not mutually exclusive and all interacted, leading to the development of a large volume of information. The three stages were:

- I. a detailed literature review using external and internal libraries;
- II. discussions and meetings with appropriate government organisations and NGOs; and
- III. field visits to selected pilot areas.

2.2 Literature Review

Internal and external library resources were used to identify relevant contacts and articles concerning how the WFOS:

- may operate as a pollution buffer, conservation and landscape resource;
- may fit within agricultural and environmental protection policies;
- compares against other agri-environment measures in design and management; and
- may effect the environment. Information has been collated from the evidence of environmental change under different agri-environment measures.

2.3 Consultations

Consultations with relevant organisations and Agency staff were conducted through meetings and by telephone conversations. Table 2.1 illustrates the local Agency offices responsible for each pilot area.

Consultations with the Agency were conducted at all levels, to ascertain data and opinions from national perspectives down to those at a local level. A proforma was used for consultation with regional and local Agency offices to obtain structured information concerning the range of pressures and pollution hazards on each stretch of river. This helped the authors to identify possible data sources, the type of agriculture in the catchment and its potential to pollute the watercourse in the context of other types of local pressures and land uses.

Table 2.1 WFOS Pilot Areas and Relevant Environment Agency Offices

Pilot Area	Agency Region	Agency Local Offices
Rivers Avon/Nadder/Wylfe	South West	Blanford Forum
Shrophire Meres	Midlands	Shrewsbury
River Derwent and Rye	North East	Ridings
River Beult	Southern	Addington
Swanside/Ings Becks	North East	Preston
Slapton Ley	South West	Exeter

Meetings were held with MAFF, WFOS managers, Farming Rural Conservation Agency (FRCA) - the organisation responsible for implementing the scheme - and ADAS who were responsible for conducting the environmental monitoring.

Conversations and meetings with FRCA project officers were restricted by FRCA to two pilot areas so as not to duplicate work being conducted in the preparation of a report by FRCA field officers. The authors of this report understand that the FRCA report will identify deficiencies and/or benefits of the scheme and provide practical advice concerning implementation, management, prescription design and reasons for an apparent low uptake. The authors believe that that report will be a valuable document in identifying areas where implementation and management of the scheme may be improved.

The authors have had several meetings and conversations with the ADAS team compiling the environmental monitoring report on the WFOS on behalf of MAFF and some data has been acquired. Where this data has concerned the water fringe, it has been included in this report. Uptake of the scheme and the environmental changes to bank condition and infield and riparian flora i.e. the terrestrial benefits will be analysed in the ADAS report. This report should be a key tool in identifying components of the scheme beneficial to improving the water environment.

Further consultations have been made with MAFF, FRCA and English Nature officers responsible for the additional agri-environment measures.

2.4 Site Visits

Site visits have been conducted on two of the pilot areas. These have included visits to the River Derwent and Rye and River Avon accompanied by the appropriate FRCA project officer.

Swanside/Ings Becks (River Ribble) Pilot Area was also visited but without the FRCA project officers and accordingly specific areas within the scheme could not be identified. However these visits allowed the authors to obtain a visual indication of the river channel and the condition of the water environment.

2.5 Observation

Due to the nature of the project and the unavailability of key documents, such as the ADAS report, many of the conclusions of this study are based on anecdotal evidence provided by MAFF, ADAS, FRCA and Agency officers.

With the publication of the reports on the current management of the WFOS (FRCA report) and the environmental changes caused due to the scheme (ADAS report), the authors' observations and subsequent conclusions may need to be reviewed. However, the authors believe that the findings and conclusions of this report should still remain valid.

3. WATER FRINGE OPTION SCHEME

3.1 Background

This section reviews the WFOS with respect to its design, management, implementation and uptake, future of the scheme, and the environmental monitoring and results undertaken by ADAS where appropriate to this study.

The Habitat Scheme was launched in 1994 as a component of a number of measures implementing EC Council Regulation 2078/92 on Agri-environment Regulation and is part funded by the European Union. The Habitat Scheme aims to encourage farmers to *'create or enhance valuable wildlife habitats on their land in return for annual payment'* (MAFF 1996^a). The Habitat Scheme is made up of three specific options, namely the water fringe, coastal saltmarsh and former set-aside land.

In 1993, MAFF recognised that the quality of waterside habitats in England was in decline. The WFOS is a pilot scheme aiming to enhance and protect the value of the watercourses and the adjacent land by encouraging farmers to manage the waterside land in an appropriate manner.

3.2 WFOS Design

Under the WFOS farmers may enter land immediately adjacent to the pilot watercourses into three management options which either:

- i) withdraw strips of land from production for 20 years;
- ii) revert existing management to extensive grassland management for 10 years; or
- iii) raise water levels on land entered into i) or ii).

3.2.1 Withdrawal from Agriculture

This option requires the farmer to withdraw from production a strip of land between 10 and 30m wide to create a buffer. Land may be withdrawn from production from permanent grassland (Option 1a) and arable production (Option 1b). Where a field is narrow the whole field may be entered into the scheme if it will enhance further the benefits of the scheme. Land up to 20m from the riparian edge may be entered into the scheme if it is separated from the watercourse by non-productive land. Land entered into this option is removed from production for 20 years and the scheme provides no 'break clause' to allow the farmer to opt out at a specific period of the agreement³.

³ A break clause is operated under the ESA scheme and is included to allow the farmer to release his land from the agreement with no penalty after 5 years.

The management of the buffer strip is agreed between the farmer and the WFOS local project officer. The management options are designed to be flexible as the vegetation changes overtime and include:

- i) leaving the buffer strip unmanaged letting it develop into scrub;
- ii) cutting the vegetation growth at specific times of the year; and
- iii) or a mixture of these two basic options.

If arable land is entered into the scheme, the farmer is required to establish a sward of grass (with an approved seed mix) within 7 months of joining the scheme. After mowing, cuttings must be removed from the buffer strip and disposed of by means unlikely to cause pollution, for example being fed to horses. This practice aims to gradually reduce nutrients in the soil which may facilitate an increase in sward biodiversity.

The management of Option 1 land does not provide any capital payments to encourage planting of trees or shrubs which may increase the buffer's wildlife value or stabilise river banks. The buffer strip must be fenced off if livestock occupy adjoining land, and a capital payment is available to allow farmers to comply with this requirement.

3.2.2 Extensive Grassland Management

This option allows the farmer to undertake extensive grassland management on former permanent pasture (Option 2a) or arable land (Option 2b) on a proportion or the whole field adjacent to the watercourse. The agreement is for 10 years. There are no specific management agreements with the farmer although he/she must continue to graze the land with livestock but avoid inappropriate grazing pressures. The grazing pressure should be adjusted throughout the year to minimise the likelihood of over or undergrazing, poaching, or disturbance to the ground nesting birds during April and May. The latter period requires stocking densities to be no more than 1.4 livestock units⁴ per hectare.

If land is entered from arable production (including short term leys) then cultivation and re-seeding is required to create a sward within 7 months, or where practical, within 3 months. If it is considered that the cultivation and re-seeding of short-term leys would create a pollution risk to the watercourse, or if the naturally regenerated cover is of particular environmental value, then the existing sward is left. Re-seeding is completed with an approved mix of grasses to create greater biodiversity.

3.2.3 Raised Water Level Supplement

A farmer may enter his Option 1a/b and 2a/b land for a supplemental payment aimed at raising water levels in surrounding drainage channels and/or decreasing in-field drainage capabilities. The maintenance of high

⁴ Livestock units are a Government measure of grazing intensity/per year

water levels from December to the start of May would potentially benefit over-wintering or breeding bird species, particularly waders. Reducing infield drainage will increase the soil moisture content favouring species tolerant of prolonged wet conditions. The supplementary payment covers the same duration as the land upon which it is entered (for example Option 1a).

Alteration to existing drainage systems has implications for the duties of other statutory agencies and consultation should take place and agreements reached with these bodies prior to its implementation. Appropriate agencies include the relevant Internal Drainage Boards (IDB) and the Agency.

If the site is considered to be of conservation importance (it may also be affected by soil moisture changes) the relevant conservation groups need to be contacted. This includes English Nature, local authorities and the local wildlife trusts for nature conservation; and English Heritage and the County Archaeologists for areas of archaeological or historic interest.

Furthermore, the alteration of field drains may effect the drainage of surrounding land. Landowners and their tenants should be contacted if their land is likely to be affected any changes.

3.2.4 Standard Management Prescriptions

Land entered into the WFOS under both Options 1 and 2 are subject to standard management prescriptions which facilitate good management and the reduction of harmful inputs onto the land. These include:

- no applications of inorganic or organic fertilisers;
- no applications of lime, slag or other substances to reduce soil acidity;
- no application of fungicides or insecticides;
- reduced and controlled applications of approved herbicides to control non-indigenous weeds. Control of other weeds is conducted only by hand-held wiper or spot treatment;
- controlled removal of bracken;
- no dumping or storage of pesticides (including sheep dip);
- MAFF and other agencies must agree any proposed tree and shrub planting;
- retain and manage existing trees, shrubs and hedges on or bordering the agreement area;
- maintain existing watercourses, ditches, ponds, pools and reed beds within or bordering the agreement area;

- no installation or modifications to existing land drainage systems which may bring about improved drainage;
- management of the area should not damage/destroy or remove any traditional buildings, stone walls or features of archaeological or historic interest;
- the requirement to obtain written advice from the local project officer on citing and materials before constructing buildings/roads/ or other engineering operations which do not require planning permission or prior notification determined by the Local Planning Authority; and
- the agreement with MAFF of any additional public access to the agreement areas.

3.3 WFOS Pilot Areas

The WFOS is piloted in six areas. The authors assume that the selection was achieved through a consultation process involving the National Rivers Authority (now the Agency), English Nature, ADAS and MAFF.

The following sections identify the specific pressures within each of the pilot areas and MAFF's reason for selection as provided in the MAFF Press Release of 16th May 1994 (MAFF 1994^a) (words in italics).

3.3.1 River Avon

'The River Avon above Netheravon and the River Wylye and River Nadder and their tributaries near Salisbury form part of one of the best chalk rivers systems in England which is noted for its rich wildlife habitats. The rivers support some 27 species of fish, including Brown Trout, dace and grayling, as well as a diverse river flora. The river banks are likely to be a key area for otters as they spread eastwards from the south west of England. The Avon south of Netheravon is already included in the Ministry's Environmental Sensitive Areas Scheme'.

The upper River Avon and its tributaries are a fine example of a chalk river system. The traditional extensive pastoral farming on the water fringes has created species-rich meadows adjacent to the watercourses. The river system in the pilot area is designated as a Site of Special Scientific Interest (SSSI) due to the range of species supported by the chalk rivers.

In recent times, land use and management changes have caused stress to both the river system and adjoining land. In the Upper Avon and its tributaries, changes in the intensity of pastoral farming practices and the increase in arable production have been cited as the driving factor in the deterioration of the water environment. The rivers are suffering from a condition termed 'chalk malaise' which is symptomatic of changes in agricultural practice, from extensive pasture to arable production. Chalk malaise can be described as a deterioration in the aesthetic quality of the river and sedimentation of gravel beds. Chalk malaise, which is often associated with a decrease in

stream biodiversity, is particularly acute with respect to fish populations and the effectiveness of spawning grounds.

3.3.2 River Beult

'The River Beult is the longest tributary of the River Medway. It is a typical clay catchment river which carries water draining off the Kentish Weald. The river and riverside vegetation support a range of different species, including water plants such as Yellow Lily and birds such as Reed Warbler, Reed Bunting and kingfisher, as well as scarce dragonfly species such as the White Legged Damselfly and the Ruddy Darter Dragonfly.'

The River Beult is a fine example of a clay based river system. The river is highly ephemeral in nature due to the impervious geology, with 'flash' floods occurring in periods of high rainfall and low run-off rates during summer. The river flows through an agricultural catchment with grazing for sheep and cattle, orchards and arable land. The river flows are dependant upon surface run-off and weirs constructed in spring to maintain flow levels.

The River Beult is one of the few remaining streams that still retains the characteristic flora and fauna of a clay based river system. The river supports some 100 different types of vegetation, providing a variety of habitats and a diverse range of invertebrates and birds. Due to this diversity of flora and fauna, the river is designated as a SSSI (English Nature 1994).

Currently, the river is suffering high levels of nutrient enrichment due to the presence of a large number of sewage outfalls and the contribution of agricultural inputs. The channel has been extensively modified to accommodate the 'flashy' nature of the flow; English Nature have cited that this has historically caused a reduction in the diversity of the river system.

