The River Avon cSAC Conservation Strategy

Conserving Natura 2000 Rivers

The River Avon cSAC Conservation Strategy

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Contents

Overview **1**

Summary **3**
The River Avon cSAC 3
Development of the Conservation Strategy 4
Key Issues Considered by the Strategy 4
Priorities for Action 11

Section 1. Introduction **23**
1.1 Life in UK Rivers 23
1.2 Background to the Conservation Strategy 23
1.3 River Avon Conservation Strategy 24
1.4 The River Avon cSAC 24
1.5 The Local Natura 2000 Network 27
1.6 Statutory Management of the River Avon cSAC 28

Section 2. The River Avon cSAC: Conservation Objectives and Status of the Features **33**
2.1 Bullhead (*Cottus gobio*) 33
2.2 Brook Lamprey (*Lampetra planeri*) 38
2.3 Sea Lamprey (*Petromyzon marinus*) 42
2.4 Desmoulin's Whorl Snail (*Vertigo moulinsiana*) 46
2.5 Atlantic Salmon (*Salmo salar*) 49
2.6 Watercourses of Plain to Montane Levels with Submerged or Floating *Ranunculion fluitantis* and *Callitricho-Batrachion* Vegetation 57
2.7 Influences on the Status of the River Avon cSAC 62

Section 3. Discharge of Polluting Substances **65**
3.1 Sources of Pollution 65
3.2 Issues Related to Point-source Discharges 66
3.3 Issues Relating to Diffuse Pollution 70

Section 4. Water Resources and Flow **77**
4.1 Water Resources in the Avon Catchment 78
4.2 Issues Related to Existing Licensed Abstractions 78
4.3 Issues Related to Future Abstraction Licences 80

Section 5. Fisheries **83**
5.1 Fisheries in the River Avon 83
5.2 Current Fish Stocks 85
5.3 Influence of Recreational Fisheries 85
5.4 Exploitation of Salmon Stocks 91
5.5 Eel Traps 93
5.6 Fish Farms 93

Section 6. Flood Defence, Land Drainage and Water-level Management **95**
6.1 Environment Agency Operational Maintenance 96
6.2 Water Level Management Plans 99
6.3 Flood Alleviation and the Catchment Context 100
6.4 Development 101

Section 7. Problem Species **103**
7.1 Non-native Invasive Plant Species 103
7.2 Mute Swans 109
7.3 Avian Predation 111
7.4 Signal Crayfish 112
7.5 Mink 113

Section 8. Planning and Development **115**
8.1 Current Developments in the Catchment 115
8.2 Issues Related to Planning and Development 116

Section 9. Rehabilitation **119**
9.1 Strategic Approach to Rehabilitation on a Catchment Scale 120
9.2 Guidance on Rehabilitation 123

Section 10. Additional Issues **125**
10.1 Communication and Accessibility 125
10.2 Data Management 126
10.3 Boundary of the River Avon cSAC and River Avon System SSSI 125
10.4 Monitoring River SACs in Relation to Conservation Objectives 126
10.5 Climate Change 127

Section11. Glossary of Terms and Abbreviations Used **131**

Section 12. References **135**

Acknowledgments **138**

Appendix A. Details of the Designation of the River Avon cSAC/SSSI and the Avon Valley SPA/SSSI **139**

Appendix B. Draft Favourable Condition Tables for the River Avon cSAC **151**

Appendix C. Relevant Projects and Initiatives in the Avon Catchment **167**

Appendix D. Summary of Water Quality Data **173**

Appendix E. Draft Weed Cutting Protocol **179**

Appendix F. Flood-defence Schemes **181**

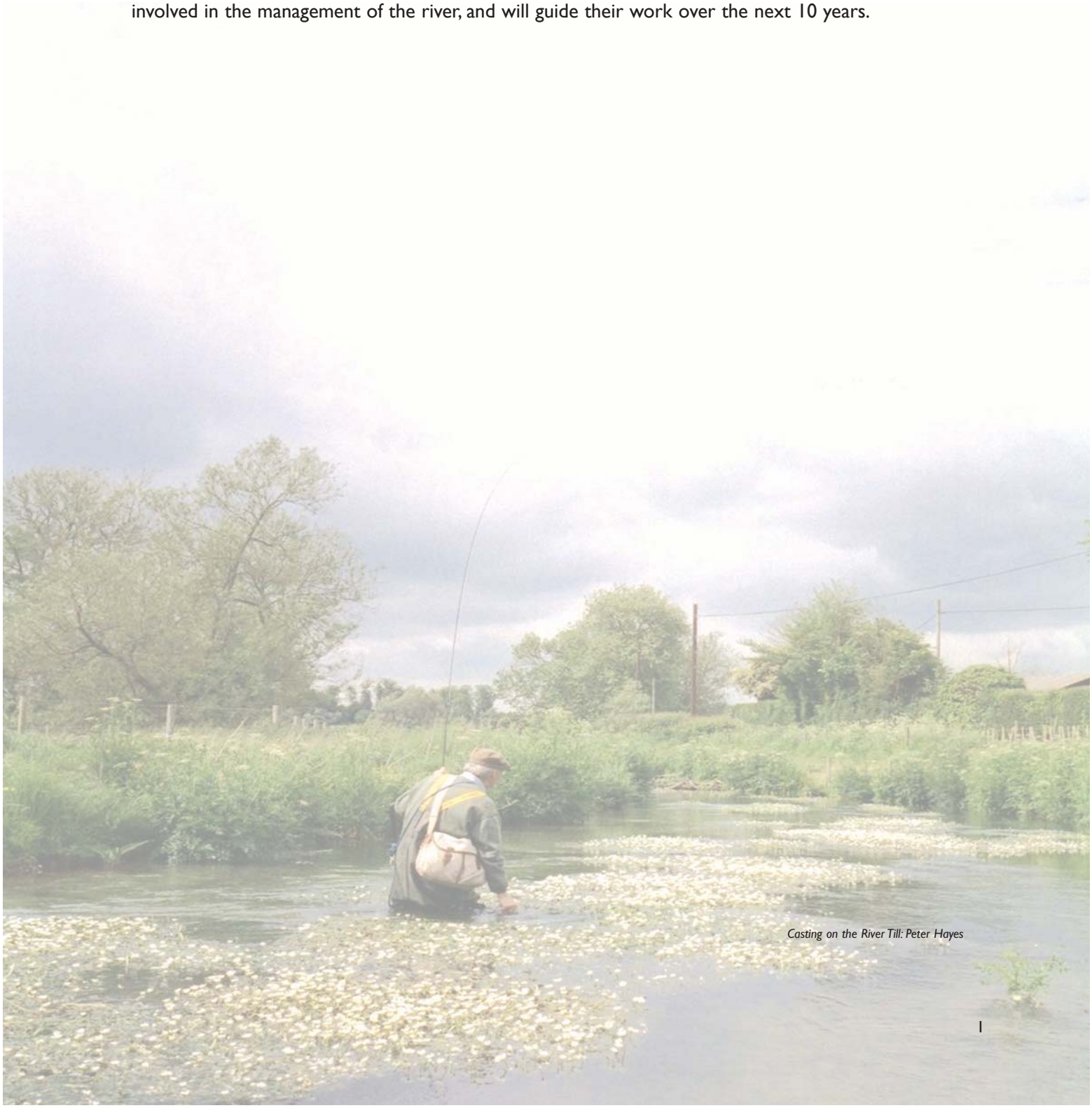
Appendix G. Development Schemes **183**

Appendix H. Summary of Physical Habitat Data **187**

Overview

The River Avon, rising in the Pewsey Vale and flowing through Salisbury to the sea at Christchurch, is one of the UK's most biodiverse chalk streams. The importance of the River Avon and its tributaries has been recognised by its designation as one of the first candidate Special Area of Conservation (cSAC) rivers in the UK, under the 1992 European Commission's Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (known as the Habitats Directive).

As part of **Life in UK Rivers**, conservation strategies are being developed on seven river cSACs. **Life in UK Rivers** is a partnership project between the European Union LIFE Nature fund and the main statutory conservation bodies in the UK. On the Avon this strategy aims to define issues affecting the river, to note and assess the effectiveness of mechanisms already in place to address these issues, and to identify any further action required. The strategy has been developed by key organisations and individuals involved in the management of the river, and will guide their work over the next 10 years.



Casting on the River Till: Peter Hayes

Summary

The River Avon cSAC

The importance of the River Avon and its major tributaries is recognised by its designation as a candidate Special Area of Conservation (cSAC) for the following internationally rare or vulnerable species and habitat:

- The river habitat as characterised by flowing water vegetation including *Ranunculus* species
- Populations of Atlantic salmon
- Populations of bullhead
- Populations of brook and sea lamprey
- The river and particular adjoining areas as habitat for populations of Desmoulin's whorl snail.

The Habitats Directive requires member states to maintain or restore individual sites such as the River Avon cSAC to 'favourable condition'. Favourable condition is a range of conditions within which the various influences on a designated habitat or species do not adversely affect its distribution, abundance, structure or function throughout the cSAC in the long term.

The River Avon cSAC includes the rivers Avon, Bourne, Nadder, Wylye, Till and the Dockens Water, as shown in Figure 1. The lower River Avon flows through the Avon Valley Special Protection Area (SPA), which encompasses the River Avon and its floodplain between Bickton and Christchurch. The Avon valley is intrinsically linked to the River Avon by a complex network of drainage ditches that determine water levels in the SPA. However, it is outside the scope of the strategy to consider the management of the SPA, except where it affects the cSAC.

David Withrington/English Nature

The River Avon system has been designated as a cSAC because of its importance as habitat for several internationally rare or vulnerable species.

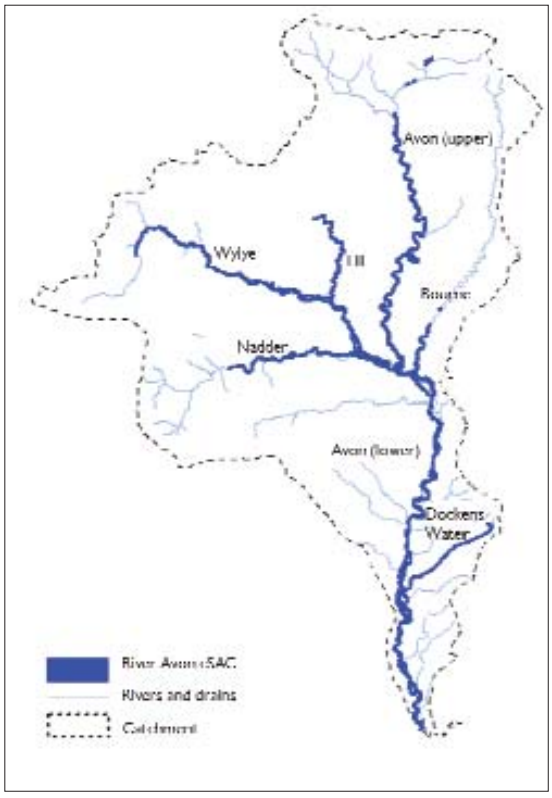


Figure 1. As well as the River Avon, the cSAC includes the rivers Till, Wylye, Nadder and Bourne, and the Dockens Water.

Development of the Conservation Strategy

The objectives of the conservation strategy are:

- To identify issues affecting the cSAC
- To assess existing measures to address these issues
- To identify and prioritise further measures required.

Identifying Issues

Key organisations involved in the management of the River Avon cSAC were brought together in a working group to identify objectives for the conservation strategy and the issues on which it should focus. The group was made up of county, district and borough councils, the Department for the Environment, Food and Rural Affairs (DEFRA), the Wildlife Trusts, water companies, representatives of riparian owners and fishing interests, English Nature and the Environment Agency.

Assessing Existing Measures

The working group first identified issues adversely affecting the cSAC and assessed existing measures in place to address them. Topic groups made up of participants with specialist knowledge of, or involvement in, these areas were then set up. Further groups met to discuss ways for fishery managers to help conserve the cSAC, and abstraction issues. This process further refined the issues that potentially or actually impact on the river system.

Prioritising Further Measures Required

The working group then prioritised the issues identified by considering each against a set of criteria that it had developed. The most important of these criteria was the extent to which the resolution of any particular issue would impact favourably on the condition of the cSAC. Other criteria were also identified, including: public perception, cooperation from main users of the river, impact on stakeholder commitment, and wider biodiversity (including the SPA).

The process resulted in the clear identification and prioritisation of certain key issues that impact on the condition of the cSAC. These key issues are summarised below.

Key Issues Considered by the Strategy

Point-source Discharges

The River Avon cSAC receives discharges of polluting substances from a variety of sources, including public and private domestic sewerage, agriculture, aquaculture (watercress and fish farms), and industry.

Particular issues of concern include phosphorus discharges from major sewage treatment works, the impact of water quality in Christchurch Harbour on salmon, hormone-disrupting substances, and the effect of new building developments.

Discharges of phosphorus from point sources will be effectively reduced through statutory mechanisms, including the Environment Agency Review of Consents, the Avon Eutrophication Control Action Plan, and Asset Management Planning (AMP).

Diffuse Pollution

Diffuse pollution (in particular from agriculture) is considered to be contributing to nutrient enrichment, reduced water quality and elevated levels of silt and pesticides. Diffuse agricultural pollution is caused by herbicides, pesticides, organic and inorganic fertilisers, and soil washing off agricultural land and entering watercourses, or leaching into groundwater. Studies have identified the upper Avon as a target area for reducing agricultural diffuse pollution, and the implementation of sustainable 'best farming practices' is required.

Several national policy mechanisms are available to implement agricultural best management practices. At present, none of these mechanisms contributes effectively to an overall solution to diffuse agricultural pollution. However, as part of the ongoing review of agri-environment schemes, there may be an opportunity for the proposed Entry Level Scheme to address agricultural diffuse pollution.

In the upper Avon, the Landcare project will promote measures to control diffuse pollution, and to influence land managers, farm consultants and advisors to adopt these. The Landcare Partnership and the River Avon cSAC Conservation Strategy Agriculture Group have identified a critical need for increased funding for the project over a sustained period.

Other aspects of diffuse pollution that require action are: research into the role of bed sediments in recycling nutrients in the

Paul Bryson/Environment Agency

David Withrington/English Nature

Diffuse agricultural pollution is caused by soil, pesticides and fertilisers washing off agricultural land, such as maize fields (above) or wheat fields (below) into watercourses, or leaching into groundwater. Point-source pollution includes overflows from private septic tanks (left).

Paul Bryson/Environment Agency

river system, and the development of guidance to ensure that ditching works do not adversely impact on the cSAC due to silt and nutrients being released.

Abstraction

Abstraction from the River Avon catchment is carried out for a variety of uses, including public and private water supply, agriculture, aquaculture (watercress and fish farms), and industry. The rivers Wylye, Bourne and Nine Mile River, and Fonthill Stream are considered to be at risk from groundwater abstraction for public water supply.

The following statutory mechanisms are being used to evaluate and address impacts of abstraction on the river system: the Review of Consents, Catchment Abstraction Management Strategy, and Asset Management Planning. The proposed draft Water Bill should also benefit the cSAC, water companies and consumers by establishing a more flexible abstraction licensing system.

Recreational Fisheries Management

Fisheries management is an important influence throughout the river system and includes several activities that may significantly affect the cSAC. The upper Avon is primarily managed as a game fishery, and the lower Avon as a coarse fishery. A topic group agreed that it would be useful to develop guidance on fishery management for conservation, initially for the upper Avon, which is more highly managed.

Managing Exploitation of Salmon Stocks

Exploitation of salmon stocks must be managed to ensure the restoration and maintenance of healthy salmon populations. Particular issues include the need for continued catch and release of salmon from both rods and nets, return of salmon caught as a by-catch of mullet and bass fisheries, and illegal fishing.

Riparian owners and the Mudeford Netsmen have recently agreed voluntary catch and release of all salmon caught by both rods and nets until sustainable salmon stocks are achieved and maintained in the Avon. Legal mullet and bass fisheries operate in Christchurch Harbour, and any salmon caught as a by-catch of these fisheries must be returned (dead or alive). This requirement is enforced.

Guy Mawle/Environment Agency

A voluntary catch-and-release scheme has been instigated for all salmon caught by both rods and nets in the River Avon cSAC until sustainable stocks are achieved.

Some illegal salmon fishing is believed to occur in Christchurch Harbour, in the estuary and immediately offshore, and on the spawning grounds. A consistent police response would benefit enforcement activities related to the bass and mullet fisheries and any illegal fishing. An initiative to tag legally caught sea trout seems to be successfully reducing illegal sea trout fishing and associated salmon catches.

Flood Defence and Land Drainage Activities

The Environment Agency is the principal body undertaking flood-defence operations and maintenance activities in the cSAC.

Activities of concern include mechanical weed cutting, the maintenance of ex-Internal Drainage Board drains, and removal of woody debris from the channel.

Routine maintenance activities related to flood defence, including blockage and debris removal, de-silting and weed cutting, have been agreed by English Nature and the Environment Agency, and are set out in 1993 River Avon (Salisbury–Christchurch) Operational and Maintenance (O&M) plan. The plan is currently under review to ensure the Environment Agency fulfils its responsibilities under the Habitats Regulations 1994 and Wildlife and Countryside Act 1981.

Water-level Management

Water-level management is an issue in the upper Avon, where sluices and hatches control water levels, and in the lower Avon, where land drainage impacts on the Avon Valley SPA. Water Level Management Plans (WLMPs) are being developed for the River Avon cSAC/SSSI (Site of Special Scientific Interest) and Avon Valley SPA/SSSI. Their successful implementation is vital in ensuring wildlife gain. For the River Avon cSAC, the priority is to ensure appropriate water-level management for the river, taking into account seasonal variations in flow. In the lower Avon, the plans aim to establish appropriate water-level management in the SPA, which could impact on the river.

Catchment Flood Risk Management

In the next five years, the Environment Agency will develop Catchment Flood Management Plans (CFMPs). These plans will provide the context for flood management, and have the potential to benefit biodiversity as well as to deliver flood protection. New flood defence schemes are proposed to protect Downton, Ringwood, Fordingbridge and parts of Salisbury from flooding. It is essential that the CFMP and any new flood defence schemes take into consideration the water level and flow requirements of the River Avon cSAC.

Problem Species

Non-native Invasive Plant Species

The impact of bankside and aquatic non-native invasive plant species has become a major concern in many habitats of conservation importance, due to their ability to achieve dominance over native species and difficulty in their control or eradication. Himalayan balsam and Japanese knotweed are present in localised patches in the Avon catchment and are a risk to the cSAC, in particular Desmoulin's whorl snail habitat.

There is a need to collate existing data on invasive plants and to instigate a control and eradication programme. In the Avon catchment, awareness raising of non-native

Ian Killeen

Jenny Wheeldon/English Nature

Non-native plants such as Himalayan balsam (right) may come to dominate riverine areas. They present a particular risk to Desmoulin's whorl snail (left).

Catherine Duigan/CCW

Japanese knotweed is present in local patches in the River Avon cSAC, and poses a risk to native plant species.

invasive plant species is required to reduce the risk of further introductions of invasive plants.

Grazing of Water Crowfoot by Flocks of Mute Swans

Grazing by flocks of unmated mute swans has been observed to have a marked local effect on beds of water crowfoot (*Ranunculus*) in the River Avon system. In some instances this is due to, or related to, other impacts known to be affecting the condition of the vegetation communities. Grazing of *Ranunculus* species is thought to impact the SAC by depleting the vegetation community and reducing refuges for salmon and bullhead.

English Nature has recently commissioned a review of available literature related to swan grazing on the Avon cSAC to draw together existing knowledge, attempt to determine the impact of grazing on the cSAC, and to guide future efforts to minimise it.

Avian Predation

Cormorant predation on fish is of increasing concern to fishery managers in the cSAC, but it is not currently thought that management of cormorant on the Avon is required on conservation grounds.

However, juvenile salmon and smolts may be vulnerable at particular times and locations, and this should be investigated.

Signal Crayfish

It is not known whether signal crayfish are currently having an adverse ecological effect on the cSAC, although there are established populations at several locations. However, signal crayfish have been shown to be negatively correlated with bullhead, suggesting competitive and/or predator-prey interactions. The spread of signal crayfish in the catchment could therefore lead to localised extinction of bullhead.

Development and Road Schemes

There are several building developments and road schemes proposed within the Avon cSAC catchment. The main potential impacts of developments and road schemes on the cSAC are: pollution of the river system during construction, runoff during operation/usage, indirect pressures on the river if floodplain dynamics are altered, increased demand on water resources in the area, increased need for sewage disposal, and fragmentation of habitat.

Under the Habitats Regulations any development that may have an impact on the cSAC requires scrutiny and is also subject to statutory planning legislation, land drainage and pollution controls. The River Avon cSAC/SSSI designations place considerable demands on public bodies specifically to address this aspect. Despite the statutory measures already in place, there are several issues to consider. In particular, few of the local authorities in the Avon catchment have experience of implementing the Habitats Regulations.

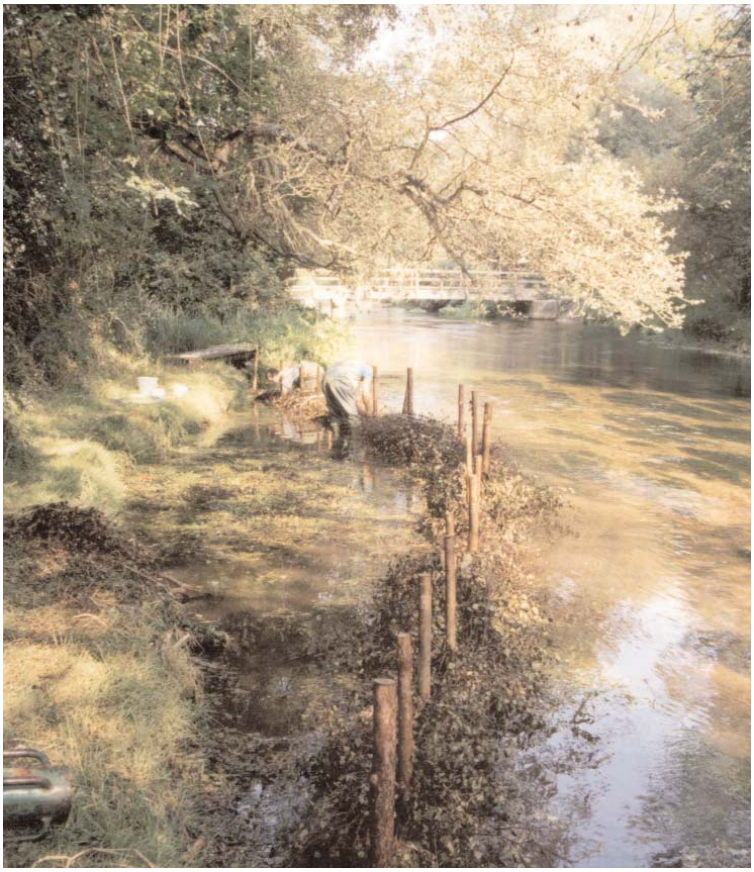
It is recommended that a planning forum and seminars are established to help identify development

proposals likely to affect the cSAC, potential issues related to these, responsibilities and a timetable for action. Local planning authorities and highways authorities also need to strengthen their procedures for consultation with the Environment Agency and English Nature early in the planning process.

Strategic Approach to River Rehabilitation

The river habitat is damaged or in poor condition in places, often as a result of historical land drainage and engineering activities. To try and improve the physical habitat of the river system, various organisations and individuals undertake habitat enhancement works. These enhancement schemes have varied aims.

A strategic approach to rehabilitation must be developed to maximise ecological gain for the cSAC, comprising clear objectives and a framework within which to identify sites that would benefit most from this work. The approach must also consider any constraints at those sites.

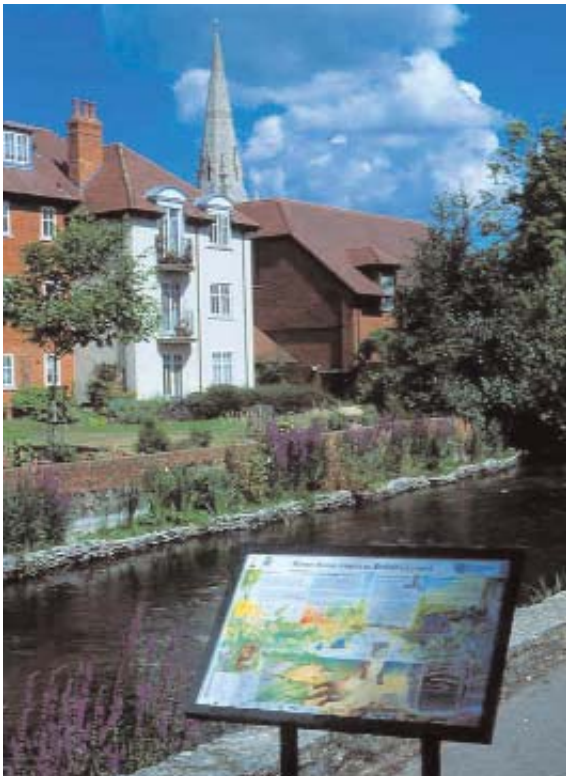


Several rehabilitation schemes are being undertaken on the River Avon, including here at Figheldean. When rehabilitation work is finished, the water is clear and submerged plants such as water crowfoot can flourish, providing habitat for numerous species.

Both photos by Tony Wells

Communication and Access

Ineffective communication has been identified as an issue that undermines co-operation between river managers. In addition, the wider community has limited opportunities to access information about the river. Improved communication and access to information would help create an identity and sense of ownership for the river in the wider community, and improve levels of co-operation from key groups.



Steve Davies/English Nature

Information available to the public, such as here at Salisbury, is vital to help create a sense of ownership of the river and habitats.

Particular action is required to investigate how best to improve communication between stakeholders and statutory bodies, and how best to improve public understanding and managed access to the river system. Depending on the outcome of the WLMP initiative, a similar structure could be used for future consultation between parties (statutory, regulatory and riparian owners) involved in management of the River Avon cSAC.

Data Collation and Information Management

Large amounts of data exist for the River Avon cSAC, but are currently dispersed between organisations. To improve understanding of the processes and needs of the river system, further action is required to ensure information is collated and stored in a useful format (GIS-based) and long-term management assured.

Boundary of the River Avon cSAC

The boundary of the River Avon cSAC/SSSI was based on the available scientific knowledge at the time of notification. New information indicates that the boundary could be revised.

Survey and Monitoring of the cSAC's Habitats and Species

Adequate data exist on water quality, flows and salmon stocks, but there is inadequate information regarding the distribution, range and size of bullhead and lamprey populations. Surveys to gain more information on populations of these species in the river system are underway. To improve our knowledge of the river and to allow reporting on favourable condition there is a need to determine a monitoring strategy for the cSAC.

Climate Change

The consensus for the impact of climate change on the weather in southeast England is drier summers, wetter winters and increased likelihood of extreme events such as storms and droughts. It is vital that the actions recommended throughout the strategy are implemented through sustainable solutions, which take into consideration climate change.

Priorities for Action

Careful consideration of the key issues above via the prioritisation process described has resulted in the detailed action tables following. Within these tables, four levels of priority for further action have been identified: Key Major, Major, Intermediate and Minor. In considering the actions listed in the tables it is important to bear in mind that these priorities have been assigned in the specific context of the strategy. Consequently, where a key issue is judged already fully or partially in hand, any adjustment or addition to the existing action may well be considered a lower priority when compared to an issue that has been neglected hitherto. Equally, because of the criteria used, issues that have a localised impact (perhaps applicable to the upper or lower Avon only), or which are not directly relevant to the cSAC (such as management of the SPA), have also been accorded a lower priority.

The summary action tables therefore show the prioritised issues and associated further actions required. Where an action is mainly relevant to a localised area, this has been indicated. All the actions shown in the tables need to be tackled. However, those in priority groups Key Major and Major will be most urgently acted upon. For further information on each action, refer to the corresponding section of the strategy, as indicated in the tables. A copy of the full strategy document can be obtained from English Nature.

Twenty-four general issues affecting the cSAC were identified, many of which are being addressed in part or entirely by existing measures. Agricultural diffuse pollution and strategic habitat rehabilitation were identified as major key issues where the action required cannot be delivered through the existing work of organisations.

An example table follows, while a key to the symbols and abbreviations used is given on the following page.

Action tables

Example

Issue	**Existing measures**	**Priority**	**Area**	**Action required**	**By whom/Lead and potential partners)**	**Mechanism**	**Date**
Name of issue	Measures already in place	Priority for **further** action	Area where action is most applicable	Further actions required over and above those already in place	Potential partners. Where a clear lead has been identified this is indicated in **bold**. The symbol * indicates that a lead needs to be identified.	Suggested delivery mechanism	Suggested date by which action should be carried out.

Key to symbols and abbreviations

The abbreviations used to describe organisations and mechanisms referred to in the strategy document and a key for priorities for action are as follows:

Organisation		**Mechanism**	
A&SRA	The Avon and Stour Rivers Association	AMP	Asset Management Planning
CERC	Relevant County Environmental Record Centres	BAP	Biodiversity Action Plan
DEFRA	Department of the Environment, Fisheries and Rural Affairs	CAMS	Catchment Abstraction Management Strategy
EA	Environment Agency	CFMP	Catchment Flood Management Plan
EN	English Nature	CSS	Countryside Stewardship
GCT	Game Conservancy Trust	ECAP	Eutrophication Control Action Plan
HA	Highways Authority	ESA	Environmentally Sensitive Area
LA	Local Authorities (both district, county and borough councils)	FAP	Fisheries Action Plan
		LEAP	Local Environment Agency Plan
LA 21	Local Agenda 21	NT&GS	National Trout and Grayling Strategy
RRC	River Restoration Centre	O & M	Operational and Maintenance Plan
RSPB	Royal Society for the Protection of Birds	PSYCHIC	Project developing a risk assessment and decision-making tool for agricultural diffuse pollution
WCO	Water companies		
WFA	Wiltshire Fishery Association	RoC	Review of Consents
WSRT	Wessex Salmon and Rivers Trust	SAP	Salmon Action Plan
WTs	Wildlife Trusts	WLMP	Water Level Management Plan
WTT	Wild Trout Trust		

Note: In the action tables on the following pages, reference is made to the following:
Fisheries interests – fishing clubs, representative organisations e.g. WFA, A&SRA and sources of expertise e.g. WTT, GCT
Landowner interests – landowners, tenant farmers and representative organisations e.g. NFU, CLBA

Area action primarily applies to		**Priorities for action**	
UA	Upper Avon (above Salisbury	1	Key Major
LA	Lower Avon (below Salisbury	2	Major
A	All Avon	3	Intermediate
H	Christchurch Harbour	4	Minor

Issue		Existing measures	Priority	Area	Action required		Lead (in bold) and potential partners	Mechanism	Date	Section
1	Existing point-source discharges	RoC, AMP	2	A	1.1	Ensure that appropriate discharges from the Stour are included in the Review of Consents.	**EA**, WCO	RoC	2003	3.2.3
			2	H	1.2	Investigate water quality in Christchurch Harbour to determine if this is a significant influence on salmon and lamprey	**EA**	RoC/ research	?	3.2.3
		EA research and monitoring	2	A	1.3	If national-level Environment Agency work finds that the Avon is at risk from hormone-disrupting substances, investigate options for reducing this risk.	**EA**	Research	2003+	3.2.4
2	New discharges	AMP, PSYCHIC, Landcare	2	A	2.1	The Avon ECAP must have regard to the cSAC favourable condition targets, and in particular soluble reactive phosphorus levels.	**EA**	ECAP	2002/3	3.2.1.2
		LEAP, Landcare, local plans	2	A	2.2	Promote the use of Sustainable Urban Drainage Systems in all new developments or road schemes to ensure no significant effect on the cSAC.	**LA, EA, EN**	Planning process	Ongoing	3.2.5
3	Agricultural diffuse pollution	EA/EN national policy work	1	UA	3.1	Seek funding to develop the Landcare project within the River Avon catchment, including the provision of financial support for farmers and riparian owners prepared to adjust their farming practices in order to benefit the conservation interests of the cSAC.	**EA**,EN, DEFRA	Agri-environment scheme review?	2003+	3.3.1.1
		CSS, ESA consultation, Landcare	1	A	3.2	Provide agri-environment scheme advisors and project officers with information on where to target advice on best farming practice.	**Landcare**, DEFRA	Landcare, DEFRA, WTs	2003+	3.3.1.2
			1	A	3.3	Support agri-environment scheme advisors and project officers to increase their knowledge of best farming practices, including soil and nutrient management.			2003+	3.3.1.2
			1	LA	3.4	Ensure that advisors in the Lower Avon are kept informed of experiences from the Landcare project and have access to further information if required.			2003+	3.3.1.5
		AMP, PSYCHIC, Landcare	1	LA	3.5	Investigate the contribution of diffuse pollution to water quality on the Lower Avon if phosphorus levels indicate this may be an issue.	**EA,** EN, DEFRA	EA investigation	?	3.3.1.6

Issue		Existing measures	Priority	Area	Action required		Lead (in bold) and potential partners	Mechanism	Date	Section
3	Road runoff	Landcare	1	A	3.6	Seek funds to support best farming practices where agricultural land use contributes to road runoff.	**EA**, EN, HA, LA	Maintenance savings?	2003+	3.3.2
4/5	Current and future abstractions	AMP, RoC	2	A	5.1	Support the implementation of the South West Region Water Resources Strategy, promoting ways to manage demand for water.	EA, EN, WCO, WTs	Routine work	2003+	4.3.2
			2	A	5.2	The CAMS ecological assessment must have regard to the favourable condition flow targets for the Avon cSAC.	**EA**	CAMS	2003+	4.3.3
6	Recreational fishery management	Training seminars, Licensing and consents and NT&GS Research	2	A	6.1	Avon FAP to take into account potential interactions between stocked brown trout and the River Avon cSAC/SSSI features	**EA**, EN, WTs, - fisheries interests	NT&GS, FAP	? ? ?	5.3.3.2
			2	A	6.2	Avon FAP to address the issue of the stocking of rainbow trout in the Avon cSAC				
			2	A	6.3	Avon FAP to take into account potential interactions between the coarse fishery and the cSAC/SSSI features				
		ESA scheme	2	LA	6.4	In the Avon Valley SPA/SSSI, remove fences at the earliest opportunity once appropriate grazing regimes are established	EA, **EN**, DEFRA, Fisheries and landowner interests	ESA, CSS	2003+	5.3.4.3,
		Research	2	A	6.5	Revise the gravel-cleaning protocol to take into account the cSAC features and the findings of the *Decline of Chalk Stream Salmon* research project.	**EA**	Research	2003	5.3.5
		Advisory services	2	A	6.5	Develop guiding principles for sensitive management of fisheries within the cSAC, in partnership with fishing interests.	EN, EA, WTs, WFA, A&SRA, fishing interests	Voluntary partnership	2004	5.3.6
			2	A	6.7	Promote adoption of principles of sensitive management as a voluntary code of practice.			2004	

Issue		Existing measures	Priority	Area	Action required		Lead (in bold) and potential partners	Mechanism	Date	Section
7	Exploitation of salmon stocks	Voluntary agreements	3	A	7.1	Keep catch and release guidance for the Avon fisheries under review and develop suitable guidance taking account of temperature effects.	EA, fisheries interests	Research	2003+	5.4.1
		Byelaws and net limitation orders	3	H	7.2	Keep local sea fishery netting bylaws under review and if necessary and appropriate put forward proposals for further bylaws to protect salmon.	**EA**	Review	2003+	5.4.2.1
		Enforcement	3	A	7.3	Work with the police to ensure an adequate response to illegal activity, particularly resolving county/borough boundary issues.	**EA**, police	Enforcement	2003+	5.4.2.2/3
8	Operation of eel traps	Monitoring	4	A	8.1	Continue with actions underway	**EA**	Monitoring	Ongoing	5.5
9	Escapes from fish farms	Enforcement New legislation	4	A	9.1	Continue with actions underway	**EA**	Enforcement	Ongoing	5.6
10	Flood defence operations and maintenance	Revision of O & M plan Review of weed-cut protocol, review of ex-IDB drain maintenance	2	LA	10.1	Incorporate the revised Weed Cutting Code of Practice into the Operational and Maintenance Plan once English Nature, the Environment Agency and ESA officer are satisfied with the new procedure.	**EA**, EN, DEFRA	O & M plan	2003	6.1.2.1
			2	LA	10.2	Review the Weed Cutting Code of Practice regularly and amend the Operations and Maintenance Plan accordingly.			2003+	6.1.2.1
			2	LA	10.3	Consider appropriate monitoring to determine changes in *Ranunculus* communities on the river in response to Environment Agency weed cuts and to determine if the cuts achieve their water-level management objectives.	**EA**	?	?	6.1.2.1
			2	A	10.4	Have regard to the suitability of weed-cutting equipment and collection, removal and disposal of weed.	**EA**	O & M plan	2003+	6.1.2.1
			2	A	10.5	Leave coarse woody debris in place where this will not increase the risk of flooding or damage to infrastructure.	**EA**	O & M plan	2003+	6.1.3

Issue		Existing measures	Priority	Area	Action required		Lead (in bold) and potential partners	Mechanism	Date	Section
11	Water-level management	WLMPs, Weed Cutting Protocol, LIFE research	3	A	11.1	Ensure that any new or reinstated water level management structures (as part of WLMPs or other initiatives) do not compromise the safe passage of salmon, lamprey and bullhead.	**EA, EN, DEFRA**, fisheries and landowner interests	WLMPs (rolling programme)	2003+	6.2
			3	LA	11.2	Ensure the implementation of the Water Level Management Plan for the Avon Valley SPA/SSSI takes into account potential conflicts with the cSAC interests.			Ongoing	6.2/9.2
			3	LA	11.3	Take the revised Weed Cutting Code of Practice into account in the Water Level Management Planning Initiative.			2003+	6.2
			3	A	11.4	Take into account the results of a **Life in UK Rivers** investigation into the hydrological requirements of Desmoulin's whorl snail and identify areas for potential habitat enhancement.			2003+	6.2
			3	UA	11.5	In the upper Avon, enhancement of Desmoulin's whorl snail habitat must take into account seasonal variations in flow and ensure that flow levels for the in-river interests are maintained at all times.			2003+	6.2
12	Catchment flood-risk management		3	A	12.1	Flood-defence schemes should provide integrated solutions to reducing flood risk, delivering net wildlife gain.	**EA, LA**	Flood-defence schemes	2003+	6.3
			3	A	12.2	The Catchment Flood Management Plan must take into account the ecological requirements of the River Avon cSAC and the Avon Valley SPA and opportunities for wildlife enhancement.	**EA**, EN	CFMP	?	6.3

Issue		Existing measures	Priority	Area	Action required		Lead (in bold) and potential partners	Mechanism	Date	Section
13	Non-native invasive plant species	Publicity campaigns	3	A	13.1	Undertake a co-ordinated Avon-wide publicity campaign to inform and educate the public regarding the need to take a responsible attitude to the introduction and control of invasive plant species.	*EA, EN, WTs, LA 21, fisheries and landowner interests	Publicity campaigns	2004?	7.1.3.2
			3	A	13.2	Inform and educate target groups on identification, sources of advice and management of invasive non-native plants.		Workshops	2004?	7.1.3.2
			3	A	13.3	Collate information on invasive plant species locations for storage in a central database that is compatible with both Mapinfo and Arcview geographic information systems.	* EN, EA, CERC, LA, HA, WTs, all bodies undertaking survey fisheries and landowner interests	Data collation	2004	7.1.3.3
		CERC data	3	A	13.4	Ensure that relevant data on invasive plants collected as part of other surveys are input to the invasive species database.		Data management	2004?	7.1.3.4
			3	A	13.5	Improve and develop existing recording networks and reporting mechanisms to collect and store information on invasive plants.		?	2004?	7.1.3.4
			3	A	13.6	Create an invasive plant species forum in the Avon catchment, to identify target areas for action and to instigate a programme of appropriate management.		Forum	2004	7.1.3.5
14	Mute swan grazing	Literature review	3	UA	14.1	Collate information on mute swans for storage in a central database that is compatible with both Mapinfo and Arcview geographic information systems.	* DEFRA,EN, EA, fisheries interests	Data collation	2004	7.2.1.1
			3	UA	14.2	Determine the ecological impact of mute swan grazing on the cSAC. If necessary, identify practical options for reducing the impact of mute swan grazing on the cSAC.	**EN**, DEFRA, fisheries interests	?	2003/4	7.2.1.2

Issue		Existing measures	Priority	Area	Action required		Lead (in bold) and potential partners	Mechanism	Date	Section
15	Avian predation		3	A	15.1	Keep a watching brief on the number of cormorants and other avian predators and any trends affecting the cSAC.	* DEFRA, EA, EN, fisheries interests, RSPB	DEFRA, EA research	2003+	7.3
			3	A	15.2	Carry out an investigation to assess whether there is a likely significant effect of avian predation on salmon juvenile numbers (particularly smolts) at certain times and places), and formulate appropriate action.			?	7.3
16	Signal crayfish	Native Crayfish BAP	4	UA	16.1	Investigate current population densities of signal crayfish in the Nadder and Eastern Avon and determine if there has been an impact on bullhead and *Ranunculus* habitat.	**EA**, EN, WTs	BAP	?	7.4
17	Planning and development	Appropriate assessment, planning process	2	A	17.1	Ensure that Regional Development Plans contain policies that safeguard the River Avon cSAC.	Regional planning authority, EA, EN, WTs	Regional development plans	2003+	8.2.1
			2	A	17.2	Establish a planning forum to broadly identify development proposals likely to affect the cSAC, potential issues, responsibilities and a timetable for action.	EN, **LA**, HA	New planning forum	2004	8.2.2
			2	A	17.3	Hold seminars to determine what support public bodies responsible for planning and development need and discuss local case studies of good practice.	EN, **LA**, HA	Seminar	2003/4	8.2.2
			2	A	17.4	Local planning authorities and Highways Authorities must strengthen consultation with the Environment Agency and English Nature early in the planning process, to ensure proposals have no significant effect on the cSAC.	**LA, HA**	Appropriate assessment	2003+	8.2.2.1

Issue		Existing measures	Priority	Area	Action required		Lead (in bold) and potential partners	Mechanism	Date	Section
18	Habitat rehabilitation	Condition assessment	1	A	18.1	Use condition assessment criteria to determine whether and where rehabilitation is required to achieve favourable condition.	EA, EN	Condition assessment	2003	9.1.2
		Strategy partnership	1	A	18.2	Consider whether major investment in a programme of larger-scale rehabilitation is required. If so establish the necessary partnership and seek funding.	**Strategy Working Group partnership,** RRC	n/a	2003	9.1.2
		Life in UK Rivers	1	A	18.2	Refine the proposed strategic approach to rehabilitation, using the River Wylye as a pilot catchment.	**EA , EN**	Investigation	2003	9.1.2
			1	A	18.3	Undertake a detailed geomorphological assessment of the remainder of the cSAC, using the refined Wylye approach.			2003/4	9.1.2
			1	A	18.4	Evaluate the physical and ecological impact of existing rehabilitation schemes in the cSAC to help identify the most appropriate techniques.	**EA, EN**	Research	2004	9.1.2
			1	A	18.5	Adopt the strategic approach as a framework for targeting rehabilitation projects that bring maximum ecological gain to the cSAC and preserve/enhance important archaeological features.	EA, EN, WTs, fisheries interests	Policy	2004/5	9.1.2/9.2

Issue		Existing measures	Priority	Area	Action required		Lead (in bold) and potential partners	Mechanism	Date	Section
19	Habitat rehabilitation guidance		3	A	19.1	Undertake research to evaluate the physical and ecological impact of rehabilitation techniques, including type of materials used.	**EA, EN**	Research	2003+	9.2
		WCSP/EA advice on projects	3	A	19.2	Develop, evaluate and disseminate best-practice guidance to ensure that in-channel rehabilitation projects have maximum ecological gain for the cSAC and preserve/enhance important archaeological features.	EA, EN, DEFRA fisheries and landowner interests, WTs, RRC, LA	Research	2003/4	9.2
			3	A	19.3	Develop, evaluate and disseminate best-practice guidance to ensure that floodplain rehabilitation has maximum ecological gain for the cSAC and archaeological features.		Research	2003/4	9.2
20	Accessibility	Newsletters	2	A	20.1	Investigate how best to improve communication between stakeholders and statutory bodies.	EA, EN, WTs, fisheries and landowner interests, LA	?	2004	10.1
		WLMP consultation	2	A	20.2	Depending on the outcome of the WLMP initiative, consider using a similar structure for future consultation between parties (statutory, regulatory and riparian owners/tenants) involved in management of the River Avon cSAC.		-	2003+	10.1
			3	A	20.3	Investigate how best to improve public understanding and managed access to the river system.		?	2003+	10.1

Issue		Existing measures	Priority	Area	Action required		Lead (in bold) and potential partners	Mechanism	Date	Section
21	Data management	Investigation	2	A	21.1	Collate data related to the River Avon cSAC, put in place a database management system and investigate options for making elements of the database publicly available	**EA, EN,** CERCs, NBN	?	2004	10.2
22	Boundary of the cSAC		3	A	22.1	Review the boundary of the cSAC/SSSI if new information indicates that additional parts of the river system fulfil the criteria for inclusion in the cSAC/SSSI.	**EN**	Routine	?	10.3
23	Survey and monitoring	Surveys	2	A	23.1	Develop a monitoring strategy for the River Avon cSAC in order to report on favourable condition.	**EN, EA**	Reporting	2003/4	10.4
24	Climate change	All	n/a	A	24.1	All actions recommended in the River Avon cSAC strategy to be implemented using sustainable solutions, which take into consideration climate change.	All	All	Ongoing	n/a

Section 1
Introduction

The River Avon and its tributaries are of national and international importance for their wildlife communities. The River Avon was one of the first seven rivers selected as Special Areas of Conservation (SACs) in the UK and was confirmed as a candidate SAC (cSAC) in 2000.