3.3.3 Derwent and Rye System

'The Derwent and Rye system in the Vale of Pickering is an extensive river system draining off the North York Moors and the fertile agricultural land of the Vale of Pickering. An important objective of the scheme is to improve the water environment to the benefit of fish such as Brown Trout, grayling, dace, barbel and chub, as well as river flora such as Water Crowfoot, and to extend riverside habitats to the benefit of plant species such as Marsh Marigold.'

The pilot area lies within the Vale of Pickering, which is dominated by arable production, in particular winter cereals and potatoes. Many of the fields are cultivated up to the river bank as Plate 1 which shows a small narrow field sown with winter cereals on the bank edge.

Despite the Derwent river system undergoing significant channel modification from the 19th Century through to the 1970s, the river is predominantly of good chemical and biological quality. The river has many flood banks set back from its main channel and tributaries. The flood banks

are generally maintained as grassland grazed by livestock throughout the year. Arable production occurs up to the flood banks as shown in Plate 2.

Similarly to the Derwent system the River Rye's main channel is flood banked along a proportion of its length, however the channel has not been heavily modified and the river boasts high fish populations.

3.3.4 Shropshire Meres

'The Shropshire Meres (Fenmere, Crosemere, Berrington Pool and Bretton Pool) near Shrewsbury are nationally important open water sites which support rich populations of aquatic plants, animals and birds such as White and Yellow Water-lilies, dragonflies and over wintering birds such as the Little Grebe'.

The area is dominated by intensive agricultural production and no land has been entered into any of the options under the WFOS since its implementation. Consequently, the pilot area has not been studied in detail.

3.3.5 Swanside Beck, Ings Beck

'Swanside Beck and Ings Beck and their feeder streams, tributaries of the River Ribble, are important spawning areas for salmon and trout coming from the River Ribble, as well as for dippers and kingfishers. An important objective of the scheme is to improve the quality of the water environment for salmon and trout, as well as for the river birds such as dippers and kingfishers'.

The agricultural systems operated in the River Ribble catchment and the pilot study area of Swanside and Ings Becks are characterised by livestock rearing and dairying. A few short term leys occur in fields adjacent to the watercourse although none were identified at the time of the site visit. The rivers meander and are predominantly unmodified with mature trees on either bank. Livestock is excluded from several reaches of the rivers by stone walls and stock-proof fences. The rivers' flow regimes alter along the channel with varying depth and bed composition, the latter mainly consisting of gravels and stones.

The Agency indicated that these channels were of good quality with no monitored signs of stress except that fish populations and spawning rates have decreased in recent years. The Agency's monitoring station on the rivers has not been able to identify any changes in chemical or biological quality. The Agency conducted a site survey into the causes of the decline in spawning and could not identify any significant pollution sources from the surrounding land. Sediment has been indicated as the possible pollutant responsible for decreasing spawning rates. Potential sources of sediment within the pilot area are the short term leys and muddied footpaths which run along the bank edge. However it has been suggested that moorland (and common grazing land) from which the tributaries drain, is a more likely source of sediment.

3.3.6 Slapton Ley

'The Slapton catchment in South Devon feeds the Slapton Ley, the largest natural freshwater coastal lake in south-west England. The Ley is a statutory National Nature Reserve. The reserve holds over 490 species of plants including the nationally rare Strapwort. Important animal populations supported by the rich aquatic habitats include otter and over 10% of British Cetti's Warbler'.

The Ley is fed by a network of small streams which feed the River Gara (feeding into the Higher Ley) and the Start River (feeding into the Lower Ley). The catchment is predominantly rural and the agricultural land use is dominated by mixed farming which has recently increased in intensity (Tytherleigh 1997). Subsequently, Slapton Ley has suffered from increased nutrient and sediment loads.

3.4 WFOS Implementation

The scheme is operated and funded by MAFF, however it is implemented by the local project officers from the Farming Rural Conservation Agency (FRCA) (formerly ADAS). The project officers play a critical role in determining the uptake of the scheme because they are directly responsible for promoting the scheme to farmers (conducted through mail shots, meetings and visits). In addition to their promotional duties, the FRCA officers are responsible for the management of the scheme once the agreement is in place. This includes: designing the management agreement; monitoring vegetation development and altering management prescriptions accordingly; advising the farmer on implementation and liaising with other agencies where conflicts of interest arise; and ensuring that the management prescriptions are complied to.

The local FRCA project officer is the principle liaison between relevant government and non-governmental organisations at a local or regional level. It should be noted that the author believes that there is no statutory requirement for the FRCA officer to consult with these agencies or NGOs.

The levels of consultation between FRCA officers and the Agency varied considerably between the pilot areas, ranging from structured discourse with a sharing of information concerning the location of land entered into the scheme, to zero contact after the initial set-up of the scheme.

3.5 WFOS Payment Rates

The payment rates offered to the farmers for entering their land into the management prescriptions offered under withdrawal and extensive grassland option are calculated on 'income forgone'⁵ and the cost of implementing and managing the scheme. The income forgone can vary according to market

⁵ 'Income Forgone' is calculated on the gross loss of production as experienced under the scheme. An incentive element may be added where necessary, but must it will not normally exceed 20 percent of income forgone and costs.

trends and as a result payments may fluctuate. Payment rates changed in 1996 when the funding for various options altered. The current and initial payment rates are shown in Table 3.1 below. In a MAFF press release in March 1996, the payment increases were justified to bring a greater area of arable land into the scheme in order for the WFOS to achieve fully its environmental objectives.

Table 3.1 WFOS Payment Rates

Description	1994 £/Ha	1996 £/Ha
<i>Option 1</i>		
a) Withdrawal from Permanent Pasture	240	240
b) Withdrawal from Arable Production	360	485
* included as part of the farmers set aside quota		405*
<i>Option 2</i>		
a) Extensive Grassland Management from Permanent Pasture	125	125
a) Extensive Grassland Management from Arable Land	260	435
<i>Option 3</i>		
Raised Water Level Supplement	40	40

Source: MAFF 1996^a.

3.6 The Future of the WFOS

In 1995 the Government stated that it would:

- *'give high priority to providing the extra funds necessary to enable Stewardship to continue to grow as the Government's main incentive scheme for the wider countryside outside Environmental Sensitive Areas'; and*
- *'further expand Stewardship by integrating its payments for conservation purposes under the Farm and Conservation Grants Scheme; and consider further integration with the Habitat Scheme, the Countryside Access Scheme and the Moorland Scheme when they complete their pilot phase in 1998/99' (DoE & MAFF 1995).*

This would suggest that in the near future the WFOS may be incorporated into the Countryside Stewardship Scheme. More recently the Government's Agricultural Committee made further recommendations which endorsed the 1995 proposal. However, the recommendations also cast doubt as to whether, in the long term, the Countryside Stewardship Scheme would continue in its current format. These recommendations included:

- *that it is 'too early to make a definitive judgement on whether the Countryside Stewardship Scheme will be adequately resourced to achieve its objectives, and we note that the funding of the scheme is set to increase substantially over the next few years'; and that*
- *'the integration of all schemes [agri-environment] into a single national framework is logical and appropriate, and should provide*

clear efficiency benefits in monitoring and administration, as well as making schemes more comprehensive and attractive to farmers and assisting in the co-ordination of agri-environmental objectives. (MAFF 1997^h).

It should be noted that the long term future of the Countryside Stewardship Scheme remains undecided due to the strains on funding and the uncertainty of how management of the environment can be best and most effectively achieved through the Government's agri-environment schemes. This is highlighted in the Government's declaration that it will *'reflect on the recommendation [of the Agricultural Committee] that in the longer term English ESAs and the Countryside Stewardship Scheme could be amalgamated, alongside other options such as promoting closer compatibility between agri-environment schemes'* (MAFF 1997^h).

3.7 WFOS Uptake

Since its implementation in April 1994, approximately 1088 hectares of land have been entered into the various water fringe options. The uptake by time, region and option has been varied. Figures 3.1 and Table 3.2 show the extent of land submitted into the various options.

The authors believe that the reasons behind the different levels of uptake within the pilot areas and the individual options depend on a number of factors. These are:

- i) *the different time period for the binding agreement under Option 1 and 2.* Option 1 (a and b) binds the farmer into a 20 year agreement, removing their land from production for this duration. Water Fringes are often some of the most fertile and productive soils in a catchment. The farmer may be unwilling to take this land out of production for this length of time when a shorter option is available, as in Option 2 (a and b). The issue of the period for the binding agreement affecting uptake was highlighted in the Government's response to the Agriculture Committee, however it was noted that the inclusion of a break clause was constrained by legislation concerning environmental set aside land (MAFF 1997^h).
- ii) *the payment rates being calculated on income forgone.* Income forgone offers no incentive to bind the land into an agreement lasting a minimum of 10 years. A payment which only reflects lost production and not the loss of farming system flexibility may affect the long-term viability of the holding. This might explain the low uptake for Option 1 which has a binding agreement of 20 years. Anecdotal information suggests that this may be the reason for the zero uptake surrounding the Shropshire Meres which is a highly productive arable region.

The Supplement Payment for raising water levels does not include a capital payment provision to offset the additional cost of construction materials required. Typically, these capital works could include either constructing a sluice or purchasing sand bags, as shown in Plate 3, to maintain water levels in ditches. Likewise a farmer intercepting field drains might experience diminished profitability. The farmer would need to spend time re-inserting the field drains at the end of the agreement period to return his land to full productivity. A sum of £40/hectare appears to be little compensation to offset the cost of lowering of productivity (with reduced land drainage) or for the capital expenses involved in damming up ditches or maintaining water levels;

- iii) ***the type of agriculture taking place in the pilot areas.*** The type of option a farmer may enter his land into is dependant upon its current use. The greater the proportion of pasture land in the pilot area the greater the uptake of Option 1a and 2a land;
- iv) ***the suitability of the land.*** Local physical characteristics of the site or non-agricultural management practices may determine the suitability of the site to each of the options. For example, the River Derwent is characterised by the flood banks running adjacent to the river bank. Although arable production takes place up to the flood bank, extensive grazing mainly takes place across the banks and down to the water's edge. Therefore Options 1b and 2b are unlikely to have a significant uptake within these areas.

The supplement for raising water levels may be compromised by the existing wetness of the soil. Conversations with various bodies involved at the Slapton Ley pilot area suggested that the uptake of Option 3 was affected by the soils already being extremely wet. The supplement was perceived as acting to make the soil even more moist which would render the soil unacceptable for livestock, dairy or for arable production; and

- v) ***the level of promotion by the local project officer.*** The numbers of farmers entering the scheme may be determined by the level of activity of the FRCA officer in promoting the scheme or particular aspects of it. For example, if, after the FRCA project officer had consulted with the Agency or English Nature and an aspect of the scheme was thought to be inappropriate they may decide not to actively promote it reducing the uptake of the option.

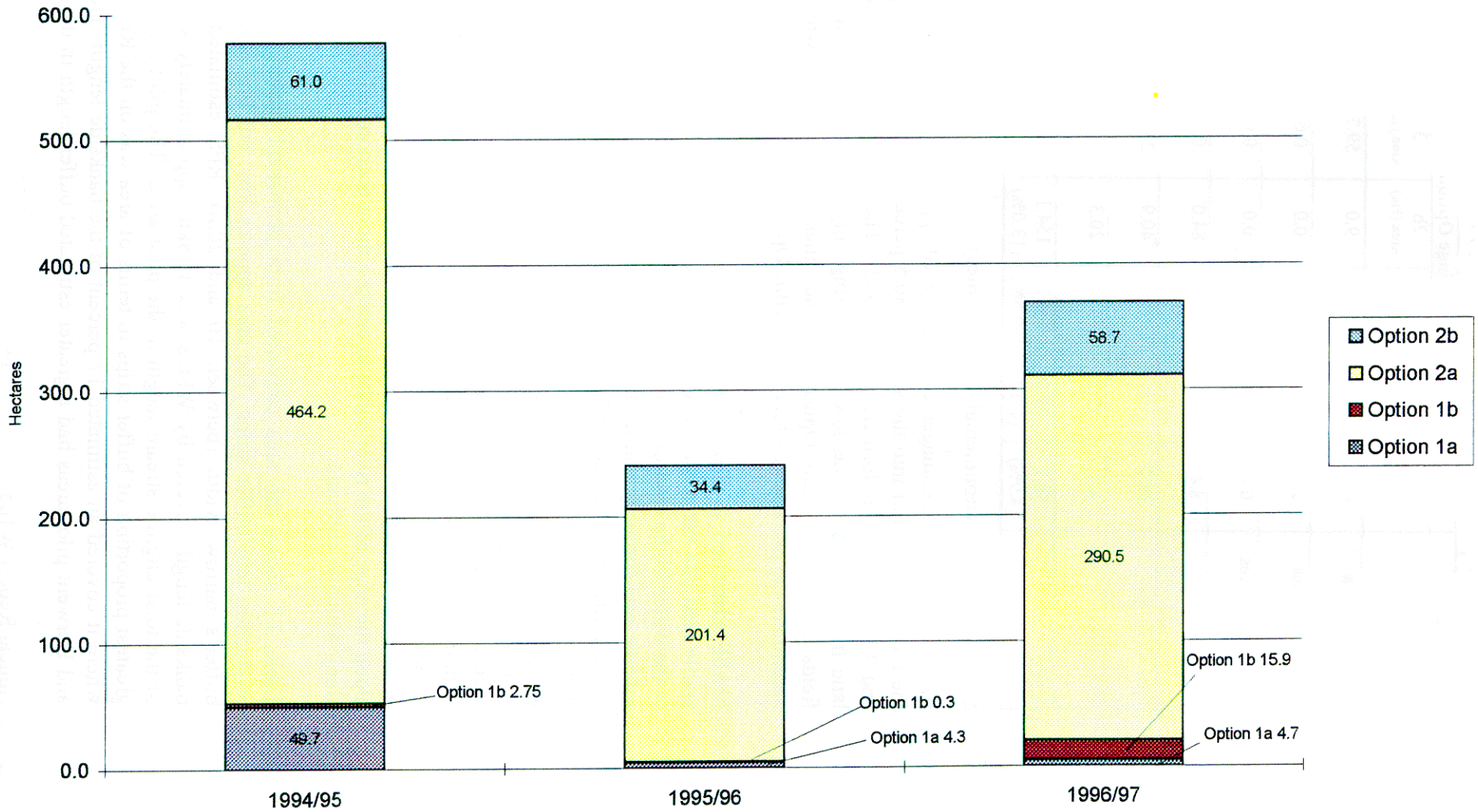


FIGURE 3.1. Water Fringe Option Scheme: Land Uptake by Option and Year

Table 3.2 Uptake of WFOS up to April 1997

Pilot Area	Water Fringe Option						Total No. of Agreements
	1a Area (Ha)	1b Area (Ha)	2a Area (Ha)	2b Area (Ha)	3 Area (Ha)	Total Area (Ha)	
Avon, Wylde & Nadder	14.7	4.5	585.7	9.0	59.7	613.8	75
Ribble Tributaries	2.5	0.0	81.5	0.0	0.0	84.0	14
Shropshire Meres	0.0	0.0	0.0	0.0	0.0	0.0	0
Slapton Ley	8.4	0.5	42.4	84.0	0.0	135.2	17
Derwent & Rye	29.0	0.5	165.6	40.9	23.0	236.0	24
River Beult	4.1	13.5	81.0	20.3	0.0	118.9	23
Total	58.7 (4.9%)	19.0 (1.6%)	956.1 (80.5%)	154.1 (13.0%)	82.7	1187.9	153

Source: MAFF Environmental (Bryan Symes)

Extensive grassland management represented approximately 93.5 percent of the total land entered into the scheme (80.5 percent from permanent pasture and 13 percent from formerly arable land). The permanent withdrawal of land from production was low, representing only 6.5 percent. Whole or part fields are entered into Option 2 rather than buffer strips, which may accentuate the percentage of land under this Option.

MAFF identified in their press release in 1996 that the incorporation of arable land into the scheme could potentially bring about the greatest benefit to the water fringe environment. Only 15 percent of the land entered into the scheme was formerly arable. The arable area withdrawn from production to create buffer strips remained low throughout the monitoring period, although it did increase after the new payment rates were introduced in 1996. The amount of arable land converted into extensively managed grassland under Option 2b dropped after the first year but like Option 1b increased with the higher payment rates. The authors noted that many of the arable areas withdrawn from production or converted to extensively managed grassland were formerly difficult to cultivate or manage due to their topography, shape or size. Many farmers had taken a narrow band out of arable production along the edge of the river banks to create a more economical field boundary along which to cultivate.

Table 3.3 shows the area converted from permanent pasture and arable production into buffer strips. The area appears low, but this is due to the buffer's narrow width (between 10 and 20m). RPS estimated that the bankside length covered by WFOS was 38.8km, approximately 4.8 percent of the total eligible stream length in the pilot areas. The pilot area with the greatest proportion of buffer strips in terms of area was on the River Beult, where it covered an estimated 17 percent of the bankside length. The Avon and Derwent pilot areas had a greater estimated buffer length in the scheme

but proportions were small in terms of the total eligible bankside length. Detailed clarification on the eligible area under Option 1 agreements may be provided in the ADAS report.

Possibly because of its funding or unsuitability to the pilot areas, the uptake of the Supplement Payment (made to farmers) to raise water levels in surrounding ditches or to reduce infield drainage capabilities has been extremely low. Obtaining the necessary permissions for altering existing drainage systems from the agencies listed in 3.2.4 may be inconvenient for farmers in terms of delays. Only 7 percent of the total area within the WFOS has a supplementary payment and these areas all lie within the Avon and Derwent and Rye pilot areas.

Table 3.3 Buffer Strip Creation

Pilot Area	Total Eligible Bankside Length (km)	Area in Buffer Strip (Ha)	Buffer Strip Bankside Length (km)	Proportion of Total Length (%)
Avon, Wylde & Nadder	237	19.2	9.6	4.0
Ribble Tributaries	50	2.5	1.2	2.5
Shropshire Meres	4.8	0.0	0.0	0.0
Slapton Ley	162	8.9	4.4	2.7
Derwent & Rye	295	29.5	14.7	5.0
River Beult	52	17.7	8.8	17.0
Total	800.8	77.6	38.8	4.8

Source: MAFF Environmental

Buffer Strip Bankside Length is estimated by dividing the buffer area by the average buffer width (RPS presume average width to be 20m).

3.8 Environmental Monitoring and Preliminary Results

ADAS (consultancy) were commissioned by MAFF to monitor the WFOS to assess whether its objectives are being fulfilled. The monitoring strategy was to examine the following:

- *land use and uptake.* The land use was examined to provide contextual information concerning the scheme and to estimate the eligible area. Information concerning land use was collated from aerial photography and remotely sensed data. The eligible bankside length was calculated from the land use data and this was then used to assess uptake. Land entered into the scheme was recorded on a Geographical Information System (GIS) and areas and bankside length were then calculated;
- *landscape.* The landscape characteristics of each pilot area was assessed and described. The information provided a context within

which to describe the changes brought about through the uptake of the WFOS;

- *changes in vegetation composition.* Species were sampled using quadrats in a range of fields selected to provide an overview of the various options within each pilot area. The data collected is to be assessed and manipulated into performance indicators which can be further linked to the vegetation's capability to support particular types of fauna. The authors understand that these performance indicators are being employed to determine the water fringe's suitability to support the water vole; and
- *water quality.* At the outset of the project water quality was to be examined using National River Authority data provided from their routine monitoring sites. In addition, supplemental information could be provided by River Corridor Survey (RCS) data. Furthermore, to provide an indication of changes in bank disturbance due to livestock on land in the WFOS the number of muddied access points was to be monitored.

It is the authors' understanding that the water quality benefits of the WFOS will not be included in the ADAS report due to the lack of 'useful' data. The RPS report also does not assess actual changes in water quality brought about under WFOS as the authors believe that information available is not sufficiently detailed, as:

- i) General Quality Assessment data available from the routinely monitored stations only includes reactive determinants in the water environment, including ammonia, dissolved oxygen and biochemical oxygen demand. This may fail to identify the particular benefits of the scheme, possibly reduced sedimentation, pesticides or nutrient enrichment;
- ii) monitoring points under the GQA system are at specific locations which may not coincide with areas entered into the WFOS. Furthermore, pollution entering the watercourse from alternative sources (non-agricultural and agricultural land not within the WFOS) may influence the monitoring results. Subsequently, it is the authors' belief that the GQA data would relate poorly to changes in water quality brought about through the scheme; and
- iii) the poor availability of River Corridor Surveys (RCS) and River Habitat Surveys (RHS) data within the pilot study boundaries and the WFOS duration. Furthermore, it would be impossible to assess those reaches of the RHS and RCS which coincided with land entered into the agreement.

Theoretical benefits and issues are identified in Chapter 4.

4. WATER FRINGE OPTION SCHEME AND THE AGENCY

4.1 Background

This section examines the relationship between the WFOS and the Agency's duties. To identify the relationships, this report examines the differing types of Agency activity and examines how they interact with the WFOS.

4.2 Agency Objectives and Duties

The Agency's principle aim, as stipulated in the Environment Act 1995, has led to the development of a number of specific Agency objectives which relate to the water environment, namely:

- i) *'to achieve significant and continuous improvement in the quality of air, land and water, actively encouraging the conservation of natural resources, flora and fauna;*
- ii) *to maximise the benefits of integrated pollution control and integrated river basin management;*
- iii) *to provide effective defence and timely warning systems for people and property against flooding from rivers and the sea;*
- iv) *to manage water resources to achieve the proper balance between the needs of the environment and those of abstractors and other water users;*
- v) *to improve and develop salmon and freshwater fisheries; and*
- vi) *to conserve and enhance inland and coastal waters and their use for recreation'* (Environment Agency 1996).

These objectives relate to two types of duties: Pollution Prevention Control and Water Management. The key activities within these categories are shown in Figure 4.1.

It should be noted that although many of the objectives cover catchments and involve the riparian edges, the Agency has no remit to alter land management other than through legal action, education or persuasion.

4.3 Pollution Prevention Control

The Agency is the main statutory agency responsible for Pollution Prevention Control which is administered through the following internal functions: Integrated Pollution Control (IPC), Water Quality, Waste Regulation and Radioactive Substances.

The WFOS does not interact with either IPC or relate to Radioactive Substances. However the de-intensification around the water edge provided

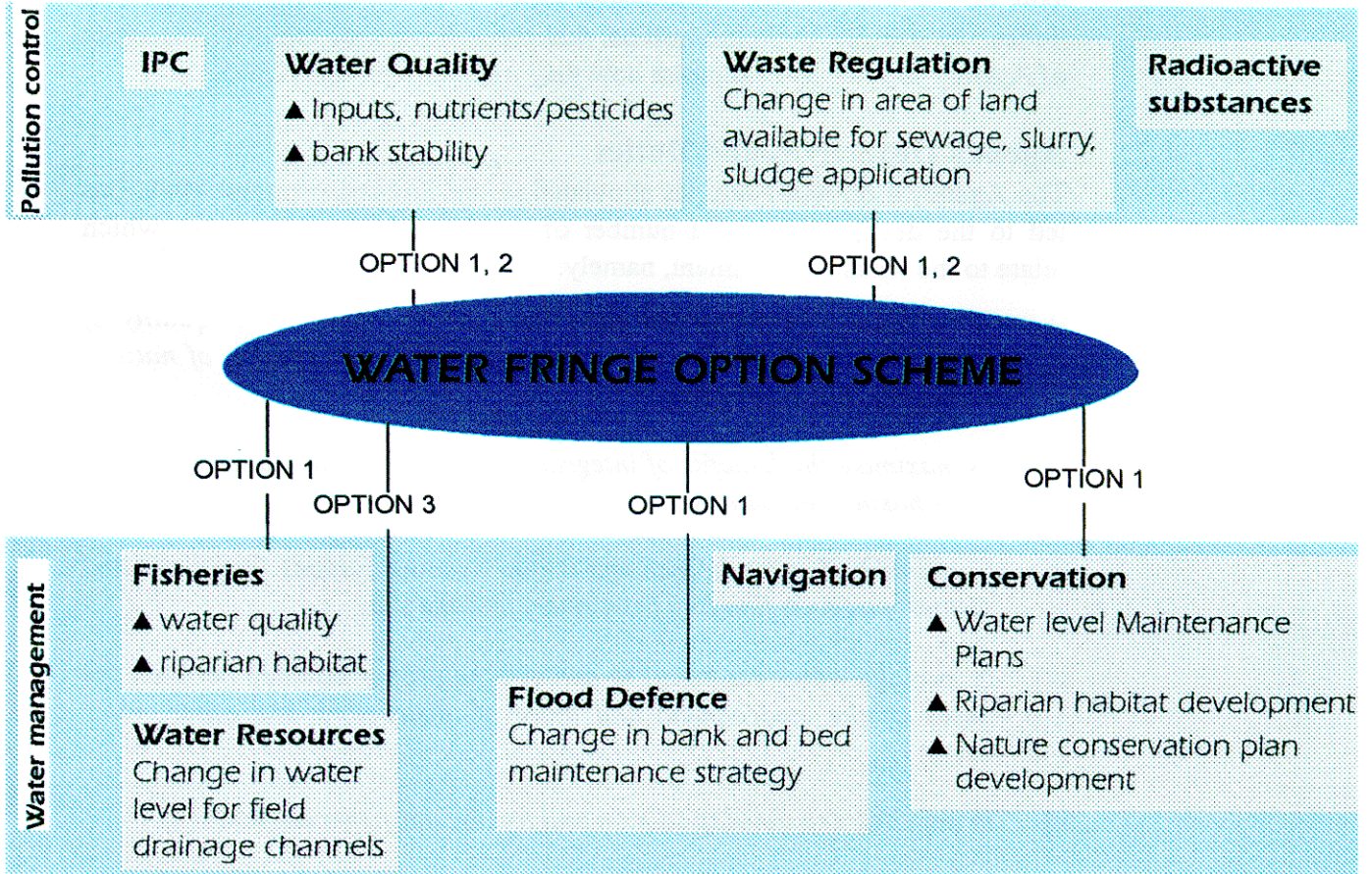


Figure 4.1. Water Fringe Option Scheme Relationship with Environment Agency Activities

by Options 1 and 2 of the WFOS offers the potential to directly benefit water quality and indirectly waste regulation.