Natura 2000 is a network of areas designated to conserve natural habitats that are rare, endangered or vulnerable in the European community. The Natura 2000 network includes two types of area: An SAC may be designated where the site supports certain rare, endangered or vulnerable species or habitats. If an area supports significant numbers of wild birds and their habitats it may become a Special Protection Area (SPA).

The term Natura 2000 comes from the 1992 European Commission Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora, known as the Habitats Directive. This symbolises the conservation of precious natural resources from the year 2000 and beyond. In the UK the implementation of the Habitats Directive is through the 1994 Conservation (Natural Habitats, & c.) Regulations, known as the Habitats Regulations.

1.1 Life in UK Rivers

Life in UK Rivers was set up by a partnership comprising English Nature, the Environment Agency, the Countryside Council for Wales, Scottish Natural Heritage, the Scottish Environment Protection Agency, and the Scotland and Northern Ireland Forum For Environmental Research. The partners and the European Commission's LIFE Nature Fund jointly funded the project.

The aim of the project was to support the implementation of the Habitats Directive on rivers designated as SACs throughout the UK. As part of this work, conservation strategies were established on seven cSAC rivers. The experience gained will be used to demonstrate good practice to others.

The project also undertook a programme of work to develop knowledge and understanding of ecological requirements of 13 riverine species and one habitat listed on Annexes I and II of the Habitats Directive. Guidance and practical tools for achieving, monitoring and reporting on these species and habitats were also developed.

1.2 Background to the River Conservation Strategy

The main aim of the Habitats Directive is to promote the maintenance of biodiversity. In particular, member states must work towards the maintenance or restoration to favourable conservation status of the threatened habitats and species listed on Annexes I and II respectively of the Habitats Directive.

The Habitats Directive specifies;

- Member states must establish conservation measures for SACs, including management plans.
- Appropriate steps must be taken to protect designated sites from deterioration of the protected habitats; deterioration of habitats required by species; and disturbance of species.

Life in UK Rivers developed river conservation strategies to address the requirement for management plans for river SACs. The strategies place considerable emphasis on identifying appropriate management to maintain or restore individual sites to favourable condition. This will contribute to achieving favourable conservation status of the features at a national and European level.

1.3 River Avon Conservation Strategy

This conservation strategy aims to identify the issues affecting the River Avon cSAC, existing mechanisms to address these issues, whether these are working, and any further action required. It creates a framework for achieving favourable condition for the designated features, and extends in scope beyond the cSAC boundaries where off-site impacts warrant this. Achieving favourable condition in the River Avon cSAC will depend on the subsequent implementation of the strategy and other ongoing related initiatives.

The strategy was developed in partnership with organisations and individuals involved in managing the river. The first stage in the process was to set up a working group to agree the objectives of the strategy, set parameters for the process, and to define the issues on which the strategy should focus. Topic groups involving a wider range of participants with specialist knowledge of key issues identified by the working group were then established.

1.4 The River Avon cSAC

The River Avon cSAC site was notified as of European importance for the following internationally rare or threatened features:

- Watercourses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation
- Populations of Atlantic salmon (*Salmo salar*)
- Populations of bullhead (*Cottus gobio*)
- Populations of brook lamprey (*Lampetra planeri*) and sea lamprey (*Petromyzon marinus*)
- The river and adjoining land as habitat for populations of Desmoulin's whorl snail (*Vertigo moulinsiana*).

David Fraser/English Nature

The rivers and streams in the River Avon cSAC are considered of European importance for their flowing water vegetation habitat, such as here on the River Till.

The River Avon is one of the most biodiverse chalk streams in the UK, with over 180 species of aquatic plant having been recorded, one of the most diverse fish faunas, and a wide range of aquatic invertebrates.

The river rises in the Pewsey Vale as a network of clay streams fed by chalk springs, which converge to form the main Avon. The River Avon then flows through Salisbury Plain to Salisbury, to its confluence with the rivers Nadder, Wylye and Bourne. South of Salisbury it develops into a large calcareous river flowing over more acid sands and clay as it passes the New Forest and the Dorset Heaths.

The River Avon cSAC includes the rivers Avon, Bourne, Nadder, Wylye, Till and the Dockens Water. The cSAC is underpinned by five component Sites of Special Scientific Interest (SSSIs): the River Avon system (rivers Avon, Nadder, Wylye, Bourne), River Till, Jones Mill, Porton Meadows, and Lower Woodford Water Meadows, as shown in Figure 2. Where land adjoining the river (mainly small areas) provides suitable habitat for Desmoulin's whorl snail it has been included in the cSAC boundary.

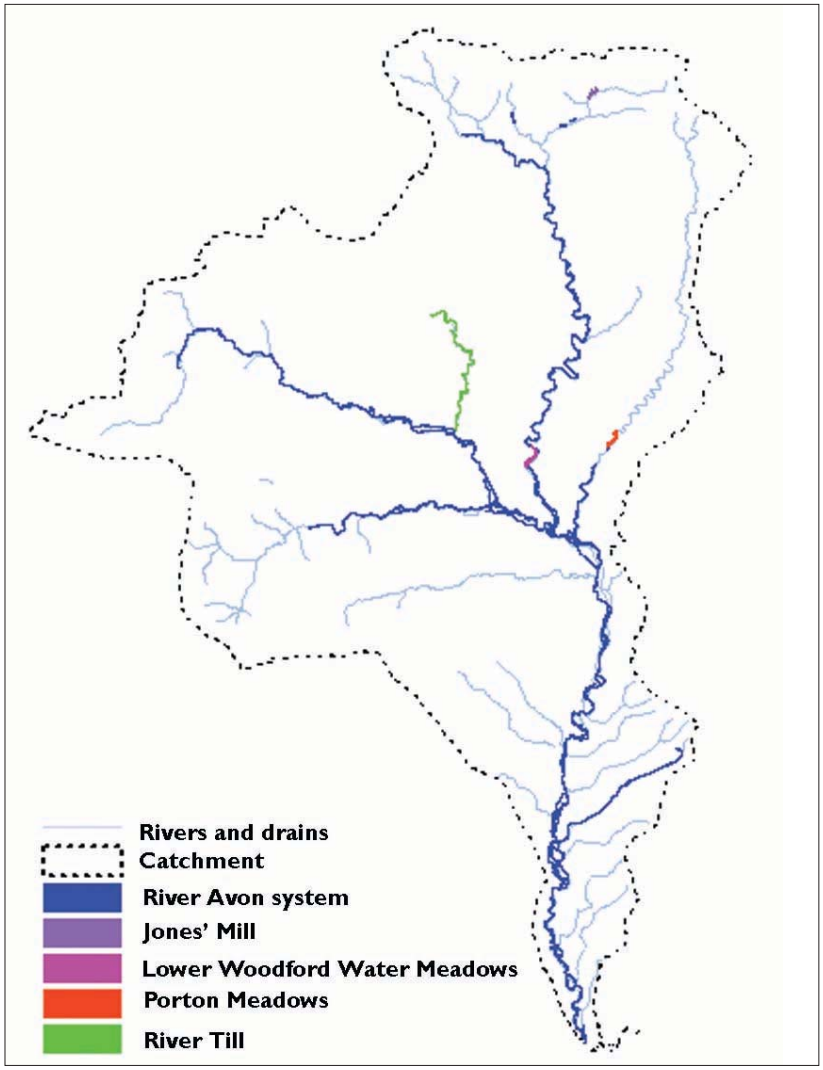


Figure 2. River Avon cSAC component SSSIs

The River Avon System SSSI was notified in December 1996. At the same time, consultations were conducted on the proposed River Avon SAC, based on existing knowledge and some additional survey. Tributaries were included if known to add representation of different river vegetation communities and SAC features. English Nature's knowledge (both locally and nationally) of the river system has developed considerably since that time, and new information indicates that the site's interests extend beyond the current boundary. See Section 10.3 for further details.

Full details of the cSAC and SSSI designations including flora and fauna, and a list of Operations Likely to Damage the SSSI (OLDs list) are given in Appendix A.

The River Avon cSAC is almost entirely semi-natural in character, having been managed over centuries for agricultural, industrial and sporting purposes. The Upper Avon, Wylye and Bourne are primarily 'chalk stream' in character, while the Nadder is primarily derived from a clay and greensand or sandstone catchment and therefore has a different character. The cSAC also includes the River Till, which is a winterbourne on chalk, and the Dockens Water, running off the New Forest gravels.

Throughout this document reference is made to the upper and lower Avon, meaning the river system north and south of Salisbury respectively.

1.4.1 Catchment Land Use

In the north of the catchment, the main influence on the rolling chalklands and sheltered chalk river valleys is intensive farming and military activity on and around Salisbury Plain. In the upper reaches of the system the rivers support outstanding chalk stream fisheries. The surrounding land is mainly grazed or arable. The land adjacent to the upper Avon includes small fragments of agriculturally unimproved flood pasture, swamp, fen and wet woodland.

In the south of the catchment, the Avon valley is a flat-bottomed floodplain of primarily low-lying pasture, the exception being waterbodies created by sand and gravel extraction. From Salisbury to Ringwood the floodplain is much broader and the river becomes braided where old water meadow channels exist. The floodplain grassland of the lower Avon Valley is of international importance for wintering wildfowl (see Section 1.5.2).

1.4.2 Historic and Current Influences

Although the River Avon is considered to be one of the most biodiverse in lowland Britain, there is concern that a combination of factors is affecting the ecology. Problems include reduced water quality due to increasingly intensive land use, especially where combined with insensitive engineering and/or management. Factors such as climate change and water resource exploitation on a regional basis are also impacting on the ecology.

The River Avon cSAC is a highly managed system and there have been significant historic and ongoing modifications to the river and its floodplain:

- The creation and manipulation (including bank stabilisation) of a network of channels across the river valleys to feed water meadows and mills. South of Ringwood, water meadow systems are replaced by grazing marsh systems, still with a network of channels and ditches.
- Manipulation of flows using an elaborate system of hatches, sluices and weirs (affecting the whole channel network).
- Management of in-channel and marginal vegetation, primarily for fishing and flood defence purposes.
- Removal of woodland.
- Conversion of swamp and fen habitats to agriculture (including pasture).
- Abstraction of groundwater for agricultural and public water supply.
- Fishery management including stocking, weed cutting and manipulation of wild fish populations, especially for control of coarse fish in the chalk stream reaches.
- Built development.
- Disposal of waste products, such as sewage.
- Watercress farming using the headwater springs.
- Substantial widening and deepening of the river channels for agricultural drainage and flood relief. This has resulted in the river becoming functionally separate from the floodplain in places, in particular on the Wylye.
- Intensified grazing management adjacent to the rivers, especially north of Salisbury, leading to bank erosion.
- Conversion of river valley pastures to arable or improved grassland, exacerbating the requirement for drainage and increasing runoff.
- Development of intensive fish farms.
- Intensification of arable cultivation in the wider catchment, increasing erosion of soils and siltation of the river.

1.5 The Local Natura 2000 Network

The River Avon cSAC is closely linked to several Natura 2000 sites, influencing both supply of water to, and drainage from, these sites. The main Natura 2000 sites related to the Avon are shown in Figure 3 and detailed below.

1.5.1 Salisbury Plain cSAC and SPA

Salisbury Plain supports the largest known expanse of unimproved chalk downland in northwest Europe, and is 41% of Britain's remaining area of this rich wildlife habitat. Salisbury Plain is important to the river Avon as it forms much of the catchment of the upper Avon, Bourne, Wylye and Till. Salisbury Plain cSAC is consistent with the Salisbury Plain and Porton Down SPAs, and the area as a whole is of national and international importance for breeding and wintering birds.

A LIFE partnership project recently begun on Salisbury Plain aims to restore the cSAC and SPA site to favourable condition. The £2.3 million project will focus on clearing 294 ha of scrub and 120 ha of plantation, and restoring grazing to 3,663 ha of grassland.

1.5.2 Avon Valley SPA

The Avon Valley SPA encompasses the lower reaches of the River Avon and its floodplain between Bickton and Christchurch. The site follows the boundary of the Avon Valley SSSI with the exception of a few small areas to the east and west of the river. The Avon Valley SPA comprises one of the largest expanses of unimproved floodplain grassland in Britain and also includes a series of gravel pits known as the Blashford Lakes.

Features supported by the site include breeding waders and migratory birds. Further details of the SPA and SSSI are given in Appendix A. The Avon Valley is also designated as a Ramsar site.

The Avon valley is intrinsically linked to the River Avon and the drainage ditches connected to it, which form a complex network that determines water levels in the valley. The Avon Valley SPA is suffering a decline, due to a combination of management factors associated with current land use and seasonal variations producing a decrease in water levels on the floodplain.

1.5.3 The New Forest cSAC

The New Forest cSAC is one of the most important sites for wildlife in the UK, and is recognised as being of exceptional importance for nature conservation across the European Union. The New Forest is scheduled to become a National Park, which will provide additional protection and status. The proposed park will include a

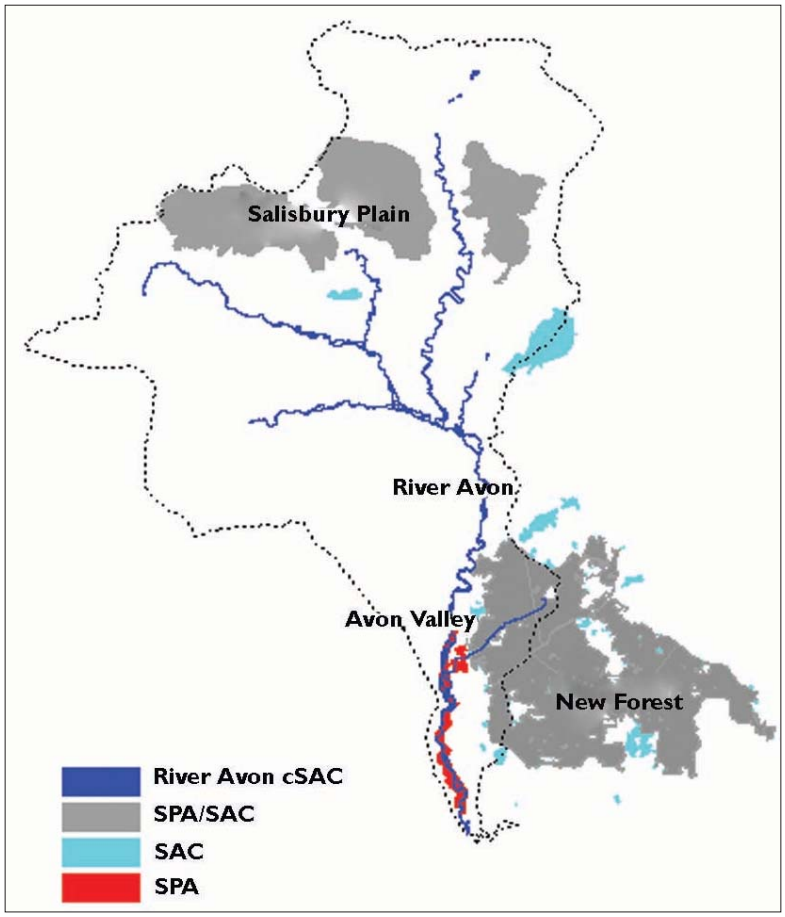


Figure 3. Major local Natura 2000 sites.

Jenny Wheeldon/English Nature

The New Forest drains to the River Avon through six streams, including the Dockens Water.

substantial part of the lower Avon valley.

The New Forest cSAC supports a complex mosaic of habitats. Major components are the extensive wet and dry heaths, with rich valley mires and associated wet and dry grasslands, the ancient pasture and enclosed woodlands, rivers and streams, and permanent and temporary ponds. Excellent examples of 13 habitats of European interest are represented, including two priority habitat types.

The drainage pattern of the New Forest is determined largely by three main drainage basins. The New Forest drains to the River Avon via six streams including the Dockens Water, which is part of the River Avon cSAC. New Forest streams are characterised by high winter flood flows and very low summer flows due to the underlying clay strata. (Wright & Westerhoff 2001).

1.6 Statutory Management of the River Avon cSAC

The River Avon is managed either directly or indirectly by a large number of organisations, each with different roles and responsibilities under the Habitats Regulations.

1.6.1 Conservation Objectives

The purpose of selecting and managing SACs across Europe is to contribute to sustaining natural resources by maintaining or restoring interest features to favourable conservation status. On an individual SAC level, this term is translated as favourable condition.

In the UK the Joint Nature Conservancy Council (JNCC) has instigated a process through which common standards for establishing conservation objectives and associated monitoring programmes are applied. This has led to the development of a UK approach to establishing SAC conservation objectives.

Conservation objectives set the standard for favourable condition for each feature in a cSAC. They provide the targets that management of the site should achieve, and can be used to report on the effectiveness of measures to maintain or achieve favourable condition.

Conservation objectives are described by a set of attributes that describe or support the features of European importance. English Nature has advised what these attributes should be and their associated targets based on best available knowledge. These attributes are set within draft Favourable Condition Tables (FCTs). For many features, the level of current understanding means that it is not possible to set exact numerical targets and ranges. Therefore, the FCTs may be subject to future modifications as our knowledge develops. The full draft FCTs for the cSAC can be found in Appendix B.

1.6.2 Condition Assessment and Reporting

In order to assess the status of the habitats and species listed in the Habitats Directive, member states must report every six years on the condition of their Natura sites. 2002 is the last in the six-yearly reporting cycle on condition of cSACs. In the UK, it will be possible to report on a number of riverine attributes, but methodologies for certain others will not be finalised. There will be an evolutionary process in which attributes are brought on-line for assessment as and when methodologies are ready. Discussions are ongoing to decide who will monitor particular attributes.

Life in UK Rivers has established the ecological requirements of 13 freshwater SAC species and one habitat, and developed methodologies for monitoring these features. This work will contribute to refining the FCTs for SACs and establishing monitoring protocols for the features.

Further information on SAC site selection, conservation objectives and monitoring can be found on the JNCC website (www.jncc.gov.uk).

1.6.3 Role of Statutory Authorities

The Habitat Regulations place a general duty on all statutory authorities exercising legislative powers to perform them in accordance with the Habitats Directive. Additionally, relevant and competent authorities in the Avon catchment have particular duties under the Habitats Regulations and Wildlife and Countryside Act.

The Habitat Regulations identify relevant authorities as having particular and special roles in the management of a site. They are defined as statutory bodies having powers and functions that have, or could have, an impact on the area within or adjacent to a European site.

Relevant authorities include the following organisations, with the main relevant authority on the Avon in parentheses:

- Country nature conservation agencies (English Nature)
- Local authorities (relevant district, county, borough and parish councils in Hampshire, Dorset, Wiltshire)
- Environmental agencies (the Environment Agency)
- Sea fisheries committees (the Environment Agency and DEFRA)
- Port, harbour and navigation authorities (Christchurch Borough Council)
- Land drainage authorities (the Environment Agency, local authorities)
- Water companies (Wessex Water, Thames Water, Bournemouth and West Hants Water, Cholderton and District Water).

Competent authorities are those entitled to give an authorisation or consent to a plan or project. They are defined in the Habitats Regulations and include any public or statutory body, including ministers, government departments, public or statutory undertakers, public bodies of any description, any person holding public office, and any person exercising a function of a competent authority. All relevant authorities are competent authorities. Competent authorities have a major role in appropriate assessment of plans or projects and the Review of Consents.

The River Avon System is also designated as an SSSI. Under the Wildlife and Countryside Act (WCA), as amended by the Countryside and Rights of Way Act (2000), English Nature must secure favourable condition of the SSSI and may enforce management to achieve this. Other statutory bodies also have a duty to conserve and enhance SSSIs in carrying out their own works and any consents that they issue.

1.6.4 Consideration of New Plans or Projects

Unless directly connected with the management of the site, any new plan or project likely to have a significant effect on the cSAC, either alone or in combination with others, must be subject to an appropriate assessment, even if a plan or project is not located within the cSAC. Appropriate assessment must be carried out in consultation with English Nature as part of a wider decision-making framework required by the Habitat Regulations, as shown in Figure 4.

The scope and content of an appropriate assessment will be determined by the location, size and significance of the proposed plan or project. In general terms, the assessment must consider the implications of the proposal in relation to the site's conservation objectives and should enable the competent authority to ascertain if the proposal will adversely affect the integrity of the site.

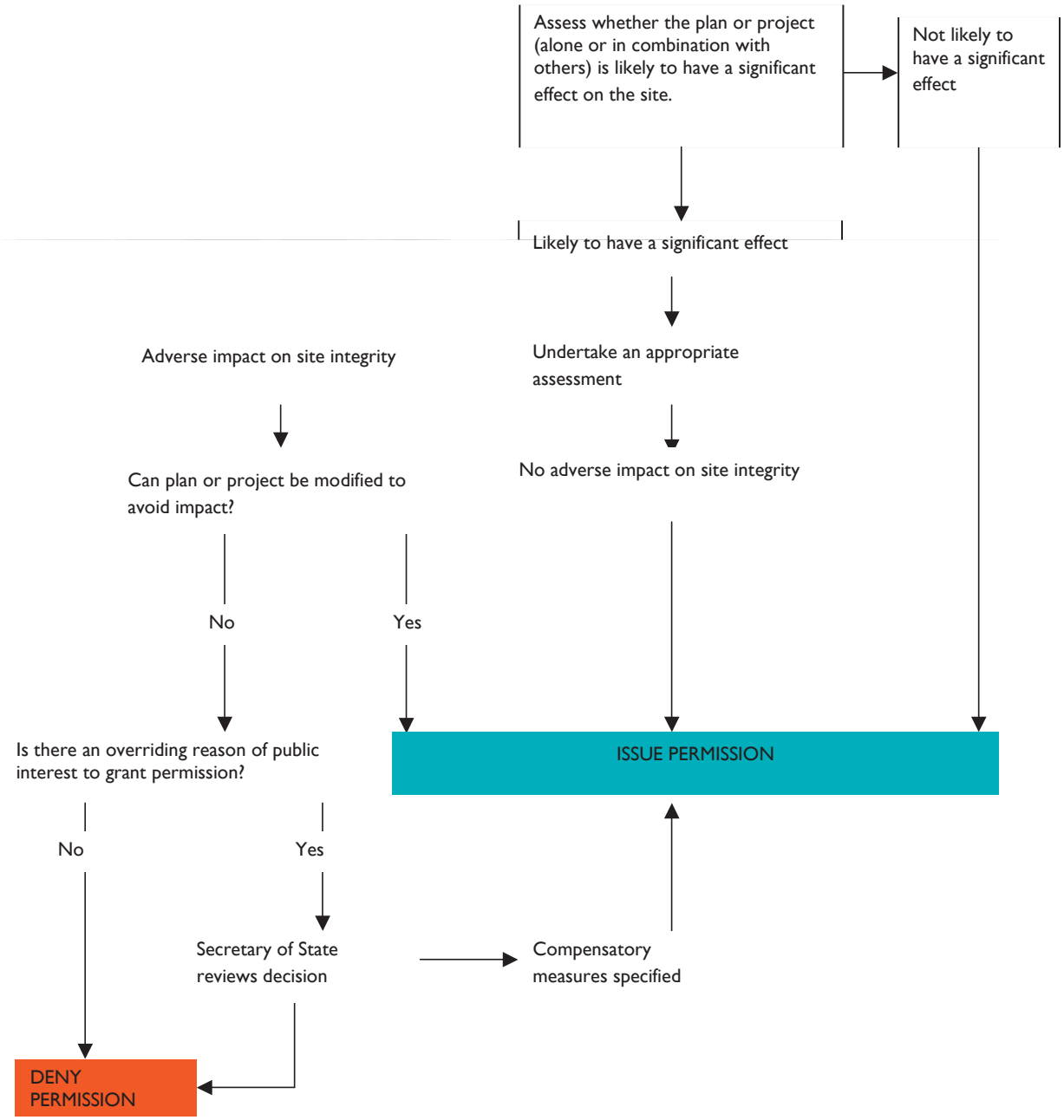


Figure 4. The decision-making framework required by the Habitats Regulations.

The decision-making framework required by the Habitats Regulation, and in particular the appropriate assessment, can be a complex task, particularly where any in-combination effects must be considered. In many cases, competent authorities will not have the expertise to assess the effect of plans or projects, and will need to take advice from English Nature.

The decision-making framework provides a powerful mechanism to ensure that future plans and projects (including consents to discharge, water abstraction licenses, waste management licences, Integrated Pollution Control authorisations and planning permissions) do not have a significant effect on the River Avon cSAC.

1.6.5 Review of Consents

Under the Habitats Directive, all competent authorities have a duty to review all outstanding decisions, permissions, consents or authorisations likely to have a significant effect (alone or in combination) on a Natura 2000 site. On the River Avon cSAC the Environment Agency has responsibility for the majority of the existing consents relevant to the site. Planning authorities must also review all outstanding planning permissions granted but not yet fully implemented. The Review of Consents Process is outlined in Figure 5.

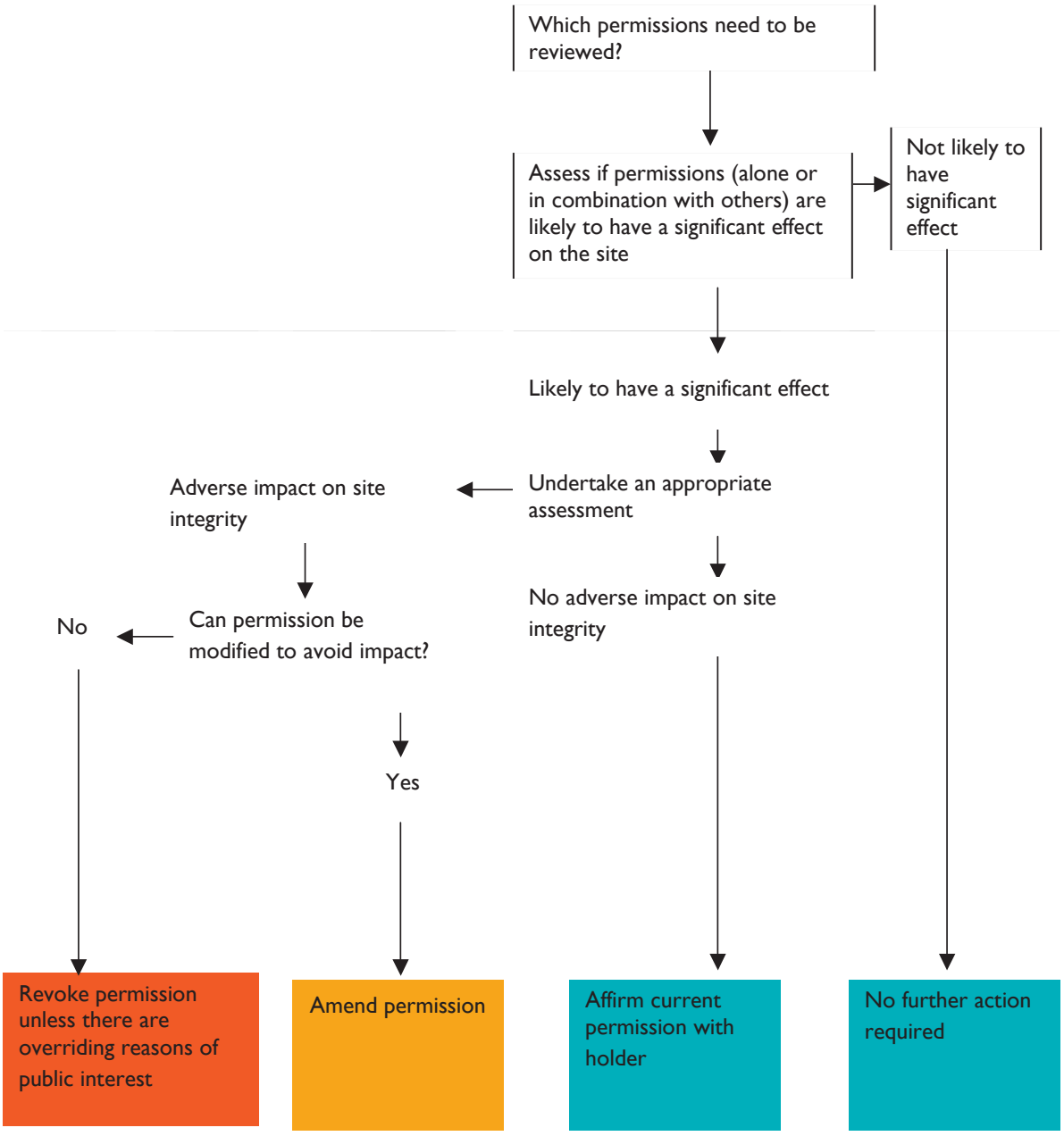


Figure 5. The Review of Consents Process (adapted from Environment Agency 2000)

Section 2
Conservation Objectives and Status of the Features

The general conservation objective for the River Avon cSAC, subject to natural change, is to maintain or restore in favourable condition:

The river habitat as characterised by

- Submerged or floating formations of *Ranunculus* and associated *Callitricho-Batrachion* vegetation

The river as habitat for populations of

- Atlantic salmon (*Salmo salar*)
- Bullhead (*Cottus gobio*)
- Brook lamprey (*Lampetra planeri*)
- Sea lamprey (*Petromyzon marinus*)

The river and adjoining land as habitat for populations of

- Desmoulin's whorl snail (*Vertigo moulinsiana*).

The following sections describe the features of the River Avon cSAC, including an indication of relevant attributes and the status of the features. Detailed information on the ecological requirements and monitoring methods for SAC species and habitats, including those in the River Avon cSAC, will be published by **Life on UK Rivers** during 2003.

2.1 Bullhead (*Cottus gobio*)

The bullhead is the only freshwater cottid found in the UK. It is a small fish, typically 10–15 cm long, exceptionally reaching 18 cm. A combination of male parental care and nest building, production of sounds, potential for mate choice, high degree of territoriality, and a body and eyes adapted to a flowing environment make the bullhead a unique and distinctive fish.

2.1.1 Status of bullhead in the River Avon cSAC

Based on the observations and experience of the Environment Agency fisheries staff, bullhead are thought to be widespread and abundant throughout the cSAC and to utilise several tributaries of the Avon outside the cSAC boundary. An indication of the known distribution of bullhead in the cSAC is shown in Figure 6.

Sue Scott

The bullhead is abundant throughout the River Avon cSAC, but there are no data on population densities and age-class structure.

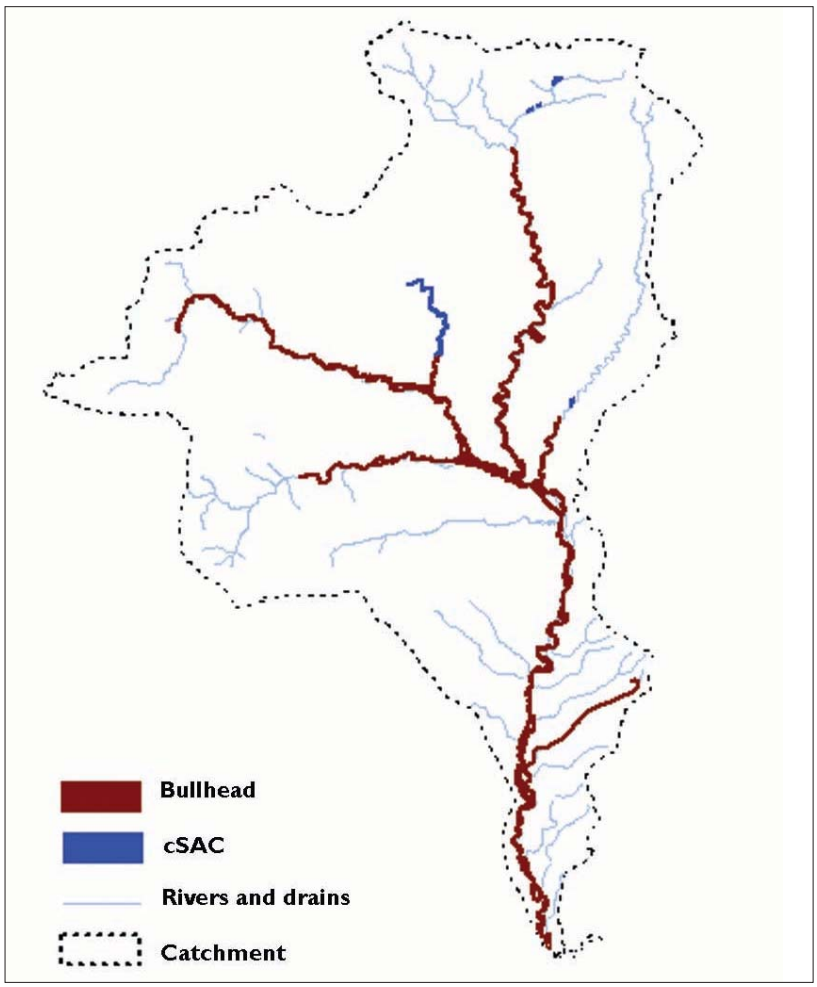


Figure 6. Known extent of bullhead in the cSAC.

Quantitative data on population densities and age-class structure of bullhead in the Avon cSAC are scarce. Bullhead are not routinely surveyed, and historically only their presence or absence has been recorded as part of other survey work. There is a need to define the status of the bullhead population in more detail, including an assessment of the limits of their distribution, age-class structures and densities.

There is currently inadequate regular monitoring of bullhead to allow reporting on favourable condition. The results of a survey undertaken in summer 2002 should help determine the known distribution and status of bullhead in the cSAC more accurately.

2.1.2 Influences on the status of bullhead

Factors influencing bullhead populations in the Avon have been identified based on current information and incorporated into the draft Favourable Condition Tables (Appendix B). Research being undertaken as part of **Life in UK Rivers** will contribute to our knowledge of the ecological requirements of riverine SAC species, including bullhead. Attributes with an important influence on bullhead populations are summarised in Table 1.

2.1.2.1 Water quantity and flow

Bullhead are potentially or actually at risk from the following water quantity and flow issues:

- Uncharacteristically low flows and current velocities
- Uncharacteristically high flows and high current velocities
- Uncharacteristically low diversity of flows.

Chalk rivers are principally groundwater fed and exhibit less seasonal variation in flow than other river types. However, modification of characteristic flows can have a number of impacts on bullhead. Unnaturally low flows can result in a decreased area of useable habitat, reducing available territory and refuges. In some cases nest sites may be exposed, causing mortalities of eggs. Low flows can result in reduced velocities, which can increase siltation in refuges, reduce viability of spawning nests by reducing aeration, and may also affect the type and abundance of invertebrate food sources available to bullhead.

Uncharacteristically high flow (natural or controlled) events generally result in higher velocities, disturbing bullhead habitat for all lifestages. Bullhead prefer moderate velocities, and can become displaced from their home territory by high flow events unless adequate refuge is available.

A diversity of flow characteristics should be maintained in order to provide suitable habitat for all life stages of bullhead. In particular, moderate flowing riffles and slack water refuges are thought to be important.

Table 1. Main influences on the status of bullhead populations in the River Avon cSAC.

Attribute	Aspect
Flow	Limits on licensed abstractions after modelling impacts. Audit every six years, if possible via CAMS.
Water quality	Biological class - Environment Agency's General Quality Assessment (GQA) scheme.
	River Ecosytem class
	Suspended solids
	Soluble reactive phosphorus
River substrate	Silt content
River form	Assess channel form by hydrogeomorphological survey
Habitat structure	Extent of gravel/pebble-dominated substrate.
	Extent of refuges
	Extent of high canopy tree cover
	Extent of submerged higher plants
	Extent of woody debris
	River form
Access	Artificial obstructions
Biological disturbance	Introductions

Extreme flow events may occur with increasing frequency in the future as a result of climate change, with potential implications for all stages of the life cycle of bullhead.

2.1.2.2 Water quality

Bullhead are potentially or actually at risk from the following water quality issues:

- Organic pollution events
- Elevated nutrient levels
- High levels of suspended solids
- Elevated levels of elements such as pesticides.

Bullhead may be vulnerable to poor water quality from both point-source and diffuse organic pollution. The effects of specific aspects of water quality on bullhead are unknown. However, as poor swimmers, bullhead may find it difficult to avoid conservative pollution. As bullhead tend to occur where there are brown trout, is it feasible that they have similar oxygen requirements (Perrow 2002).

Elevated levels of nutrients are likely to be detrimental to bullhead if resulting in the growth of filamentous algae, which coat coarse hard substrates, thereby influencing the number and type of invertebrate food sources available.

The exact tolerance of bullhead to suspended solids is not known, but uncharacteristic and excessive levels can clog the gills of all fish, including bullhead, and can affect feeding patterns.

The tolerance of bullhead to pesticides, including synthetic pyretheroid (SP) sheep dips, and atrazine, is also unknown. However, as these types of substance can be highly toxic, even small amounts can eliminate organisms on which bullhead feed. It should be assumed that the impact of pesticides would be negative. Recent work by the Environment Agency has highlighted the potential effects of endocrine-disrupting substances on fish, including oestrogen, and this may be of concern for bullhead.

2.1.2.3 River form and habitat structure

Bullhead are potentially or actually at risk from the following habitat and form modifications:

- Channel modifications
- Removal of woody debris

- Bankside tree management, and other riparian vegetation management
- Excessive management of aquatic vegetation
- Removal of gravels.

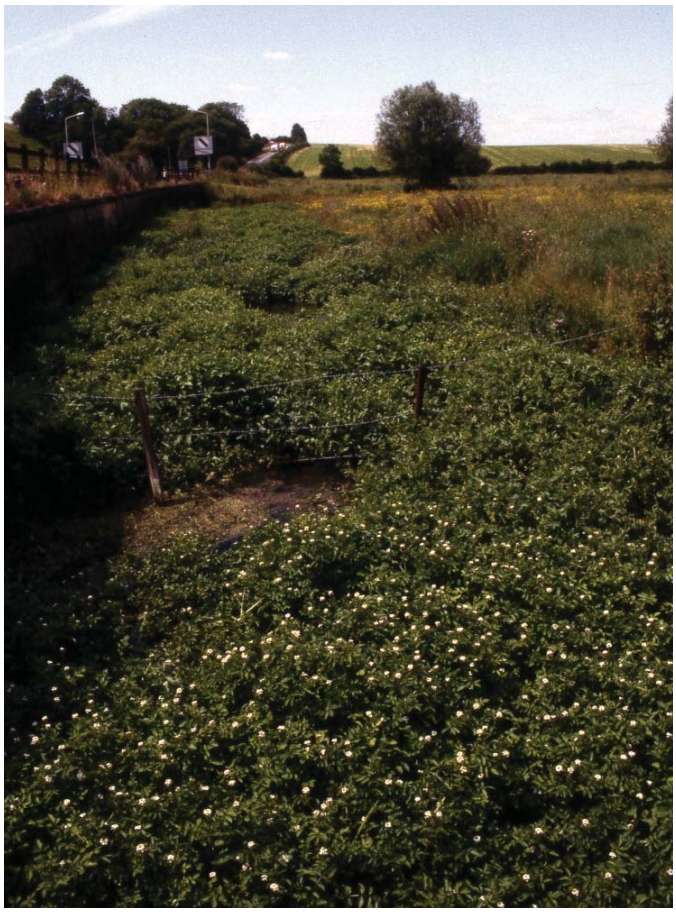
Perrow *et al.* (1997) concluded that a natural sinuous channel form with associated pools and riffles provides the necessary substrate and flow for bullhead, and will support greater densities of bullhead than in modified rivers. Operations that widen, deepen and/or straighten the channel can reduce variations in habitat. New operations that would have this impact should be avoided within the cSAC, and habitat rehabilitation will be needed in some reaches.

Refuges are important for shelter against high-flow conditions. Suitable refuges in the Avon system include cobbles, side channels, pools, woody debris, submerged tree root systems and marginal vegetation with water more than 5 cm deep.

Removal of woody debris (wood of diameter greater than 1cm) causes a reduction in habitat diversity, cover and refuge, particularly for larger bullhead, and should be avoided if possible, particularly where coarse substrate is of limited availability.

The importance of submerged plants, including *Ranunculus* species, to bullhead is unclear, but it is likely that they are used for refuge and cover against predators. Cutting operations or other perturbing activities should aim to leave a significant proportion of vegetation in a mosaic pattern with clean gravel in-between. The greatest effect of cutting will be where cover and refuge from other sources are limited. Some higher plants may be avoided by bullhead, and it has been shown that they avoid areas where the cover of emergent vegetation is greater than 40% (Perrow 2002).

Bankside tree and other riparian vegetation management can have an impact on bullhead, but will only be important if there is little or no cover within the channel. The relative importance of shade, compared to the provision of woody debris, is unclear, but the maintenance of intermittent tree cover in conjunction with retention of woody debris should ensure that habitat conditions are suitable.



Rob Cathcart/English Nature

Bullhead avoid waters where the cover of emergent vegetation is greater than 40%.

2.1.2.4 Substrate

Bullhead are potentially or actually at risk from impacts on substrate quality, in particular:

- Elevated levels of fine sediments in gravels
- Removal of gravels.

Siltation over coarse substrates due to changes in flow regime or sediment supply and transport rates decreases the available habitat for bullhead reproduction. Females lay sticky eggs on the underside of stones on a hard substrate, so the presence of clear spaces between the streambed and the underside of pebbles/cobbles is therefore important.

Varied substrate size composition is important for a number or reasons, including shelter, and provides preferred habitat for bullhead of all ages. The removal

of gravels is to be avoided as far as possible, particularly since the Avon has been subject to significant gravel loss in the past.

2.1.2.5 Barriers to Migration

Bullhead are potentially or actually at risk from barriers to migration in particular:

- Structures over 20 cm high, where no bypass route exists.

Vertical drops of more than 18–20 cm are sufficient to prevent upstream movement of adult bullheads (Utzinger *et al*. 1997). This means that populations are vulnerable to fragmentation, isolation and possible extinction. There are many control structures on the Avon system, and their significance in influencing bullhead movement is unclear. Many structures in the Lower Avon can be bypassed during high flows using back channels. Assessments of whether barriers limit the upstream limit of bullhead should be made in light of further information on their distribution, focusing on the headwaters.

Jenny Wheeldon/English Nature

Bullhead prefer natural rivers, with tree roots and gravels providing refuge, such as this winterbourne section of the River Till.

As part of the implementation of Water Level Management Plans (see Section 6.2), additional control structures may be put in place. This poses a threat to bullhead and it is important to ensure that any such structures are passable either by alternative routes or by modifying the structure design.

2.1.2.6 Transfer or stocking of bullhead

Bullhead are potentially or actually at risk from biological disturbance, in particular:

- Introductions of other bullheads.

Bullheads are relatively sedentary and interactions between populations in different parts of the catchment and in different catchments are likely to be limited, suggesting the existence of genetically discrete populations. Since they are of no angling interest, deliberate transfers between sites are unlikely to have been undertaken in the past, so the genetic integrity of populations is likely to be intact. In order to preserve to genetic integrity of the Avon population, stocking or transfer of bullhead is not thought to be in the best interests of the cSAC.

2.1.2.7 Introductions of other species

Bullhead are potentially or actually at risk from the following introductions:

- Excessively high levels of salmonids
- Presence of non-native crayfish.

The presence of artificially high densities of salmonids can impact bullhead through a variety or mechanisms, particularly if large fish are continually introduced and/or habitat is limiting (Environment Agency 2001).

Bullhead densities have been found to be negatively correlated with high densities of non-native crayfish, suggesting competitive and/or predator-prey interactions. The further spread of crayfish could lead to localised extinction of bullhead (Guan & Wiles 1997). Where possible, control measures should be undertaken with the aim of reinstating/maintaining bullhead and native crayfish populations.

2.1.2.8 Exploitation

Bullhead are not generally a target fish for anglers. However, a precautionary principle of zero exploitation of bullhead should assumed.

2.2 Brook Lamprey (*Lampetra planeri*)

The brook lamprey is an eel-like fish, one of only two surviving remnants of an ancient group of vertebrates, the jawless fish (Johns 1996). It has a smooth, cartilaginous, mucus-coated body, and a suctorial disc with an array of blunt teeth. As juveniles (ammocoetes) brook lamprey are a dull grey-brown colour, but become silvery following metamorphosis. Adults grow up to a maximum of 19 cm.

Brook lamprey spawn in March/April. They lay their eggs in shallow depressions in suitable gravels, created by lifting away small stones with their suckers. After hatching, the ammocoetes swim or drift downstream to areas of silt in still water, in which they burrow. Ammocoetes can remain in their nursery habitat for up to seven years before metamorphosis and emergence as adults.

Adult brook lamprey do not feed, and die approximately one month after spawning (Lohnisky 1975). Brook lamprey do not migrate far as adults, so close proximity of nursery and spawning habitat is important.

2.2.1 Status of Brook Lamprey in the River Avon cSAC

The primary reference for the information given below is Johns (1996). Brook lamprey are believed to utilise all the cSAC and most of the catchment, with the exception of the western arm of the upper Avon.

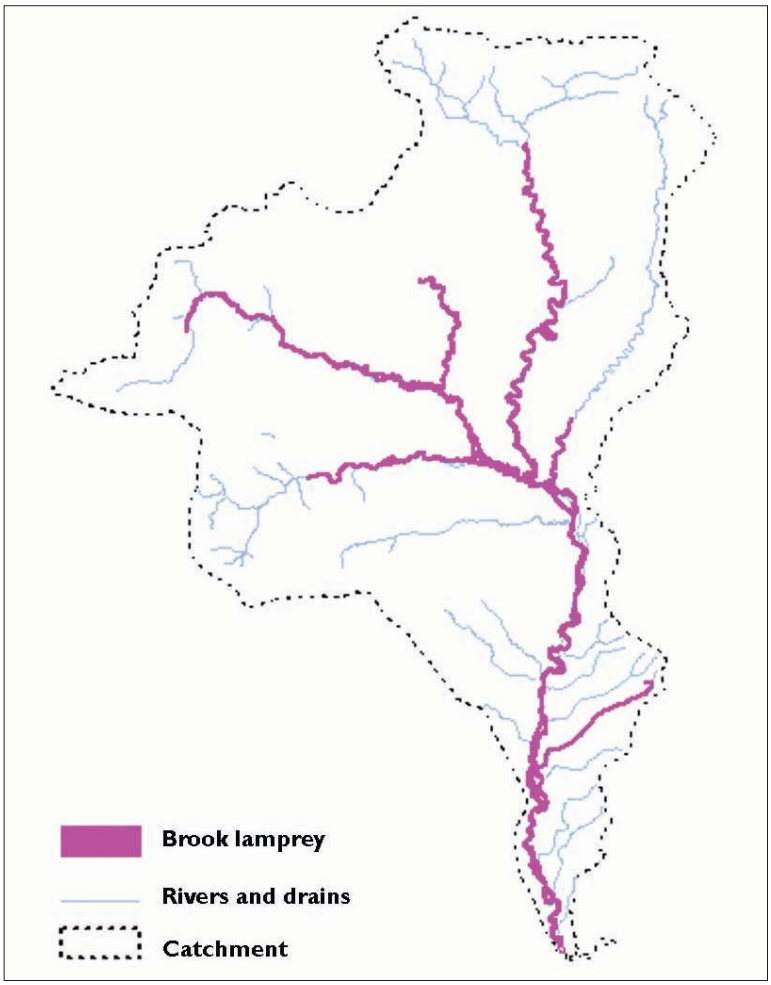


Figure 7. Known extent of brook lamprey in the Avon cSAC.

Brook and river lamprey are often termed paired species, as in many cases they display similar morphological characteristics when found in the same locality. It is unclear whether river lamprey are also present in the Avon catchment.

Brook lamprey are not routinely surveyed, and historically only their presence or absence has been recorded as part of other survey work. To determine the extent of their distribution in the catchment, specific surveys were undertaken in 1996, 1997 (Johns 1997) and 1998 (Johns 1998) The known distribution of brook lamprey based on these surveys and Environment Agency knowledge is shown in Figure 7.

The 1996 survey found no empirical evidence of lamprey (sea or brook) on the main Avon channel, although some sites did have suitable habitat. However, lower-energy side channels, including water meadow carriers, were found to contain ammocoetes of unidentified type. Ammocoetes (brook or river) were found at a higher proportion of

Ross Gardiner

The brook lamprey, which belongs to one of the most ancient groups of fish, is believed to use all the River Avon cSAC. There is currently inadequate monitoring of brook lamprey populations and distribution.

sites on the rivers Ebble, Nadder, Wylye and Bourne than on the main Avon. The River Bourne had the highest density, due to extensive silt beds above and below a millrace, and more suitable flow conditions.

In 1997 a survey in the eastern arm of the Avon between Upavon and Pewsey found between nine and 77 brook lamprey ammocoetes per 100 m of river. This stretch of the river had conditions more favoured by brook lamprey, characterised by less flow volume and velocity than in the lower main Avon.

A survey of the western arm of the Avon was undertaken between Upavon and Patney in 1998 (Johns 1998). No brook lampreys were found. Macrophyte encroachment, reduction in flow velocities and the presence of anoxic silts/detritus deposits had degraded much of the potential habitat. The report recommended that, in order to extend the range of brook lamprey and improve the potential for them to (re)colonise, de-silting and vegetation removal would be required. The weir at the confluence with the eastern arm may be a barrier to re-colonisation, and this requires investigation and subsequent modification if required.

There is a need to define the status of the brook lamprey population in more detail, including assessment of the relative importance of sub-catchments and the limits of brook lamprey distribution in the catchment. The results of a survey undertaken in summer 2002 should help determine the known distribution and status of brook lamprey in the cSAC more accurately. There is inadequate regular monitoring of brook lamprey in order to report on favourable condition.

2.2.2 Influences on the Status of Brook Lamprey

Factors influencing brook lamprey populations in the Avon have been identified based on current information and incorporated into the draft Favourable Condition Tables (Appendix B). Research being undertaken as part of **Life in UK Rivers** will contribute to knowledge of the ecological requirements of riverine SAC species, including brook lamprey. Factors with an important influence on brook lamprey are summarised in Table 2.

2.2.2.1 Water quantity and flow

Brook lamprey are potentially or actually at risk from the following water quantity and flow issues:

- Uncharacteristically low flows and low current velocities
- Uncharacteristically high flows and high current velocities
- Uncharacteristically low diversity of flow types.

Chalk rivers are principally spring-fed and exhibit less seasonal variation in flow than other river types. Modification of characteristic flows can have a number of impacts on brook lamprey, despite their ability to move to more suitable habitat if necessary. Maintaining a diversity of localised velocity and flow characteristics is important in order to produce the mosaic of habitat required by all life stages.

Table 2 . Main influences on the status of brook lamprey populations in the River Avon cSAC.

Attribute	Measure
Flow	Limits on licensed abstractions after modelling impacts. Audit every six years, if possible via CAMS.
Water quality	Biological class – Environment Agency's General Quality Assessment (GQA) scheme.
	River Ecosytem class
	Suspended solids (annual average)
	Soluble reactive phosphorus (annual mean)
River substrate	Silt content
River form	Assess channel form
Habitat structure	Distribution and area of spawning habitat.
	Distribution and area of nursery habitat.
	Area of emergent riparian vegetation
	Extent of bankside tree cover
	River form
Access	Artificial obstructions

Unnaturally low flows can decrease the area of useable habitat and result in the exposure of nursery habitat, causing mortalities of ammocoetes. Low velocities are required in localised areas for the deposition of nursery habitat. However, where low flows result in reduced mid-channel velocities, spawning beds may become clogged with silt.

Natural or controlled high-flow events can prevent the burrowing of ammocoetes, as they will be taken downstream by the current (Thomas 1962). Extreme-flow events may occur with increasing frequency in the future as a result of climate change, with potential implications for all stages of the brook lamprey life cycle.

2.2.2.2 Water quality

Brook lamprey are potentially or actually at risk from the following water quality issues:

- Organic pollution events
- Elevated nutrient levels
- Elevated levels of toxins bound to sediments
- Presence of hydrocarbons and pesticides.

The tolerance of brook lamprey to organic pollution is not known. However, the effects on ammocoetes and adults may be restricted due to their low oxygen consumption. In contrast, spawning habitat needs to be well aerated, as eggs may be impacted by organic pollution if it results in oxygen levels falling below a critical threshold.

The effect of persistent and toxic compounds such as hydrocarbons and pesticides is not known. However, due to the persistence of some of these substances, and the fact that they may become bound to sediments, they have the potential to adversely affect brook lamprey.

Elevated levels of nutrients are likely to be detrimental to brook lamprey if resulting in the growth of filamentous algae, which can smother spawning and nursery habitat. The Avon is known to be suffering from elevated phosphate concentrations.

The tolerance of brook lamprey to suspended solids is not known, but uncharacteristic and excessive levels over time could lead to clogging of ammoceote burrows and spawning gravels.

2.2.2.3 River form and habitat structure

Brook lamprey are potentially or actually at risk from the following habitat modifications:

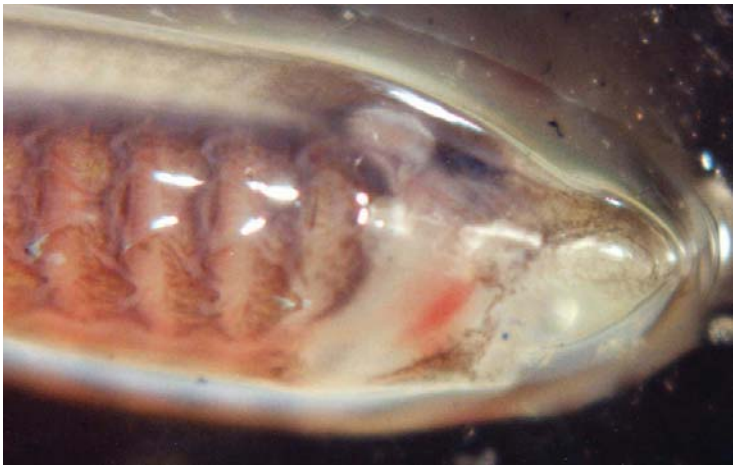
- Dredging works
- Channel modifications
- Removal of woody debris
- Bankside tree management, and other riparian vegetation management
- Excessive management of aquatic vegetation
- Removal of gravels.

A diversity of flow characteristics is required in order to provide a mosaic of microhabitat for brook lamprey, and close proximity of different habitats facilitates movement to preferred habitats with age. Channel works, such as re-sectioning, re-profiling, dredging, and narrowing, that reduce variations in microhabitat should be avoided within the cSAC, and restoration will be needed in some reaches (see Section 9).

Spawning habitat is defined as well-oxygenated gravel/pebble-dominated substrate overlain by a range of water depths. Removal of gravels directly impacts on available spawning habitat and should be avoided where possible, particularly since much gravel has been removed from the Avon in the past.

Nursery habitat is defined as open-structured, aerated, silty and sandy substrates. Nursery habitat is particularly vulnerable to land drainage and dredging, and these operations need to be screened to ensure their impact is minimised, particularly during the March–May spawning and incubation period. As part of the implementation of Water Level Management Plans, ditching works may be carried out, and guidance must be given to protect lamprey habitat. See Section 6 for further details.

Submerged, floating and emergent vegetation has several roles in the lamprey's life cycle. It helps create and maintain nursery habitat by trapping silt, acts as a source of organic matter (ammocoete food), and can locally increase current velocities in clean spawning gravels. The routine cutting or removal of aquatic and emergent vegetation (including communities of *Ranunculus* species) should be minimised.



Ross Gardiner

Despite having undeveloped eyes, brook lamprey ammocoetes show an aversion to high levels of light.

Ammocoetes show an aversion to high levels of light (photophobia). Shade from bankside trees and riparian vegetation is therefore important in protecting ammocoetes from elevated levels of light and encouraging the growth of diatoms (a food source). Trees and riparian vegetation also provide a source of organic matter. The proximity of nursery habitat needs consideration in management of trees and other vegetation.

2.2.2.4 Substrate

Brook lamprey are potentially or actually at risk from impacts on substrate quality, in particular:

- Elevated levels of fine sediments in spawning gravels
- Changes in sediment supply and transport rates.

Spawning habitat for brook lamprey is defined as well-oxygenated substrate of an average particle size of less than 0.5 cm (Maitland 2002). The presence of fines is not desirable, and although a critical particle value is not known, the value for salmon has been adopted on a precautionary basis. The Avon cSAC is thought to be impacted by elevated levels of sedimentation in gravels.

Typical brook lamprey redds may be up to 10 cm deep. However, no information is available on the actual depths of gravel required for spawning. Suitable sediment for spawning is vital and can be adversely affected by uncharacteristically high and low flows, river management and construction (such as road bridges and impoundment), which may increase suspended solid loads, resulting in an elevated risk of sedimentation.

Nursery habitat for brook lamprey requires open-structured, aerated, silty and sandy substrates up to 40 cm deep (Potter 1970). Sediments with only moderate oxygen content may become unviable during the metamorphosis of larvae into ammocoetes. In this case, individuals will seek coarser substrates with a faster flow.

The continued supply of suitable sediment through a river system is vital to maintain nursery beds, as high flows and certain types of river management can remove them.

2.2.2.5 Barriers to migration

Brook lamprey are potentially or actually at risk from barriers to migration, in particular:

- Impassable structures
- Entrapment at intakes.

Brook lamprey do not generally undertake long migrations. However, after metamorphosis, most adults migrate upstream, sometimes for considerable distances, to find suitable spawning habitat (Maitland 2001). Migrating adults are able to negotiate most barriers but may not be able to pass particular structures. Barriers may also inhibit the downstream migration of brook lamprey ammocoetes. However, as they tend to migrate downstream with flow, only impassable structures are a concern.

Where lamprey are absent and there is no donor population of ammocoetes upstream, structures may prevent re-colonisation. Site-based observations are required to determine whether a structure is impassable.

A study on the Avon has found that brook lamprey are at risk from entrapment at intakes (A Strevens pers com).

2.2.2.6 Stocking

Brook lamprey are potentially or actually at risk from biological disturbance, in particular;

- Introductions of lamprey.

It is not known if the Avon population of brook lamprey is a locally adaptive genotype, so the precautionary approach of zero stocking should be applied. Stocking is not currently considered to be in the best interests of the cSAC.

Andy Strevens/Environment Agency

The sea lamprey is the largest of the lampreys, and migrates between the sea and fresh water to spawn.

2.2.2.7 Exploitation

Lamprey have become increasingly popular as pike fishing bait; river lamprey were identified by the *Anglers Mail* (January 30, 1999) as the most popular form of dead bait. A precautionary principle of zero exploitation of brook lamprey should assumed.

2.3 Sea Lamprey (*Petromyzon marinus*)

The sea lamprey is the largest lamprey, and is also known as the marine lamprey or lamprey eel. It is a jawless, anadromous (migrates from sea to fresh water to spawn), parasitic fish, growing up to a maximum of 120 cm and a weight of 2.5 kg. Eel-like in form, it has a smooth, cartilaginous, mucus-coated body, and a suctorial disc with an array of sharp teeth. Juveniles (ammocoetes) are dark, greyish-brown above and light grey

below. Newly metamorphosed sea lamprey are slatey grey-blue on top, metallic blue on the sides, with a pale white belly. Adults are brown-grey with extensive black mottling. Sea lamprey are in a separate genus from river and brook lamprey.

Sea lamprey spawn in June/July, laying their eggs in shallow depressions in suitable gravels created by lifting away small stones with their suckers. After hatching, the ammocoetes swim or drift downstream to areas of silt in still water in which they burrow. Ammocoetes can remain in their nursery habitat for up to four years before metamorphosis and emergence as adults and migration to the sea.

Adult sea lamprey feed on a range of fish on their journey downstream to the sea. They remain at sea for one–two years, growing dramatically by feeding on fish such as cod, herring, haddock and salmon, and are often seen attached to basking sharks. Sea lamprey return to fresh water to spawn, but it is not known if they return to their natal (home) river.

2.3.1 Status of Sea Lamprey in the River Avon cSAC

Sea lamprey are not routinely surveyed, and historically only their presence or absence has been recorded as part of other survey work. To determine the extent of their distribution in the catchment specific surveys were undertaken in 1996, 1997 and 1998 (Johns 1996, 1997,1998). The known distribution of sea lamprey based on these surveys, anecdotal evidence and Environment Agency knowledge is shown in Figure 8.

The 1996 survey found no empirical evidence of lamprey (sea or brook) in the main Avon channel, although some sites did have suitable habitat. The survey was hampered by the size and depth of the channel in the lower reaches. However, lower-energy side channels, including water meadow carriers, were found to contain ammocoetes of unidentified type. Anecdotal evidence from river keepers suggests that sea lamprey are present in the lower main Avon, and have been described as abundant in the recent past.

No attempt has been made to determine the movements of sea lamprey in Christchurch Harbour and nearby coastal waters.

There is a need to define the status of the sea lamprey population in more detail, including assessment of the relative importance of sub-catchments, limits of sea lamprey distribution, and movements in Christchurch Harbour and coastal waters. The results of a survey undertaken in summer 2002 should help determine the known distribution and status of sea lamprey in the cSAC more accurately. There is inadequate regular monitoring of sea lamprey in order to report on favourable condition.

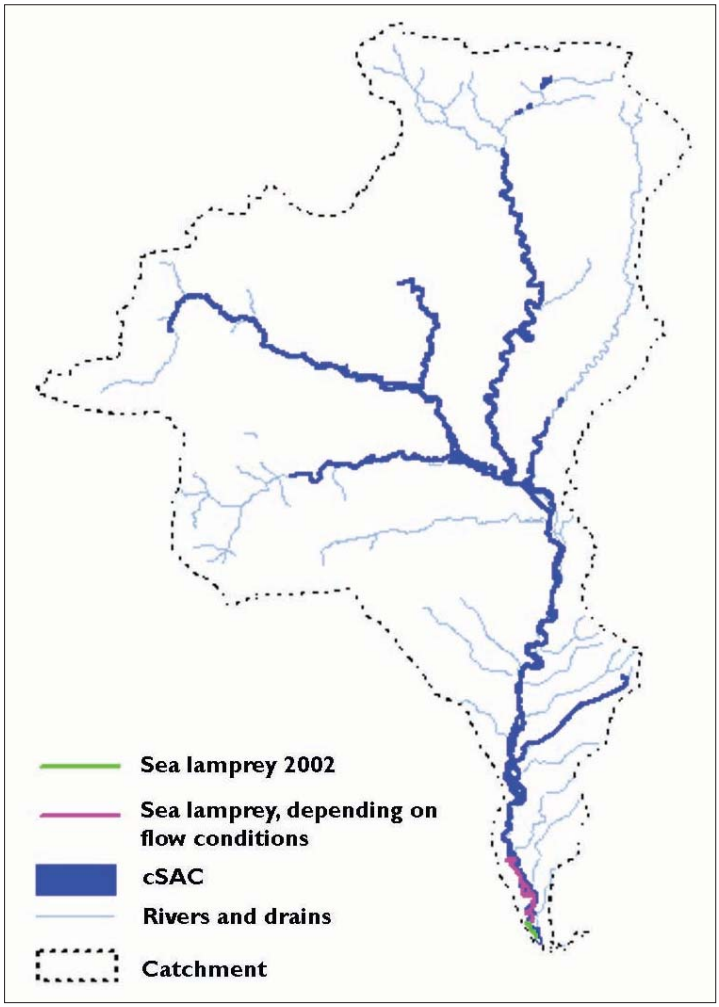


Figure 8. Known extent of sea lamprey in the Avon cSAC.

2.3.2 Influences on the Status of Sea Lamprey

Factors influencing sea lamprey populations in the Avon have been identified based on current information

and incorporated into the draft Favourable Condition Tables (Appendix B). Research being undertaken as part of **Life in UK Rivers** will contribute to knowledge of the ecological requirements of riverine SAC species, including sea lamprey. Attributes with an important influence on sea lamprey populations are summarised in Table 3.

Table 3. Main influences on the status of sea lamprey populations in the River Avon cSAC.

Attribute	Measure
Flow	Limits on licensed abstractions after modelling impacts. Audit every six years, if possible via CAMS.
Water quality	Biological class – Environment Agency's General Quality Assessment (GQA) scheme.
	River Ecosytem class
	Suspended solids (annual average).
	Soluble reactive phosphorus (annual mean)
River substrate	Silt content
River form	Assess channel form by hydrogeomorphological survey
Habitat structure	Distribution and area of spawning habitat.
	Distribution and area of nursery habitat.
	Area of emergent riparian vegetation
	Extent of bankside tree cover
	River form

2.3.2.1 Water quantity and flow

Whilst in river, sea lamprey are potentially or actually at risk from the following water quantity and flow issues:

- Uncharacteristically low flows and low current velocities
- Uncharacteristically high flows and high current velocities
- Uncharacteristically low diversity of flows from large to small scales.

Chalk rivers are principally spring-fed and exhibit less seasonal variation in flow than other river types. However, modification of characteristic flows can have a number of impacts on sea lamprey, despite their ability to move to more suitable habitat if necessary. Maintaining a diversity of localised velocity and flow characteristics is important in order to produce the mosaic of habitat required by all life stages.

Unnaturally low flows can decrease the area of useable habitat, and result in the exposure of nursery habitat, causing mortalities of ammocoetes. Low velocities are required in localised areas for the deposition of nursery habitat. However, where low flows result in reduced mid-channel velocities, spawning beds may become clogged with silt.

Natural or controlled high-flow events prevent the burrowing of sea lamprey ammocoetes, as at velocities above 0.6–0.8 ms^{-1} they are taken downstream by the current (Thomas 1962). The relative swimming speed of sea lampreys is low but they can tolerate higher velocities than other lamprey.

Extreme flow events may occur with increasing frequency in the future as a result of climate change, with potential implications for all stages of the sea lamprey life cycle.

2.3.2.2 Water quality

Sea lamprey are potentially or actually at risk from the following water quality issues:

- Elevated nutrient levels
- Elevated levels of toxins bound to sediments
- Presence of hydrocarbons.

The threats of poor water quality to sea lamprey are similar to those for brook lamprey, as described in Section 2.2.2.2.

The effect of water quality on the marine phase is currently unknown, and the behaviour of sea lamprey in this phase is not well understood. There may be additional threats to sea lamprey from poor marine water quality.

2.3.2.3 River form and habitat structure
Sea lamprey are potentially or actually at risk from habitat modification, in particular the following:

- Dredging works
- Channel modifications
- Removal of woody debris
- Bankside tree management, and other riparian vegetation management
- Excessive management of aquatic vegetation
- Removal of gravels.

Sea lamprey spawn in faster and deeper water than brook lamprey, and nursery habitat can also be located deeper, in up to 2.2 m of water. For details of threats due to sea lamprey from habitat and form modification, see Section 2.2.2.3 on brook lamprey.

2.3.2.4 Substrate
Sea lamprey are potentially or actually at risk from impacts on substrate quality, in particular:

- Elevated levels of fine sediments in spawning gravels
- Changes in sediment supply and transport rates.

Spawning habitat for sea lamprey is defined as well-oxygenated substrate. The presence of fines is not desirable, and although a critical particle value is not known, the value for salmon has been adopted on a precautionary basis. For details of threats to sea lamprey related to substrate quality see Section 2.2.2.4 on brook lamprey.

2.3.2.5 Barriers to migration
Sea lamprey are potentially or actually at risk from barriers to migration, in particular:

- Impassable structures, both natural and man made.

Sea lamprey adults migrating upstream and downstream are able to negotiate most barriers but may experience difficulties at particular structures. Adults migrating upstream are able to negotiate most barriers unless flows are low. If a structure is thought to be impassable, site-based observations are required to evaluate the feasibility of resolving the situation.

The operation of eel traps potentially present a barrier to migration and could lead to entrapment of sea lamprey. However, the only trap on the Avon in their known range does not operate during the migration run.

2.3.2.6 Lamprey introductions
Sea lamprey are potentially or actually at risk from biological disturbance, in particular:

- Introductions of sea lamprey.

It is not known if the Avon population of sea lamprey is a locally adaptive genotype, and the precautionary approach of zero stocking should be applied on the Avon. Stocking is not currently considered to be in the best interests of the cSAC.

2.3.2.7 Exploitation
Lamprey have become increasingly popular as pike fishing bait; river lamprey were identified by the *Anglers Mail* (January 30, 1999) as the most popular form of dead bait. Sea lamprey may be a bycatch of marine fishing activity. However, as it is not known if those caught are natal, or the size of this potential impact, it is not possible to quantify this risk. A precautionary principle of zero exploitation of sea lamprey within the cSAC should be assumed.

2.4 Desmoulin's whorl snail (*Vertigo moulinsiana*)

Desmoulin's whorl snail is a small species inhabiting mainly calcareous fens and marshes. Adult snails can be up to 3 mm in size, while juveniles are approximately 1 mm (about the size of a pen tip). The snails live for about a year, with the population being at its highest in September and October.

Roger Key/English Nature

Desmoulin's whorl snail relies on a high water table to keep its habitat wet.

Desmoulin's whorl snails spend most of the warmer part of the year on the leaves of tall wetland plants. When the plants die down in winter, the snails remain in leaf litter before climbing the tall vegetation stands in spring to feed on microflora on the surface of the leaves.

The number and distribution of Desmoulin's whorl snail at any site is highly dependent on the availability of suitable habitat, which is influenced by factors such as water levels, grazing, management and natural climatic cycles. In periods of high flow, the snail may be able to colonise new areas by floating downstream.

2.4.1 Status of Desmoulin's Whorl Snail in the cSAC

To determine the extent of the distribution of Desmoulin's whorl snail in the catchment, specific surveys were undertaken in 1996 (Killeen 1997 a, b, c), 2000 (Killeen 2001), and 2001 (Killeen & Willing 2002). Positive records of Desmoulin's whorl snail since 1996 are shown in Figure 9.

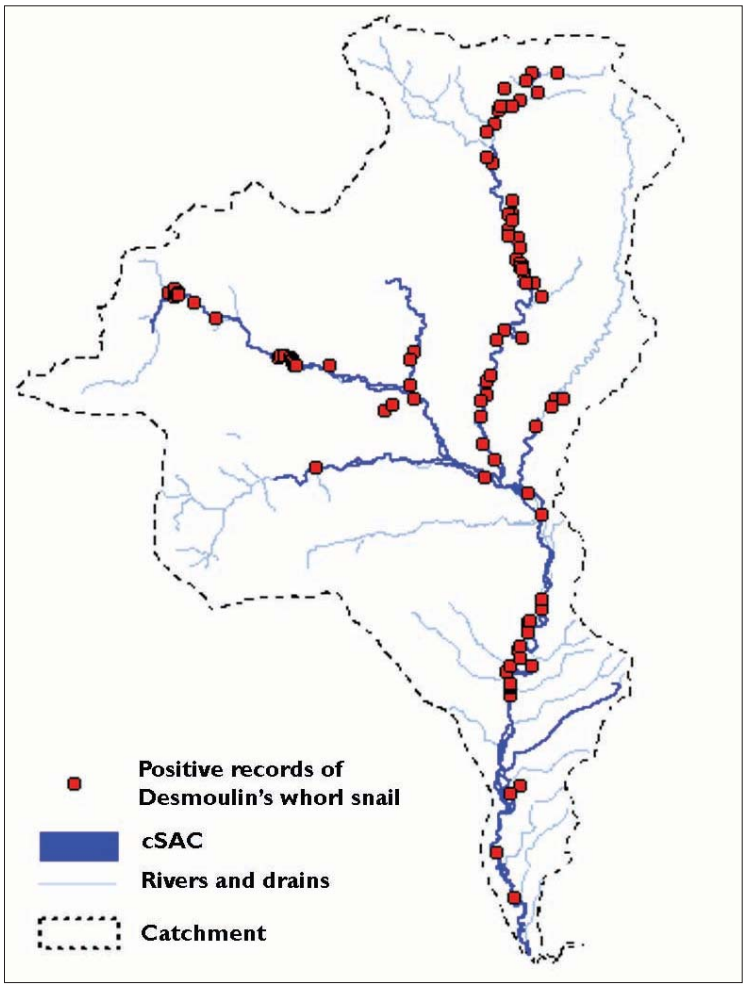


Figure 9. Known positive records of Desmoulin's whorl snail in and adjacent to the River Avon cSAC.

During the surveys of 1996, Desmoulin's whorl snail was located at 29 sites – 24 on the Avon, three on the Bourne, and at single sites on the Wylye and Till. The data showed that several component SSSIs and marginal river areas were worthy of inclusion in the cSAC due to their Desmoulin's whorl snail populations, including Jones's Mill and Porton Meadows, and marginal vegetation at Little Wishford, Berwick St James and Winterbourne Gunner.

Twenty-eight new sites were identified in 2001, nearly doubling the number of known populations in the cSAC from 34 to 62 (Killeen & Willing 2002).

When considering the condition of the Desmoulin's whorl snail population it is important to remember that although the mean number of snails per sample can indicate relative abundance, there is a high level of monthly and inter-annual variation at sites. In general, the Avon population is more fragmented and less abundant than the Kennet and

Lambourn cSACs, but still supports an important number of Desmoulin's whorl snail populations (Killeen 2001).

To make an assessment of the condition of the species, long-term data must be collected and analysed. There is currently inadequate regular monitoring of Desmoulin's whorl snail to allow reporting on favourable condition.

2.4.2 Influences on the Status of Desmoulin's Whorl Snail Populations

Factors influencing Desmoulin's whorl snail in the Avon have been identified based on current information and incorporated into the draft Favourable Condition Tables (Appendix B). Research being undertaken as part of **Life in UK Rivers** will contribute to knowledge of the ecological requirements of riverine SAC species, including Desmoulin's whorl snail. Attributes with an important influence on Desmoulin's whorl snail populations are summarised in Table 4.

Table 4. Main influences on the status of the Desmoulin's whorl snail population in the River Avon cSAC.

Operational Feature	Attribute	Measure
Rivers	Structure and composition of marginal vegetation	Extent of habitat
Fens/swamp	Structure and composition of tall fen and swamp vegetation	Area of stand of appropriate vegetation
Rivers Fens	Water table	1. Depth below ground level; 2. Vegetation indicators of drying out.
Rivers Fens	Vegetation height	Height
Rivers Fens	Shading by shrubs and trees (e.g. sallow, alder)	Percentage of habitat with potential for supporting the snail.
Rivers Fens	Water quality	Biological class – Environment Agency's General Quality Assessment scheme.
Fens/swamp	Leaf litter	Approximate thickness

2.4.2.1 Water quantity and flow

Desmoulin's whorl snail populations are potentially or actually at risk from changes in hydrology, in particular;

- Uncharacteristically low flows
- Uncharacteristically high flows
- Inappropriate water level management.

Populations of Desmoulin's whorl snail rely on the presence of suitable habitat, which is influenced by changes in hydrology. High groundwater levels are important in ensuring suitable vegetation is present and maintaining humidity levels in the vegetation. The water table must remain high all year so that a small pressure causes water to rise to the surface. A study to quantify the hydrological requirements of Desmoulin's whorl snail was undertaken as part of **Life in UK Rivers**.

Uncharacteristically low flows can result in a lowered water table, and if this produces changes in the vegetation community, a consequent reduction in suitable snail habitat. The water level must remain close to the surface so that the ground remains at least moist for the majority of the summer, although some drying is acceptable (Killeen 2001). Indicators of a site drying out are the gradual replacement of preferred dominant plant species by plants of drier conditions, such as nettles (*Urtica* species) and great willowherb (*Epilobium hirsutum*), or by dense, tall reeds.

In the upper Avon, investigations into the impacts of abstraction have identified significant effects on low summer–autumn flows, particularly where abstraction points are located in sensitive upper and

winterbourne reaches. The effects of abstraction on Jones' Mill are being investigated under the Environment Agency Restoring Sustainable Abstractions programme.

Uncharacteristically high flows can directly and indirectly affect Desmoulin's whorl snail populations. In high-flow events the snails can be washed downstream and may be deposited in unsuitable habitat. Flooding in summer can result in unfavourably wet conditions. If this continues in the long term, it may produce changes in the vegetation community, and a consequent reduction in suitable habitat. Indicators of a site being too wet are the gradual replacement of preferred dominant species by plants of wetter conditions, such as fool's watercress (*Apium nodiflorum*).

Where water-level management is undertaken at sites with suitable Desmoulin's whorl snail habitat, it should aim to maintain the high groundwater levels favoured by the snail. Water Level Management Plans are being developed for the Avon cSAC/SSSI and Avon Valley SPA/SSSI and must take into account the conditions required for the species.

Extreme-flow events may occur with increasing frequency in the future as a result of climate change, with potential implications for Desmoulin's whorl snail.

2.4.2.2 Water quality

Desmoulin's whorl snail is potentially or actually at risk from the following water quality issues:

- Elevated phosphate levels
- Organic pollution.

The species may be directly vulnerable to organic pollution, particularly during periods of high flows when the snails can be immersed or transported.

Elevated levels of nutrients, particularly phosphates, may be detrimental if resulting in changes in the vegetation community. This is particularly relevant to snail habitat in river margins and drains. Influences on water quality are discussed in detail in Section 3.

Jenny Wheeldon/English Nature

Desmoulin's whorl snail lives in wetlands and river margins where there is a high water table and plants on which it can spend the summer, feeding on microflora. The snail overwinters in leaf litter.

2.4.2.3 Habitat structure

Desmoulin's whorl snail is potentially or actually at risk from the following habitat modifications:

- Cutting, mowing or grazing
- Ditching works
- Management of shrubs, trees and scrub
- Water-level management.

Appropriate habitat management should be undertaken at all known snail sites and areas with suitable habitat elsewhere in the cSAC.

Desmoulin's whorl snail requires unbroken stands of reed sweetgrass (*Glyceria maxima*) and/or greater pond sedge (*Carex riparia*), and/or lesser pond sedge (*C. acutiformis*) on river banks, drainage ditches, and fens or swamps. Management such as cutting or mowing river margins and ditches can reduce this habitat, and therefore must be undertaken sensitively. At sites with no history of mowing or cutting programmes this activity should not be introduced.

Heavy cattle grazing or mowing can be detrimental if it removes most of the taller clumps of vegetation. In addition, heavy cattle poaching of ditch margins should be avoided.

Shading vegetation, including trees and scrub, should not be allowed to develop to the extent that it becomes dominant or dries out the ground. Management of trees and scrub should ensure less than 10% of suitable habitat remains in deep shade, and less than 30% in dappled shade. Light, patchy cattle grazing may be acceptable as a way of limiting scrub encroachment. Herbicides can be used to control scrub, but only with good reason and if used sensitively. Advice should be sought from the Environment Agency regarding licensing and those herbicides permitted for use on, or near watercourses.

2.4.2.4 Problem species

Desmoulin's whorl snail is potentially or actually at risk from non-native invasive plants. Non-native emergent plants are a major threat to suitable habitat due to their ability to achieve dominance over native species, and the difficulty of controlling their spread. Species of concern include Japanese knotweed (*Polygonum japonica*), Himalayan balsam (*Impatiens glandulifera*) and giant hogweed (*Heracleum mantegazzianum*). These riparian plants may directly alter the composition of suitable habitat by replacing preferred species, and can influence conditions through increased shading.