4.3.1 Water Quality

This section offers a brief overview of the current understanding of how pollution can be reduced by buffer strips (Option 1) or through extensive grassland management (Option 2).

The creation of buffer strips and extensive management both offer a reduction in inputs (organic and inorganic fertilisers, pesticides and sludge). The WFOS also decreases the likelihood of soil erosion occurring from the land due to increased vegetative cover, reducing erosivity of rainsplash and overland flow and causing entrapment of the sediment particles as they flow over the surface. The most significant improvements will be from arable land entered into Options 1 and 2. Arable land has periods when soil is denuded and erodible and has higher inputs of pesticides and fertilisers compared to that under an intensive grassland regime.

Buffer Strips (Option 1)

The creation of vegetative buffers adjacent to watercourses has a number of beneficial effects on water quality of surface runoff. However, the author believes that a substantial area of land would have to be entered into the scheme to make any discernible changes to the water quality of the main watercourse. Similarly, improvements in water quality are more likely to be achieved where the scheme has been targeted to the most significant sources of sediment, pesticide and nutrient inputs. Primarily water quality may be improved by banning fertiliser inputs and reducing soil nutrient levels by mowing and removing the cuttings. Likewise the sensitively managed application of limited amounts of herbicide reduces the likelihood of significant quantities entering the land and watercourse.

The vegetative buffer intercepts the overland flow of sediments and adsorbed, or dissolved pollutants thereby reducing the overland inputs into the watercourse. Likewise, the greater volume of vegetation may create an increase in the uptake of nutrients from subsurface flow. However it should be noted that the deeper the subsurface flow the less likely the uptake by vegetation unless deep rooted species have established, for example willow.

The uptake of subsurface flow of nutrients and pesticides is minimal if field drains are successfully removing large volumes of water from the surrounding area. The establishment of deep-rooted vegetation may potentially disrupt field drains by fracturing their structure. The supplementary payment of Option 3 addresses the issue of field drainage affecting water quality by providing a means of intercepting the drains.

The creation of a buffer strip may also have indirect benefits by increasing the distance between crops and the water fringe thus minimising the risk of spray drift causing direct pollution. These problems may be particularly acute

on narrow fields adjacent to the watercourse, where there is no distance between the sprayed area and the watercourse, as shown in Plate 1. Where a buffer strip has been created adjacent to either short term leys or pasture land, stock proof fencing must be established, restricting the livestock from the buffer strip. This indirectly acts to stop poaching of the bank minimising the risk of bank destabilisation.

The management of buffer strips must consider a number of factors particularly where they are implemented to limit soil erosion. The buffer strip traps sediment particles due to the increased resistance offered by the vegetation. The sediment should be removed otherwise the strip itself may become a sediment source. The vegetation composition on the bank requires monitoring and appropriate management to reduce the likelihood of inappropriate species encroaching upon the bank, causing destabilisation leading to erosion.

If managed carefully, the buffer may reduce inputs not only from the area withdrawn from production but from the surrounding land which drains across or through it. Further reading concerning the creation of buffer zones is provided in Quest Environmental's '*Buffer Zones - Their Processes and Potential in Water Protection*' (Haycock et al 1997).

Extensive Grassland Management (Option 2)

Extensive grassland management provides potential benefits to the water environment principally by removing nutrient and reducing pesticide and sediment inputs.

Extensive grassland management benefits water quality through the imposed standard management prescriptions and the careful management of the stocking density. If limited and controlled applications of herbicide are used then there is little opportunity for either spillage or wastage onto the soil surface and therefore reduced opportunity for its uptake in subsurface or overland flow. Organic and inorganic fertiliser applications are not permitted on land within the scheme which reduces the potential of run-off and nutrient loading of the watercourse

Controlled stocking densities is likely to reduce soil disturbance and subsequent soil erosion caused by poaching, in particular around feeding troughs and on stock trails. Capital grants are available for the construction of new permanent fencing on Option 1 and 2 land. Farmers must fence off Option 1 land if adjoining land is grazed by stock, however Option 2 land is fenced at the farmer's discretion. Fencing on Option 2 land seeks to protect watercourse edges and reduce the potential of soil erosion. The provision of alternative drinking water supplies for stock is not funded by the WFOS but grants are available under the Countryside Stewardship Scheme where it meets the objectives of the scheme in that area (more detail concerning the Countryside Stewardship Scheme is available in Chapter 5).

The provision of stock proof fencing is promoted by the Agency in its booklet 'Understanding River Bank Erosion' (Environment Agency 1997). Although stock proofing is widely acknowledged to increase bank stability it should be not considered a panacea to bank erosion. The location of stock proof fencing along the river bank has to be considered carefully, measuring its water quality benefits against nature conservation, landscape and livestock management issues, namely:

- i) nature conservation may increase with increased bank stability as it facilitates the stability of the soil, however some important species require trampling along the riparian edge to create a suitable environment for their establishment. The River Beult's diverse flora often requires trampled areas for species to exist, typical species include Brooklime, Blue Water Speedwell and Water Mint. In areas where fencing predominates the diversity reduces and reedbeds and grasses dominate (English Nature 1994);
- ii) in certain landscapes the establishment of fencing may impinge upon the riverine landscape detracting from the aesthetic experience; and
- iii) livestock require access for controlled drinking and 'cooling down' offered by the river. If stretches of river are fenced off with no controlled access for drinking and shade then livestock health will decline unless they can be provided by alternative means.

The most significant benefits of reducing inputs and pollutants brought about through the extensive grassland management option, are on former arable land.

Observations

The potential benefits of the WFOS to water quality and in aiding the Agency attain its objectives i), ii), and iii) may vary according to the physical characteristics of each site. For example, the steeper the land the greater the potential for sediment, pesticides and nutrients to reach the watercourse. In addition, the presence of features such as land drains will dramatically alter the success of a buffer strip.

However, to achieve significant alterations in water quality would require substantial areas of land to be entered into the scheme along the main channel and headwaters.

In all options the design, implementation, maintenance and management of the land within the scheme (in particular with respect to buffer strips) will determine the effectiveness of the scheme in minimising pollution loading from agricultural sources in surrounding watercourses.

However discussions with the Agency, in particular on the Avon, Derwent and Ribble, identified that pollutants entering the watercourse may arise from land away from the riparian edge, through field drainage, or arterial drainage

(drains from roads adjacent to cultivated land or field ditches). Consequently, appropriate management of the water fringe may have little overall benefit on the pollution loading of the main water channels. Targeting these ditches, drains or problem areas may result in greater effectiveness and efficiency in achieving the Agency's objectives. Likewise, the benefits of creating a buffer or converting arable to extensive grassland would best serve water quality through targeting critical areas such as, fields on slopes adjacent to watercourses, known to be causing pollution problems.

4.3.2 Waste Regulation

The WFOS only indirectly effects waste regulation by reducing the land area available for sludge applications of industrial and agricultural wastes. Greater volumes of slurry may be targeted onto other less appropriate areas of land. Consequently, farm sludge and slurry applications should be considered by the local project officer at the initial inquiry from the farmer.

4.4 Water Management

Under the Environment Act 1995, the Agency is charged with managing the water environment. Water management comprises of a range of components which all interact with each other including water quality. Accordingly, water management requires an integrated approach and the main functions are shown in Figure 4.1. Water management is a vital component for fulfilling all of the Agency's objectives as defined in this report.

The components reviewed in this section are: nature conservation, water resource management, flood defence, fisheries and recreation. Navigation is a component of water management, however the authors believe that no element of the WFOS interacts with the elements of navigation.

4.4.1 Nature Conservation

The Agency is not the principle agency involved in nature conservation in the UK (this is English Nature) however it has a duty under the Environment Act 1995 to have regard to conservation in all of its activities (objective i), and to play its role in achieving sustainable development.

The Agency made a number of statements with respect to enhancing biodiversity which include:

- i) 'playing a full part in implementing the EC Habitats Directive;*
- ii) playing a full part in delivering the UK's Biodiversity Action Plan by acting as the 'contact point' for the chalk rivers action plan for 12 aquatic animal and plants, including otter, water vole and rare species of fish and acts as 'lead partner' for 12 others;*
- iii) implementing a series of regional projects, in partnership with local conservation groups to deliver specific biodiversity targets...:*

- iv) *using and promoting best environmental practice for the protection/restoration of river habitats; and*
- v) *ensuring specific projects to restore habitats in rivers and lakes....'*
(Environment Agency Date 1989¹);

It should be noted that the WFOS capabilities in improving water quality will have beneficial results with respect to improving in-stream biodiversity and any wetlands which they feed. The increases in aquatic biodiversity due to changes in water quality are not considered in this section as they will occur away from the WFOS sites. The effect of WFOS on water level management plans is considered in the Water Resource section.

The re-seeding of arable areas, where practical, should be with a seed mix of British origin and with no individual variety contributing to more than 30 percent of the total mix. This creates a species rich sward compared to the monocultures which dominate on short term leys, and to a lesser extent on permanent pastures. Both buffer strips and extensive grassland management should provide a greater diversity of flora than the monoculture regime of cultivated land.

Buffer Zones

The creation of buffers through Option 1 details two management options, I) topping the vegetation in late summer and II) allowing scrub develop.

Regardless of the management of the site, the buffer initially is comprised of the sown grasses, the original crop (where removed from arable production) and species favouring the initially high level of nutrients, typically nettles. Plate 4 shows a buffer strip entered into the agreement in 1996 in the Avon Pilot Area where a few grass and arable weed species are dominant in association with the former crop; oilseed rape.

Late Cutting: The late cutting and removal of vegetation on the buffer strip aims to increase the rate of nutrient removal from the soil and create a less fertile soil environment. This increases sward diversity as the typically dominant grasses and nettles can no longer tolerate the less fertile conditions and species favouring these conditions can invade. The vegetation is left to grow for longer periods and cut later than under pastoral systems. Subsequently, the vegetation is taller than under grazing regimes providing additional shelter for breeding birds. Late cutting also allows plant species to set seed and increase the field's seed bank. The disposal of cuttings may pose a potential pollution problem; suggestions for their safe disposal include composting or feed to horses or donkeys.

Leaving the Buffer to go to Scrub: This is a 'reduced management' option allowing the vegetation to regenerate naturally. Some management to remove inappropriate vegetation is permitted, typically these include bracken, thistles, nettles and docks.

Scrubland provides many more opportunities than intensively managed land, in terms of food and habitat for a wide range of wildlife, including shelter for small mammals and nectar for invertebrates. Scrubland, particularly dense vegetation approximately 0.5 metres from the ground, forms a secure habitat type for otters. The nature conservation significance of the scrubland in the Pilot Areas remains unknown, however the ADAS report may provide some information on the type of habitats developing.