2.5 Atlantic Salmon (*Salmo salar*)

The wild-breeding Atlantic salmon characteristic of the Avon is considered a pristine form of the southern chalkstream genotype, and its genetic base is thought to be the purest for this form.

Salmon start life as eggs laid in a depression in riverbed gravels (known as a redd) and covered over with gravel by the spawning fish's body and tail actions. They then hatch as alevins, which remain in the gravel for several weeks before emerging as tiny fry. On reaching the size of a finger, the fry are described as parr. As parr they closely resemble brown trout, being browny grey in colour, with a series of brown marks along their sides. Juvenile salmon can remain as parr for up to four years (but usually one, and occasionally two years in the Avon) before undergoing smoltification, when they turn silver and migrate to the sea.

After migration to feeding grounds in the North Atlantic, salmon return to the river of their birth, either after one winter at sea (such fish being known as 'grilse') or two or more winters (such fish being referred to as 'multi-sea-winter', or MSW, salmon).

On their return to fresh water, adults change in appearance: males become increasingly red and brown and develop a pronounced hook in their bottom jaw (known as a kype), and females become increasingly grey-black in colour. These changes are known as secondary sexual characteristics.

Sue Scott

Upon returning to fresh water, male salmon become red and brown and develop a hooked lower jaw.

After spawning, most of the salmon (known as kelts) die. However, a proportion survive and gradually lose their secondary sexual characteristics. The kelts regain their previous appearance – albeit with a substantially decreased body mass due to not feeding for several months – and then return to sea again.

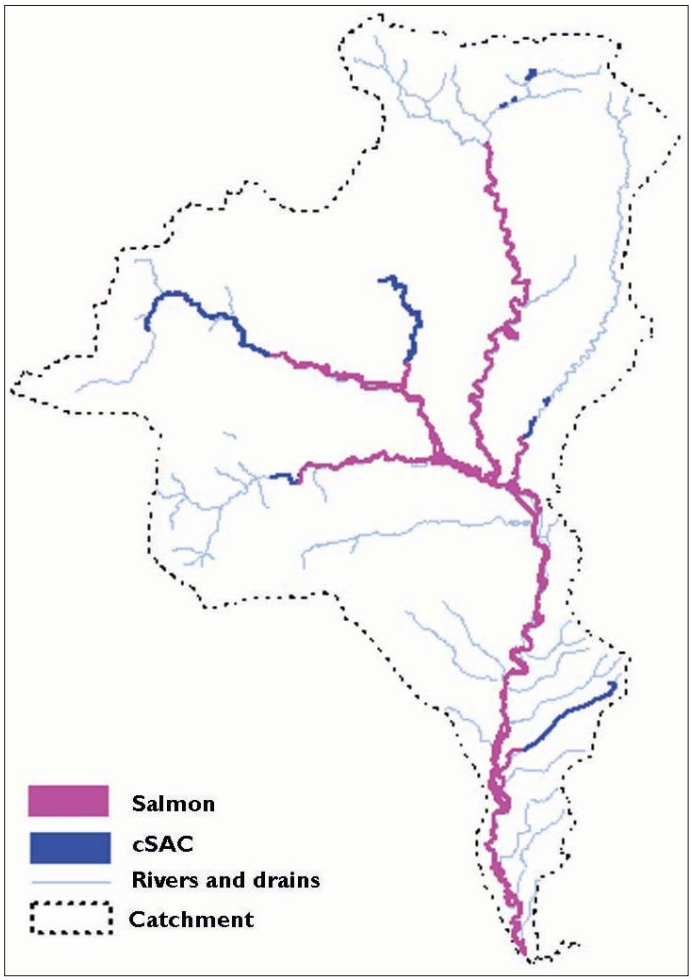


Figure 10. Known extent of salmon in the River Avon cSAC.

2.5.1 Status of Salmon in the River Avon cSAC

Atlantic salmon utilise all the main tributaries of the cSAC, as shown in Figure 10, but rarely gain access to the Upper Wylye and the Ebble, which is not part of the cSAC. The Nadder is considered to be particularly important to the Avon population for spawning, having consistently the highest number of spawning beds or redds.

There appears to have been a widespread crash in salmon stocks, thought to be due in part to poor survival during the marine phase of their life cycle. The Avon salmon population has suffered a severe decline over the last 10 years, with a crash occurring in the late 1980s–early 1990s, during four years of exceptionally dry weather. However, the 2002 data suggest an encouraging increase in stock levels.

The population decline on the Avon can be divided into two components, a long-term

decline of spring running salmon, concurrent with a national trends and a shorter-term decline of later-running salmon (Environment Agency 1997). Management on the Avon needs to try and create optimal conditions for recovery of the species.

The decline of the spring catch since the 1950s has been a drop in numbers of three- sea-winter and four-sea-winter fish, combined with a drop in one-sea-winter and two-sea-winter numbers since 1988. Changes in sea-age composition have occurred previously, but the present paucity of three-sea-winter fish appears more extreme and long lasting than other fluctuations in the last 120 years (Environment Agency 1997).

Rod and net catch data from the last few years indicate a stabilisation in stock, but at a much-reduced level from that recorded until the late 1980s, as shown in Figure 11. The net catch is currently the most reliable indicator of stock status, until completion of work to improve counting arrangements at Knapp Mill.

As shown in Figure 11, the salmon rod catch dramatically declined between 1989 and 1993. The decline may be accentuated by decreasing fishing effort for salmon, but there has clearly still been a decline in rod catches. Encouragingly, in 2002, the rods caught 123 salmon.

Net catches also declined dramatically between 1989 and 1993. However, in the 2002 season, the Mudeford nets caught 204 salmon, of which 202 were released alive.

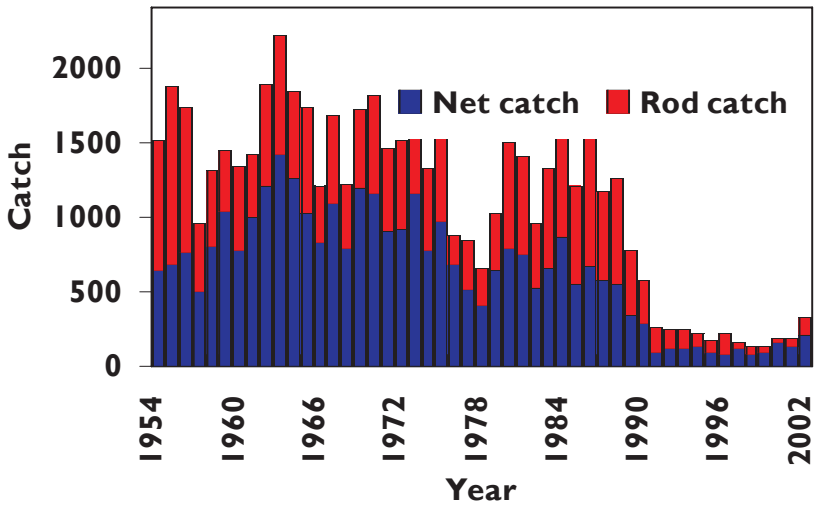


Figure 11. Historical rod and net chatches of salmon.

The Minimum Biologically Acceptable Level (MBAL) egg deposition target has been set as a conservation limit in the cSAC. The MBAL is a minimum spawning level that the Environment Agency aims to exceed in four out of every five years, It has been calculated for the River Avon as 8.53 million eggs. Historic egg deposition, as shown in Figure 12, illustrates that Avon has not attained this target since 1989. Net catch data for 2001 indicated an approximate egg deposition of 30–40 % of MBAL (Environment Agency 2001). Encouragingly, the 2002 catch suggested a run of approximately 2,018 salmon, equating to egg deposition of 74% of the conservation limit.

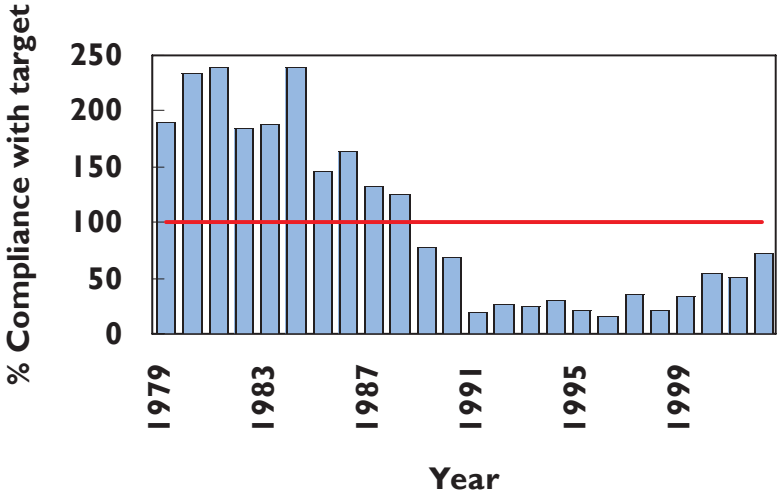


Figure 12. Egg deposition compared to conservation limit (MBAL).

2.5.2 Influences on the status of Atlantic Salmon

Factors influencing Atlantic salmon have been identified based on current information and incorporated into the draft Favourable Condition Tables (Appendix B). Research undertaken as part of **Life in UK Rivers** will contribute to knowledge of the ecological requirements of riverine SAC species, including Atlantic salmon. Attributes with an important influence on Atlantic salmon populations are summarised in Table 5.

Table 5. Main influences on the status of the Atlantic salmon population in the River Avon cSAC.

Attribute	Measure
Flow	Limits on licensed abstractions after modelling impacts. Audit every six years, if possible via CAMS.
Water quality	Biological class – Environment Agency's General Quality Assessment (GQA) scheme.
	River Ecosytem class
	Suspended solids (annual average).
	Soluble reactive phosphorus (annual mean)
River substrate	Silt content
River form	Assess channel form
Habitat structure	Distribution and area of spawning habitat.
	Distribution and area of nursery habitat.
	Presence of adult holding areas.
	Extent of submerged and marginal plants
	Extent of bankside tree cover with submerged tree root systems
	River form
Access	Artificial obstructions (Baseline survey, then check every six years).
Biological disturbance	Fish introductions
	Exploitation (Application of voluntary agreements and Environment Agency bylaws.)

The Environment Agency produced a Salmon Action Plan in 1997 (Environment Agency 1997a), which identifies actions to address the key issues thought to be affecting salmon populations. Action has been taken on some of the key points and the plan is scheduled for review in 2002. The River Avon Strategy does not intend to duplicate all the actions required under the Salmon Action Plan, rather to highlight additional areas in need of action. Listed below are brief details of key factors affecting the salmon population. Further information on factors potentially affecting stocks is contained in the Salmon Action Plan.

2.5.2.1 Water quantity and flow

Salmon are at risk from the following modifications to water quantity and flow characteristics:

- Uncharacteristically low flows for the time of year
- Uncharacteristically high flows for the time of year
- Modifications to the characteristic flow regime.

Chalk rivers are principally spring-fed and exhibit less seasonal variation in flow than other river types. Uncharacteristically low flows can result in a decreased area of useable habitat, reducing available territory and refuges. In some cases, spawning areas may be exposed, causing mortalities of fry and young parr. Low flows can result in reduced velocities and hence increased siltation of redds, and may also affect the type and abundance of invertebrate food sources available to salmon (APEM 2001). Reduced velocity can also decrease the area of suitable habitat, increasing competition between parr and other species, such as trout.

The timing of the first big rise in flow in autumn is critical for getting adults to spawning areas. This 'flushing flow' is also important as it carries away silt of high organic content, improving conditions for the incubation of eggs.

Flow modification can reduce the frequency, and change the timing, of flushing flows and stimuli to

migration into and within the river, therefore providing a non-physical barrier to migration. A study by Solomon *et al*. (1999) indicated that as residual flows in the Avon estuary (after abstraction) fall below approximately 9 $m^3 s^{-1}$, an increasing proportion of fish fail to enter the River Avon. Due to the current abstraction regime, in drier years this threshold may be reached more frequently than would naturally occur, resulting in curtailed migration into the river (Environment Agency 1997). An investigation into the impact of abstraction on salmon migration is underway as part of the Asset Management Planning programme (see Section 4.3.2).

In addition to water quantity, maintaining a range of typical flow characteristics is important in order to provide suitable habitat for all salmon life stages.

Uncharacteristically high-flow events can cause the erosion of spawning beds and downstream displacement of eggs and alevins, resulting in high mortality rates. Extreme-flow events may occur with increasing frequency in the future as a result of climate change, a factor with potential implications for all stages of the Atlantic salmon's life cycle.

2.5.2.2 Water quality

Salmon are particularly vulnerable to poor water quality from both point and diffuse pollution sources. Threats to salmon include the following:

- Organic pollution
- Elevated suspended solid levels
- Trace elements such as pesticides.

Organic pollution incidents can affect all life stages; in particular eggs, which cannot avoid pollution, and spawning fish, which require more oxygen that other life stages. In addition, organic pollution can result in reduced food availability.

Elevated levels of suspended solids may clog gills, literally choking the fish, and can affect feeding patterns in juveniles.

Salmon are vulnerable to a range of elements including synthetic pyrethroid (SP) sheep dips, and atrazine. Atrazine (used primarily in the maize-growing industry) and pyrethroids are highly toxic, and small amounts can eliminate organisms on which juvenile salmon feed, even where direct mortality of fish has not been observed. Recent work by the Environment Agency has highlighted the potential effects of traces of endocrine-disrupting substances, including oestrogen, on salmonids.

2.5.2.3 River form and habitat structure

Salmon are potentially or actually at risk the following modifications to habitat:

- Channel modification (widening, straightening, deepening of the channel)
- Removal of gravels
- Excessive cutting of marginal and submerged vegetation.

A diversity of water depths, current velocities and substrate types is necessary to fulfil the spawning, juvenile and migratory requirements of salmon. Close proximity of different habitats facilitates movement to preferred habitat for particular life stages. Operations that widen, deepen and/or straighten the channel can reduce variations in habitat. New operations that would have this impact should be avoided within the cSAC, and habitat rehabilitation will be needed in some reaches.

The total wetted area of the Avon catchment used by salmon is 3.6 million m^2 (Environment Agency 1997), the quality of which is shown in Table 6. The existing area of suitable habitat appears to be under-utilised at current stock levels, and in-gravel survival may be a limiting factor (see Section 2.5.2.4).

It is vital that there is adequate habitat diversity and juxtaposition of various habitat types, including spawning and nursery regions, as well as adult holding areas.

Holding areas are defined as pools of at least 1.5 m depth, with cover from features such as undercut banks, vegetation, submerged objects and surface turbulence. They are not considered to be a critical

Table 6. Proportion of good and moderate juvenile salmon habitat in the Avon and its main tributaries.

River (subcatchment)	Juvenile Habitat	
	% area good habitat	% area moderate habitat
Avon u/s of Salisbury	20.2	17.7
Avon d/s of Salisbury	16.8	12.2
Bourne (u/s limit Ford Mill)	40	36
Dockens Water (u/s limit Moyles Court)	60	25
Ebble (u/s limit A338)	60	30
Nadder (u/s limit Sutton Hill)	50	24
Wylye (u/s limit Fisherton De La Mere	28	21

feature on the Avon system, although river management should aim to maintain a number distributed throughout the river system.

Submerged and marginal vegetation is an important source of cover and food for juvenile salmon, and cutting operations should aim to leave a proportion of this vegetation. Overhanging trees provide valuable shade and food sources, while tree root systems provide important cover and flow refuge for juveniles. Historical management of the chalk stream stretches of the Avon and the water meadows in the floodplain has resulted in a very limited extent of this habitat feature, and *Ranunculus* habitat provides the vast majority of cover.

2.5.2.4 Substrate

Salmon are potentially at risk from influences on the availability and quality of suitable substrate for all life stages, including:

- Elevated levels of fine sedimentation in spawning gravels
- Removal of gravel from the river.

Considerable evidence exists to show that the presence of fine sediment in salmon spawning gravels can adversely affect egg and alevin survival. Fines smother salmonid eggs by preventing intra-gravel currents and clogging gravel pores at the surface of the riverbed. Silt high in organic matter can lead to high BOD (biological oxygen demand), with consequential reduction of oxygen available for eggs. This can prevent or disrupt spawning and alevin emergence, as well as causing suffocation of eggs in salmon redds (APEM 2002). The Avon cSAC is thought to be impacted by elevated levels of sedimentation.

Varied substrate size composition is important for a number or reasons, including velocity shelter, provision of cover and providing preferred habitat for juveniles of different ages. Spawning habitat (well-oxygenated gravel) is vital to maintaining salmon stocks. The removal of gravels directly impacts on available spawning habitat and the characteristic river form on which salmon depend. It should therefore not be permitted, particularly since much gravel has been removed from the Avon in the past.

2.5.2.5 Barriers to migration

Salmon are potentially or actually at risk from the following barriers to migration:

- Man-made structures
- Modification to the natural flow regime
- Operation of eel traps.

Migration conditions for salmon are satisfactory, with a few exceptions that are currently being addressed. In 1995 a review of migration conditions downstream of Salisbury was undertaken (Solomon 1995) and recommendations made in order of priority. The Environment Agency has implemented all the high-priority recommendations, with work in progress to address the remaining two. In 1997 a study was undertaken to assess the possibility of enabling salmon to access the lower Ebble. The report recommended that this should not be a high priority.

As part of the implementation of Water Level Management Plans, additional control structures may be put in place within the cSAC. It is vital to ensure that any such structures are passable by migrating salmon. Care must also be taken to minimise the potential impacts of enhancing the ditch network, particularly where salmon may become trapped in blind channels. This is relevant to implementation of the Water Level Management Plans and agri-environment scheme applications incorporating water meadow restoration.

Sue Scott

Salmon need well-oxygenated gravel substrate for spawning.

In 1997, the operation of eel traps on the Avon was audited and it was found that traps can delay upstream migration for a night at a time, contributing to some of the exhausted salmon falling back onto the traps and dying. Ideally, traps would be manned constantly in order to rescue such fish. However, no mechanism exists to ensure this happens. Eel traps are audited periodically to ensure that non-target species are not entrapped.

2.5.2.6 Biological disturbance

Salmon are potentially or actually at risk from biological disturbance, in particular:

- Introductions of salmon
- Introductions of other fish species.

The Atlantic salmon in the Avon system is considered to be a pristine chalk stream form that has not been significantly altered by stocking. There is evidence that locally adaptive genetic variation in salmon stocks exists (Youngson *et al.* in press). These differences in the wild stock may have adaptive significance and therefore need to be conserved. The precautionary approach should be applied regarding stocking of salmon on the Avon.

Population enhancement by habitat improvement and control of exploitation is the main nature conservation focus; stocking should only be considered as an emergency interim measure, and it is not currently considered to be in the best interests of the cSAC. Every endeavour should be made to safeguard the remaining stock by removing constraints on natural recovery. For further details, refer to Section 6.10 of the Salmon Action Plan consultation draft (Environment Agency 1997).

Stocking of fish is widely undertaken on the Avon cSAC to supplement natural fish stocks for recreational angling purposes. The presence of artificially high densities of other salmonids can impact on salmon through a variety of mechanisms. The most significant risk to salmon fry from stocking is an increase in competition for food and territory, primarily a risk associated with non-adult salmonids (Aphrahamian *et al.* in press). Artificially stocked trout can also predate on juvenile salmon. As part of the draft National Trout and Grayling Strategy it was recommended that guidelines on appropriate brown trout stocking levels and locations should be developed on individual rivers to ensure the risk of impact on wild salmonid stocks is minimised (Environment Agency 2001).

Effective screening on all fish farm intakes and discharges is required under the Salmon and Freshwater Fisheries Act in order to prevent escapes of farmed fish and entrapment of wild salmon. Escapes from fish farms are a form of uncontrolled introduction and should be prevented.

2.5.2.7 Exploitation

The River Avon salmon stocks are vulnerable to exploitation in a number of ways:

- Legal and illegal high seas fisheries
- Legal and illegal Irish fishery
- Legal and illegal fishing in Christchurch Harbour
- Legal and illegal rod fishing.

High seas fisheries are regulated by the North Atlantic Salmon Conservation Organisation, which fixes quotas for two fisheries operational for salmon in the North Atlantic – the Faroese and Greenland fisheries – by negotiation with these parties. Currently, these fisheries are operating at a subsistence level and are not thought to impact greatly on Avon stocks.

The most significant fishery currently impacting on UK stocks is that under the jurisdiction of the Irish government. Tagging studies have indicated that 10–20% of the salmon returning to south coast rivers are intercepted by this fishery. Certain restrictions have been placed on the fishery, but they do not appear to have achieved the expected reductions in exploitation rates. For some time, the UK government has been lobbying the Irish government to phase out its fishery, and discussions are ongoing on this issue.

The action required to address the impact of the fishery on the Avon salmon is as stated in recommendation 41 of the MAFF/NAW Salmon and Freshwater Fisheries review Group Report (2000):

> *The government should continue to press the Irish Government, by all available means to take all practicable measures to reduce the impact of the Irish drift net fishery on England and Wales salmon stocks.*

The Avon-based Wessex Salmon and Rivers Trust has officially complained to the European Commissioner for the Environment that the Irish government is breaching the Habitats Directive in relation to the continued exploitation of salmon by the Irish fishery. An investigation of this complaint is underway, following which the commission will take whatever action is deemed appropriate.

Exploitation by legal rods on the Avon is managed through a closed season, bait or lure restrictions and catch and release of salmon. Although byelaws can be adopted to implement method restrictions or mandatory catch and release of salmon in the rod fishery, this is not currently necessary on the Avon due to a voluntary agreement by almost all rod fishermen to practice catch and release.

A closed season, gear restrictions and a voluntary catch-and-release scheme control exploitation by legal nets in Christchurch Harbour. Net fisheries, such as the trout and salmon nets in Christchurch Harbour, are controlled by Net Limitation Orders, and although not amenable to readily regulating the number of fishermen in response to stock status, are the only means of limiting numbers of fishermen under current legislation.

The continued participation in catch and release by the rods and nets makes an extremely valuable contribution to protecting the Avon salmon stocks

2.5.2.8 Problem species

The Favourable Condition Targets do not specifically mention predation on salmon other than in relation to biological disturbance by stocked fish. Predation of salmon is a natural phenomenon, and fish, birds and mammals have co-existed in an ecological balance for centuries. However, there is concern over the impact of piscivorous birds on fisheries, and this issue is detailed in Section 7 on problem species.

Juvenile mute swans have an indirect effect on young salmon by grazing *Ranunculus* species. This is because the necessary velocities, depth and cover required by salmon are created by the weed growth. When *Ranunculus* species are extensively grazed, the remaining habitat is less suitable, and mortality of juvenile salmon increases.

2.6 Watercourses of Plain to Montane Levels with Submerged or Floating *Ranunculion fluitantis* and *Callitricho-Batrachion* Vegetation

The description above refers to a river habitat – semi-natural watercourses characterised by 'flowing water' vegetation – not a single species or plant community. As such, the river is designated as a habitat of European importance, and is characterised by its plant community (known as the *Ranunculus* community or habitat in this document).

The plant species associated with the *Ranunculion fluitantis* and *Callitricho-Batrachion* plant community vary according to the type of river. Typically, in chalk rivers they include *Ranunculus* species, including *R. fluitans* (river water crowfoot), *R. peltatus* (pond water crowfoot), *R. penicillatus pseudofluitans* (brook water crowfoot) and *R. aquatilis* (common water crowfoot); *Potamageton* species (pondweeds); *Callitriche* species (starworts); *Myriophyllum* species (water milfoil); *Fontinalis antypyretica* (greater water moss); *Berula erecta* (lesser water parsnip); and *Zannichellia palustris* (horned pondweed) (IACR 2002).

The occurrence of this suite of species is dependent on the geomorphology of the river (flow, substrate and channel morphology), and is influenced by factors such as water quality and climatic cycles.

2.6.1 Status of the *Raununculus* habitat in the River Avon cSAC

The plant communities in the Avon, Bourne, Nadder and Wylye are characteristic of a calcareous river with a clay influence. R*anunculus* habitat forms a fundamentally structural and biological component of the river ecosystem. The plant community is dominated by *Ranunculus* species, but other species present include spiked water milfoil (*Myriophyllum spicatum*), arrowhead (*Sagittaria sagittifolius*), lesser water parsnip (*Berula erecta*) and fool's watercress (*Apium nodiflorum*). Flowering rush (*Butomus umbellatus*) occurs in both its submergent and emergent forms, perhaps its fullest expression in a British river.

Brook water crowfoot is dominant through the upper Avon, Wylye, Bourne and Nadder. In the lower Avon, river water crowfoot is present but other species form a greater part of the community. In the River Till, the upper winterbourne section contains pond water crowfoot, giving way to brook water crowfoot in the perennial section.

Nigel Holmes

The *Ranunculus* community is composed of many species of macrophytes, including *R. peltatus*.

Blunt-fruited water-starwort (*Callitriche obtusangula*) and various-leaved water starwort (*C. platycarpa*) grow on the riverbed with *Ranunculus* species throughout the system. Common water starwort (*C. stagnalis*) is more frequent in the chalk tributaries, and intermediate water starwort (*C. hamulata*) in the Dockens Water.

Pondweeds reflect the more enriched nature of the main River Avon, with fennel pondweed (*Potamageton pectinatus*) and perfoliate pondweed (*P. perfoliatus*), which are characteristic of the upper reaches. Shining pondweed (*P. lucens*), willow-leaved pondweed (*P. salicifolius*) (a hybrid between the last two species), and small pondweed (*P. berchtoldii*) characterise the lower part.

The nationally scarce river water dropwort (*Oenanthe fluviatilis*) is found in the Avon and the Wylye, and the locally important hemlock water dropwort (*Oenanthe crocata*) also occurs in the Avon, although more characteristically at the river edge.

Nigel Holmes

The nationally scarce river water dropwort is found in the cSAC.

The River Till is of note for its characteristic winterbourne vegetation communities. The upper winterbourne section is dominated by fool's watercress. In the middle section, pond water crowfoot, which is typical of streams with winterbournes, grows in the channel. As the flow becomes more consistent downstream this is replaced by brook water crowfoot, which is typical of chalk rivers.

The Dockens Water is predominantly characterised by bryophytes and moorland-edge species, typically without submerged vascular plants, reflecting the underlying acid geology. The Dockens Water supports lesser spearwort (*R. flammula*) and round-leaved water crowfoot (*R. omiophyllus*), which are more characteristic of bogs than rivers; bog pondweed (*P. polygonifolius*) and broad-leaved pondweed (*P. natans*) are also found. The influence of the more acid sands is also illustrated by the occurrence of common spike-rush (*Eleocharis palustris*) and hemlock water-dropwort.

In 1999 and 2000 (Grieve *et al.* 1999 and 2000) a continuous walking survey was carried out over the entire length of the Avon cSAC. The survey provided a snapshot of the extent and general condition of the *Ranunculus* habitat, and particular note was made of the extent of silt, impact of mute swans and the plant communities. The observed impacts are summarised in Figure 13. Where possible, the survey included assessment of any impacts, including excessive silt, channel modifications and land use.

In the 1999 survey, *Ranunculus* habitat was found to be most abundant on the River Wylye, followed closely by the Avon, with the River Nadder having the least abundant *Ranunculus* species. In the 2000 survey the lower Avon was found to have the most abundant *Ranunculus* species and the Bourne the least. Both surveys found that the physical condition and extent of *Ranunculus* habitat was variable throughout the channel, and in places impacted by swan grazing and extensive siltation. Indicators of elevated nutrient levels were observed.

The survey provided useful information on the scale of impacts on *Ranunculus* but it is difficult to draw conclusions as to the status of *Ranunculus* habitat in the Avon cSAC, as abundance is only one indicator of condition. No formal assessment of the status of the *Ranunculus* community and habitat was made at the time of the surveys, and since then, our understanding of the expected plant community and of favourable condition has developed considerably. There is currently no regular monitoring of *Ranunculus* habitat on the Avon.

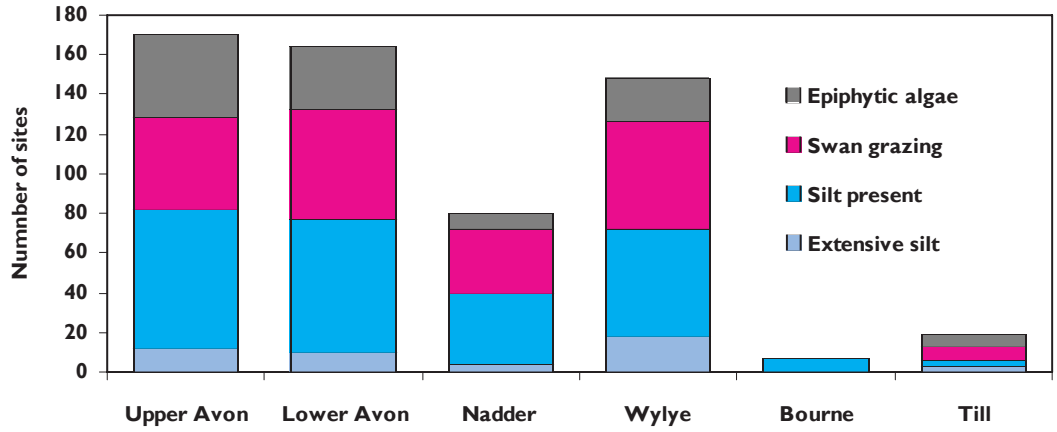


Figure 13. Summary of impacts on *Ranunculus* habitat observed during the 1999/2000 survey

2.6.2 Influences on the Status of *Ranunculus* Habitat

Factors influencing *Ranunculus* habitat have been identified based on current information and incorporated into the draft Favourable Condition Tables (Appendix B). Research being undertaken as part of **Life in UK Rivers** will contribute to knowledge of the ecological requirements of riverine SAC species, including *Ranunculus* habitat. Attributes with an important influence on *Ranunculus* habitat are summarised in Table 7.

Table 7. Main influences on the status of *Ranunculus* habitat in the River Avon cSAC.

Attribute	Measure
Flow	Limits on licensed abstractions after modelling impacts. Audit every six years, if possible via CAMS.
Water quality	Biological class – Environment Agency's General Quality Assessment (GQA) scheme.
	River Ecosytem class
	Suspended solids (annual average).
	Soluble reactive phosphorus (annual mean)
River substrate	Silt content
River form	Assess channel form by hydrogeomorphological survey
Extent and composition of *Ranunculus* communities	Mapping of representative sample stretches

2.6.2.1 Water quantity and flow

Ranunculus habitat is potentially or actually at risk from the following water quantity and flow influences:

- Uncharacteristically low flows and low current velocities
- Uncharacteristically high flows and high current velocities
- Uncharacteristically low diversity of flow types.

Chalk rivers are principally spring-fed and exhibit less seasonal variation in flow than other river types. However, unnaturally low flows and low velocities can have an adverse impact on *Ranunculus* communities. Winterbournes and headwaters subject to abstraction and drought will exhibit a decline in the extent and condition of *Ranunculus* habitat, and an increase in species adapted to slower water, such as common water starwort and watercress (*Rorippa nasturtium-aquaticum*).

In addition, marginal species, such as water mint (*Mentha aquatica*) and water forget-me-not (*Myosotis scorpioides*) will increase in cover, and with longer periods of drying this will lead to a transition to

terrestrial grasses (Holmes 1996). Low flows will generally decrease the dilution of pollutants entering the river and may accelerate the buildup of silt, which is not washed away downstream.

Uncharacteristically high flows and high velocities can also impact the *Ranunculus* habitat. *Ranunculus* species grow better with improved (higher) flows due to morphology and physiological adaptations. However, high flows can also lead to premature 'washing out', particularly where the plants are rooted in silty substrate or have been physiologically weakened by low flows during the preceding summer. Extreme-flow events may occur with increasing frequency in the future as a result of climate change, a factor that has implications for the *Ranunculus* habitat.

2.6.2.2 Water quality

Ranunculus habitat is potentially or actually at risk from the following water quality problems:

- Elevated nutrient levels
- High levels of suspended solids
- Elevated levels of trace elements.

Elevated nutrient levels (eutrophication) are regarded as the major water quality issue affecting plant communities in British rivers (Environment Agency 2000), and are a major concern in the Avon cSAC.

Increasing nutrient supply can lead to a shift in vegetation community composition by an overall reduction in the number of species, with a loss of *Ranunculus* species and an increase in pollution-tolerant species such as fennel pondweed (*P. pectinatus*), spiked water milfoil (*M. spicatum*), unbranched bur reed (*Sparganium emersum*), common club rush (*Schoenoplectus lacustris*), and filamentous algae. More extreme nutrient increases lead to an overall impoverishment of the community, with algae dominating. In some cases epiphytic algae dominate, smothering and shading macrophytes.

A recent report on *Ranunculus* habitat in chalk rivers (Environment Agency 2001b) acknowledges that it has been difficult to demonstrate a strong correlation between growth of *Ranunculus* species and water quality parameters. This can partly be attributed to the combined effects of the main controlling factors, such as flow, light and temperature (climate), masking the response to additional nutrient inputs.

Turbidity due to suspended solids has an impact on channel plant communities (Brookes 1986), and can cause a shift in species composition due to decreased light and the effects of abrasion.

Elevated levels of trace elements may directly impact on *Ranunculus* habitat. Pesticides such as atrazine are of particular concern where present at levels harmful to aquatic vegetation.

2.6.2.3 River form and habitat structure

The *Ranunculus* habitat in the River Avon cSAC is potentially or actually at risk from habitat modification, in particular:

- Channel modification
- Vegetation management (marginal and bankside)
- Aquatic vegetation management (known as weed cutting).

Ranunculus habitat in the River Avon cSAC has been significantly affected by channel modification, including dredging, widening, straightening, re-profiling and channel reinforcement. Both aquatic and marginal plant species may no longer be able to find a foothold in modified channels. A varied river form provides opportunities for the growth of different *Ranunculus* community species.

Maintaining a characteristic marginal and bankside plant community is important in order to retain all the plants that occur naturally in this type of river. This vegetation also supports an important assemblage of invertebrates, including Desmoulin's whorl snail, provides shade and food for fish, and helps prevent erosion of banks through trampling by cattle. It is therefore important to retain existing areas of marginal vegetation in the cSAC and to allow them to re-establish in badly eroded areas. Cutting of marginal and bankside plants should be carried out sensitively on a rota basis.

Management of *Ranunculus* or 'weed' cutting in the river itself has historically been undertaken for flood

David Withrington/English Nature

***Ranunculus* communities, such as this one in the headwaters of the River Avon at Fonthill Bishop, provide important habitat for a variety of species. The community is managed for flood defence and fisheries.**

defence and fisheries purposes. 'Weed' is something of a misnomer and means the *Ranunculus* community.

Flood-defence cuts are carried out mechanically and have the potential to remove a large proportion of the plant community, together with the invertebrates that live on them. Mechanical weed cutting should be minimal and only undertaken for good reason in the cSAC, following an agreed protocol. See Section 6 for more details on management of *Ranunculus* habitat for flood defence.

Management of *Ranunculus* for fisheries purposes is primarily carried out by hand, and sensitive cutting can be used in a positive way to improve flows in modified channels, remove silt deposits, and reduce bank erosion. See Section 5 for further detail on fisheries weed cuts.

The relative importance of seed production in the propagation of *Ranunculus* habitat is not well understood. As a precaution, any in-channel vegetation management should ensure that a significant proportion of the *Ranunculus* community is allowed to flower and set seed naturally.

2.6.2.4 Substrate

The *Ranunculus* habitat is at risk from influences on substrate type and quality, in particular:

- Elevated levels of siltation
- Elevated levels and of suspended solids.

In general, the physical habitat typified by *Ranunculus* species is one of clean substrate and moderate to swift flow. Except for the channel margins (and localised deposits associated with *Ranunculus* and *Callitriche* beds) the river channel should be free of silt. Excessive amounts of silt (both suspended and deposited) can lead to increased storage of nutrients and affect the plant community through several mechanisms.

Silt-rich sediments retain nutrients and are likely to have high levels of nitrogen and phosphorus (Mainstone *et al.* 2000). This provides good conditions for the growth of benthic algae, which can hinder the growth of channel plants in the spring. In addition, plants growing in rich sediments tend to have shorter shoots and weaker roots, and are therefore prone to washout.

Ranunculus species are not able to vary their rooting level in response to increased silt deposition and can become smothered by it. The effect can be long lasting due to the poor flushing capacity of chalk streams. Rivers with a degraded riparian strip, or no buffer strip, are particularly vulnerable to silt impact

from storm runoff and cattle access to the channel.

As previously stated, the reproduction of *Ranunculus* species is not well understood, but re-growth from seed is thought to be particularly important for pond water crowfoot, which is characteristic of the winterbourne sections of the River Till. The seeds of *Ranunculus* species do not survive in the anoxic conditions that develop within organic sediments, and are easily lost when the silt becomes flushed out with higher flows (Mainstone 1999).

2.6.2.5 Problem species

The *Ranunculus* habitat is potentially or actually at risk from the following:

- Aquatic and riparian non-native invasive plants
- Signal crayfish
- Flocks of unmated swans.

Non-native invasive emergent plants are a major concern due to their ability to achieve dominance over native species and the difficulty of controlling their spread. These riparian plants may not directly alter the composition of the *Ranunculus* community, but can influence conditions through increased shading or siltation (through greater bank erosion). Of the problem species, Japanese knotweed will grow in river channels on exposed bars, and may alter local geomorphology as well as vegetation, possibly leading to localised flood events. For further information, refer to Section 7.

Signal crayfish (*Pacifastacus leniusculus*) can consume large quantities of plant material under certain conditions, and may have an impact on *Ranunculus* habitat if present in sufficient numbers. They are also thought to impact negatively on bullhead populations.

Grazing of *Ranunculus* habitat by flocks of unmated mute swans is considered problematic at specific locations where large numbers of swans are present, particularly on the rivers Wylye and Avon. The mute swans appear to preferentially graze new shoots, preventing the establishment of *Ranunculus* species. The effect of grazing is exacerbated by periods of low flow when *Ranunculus* species may already be stressed, and swans can more easily graze shoots right down to bed level.

2.7 Influences on the Status of the River Avon cSAC

The following sections describe the influences acting on the River Avon cSAC and key issues that must be addressed in order to achieve favourable condition. Throughout the text actions are identified, including those already underway that need to be maintained, and further actions required. All the further actions required are listed in the executive summary at the front of the document.

An example of the action tables is given below. For actions already underway the organisations, mechanism and time-scale for delivery have been shown. In the case of further actions required, key partners, mechanisms and a time-scale for delivery have been suggested.

Example action table

The abbreviations used to describe organisations and mechanisms referred to in the tables are listed in the Executive Summary.

Action underway/required		**Delivery**		
		By whom (suggested)	**Mechanism**	**Date (suggested)**
Relevant area of activity	Action underway (and to be continued) or further action required	Suggested partners	Delivery mechanism (if one exists)	Deadline (if already existing) or suggested target date
e.g. WLMPs	Develop Water Level Management Plans in order deliver wildlife gain for the River Avon cSAC/SSSI and Avon Valley SPA/SSSI.	EA, EN, DEFRA, landowners and fisheries interests	WLMP	2004

Section 3
Discharge of Polluting Substances

Maintenance of an adequate water quality is essential to the cSAC features, as described in Section 2. It has been demonstrated that the Avon is undergoing nutrient enrichment, is eutrophic in the headwaters, and occasionally experiences failures of river quality objectives. Nutrient enrichment is from both point and diffuse sources and any efforts to reduce nutrient levels must address both.

Other issues of concern are elevated levels of suspended solids, intermittently elevated pesticide levels and the possible effects of endocrine-disrupting substances.

The River Avon cSAC receives discharges of polluting substances from a variety of sources, including public and private domestic sewerage, agriculture, aquaculture (watercress and fish farms), and industry. The likely effect of any discharge on water quality is strongly linked to volume of flow in the receiving waters. Water quality data for the River Avon can be found in Appendix D.

There are over 600 consented discharges in the catchment, including the major continuous and intermittent point discharges of effluent. Continuous discharges include sewage treatment works (STWs) – Salisbury and Christchurch STWs contribute the largest proportion of effluent to dry weather flow in the river.

Particular attributes related to water quality are relevant to the species and habitats of the River Avon cSAC, and are shown in Table 8.

Table 8. Relevant attributes related to water quality.

Attribute	Measure
Water quality	Biological class
	River Ecosystem class
	Suspended solids (annual average).
	Soluble reactive phosphorus (annual mean)
River substrate	Silt content
Additional water quality considerations	Heavy metals, herbicides, pesticides.
	Water hardness
	Temperature
Sediment quality considerations	Sediment phosphorus
	Sediment oxygen

3.1 Sources of Pollution

3.1.1 Public Sewage Treatment Works

STWs have been recognised as a major contributor to elevated phosphate levels, and this issue is being tackled under the Asset Management Planning Programme (see Section 3.2.1.1). The effluents discharged from STWs are primarily domestic in origin, with a small trade effluent content. The majority of public sewerage is licensed to Wessex Water Plc and Thames Water Utilities. Intermittent overflows occur from most sewage treatment systems and are subject to consents, which are aimed at limiting the frequency of these discharges to periods of high rainfall (NRA,1992).

Concern has recently been expressed regarding the effect of hormone-disrupting substances, including estrogenic steroids, on aquatic ecology. The potential effects on fish are of sufficient concern to the

Environment Agency that it is developing a risk-management strategy and investigating possible changes in sewage treatment practices.