Extensive Grassland Management

The extensive grassland management option offers greater nature conservation benefit compared to intensively managed grasslands/leys which generally have low species diversity due to high grazing pressures and nutrient inputs. The management of grazing pressures may facilitate the development of the grass 'tussocks' which provide a habitat for overwintering birds and provide nesting sites in spring for waders. In addition, it may provide a better combination of habitats and sources of food benefiting birds and other fauna.

The extensive grazing option can also be used to maintain the existing flora on old meadow land, wetlands or traditionally extensively grazed fields which are species rich and would otherwise be at risk from increased grazing pressures. Plate 5 shows a former water meadow which is currently extensively grazed under Option 2a of the WFOS. The soil in the meadow is naturally wet and the vegetative species diversity is high, especially in the former drainage channels. The WFOS serves to restrict intensification on this land which would lead to a decline in the species diversity.

Raising Water Levels

The supplement paid to farmers to raise water levels covers two management practices, namely: intercepting field drainage flows or maintaining the water levels within ditches.

Intercepting field drainage increases the soil's moisture content whilst also reducing the flow of nutrients and sediment to the watercourse. Increases in the moisture content of the soil adds stress and creates less favourable growing conditions for typical dominant species. Subsequently, species tolerant to the wetter conditions may invade leading to an increase in diversity.

Maintaining water levels in the ditches has potential benefits of providing wetland areas close to infield habitats. Plate 6 shows water backing up a former drainage channel due to the sandbags in a field drain (Plate 3). The raised water levels within the field may provide an appropriate environment for rare aquatic plants. Furthermore, the ditches may be able to provide suitable feeding grounds for waders, typically the red shank and lapwing (MAFF 1994^b).

Observation

The management options offer the potential to increase the biodiversity of the wetland fringes, however it is uncertain which species benefit from the different options. Presumably, these will be identified in the current and subsequent ADAS monitoring reports.

The creation of vegetated banks may facilitate the establishment or recovery of some species within the Biodiversity Action Plan that require densely vegetated habitats on the river edge. For example, the water vole which is most commonly located on '*densely vegetated banks of ditches, dykes, rivers and streams, generally where the current is slow and water is present throughout the year*' (Corbet & Harris 1991). However, other species within the UK Biodiversity Action Plan may require more specific habitat creation and management. Payments could be targeted for planting particular species and to conduct appropriate management to make the water fringe suitable for a species to colonise. A species requiring habitat creation is the otter which needs suitable features for the development of holts for breeding.

When the Agency is developing nature conservation plans at a strategic level in a catchment it is important to know the location of lands entered into agri-environment schemes so they can be incorporated into the strategy. The WFOS may offer important potential habitat gains in a catchment and therefore it is important that these areas are known to the developers of the plan.

4.4.2 Water Resources

Under the 1995 Environment Act the Agency has a duty to:

- *'take action as the Agency considers desirable to conserve, redistribute or otherwise augment water resources and secure their proper use;*
- *enter into and maintain water resource operating arrangements with water companies where necessary;*
- *publish information about the demand for water and available resources;*
- *administer a system of licensing abstraction and impoundments;*
- *enforce abstraction law;*
- *keep a public register recording abstraction licenses, and details of applications and successions; and*
- *act as a statutory consultee on drought order applications made to the secretaries of state by water companies to enable measures to be taken to cope with water shortages'* (Environment Agency 1989²).

The Agency's Water Resource duties cover multiple issues, however the WFOS is particularly related to the agricultural use of water and the volume which drains from the land. Options 1 and 2 will not significantly alter the volume of water being discharged from the land, however, Option 3 impounds water for particular periods of the year, reducing the overall volume of water entering the main channel. If water availability to the main river is altered from land entered into the scheme, the applicant or project officer is required to contact the Agency or the Internal Drainage Boards (IDB).

If uptake of Option 3 significantly increases then this may have an affect water levels in the system, particularly those currently suffering low flows, such as the Rivers Avon, Wylde and Nadders and their feeder streams, River Beult and Swanside Beck and Ings Beck. This may affect the nature conservation value of the river, fisheries and the ability for authorised abstractions to operate. It should be noted that the maintenance of constant water levels in drainage ditches (brought about by reducing their flow) is only prescribed in the winter and spring months from December to the end of April when the river system's water levels should be normally high.

It is the authors' understanding that the requirement for the applicant to obtain an impoundment licence has been waived by the Agency when land is entered into the Water Fringe scheme.

Changing flow levels by impounding water also affects the management of water levels to benefit conservation. Where an area is of nature or historic interest the Agency, MAFF, Internal Drainage Boards, English Nature and English Heritage have to draw up Water Level Management Plans to meet the important resource requirements (MAFF *et al* 1995). Plans have to consider abstractions from the river, drainage impoundments and maintenance, nature conservation and archaeological designations or issues. Areas of impoundment should be identified in the preparation of this plan. If the areas entered into Option 3 of the scheme are unknown to the agency developing the plan then its quality is diminished. Accordingly, emphasis should be given to communication between interested parties as to the location and management of these sites.

4.4.3 Flood Defence

One of the main objectives is to provide effective flood protection of people and land within each catchment (Objective iii). The Agency has a major role in operating, maintaining and improving flood defences. The specific flood defence responsibilities include:

- *'Supervision - duty to exercise a general supervision over all matters to do with flood defence (which includes land drainage and water level management);*

- *Flood Warning - responsibilities to disseminate flood warnings directly to the public;*
- *Maintenance and Operations - powers to maintain and operate flood defences and associated structures to reduce the incidence of flooding;*
- *Improvements - powers to build defences to reduce the risk of flooding. This includes the replacement of defences reaching the end of their effective life;*
- *Regulate and Influence - consent is required from the Agency for certain works that may affect watercourses and flood defences. Planning Authorities, with the benefit of Agency advice, are responsible for protecting the flood defence interests of people whose properties may be affected by development proposals' (Environment Agency 1989³).*

The WFOS Option 1 directly interacts in two aspects to the maintenance and operations of the Agency, namely the management of cuttings after mowing and dredging, and access along river banks.

The Agency weeds and mows banksides during specific periods, removing inappropriate vegetation from the watercourse to enable navigation and the flow regime to operate. The cut and dredged vegetation is traditionally placed on the adjacent bankside. This directly opposes the management guidelines of the WFOS where all the vegetation is removed to lower nutrient levels in the soil. Therefore, new management practices concerning the disposal of cut vegetation must be developed in areas where WFOS sites are located. If the sites are not known to the flood defence maintenance organisers then the WFOS might be inadvertently interfered with.

The access to the sites in WFOS under Option 1 may be restricted if a stock proof fence is constructed between adjacent pastures and the fringe area. The authors understand that the Agency has a public right of access between 5 and 8 metres from the river bank with which to conduct its flood maintenance operations. Thus, a provision needs to be included in the design of the scheme, specifically with regard to fencing, to enable this periodic access.

4.4.4 Fisheries

With respect to Objective v) the Agency has the vision that *'all waters of the England and Wales will be capable of sustaining healthy and thriving fish populations and everyone will have the opportunity to experience a diverse range of good quality fishing'* (Environment Agency 1989⁴).

The WFOS may indirectly affect the fish stocks of a river by de-intensifying the agriculture around the water fringe with subsequent water quality

improvements. This is particularly important with regard to soil erosion if a river channel is considered as a spawning area.

In addition, the habitats created by scrub development on Option 1 land may cast shade onto the watercourses which may improve the water environment's capability to support fish and other fauna. To achieve this the design and management of the buffer strip must be carefully prescribed requiring consultation with appropriate Agency staff.

4.4.5 Recreation

'The Agency's recreation responsibilities extend to all inland and coastal waters and associated land'. The term recreation 'covers all aspects of water-related leisure activities, from informal types such as walking, picnicking and visiting the waterside, to formal water sports such as canoeing, rowing, sailing, fishing and water-skiing' (Environment Agency 1989⁵).

The WFOS offers no provision to open up the land for access beyond the current level of use, for example maintaining an existing Public Right of Way.

However, WFOS Options 1 to 3 all potentially effect the environment with regard to influencing landscape, improving water quality and biodiversity. As such, the WFOS may indirectly alter the value of the experience of a recreational activity. However, as no environmental monitoring data has yet been provided the authors cannot comment on the indirect effects of the WFOS on recreation.

4.5 Observation

The WFOS management options impinge upon many of the duties that the Agency must conduct to reach its objectives. The diverse nature of the Agency's duties means that a formal consultation with other relevant agencies is necessary to identify the location of the WFOS sites and to allow appropriate management. Furthermore, particular pressures or conservation interests will vary in degree or importance within the catchment and the WFOS may be most effectively employed if it can be targeted at either creating specific habitats or to critical areas in the catchment. This is discussed further in Chapter 6.

5. OTHER AGRI-ENVIRONMENT MEASURES

5.1 Background

This chapter examines a range of measures which offer incentives to farmers to implement environmentally-sensitive practices which potentially benefit the water environment.

This chapter considers specifically the Countryside Stewardship Scheme, Environmentally Sensitive Areas (ESAs), the Wildlife Enhancement Scheme (WES), and Nitrate Sensitive Areas (NSAs). The schemes have different aims, typically with regard to nature conservation or landscape character. The schemes are considered against their potential to offer some benefit to the water environment as part of their objective or as a consequence of pursuing other goals.

5.2 Countryside Stewardship Scheme

The Countryside Stewardship Scheme is one of two of the major agri-environment schemes used to administer the Government's agri-environment objectives, the other being ESAs. The Countryside Stewardship Scheme differs from the WFOS and ESAs in that it is not restricted to specific locations and operates throughout England.

The scheme, launched in 1991, was run by the Countryside Commission until MAFF took over its administration in 1996. The aim of the Countryside Stewardship Scheme is to provide incentives to farmers, landowners and land managers to protect, enhance or re-create specific landscape types by adopting management techniques which bring conservation benefits.

5.2.1 Management, Targeting and Implementation

The focus of the scheme is determined by target habitats and landscapes defined at a national level. By refining these targets at a regional level, locally important characteristics are identified and objectives may reflect local variations. 'Regional Character Maps' (developed by organisations including the Countryside Commission and English Nature) are a means of identifying distinct features at a local level and are to be used by MAFF to set future scheme targets. It is unknown to what degree the Agency can influence the targeting of the scheme in terms of sites and in selecting the components of Countryside Stewardship Scheme most appropriate to fulfilling its objectives. However, the Agency is consulted to facilitate targeting at a county level.

The Countryside Stewardship Scheme is discretionary and therefore, resources can be targeted to proposals that are most likely to achieve the schemes objectives, namely to:

- *'sustain the beauty and diversity of the landscape;*
- *improve and extend wildlife habitats;*

- *conserve archaeological sites and historical features;*
- *improve opportunities for countryside enjoyment;*
- *restore neglected land or features; and*
- *create new habitats and landscapes' (MAFF 1998).*

It is the authors' understanding that the assessment of an application is conducted using a scoring system, the greater the perceived benefit the greater the weighting.

The Countryside Stewardship Scheme incentives are in the form of annual payments for on-going traditional or environmentally-sensitive management practices, or capital payments for one-off operations such as tree planting and pond creation. A programme of operations is developed to form the management agreement and reflects the specific requirements of individual sites according to the targeted landscape type and physical parameters (slope, geology etc.).

Payments for changing management practices are only given on targeted land; however, the possible impacts of the scheme on the farm as a whole (i.e. lower productivity levels) are taken into account. The combinations of management prescriptions and one-off operations are numerous, but agreement holders must implement all the works specified in the management agreement throughout its 10 year duration.

A number of landscape types have been identified under the scheme as being important, including chalk and limestone grassland and coastal land on the basis of their: wildlife habitat value (often for specific species), landscape quality characteristic of the English countryside, potential for environmental improvement and public enjoyment, and historic and archaeological value.

The landscape types and objectives covered by the Countryside Stewardship Scheme which are most pertinent to water fringe areas include:

Waterside Land: Management prescriptions may be targeted to protect its special character and to improve the water and environmental quality of rivers. The waterside land option incorporates '*wetlands, marshes and the margins of rivers, streams, canals, lakes and ponds*' (MAFF 1998). The Waterside Land option aims to:

- 'improve habitats for wildlife, both in the water and alongside rivers and streams, by restoring waterside vegetation...'* (MAFF 1998);
- conserve or restore wet pastures and meadows by adopting a cutting and grazing regime to control scrub and competitive plants (for

example, thistles, nettles, docks and ragwort), avoid overgrazing and fertiliser and pesticide applications;

- c) raise water levels to promote seasonal flooding;
- d) manage ditches and dykes on a rotational basis;
- e) restore bankside vegetation and minimise erosion;
- f) create or restore features adjacent to watercourses, such as reedbeds and ponds; and
- g) improve public access opportunities alongside watercourses.