3.1.2 Aquaculture

Another source of effluent is from aquaculture – watercress farms and fish farms, both of which contribute significant discharges to the Avon. Discharges from watercress farms can produce localised water quality problems of elevated biological oxygen demand (BOD) and suspended solid levels. The main watercress farm in the cSAC is on the Wylye at Longbridge Deverill, with smaller sites operating in the headwaters of the Nadder and Ebble.

The Avon is highly developed for fish farming, with 13 consented farms in operation, including some of the largest in England and Wales downstream of Salisbury. Discharges from fish farms can potentially produce localised water quality problems due to the discharge of organic matter.

3.1.3 Private Sewage Discharges

There are a significant number of continuously discharging private STWs that may contribute to elevated nutrient levels in the River Avon cSAC. All new private systems require a consent, and those where there are alterations to existing systems. This means that, over time, the majority of private systems will become regulated. The combined effect of discharges from consented private sewerage will be examined in the Review of Consents.

3.1.4 Diffuse Pollution

Diffuse sources of pollution are known to be contributing to eutrophication in the Avon and will have a relatively increasing influence as nutrient inputs from public STWs are reduced. Diffuse pollution in the catchment is principally influenced by agriculture, with a less-significant contribution from roads and urban areas.

Diffuse agricultural pollution is considered to be a major water quality issue in the Avon catchment, related to problems of river quality objective non-compliance, eutrophication, siltation and elevated pesticide levels (Environment Agency 2002). These problems are particularly evident in the upper Avon, and the Landcare project has been set up in order to tackle diffuse agricultural pollution in this area. Traces of pesticides are intermittently detected on the Avon, probably entering the watercourse in diffuse runoff from fields. Certain pesticides can be directly toxic to the cSAC features and also act as hormone disrupters.

Roads and tracks provide a flow path for runoff to enter the river system and can themselves be a source of pollutants if their drainage systems become overwhelmed or blocked. Attempts to map where roads are affected most frequently by runoff indicate catchment-wide occurrences. A recent study has enabled mapping of the major points that runoff enters the River Wylye.

Urban areas are a source of unconsented runoff in periods of high rainfall, when storm water drains to the river system. As the urban proportion of the catchment is low, and this effect occurs at times of high dilution, there is no evidence that urban runoff is a major contributor to water quality problems, but may result in some localised problems.

3.2 Issues Related to Point-source Discharges

3.2.1 Phosphorus Levels in Discharges from Public STWs

The Avon is suffering from eutrophication, and a study by Parr *et al.* (1998) found that major STWs have a significant influence on soluble reactive phosphorus levels (SRP) at crucial times of year. At the time of the study, point-source discharges were contributing approximately 40% of SRP. Since this study was undertaken, inputs from STWs have been reduced, and other sources of SRP, including recycling from sediments and diffuse pollution, are likely to be increasingly important.

3.2.1.1 Current discharges

There are two primary mechanisms in place for investigating and modifying discharges; the Asset Management Planning Programme (AMP), which applies to public sewage discharges, and the Review of Consents process (see Section 1.5.2), which applies to all consented discharges.

Several improvements in phosphorus discharges are included in the current AMP program (AMP3). The improvements and their current status are summarised in Table 9. Completion of the improvements should greatly reduce the input of nutrients from STWs.

Table 9. Summary of environmental improvements to STWs required under AMP 3.

Location	Improvement expected	Current Status	Driver	Timescale
Pewsey	Discharge subject to phosphate reduction	Phosphate reduction in place and effect being monitored. Marked decreases in immediate downstream orthophosphate levels observed (Environment Agency 2002a, p16)	Habitats Directive	2001
Warminster				2001
Salisbury			Habitats Directive Urban wastewater treatment directive	2001/ 2003 (storm overflows)
Netheravon	Investigation and phosphorus reduction if required	Investigation of future benefits of phosphorus reduction	Habitats Directive	Investigation by 2004 Phosphorus reduction by 2005
Rathfyn				
Amesbury				
Ringwood	Investigate and reduce phosphorus discharge if required	Investigation of future benefits of phosphorus reduction	Urban Wastewater Treatment directive	End of 2004

Action underway	Delivery		
	By whom	Mechanism	Date
Depending on the outcome of AMP 3 investigations, appropriate action will be taken to deliver further improvements in discharges of phosphorus from public sewage treatment works.	EA, Water CO	AMP	2005+

3.2.1.2 Future discharges

When determining the likely significant effect of a discharge, the Environment Agency must ensure water quality in rivers and wetlands does not fall below the minimum ecologically acceptable level required to achieve favourable condition. However, the needs of existing protected rights and lawful discharge of water must be met where possible. The Avon Eutrophication Control Action Plan (ECAP) will address this requirement, and will provide the context for assessing the likely effect of discharges on phosphate levels.

The ECAP aims to provide a structured approach to addressing complex eutrophication issues, recognising ecological risk (including vulnerability of receiving ecosystem) as a basis for action, in addition to observed impacts. Both diffuse and point sources will be considered. For more detailed information see Appendix C.

Action required	Delivery		
	By whom	Mechanism	Date
The Avon ECAP must have regard to the cSAC favourable condition targets, and in particular soluble reactive phosphorus levels.	**EA**	ECAP	2002/3

3.2.2 The Review of Consents

The Review of Consents will consider all consented discharges relevant to the cSAC, and if required will consider modifications. In most cases a solution will be identified. However, where there is no alternative, licences may be revoked.

In the case of public sewage discharges there is a timing issue between the Review of Consents and the AMP process. The Review of Consents is expected to finish in 2004, but negotiations to obtain water company investment for AMP 4 (2005–2010) are already underway. For this reason, AMP 4 is unlikely to include all the modifications required to satisfy the requirements of the Habitats Directive. This leaves two alternatives for funding any outstanding changes to public sewage discharge consents required under the Habitats Directive; inclusion in AMP 5 (2010–2015) or submission into the interim determination process.

Action underway	Delivery		
	By whom	Mechanism	Date
Changes to public sewage discharge consents identified early in the Review of Consents process will included in AMP4 or the interim determination process as soon as possible.	EA, WCO	RoC, AMP	2003+

3.2.3 Water Quality in Christchurch Harbour

There is concern that water quality in Christchurch Harbour may impact on the migratory cSAC species, particularly salmon, which congregate at the bottom of the River Stour before ascending the Avon. There is currently little evidence of water quality in the Harbour impacting on the cSAC but no detailed investigation has been carried out. Current mechanisms in place to investigate water quality issues include the Review of Consents.

Action required	Delivery		
	By whom	Mechanism	Date
Ensure that appropriate discharges from the Stour are included in the Review of Consents.	**EA**, WCO	RoC	2003
Investigate water quality in Christchurch Harbour to determine if this is a significant influence on salmon and lamprey.	**EA**	RoC/ research	?

3.2.4 Hormone-disrupting Substances

Recent research by the Environment Agency has found that the incidence of feminisation of male fish is significantly higher downstream of discharges from sewage treatment works and that the severity of effect is linked to the size of discharge (Jobling *et al.* 1998).

The Environment Agency is developing a risk-management strategy for oestrogen in sewage effluent including consideration of changes to sewage treatment technologies. Over the next two years it will work to identifying sewage treatment works that should be considered for action. It is not yet known if this is an issue in the River Avon cSAC but if it is thought to be so, it will be included in this investigation.

A DEFRA-funded research project has just commenced to examine the effects of potential hormone-disrupting compounds from fish farms and other sources on wild salmonids. Part of this four-year study is likely to take place on the Avon.

Action underway	**Delivery**		
	By whom	**Mechanism**	**Date**
Develop an environmental quality target for total steroids.	EA	EA research	Ongoing
Refine work on identifying high-risk rivers likely to have high steroid concentrations.	EA		Ongoing
Carry out targeted monitoring of steroids at high-risk sites.	EA	EA monitoring	2000/3
Undertake collaborative projects on high-risk catchments to investigate ecological relevance of endocrine disruption, options for reducing inputs including research into wastewater treatment options, and undertake cost-benefit assessments.	EA	EA research	2000/4
Action required			
If national-level Environment Agency work finds that the Avon is at risk from hormone-disrupting substances, investigate options for reducing this risk.	**EA**	Research	2003+

3.2.5 Development

Applications for new developments must consider the implications of arrangements for the disposal of effluent and surface water.

Surface water drainage from roads, urban and industrial areas can have significant localised impacts under certain circumstances. Impermeable surfaces such as car parks and roads with modern drainage systems remove the natural filtering effect of soil and water, which can affect water quality. The use of sustainable drainage systems should be encouraged in order to minimise the impact of any new urban, road or industrial developments. Refer to Section 8 for details of general issues related to development.

Action required	**Delivery**		
	By whom	**Mechanism**	**Date**
Promote the use of Sustainable Urban Drainage Systems in all new developments or road schemes to ensure no significant effect on the cSAC.	**LA**, **EA**, **EN**	Planning process	Ongoing

3.3 Issues related to Diffuse Pollution

Diffuse pollution in the catchment is principally influenced by agriculture, with a less significant contribution from roads and urban areas.

3.3.1 Diffuse Agricultural Pollution

Diffuse agricultural pollution takes the form of pollutants (pesticides, herbicides, organic and inorganic fertilisers, soil and silt) being washed off agricultural land and entering watercourses, or leaching into groundwater. Diffuse agricultural pollution is considered to be a major water quality issue in the Avon catchment, related to the following problems (Environment Agency 2002).

- Eutrophication
- River Ecosystem class non-compliance
- Siltation
- Elevated pesticide levels (can be toxic and may act as hormone disrupters).

The upper Avon has been identified as a target area for reducing agricultural diffuse pollution, based on studies of vulnerability to soil erosion, land use, numbers of pollution incidents and investigations of RE-class non-compliance. Wide-scale implementation of whole farm management plans that incorporate more sustainable 'best-farming practice' is required to produce a number of environmental outcomes:

- Improved compliance with River Quality Objectives (RQO), contributing to attainment of favourable condition.
- Reduced sediment loads entering the river and as a consequence improvements to gravel quality (including those used for salmonid spawning).
- Reduced nutrient loads entering the river and consequently a reduction in the risk of excessive nutrient enrichment of water and algae-related problems.
- General improvement in the biodiversity of the riverine cSAC community as a result of improvements in water quality.
- Improvements in the landscape quality, such as hedgerow management, and biodiversity of the wider catchment (for example, the stone curlew) through the promotion of more sustainable farming practices.
- Reduced risk of localised flooding through reduction in the volume of surface water run-off. This could have additional benefits by increasing groundwater recharge and thereby contributing to alleviation of low river flows which is an issue in parts of the catchment.
- Reduced risk of pesticide contamination of surface waters through improved farming practice.
- More sustainable farming practices through the minimisation of waste (in terms of reductions in the loss of soil particles, pesticide residues and nutrients from farmland).

3.3.1.1 The Landcare project

Voluntary adoption of best-management practices is currently the primary way of tackling diffuse pollution from agriculture in the upper Avon catchment. The Landcare project was set up using a partnership approach to increase knowledge of diffuse farm pollution, and to influence wide-scale adoption of measures to control diffuse pollution among land managers, farm consultants and advisors in the upper Avon. Activities have concentrated on raising awareness through the media and communication networks of partners and through the development of farmer workshops and field-scale demonstrations of better practice.

Although the Landcare project has had some success there has not been wide-scale implementation of the Environment Agency's best farming practices, and diffuse pollution remains a serious problem within the catchment. There are currently a number of barriers to greater success:

- Poor economic conditions (high uncertainty) for farmers to change.
- Difficulties in staffing the project.
- Resources unavailable for longer term: 1) Project manager; 2) Project officer (to undertake proactive farm visits).
- Provision of too much, often conflicting, information from advisory groups.
- The cost of initial capital works associated with changes in practice.

A major difficulty in addressing diffuse pollution is that changes in practice are undertaken on a voluntary basis. The Landcare Partnership and the River Avon cSAC Conservation Strategy Agriculture Group have identified a critical need for dedicated resources over a sustained period to deliver the following elements:

- Awareness raising and demonstration of best-farming practice
- Development of integrated farm plans that are practical and feasible to implement, with clearly demonstrable economic benefits
- Provision of opportunities for one to-one-farm advice and plans.
- Provision of funding support for one-off capital works resulting in improved farming practices.

Action required	**Delivery**		
	By whom	**Mechanism**	**Date**
Seek funding to develop the Landcare Project within the River Avon catchment, including the provision of financial support for farmers and riparian owners prepared to adjust their farming practices in order to benefit the conservation interests of the cSAC.	**EA**,EN, DEFRA	Agri-environment scheme review?	2003+

3.3.1.2 Existing Agri-environment Schemes

Countryside Stewardship and Environmentally Sensitive Area (ESA) Schemes are operating within the catchment but currently have a limited impact on encouraging best farming practice in relation to diffuse pollution. Prevention of diffuse pollution is not currently a specific environmental objective of Stewardship or ESA Schemes, which are aimed at landscape, wildlife and historic/archaeological protection and enhancement. Despite this, both schemes have existing options such as extensive grassland management, arable field margins and wildlife strips, which could help combat diffuse pollution if proactively and specifically targeted where they will achieve most benefit. The schemes could have more influence on diffuse pollution in the following ways;

- Encourage inclusion of best farming practices in applications to join the scheme.
- Take into consideration diffuse pollution issues when assessing applications.
- Target areas within the scheme where best management practice would be beneficial.
- Fund special projects to address diffuse pollution.

Action underway	Delivery		
	By whom	Mechanism	Date
The Environment Agency provides comprehensive responses to DEFRA consultations on agri-environment scheme applications and if appropriate forwards a copy of the EA's publication *Best Farming Practices: profiting from a good environment* to applicants.	EA, DEFRA	CSS/ESA scheme consultation	Ongoing
The Stewardship target for the Wiltshire Downs is being revised and will include a specific target related to preventing runoff into Wiltshire rivers.	DEFRA	CSS	2003
Action required			
Provide agri-environment scheme advisors and project officers with information on where to target advice on best farming practice.	**Landcare** DEFRA	Landcare, DEFRA, WTs	2003+
Support agri-environment scheme advisors and project officers to increase their knowledge of best farming practices, including soil and nutrient management.			2003+

3.3.1.3 Review of Agri-environment Schemes

A number of policy mechanisms can potentially be used to implement best farming practices including advice and awareness programmes, grant aid and quality assurance schemes. However, at present none of these mechanisms is contributing effectively to an overall solution to diffuse agricultural pollution.

Current agri-environment schemes are undergoing a review, and the first stage of which identified diffuse agricultural pollution and water quality as proposed additional objectives for revised schemes. The second stage of the review, running from December 2002 provides and opportunity for possible grant aid options to be put forward. A new Entry Level Scheme (ELS) with options aimed at wider environmental resource protection is proposed and will be field-tested in 2003.

The role of targeted grant aid is likely to be central in the short/medium term in addressing diffuse pollution and a project has been commissioned by English Nature and the Environment Agency to analyse grant aid options. This project will assess the potential of key policy mechanisms, critically review the use of grants and develop a range of practical proposals for new grant aid. The proposals will be field-tested in case study areas and will feed into the ongoing review of agri-environment schemes.

Action underway	Delivery		
	By whom	Mechanism	Date
Analysis of the role of grant aid and options for its use. Practical proposals for use of grant aid to be field-tested in case study areas.	EN, EA	National policy work	Ongoing

3.3.1.4 Nitrate Vulnerable Zones

Nitrate pollution is of concern across the UK in relation to drinking water, and agricultural land has been identified as a major source of nitrate pollution in surface and groundwater catchments. Fifty-five per cent of England, including the River Avon catchment, has been designated as a Nitrate Vulnerable Zone (NVZ). NVZs are statutory, and include measures to encourage better use of organic and inorganic fertiliser.

Grants will be available for capital works to improve storage facilities for organic manures. Although NVZs target nitrates, they are likely to encourage better fertiliser practice and therefore could have an indirect effect on other aspects of agricultural diffuse pollution.

3.3.1.5 Lower-risk Areas

In the lower part of the catchment agricultural diffuse pollution is not thought to be a widespread problem and general advice can be delivered through the Hampshire Wildlife Trust, ESA scheme, Countryside stewardship and English Nature. In order for advisors in the lower Avon to deliver guidance on diffuse pollution, the experience and information generated by Landcare must be made available to them. This either requires inclusion of this group in the Landcare Partnership or at least circulation of minutes and newsletters from the project to them.

Action required	**Delivery**		
	By whom	**Mechanism**	**Date**
Ensure that advisors in the Lower Avon are kept informed of experiences from the Landcare project and have access to further information if required.	**Landcare**, DEFRA	Landcare, DEFRA, WTs	2003+

3.3.1.6 Research Needs

The sediments of the Avon are a potential source and sink for nutrients including phosphorus. Assuming that inputs of phosphorus are reduced in future, residual levels may still remain high due to internal cycling from sinks such as bed sediments. There is a need to assess the influence of phosphorus cycling on phosphorus levels in the cSAC.

Currently, the impact of diffuse pollution on water quality in the Lower Avon is assumed not to be significant. If evidence emerges that the Lower Avon is affected by diffuse pollution, this must be investigated. The trigger for undertaking such an investigation may be that following improvements to sewage treatment works, phosphorus levels remain high.

Action underway	**Delivery**		
	By whom	**Mechanism**	**Date**
The role of internal phosphorus cycling is being investigated to determine its influence on residual phosphate levels as part of the PSYCHIC project.	PSYCHIC partnership	PSYCHIC project	2003/4
Action required			
Investigate the contribution of diffuse pollution to water quality on the Lower Avon if phosphorus levels indicate this may be an issue.	**EA**, EN, DEFRA	EA investigation	?

3.3.2 Road Runoff

The road network provides an important flow path for runoff. Roads tend to be engineered to drain quickly and easily to soakaways or drains, and if these drains become overwhelmed, the road then acts as a carrier for more runoff. In this case the volume of water will be greater than the capacity of the road drainage systems, which can cause flooding and allow dirty water to reach the river.

In order to reduce the risk of road drains being overwhelmed, in the short term road drainage systems must be adequately maintained. The long-term solution is the use of sustainable urban drainage systems

(see Section 6) and reducing the amount of runoff from land adjacent to roads.

The Landcare partnership has been working with local highways agencies to identify where roads are frequently and severely inundated by runoff from the surrounding land. The aim of this work is to assess if agricultural land-use practices are the primary cause of the problem. Ideally, the relevant land manager would then be invited to a demonstration event or to discuss possible solutions. Lack of resources means that action is limited but potential savings on highway authorities maintenance costs could be made if runoff from agricultural sources was reduced.

Privately owned farm roads and tracks can also act as a flow pathway for dirty water. As part of the Landcare project, demonstration sites will highlight this issue and potential solutions.

Action underway	**Delivery**		
	By whom	**Mechanism**	**Date**
Work with highways agencies to identify roads that experience flash flooding due to runoff from agricultural land.	Landcare	Landcare	Ongoing
Demonstration farms to illustrate runoff from farm tracks and potential solutions.	Landcare	Landcare	Ongoing
Action required			
Seek funds to support best farming practices where agricultural land use contributes to road runoff.	**EA**, EN, HA, LA	Maintenance savings?	2003+

3.3.3 Ditching Works

There is an identified need to restore/extend the ditches in the Avon valley as the current system limits the storage and transport of water and available habitat for birds and invertebrates, including the SPA and cSAC features. The implementation of Water Level Management Plans (WLMPs) (see Section 6) will instigate a phased program of ditching works to address this need, and guidance is required to ensure that the works do not adversely affect the cSAC. The potential impact of ditching works on the cSAC includes localised release of silts and nutrients and destruction of habitat.

Generic guidance on best ditching practice is available but does not account for the requirements of the specific species and habitats found in the cSAC and SPA. A method statement adapted to the ecological requirements of the SPA and cSAC and any conflicts between the two is required, clearly explaining the following:

- The potential conservation and economic benefits of improvements to the ditch network.
- How to avoid silt or nutrient release, disturbance of cSAC and SPA species or destruction of habitat.
- Timing of works.
- Disposal of dredged material.
- Design prescriptions (cross sections, lengths etc.).
- Maintenance requirements.

This information will be crucial to the implementation of the WLMPs, and a draft is under development by the Avon Valley ESA project officer.

Action underway	**Delivery**		
	By whom	**Mechanism**	**Date**
Refine draft guidance on ditching practice into a method statement that takes into account the requirements of the SPA and cSAC.	EA, DEFRA, EN	WLMP	2002/3

Section 4
Water Resources and Flow

Maintenance of an adequate characteristic flow regime is essential to the cSAC features, as described in Section 2. It should be noted that 'flow' refers to both velocity and volume.

Particular attributes related to water resources and flow are relevant to the species and habitats of the River Avon cSAC, and are shown in Table 10.

Table 10. Relevant attributes related to water resources and flows.

Attribute	Measure
Flow	Flow regime should be characteristic of the river. As a guideline at least 90% of the naturalised daily mean flow should be maintained throughout the year at all points in the river system.
	Residual flows at Knapp Mill >= 9 m^3s^{-1}

A broad review of the effect of abstraction on river flow and groundwater levels in the upper Avon was undertaken in the early 1990s. This review concluded that groundwater abstraction was having a significant effect on the rivers Wylye, Till, Chitterne Brook, Bourne and Nine Mile River (NRA 1993). It also recommended that if abstraction from Fonthill Bishop increases to its licensed quantity then the impact on the Fonthill Stream should be re-considered.

The River Wylye and tributaries were recommended for a detailed investigation, and a subsequent study found that a reduction in the volume of groundwater abstraction would significantly improve flows in the Wylye, Till and Chitterne Brook (Environment Agency 2000). The Bourne and Nine Mile River were recommended for detailed investigation once resources were available on completion of the River Wylye study. Similarly, the Fonthill Stream would be the final sub-catchments to be investigated (Halcrow 1996).

In addition to reductions in flow volume, perturbations to the flow regime can impact on migratory species. A study in by Solomon (1990) found that two surface water

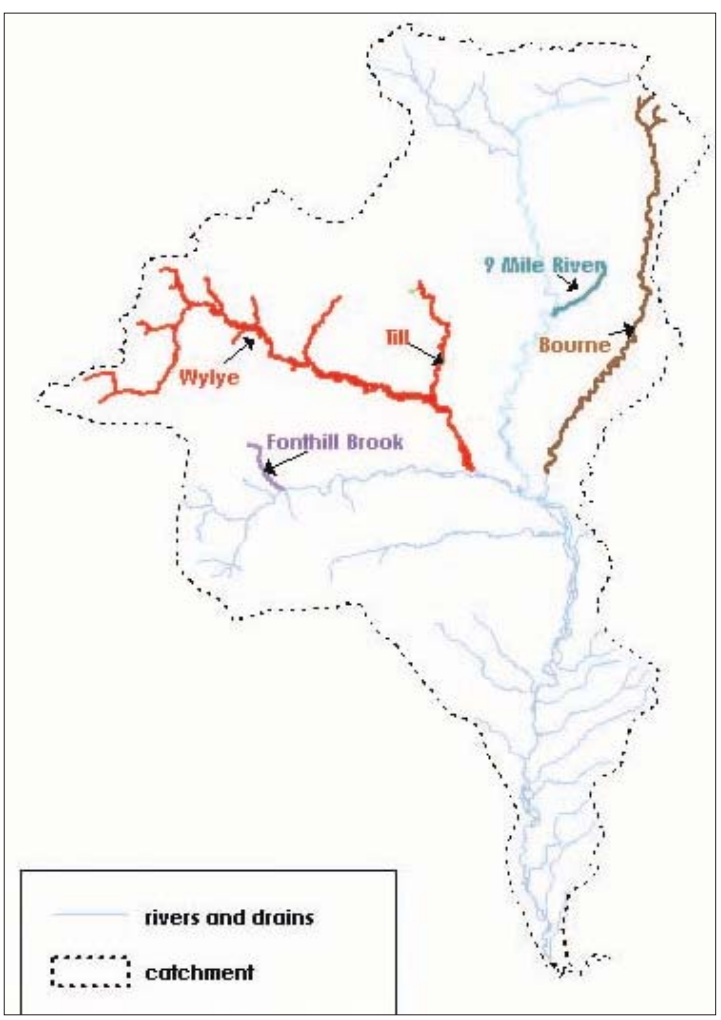


Figure 14. Rivers where risk of abstraction impacts is known or under investigation.

abstractions in the lower Avon may affect the upstream migration of salmon, and recommendations were made for optimisation of the abstraction regime.

The rivers in the Avon catchment known to be or potentially affected by abstraction are shown in Figure 14.

4.1 Water Resources in the Avon cSAC Catchment

The groundwater from the chalk aquifers in the upper part of the Avon catchment provides the majority of the water resource for in-river flow and a variety of uses, including public and private water supply, agriculture, aquaculture (watercress and fish farms), and industry. With a few exceptions, the Environment Agency licences abstraction of water to supply these needs (Environment Agency 2000) and monitors all authorised abstractions to determine any potential or actual local environmental effects.

There are approximately 600 licences for abstraction in the catchment. The licences include a mixture of surface and groundwater abstractions for consumptive and non-consumptive uses. Consumptive uses result in an effective loss of water to the catchment, while non-consumptive uses return abstracted water to the watercourse close to the point of abstraction. On a catchment scale, consumptive use is likely to be of more concern, but non-consumptive use can have a significant localised effect.

The largest licensed consumptive abstractions are for public water supply, assuming maximum uptake of licensed quantities (NRA 1994). Public water supply is not truly consumptive, as some water will be is discharged back into the catchment from which it was sourced.

The majority of abstraction for public water supply is licensed to Wessex Water Services Ltd and Bournemouth and West Hampshire Water Company. The public water supply is taken from a number of sources dominated by groundwater north of Salisbury and direct river or surface water south of Salisbury. Both Wessex Water and Bournemouth and West Hampshire Water Company pump some of the abstracted water outside of the Avon catchment. For example, water from the River Wylye supplies Bath and West Wiltshire and is discharged into the Bristol Avon, resulting in a net loss of water from the catchment.

The largest licensed non-consumptive abstractions are for fish farms, assuming maximum uptake of licensed quantities (NRA 1994).

For detailed information on abstraction in the Avon catchment, refer to the Local Environment Agency Plan (Environment Agency 2000).

4.2 Issues Related to Existing Licensed Abstractions

As described in Section 4.1, studies have shown that the rivers Wylye, Bourne, Nine Mile River, Nadder and Fonthill Stream are at risk due to groundwater abstraction. There are two primary mechanisms in place to investigate and modify abstractions, Asset Management Planning (AMP), and the Review of Consents process (see Section 1.6.5)

4.2.1 Public Water Supply Abstractions

In *A Price Worth Paying* (1998a), the Environment Agency identified several improvements to abstractions in the Avon catchment. These changes are to be delivered by AMP, which enables investigation and modification of water company functions if they are potentially impacting on the environment.

The current programme (known as AMP 3) runs from 2000 to 2005. The status of improvements in the Avon catchment to be delivered by through AMP 3 is summarised in Table 11.

In the resulting price determination for 2000–2005, OFWAT rejected the proposed scheme for the Wylye and advised that options for a more cost-effective solution should be examined. The Minister for

Table 11. Summary of environmental improvements required under AMP 3 and current status.

Catchment	Source	Improvement expected	Timescale	Current Status
Wylye and tributaries	Groundwater	Reduce abstraction at Chitterne borehole and trial stream support for Chitterne Brook.	by 2003	Options for cost-effective solution under discussion. Phase 1 solution now agreed.
Bourne and Nine Mile River	Groundwater	Investigate impacts of abstractions by three water companies and formulate necessary mitigation measures.	by 2005	Data collation and conceptual modelling complete. Detailed modelling to be undertaken and results analysed, led by the EA.
Avon	Surface water	Review abstraction impact and investigate possible optimisation of abstraction patterns to facilitate salmon migration.	by 2005	Investigation began June 2002 by BWHW Co.
Fonthill Brook	Groundwater	Investigate impacts of abstractions.	2005	Investigations underway, led by the EA.

the Environment accepted this advice, but announced that a scheme to address the effects of abstraction on the Wylye must still be put in place within the AMP 3 period.

DEFRA (formerly the Department of the Environment, Transport and the Regions) set out to review the options in consultation with the Environment Agency, OFWAT, English Nature and Wessex Water. These organisations have been developing alternative proposals and have agreed an interim solution with a view to progressing towards a sustainable solution. The interim solution will be carefully monitored and further measures may be required in the long term.

The implementation of all the AMP 3 requirements is a crucial element in ensuring that the condition of the cSAC is not significantly impacted by existing abstractions.

Action underway	Delivery		
	By whom	Mechanism	Date
Investigations and improvements to abstractions under AMP 3.	EA, WCO	AMP3	2005
Further improvements depending on the outcome of AMP 3 investigations.	EA, WCO	AMP	2005+
Implement interim solution to alleviate the effect of abstraction on the Wylye and tributaries. Solution to be monitored to inform sustainable solution.	EA, WCO	AMP 3	2003

4.2.2 The Review of Consents

Under the Habitats Directive, the Environment Agency must review relevant all existing abstractions to establish the likelihood of their significant effect (alone and in combination with other permissions, plans or projects) on the cSAC. This process is called the Review of Consents and is detailed in Section 1.6.5.

In the case of public water supply, there is likely to be a degree of overlap between the AMP 4 programme and licences identified as in need of variation through the Review of Consents. The review of consents is expected to finish in 2004, but negotiations to obtain water company investment for AMP 4 (2005–2010) are already underway. For this reason, AMP 4 is unlikely to include all the modifications required to satisfy the requirements of the Habitats Directive. This leaves two alternatives for funding changes required under the Habitats Directive through the periodic review: inclusion in AMP5 (2010–2015) or the interim determination process.

Action underway	**Delivery**		
	By whom	**Mechanism**	**Date**
Changes to public water supply abstraction licences identified in the Review of Consents process will be included in AMP4 or the interim determination process as soon as possible.	EA,EN, WCO	AMP, RoC	2003+

4.3 Issues Related to Future Abstraction Licences

4.3.1 National Legislation

In March 1999, the government published a document detailing changes to the abstraction licensing system that should make the system more flexible. Some of the changes required are achievable within the existing powers of the Environment Agency. However, alterations in primary legislation are required to make the remainder of the changes. The resulting proposed legislation is the draft Water Bill.

Important elements of the draft Water Bill are the introduction of time-limited licences and an end to the payment of compensation for the revocation of licences. It is crucial that the Water Bill progresses through Parliament and that these provisions are made to ensure the sustainable use of water resources in the future. The passing of the Water Bill is likely to take some time and, in the case of the Avon, action is needed now, which means there must be continued efforts to deliver improvements through the AMP process.

Action underway	**Delivery**		
	By whom	**Mechanism**	**Date**
National policy work to influence the Water Bill and ensure it continues to progress.	EA, EN, WTs	Policy work	2003+

4.3.2 Regional Water Resources Strategy

In 2001 the Environment Agency produced *Water Resources For The Future: A strategy for the South West Region* (2001). The strategy examines likely future patterns of water use and highlights the importance of increased efficiency in the use of water. Improved efficiency, leakage control and reduced wastage of water are important elements in managing demand, and should make a significant contribution to management of water resources in the next 25 years.

Action required	Delivery		
	By whom	Mechanism	Date
Support the implementation of the South West Region Water Resources Strategy, promoting ways to manage demand for water.	EA, EN, WCO, WTs	Routine work	2003+

4.3.3 Catchment Context

The context for assessing the likely significant effect of future abstraction licences will be provided by the Avon Catchment Abstraction Management Strategy (CAMS). CAMS considers the ecological requirements and needs of water resource users in an open way, setting out a strategy for sustainable management of water resources at a catchment scale. For more detailed information on CAMS see Appendix B.

In determining significant effect, the Environment Agency must ensure that river flows, groundwater levels and water levels in wetlands will not fall below the minimum ecologically acceptable level required to achieve favourable condition. However, the needs of existing protected rights and lawful uses of water must be met where possible. CAMS will provide a consistent framework within which to achieve this, and will inform the appropriate assessment of new or varied licences. The Avon CAMS will be developed in 2003–4 in order to take into account the findings of the review of consents.

Action required	Delivery		
	By whom	Mechanism	Date
The CAMS ecological assessment must have regard to the favourable condition flow targets for the Avon cSAC.	**EA**	CAMS	2003+

4.3.4 Development

Applications for new developments may create increased demand for public water supply. Refer to Section 8 for details of issues related to development.

Section 5
Fisheries

The Avon catchment is renowned for its salmon, migratory trout and brown trout fisheries and also its specimen coarse fish. The locations of the principle fisheries are shown in Figure 15.

Fisheries management has an important influence on the cSAC and includes a number of activities that have the potential to significantly affect the cSAC features and habitat. These include fish stocking, bank maintenance, weed cutting, gravel cleaning, electric fishing, and recreational and commercial fishing. Many fisheries management activities are regulated through Environment Agency consents and the English Nature Operations Likely to Damage (OLDS) list, which is detailed in Appendix A.

Particular attributes related to fisheries management are relevant to the species and habitats of the River Avon cSAC, and are shown in Table 12.

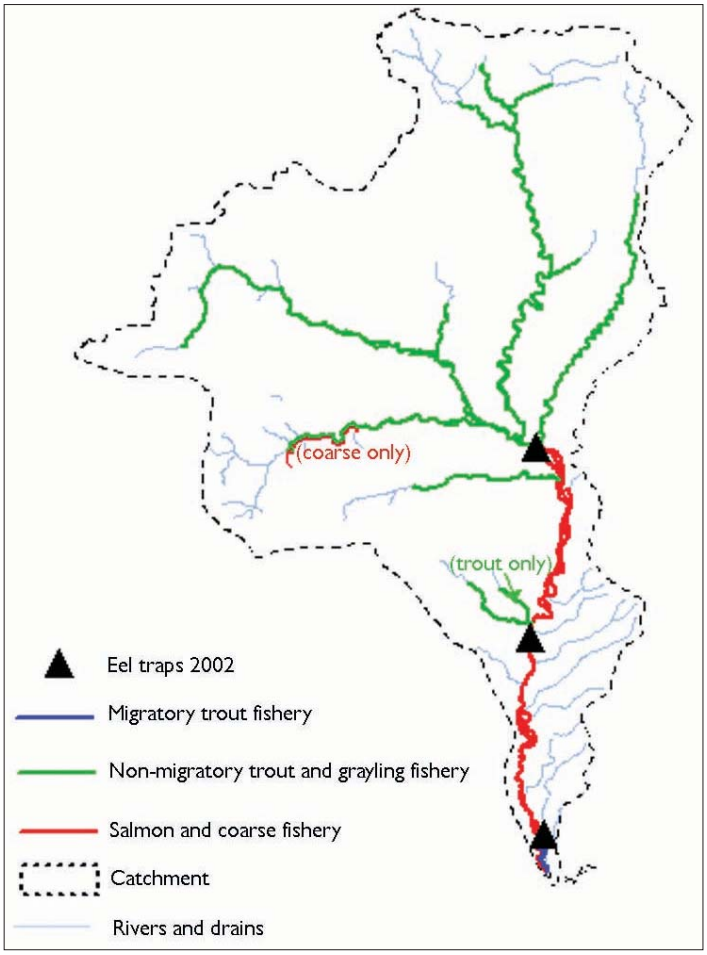


Figure 15. Principal fisheries in the River Avon cSAC.

5.1 Fisheries in the River Avon

5.1.1 Recreational Salmon and Coarse Fishery

Below Salisbury the Avon is important as a migratory salmonid and coarse fishery, with the most productive of the salmon rod fisheries occurring between Christchurch and Fordingbridge. Fisheries management is undertaken at a lower intensity than in the upper Avon. Fishing and riparian owners interests are represented by the Christchurch, Ringwood and District, and Salisbury and District fishing clubs, the Avon and Stour Rivers Association, Wessex Salmon and Rivers Trust and the Mudeford Netsman.

5.1.2 Recreational Brown Trout Fishery

The upper Avon, Wylye, Nadder and Till, and the lower reaches of the Bourne have been managed as brown trout fisheries for over 100 years, contributing to the creation of the semi-natural system that supports the cSAC features. Good-quality grayling fishing is also available in the upper Avon. Wiltshire Fishery Association (WFA) represents the riparian owners and fisheries interests in the Upper Avon, undertaking liaison between the regulatory bodies and fishing clubs.

Table 12. Relevant attributes related to fisheries management.

Attribute	Measure
River Form	River channel form assessed by geomorphological survey
Habitat structure	Distribution and area of spawning habitat
	Distribution and area of nursery habitat
	Extent of gravel/pebble-dominated substrate
	Presence of adult holding areas
	Area of emergent riparian vegetation
	Extent of submerged and marginal plants
	Extent of submerged higher plants
	Extent of bankside tree cover
	Extent of high canopy tree cover
	Extent of refuges
	Extent of woody debris
	Extent of bankside tree cover with submerged tree root systems
Access	Artificial obstructions
Water table (Rivers Fens)	Depth of water table below ground level Vegetation indicators of drying out
Extent and composition of *Ranunculus* communities	Mapping of extent and composition of *Ranunculus* communities at representative sample stretches
Reproduction of *Ranunculus* communities	Annual observations in June/July. Information will also be obtained from mapping of sample stretches for extent and composition Audit Weed Cutting Code of Practice every three years (EA and EN)
Access	Artificial obstructions
Biological disturbance	Introductions

5.1.3 Commercial Sea Fishery

The fishery in Christchurch Harbour comprises both a private and a public fishery, which present opportunities for recreational and commercial fishing. Commercial netting for bass, mullet, salmon and migratory trout takes place at the seaward end of the harbour. In the private fishery there is an excellent recreational fishery for thick- and thin-lipped mullet (NRA 1994).

5.1.4 Commercial Eel Trapping

A small amount of netting for brown eels (non-migratory stage) takes place in Christchurch Harbour and the lower Avon. Fishing for silver eels (migratory stage) takes place at several large, fixed traps. The locations of traps licensed in 2002 are shown in Figure 15.

5.1.5 Fish Farms

As described in Section 3, there are several large fish farms in the Avon system, all of which are subject to annual Environment Agency inspections of structures to ensure that wild salmonids are not trapped and that farmed fish do not escape.

5.2 Current Fish Stocks

5.2.1 Salmon

There has been a widespread decline in salmon stocks, both internationally and on a UK-wide scale, and the Avon stocks have declined acutely, as described in Section 2.5.1. This may be related to poor survival during the marine phase of the salmon life cycle. The declared rod and net catch shows that the population has suffered a severe decline over the last 10 years, with a crash occurring in the late 1980s–early 1990s. The population now appears to have stabilised, but at much lower levels than previously. The Avon stocks have been performing poorly against the conservation limit. However, the catch for 2002 indicates an improvement. Refer to Section 2.5.1 for details of the stock status.

5.2.2 Coarse Fish

In general, coarse fishing is of consistently high quality, but anglers with long experience of the river report a decline in numbers of coarse fish pre-dating the start of routine monitoring 1987. This decline is reported to be apparent both above and below Salisbury (Environment Agency 2000). However, recent Environment Agency abundance and distribution data indicate several very strong year-classes of younger fish in some locations, which should contribute to healthy stocks in future years.

5.2.3 Brown Trout

Poor recruitment of wild brown trout has been reported in recent years, which may be attributable to deterioration in spawning and incubation success. The behaviour and genetic background of stocked fish may also play a part (Environment Agency 2000). Stocking of brown trout has been undertaken for many years on the upper Avon and tributaries to supplement natural fish stocks for angling purposes. Brown trout stocking is an exemption on the OLDS list if undertaken at historic levels.

Tony Wells

The upper Avon and tributaries have been stocked with brown trout for many years for angling.

5.3 Influence of Recreational Fisheries

Fishing clubs have a major influence on the River Avon cSAC through their management activities. Since the designation of the River Avon as an SSSI there has been a growing awareness by these clubs (particularly in the upper Avon) of the coincidence of conservation and fishery interests. The main management activities that potentially influence the cSAC are:

- Bank maintenance and management
- Choice of appropriate materials
- Provision of access
- Use of fencing
- Vegetation management
- Fish stocking
- Catch and release
- Electric fishing
- Gravel cleaning
- Weed cutting

Many clubs have developed a constructive dialogue with English Nature and conservation bodies, with mutual benefit. Agreements have been drawn up for the management of specific sites, together with Site Management Statements, which are more general policy agreements that encompass the main fishery management activities.

5.3.1 Weed cutting

Channel vegetation, including *Ranunculus* communities, are managed for angling purposes in the upper Avon. The weed cutting is permitted by a special agreement between Wiltshire Fishery Association and the Environment Agency.

The impact of weed cutting depends largely on the intensity and nature of the cutting programme. If undertaken sympathetically, it can mimic the characteristic mosaic habitat of chalk rivers. Certain fisheries cut by boat, but much of the weed cutting in the upper Avon is carried out by experienced keepers using hand scythes, which means that this activity can be carried out sensitively. The long history of weed cutting on chalk streams suggests that much of the current wildlife community is in part a consequence of the weed-cutting regime (Lewis 1997).

The fishery objectives of weed cutting are essentially to:

- Maintain and extend the period of dominance by *Ranunculus* beds (and consequently maintain water levels and cover)
- Encourage trout to establish territories
- Generate focused scour of gravel substrates for salmonid spawning
- Maintain adequate open water for angling.

The maintenance of *Ranunculus* beds as the dominant feature of the plant community is not incompatible with the conservation objectives of the cSAC. However, it should be kept in mind that the designated feature is the *Ranunculus* habitat, which consists of the river itself and characteristic vegetation (Mainstone 1999).

It would be beneficial to develop principles for weed cutting in the upper Avon as part of guidance on sensitive fisheries management (see Section 5.3.6). Particular aspects to consider include:

- Allowing a significant proportion of the *Ranunculus* community to flower
- Catering for the plant community as a whole.