Arable Field Margins: These include *'uncropped and grass margins...created alongside arable fields and field boundaries and also streams and rivers'* (MAFF 1998) to act as a buffer from agricultural operations and a means of restoring wildlife habitats. Consequently, water quality may improve where margins have been created. Management agreements under this landscape-type aim to:

- i) *'establish grass strips to create a buffer from agricultural operations for field boundaries, habitats such as ponds...'*, rivers and streams; (MAFF 1998)
- ii) establish grassy or uncropped margins connected together to form a network of wildlife corridors;
- iii) *'create wildlife habitats alongside rivers and streams by creating buffer strips and restoring waterside vegetation'*; (MAFF 1998)
- iv) encourage wildflowers and insects associated with low input farming by managing the edges of cropped fields; and
- v) restore or recreate landscape features and field boundaries.

The Countryside Stewardship Scheme also incorporates annual management operations which may be implemented within a number of landscape types and have an impact on waterside land. These operations include:

- reverting cultivated land to grassland by natural regeneration, in particular on land close to watercourses or species-rich grassland, or by using a specified seed mixture. The objective is to establish a diverse sward containing plant species characteristic of the area and adopt a grazing or a haymaking and grazing regime;
- managing grassland for hay production or grazing by adopting a regime that delays cutting dates, restricts stocking levels and grazing periods, and limits rolling or chain harrowing to specific months of the year; and

- cutting reedbeds and fens on a rotational basis to create an uneven age structure, and additional payments are available to fund the creation of reedbeds, fens and carrs.

The Countryside Stewardship Scheme offers a number of capital grants for one-off operations which could potentially benefit the water fringe including: water level adjustment (using bunds, culverts or sluices); creating water features; scrub and bracken control; tree planting and management; and field boundary restoration (hedge planting etc.). Grants for new fencing are also offered under the scheme and range from £0.80/metre (for post and wire fencing) to £3.50/metre (for deer fencing), however they are only available where the work is essential to achieve the objective of the proposed agreement. Payments for water troughs and water supplies for stock may be obtained but their availability is also restricted (MAFF 1998).

The benefits of implementing the management agreements briefly described above may be categorised into biodiversity, landscape, history and amenity. Although water quality is not a main objective of the scheme management prescriptions particularly on waterside land and arable field margins may contribute to improvements in water quality by:

- restoring riparian and bank vegetation reducing the potential for erosion;
- creating margins to buffer rivers and streams from agricultural operations, and act as a barrier to overland flow; and
- general environmentally-sensitive farming practices such as limiting herbicide and pesticide applications, banning applications of inorganic and organic fertilisers, and adopting appropriate stocking rates to avoid overgrazing, undergrazing and poaching.

At the time of publication, no environmental reports concerning the relevant management aspects of the Countryside Stewardship Scheme had been produced, however reports for each management option are expected by the end of May 1998.

5.3 Environmentally Sensitive Areas

The Environmentally Sensitive Area scheme is the other major agri-environment scheme and was the first scheme to be launched in the UK in 1987 by MAFF. It is targeted to specific areas in England where agricultural practices have '*helped to create or protect landscapes, wildlife habitats or historic features*' (MAFF 1993) of national importance. The overall aim of the scheme is to offer incentives to preserve and enhance these areas by encouraging the continuation of farming practices that deliver environmental benefits rather than intensive methods.

The ESA scheme differs from the Countryside Stewardship Scheme by focusing on typically large areas which have adapted to traditional agricultural methods to create nationally distinct landscapes or wildlife habitats. The emphasis of the ESA scheme is to avoid changing traditional agricultural practices as a means of protecting and enhancing the rural environment. The CSS focuses on smaller and often fragmented landscapes; an agricultural holding may contain several targeted landscape types and incentives are aimed at changing farming practices to bring conservation benefits.

The ESA scheme is the largest agri-environment scheme in England with 22 ESAs covering approximately 10 percent of the agricultural area. The ESAs are designated by MAFF and each area has specific environmental objectives which reflect the key priorities; by achieving the locally important aims, the main principal of the scheme is addressed.

5.3.1 : Management, Targeting and Implementation

The scheme is eligible only on land within the boundary of the ESA, for example, the Pennine Dales, the Test Valley and the Lake District. Entry into the scheme is voluntary, whereby farmers and landowners agree to manage their land according to a set of management options in return for an annual payment for each hectare of land entered over a 10-year period. There is the option of terminating the agreement after 5 years. Each ESA has different sets of management prescriptions (although there may be some overlap) based on a tier system where the higher the tier, the more detailed the management operations and the greater the environmental benefit.

Management agreements for ESAs may relate to different land uses or changes in management, for example, reverting cultivated land to permanent grassland. Annual payments vary according to the tiers and the management prescriptions they contain which differ for each ESA (i.e. the more detailed the prescriptions the higher the payment): For example, payment for the reversion of arable land to permanent grassland in the Broads ESA is £260/hectare whereas in the North Kent Marshes ESA payment is £265/hectare⁶.

Incentives are also offered to create new public access on non-arable land as an additional option. Capital payments are available for a range of one-off works to target valuable features, however the type of works eligible for funding differ for each ESA and the farmer must already have an ESA management agreement. The schedule of capital works is listed in a conservation plan and a limit of £3000 (for a 2 year plan) is placed on the funds obtainable (MAFF 1993); Correspondence from MAFF states that capital limits have recently been raised significantly in most ESAs⁶.

⁶ Data provided by Bryan Symes MAFF Conservation and Rural Development Division

The authors believe that the ESAs have been made more flexible to target specific issues within a designated area. Current ESA management prescriptions that relate and may benefit the water environment are shown in Table 5.1.

5.3.2 Environmental Monitoring

Monitoring has been undertaken at each ESA to identify the benefits of the scheme and to determine whether the environmental objectives have been achieved. Most monitoring strategies included surveys in the year of ESA designation to establish baseline information. However re-surveys have not been completed or insufficient time has lapsed for the benefits of the ESA management prescriptions to develop in particular, for the most recent ESAs launched in 1993 and 1994.

As many of the environmental objectives are targeted towards terrestrial habitats, landscapes and historical features, the consequences of ESA schemes on water quality are rarely examined. However, ADAS have conducted research to assess the links between land cover changes (as a result of ESA management prescriptions) within the Suffolk River Valleys ESA and the changes in several water quality parameters. The conclusions of the study cite that only one significant relationship was identified between land cover and improvements in water quality. Biochemical Oxygen Demand was found to decrease as grassland area increased between 1988 and 1992. However, this result is too general to confirm that the ESA scheme improves water quality. To obtain a more unequivocal link the ESA scheme must cover a high proportion of any given catchment and extensive monitoring of the waterbodies is required; different management prescriptions should be examined and data analysis carried out on an annual basis.

As many of the ESA management options aim to conserve or recreate different land uses, amenity benefits may develop as a result of the ESA scheme. Environmental objectives common to many ESAs include the maintenance of existing permanent grassland and the reversion of arable land to permanent grassland. Aerial photographs have shown that the landscape value of several ESAs has been enhanced where management operations have achieved these aims. Pastoral landscapes, characteristic of many river valleys and flood plains, have been strengthened by linking blocks of grassland previously fragmented by arable land.

Table 5.1 ESA Management Prescriptions Relating to the Water Environment

Objective	Management Prescription	ESA Area
De-intensification of existing grassland	<ul style="list-style-type: none"> • Limit cultivation to chain harrowing and rolling. • Limit on application rates of farm yard manure (inorganic fertiliser not always permitted). • Stocking levels set to avoid undergrazing, overgrazing and poaching. • Grass cutting restricted to after 1 July, graze aftermath. • No improvements to existing drainage. • Herbicide use limited to control specific weeds (thistles, nettles etc.) by spot treatment. • No fungicide or insecticides. • Retain and manage waterside features (reedbeds, ponds, pollarded willows etc.). • Manage ditches on a rotational basis. 	Avon Valley, Test Valley, Suffolk River Valleys, North Kent Marshes
Enhance low-input grassland (in addition follow prescriptions above)	<ul style="list-style-type: none"> • Maintain high water levels throughout the year, providing water in ditches during winter. • Further restrictions on grazing periods, fertiliser application rates/timings and mechanical operations. 	Suffolk River Valleys
Restoring wet grasslands (in addition follow prescriptions for existing grassland)	<ul style="list-style-type: none"> • Maintain water levels at mean field level and allow shallow pools to develop in ditches/dykes from December to April (inclusive). • Maintain 30cm in ditches/dykes from May to November (inclusive). 	North Kent Marshes, Avon Valley
Reversion of Arable Land to Permanent Grassland	<ul style="list-style-type: none"> • Cease arable/ley production and establish a permanent grass sward using specified seed mixture within 12 months. • No applications of fertilisers, pesticides, lime/slag within the first 12 months. • Cut grass for hay (not before 1 July) for first 3 years and graze aftermath (No cuts for silage). • Follow prescriptions for existing grassland throughout agreement. 	North Kent Marshes, Test Valley, Avon Valley, Suffolk River Valleys

Many ESA schemes also aim to de-intensify agriculturally-improved grassland or conserve low-input and unimproved swards and therefore improve or protect their nature conservation value. Survey data indicates that the biological diversity of species-rich grasslands such as fen meadows and old water meadows (extensively managed pre-ESA) were maintained on land under the ESA agreement. Diversity had declined in similar grasslands on non-agreement land.

In the Suffolk River Valleys ESA, monitoring suggests that management prescriptions are achieving '*generally favourable trends in plant communities*' (MAFF 1997^c). The conservation value of grassland containing

species characteristic of undergrazed fen meadow (for example, sedges, rushes, Wild Angelica and Meadowsweet) was enhanced by introducing grazing with cattle and a sensitive cutting regime. The grazing and cutting programme opened up the sward and as a result, increased the proportion of plant species associated with grazing and the opportunities for wet grassland communities to develop (including Yorkshire Fog, Meadow Fescue and Marsh Foxtail). On other ESA sites, benefits are not always linked to changes in management, for example, a reduction in the proportion of species associated with high nutrient availability (nettles, thistles and Tall Oat Grass) was attributed to the regular application of herbicides rather than the adoption of a grazing regime.

In the Test Valley ESA, attempts to encourage the colonisation of agriculturally-improved grasslands by species characteristic of unimproved lowland wet grasslands have been inhibited by depleted seed sources and high residual nutrient levels in the soil. For changes in plant communities to occur on this and many similar sites, considerable time must elapse before the bans on fertiliser applications allow soil fertility to fall and for seed banks to be restored. The colonisation process may be facilitated where previously improved grassland or reverted arable land is located next to extensive grassland (MAFF 1997^e).

Changes in the botanical composition of swards have not been monitored for every ESA as few changes were expected to occur between the baseline survey and the scheme's first review. Therefore, the original survey provides the most recent information on the quality of ESA grasslands. Results from the baseline survey in the Avon Valley ESA identified that floral diversity of wet grasslands is determined largely by the extent of agricultural improvement: unfertilised and unseeded grasslands were species-rich and typically included Fescue hybrids, Fen Bedstraw, Water Avens, Brown Sedge and Marsh Valerian. Semi-improved wet grasslands comprised fewer species (including Yorkshire Fog and Rough Meadow Grass) and neglected stands predominantly contained species intolerant of grazing (for example, Tufted Hair Grass). Environmental reports for the Avon Valley ESA indicate that the botanical diversity of its wet grasslands are likely to be maintained as a result of the scheme's management prescriptions (MAFF 1997^f).

Several ESAs aim to increase the water levels in ditches and increase the total area of grassland as a means of benefiting breeding wader populations, however monitoring results indicate that the trend in breeding populations on agreement land is stable on existing grassland and an upward trend on land where water levels territories have been raised (MAFF 1997^f).

5.4 The Wildlife Enhancement Scheme

The Wildlife Enhancement Scheme (WES) was launched in 1991 and is administered by English Nature. The scheme operates on several sites designated as Sites of Special Scientific Interest and incorporates a number of rivers and wetland sites such as the River Lugg, the River Coquet, the

Pevensey Levels and the Lower Derwent Valley. The aim of the scheme is to encourage farmers to conserve and improve the wildlife interest of SSSI land using environmentally-sensitive practices. The scheme has been an important factor in the change of focus of SSSI management. The emphasis has moved from compensatory agreements (incentives for farmers to avoid operations which would damage the site), to the promotion of positive management (to allow farmers to continue beneficial practices or encourage the uptake of measures which enhance nature conservation value).

The scheme is voluntary and entry is at the discretion of English Nature. Land within specific SSSIs is eligible to enter the scheme and English Nature encourage farmers to incorporate all or most of their land which falls within the SSSI boundary. Land adjacent to the SSSIs may also be entered into WES if it will enhance the wildlife value of the SSSI.

5.4.1 Management, Targeting and Implementation

WES combines the knowledge of English Nature and the farmer or landowner to produce a management agreement that is straightforward and easy to follow. The farmer or landowner records any operations carried out on the land, for example stocking levels during grazing, as a means of monitoring the scheme and adjusting management practices to maximise the benefit to wildlife. Management agreements last for 5 years and their short duration is viewed to be an advantage by farmers or landowners unwilling to enter long-running commitments due to the uncertainties of the agricultural industry.

Farmers or landowners receive a fixed annual payment for each hectare of land entered into the scheme; the payments differ for each habitat type (for example, woodland pasture or hay meadow) and reflect the additional costs incurred from managing the SSSI for wildlife. Annual payments differ between WES sites, even though their objectives may be similar, according to the restrictions placed on agricultural production or management requirements. For example, payment for the conversion of arable land to extensive grassland management for the River Lugg is £320/hectare and £435/hectare for the River Coquet. Payments are also available for capital works which must enhance the wildlife value of the SSSI and ease daily management requirements (English Nature Dates Unknown^{a,b,c}).

The addition of the River Lugg and River Coquet to the WES was relatively recent and their objectives are targeted towards terrestrial and aquatic wildlife and natural river processes. The objectives and management options for both areas reflect the predominant land cover types, the key priorities of the SSSI and the different operations to benefit the characteristic or targeted wildlife.

As the priorities differ for the two river systems, the River Lugg and River Coquet are examined separately below.

5.4.2 River Lugg

WES objectives for the River Lugg are listed below with the associated management prescriptions.

1. Improve water quality and reduce contamination from agricultural sources:
 - de-intensify agriculturally-improved permanent grassland (land adjacent to river);
 - arable reversion to extensive grassland management (land adjacent to river);
 - removal of arable land from agricultural production (land adjacent to river);
 - create buffer zones using the management options above or by enhancing riverside woodland pastures.

2. Retain and enhance natural habitats and waterside features:
 - create wildlife habitats on waterside land removed from intensive production (natural regeneration or tree planting);
 - enhance woodland pastures;
 - fence off habitat or waterside feature from livestock;
 - de-silt headwaters.

3. Promote advantages of '*sympathetic management practices*' (English Nature Date Unknown^b) on a catchment basis:
 - encourage implementation of general management prescriptions.

5.4.3 River Coquet

WES objectives for the River Coquet are listed below with the associated management prescriptions:

1. Enhance riverside habitats and features to diversify plant species, increase food sources for wildlife, reduce erosion and conserve specific species:
 - establish a vegetated margin along the river corridor;

- fence off riverside habitats and features from livestock.
2. Enhance wildlife value of floodplain land and wetland features by changing management practices:
 - revert cultivated land to permanent grassland;
 - modify rotation to sow crops in spring rather than autumn;
 - water level management.
 3. Retain and enhance the characteristic landscape of the river system:
 - restore waterside and riparian features.
 4. Manage woodlands to encourage floral and faunal diversity.
 5. Improve water quality (English Nature & Environment Agency 1996, and English Nature Date Unknown^c).

Monitoring of the WES in terms of benefits to wildlife and achieving its objectives, has been limited particularly for the River Lugg and River Coquet as insufficient time has lapsed for any significant impacts to develop. The level of uptake is often used to monitor the success of the WES in different SSSIs; the area entered into the overall scheme and the area covered by specific management options are used to identify changes in land management and therefore benefits to wildlife (English Nature Date Unknown^{a,b,c}).

5.5 Nitrate Sensitive Areas

In 1980, the EC Drinking Water Directive set an absolute limit of 50mg/litre of nitrate in water supplied for public use. In light of the growing evidence that the main source of rising nitrate levels in water was agricultural land, MAFF introduced a pilot Nitrate Sensitive Areas scheme. Ten catchments were selected where nitrate concentrations exceeded, or were at risk of exceeding, the 50 mg/l standard. In 1994, a further 22 NSAs were designated under the Nitrate Sensitive Areas scheme, launched under the 1992 Agri-Environment Regulation. The former pilot areas were incorporated into an integrated scheme in 1995 covering 32 NSAs, all confined to groundwater catchments in England.

The scheme is voluntary and compensates farmers in NSAs for making changes to their farming systems to reduce nitrate leaching losses from their land. Farmers may enter eligible land on a field by field basis, undertaking to follow the relevant management prescriptions for a period of 5 years. The options vary in the extent of the management changes required of the farmer and in the degree of environmental benefit achieved. The payment levels reflect the loss of income incurred from entering the scheme and are based on the management option implemented and the location of the NSA.

The management options do not take account of site specific factors, such as geology, slope and rainfall levels and are fixed for all NSAs. eligibility is determined by the primary use to which the land is put together with more specific criteria, for example land which has only been used for arable cropping or set-aside may be entered into the Premium Arable option. Local objectives and key priorities are not incorporated into the scheme as it focuses completely on minimising nitrate leaching from agricultural systems as a means of protecting drinking water supplies.

The NSA scheme is made up of three main management components, with several options within each component. Farmers entering the scheme must comply with those elements of the Code of Good Agricultural Practice for the Protection of Water on all their land within the NSA, and are required to maintain environmental and archaeological features on all their land entered into the scheme. The additional prescriptions to be followed for each option are summarised in Table 5.2.

The benefits of the NSA scheme in terms of stabilising or lowering nitrate concentrations in groundwater are examined in a programme monitoring the effect of the scheme at soil level using porous pots to trap drainage water. The results indicated that the type of crop grown and the presence of a cover crop were significant factors in determining the level of nitrate leaching, in addition to the rates and timing of N applications. Sources of high nitrate losses included intensive grassland and crops such as linseed, forage maize, potatoes and onions. Nitrate losses increased on sites where sugar beet was grown in the previous year (particularly when the harvest was late), when rainfall levels were low and where the establishment of cover crops was poor. Nitrate losses to drainage water were most effectively controlled by extensive grassland and mustard and ryegrass cover crops (ADAS 1996).

Table 5.2 NSA Management Options

Management Component	Management Options
Premium Arable Scheme	<p>Converting arable land to permanent grassland:</p> <p>A - unfertilised, ungrazed grass (no fertiliser/grazing, cutting regime);</p> <p>B - unfertilised, ungrazed grass using specified seed mix (same as above but more emphasis on creating wildlife benefits; e.g. grass cutting prohibited between April & mid July);</p> <p>C - unfertilised grass, with grazing (as for A, also avoid overgrazing & supplementary feeding);</p> <p>D - grassland with application not exceeding 150kg N/ha/year & optional grazing (avoid overgrazing & supplementary feeding; N application banned between mid August & 1 February; organic N must be from own holding).</p> <p>S - as B but land may count towards set-aside; no agricultural or lucrative use permitted</p>
Premium Grass Scheme	<p>Extensification of intensive permanent grassland:</p> <p>reduce N applications to maximum 150kg/ha/year; organic N must be from own holding; N application banned between mid August & 1 February; no cultivation; and avoid overgrazing & supplementary feeding.</p>
Basic Scheme Options	<p>General guidelines:</p> <p>establish autumn cereals and oilseed rape by 15 October;</p> <p>establish cover crop, as soon as soil conditions permit, if no crops to be sown between 15 October & 1 January;</p> <p>do not remove cover crop before 1 December (1 February on sandy soils) unless crop to be sown within 4 weeks of removal;</p> <p>N application banned between mid August & 1 February (inorganic) or between 1 July & 1 December (slurry/poultry manure); organic N must be from own holding; avoid supplementary feeding (when grazing crops, crop residues or cover crops); no animals or birds to be housed on land; no conversion of permanent grassland to arable; adjusted timing & rates of N application according to crop.</p> <p>Additional Requirements</p> <p>A - restricted arable rotation - low N input (limit rate of N application to 150kg/ha/year; do not grow potatoes or vegetable brassica crops (cauliflower, cabbage etc.)</p> <p>B - standard arable rotation - low N input (limit rate of N application to 150kg/ha/year in 4 years out of 5; in fifth year maximum rate is 200kg N/ha/year.</p>

Source: MAFF 1994

5.6 Observations

The brief assessment of the agri-environment schemes relating to the water environment identifies a range of management prescriptions which would possibly lead to benefits in the water environment. However, many of these management prescriptions do not tackle the issue of water quality. The main exception to this is the Government's NSA scheme which directly targets reducing nitrate levels in areas where it is perceived as a current or an emerging issue.

The ESA and Countryside Stewardship Scheme are both multi-functional, however both possess a specific bias towards landscape and nature conservation. In the case of the Countryside Stewardship Scheme this may be due to the scheme being piloted by the Countryside Commission which was charged with preserving the rural landscape and its amenity value. This is borne out in the fact that the targeting of the Countryside Stewardship Scheme is based on the Countryside Commission's and English Nature's 181 landscape character areas which are designated on a criteria including landscape, wildlife and natural features. Although NSAs are orientated to reducing the nitrate loading in receiving waters, most of the schemes available do not directly tackle the range of pollution issues currently experienced in water bodies which include sedimentation, phosphates and pesticides. Similarly, the management prescriptions offered under the schemes may not include the flexibility to create habitats which the Agency require to meet their biodiversity targets.

The ability to target particular issues (as offered under the nationwide Countryside Stewardship Scheme and in particular areas as identified in the ESA and NSA schemes and the WES) offers the Agency the capability to cost effectively tackle particular pollution or water environment concerns at discreet locations. The former statement assumes that the appropriate land management prescriptions are contained within the agri-environment scheme. Furthermore, many of the schemes outlined above offer capital grants to facilitate the development and maintenance of the habitat, landscape or amenity feature, enhancing the likelihood of uptake.

6. DISCUSSION AND CONCLUSION

This chapter pulls together the observations made throughout this report examining the limitations and benefits of the WFOS and concludes how its management and design might be altered to benefit the Agency's aims and objectives. The observations are made in the context of the future of the scheme under the Countryside Stewardship Scheme as declared in recent literature from the Government.

It should be noted that the WFOS is only a pilot project which has broad aims to benefit the water fringe environment. Many of the WFOS objectives are peripheral to those of the Agency, such as landscape and terrestrial ecology. This chapter only examines the aspects of WFOS which may be facilitating the Agency in reaching its environmental objectives and not the scheme's wider objectives. The Government are currently reviewing the Habitat Scheme as a whole with a view to integrating successful elements into the Countryside Stewardship Scheme.

6.1 WFOS Design and Implementation

In the UK, watercourses are susceptible to different pressures from agriculture depending upon the catchment's physical make-up, surrounding land use and climate.

The WFOS management prescriptions are set at a national level and offer little flexibility in determining how the scheme may address particular local pressures. Flexibility is required for targeting 'critical' locations and to adjust management prescriptions to address particular concerns.

The areas where the WFOS can be implemented are strictly controlled in terms of eligibility and by the pilot area boundaries, rendering it difficult to target critical areas for habitat implementation or pollution control. For example the River Avon and its tributaries are suffering 'chalk malaise', however it is believed that the main pollution sources are cultivated land on slopes away from the water fringe. The pollutants enter the watercourses through arterial drainage or drainage ditches, bypassing the potential pollution buffer provided by the WFOS. However, if the extensive grassland management option could be targeted at these fields then it would reduce inputs and soil erosion and subsequent pollution of the watercourse.

The Agency as a partner in increasing the biodiversity of the UK, needs to understand how the WFOS management prescriptions are affecting the riparian zone with respect to habitat development. Furthermore, it is important to assess whether the habitats developed under the WFOS are suitable for supporting those species on the Biodiversity Action List for which the Agency is the lead agency.

The WFOS would benefit from its inclusion into the Countryside Stewardship Scheme because this would offer increased flexibility in design.

and improve targeting in terms of nature conservation and water quality. Furthermore, the planting of particular species to create habitats, to provide alternative drinking water supplies for stock, or the construction of structures required to effectively operate Option 3 may be paid for by Countryside Stewardship Scheme' capital payments.