5.3.2 Electric Fishing

Electric fishing is a technique routinely used for two purposes: surveying and estimating densities of juvenile fish (including salmon), and selective removal of predators from game fisheries.

The Environment Agency issues consents for electric fishing under the Salmon and Freshwater Fisheries Act (1975). Due to the potential of the activity to injure salmon, bullhead and lamprey, the Environment Agency must also complete an Appendix 11 form to determine if an appropriate assessment is required. English Nature is consulted on electric fishing applications, as the activity is included on the River Avon System SSSI OLDS list.

Attention has been increasingly focused on the risk of damage to fish from electric fishing. Because Atlantic salmon are adapted for explosive bursts of energy, they are more vulnerable to injury than other fish species. The Environment Agency has recently published best-practice standards for electric fishing (Beaumont *et al.* 2002), which should safeguard cSAC fish species, including juvenile salmon.

Electric fishing is an essential tool for monitoring fish populations, and an approach based on a balance between risk and the need to monitor has to be adopted. Although a risk does exist to salmon, bullhead and lamprey, at a population level this risk is very small and therefore acceptable, given the need to monitor these species under the Habitats Directive.

In the upper Avon fisheries managers use electric fishing to remove pike and sometimes grayling, reducing predation on trout (and incidentally salmon). This activity is likely to have a net beneficial effect on salmon, if it is undertaken effectively following best practice before adult salmon reach the upper Avon. The Environment Agency conducts training events for river keepers on best practice, which should be extended to all fishing club members who regularly carry out electric fishing in the cSAC.

The Environment Agency/English Nature Freshwater Fisheries Technical Advisory Group is currently

considering the issue of electric fishing and may issue further guidance.

Action underway	Delivery		
	By whom	Mechanism	Date
Provide workshop on electric fishing best practice, with priority given to river managers regularly undertaking this activity in the cSAC.	EA	Workshop	Minimum every five years
Provide guidance on electric fishing best practice when issuing licenses.	EA	Licensing	Ongoing

5.3.3 Fish Stocking

All fish stocking in the River Avon system must be given consent by the Environment Agency under Section 30 of the Salmon and Freshwater Fisheries Act (1975) in consultation with English Nature. Under the Habitats Directive, the Environment Agency must also establish whether an appropriate assessment is necessary, recording the decision on an Appendix 11 form. Given the potential for fish stocking to increase predation pressure on wild fish and competition for food and space, consideration must be given to the impact of stocking on the cSAC features.

In future, Environment Agency stocking policies will be guided by the National Trout and Grayling Strategy, which takes account of its responsibilities for both fisheries and conservation (Environment Agency 2000). The strategy will be delivered through the local Fisheries Action Plan (FAP), to be developed by the Environment Agency in consultation with local fisheries interests. FAPs will cover all types of fishery in the catchment.

Tony Wells

Angling clubs stock brown trout to the River Avon cSAC to supplement natural fish stocks.

5.3.3.1 Trout

Consents to stock approximately 24,000 hatchery brown trout of fingerling size and above are issued for the Avon system each year, and to stock two fisheries on the River Nadder with approximately 1,300 rainbow trout. It is likely that the fisheries could not be sustained without some stocking, with consequent implications for the local economy and the existing environment.

Traditional stocking of brown trout is listed as an exemption on the River Avon SSSI OLDs list, so permission from English Nature is not required. However, as detailed in Section 5.3.3, all fish stocking requires consent from the Environment Agency and consideration of the impact on the cSAC features of interest through an Appendix 11 form. Stocking should be included in guidance on sensitive fisheries management (see Section 5.3.6).

As part of the National Trout and Grayling Strategy it was recommended that guidelines on appropriate brown trout stocking levels and locations should be developed on individual rivers to minimise the risk of impact on wild salmonid stocks (Environment Agency 2001). Current knowledge of the interactions between stocked brown trout and wild salmonids will be drawn together, and further research undertaken in order to inform development of guidance.

Two fisheries on the River Nadder are currently stocked with North American rainbow trout. The draft National Trout and Grayling Strategy (Policy18) states that, where there is a history of stocking to sustain a fishery, stocking of rainbow trout will be permitted. However, the stocking of this territorial non-native species is at odds with the conservation of the native fish fauna of the Avon cSAC and SSSI. In the 1990s the Local Fisheries Advisory Committee for the Avon recommended that stocking of rainbow trout should be ended by persuasion, and this will continue to guide practice in the cSAC.

5.3.3.2 Coarse Fish

Enhancement stocking of coarse fish is undertaken on the lower Avon, particularly where populations are thought to be sub-optimal. However, addressing constraints on the coarse fish population is preferable to stocking, and relevant alternative actions to address constraints are set out in the LEAP (Environment Agency 2000).

Certain elements of coarse fish stocking may impact on River Avon cSAC features of interest and this interaction needs to be considered in the FAP.

Action underway	**Delivery**		
	By whom	**Mechanism**	**Date**
Knowledge on the interactions between stocked brown trout and wild salmonids will be drawn together and further research undertaken in order to inform development of guidance.	EA	NT&GS	?
Continue to use persuasion to reduce and ultimately end stocking of rainbow trout in the Avon cSAC as the environment of the Nadder improves and the reason for stocking this species is removed.	EA	S30 consents	Ongoing
Action required			
Avon FAP to take into account potential interactions between stocked brown trout and the River Avon cSAC/SSSI features.	**EA**, EN, WTs, fisheries interests	NT&GS, FAP	?
Avon FAP to address the issue of the stocking of rainbow trout in the Avon cSAC.			
Avon FAP to take into account potential interactions between the coarse fishery and the cSAC/SSSI features.			

5.3.4 Bank Maintenance and Repairs

Management of the river banks by fishing clubs and riparian owners includes the following:

- Maintenance and repairs to banks
- Management of vegetation
- Provision of access for anglers
- Fencing areas at risk from excessive cattle poaching.

These activities are primarily regulated by land drainage consents and the River Avon system SSSI OLDs list. In cases where land drainage consent is required, permission must be sought from the Environment Agency in consultation with English Nature.

The use of appropriate materials and techniques for bank maintenance and repair and access structures is important in order to maintain suitable habitat for a range of cSAC, SSSI and BAP interests. In certain cases, 'hard' engineering may be required, particularly where safety is an issue. However, in a low-energy system such as the Avon, 'soft-engineering' approaches are favoured to ensure banks remain as natural as possible.

5.3.4.1 Management of bank vegetation

Management of bank vegetation is undertaken for several reasons including agriculture, flood defence, land drainage and provision of access for fishing. In the case of vegetation management for angling, infrequent management of bank edges is typically accompanied by the cutting of narrow paths to facilitate access to the river. An appropriate management regime can allow characteristic vegetation to flourish. However, more intensive regimes can damage the vegetation community and related fauna, such as Desmoulin's whorl snail and nesting birds. Advice on appropriate management of bank vegetation should be included in the guidance described in Section 5.3.6.

5.3.4.2 Provision of access

Access (particularly vehicular) to the river within the Avon Valley may have an impact on the SPA, as birds and their habitat are sensitive to disturbance. Access to the river by vehicles and anglers should minimise potential effects on the SPA, SSSI and wider biodiversity.

5.3.4.3 Fencing

High livestock densities adjacent to the river can lead to excessive trampling and poaching, contributing to siltation and destruction of the characteristic bankside plant community. However, an appropriate level of grazing is required to maintain a diverse plant community and wetted margins suitable for invertebrates. In the lower Avon Valley, an increasing number of the river banks are fenced, and certain areas are dominated by monocultures of nettles, which require heavy mowing to provide access to the river.

Where high stock densities are creating bank erosion problems and efforts to reduce stocking levels have failed, fencing may be used in a targeted way to protect riverbanks. Temporary fencing should be considered, and measures to allow limited grazing beyond the fenceline. Depending on the proximity to the river, erection or modification of fences requires land drainage consent from the Environment Agency, which will consult English Nature.

The long-term solution to preventing cattle impacting on the cSAC is to ensure appropriate light stocking regimes are in place. This is consistent with the aims of the Avon Valley ESA scheme and Countryside Stewardship in the upper Avon.

Action underway	**Delivery**		
	By whom	**Mechanism**	**Date**
Encourage appropriate stocking densities next to the river through agri-environment schemes and farm advisors.	DEFRA, EN	ESA, CSS, management agreements	Ongoing
Action required			
In the Avon Valley SPA/SSSI, remove fences at the earliest opportunity once appropriate grazing regimes are established.	EA, **EN**, DEFRA, fisheries and landowner interests	ESA, CSS	2003+

5.3.5 Gravel cleaning

Since 1993, annual gravel-cleaning initiatives and evaluations of the use of cleaned sites have been undertaken by the Environment Agency and fisheries interests to improve the quality of spawning gravels for salmon.

Gravel cleaning requires consent from the Environment Agency. This activity is an exemption on the OLDS listed (depending on the technique used), but the Environment Agency consults English Nature on the potential impacts on the cSAC, using an Appendix 11 form.

The 1997 Salmon Action Plan (SAP) set out strategic measures to restore salmon stocks to sustainable levels on the Avon, including gravel cleaning. In addition to benefiting salmon, a limited amount of gravel cleaning is likely to benefit other interests of the river system that rely partly on clean gravels, including *Ranunculus* habitat, wild trout and lamprey.

While the issues affecting the salmon population can and should be addressed by changes in policy and practice, it is recognised that impacts on the river may be long lasting and therefore take some time to resolve. In the context of a programme of strategic measures, short-term measures such as gravel cleaning can be used to assist struggling salmon populations. The recently published results of a national Environment Agency research project, *Decline of Chalk Stream Salmon* (APEM 2002a), confirm that gravel cleaning by water jetting improves hatching rates and fry survival.

Technical aspects of gravel cleaning are set out in an Environment Agency protocol. This protocol requires revision to incorporate relevant findings of the national research, and the habitat requirements of the cSAC, including the need to avoid cleaning marginal silt beds used by lamprey, particularly in the lower Avon side channels. The revised guidance should be issued with gravel-cleaning equipment.

If future research indicates that the gravel-cleaning programme is no longer required, then the programme will be reviewed.

Action required	**Delivery**		
	By whom	**Mechanism**	**Date**
Revise the gravel-cleaning protocol to take into account the cSAC features and the findings of the *Decline of Chalk Stream Salmon* research project.	**EA**	Research	2003

5.3.6 Guiding principles for Fisheries Management

The development of guiding principles for sensitive management of fisheries (including the activities described in sections 5.3.1–5.3.5) would be a useful tool in assisting fishery managers to contribute to the conservation of the cSAC. Wiltshire Fishery Association has agreed in principle to assist with the development of guidance, and discussions should be opened with other fishing interests.

The guiding principles could be voluntarily adopted by fishing bodies and distributed to their members, raising awareness of how sensitive management can contribute to conservation of the cSAC, and highlighting interactions with the SPA where relevant.

Action required	**Delivery**		
	By whom	**Mechanism**	**Date**
Develop guiding principles for sensitive management of fisheries within the cSAC, in partnership with fishing interests.	EN, EA, WTs, WFA, A&SRA, fishing interests	Voluntary partnership	2004
Promote adoption of principles of sensitive management as a voluntary code of practice.			2004

5.4 Exploitation of Salmon Stocks

5.4.1 Rods

The practice of catch and release of salmon caught by rods is a valuable tool in the conservation of current salmon stocks. Catch and release of salmon before June 16 was instituted under the 1998 National Salmon bylaws throughout England and Wales to protect MSW salmon returning in the spring. This policy will be reviewed in 2008.

Voluntary catch and release has been promoted on the Avon by the Wessex Salmon and Rivers Trust, and sponsored by Tesco since 1995. From 2000 to 2002 the riparian owners have agreed to 100% catch and release throughout the season. The practice will hopefully continue until healthy stock levels are achieved and subsequently maintained. In order to ensure a low mortality rate from catch and release of all fish, the Environment Agency best-practice guidance should be promoted and followed.

Recent research suggests that successful catch and release of salmon is significantly affected by water temperature (Dempson *et al*. 2002). This may mean that if water temperatures are above a certain threshold, mortalities following catch and release start to rise. Further information on this aspect should be considered as it becomes available, and appropriate guidance for the Avon fisheries developed.

Action underway	**Delivery**		
	By whom	**Mechanism**	**Date**
Promote and encourage the adoption of catch-and-release best-practice guidelines in order to ensure salmon stocks are achieved and maintained.	EA, WSRA, A&SRA	Voluntary	Ongoing
Action required			
Keep catch-and-release guidance for the Avon fisheries under review and develop suitable guidance taking account of temperature effects.	EA, fisheries interests	Research	2003+

5.4.2 Nets

5.4.2.1 Migratory salmon and trout fishery

There is potential for the migratory trout and salmon fishery at Mudeford to have a significant effect on salmon stocks. The migratory trout and salmon fishery (known as the Mudeford nets) operates between June 1st and July 31st, allowing spring salmon to migrate successfully through the estuary before the netting begins. Sea trout make up approximately 80% of the catch (A Strevens pers. comm.).

A combination of measures is in place to minimise the impact of the Mudeford nets on salmon:

- Net limitation orders, bylaws and licences controlling fishing effort
- Statutory netting period providing protection to spring salmon
- Privately negotiated 100% catch-and-release scheme.

The maximum number of nets that the Environment Agency can licence is six, as set by DEFRA in a 10-year Net Limitation Order (NLO). The NLO is currently under review, and the Environment Agency may propose a reduction to a maximum of four licences, effective for three years from 2004. Subsequent NLOs may further reduce the number of licences if appropriate, taking into account the status of salmon stocks, measures to protect and enhance stocks, and socioeconomic factors.

Catch and release has a crucial role in minimising the impact of the nets on salmon stocks. Sponsorship of the scheme (previously by Wessex Salmon and Rivers Trust and currently the Avon and Stour

Association) and the co-operation of the netsmen has been an important factor in its success. During the net season, salmon are released at the end of each netting session.

Action underway	**Delivery**		
	By whom	**Mechanism**	**Date**
Review the Net Limitation Order in conjunction with legislative and voluntary means of ensuring that mortality is controlled to ensure healthy salmon stock levels are achieved.	DEFRA, EA,EN	NLO review	2002/3
Continue with catch-and-release approach at the levels necessary to ensure healthy salmon stock levels are achieved and maintained.	Mudeford nets, A&SRA	Voluntary catch and release	Ongoing
Action required			
Keep local sea fishery netting bylaws under review and if necessary and appropriate put forward proposals for further bylaws to protect salmon.	**EA**	Review	2003+

5.4.2.2 Mullet and bass fishery

As previously detailed, legal mullet and bass fisheries operate in Christchurch Harbour. Under the Salmon and Freshwater Fisheries Act 1975, any salmon caught as a by-catch of these fisheries must be returned, dead or alive. Monitoring and enforcement of this legislation encounters the same difficulties as measures to combat illegal fisheries (see Section 5.4.2.3 below).

Action underway	**Delivery**		
	By whom	**Mechanism**	**Date**
Maintain enforcement activity to ensure that the legal mullet and bass fishery returns all salmon and sea trout.	EA, police	Enforcement	Ongoing

5.4.2 3 Illegal fishing

Illegal salmon fishing is believed to occur in Christchurch Harbour, in the estuary and the sea immediately offshore, and on the spawning grounds. Evidence suggests that illegal fishing targets sea trout, and that salmon are a small by-catch. This fishery may be more of a problem in low-flow summers when salmon accumulate in the harbour and tidal river (Environment Agency 1998). Anti-poaching patrols are carried out by the Environment Agency at vulnerable times, but county/borough boundary issues mean that ensuring a consistent and adequate police response can be difficult.

Occasionally, spawning fish are caught illegally by foul hooking (snatching) in December/January, and the Environment Agency undertakes patrols to target this activity.

An initiative to tag legally caught sea trout was launched in 2002 by the Wessex Salmon and Rivers Trust and the Mudeford nets. Netsmen, wholesalers and retailers have co-operated fully, and all indications suggest that the local sale of illegally taken sea trout is now almost impossible. While the scheme targets sea trout, as a few salmon are a by-catch of the illegal fishery, they are therefore likely to benefit from the scheme.

Action underway	Delivery		
	By whom	Mechanism	Date
Maintain measures to prevent illegal exploitation of salmon.	EA, police	Enforcement	Ongoing
Tagging of legally caught sea trout.	WSRT, Mudeford nets, retailers	Voluntary scheme	Ongoing
Action required			
Work with the police to ensure an adequate response to illegal activity, particularly resolving county/borough boundary issues.	**EA**, police	Enforcement	2003+

5.5 Eel Traps

Several eel traps operate in the autumn in the Avon cSAC under a licensing system administered by the Environment Agency. The locations of traps licensed in 2002 are shown in Figure 15. There is a risk that traps can delay upstream salmon migration, with some exhausted salmon also falling back onto the traps and possibly dying. In certain conditions there is a risk that inappropriate eel trap operation can result in upstream flooding, having a negative impact on the Avon Valley SPA.

In order to minimise the effect of eel trapping, the Environment Agency has made recommendations to owners and operators and carries out inspections of the traps annually.

Action underway	Delivery		
	By whom	Mechanism	Date
Monitoring of fixed eel traps by Environment Agency staff to continue, and if there is evidence of a significant impact, appropriate action will be taken.	EA	Licensing	Ongoing
Action required			
Continue with actions underway	**EA**	Monitoring	Ongoing

5.6 Fish Farms

There are a number of large fish farms in the Avon system, all of which are subject to annual Environment Agency inspections. The potential impacts of fish farms on the cSAC include entrapment of wild fish (upstream and downstream), localised water quality problems (see Section 3) and escapes. Since 1999 all qualifying sites have been inspected and some recommendations made. A number of issues at low priority sites still must be resolved, and escapes from fish farms remain a concern.

Action underway	**Delivery**		
	By whom	**Mechanism**	**Date**
Pursue means of reducing and eliminating escapes from fish farms.	EA	Enforcement New legislation	Ongoing
Action required			
Continue with actions underway	**EA**	Enforcement	Ongoing

Section 6
Flood Defence, Land Drainage and Water-level Management

Flood defence and land drainage activities are undertaken in the Avon cSAC catchment to ensure that water levels within the main river and former Internal Drainage Board (IDB) drains are compatible with existing land use. These activities can have a significant effect on the River Avon cSAC/SSSI and Avon Valley SPA/Ramsar/SSSI.

The implementation of Water Level Management Plans (WLMPs) is essential in ensuring wildlife gain in the cSAC and SPA. However, care must be taken to ensure that measures required to benefit the Avon Valley SPA do not adversely affect the cSAC interests, and vice versa.

New flood-defence schemes should provide integrated solutions to reducing flood risk while delivering net wildlife gain.

Particular attributes related to flood defence, land drainage and water-level management activities are relevant to the species and habitats of the River Avon cSAC, and are shown in Table 13.

Table 13. Relevant attributes related to flood defence, land drainage and water-level management.

Attribute	Measure
River Form	River channel form assessed by geomorphological survey
Habitat structure	Distribution and area of spawning habitat
	Distribution and area of nursery
	Extent of gravel/pebble-dominated substrate
	Presence of adult holding areas
	Area of emergent riparian vegetation
	Extent of submerged and marginal plants
	Extent of submerged higher plants
	Extent of bankside tree cover
	Extent of high canopy tree cover
	Extent of refuges
	Extent of woody debris
	Extent of bankside tree cover with submerged tree root systems
Access	Artificial obstructions
Water table (rivers, fens)	Depth of water table below ground level. Vegetation indicators of drying out
Extent and composition of *Ranunculus* communities	Mapping of extent and composition of *Ranunculus* communities at representative sample stretches
Reproduction of *Ranunculus* communities	Annual spot-checks in June/July. Information will also be obtained from mapping of sample stretches for extent and composition Audit Weed Cutting Code of Practice every three years (EA and EN)

6.1 Environment Agency Operational Maintenance

The Environment Agency undertakes management along designated main rivers in a manner appropriate to adjacent land use, in order to alleviate the flooding of property, and to ensure that flood-alleviation schemes provide protection up to their design standard. Operational maintenance activities include tree removal, bank repair, control of hatches, maintenance and repair of flood banks and cutting the *Ranunculus* community (known as weed cutting). In some cases, dredging is undertaken to maintain the carrying capacity of the channel, but this is far less common than in the past.

Routine maintenance activities related to flood defence, including removal of blockages and debris, de-silting and weed cutting, were set out in 1993 River Avon (Salisbury–Christchurch) Operational and Maintenance Plan, agreed by English Nature and the Environment Agency. The subsequent cSAC, SPA, Ramsar and SSSI designations of the River Avon and Avon Valley mean that this plan is currently under review.

The Environment Agency is both a competent and relevant authority (see Section 1.6) with respect to the River Avon cSAC, and Avon Valley SPA/Ramsar site. As a competent authority the Environment Agency has a duty to ensure that in its own operations and authorisations, and the consents it issues, do not have a significant effect on the cSAC or SPA/Ramsar site. Under the Wildlife and Countryside Act 1981, the Environment Agency also has a duty to further the conservation and enhancement of features of interest on all SSSIs, and must consult English Nature if undertaking work or determining an authorisation that may damage the SSSI. It is essential that the revised Operational and Maintenance Plan fully takes into account the cSAC interests and is rigorously adhered to by the Environment Agency and any contractors carrying out work on its behalf.

Action underway	**Delivery**		
	By whom	**Mechanism**	**Date**
Revise the River Avon Operational and Maintenance Plan to take account of the cSAC, SPA, Ramsar and SSSI designations and the Wildlife and Countryside Act.	EA	Internal review	2003/4

6.1.1 Aquatic Vegetation Management

Downstream of Salisbury, aquatic vegetation management, or weed cutting, is currently undertaken by the Environment Agency for land-drainage purposes. Weed cutting is also carried out upstream of Salisbury, primarily for fisheries management purposes (see Section 5). All weed cutting in the Avon Valley SSSI is included on the OLDS list, so it is necessary for the Environment Agency to obtain English Nature's assent for the works. In the upper River Avon system weed cutting for fishery purposes is an exemption, see Section 5.3.1).

Because the Environment Agency weed cuts are carried out mechanically, there is potential for this activity to significantly effect the *Ranunculus* habitat, and to disrupt the habitat of bullhead, lamprey, salmon and Desmoulin's whorl snail. Depending on the extent of weed cut, the implications for the cSAC include reduced cover for fish, removal of invertebrates and potential impacts on water quality. However, some level of cutting may be required for flood-defence purposes, and to ensure that the grazing requirements of the ESA scheme can be fulfilled. A careful balance must be struck whereby weed cuts are only undertaken to achieve appropriate water levels and management in the ESA.

An audit of weed-cutting activities in the Avon recommended that the Weed Cutting Code of Practice set out in the Operational and Maintenance Plan required updating to take into account the Environment Agency's responsibilities under the Habitats Directive and WCA (Menendez 1999).

A revised Weed Cutting Code of Practice and consenting protocol is under development and will include

criteria that must be fulfilled before a cut can be approved. The draft consenting protocol between the Environment Agency and English Nature includes criteria for instigating cuts, as detailed in Appendix E. The draft protocol was trialled in 2002 and is being reviewed for 2003. Requests for Environment Agency weed cuts are usually in June/July to allow haymaking or silage cutting, and in autumn to allow grazing. The revised Code of Practice must consider flow rates, water levels, weed growth, and wetness of adjacent land (see weed-cutting criteria) in determining whether a cut may be instigated. In addition, there must be a need to cut, which will only be demonstrated if weed cutting will contribute to conservation of the Avon Valley; for example to allow appropriate grazing regimes in the ESA.

Currently, observed flow as a proportion of long-term average flow is used to determine the percentage of weed to cut. This approach assumes that when flow is high, water levels are elevated. However, in years when weed growth is low, water levels can also be low even though flow rates indicate a need to cut. To avoid excessive cutting in this situation, water levels must also be used to determine the proportion of weed cut. As a guide, a minimum of 25% of floating *Ranunculus* should be retained per 100m stretch of river.

Once the proportion of weed to cut has been decided, the pattern of cut is selected. The type of cut along any particular reach should perhaps be varied annually, as using a fixed type can alter channel morphology and vegetation.

It is likely that the Code of Practice will evolve over several years, and will need to be regularly reviewed to take into account changes in land use and climate. It is recommended that the potential effects of mechanical weed cutting on the cSAC are described in the revised Code of Practice. Consideration must be given to monitoring the effect of weed cutting on water levels, and the cSAC/SPA features must be monitored to assess the effectiveness of the works and the impact on the wildlife interests. This monitoring information would inform subsequent reviews of the Code of Practice.

Weedcutting is also required in the vicinity of Environment Agency gauging structures to ensure that they conform to British and international flow-measurement standards and therefore measure flow accurately.

6.1.2.1 Practical considerations

In addition to the revising the Code of Practice, the following practical considerations should be made with respect to the cutting, removal and disposal of the weed:

- Availability of suitable weed-cutting equipment. Where the channel is narrow and only a small proportion of weed is to be cut, it is difficult for large boats to cut with the required precision to prevent overcutting. The Environment Agency must ensure that suitable equipment is available to carry out the level of cutting required.
- Location and maintenance of booms. At locations where the nearest boom site for collecting cut weed is some distance downstream, additional cutting is carried out to enable the free passage of the cut weed to existing boom sites. Where this happens regularly, alternative arrangements for collection and removal of weed should be investigated, including possibilities for reopening disused boom sites or opening new ones.
- Disposal of weed. If cutting is undertaken outside the period when weed is removed at boom sites, following removal, cut weed should be temporarily deposited on the bank (to allow invertebrates to return to the river) before removal off site. The Flood Defence Conservation Requirements for Watercourse Maintenance Works (1998) state that in the long term, cut weed should be disposed of at a location where runoff cannot pollute watercourses, or smother important wildlife habitats. The Environment Agency must ensure that disposal arrangements in the Avon catchment satisfy this requirement.

Action underway	Delivery		
	By whom	Mechanism	Date
Develop and agree a revised Weed Cutting Code of Practice in conjunction with the development of Water Level Management Plans.	EA, EN, DEFRA	Consultation	2003+
Action required			
Incorporate the revised Weed Cutting Code of Practice into the Operational and Maintenance Plan once English Nature, the Environment Agency and ESA officer are satisfied with the new procedure.	**EA**, EN, DEFRA	O & M plan	2003
Review the Weed Cutting Code of Practice regularly and amend the Operations and Maintenance Plan accordingly,			2003+
Consider appropriate monitoring to determine changes in *Ranunculus* communities on the river in response to Environment Agency weed cuts and to determine if the cuts achieve their water-level management objectives.	**EA**	?	?
Have regard to the suitability of weed-cutting equipment and collection, removal and disposal of weed.	**EA**	O & M plan	2003+

6.1.2 Maintenance of ex-Internal Drainage Board Drains

The Environment Agency is responsible for maintaining ex-Internal Drainage Board (IDB) drains in the lower Avon floodplain. Although the drains are not part of the River Avon cSAC they may provide important habitat for lamprey and bullhead, which are likely to favour the flow conditions in the drains over those in the main River Avon. The maintenance of ex-IDB drains was reviewed by Menendez (1999) and found to be damaging to the designated floodplain interest features of the Avon Valley. The Environment Agency is now taking steps to revise the maintenance regime of ex-IDB drains. This work will be linked to the implementation of WLMPs and ESA agreements and will need regular review to ensure compatibility with both.

Action underway	Delivery		
	By whom	Mechanism	Date
Develop a revised maintenance regime for the ex-IDB drains, compatible with the adjacent land use to ensure that this activity does not damage the interests of the Avon Valley SPA/SSSI/Ramsar site or the cSAC, and promotes enhancement of biodiversity interest where appropriate.	EA, EN, DEFRA	Review of ex-IDB drain maintenance	2002/3

6.1.3 Debris Removal

In fulfilling its flood-defence and land-drainage duties the Environment Agency may remove debris. This may include material of importance to riparian fauna for shelter, especially coarse woody debris such as fallen or overhanging trees. A geomorphological study of the River Wylye (Section 9.1.2) suggests that

coarse woody debris contributes to localised variations in flow and habitat and is potentially an important factor in maintaining or creating habitat diversity in the cSAC. Where fallen and overhanging trees do not present a risk of flooding or to infrastructure there should be a presumption in favour of leaving them in place and securing if necessary.

Action required	Delivery		
	By whom	Mechanism	Date
Leave coarse woody debris in place where this will not increase the risk of flooding or damage to infrastructure.	**EA**	O & M plan	2003+

6.2 Water Level Management Plans

The DEFRA (formerly MAFF) Water Level Management Plan (WLMP) initiative provides a means by which the water-level requirements for a range of activities in SSSIs and Natura 2000 sites, including conservation, agriculture and flood defence, can be balanced and integrated. Water-level management is a key part of achieving favourable condition in the River Avon cSAC and Avon Valley SPA/Ramsar site. WLMPS are being developed with landowners in order to deliver sustainable water level management and environmental improvements.

In the lower Avon the plans aim to establish appropriate water-level management in the SPA/SSSI, reversing the decline in grazing marsh habitat, breeding waders and wintering wildfowl. The plans will take into account the needs of the SAC, but primarily focus on restoring appropriate water levels in the floodplain. In the upper Avon, the priority for WLMPs is to ensure appropriate water-level management for the SAC/SSSI, taking into account seasonal variations in flow. Enhancement of Desmoulin's whorl snail habitat in the upper Avon should only take place at locations and times when this will not impact on the riverine interests.

Implementation of the WLMPs should result in both flood risk management and conservation benefits for the Avon Valley SPA/Ramsar site and the River Avon cSAC. Further details of the WLMP initiative are given in Appendix C.

The WLMPs are essential to ensure wildlife gain in the cSAC and SPA. However, some of the measures required to benefit the Avon Valley potentially impact on the cSAC features. Of particular concern are the following:

- The construction or refurbishment of control structures has the potential to prevent the migration of lamprey, bullhead and salmon. However, it also has potential to increase available habitat for several fish species. The design of new or refurbished structures or operation of control structures should allow the safe passage of these fish. Where this is not possible, alternative routes or habitat improvements should be ensured (such as back channels, streams, ditches), or management ensured that allows access at important times of year.
- Modifications to the existing drainage system may include the reinstatement of some drainage channels. This could have negative impacts on the cSAC due to localised increases in sediment loads and extraction of water, decreasing flow, but has the potential to increase available habitat for fish species. Guidance on ditching works clearly explaining best practice should be developed as detailed in Section 3 (water quality).
- Weed cutting is an important element of water-level management in the lower Avon and must be taken into account in the Water Level Management Planning initiative. The revised Code of Practice should be incorporated into the implementation phase of WLMPs (see Section 6).
- The maintenance of appropriate water-level management is particularly important or Desmoulin's whorl snail. As part of **Life in UK Rivers**, a study to quantify the hydrological requirements of Desmoulin's whorl snail is underway. The results should be taken into consideration in the WLMPs and areas identified where there is potential to enhance habitat by

modifying water-level management. In the upper Avon, enhancement of Desmoulin's whorl snail habitat must take into account seasonal variations in flow and ensure that flow levels for the in-river interests are maintained at all times.

Action underway	**Delivery**		
	By whom	**Mechanism**	**Date**
Develop and implement Water Level Management Plans to deliver wildlife gain and contribute to favourable condition in the River Avon cSAC/SSSI.	EA, EN, DEFRA, WFA, A&SRA, landowners, tenant farmers and fishing interests	WLMPs (rolling programme)	Ongoing
Action required			
Ensure that any new or reinstated water-level management structures (as part of WLMPs or other initiatives) do not compromise the safe passage of salmon, lamprey and bullhead.	**EA**, **EN**, **DEFRA**, fisheries and landowner interests	WLMPs (rolling programme)	2003+
Ensure the implementation of the Water Level Management Plan for the Avon Valley SPA/SSSI takes into account potential conflicts with the cSAC interests.			Ongoing
Take the revised Weed Cutting Code of Practice into account in the Water Level Management Planning initiative.			2003+
Take into account the results of a **Life in UK Rivers** investigation into the hydrological requirements of Desmoulin's whorl snail and identify areas for potential habitat enhancement.			2003+
In the upper Avon, enhancement of Desmoulin's whorl snail habitat must take into account seasonal variations in flow and ensure that flow levels for in-river interests are maintained at all times.			2003+

6.2.1 Stakeholder Consultation

In order to produce effective WLMPs, the river and associated floodplain have been divided up into 30 hydrological units. Implementation of the WLMPs will involve meetings between the Environment Agency, English Nature and stakeholders within each hydrological unit. This will be the first time these interest groups have been formally brought together across the cSAC/SPA/SSSIs to decide how to integrate management for agriculture, flood defence and conservation. If the meetings are successful, it could be a useful structure for addressing future management issues in the river and valley should the need arise. The action required is detailed in Section 10.1.

6.3 Flood Alleviation and the Catchment Context

Past flood alleviation and land-drainage works have included dredging, widening and straightening river channels, which have had an impact on the habitat of the cSAC and the SPA. In some locations this has

led to the river being isolated from its floodplain and the loss of channel substrate and habitat features of ecological value.

New flood-alleviation schemes are required to protect Downton, Ringwood, Fordingbridge and parts of Salisbury. The Environment Agency is currently investigating options for schemes as detailed in Appendix F. In the case of new schemes, the Environment Agency will seek integrated solutions to reducing flood risk, including floodplain and water-level management where appropriate (Environment Agency 2000). Wherever possible, flood-defence options that deliver net wildlife gain in the catchment should be explored.

In the future, Catchment Flood Management Plans (CFMPs) will provide the context for flood management, and have the potential to benefit biodiversity as well as deliver flood protection. CFMPs will consider the adequacy of existing infrastructure and options for managing flood flows on a catchment basis. It is essential that the Avon CFMP takes into consideration the water level and flow requirements of the River Avon cSAC and SPA and opportunities for enhancement (including SAC, SPA and BAP species).

Action required	**Delivery**		
	By whom	**Mechanism**	**Date**
Flood-defence schemes should provide integrated solutions to reducing flood risk, delivering net wildlife gain.	**EA**, **LA**	Flood defence schemes	2003+
The Catchment Flood Management Plan must take into account the ecological requirements of the River Avon cSAC and the Avon Valley SPA and opportunities for wildlife enhancement.	**EA**, EN	CFMP	?

6.4 Development

The Environment Agency, English Nature and local planning authorities must work in partnership to ensure that development plans for the catchment contain suitable policies to protect and enhance the cSAC and its floodplain. CFMPs should inform and influence future development plans with respect to the location of new developments. The following aspects of development are of relevance:

- New developments at risk of flooding or aggravating flood risk elsewhere.
- Development on the floodplain where this would obstruct flows and reduce floodplain storage and wildlife habitat value.
- The use of Sustainable Drainage Systems should be promoted in order to minimise the impact of any new urban, road or industrial developments on receiving watercourses.

For details of issue and actions related to development refer to Section 8.

Section 7
Problem or Nuisance Species

Problem species are defined as those whose presence may have a significant effect on the cSAC species and habitats. In addition to those that are a threat to the cSAC, some species affect the River Avon System SSSI interests and BAP species. However, it is outside of the scope of this strategy to address them.

Species that pose actual or potential threats to the habitat structure and biology of the cSAC are:

- Non-native invasive plants
- Flocks of unmated mute swans
- Signal crayfish
- Fish-eating birds.

In addition, fish such as brown and rainbow trout may be considered as problem species if stocked at excessive levels (for further information refer to Section 5, fisheries management).

Particular attributes related to problem species are relevant to the species and habitats of the River Avon cSAC, and are shown in Table 14.

Table 14. Relevant attributes related to problem or nuisance species

Habitat structure	Extent of refuges
	Area of emergent riparian vegetation
	Extent of submerged and marginal plants
	Extent and composition of *Ranunculus* communities
Habitat structure (rivers)	Structure and composition of marginal vegetation
Habitat structure (fens/ swamp)	Structure and composition of tall fen and swamp vegetation
Biological disturbance	Introductions

7.1 Non-native Invasive Plant Species

7.1.1 Bankside Species

The impacts and management of non-native invasive plants have become a major concern in many habitats of conservation importance, due to their dominance over native species and difficulty in control. Non-native invasive species grow to the exclusion of other, less-competitive organisms, which leads to a change in the vegetation community. Rivers provide good conditions for the arrival and spread of invasive plants such as Japanese knotweed (*Polygonum japonica*), Himalayan balsam (*Impatiens glandulifera*), and giant hogweed (*Heracleum mantegazzianum*)(IACR 2002). These riparian plants may not directly alter the composition of the in-channel plant community, but can influence conditions in the following way:

- Loss of Desmoulin's whorl snail habitat by out-competing preferred vegetation.
- Loss of bankside vegetation diversity.
- Increased shading and/or siltation (through greater bank erosion).
- Alteration of local geomorphology as well as vegetation, possibly leading to localised flood events (due to Japanese knotweed growing in river channels on exposed bars).

7.1.1.1 Distribution

Japanese knotweed, Himalayan balsam and giant hogweed are all present on the Avon cSAC. There are pockets of Japanese knotweed dotted around the catchment, particularly in Salisbury. At Wilton the Environment Agency is currently involved in eradicating stands at flood defence works. Himalayan balsam is found at low levels through out the catchment – for example, in the Ham carrier and the Dockens Water downstream of Blashford Lakes study centre. Giant hogweed is present at low levels, particularly on the River Nadder and around Ringwood, and is not as virulent as other the other species mentioned.

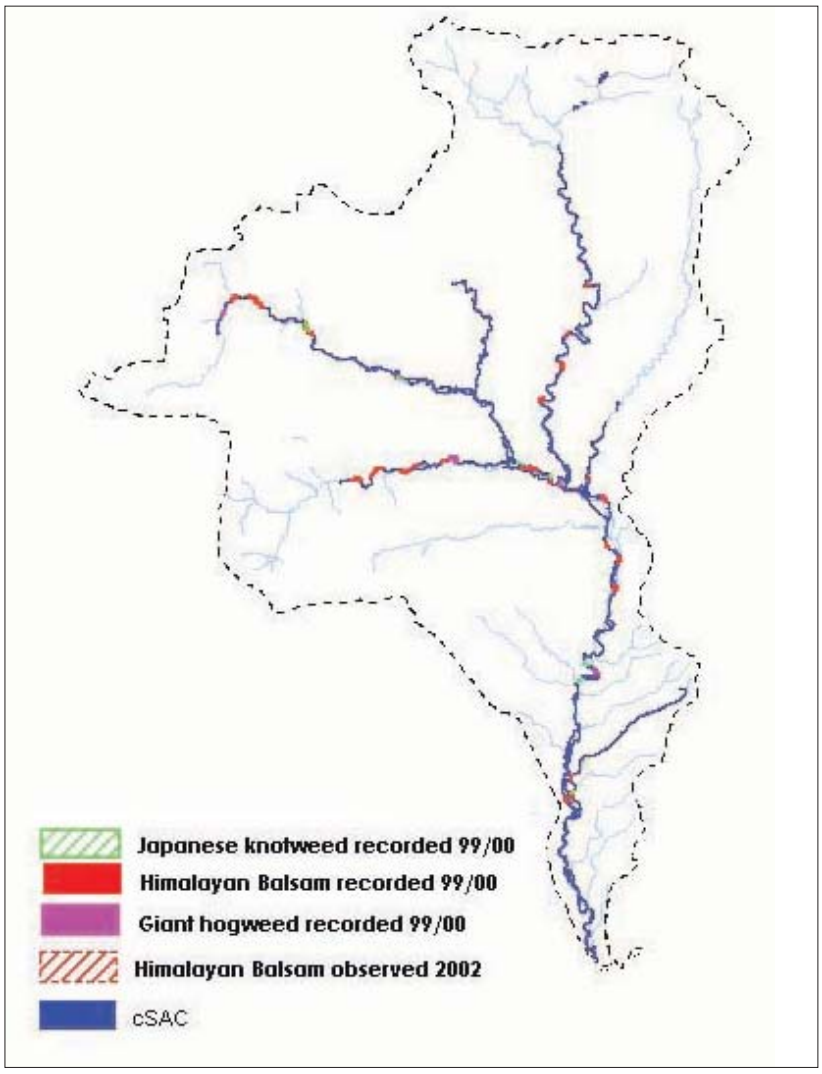


Figure 16. Distribution of Japanese knotweed, Himalayan balsam and giant hogweed recorded in 1999/2000 and observed in 2002.

Figure 16 shows the location of invasive plant species recorded during the 1999/2000 *Ranunculus* survey (Grieve 1999/2000). The survey did not include the Dockens Water, but it is known that Himalayan balsam is present there.

7.1.2 Aquatic species

Species such as Australian swamp stonecrop (*Crassula helmsii*), floating pennywort (*Hydrocotyle ranunculoides*), parrot's feather (*Myriophyllum aquaticum*) and curly waterweed (*Lagarosiphon major*) have had an impact on still and slow-flowing habitats (ponds, drains, canals). They have not impacted flowing water habitats as yet. In particular, curly waterweed may have the potential to cause a problem in rivers in the UK.