The role of Countryside Stewardship Scheme and ESAs in enhancing the water environment is discussed in the later sections of the chapter.

6.2 WFOS Consultation

The WFOS interacts with many of the Agency's duties and activities. Often these are simply management issues concerning the method by which the Agency conducts its activities. Many of the interactions if managed correctly have benefits both to the WFOS and the Agency, and accordingly a consultation process in each region would facilitate both the operations of the Agency and the benefits of the water fringe scheme.

The level of formal consultation between FRCA and the Agency varied considerably between regions, ranging from no contact to regular structured meetings. The former leaves the local Agency officers with little understanding of the scheme and accordingly little opportunity to modify any activities which affect the WFOS area or to provide recommendations concerning its design. Without this information exchange the benefits derived through the scheme and the efficiency with which the Agency conducts its activities may be compromised.

A structured discourse between FRCA and local Agency officers to identify the location of WFOS sites and where they interact with Agency activities would facilitate the development of management plans, typically: water level agreements; flood protection maintenance programmes; and nature conservation plans.

If the WFOS is incorporated into Countryside Stewardship Scheme, the opportunity for structured discourse may be provided at the targeting meeting which is attended by the Agency.

6.3 WFOS Funding

The method of funding will influence the site design and uptake of the scheme. If the payments offered to the farmers include an incentive to bind their land into long term agreements, rather than just a payment based on income forgone, then uptake may increase, enhancing the benefits of the scheme. The greater the bankside length and area buffered or managed extensively, the greater the reduction in the pressure on the water fringe environment.

Uptake of Option 1 land may be further improved if a 'break clause' could be introduced into the scheme, to provide greater flexibility.

The inclusion of capital payments may have two benefits: I) promoting the planting of specific species to create certain habitats and to include payments for specific management operations on Option 1 land, and II) allowing a payment to be made for the construction and management of structures required for implementation and operation of Option 3, which encourage further uptake.

6.4 Environmental Monitoring

The environmental monitoring of the WFOS by ADAS may indicate benefits in terms of landscape and nature conservation. Changes in vegetative composition and nutrient levels are naturally slow and further changes would be expected beyond this monitoring period.

Unfortunately, there has been little 'useful' data linking the scheme to improvements in water quality as no direct monitoring of the pollutant loading surrounding the sites has been conducted. GQA data and RHS are considered to be unsuitable for identifying changes in water quality parameters as a result of inputs in to the water system.

Monitoring of the effects of the WFOS on water quality would be extremely difficult to achieve and very expensive to provide. The reasons for this include:

- the requirement of monitoring sites upstream and downstream to measure the changes brought about in the study area;
- changes in water quality would be extremely small from individual sites and therefore are difficult to detect;
- contamination may occur from non-agricultural sources or non-WFOS land within the monitored reaches;
- the frequency of sampling would have to be sufficient to pick up episodic events leading to the pollution of the watercourse, for example a surge in nutrients post rainfall.

The role of buffer strips in terms of conservation importance has long been debated. The WFOS may provide the Agency with an opportunity to examine a range of buffer strips in a variety of circumstances, in terms of physical makeup (topography and soils etc.) or species composition. The WFOS may provide the opportunity to evaluate how buffer strips perform in these circumstances and to identify the best and worst management techniques with respect to habitat enhancement or as a pollution buffer.

6.5 The Role of the Agency and MAFF in Enhancing the Water Environment

One of MAFF's aims is to balance the needs of the farming community with its wider duty to conserve the nation's natural resources and to protect the environment from pollution by agriculture. One of the principal impacts of agriculture is on the water environment through increasing inputs of

sediment, nutrients and pesticides. MAFF have addressed pollution issues in the Code of Good Agricultural Practice for the Protection of Water and in the establishment of the pilot WFOS, the waterside and arable field margin options in the Countryside Stewardship Scheme, and NSAs. However, specific best land management techniques to reduce pollutants have not been addressed widely in either the Countryside Stewardship Scheme or ESAs.

The Agency has limited influence on land use other than through legal action, enforcement, or through persuasion and education. If legal action is the main persuasive route open to the Agency then it may be costly to enforce whilst also alienating the farming community.

Under MAFF's requirement to balance the needs of agriculture with the protection of natural resources and the environment, a more proactive approach may be to promote good agricultural management practices to reduce pollution and to create targeted habitats through MAFF's agricultural policy and through its agri-environment schemes. The specific techniques employed within the NSAs need to be more widely promoted.

6.6 Implications of the WFOS Merging with the Countryside Stewardship Scheme

Under the proposal to merge the WFOS with the Countryside Stewardship Scheme, the water fringe element may become a single option within the overall scheme or become adopted within the existing waterside land component. Inclusion in the Countryside Stewardship Scheme may modify implementation, in terms of design and management, which subsequently may alter the duration of agreements, the method of calculating funding (i.e. payments '*set by reference to market research*' Countryside Commission 1997); and attractiveness to farmers.

The present form of the Countryside Stewardship Scheme contains similar objectives to the WFOS: both seek to improve the wildlife and conservation value of river or stream banks and adjacent agricultural land. Improving water quality is not a primary objective of either scheme, but both have the potential to improve the water environment through the adoption of good management practices. Both schemes promotesuch practices.

The Countryside Stewardship Scheme handbook confirms the scheme's intention to include waterside land as a targeted landscape. Management prescriptions under this option seek to '*improve habitats for wildlife, both in the water and alongside rivers*' (MAFF^a) and as a consequence, water quality may be improved. The handbook also implies that the scheme's prescriptions will '*make the best of their [riverbanks and lakesides] special character and...protect water quality in streams, rivers and ditches*' (MAFF 1998^a).

Other landscape types targeted by the Countryside Stewardship Scheme reiterate this point, in particular, the establishment of '2 Metre Grass Margins' on arable land '*along field boundaries and streams and rivers to*

buffer them from agricultural operations' (MAFF 1998^a). This management prescription is comparable in principle with the buffer strips of the WFOS, however the flexibility of the Countryside Stewardship Scheme allows land adjoining the margin to be managed in conjunction with other schemes, in particular the Game Conservancy Conservation Headlands.

Both the Countryside Stewardship Scheme and the WFOS acknowledge that land management can significantly affect the wildlife value of aquatic and terrestrial habitats. The extensification of agricultural practices is featured throughout the WFOS as a means of allowing the regeneration of arable land and permanent grassland with characteristic flora.

Although the Countryside Stewardship Scheme promotes a lower input or less intensive use of land, its management options are tailored to specific landscape types (for example, chalk and limestone grassland) and the scheme does not specifically target these practices per se to land adjacent to watercourses. The Countryside Stewardship Scheme does incorporate an option to convert arable land to grassland and establish a diverse sward by natural regeneration or by using an approved grass mix and an extensive management programme thereafter. However it is apparent that the objective of this option and of the supplementary payment (to control invasive species or introduce grasses and flowers) is to increase the nature conservation value, and any improvements in the water environment and quality would be a secondary benefit.

Other management options under the Countryside Stewardship Scheme are also pertinent to the WFOS; for example, raising water levels to allow seasonal flooding. WFOS's Option 3 'raised water level supplement' promotes similar management prescriptions to those of the Countryside Stewardship Scheme, however the former scheme does not fund the construction of the structures required to adjust the water levels and therefore offers less incentive to farmers to implement it.

Under the Countryside Stewardship Scheme, funds are available for operations which do not comply with the guidelines or payments for other management prescriptions. Special Projects may include the restoration of water features, banks or ditches, or the production of informative literature about an area of countryside. A management plan must be completed to apply for funds; there is no set payment which may be for one-off capital works or an on-going management programme.

The Agency could assist MAFF in the development of 'Special Projects' within the Countryside Stewardship Scheme, covering critical areas and particular pressures. Special projects may include such aims as reducing sedimentation of spawning grounds or reducing bank destabilisation and involve a range of land management techniques.

In order to best implement the WFOS the Agency would need to identify the critical areas requiring pollution control or habitat creation. This will enable the Agency officer to promote these discreet areas as a priority for targeting under Countryside Stewardship Scheme.

In addition to 'critical' areas, the Agency could act as a facilitator of the uptake of the scheme. A facilitatory role could include working with the appropriate project officers (FRCA) to identify suitable land owners and users and persuade them to participate together under one application. This will increase the area in the application and enhance its potential benefits to the water fringe. The greater the perceived benefit the greater the likelihood of acceptance of the application into the scheme.

6.7 Integrating Best Land Management Techniques into the Countryside Stewardship Scheme and ESAs

The length of watercourse affected by the creation of buffer strips and the extensification of agricultural land would need to be substantial, in critical areas of a catchment, to cause a discernible improvement in water quality. Alternative land management techniques applied to these areas may have more significant results. The land management techniques could include minimum cultivation, conservation cropping, crop residue management and livestock exclusion designed to restrict bank poaching and subsequent destabilisation (Browning *et al* 1996).

Many of these techniques are included within the pilot Arable Stewardship component of the Countryside Stewardship Scheme which is specifically designed to enhance wildlife (MAFF 1998). The emphasis of practices prescribed by Arable Stewardship may be modified to target and protect the water environment. To tailor the land management techniques to protecting the water environment, as opposed to promoting nature conservation value, may require the adjustment of some of the management practices, accordingly requiring some testing. The author understands that the Agency is conducting trials evaluating the best design and effectiveness of a range of techniques.

Land management techniques may conflict with other goals including landscape, nature conservation and their effect on amenity value. Therefore, prior to their inclusion into the Countryside Stewardship Scheme or ESAs, studies should be conducted into the effects of the techniques on other environmental parameters and to identify the circumstances when their implementation would be most beneficial.

6.8 Conclusion

The extensification options available under the WFOS may benefit the Agency in fulfilling some of its objectives, such as the need to improve water quality and the water fringe habitat. The water quality benefits of the WFOS are, however, a by-product of riparian land management. In addition, further

monitoring and analysis is required to identify the actual long term benefits of the scheme to the water environment.

The following recommendations aim to enhance the WFOS' capability in assisting the Agency to fulfil its aims and objectives:

- i) create an increase in the flexibility of the management of the buffer strip and grasslands to either establish targeted habitats or reduce diffuse pollution. This could involve the planting of particular species of trees or shrubs; according to the objective of the buffer;
- ii) include capital grants to assist the purchasing and planting of vegetation and to construct and maintain structures where required. Structures might typically include sluices or alternative drinking water supplies for stock;
- iii) target the scheme to critical areas within a catchment i.e. the main sources of pollution. This will ensure that the efficiency of the scheme is maintained;
- iv) structured consultation between the Agency and FRCA concerning implementation and management of the scheme, with full disclosure of where the WFOS sites are located. This will enable the appropriate preparation of policies, plans, and management programmes. Consultation between MAFF and the Agency should also be conducted with respect to the development of monitoring programmes tailored to the detection of the effects of agri-environmental schemes on water quality;
- v) a review of the payment structure to facilitate uptake, especially with regard to inserting a break clause;
- vi) the continuation of the environmental monitoring programme and assessment to allow the long term environmental effects of the scheme to be determined. The monitoring results should be disseminated to all interested parties; and
- vii) monitoring of the WFOS Option 1 land by the Agency, EN and/or MAFF concerning the best practices with regard to creating and maintaining buffer strips. The monitoring could include examining the sites geography against its nature conservation value and effectiveness as a pollution barrier. Accordingly all the results should be disseminated between interested parties.

The options of buffer strip creation and the reversion to extensive grassland management offered under the WFOS can be only be considered as one of a number of tools required to address the varied pressures on the water environment.

If MAFF's Countryside Stewardship Scheme can be manipulated to house a suite of appropriate land management techniques, then they would offer the Agency an opportunity to pro-actively improve the water environment without having to proceed down the expensive and potentially negative results of the legal procedure. The Agency would need to assist FRCA and MAFF in identifying areas considered as under pressure to assist in the targeting of these techniques. In such circumstances, the Countryside Stewardship Scheme could provide similar benefits to the WFOS

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Plate 1: Cultivated field on water fringe



Plate 2: Extensively grazed flood bank and fringe under WFOS Option 2a



Plate 3: Sandbags used to maintain water level in field ditch under Option 3



Plate 4: Young buffer strip created from arable land under WFOS Option 1b



Plate 5: Old water meadow under WFOS Option 2a



Plate 6: Increased water levels under WFOS Option 3