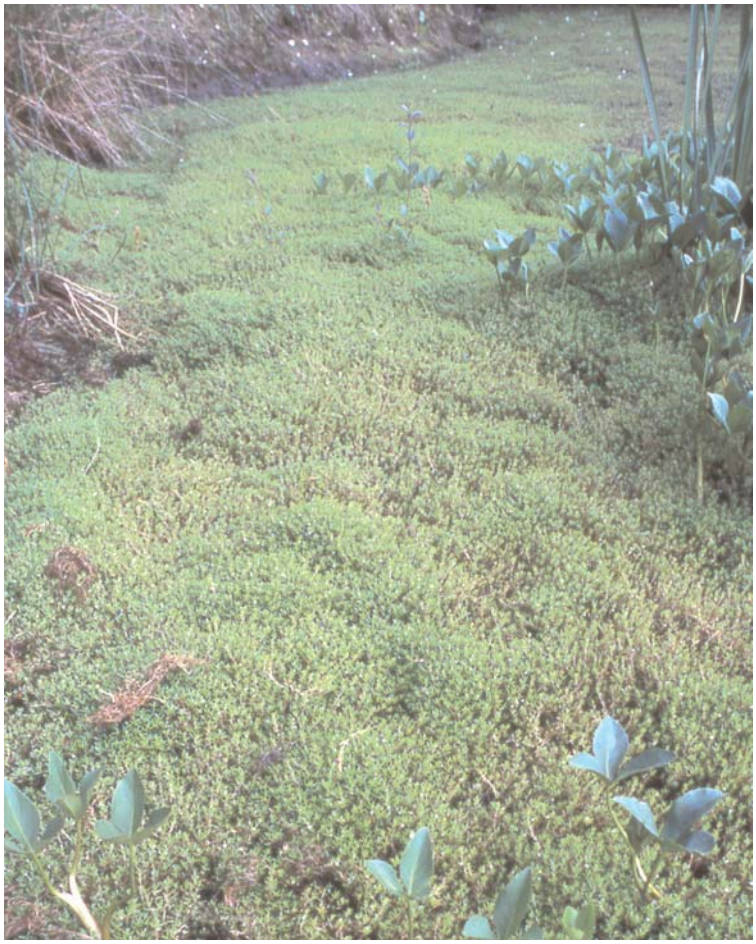
Free-floating aquatic species tend to be confined to static water, usually among emergent vegetation at the margins, or forming floating mats behind obstacles such as fallen trees. Least, or American, duckweed (*Lemna minuscula*) and water fern (*Azolla filliculoides*) occur in these habitats. Invasive aquatic plants can have the following effects:

- Replacing native vegetation, including possible perturbations to *Ranunculus* communities, salmon, bullhead and lamprey habitat.
- Coverage can be so great that the plants die underneath, impacting on water quality by reducing the oxygen available for fish and invertebrates. This die-back may contribute to elevated levels of organic matter deposited on the river bed, reducing substrate suitability for cSAC species.

7.1.2.1 Distribution

Least duckweed is widespread throughout the Avon cSAC, but is confined to the marginal vegetation

(N Grieve pers. com.). Small amounts of North American skunk cabbage (*Lysichyton americanus*) have recently appeared in New Forest streams. Water fern is found in ditches, for example on the Bourne, and around Breamore. Current information suggests that floating pennywort and other invasive species are absent, although they could be present and not recorded. Australian swamp stonecrop is widespread and abundant in several of the Blashford Lakes. Parrot's feather is present near Ringwood and Kingston Common.



Sue Scott

If left unchecked, non-native plants such as swamp stonecrop can over-run indigenous species and have a negative impact on habitats, such as in the ditch above (not in the cSAC). So far in the Avon system, stonecrop is only widespread in the Blashford Lakes.

7.1.3 Strategic Approach to Invasive Plants

Invasive plant species can be extremely difficult and costly to eradicate even if present at low levels. In the case of Japanese knotweed, management can require several years of repeated action. It would be prudent to begin a control strategy for both aquatic and emergent invasive plant species before they become widespread and prohibitively costly to eradicate. The example of the River Frome may be taken as a warning against inactivity: seven years ago the Frome had small patches of Himalayan balsam that were left uncontrolled, and it now has extensive monocultures of the plant (A Frake pers. com.).

In order to develop a comprehensive future strategy for invasive plants, the following must be considered:

- Policy measures to prevent the sale of existing and future invasive plant species
- Information provision and awareness raising
- Collation of existing information on locations of invasive plants
- Development and implementation of effective management techniques.

7.1.3.1 National legislation and policies

There is currently no control on the purchase of many invasive plant species; indeed it is likely that these species are still being planted, which will have implications for the future. National legislation regarding the sale of aquatic invasives would limit the potential for new aquatics to get into gardens and subsequently rivers. English Nature is currently challenging the sale of invasive alien species through the DEFRA review of non-native species policy. The proposal is to add aquatic invasives such as Australian swamp stonecrop to Japanese knotweed and others, which are already illegal to sell. The outcome of the review should be known in early 2003.

There is legislation in the WCA making it illegal to let certain species escape into the wild, but it is unlikely that this legislation is effectively enforced.

Action underway	Delivery		
	By whom	Mechanism	Date
Continue to work to influence the DEFRA review of non-native species, to help prevent the sale and spread of invasive non-native plants.	EN, EA, WTS	Policy review	Ongoing

7.1.3.2 Awareness raising and information provision

At a national level, English Nature, the Environment Agency and the Wildlife Trusts are working to raise awareness of invasive plant species by distributing information to garden centres and the horticultural trade. A database and practical guide to alien invasive plant species are under development and are due to be launched on the English Nature website in 2003.

At a local levels, awareness raising of problem species with landowners, fishing clubs, the general public and retailers is required to reduce the risk of further introductions of invasive plants into the Avon cSAC.

Dorset Wildlife Trust has a campaign to target garden centres in the county. The profile of invasive plant species needs to be raised within the Avon catchment by undertaking a co-ordinated local publicity campaign. There is a wealth of available literature on identifying and controlling invasive plant species and this needs to be actively promoted in the Avon catchment. Publicity information should be tailored to the catchment and include;

- Names and photos of invasive plants
- Why they are a problem
- Who to contact if you see invasive plants
- Where to get advice on management.

There are numerous existing routes through which to disseminate information in the catchment, including newsletters, the press and the Internet. The key is to publicise the issues from several sources, reaching as wide an audience as possible.

Action underway	Delivery		
	By whom	Mechanism	Date
Continue to work at a national level to raise awareness of the impacts of non-native species.	EN, EA, WTs	Publicity campaigns	Ongoing
Continue to work nationally to promote sound practice among garden centres, the horticultural trade and contractors regarding the sale and introduction of non-native plants.			
Action required	**Delivery**		
	By whom	**Mechanism**	**Date**
Undertake a co-ordinated Avon-wide publicity campaign to inform and educate the public regarding the need to take a responsible attitude to the introduction and control of invasive plant species.	*EA, EN, WTs, LA 21	Publicity campaigns	2004?
Inform and educate target groups on identification, sources of advice and management of invasive non-native plants.	EN, LA 21, fisheries and landowner interests	Workshops	2004?

7.1.3.3 Collation of existing data

Existing data on the extent and distribution of invasive plants in the cSAC must be collated in order to manage the existing affected sites and identify any new sites. Current information is patchy, is stored in a

number of locations and is not in a single accessible format. Table 24 details the existing data and suggests actions.

Table 24 . Summary of available data on invasive plants species.

Source of data	Format	Action required
Environment Agency RHS (25% coverage)	Tick box in electronic database Possible to extract	Extraction and mapping in GIS
English Nature *Ranunculus* database (100% coverage)	Access database	(Mapped information on bankside invasive plants and aquatic species for the cSAC in GIS (excludes Dockens Water))
Biological Record Centres	Paper (vole survey) River monitor data on paper	Extract and map in GIS Check content
Salisbury Project	Paper map for parts of Salisbury	Extract and map in GIS
National plant databases	?	Investigate level of data for Avon cSAC
JNCC rivers database	Electronic database	Extract and map in GIS if applicable

The English Nature *Ranunculus* survey data, including observations of invasive plants, has been input to a GIS-compatible database. This allows mapping of aquatic and bankside invasive plants in the whole cSAC (excluding the Dockens Water) and provide a comprehensive baseline for future reference. Other sources of data can be used to cross-check and add to this database.

Action required	Delivery		
	By whom	Mechanism	Date
Collate information on invasive plant species locations for storage in a central database that is compatible with both Mapinfo and Arcview geographic information systems.	*EN, EA, CERC, CERC, LA, HA, WTs, all bodies undertaking survey Fisheries and landowner interests	Data collation	2004

7.1.3.4 Monitoring

Once the baseline dataset has been established, monitoring of the extent and location of invasive species is required in order to inform decisions on management. Recording is undertaken sporadically by the Environment Agency and others, usually as an aside to surveys whose primary focus is not invasive plants. These data are potentially useful, and need to be captured centrally.

Fishing clubs have detailed knowledge of their stretches of river, and their help would be invaluable in logging invasive non-native plant species and monitoring growth. In order for fishing clubs to monitor invasive plants, some training on plant identification may be required. A standard logbook could be issued for recording and periodic submission to the central administrator of the invasive plants database. Similarly, volunteers from Wildlife Trusts and other organisations could be more involved in monitoring invasive plants.

Action required	Delivery		
	By whom	Mechanism	Date
Ensure that relevant data on invasive plants collected as part of other surveys are input to the invasive species database.	*EN, EA, CERC, HA, WTs, all bodies undertaking survey, fisheries and landowner interests	Data management	2004?
Improve and develop existing recording networks and reporting mechanisms to collect and store information on invasive plants.		?	2004?

7.1.3.5 Advisory service and management

Advice on eradication techniques, health and safety, licences and disposal of invasive plants is already available from the Environment Agency.

In order to minimise the spread of invasive plants, a system must be in place to prioritise the most extensive or rapidly spreading patches of invasives, and carry out management projects. In several counties, including Cornwall and Devon, a forum has been created to identify patches of Japanese knotweed and allocate responsibility for control of the plant. This type of approach is suggested in order to take action on invasive species in the Avon catchment. Following the creation of a forum, a programme of management needs to be put in place. Table 25 contains recommendations for action on particular species. Managing Japanese knotweed presents particular difficulties and should be treated on a case-by-case basis.

Table 25. Summary of recommended action for invasive non-native plant species in the River Avon cSAC.

Plant	Current status	Recommended action	Priority
Japanese knotweed	Present in isolated patches	Eradicate	High
Himalayan balsam	Present in isolated patches		
Giant hogweed	Present in isolated patches	Eradicate	Medium
North American skunk cabbage	Present in New Forest streams at low levels		
Water fern	Present in ditches, not spreading	Monitor	Low
Least duckweed	Present in river margins, not spreading		
Parrot's feather	Absent, prefers still waters	Monitor Eradicate if detected	High
Australian swamp stonecrop	Absent, prefers still waters		
Floating pennywort	Absent, prefers still waters		
Curly waterweed	Absent, prefers still waters		

Action underway	Delivery		
	By whom	Mechanism	Date
Continue to provide an advisory service on management of invasive non-native plant species	EA	Advisory service	Ongoing
Action required			
Create an invasive plant species forum in the Avon catchment, to identify target areas for action and to instigate a programme of appropriate management.	*EN, EA, CERC, LA, HA, WTs, all bodies undertaking survey, fisheries and landowner interests	Forum	2004

Research is being undertaken nationally into biological control methods for invasive plants and should be taken into account once the results are available.

7.2 Mute Swans

In the upper Avon, mute swans feed in the river, and where large flocks are concentrated they can significantly deplete the *Ranunculus* beds, reducing structural and biological habitat diversity. In the middle and lower Avon, the increased depth of channel prevents serious damage occurring. Mute swan grazing has a marked local effect on *Ranunculus* beds in the upper River Avon system, in some instances due to or related to other impacts known to be affecting the *Ranunculus* communities. The effects of intensive swan grazing are:

- Depletion of the *Ranunculus* community and grazing of re-growth, preventing a recovery.
- Reduction of refuges for salmon parr and bullhead due to removal of the *Ranunculus* community.

Refer to Section 2.6.2.8 for further information on the ecological effects of swan grazing.

7.2.1 Strategic Approach to Mute Swan Grazing

In recent years, the populations of mute swans on the upper River Avon and the River Wylye have expanded considerably, with large flocks of unmated mute swans occupying parts of these river valleys. Currently, numbers north of Salisbury seem to have stabilised, while south of Salisbury numbers increased until the mid-1990s but may now be stabilising (D. Trump, pers. com). From the English Nature *Ranunculus* survey (Grieve *et al*. 1999 and 2000) swan grazing was estimated to have affected approximately 30% of the overall cSAC length.

On a narrow stretch of river the establishment of breeding pairs upstream and downstream of a flock can contain them, but it is hard to establish a breeding pair where a large group of juveniles exist. Current management by Wiltshire Fishery Association is aimed at encouraging breeding pairs by avoiding disturbance and providing nesting material and habitat. Recently, black swans have been increasing in numbers, which pressurises the breeding mute swans, as cobs of both species fight for territory.

Action underway	**Delivery**		
	By whom	**Mechanism**	**Date**
A contract to carry out a literature review of the existing information on mute swans on the Avon has been let by English Nature.	EN	Review	2002
Action required			
Collate information on mute swans for storage in a central database that is compatible with both Mapinfo and Arcview geographic information systems.	*DEFRA, EN, EA, fisheries interests	Data collation	2004

7.2.1.1 Collation of existing data

In order to develop a strategy for managing mute swan grazing, the existing information on swan populations in the cSAC must be collated. Table 26 details available data on factors affecting numbers and impacts of mute swans and suggests actions to make the data more accessible.

7.2.1.2 Proposed way forward

It is clear that some fundamental questions must be answered in order to formulate a plan of action to address the effects of mute swans, and to define the role of each interested body. It is also clear that no one body is responsible for or will be able to resolve the issues.

Table 26. Summary of available data on mute swans.

Factor	Details	Available information	Comments
Attractors	Food (land use) improved grassland winter cereals *Ranunculus* (post-winter barley)	Habitat preference survey by ADAS (then part of MAFF) on Wylye, 1985-8, 1991–2 and 1995–6. Primarily looked at land use but had some elements of in-channel habitat. CSL undertook similar studies 1997–2000 following licensed egg control.	Extract data
	Access points Pools and meanders	WFA knowledge (not recorded)	Needs to be recorded on maps
Physical habitat at preferred locations		**Life in UK Rivers** geomorphological study, RHS (EA 25% coverage) *Ranunculus* survey RHS component and swan observations Habitat preference surveys by ADAS and CSL	Extract data and correlate preferred locations and physical habitat (in-channel and land use)
Locations of flocks and numbers		BTO mute swan surveys, *Ranunculus* survey, DEFRA (MAFF/ADAS) maps 1985–8, 1989, 1991–2 and 1995–6, and CSL studies 1997–2000. David Stone (swan upper) at the Horticultural Research Inst, Stafford. Angling sources in the lower Avon (data passed to D Stone) Further information may be available from Wiltshire Ornithological Society.	Collate, extract data and maps. Analyse to see if there are preferred locations
Other factors	Management	WFA experience of herding, use of barriers etc.	Needs formal recording, particularly which techniques work under what circumstances.
	Behaviour		Behaviour is not well understood
	Deterrence	DEFRA work (little available information). Limited use of shell crackers in 1984–5.	Feasibility of techniques unknown
Summary of information relating to the Wylye Valley	Population and habitat use	A summary paper Mute Swans in the Wylye Valley: *Population dynamics and habitat use* (1994), Trump DPC *et al.*	Extract useful data

The main questions are:

- Is the impact of swan grazing having a significant effect on the condition of the qualifying interests?
- Is the impact of mute swan grazing a natural impact (the increase in populations a natural change)?
- What factors attract mute swans to the areas they occupy on the rivers Avon and Wylye?
- Can non-breeding flock sizes and/or impacts be reduced by active deterrence or by habitat modifications to the river channel and/or the wider river valley? If a change in land use (more tussocky grassland, swamp and fen habitats, etc.) would reduce swan damage, this would be in line with the aims of the Environmentally Sensitive Area Scheme, Countryside Stewardship and English Nature management objectives.
- Is there any justification for control of breeding success? Could it contribute to a reduction in swan damage as part of a co-ordinated strategy that addressed other factors bringing mute swans into the area? If so, is the driver the protection of conservation interests or of economic interests?

The determination of the ecological effect of swan grazing has implications as to whether the driver to address swan grazing is the protection of conservation or economic interests. This in turn has consequences for the obligations of English Nature and DEFRA to take action, and the nature of that action.

Action required	**Delivery**		
	By whom	**Mechanism**	**Date**
Determine the ecological impact of mute swan grazing on the cSAC. Depending on the outcome, identify practical options for reducing the impact of swan grazing on the cSAC.	**EN**, DEFRA, WFA, A&SRA	?	2003/4

7.2.1.2. Monitoring

Fishing clubs in the upper Avon often observe numbers of mute swans, but this information is not formally recorded or collated. Provision should be made within the invasive non-native plant species recording system to record information on mute swans, as the same group of recorders are likely to observe mute swans. In certain sections of the lower Avon information is already recorded by anglers and is passed to the Horticultural Research Institute in Staffordshire.

7.3 Avian Predation

Cormorant numbers have risen rapidly throughout Europe in the last 20–30 years (RDS 2001) including on the Avon. Under the Wildlife and Countryside Act there is provision to prevent birds from doing serious damage to a fishery. Licences to control cormorants to prevent serious losses from fisheries may be issued by DEFRA. Licences are only issued to control limited numbers of cormorants as part of an auditory and visual scaring, proofing (where appropriate) and stocking regime strategy. Numbers of cormorants on the Avon are of increasing concern to fisheries and there has been a rise in successful applications to undertake control measures.

Cormorants are opportunistic feeders and particularly predate on stocked trout and coarse fish, as these are easiest to catch. As long as alternative food sources are available, salmon are not likely to be the preferred catch on the Avon, with the possible exception of smolts at certain points where they accumulate on their migration. Predation on bullhead and lamprey is not likely to be at significant levels.

Goosander are also present and breeding in the Avon catchment and will predate upon salmon, bullhead and lamprey.

The inter-relationship between predator and prey is part of the overall balance between species and it is not currently thought that the control of cormorants or other avian predators on the Avon is required on conservation grounds. However, if numbers continue to rise and a significant effect on conservation interests is shown, the situation may be reconsidered.

During their downstream migration, salmon smolts collect in Christchurch Harbour, where they may be particularly vulnerable to avian predation, providing a relatively concentrated source of food. There could be an opportunity to protect salmon from avian predation in Christchurch Harbour, providing the movements of salmon within the harbour are known. There have been several studies of salmonid movements in the harbour and an assessment of the results is required to determine if they provide enough information.

Action required	Delivery		
	By whom	Mechanism	Date
Keep a watching brief on the number of cormorants and other avian predators and any trends affecting the cSAC.	*DEFRA, EA, EN, fisheries interests, RSPB	DEFRA, EA research	2003+
Carry out an investigation to assess whether there is a likely significant effect on salmon juvenile numbers (particularly smolts) at certain times and places, and formulate appropriate action.			?

7.4 Signal Crayfish

The signal crayfish (*Pacifastacus leniusculus*) is of most concern because of its impact on native crayfish, but it is also negatively correlated with bullhead, suggesting competitive and/or predator-prey interactions. The further spread of signal crayfish could lead to localised extinction of bullhead (Guan & Wiles 1997). The potential effects of signal crayfish on the cSAC features are as follows:

- They can consume large quantities of plant material under certain conditions in their native habitat and may have an impact on *Ranunculus* communities if present in large numbers.
- At high densities they can contribute to increased bankside erosion as a result of burrowing.
- Signal crayfish have a negative correlation with bullhead as well as native crayfish.

The first signal crayfish farm was established at Pewsey in 1984 and within weeks an outbreak of crayfish plague was confirmed. Mortalities of native crayfish along 65 km of the main river were observed within two months of the initial infection (Hutching 1999). The upper Avon was surveyed in 1998 to determine the location and number of signal and native crayfish. Healthy signal crayfish populations were found in the upper Avon (eastern arm) and the upper reaches of the Nadder. The rivers Wylye and Ebble also contain signal crayfish in apparently small numbers.

The surveys suggest that signal crayfish are not present in large numbers except at the top of the Nadder and Avon, and it is not known if signal crayfish are having a significant effect on the Avon cSAC. The Native Crayfish Species Action Plan is aimed at conserving native crayfish species in the South Wessex area. This includes actions to minimise the introduction and spread of signal crayfish. Unless it is thought that signal crayfish are having a significant effect on the cSAC, no further actions over and above those within the action plan are recommended. However, if the numbers of signal crayfish rise then this situation should be reviewed.

Action underway	Delivery		
	By whom	Mechanism	Date
Support the implementation of the Native Crayfish Species Action Plan and ensure that it is progressed.	EA, EN, WTs	BAP delivery	?
Action required			
Investigate current population densities of signal crayfish in the Nadder and eastern Avon and determine if there has been an impact on bullhead and *Ranunculus* habitat.	**EA**, EN, WTs	BAP	?

7.5 Mink

Mink are present throughout the catchment, and pose a particular threat to water vole populations. Provided alternative food sources are available, salmon are not likely to be the preferred catch on the Avon and predation on bullhead and lamprey is not likely to be at significantly high levels. It is not currently thought that mink have a significant effect on the status of the Avon cSAC. However, it is vital that populations are controlled in order to protect water vole populations.

Section 8
Planning and Development

All the favourable condition targets as shown in Appendix B are relevant to planning and development.

8.1 Current Developments in the Catchment

There are several development and road schemes within the Avon cSAC catchment, all at different stages in the planning process. The proposed developments have considerable potential to impact on the designated sites, in particular the River Avon cSAC. The main considerations are:

- Pollution of the river system during construction – runoff, spillage, leakage, etc. (sediment ingress is of particular concern).
- Runoff during operation/usage of the developments.
- Indirect pressures on the river system if floodplain dynamics are altered.
- Increased demand on water resources in the area from the increased resident, working and visitor populations.
- Increased sewage disposal, possible requiring construction works at nearby sewage treatment works.
- Fragmentation of habitat.

These could result in:

- Reduced water quality (including contaminated water, elevated levels of nutrients and suspended solids, and chronic inputs of road traffic products).
- Loss of habitat and reduced habitat quality (such as sedimentation of the river bed).
- Altered hydrology, leading to reduced flow in the river system.
- Disturbance to biodiversity, including habitat fragmentation.

Current development proposals requiring scrutiny under the Habitats Regulations and Wildlife and Countryside Act are listed below (excluding flood-defence schemes, see Section 6). For further details of the proposals, see Appendix G.

- Development at Amesbury
- Development at Allenby/Connaught
- Road schemes in Wiltshire
- Blashford Lakes
- Avon Common gravel extraction.

County and District Councils and Unitary Authorities set out proposals for development (including the road network) in the Structure Plan and the Transport Policies and Programme submission. County Structure and Transport Plans and policies guide the Local Plans, which set out a strategy for development and the road network in more detail.

The cSAC and SSSI designations place considerable demands on the public bodies involved in developments and road schemes. Any development or road scheme proposal that may have an impact on a cSAC and SPA requires scrutiny under the Habitats Regulations (see Section 1.6.4 on appropriate assessment) and on SSSIs, under the Wildlife and Countryside Act.

8.2 Issues Related to Planning and Development

In addition to the Habitats Regulations and WCA, development proposals and road schemes are subject to statutory planning legislation, land drainage and pollution controls. County councils are the planning authorities responsible for minerals, waste and highways, while district councils have responsibility for all other planning permissions. Both have a important role in reviewing consents and appropriate assessment.

Historically, local planning has not considered the potential impacts of development on the water environment. However, the River Avon cSAC/SSSI designations place considerable demands on public bodies to specifically address this aspect. Despite the statutory measures already in place, there are several issues to consider, including appropriate regional planning guidance, planning consultation and appropriate assessment procedures.

8.2.1 Regional and Local Planning Guidance

Local plans are highly dependent on regional and county planning guidance. It is crucial that regional development plans contain policies that safeguard the River Avon cSAC, and that these are then translated into the structure and local plans. Particular aspects to consider in policies are effluent disposal, additional demands on water resources and impacts on the hydrological functioning of the River Avon and its floodplain.

Action required	**Delivery**		
	By whom	**Mechanism**	**Date**
Ensure that Regional Development Plans contain policies that safeguard the River Avon cSAC.	Regional planning authority, EA, EN, WTs	Regional development plans	2003+

8.2.2 Role of Planning Authorities in Appropriate Assessment

As already described, the decision-making process required by the Habitat Regulations, in particular where there are several plans and projects to assess in combination, can be very challenging. Because of the potentially complex decision-making process and the number of bodies involved (particularly for in-combination assessments), it is crucial that adequate time is allocated to deal with developments, and a strong working relationship is established between all the interested parties.

It is suggested that a forum be convened to examine the regional and local development and transport plans, and to identify all potential developments likely to be relevant to the cSAC, and the roles of local planning authorities, English Nature and the Environment Agency. The forum would then develop a timetable for action, broadly identifying potential issues, responsibilities and a timetable for the associated planning case-work. This approach should contribute to strengthening planning liaison, and ensure consistency and adequate time for consultation.

In the case of flood risk, local planning authorities do not have to carry out their own assessment. The role of English Nature and the Environment Agency in assessing flood risk and impacts on the cSAC and providing expert advice should be considered as part of the planning forum. There is a growing emphasis on the responsibility of developers to provide suitable expert advice on how concerns raised by development proposals are to be addressed. This means that both English Nature and the Environment Agency are likely to receive more pre-application requests for advice from developers.

English Nature has previously held seminars for local planning authorities on the application of the Habitats Regulations, and what constitutes an appropriate assessment is set out fully in Annex C of PPG 9 and English Nature guidance. Now that the Habitats Regulations have been in place for several years, it may be useful undertake some refresher seminars using case studies with bodies responsible for planning and development. These seminars could be linked to the planning forum discussed above.

Action required	Delivery		
	By whom	Mechanism	Date
Establish a planning forum to broadly identify development proposals likely to affect the cSAC, potential issues, responsibilities and a timetable for action.	EN, **LA**, HA	New planning forum	2004
Hold seminars to determine what support public bodies responsible for planning and development need, and discuss local case studies of good practice.	EN, **LA**, HA	Seminar	2003/4

8.2.2.1 Consultation

It is vital that all aspects of developments or roads are considered early on in the planning process to ensure significant effects on the water environment are avoided. Water supply, surface and foul-water drainage are often overlooked in development, which can result in planning permission being granted without relevant consents, leaving little scope to ensure there is no significant effect on the cSAC (see Section 1.6.4).

Given the responsibility of local planning authorities to ensure developments do not significantly effect the cSAC, it is crucial that the Environment Agency and English Nature are consulted at an early stage. Particular aspects to consider in appropriate assessment are effluent disposal, additional demands on water resources and impacts on the hydrological functioning of the River Avon and its floodplain. Involving the Environment Agency and English Nature at a early stage ensures that any potential issues are highlighted early and proposals can be amended accordingly.

Action required	Delivery		
	By whom	Mechanism	Date
Local planning authorities and highways authorities must strengthen consultation with the Environment Agency and English Nature early in the planning process, to ensure proposals have no significant effect on the cSAC.	**LA**, **HA**	Appropriate assessment	2003+

Section 9
Rehabilitation

(Attributes relevant to rehabilitation are as shown in Table 13, in Section 6)

The River Avon and its floodplain have been subject to modifications over centuries. Historically, this included modification to the channel for mills and water meadows, and in the last century for flood defence, land drainage and agricultural purposes, resulting in alterations to the shape and plan form of the river by widening, straightening and deepening channels. A summary of information relevant to the physical habitat in the cSAC can be found in Appendix H. In addition to changes to river form, the floodplain has been affected by changes in water level management with resulting impacts on the Avon Valley SPA.

Natural recovery of channel geomorphology (river form) is dependent on the ability of the river to rework sediments. Because the River Avon is a low-energy system, it is highly sensitive to modifications, and lost geomorphology can generally not be regained through natural processes (Geodata 2002).

Both photos by Rob Cathcart/English Nature

In order to try and improve the physical habitat of the river system, various organisations and individuals, including fishing organisations, riparian owners, the Environment Agency and Wildlife Trusts, undertake habitat enhancement works. These enhancement schemes can have several different aims, including improving fishing, habitat, amenity/aesthetic value, flood management and erosion control to protect land and infrastructure. In the absence of sound information on the current geomorphological status of the river, the schemes are designed in response to a specific need in a short stretch of river.

Rehabilitation of the floodplain aims to manage water levels for the designated interests of the Avon Valley SPA, improve flood management, preserve landscape and archaeology and bring wider biodiversity benefits. It is relevant to this strategy because it has implications for the cSAC. Floodplain rehabilitation has the potential to expand the range of suitable habitat for the cSAC features. However, there are also some potential negative effects that must be considered.

Rehabilitation projects such as erosion control on the River Wylye (above) and bank restoration in Salisbury (top), are an important tool in managing the catchment for habitat enhancement.

Water Level Management Plans (WLMPs) are being developed to establish appropriate water-level management in the SPA, reversing the decline in grazing marsh habitat, breeding waders and wintering

wildfowl. There will also be a WLMP for the cSAC, which will consider factors such as the impact of water-level management structures. The main mechanism for implementing the plans at farm scale will be through the Environmentally Sensitive Area scheme and Countryside Stewardship. Bigger schemes at the water-level management unit scale will require wider partnership funding.

9.1 Strategic Approach to Rehabilitation on a Catchment Scale

There is a need to develop a strategic approach to rehabilitation in order to maximise ecological gain for the cSAC. A strategic approach must comprise clear objectives and a framework within which to identify sites that would benefit most from rehabilitation, and consider any constraints at those sites.

The difference between rehabilitation and restoration is important when considering a target condition for the cSAC. Restoration implies complete structural and functional return to a pre-disturbance state, while rehabilitation is any structural or functional improvement to ecological or habitat quality. In a system such as the Avon, which is almost entirely semi natural, rehabilitation seems a realistic description of what might be undertaken to achieve favourable condition. The scale on which rehabilitation is required in order to contribute to achieving favourable condition must be determined as the starting point of a strategic approach.

9.1.1 Framework for Strategic Approach

A flexible system that can be applied to all in-channel rehabilitation projects and floodplain works has been developed to determine what rehabilitation is required, where it should take place in the future and to ensure maximum benefit to the cSAC. The proposed framework shown in Figure 17 applies to both in-channel and floodplain works, and may also be applied to proposed rehabilitation outside the SAC that will benefit the site – for example, the opening up of old channels or carrier ditches.

A consistent way of identifying and prioritising sites is required to underpin this framework. The essential elements required are as follows:

- Definition of a target condition.
- Determination of whether rehabilitation is required to achieve favourable condition, or if it is an enhancement.
- Quantitative evaluation of the physical and ecological impact of rehabilitation techniques.
- Identification and mapping of the best reaches (physical and ecological habitat).
- Identification and prioritisation of sites for rehabilitation.
- Relationship to floodplain (including benefits to archaeological sites, such as water meadows).
- Delivery of rehabilitation projects.
- Pre- and post-project monitoring and evaluation.

As part of **Life in UK Rivers**, a full geomorphological audit of the River Wylye has been undertaken. The main objectives of the project are to map the physical alterations to the river, develop an understanding of physical processes, and examine the impact of existing rehabilitation projects and the link between geomorphology, salmon and *Ranunculus* communities.

A combination of geomorphological and ecological data, complemented by RHS (if suitable) and the knowledge of river users should be developed to identify and prioritise sites that would benefit from rehabilitation. This approach would take account of physical processes and could be applied consistently across the catchment.

The work on the River Wylye provides a basis for further development of a strategic approach and should allow some assessment of the level of geomorphological audit required, the usefulness of RHS data, and what extra analysis is required to support application of the method. Depending on the outcome, the technique should be modified and applied across the catchment. In order to be successful, the strategic

approach must be adopted by all organisations involved in rehabilitation, particularly those bodies that fund rehabilitation projects.

Action required	**Delivery**		
	By whom	**Mechanism**	**Date**
Use condition assessment criteria to determine whether and where rehabilitation is required to achieve favourable condition.	EA, EN	Condition assessment	2003
Consider whether major investment in a programme of larger-scale rehabilitation is needed to achieve favourable condition. If so, establish the necessary partnership and seek funding.	**Strategy Working Group partnership** RRC	n/a	2003
Refine the proposed strategic approach to rehabilitation, using the River Wylye as a pilot catchment.	**EN**, **EA**	Investigation	2003
Undertake a detailed geomorphological assessment of the remainder of the cSAC, using the refined Wylye approach.			2003/4
Evaluate the physical and ecological impact of existing rehabilitation schemes in the cSAC to help identify the most appropriate techniques.	**EN**, **EA**	Research	2004
Adopt the strategic approach as a framework for targeting rehabilitation projects that bring maximum ecological gain to the cSAC and preserve/enhance important archaeological features.	EA, EN, WTs, fisheries interests	Policy	2004/5

9.1.2 Objectives for Rehabilitation in the cSAC and Surrounding Floodplain

Objectives for identifying and prioritising potential rehabilitation projects have been developed by a group comprising representatives from English Nature, the Environment Agency, Wiltshire Fishery Association, the Wildlife Trusts, DEFRA, Game Conservancy Trust, and a landowner. These objectives are as follows:

- Rehabilitation should result in structural or functional improvements to the ecological or habitat quality of the cSAC, contributing to favourable condition.
- Sites should be targeted and prioritised in a way that maximises benefit to the cSAC's interests, wider biodiversity and archaeology.
- Rehabilitation projects should provide sustainable solutions that are adaptable to future scenarios (such as climate change), and require minimum management.
- Rehabilitation projects should be considered in the context of the river (reach or whole river, including the floodplain, depending on scale of the project) rather than in isolation.

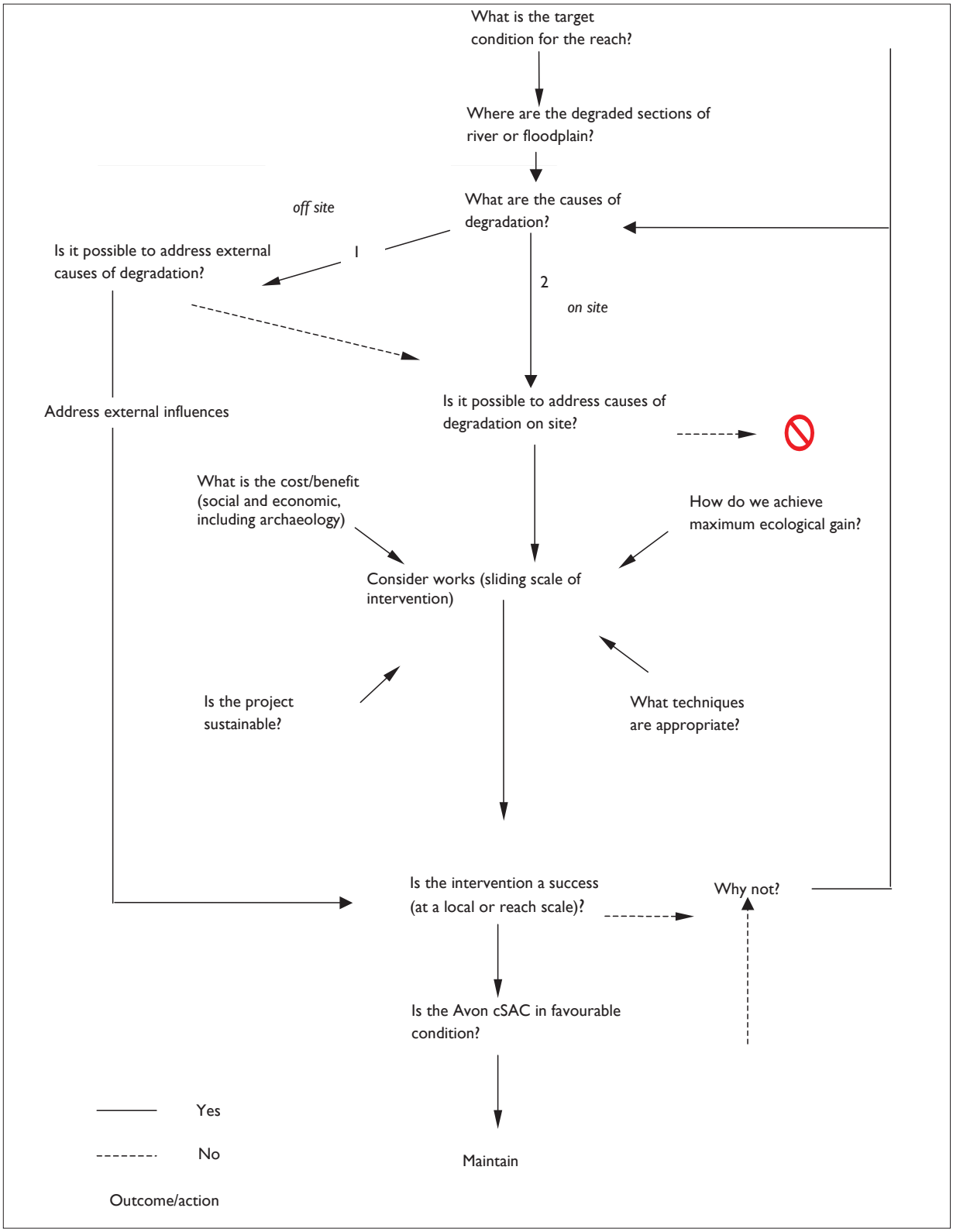
The implication of these objectives is that rehabilitation schemes aiming for maximum ecological gain to the cSAC and biodiversity will be high priority.

Where it is thought that rehabilitation within the floodplain may benefit the cSAC, the following objectives apply:

- Floodplain rehabilitation that primarily maintains or enhances the available habitat for the cSAC features must not compromise the SPA/Ramsar site.
- Sites should be targeted and prioritised in a way that maximises benefit to the cSAC, SPA, Ramsar, SSSI, wider biodiversity and archaeology.

- Rehabilitation projects should provide sustainable solutions that are adaptable to future scenarios (such as climate change), and require minimum management.
- Rehabilitation projects should be considered in the context of the surrounding floodplain, rather than in isolation.

Figure 17. Framework for strategic approach to rehabilitation projects



9.2 Guidance on Rehabilitation

In order to ensure consistency, there is a need to provide best-practice guidance for people carrying out and advising on rehabilitation schemes. The suggested scope of the guidance is as follows:

- How to determine if a project is needed
- Objectives for rehabilitation including target species and habitats
- Using river processes
- Evaluate options, utilise design and construction best practice
- Necessary authorisations
- Feasibility (cost/benefit, constraints)
- Funding options
- Implementation and project management
- Post-project appraisal.

It should be noted that any guidance could only cover appropriate techniques based on current knowledge, which is limited; future research is needed to evaluate techniques.

Similarly guidance is needed on floodplain rehabilitation, most urgently for the agencies and landowners involved in the implementation of the Water Level Management Plans. The suggested scope of the guidance is as follows:

- How to determine if a project is required
- Objectives for rehabilitation including target species and habitats
- Identification/resolution of conflicts to accommodate the needs of the cSAC
- Evaluate options, utilise design and construction best practice
- Feasibility (cost/benefit, constraints and consents)
- Funding options
- Implementation and project management
- Post-project appraisal,

Ditching works and new structures will be part of implementing the Water Level Management Plans and have been identified as having a potential positive as well as negative impacts on the cSAC. Advice tailored to the particular interest features of the cSAC and SPA is required as mentioned in Section 3 (water quality). The Water Level Management Plan and ESA scheme must be able to give clear practical advice on issues related to floodplain rehabilitation, including the potential benefits and conflicts with the cSAC.

Action required	**Delivery**		
	By whom	**Mechanism**	**Date**
Undertake research to evaluate the physical and ecological impact of rehabilitation techniques, including type of materials used.	**EA**, **EN**	Research	2003+
Develop, evaluate and disseminate best-practice guidance to ensure that in-channel rehabilitation projects have maximum ecological gain for the cSAC and preserve/enhance important archaeological features.	EA, EN, DEFRA, fisheries and landowner interests, WTs, RRC, LA	Research	2003/4
Develop, evaluate and disseminate best-practice guidance to ensure that floodplain rehabilitation has maximum ecological gain for the cSAC and archaeological features.		Research	2003/4

Section 10
Additional Issues

10.1 Communication and Accessibility

Ineffective communication has been identified as an issue that undermines co-operation between stakeholders and statutory bodies. There is confusion about the numerous initiatives in progress and a perceived lack of co-ordination between different organisations. Improving communication will create an identity and sense of ownership for the river in the wider community, and improve levels of co-operation from key groups.

Possible solutions are:

- Production of a River Avon website and publication, explaining why the river is special, the issues affecting it, how these are being addressed and ways that people can get involved. The website would be authored by a partnership of organisations and ideally hosted by a non-statutory body.
- A seminar related to the River Avon, giving riparian owners and managers an opportunity to learn about ongoing initiatives in the catchment

Because of the large number of riparian owners and managers with an influence on the River Avon cSAC, it has been difficult for regulatory and statutory bodies to work with this group in a structured way. The groups related to hydrological units used in implementation of the WLMPS could be a useful structure for addressing future management issues in the river and valley.

Public access to and involvement with the river is currently relatively limited. Physical access to the river, such as that provided by the Avon Valley path, has potential impacts on the cSAC, and access must be carefully managed to minimise disturbance to the site. However, there are several possible ways in which managed access to the river system and understanding of its biodiversity could be enhanced:

- Enhancement of sites where managed access is possible, for example the rehabilitation project at Netton Bridge.
- Opportunities for the public to get involved in practical work (restoration, monitoring problem species).
- Provision of interpretative material in a variety of media at suitable locations, such as car parks that overlook the river.
- Public events hosted by project partners.

Action required	**Delivery**		
	By whom	**Mechanism**	**Date**
Investigate how best to improve communication between stakeholders and statutory bodies.	EA, EN, WTs, fisheries and landowner interests, LA	?	2004
Depending on the outcome of the WLMP initiative, consider using a similar structure for future consultation between parties (statutory, regulatory and riparian owners/tenants) involved in management of the River Avon cSAC.		-	2003+
Investigate how best to improve public understanding and managed access to the river system.		?	2003+

10.2 Data Management

Large amounts of data exist for the River Avon cSAC, but they are dispersed between organisations and are often not in the most useable format. A possible solution is collating existing data and storing them in a useful format (GIS-based) that would ensure long-term management of the data resource – for example by placing the database with a record centre that would maintain it and distribute regular updates to subscribers. This would provide a tool for management decisions and enable elements of the data resource to be publicly available via a website.

Disseminating elements of the collated data to the wider public would contribute to improving public access to information about the river. There are several possible routes for making data more widely available; the Chalk Rivers website (under development), the Southern Regional Observatory site, or the National Biodiversity Network.

Action underway	**Delivery**		
	By whom	**Mechanism**	**Date**
Data collation and management is currently being investigated by a number of organisations, and as part of **Life in UK Rivers**.	EA, EN, CERCs	?	?
Action required			
Collate data related to the River Avon cSAC, put in place a database management system and investigate options for making elements of the database publicly available	**EA**, **EN**, CERCs, NBN	?	2004

10.3 Boundary of the River Avon cSAC and River Avon System SSSI

English Nature has responsibility for identifying and notifying SSSIs under the Wildlife and Countryside Act. It also carries out the designation of SACs and SPAs, although the government itself is responsible for selection of international sites. All designations are made in accordance with published guidance. The boundaries of the River Avon cSAC/SSSI were based on the available scientific knowledge at the time of notification. If in future new information indicates that the site's interests extend beyond the current boundary English Nature will examine relevant information against the SAC and SSSI selection guidelines, and consider if the designated site should be amended. Any amendment would require formal consultation with all interested parties.

Action required	**Delivery**		
	By whom	**Mechanism**	**Date**
Review the boundary of the cSAC/SSSI if new information indicates that additional parts of the river system fulfil the criteria for inclusion in the cSAC/SSSI.	EN	Routine	?

10.4 Monitoring River SACs in Relation to Conservation Objectives

10.4.1 Favourable Condition Tables

In 2000, English Nature drew up conservation objectives for all SACs, following common standards developed by the statutory conservation agencies in the UK, working through the Joint Nature Conservation Committee (JNCC). These comprise an overall aim – to maintain at (or restore to)

favourable condition the habitats and species for which the SAC was designated – and a set of targets designed to achieve this aim is contained in a favourable condition table (FCT). In rivers, these targets cover attributes such as water quality, flows, morphology and substrate, extent of the plant community, management, disturbance and access for migratory fish.

10.4.2 Assessment Techniques

English Nature has set 2003 as a deadline for completion of the first six-yearly reporting cycle on the condition of SACs and SSSIs. Guidance on the assessment of condition is being drawn up through the JNCC. This involves the development of robust and cost-effective techniques for assessing, for example, plant communities and morphological aspects, such as silt. Some of these are being developed and tested through **Life in UK Rivers**, which will finish at the end of 2003. These include a fluvial audit of channel structure, which was pioneered on the River Wylye, part of the Avon system. This will facilitate the targeting of restoration work.

At present, the only attributes for which there is a tried-and-tested monitoring approach is water quality and the identification of barriers to access by fish. While the water quality targets can be accurately assessed, English Nature has developed a questionnaire approach for the other attributes, based on existing knowledge of the rivers. This is standardised across England to provide a basis for the next cycle of assessment, and to help identify the impacts that are causing unfavourable condition. Measures will be identified – such as those outlined in this conservation strategy – to help achieve the government's target that 95% of SSSIs should be in favourable condition by 2010.

10.4.3 Dividing the Avon into Units

Monitoring depends upon having a unit to monitor. English Nature has divided the Avon system into 13 units, reflecting the slightly changing character of the river and its tributaries. Each one will have an Environment Agency monitoring point for water quality. Other attributes will be assessed, either for the whole reach or at standardised monitoring points.

Action underway	**Delivery**		
	By whom	**Mechanism**	**Date**
Undertake surveys to improve knowledge on the range, distribution and number of bullhead and lamprey in the Avon catchment.	EN, EA	Survey programme	2003
Survey of Ranunculus communities	EN	Survey programme	2002
Surveys of Desmoulin's whorl snail	EN	Survey	2000
Geomorphological audit of River Wylye	EA/EN	Survey	2002
Complete condition assessment of Avon	EN	Assessment	2003
Undertake surveys to improve knowledge on the range, distribution and number of bullhead and lamprey in the Avon catchment.	EN, EA	Survey programme	2003
Action required			
Develop a monitoring strategy for the River Avon cSAC in order to report on favourable condition	**EN**, **EA**		2003/4

10.5 Climate Change

Changes in climate have affected the world, and the distribution and abundance of its plants and animals, since the beginning of time. However, during the 20th Century, the rate of climate change increased

dramatically (the greatest in the last 1,000 years), with the 1990s being the warmest decade on record. This coincided with industrial and social development increasing the level of greenhouse gases in the atmosphere and accelerating what is essentially a natural process. Indeed, a recent report by the Intergovernmental Panel on Climate Change concluded that "there is now strong evidence that most of the warming over the last 50 years is attributable to human activities" (IPCC 2001).

This trend is set to continue for at least the first half of the 21st Century, even if a global reduction in greenhouse gases is achieved. IPCC expects average global temperatures to rise between 1.4°C and 5.8°C by 2100, depending on future levels of greenhouse gas emissions. Warming will be accompanied by changing precipitation patterns and increased frequencies of extreme weather events, such as floods and storms. Sea levels will also continue to rise as ice sheets and glaciers melt, and as sea water expands in response to higher temperatures.

Climate change presents a series of important and immediate challenges to scientists, policy makers and the public. In nature conservation, there is already clear evidence to show that plants and animals, including those characteristic of the British countryside and seas, are being affected by climate change. This includes changes in populations, ranges, migration patterns, and seasonal and reproductive behaviour of certain species. Such effects are likely to become more apparent and extensive as climate continues to change, with local species' extinctions and habitat loss.

Conservation organisations in the UK and Ireland are working together to understand the scientific and policy implications of climate change for nature conservation. A programme of research is underway to evaluate the impacts of climate change on nature conservation resources and propose actions to accommodate these, either by complementing existing activities or through new approaches.

10.5.1 Modelling Natural Resources Response to Climate Change

Conservation organisations in the UK and Ireland commissioned the MONARCH (Modelling Natural Resources Response to Climate Change) study to provide quantitative evidence to complement the

Nigel Holmes

The New Forest forms part of a case study into climate change and its effect on the River Avon cSAC.

biodiversity assessments based on expert judgement already carried out. In Phase 1 of the study, complex computerised models were developed to estimate changes in the distribution of species under climate change conditions. The Phase 1 study covers the impacts of climate change on a broad range of species (including plants, birds and amphibians) and geological features in terrestrial, freshwater, coastal and marine environments in Britain and Ireland, and considers the implications for nature conservation policy.

The findings of Phase 1 of the MONARCH study can be obtained from the UKCIP Programme Office, or downloaded from www.ukcip.org.uk/model_nat_res/model_nat_res.html.

A Phase 2 study is now underway. It aims to advance the science of predicting possible responses of species to climate change, by adapting the previous approach to a local scale. This will take into account factors such as the suitability of the climate for species distribution, and the capacity for species dispersal, given potential land-use change and restrictions. The outcomes are being assessed for selected case-study areas, including an evaluation of policy and management problems relating to conservation objectives.

The New Forest forms part of one of the case-study areas, and the River Avon cSAC marks its western boundary. Although the focus of the work will be on the species and habitats of a wider area of Hampshire, it may help us to understand the potential impacts of climate change on part of the cSAC.

10.5.2 Potential impacts

Although predictions of the exact impacts of climate change are still uncertain, they all show a similar pattern of changed rainfall and temperature. The consensus for the impact of climate change on the weather in southeast England is drier summers, wetter winters and increased likelihood of extreme events such as storms and droughts (Hampshire's Water Project 2002).

Several studies indicate that projected climate change will have important impacts on freshwater fisheries and aquatic ecosystems. The exact impact of climate change on the River Avon cSAC is not known. However, based on current knowledge, the following may have a direct or indirect impact on the cSAC habitats and species:

- Heavier, more prolonged winter rainfall, increasing frequency and degree of flooding.
- Decrease in summer rainfall leading to drying out of wetland areas, and a decrease in summer flows, including important flushing flows.
- Higher intensity and frequency of summer storms, resulting in flash flooding.
- Groundwater flooding, causing longer-term flooding.
- Increased evaporation and less frequent rain in summer, leading to lower summer flows.
- Impacts on water quality due to reduced dilution of effluent from point and diffuse sources in summer.
- Higher turbulence and silt loads due to increased runoff.
- Changes in water temperature and light levels.
- Increased temperature leading to increased demand for water for domestic and agricultural use.
- Changes in survival, reproductive capacity, and growth of fish and the organisms and habitats on which they depend.

It is outside the scope of this strategy to recommend particular actions to address climate change. However, it is vital that the actions recommended throughout this strategy are implemented using sustainable solutions, which take into consideration climate change.

Action required	**Delivery**		
	By whom	**Mechanism**	**Date**
All actions recommended in the River Avon cSAC Strategy to be implemented using sustainable solutions, which take into consideration climate change.	All	All	Ongoing

Section 11
Glossary of Terms and Abbreviations

Annex I Habitats
A natural habitat listed on Annex I of the Habitats Directive for which Special Areas of Conservation can be selected.

Annex II species
A species listed on Annex II of the Habitats Directive for which Special Areas of Conservation can be selected.

Attribute
A characteristic of a habitat, biotope, community or population of a species or habitat that most economically provides an indication of the interest feature to which it applies. For species this may include measures of population size, structure, habitat requirements and distribution. For habitats, attributes may include measures of area covered, composition, typical species and structure of supporting processes.

Appropriate Assessment
An appropriate assessment must consider the implications of the proposal in relation to the site's conservation objectives and should enable the competent authority to ascertain if the proposal will adversely affect the integrity of the site.

Aquaculture
Commercial farming of fish and watercress.

Competent Authorities
Authorities entitled to give an authorisation or consent to a plan or project. Includes any public or statutory body, including ministers, government departments, public or statutory undertakers, public bodies of any description, any person holding public office and any person exercising a function of a competent authority.

Conservation Objectives
A statement of nature conservation aspirations for the features of interest of a site, expressed in terms of the favourable condition that the species/habitats for which the site has been selected should attain.

Endocrine disrupters
Chemicals that mimic or inhibit the effects of hormones.

Eutrophication
Eutrophication is the process of nutrient enrichment.

Favourable conservation status
Favourable conservation status is the condition of a natural habitat or species in which the sum of influences on that habitat or species does not adversely affect its distribution, abundance, structure or function throughout the EU in the long term (the condition at which the habitat or species is capable of sustaining itself in the long term).

Favourable condition
A range of conditions for a natural habitat or species in which the sum of the influences upon that habitat or species does not adversely affect its distribution, abundance, structure or function throughout the individual cSAC in the long term.

Habitats Directive
The abbreviated term for the Council Directive 92/43/EEC of 21 May 1992 on the Conservation of Natural Habitats and of Wild Fauna and Flora.

Habitats Regulations
The abbreviated terms for the Conservation (Natural Habitats, & c.) Regulations 1994, which translate the Birds Directive and Habitats Directive into UK law.

Interest feature
A natural or semi-natural feature for which a site has been selected. This includes any Annex I habitat and Annex II species, and any population of bird species for which an SPA has been designated.

Minimum Biologically Acceptable Limit
The Minimum Biologically Acceptable Limit (MBAL) or Conservation Limit is the river-specific threshold for fish egg production. It is calculated from an assessment of the capacity of the river network to generate smolts from spawning and juvenile rearing habitat, representing the minimum egg production necessary to maximise smolt output from the system.

Natura 2000 network
The European network of protected sites established under the Birds Directive and Habitats Directive.

Plans and projects
Any proposed development within a relevant authority's function to control, or over which a competent authority has a statutory function to decide on applications for consents, authorisations, licences or permissions.

Precautionary principle
The assumption that where there are real threats of serious damage to the environment, lack of full scientific information should not be used as a justification for postponing measures to prevent such damage occurring.

Relevant authority
Statutory bodies having powers and functions that have or could have an impact on the area within or adjacent to a European site.

Special Area of Conservation (SAC)
A site of European Community importance designated by the member states, where necessary conservation measures are applied for the maintenance or restoration, at favourable conservation status, of the habitats and/or species for which the site is designated.

Special Protection Area (SPA)
A site designated under the Birds Directive by the member states where appropriate steps are taken to protect the bird species for which the site is designated.

Abbreviations

AMP	Asset Management Planning Programme
BAP	Biodiversity Action Plan
CAMS	Catchment Abstraction Management Strategy
CFMP	Catchment Flood Management Plan
CSS	Countryside Stewardship
CROW	Countryside and Rights of Way Act
ECAP	Eutrophication Control Action Plan
ESA	Environmentally Sensitive Area
LEAP	Local Environment Agency Plan
NT&GS	National Trout and Grayling Strategy
O&M	Operational and maintenance plan
RoC	Review of Consents
SAC	Special area of Conservation
SAP	Salmon Action Plan
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
WCA	Wildlife and Countryside Act 1981, as amended by the Countryside and Rights of Way Act
WLMP	Water Level Management Plan

Abbreviations for Organisations

A&SRA	The Avon and Stour Rivers Association
CERC	County Environmental Records Centre
DEFRA	Department of the Environment, Fisheries and Rural Affairs
EA	Environment Agency
EN	English Nature
GCT	Game Conservancy Trust
HA	Highways Authority
LAs	Local Authorities
LA 21	Local Agenda 21
LRC	Local Record Centre
RRC	River Restoration Centre
RSPB	Royal Society for the Protection of birds
WFA	Wiltshire Fishery Association
WSRT	Wessex Salmon and Rivers Trust
WTs	Wildlife Trusts
WTT	Wild Trout Trust
W COs	Water companies

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Appendix A
Details of the Designation of the River Avon cSAC/SSSI and the Avon Valley SPA/SSSI

A1.1 River Avon cSAC citation

Description of site

Area name: River Avon

Administrative area: Bournemouth
Dorset
Hampshire
Wiltshire

Component SSSI: Jones' Mill
Lower Woodford Water Meadows
Porton Meadows
River Avon System
River Till

Reasons for recommendation as a cSAC

This area has been recommended as a candidate Special Area of Conservation (SAC) because it contains habitat types and/or species that are rare or threatened within a European context. The SSSI citation describes the special interests for which the site was notified in the British context. [NB: not for marine interests below mean low water mark]. The interests for which the site was selected as SSSI may differ from the interests selected in a European context.

The area is considered to have a high diversity of habitats/species of European importance.

Interest(s) submitted to the European Commission

European interest(s):
1. Bullhead (*Cottus gobio*), for which this is considered to be one of the best areas in the UK.
The bullhead is a small bottom-living fish found in the upper reaches of lowland rivers and lower and middle reaches of upland rivers in England and Wales. It is not found in badly polluted rivers.

2. Brook lamprey (*Lampetra planeri*), for which this is considered to be one of the best areas in the UK. The brook lamprey is a primitive, jawless fish resembling an eel and is the smallest of the lampreys found in the UK. It lives entirely in fresh water and occurs over most of the UK in streams and occasionally in lakes.

3. Sea lamprey (*Petromyzon marinus*), for which this is considered to be one of the best areas in the UK. This is a primitive, jawless fish resembling an eel. It is the largest of the lampreys found in the UK. It inhabits North Atlantic coastal waters and migrates to spawn in rivers. It has a widespread distribution within the UK, although populations have declined due to pollution and barriers to migration.

4. Atlantic salmon (*Salmo salar*), for which this is considered to be one of the best areas in the UK. The Atlantic salmon is the largest of our migratory fish and spawns in the least polluted rivers of northwest

Europe. It has declined due to over-fishing at sea, pollution and barriers to migration within its spawning rivers. The UK supports a large proportion of the salmon population in the European Union.

5. Desmoulin's whorl snail (*Vertigo moulinsiana*), for which this is considered to be one of the best areas in the UK. This small snail is found in base-rich wetlands where there are long-established swamps, fens and marshes, usually bordering lowland rivers and lakes. It lives on the leaves of reed sweet-grass (*Glyceria maxima*) and large sedges (*Carex* species). It occurs at scattered sites in a broad band stretching across England, from the Norfolk Broads to Dorset, with isolated populations elsewhere. Within the European Union, only England and Ireland are considered to have reasonable populations.

6. Watercourses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation, for which this is considered to be one of the best areas in the UK. Rivers that support characteristic communities of water-crowfoot (*Ranunculus* species), which often dominate the plant community in the river channel. This vegetation occurs in relatively unpolluted waters, in a diverse range of river types.

A1.2 River Avon System SSSI Citation

Site name: River Avon System

Status: Site of Special Scientific Interest (SSSI) notified under Section 28 of the Wildlife and Countryside Act 1981 (as amended).

Environment Agency Region:
South Wessex

Water Company:
Wessex Water plc, Bournemouth and West Hampshire Water Company

Local Planning Authorities:
Hampshire County Council, Dorset County Council, Wiltshire County Council, East Dorset District Council, New Forest District Council, Christchurch Borough Council, Salisbury District Council, Kennet District Council, West Wilts District Council

National Grid Reference:
SZ163923 (Christchurch Harbour) to: SU073583 (Avon) ST867413 (Wylye) ST963297 (Nadder), SU170344 (Bourne) SZ241147 (Dockens Water)

Extent of River SSSI:
Approx 205.11 km, 507.79 ha

Ordnance Survey Sheet:
(1:50 000) 173 183 184 195

Date notified (under 1981 Act):
16th December 1996

Other Information:
New river SSSI.

This site is listed as Grade 1* quality in *A Nature Conservation Review* (1977), edited by DA Ratcliffe, Cambridge University Press.

Parts of the site are separately notified as: Lower Woodford Water Meadows SSSI (1987); East Harnham Meadows (1995); Britford Water Meadows (1987); Avon Valley (Bickton-Christchurch) SSSI (1993).

The site is significant for the following habitat and species covered by Council Directive 92/43/EEC on The Conservation Of Natural Habitats and of Wild Flora and Fauna:

Habitat
Floating vegetation of *Ranunculus* of plain and submountainous rivers

Species

Sea lamprey (*Petromyzon marinus*)	Annex IIa
Brook lamprey (*Lampetra planeri*)	Annex IIa
Atlantic salmon (*Salmo salar*)	Annex IIa, Va
Bullhead (*Cottus gobio*)	Annex IIa
Desmoulin's whorl snail (*Vertigo moulinsiana*)	Annex IIa

Parts of the site lie in the Avon Valley Environmentally Sensitive Area (ESA) and/or the West Wiltshire Downs and Cranborne Chase Area of Outstanding Natural Beauty (AONB). It also passes through the New Forest.

Description and Reasons for Notification

Key Features
The River Avon and its tributaries are of national and international importance for their wildlife communities.

The Avon is richer and more varied than in most chalk streams, with over 180 species of aquatic plant having been recorded, one of the most diverse fish faunas in Britain, and a wide range of aquatic invertebrates. It rises in the Pewsey Vale as a network of clay streams fed by chalk springs. These converge to a chalk river running through Salisbury Plain. At Salisbury this is joined by the main Wiltshire tributaries and develops into a large calcareous river flowing over more acid sands and clay as it passes the New Forest and the Dorset Heaths. The site includes the Dockens Water, a largely unmodified acid stream draining New Forest heathlands.

The Wiltshire tributaries, of interest in their own right and with contrasting geologies, are included primarily on account of their importance, with the Avon itself for internationally rare or threatened species (*Ranunculus* vegetation, sea lamprey, brook lamprey, bullhead, Atlantic salmon and Desmoulin's whorl snail). The Bourne section is a pure chalk stream, the Wylye rises in clay and develops into a chalk stream, and the Nadder is influenced by greensand but again primarily calcareous in character.

In the upper reaches of the system the rivers support outstanding chalk stream fisheries. The surrounding land is mainly grazed or arable. From Salisbury to Ringwood the floodplain is much broader and the river becomes braided where old water meadow channels exist. The floodplain is largely given over to grazing.

The upper reaches of the rivers are largely fed from chalk springs, and in the Avon itself, flows are relatively constant. The water quality of the Avon and northern tributaries is affected by high levels of phosphates and nitrates. These appear to adversely affect the flora, especially downstream of sewage discharges.

Flora

The plant communities in the Avon and the three northern tributaries are characteristic of a calcareous river with a clay influence. The water crowfoot *Ranunculus penicillatus* var. *pseudofluitans* is dominant through most of the river. Other water crowfoot species are present, reflecting different conditions. In the upper reaches, *R. peltatus* occurs, in the middle reaches, *R. fluitans*, and in the lower, more sluggish, river, *R. circinatus*. The Dockens Water supports *R. flammula* and *R. omiophyllus*, which are characteristic more of bogs that rivers.

Two other groups of aquatic plant are characteristic of the different geological influences. The starworts *Callitriche obtusangula* and *C. platycarpa* grow with water crowfoot in clumps on the riverbed. *C. stagnalis* is more frequent in the chalk tributaries and *C. hamulata* in the Dockens Water. Pondweeds reflect the more enriched nature of the Avon itself, with *Potomageton pectinatus* and *P. perfoliatus* in the upper reaches, and *P. lucens*, *P. silicifolius* (a hybrid between the last two species) and *P. berchtoldii* in the lower section. In the more acid Dockens Water, bog pondweed, *P. polygonifolius*, and broad-leaved pondweed, *P. natans*, are found.

The influence of the more acid sands is also illustrated by the occurrence of common spike-rush, *Eleocharis palustris*, and hemlock water-dropwort, *Oenanthe crocata*.

Other species of the channel flora in the Avon include spiked water-milfoil (*Myriophyllum spicatum),* arrowhead (*Sagittaria sagittifolius*), lesser water-parsnip (*Berula erecta*) and fool's watercress (*Apium nodiflorum*). Flowering rush (*Butomus umbellatus*) occurs in both its submergent and emergent forms, perhaps its fullest expression in a British river. The nationally scarce river water dropwort (*Oenanthe fluviatilis*) is found in the Avon and the Wylye, and the locally important hemlock water dropwort (*Oenanthe crocata*) also occurs in the system, although more characteristically at the river edge.

Adjacent and associated habitats comprise swamp, wet woodland and flood pasture habitats that are now rare both locally and nationally, although they would once have dominated the floodplains of the upper Avon. The swamp communities are dominated by reed sweet-grass (*Glyceria maxima*), common reed (*Phragmites australis*) or lesser pond sedge (*Carex acutiformis*). These are especially important habitats for invertebrates and birds.

The wet woodlands are dominated by alder (*Alnus glutinosa*). Their ground flora is governed by the water levels, with stinging nettle (*Urtica dioca*) on drier ground, and greater tussock sedge (*Carex paniculata*) in wetter areas. There are small stands of mixed alder-ash ((*A. glutinosa–Fraxinus excelsior*) woodland, whose ground flora is characterised by creeping jenny (*Lysimachia nemorum*).

The site includes small fragments of agriculturally unimproved flood pasture. These are dominated by three rare grassland types: meadow foxtail–great burnet (*Alopecurus pratensis–Sanguisorba officianalis*; crested dog's tail–black knapweed (*Cynosurus cristatus–Centaurea nigra*) and crested dog's tail–marsh marigold (*C. cristatus–Caltha palustris*.

These flower-rich grasslands are relics of traditional grazing systems once common throughout Wiltshire's river valleys. Their swards are more productive without fertilisers than many other grassland types. However, they are inferior by modern agricultural standards, and most have been lost to drainage and fertilisation.

Invertebrates

The invertebrate fauna of the Avon is extremely rich and contains most of the species associated with a large river running through calcareous areas. In the upper stretches, over clay, there is a reasonable range of mayfly species and a variety of gastropods. The middle reaches have the most diverse fauna, again especially mayflies and mollusca, including the very localised *Baetis atrebatinus*. Tall fen habitats are notable for the presence of the internationally important Desmoulin's whorl snail. From the lower river two species of aquatic mollusc have been recorded: *Valvata macrostoma* (vulnerable status) and the pea mussel, *Pisidium tenuilineatum* (rare status), both inhabitants of slow-flowing waters.

Birds

The river system and its adjacent vegetation provide a variety of habitats for breeding, wintering and migrating birds. The lower Avon supports a good breeding populations of kingfisher (*Alcedo atthis*), reed warbler (*Acrocephalus scirpaceus*) and sedge warbler (*Acrocephalus schoenobaenus*). It is also important as a feeding site for passage birds, in particular, common sandpiper (*Tringa hypoleucos*), green sandpiper (*Tringa ochropus*) and garganey (*Anas querquedula*). Several pairs of the rare Cettis warbler (*Cettia cetti*) are associated with the riverine habitats.

Around Salisbury and in the upper reaches of the system birds breeding on the river include little grebe (*Tachybaptus ruficollis*), kingfisher and mute swan (*Cygnus olor*). Fringing vegetation is used by reed bunting (*Emberiza schoeniclus*), yellow wagtail (*Motacilla flava*), sedge and reed warblers.

Fish

The system has an extremely diverse fish fauna, with more species recorded in the Avon than in any other British river. The renowned salmonid fisheries, with wild populations of migratory sea trout and brown trout (*Salmo trutta*) and Atlantic salmon (*Salmo salar*). A wide range of coarse fish is present, including bullhead (*Cottus gobio*), minnow (*Phoxinus phoxinus*), three-spined stickleback (*Gasterosteus aculeatus*), dace (*Leuciscus leuciscus*), stone loach (*Noemacheilus barbatulus*), pike (*Esox lucius*), grayling (*Thymallus thymallus*), eel (*Anguilla anguilla*), perch (*Perca fluviatilis*), roach (*Rutilus rutilus*), gudgeon (*Gobio gobio*), bleak (*Alburnus alburnus*). The system is notable for sea lamprey (*Petromyzon marinus*) and brook lamprey (*Lampetra fluviatilis*), the latter having particularly important spawning areas in the upper reaches.

Mammals

The system as a whole is well used by the water vole (*Arvicola terrestris*) and water shrew (*Neomys fodiens*), with occasional recent evidence of European otter (*Lutra lutra*).

A1.3 SSSI Operations Likely to Damage (OLDS) List

(Please note that certain exclusions and other relevant information are defined in the footnotes).

Standard Reference Number	Operation
1	Cultivation including ploughing, rotovating, harrowing and re-seeding except as defined in Footnote 1.
2	The introduction of grazing and alterations to grazing regimes (including type of stock, intensity or seasonal pattern of grazing).
3	Introduction of stock feeding and alterations to stock feeding practice.
4	Alterations to mowing or cutting regimes on agricultural land (including a change from haymaking to silage). The introduction of mowing or cutting vegetation to new areas, including cutting and mowing to make new fishing paths, extend existing ones or re-open disused ones.
5	Application of manure, slurry, silage liquor, fertilisers and lime.
6	Application of pesticides, herbicides and veterinary products, whether terrestrial or aquatic except for the spot-spray or wick (weed-wipe) treatment, in accordance with correct practice and application (as defined in Footnote 2) of creeping thistle, spear thistle, nettle, broad-leaved dock, butterbur, Japanese knotweed, Himalayan balsam, common ragwort, giant hogweed and other notifiable agricultural weeds.
7	Dumping, spreading or discharging of any materials (including effluent disposal) except for works defined in footnotes 1 and 3.
8	The introduction of burning, and alterations to the pattern or frequency of burning.
9	Release into the site of any wild, feral, captive bred or domestic animal*, plant, seed or micro-organism (including genetically modified organisms) except for: i) Brown trout, as currently** undertaken, as defined in footnotes 4 and 5 ii) Game birds as currently** undertaken.
10	Killing, injuring, taking or removal of any live wild animal*or its eggs and nests, including pest control, and disturbing them in their places of shelter (see Footnote 5) except for: i) Fishing with rod and line for all game and coarse fish quarry species other than brook, river and sea lamprey, bullhead and stone loach. ii) The operation of any existing fixed eel traps for catching eels. iii) Mink, brown rat, rabbit, grey squirrel, mice, mole, deer, fox, wasps (where nests in or by the river banks are causing a nuisance) and any non-native crayfish species, by lawful means. iv) Game birds and species covered by a DoE General Licence (Wildlife and Countryside Act 1981 as amended 1991) or any specific DoE or MAFF licence.
11	Destruction, displacement, removal or cutting of any plant or plant remains, including tree, shrub, herb, hedge, dead or decaying wood, alga, moss, lichen and fungus except for: i) Selective cutting and removal of submerged and emergent water plants and riverbank vegetation as currently** undertaken for fishery purposes (see Footnote 5) ii) The mowing of existing fishing paths and rotational scrub control as currently** undertaken
12	The introduction of or alteration to tree and woodland management including planting of trees and shrubs, and clear or block felling in woodland except for

i) The replacement of individual trees following their loss, with a locally appropriate native species
ii) Pollarding, pruning or tree surgery, and felling of individual trees for safety reasons or in compliance with felling regulations.

13a The introduction of or alterations to drainage, including the installation of mole, tile, tunnel or other artificial drains.

13b Modification to the structure of watercourses (rivers, streams, springs, ditches,dykes and drains) including their banks and beds, as by re-alignment, infilling, damming, regrading, revetment, sheet piling and narrowing (see Footnote 1).

13c Dredging, including the removal of vegetated silt accretions, and damage or disturbance of the riverbed except for riverbed cleaning outside spawning seasons (see Footnote 5).

14 Water impoundment, storage and alterations to water levels and tables. Abstraction from surface and groundwater bodies and water utilisation including irrigation and the introduction or restoration of water meadow flooding except as defined in Footnote 3.

15 Infilling or digging of ditches, dykes, drains, ponds, pools, marshes and pits.

16a The introduction of, and alterations to, salmonid, eel and freshwater fish rearing and aquaculture.

20 Extraction of minerals including peat, shingle, sand and gravel, topsoil, subsoil, clay and chalk, except for traditional bank maintenance and repair purposes (see Footnote 1).

21 Destruction, construction, removal, rerouting or regrading of roads, tracks, walls, fences, hard stands, banks, ditches or other earthworks, or the laying, maintenance or removal of pipelines and cables, above or below ground, except as part of traditional bank maintenance and repair (see Footnote 1).

22 Storage of materials except as part of traditional bank maintenance and repair operations (see Footnote 1).

23 Erection of permanent or temporary structures including fences, huts, bridges, boardwalks, deflectors, groynes and other structures, the undertaking of engineering works including drilling; except for: the *in situ* repair and maintenance or replacement of existing and functioning fences, deflectors, groynes, revetments, boardwalks, bridges, duck hides, huts and shelters.

26 Use of vehicles away from existing roads and tracks, and those riverbanks normally driven along, and the use of craft on the river except for:
i) Craft used on the river for fishing and fishery management
ii) Agricultural vehicles used for agricultural purposes and mowing machinery on fishing paths.

27 Introduction of recreational activities, including watersports and 'war-games'.

28a The introduction of, and alterations to, game or waterfowl management and hunting practice (includes the introduction of mink hunting with hounds).

* includes any mammal, reptile, amphibian, bird, fish or invertebrate
** 'currently' is used to denote activities undertaken on a regular basis, at least once within the five-year period preceding designation of the SSSI, and which are now carried out at the same location and the same level of intensity as the last time before the date of notification.

Footnotes

1. The repair and maintenance of river banks (ref OLDs 1, 7, 13b, 20, 21, 22)
Certain types of traditional bank repair and maintenance, where such management is already undertaken

shall not constitute Operations Likely to Damage the Special Interest. These are operations dealing with recent erosion and collapse of the bank or path, or repair, maintenance and replacement of existing revetments and bank piling. They constitute the placement and spreading of locally appropriate material – for example chalk, river gravels and local soil. Where possible the original topsoil/turves shall be replaced as far as is practical, otherwise shall be reseeded with a native grass seed mix appropriate to the location and reflecting the natural vegetation type

2. The use of weedkillers (ref OLD 6)
'Correct practice and application' shall be construed as meaning compliance with the requirements of the Food and Environment Protection Act 1985 and any regulations made under that Act, with particular reference to the Control Of Pesticides Regulations 1986 (COPR). It also comprises approved usage as relates to the product in question, as well as any Environment Agency licence/consent and MAFF or other appropriate guidance issued with the aim of safeguarding aquatic and wetland habitats and wildlife.

3. Alteration of water levels, abstractions and discharges (ref OLDs 7, 14)
The alteration of water levels with hatches and sluices operates largely through traditional arrangements and cooperation between land managers and the Environment Agency. Such operations shall not constitute Operations likely to Damage the Special Interest where currently** practised to apportion water flows between river channels (for example, to disperse cut weed and feed subsidiary channels that normally flow), unless:

a. The activity requires a consent from the Environment Agency that has not been issued;
b. No individual channel is deprived of a significant proportion of its average annual flow for more than five days.

4. Stocking with brown trout (ref OLD 9)
Where currently** undertaken under the necessary authorisations, and where not affecting the long-term survival of indigenous wild brown trout or salmon populations, stocking with brown trout shall not constitute an Operation Likely to Damage the features of Special Interest

5. Fishing and fishery operations, including water weed cutting (ref OLDs 9, 10 and 11)
These activities are subject to regulation by the Environment Agency through byelaws, licences and consents.

Where such activities comply with the appropriate regulation English Nature will not require prior notice to be given. However, the exception of any particular ongoing practices from this list cannot be construed as an endorsement by English Nature that could be used against any future changes in policy or the introduction of strategies and byelaws intended by the Environment Agency to regulate these activities.

A1.4 Avon Valley Special Protection Area

Description of site

Area name: Avon Valley SPA
Administrative area: Dorset
Hampshire
Component SSSI: Avon Valley (Bickton to Christchurch)

Reasons for recommendation as a candidate Special Protection Area

The Avon Valley SPA encompasses the lower reaches of the River Avon and its floodplain on the south coast of England. The site extends for approximately 20 km between Bickton and Christchurch. The River Avon displays wide fluctuations in water level, and parts of the valley are regularly flooded in winter. Consequently, the valley includes one of the largest expanses of unimproved floodplain grassland in Britain, including extensive areas managed as hay meadows and grazing marsh under low–intensity agricultural systems. These extensive floodplain grasslands support wintering Bewick's swans (*Cygnus columbianus bewickii*) in numbers of European importance, and Blashford Lakes Gravel Pits within the SPA are particularly important for wintering gadwall (*Anas strepera*).

Interest(s) submitted to the European Commission

European interest(s):
This site qualifies under Article 4.1 of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive:

Over winter:
Bewick's swan (*Cygnus columbianus bewickii*). 135 individuals representing at least 1.9% of the wintering population in Great Britain (five-year peak mean 1991/2–1995/6).

This site also qualifies under Article 4.2 of the Directive (79/409/EEC) by supporting populations of European importance of the following migratory species:

Over winter;
Gadwall (*Anas strepera*), 667 individuals representing at least 2.2% of the wintering Northwestern Europe population (five-year peak mean 1991/2–1995/6).

Note: Sites selected for waterbird species on the basis of their occurrence in the breeding, passage or winter periods also provide legal protection for these species when they occur at other times of the year

A 1.5 Avon Valley SSSI citation

Site name: Avon Valley (Bickton to Christchurch) SSSI

Status: Site of Special Scientific Interest (SSSI) notified under Section 28 of the Wildlife and Countryside Act 1981

Local Planning Authorities:
Hampshire County Council, New Forest District Council, Dorset County Council, Christchurch Borough Council, East Dorset District Council

National Grid Reference:
SU 147123—SZ 163923

Ordnance Survey Sheets:
1:50,000: Sheet 195
1:10,000: Sheets SZ 19 SW, SE, NW, NE; SU 10 SW, SE, NW, NE; SU 11 SW, SE

Hectares/Acres: 1383.7/3419.1

Date Notified (1949 Act):
1974 (part), 1977 (part)

Date Notified (1981 Act):
1984 (part), 1989 (part) 1993

Other Information:

The site includes three former SSSIs notified under the Wildlife and Countryside Act, 1981: Avon Valley (Bickton-Blashford) SSSI, Avon Valley (Bisterne-Christchurch) SSSI and Kitten's Farm Meadows SSSI, plus other areas previously notified under the 1949 Act but not included in the above sites.

Wessex Water, in conjunction with other bodies, manages the Blashford Lakes complex according to a management strategy and plan.

Description and Reasons for Notification

The Avon Valley Site of Special Scientific Interest encompasses the lower River Avon valley between Bickton in the north and the estuary of Christchurch Harbour in the south. In this, its lowest reach, the river meanders across a broad floodplain dissected by numerous dykes and rivulets. To either side of the floodplain the land rises in a series of river terraces to the extensive heathlands of south-east Dorset and the New Forest. To the north of the town of Ringwood, a series of lakes, known collectively as the Blashford Lakes, has been created by the excavation of aggregate from the river terraces.

The River Avon shows a greater range of habitats and a more diverse flora and fauna than any other chalk river valley in Britain. The floodplain and associated river terraces within the SSSI contain a variety of habitats ranging from herb-rich hay meadows and pastures, through a range of fens and mires to riparian woods, dune grassland and heathland. These habitats support nationally and internationally important assemblages of breeding and wintering birds and an outstanding flora, including several nationally rare and scarce species. The invertebrate fauna reflects the diversity of the habitat and includes many notable species, including dragonflies, grasshoppers and snails.

Although derived from a large chalk catchment, within the SSSI the River Avon flows over acidic sands and clays. Here the chalk river water is supplemented by acid streams draining mainly from the New Forest heaths. The Avon's aquatic flora contains plants adapted to a range of conditions. Sixty-six species of aquatic plant are known to occur in the river channels and associated dykes. The river has a very diverse fish fauna, with at least 27 species of non-salmonid fish known to be present as well as important populations of Atlantic salmon, and migratory and brown trout.

Molluscs are particularly abundant, including the rare water snail *Valvata macrostoma*, and the pea mussel, *Pisidium tenuilineatum*. Although locally modified by dredging and other engineering activities, significant stretches of the river survive that exhibit classic sluggish lowland river features such as meanders, ox-

bows, river cliffs, gravel shallows and backwaters. This diversity of riverine habitat supports populations of rare and threatened plants, such as mudwort (*Limosella aquatica*) and frogbit (*Hydrocharis morsus-ranae*). A wide range of dragonflies is known from the river and dykes, including the nationally rare scarce chaser (*Libellula fulva*).

The floodplain contains extensive areas of agriculturally unimproved grassland, much of it managed traditionally to produce hay. These grasslands support a rich and varied flora, and represent one of the largest expanses of unimproved floodplain grassland in England. Unlike other chalk rivers the Avon displays wide fluctuations in river level. The flora of the floodplain grasslands is influenced by the fluctuations in groundwater table which this produces. In areas regularly inundated with the lime-rich river water, the grasslands are dominated by grasses such as Yorkshire fog (*Holcus lanatus*), the fescues *Festuca pratensis* and *Festuca arundinacea*, and rye-grass (*Lolium perenne*). These grasslands contain an abundance of fen species such as meadowsweet (*Filipendula ulmaria*), water avens (*Geum rivale*), marsh marigold (*Caltha palustris*), common milkwort (*Polygala vulgaris*) and meadow rue (*Thalictrum flavum*).

In slightly higher ground, where the river water has less influence, a more acidic flora has developed containing species such as devil's-bit scabious (*Succisa pratensis*), bog pimpernel (*Anagallis tenella*), purple-moor grass (*Molinia caerulea*) and, on the most acid soils, heather (*Calluna vulgaris*) and cross-leaved heath (*Erica tetralix*). In the driest areas, sand sedge (*Carex arenaria*) is the dominant species of a remarkable sand dune flora associated with islands and ridges of sand deposited in the flood plain. A remarkable feature of the Avon Valley grasslands is the way in which the diversity of grassland types merge one into another, often within a relatively small area, creating some extremely species-rich grasslands containing species indicative of widely different soil conditions.

The sand and gravel river terraces, principally along the eastern edge of the floodplain, support areas of acidic grassland and heathland. Historically, some of these areas have been used as common land. They support an extremely interesting and varied flora, which includes many species more often associated with maritime acid sand dunes, and which are rare in inland Britain. In places sand sedge is the dominant species, helping to bind areas of shifting sand. Heather (*Calluna vulgaris*), bell heather (*Erica cinerea*) and sheep's-bit (*Jasione montana*) are all common in these areas. Where the sand and gravels have become stabilised, a dry open turf has developed, which includes a number of nationally rare and scarce species of clover, including knotted clover (*Trifolium striatum*), subterranean clover (*T. subterraneum*) and bird's-foot clover (*T. ornithipodioides*).

These areas of dry grassland are varied by the presence of damp depressions supporting a heathland plant community composed of purple-moor grass and cross-leaved heath, with devil's-bit scabious and lousewort (*Pedicularis sylvatica*). On trackways, and other areas of exposed sand, a flora adapted to periodic disturbance has developed, which includes mossy stonecrop (*Crassula tillaea*) and lesser quaking-grass (*Briza minor*). These species are restricted to a few localities in inland Britain and are in decline due to the loss of this particularly unusual habitat. The seasonally exposed muddy fringes of numerous ponds within the old commons provide yet another microhabitat for rare and scarce plant species. These include the largest known British population of the endangered brown galingale (*Cyperus fuscus*), a species afforded special protection under the Wildlife and Countryside Act, 1981.

On the western side of the valley a section of the river terraces is farmed under a traditional pastoral system. The localised poaching and dunging by farm stock, combined with the seasonally high water table, provides the habitat for one of the largest populations in Britain of the nationally rare small fleabane (*Pulicaria vulgaris*). In 1990 it was estimated that 22% of the British population of this species was present in this location.

Small woodlands and thickets are found throughout the Avon Valley. These display a wide variety of structure and species composition in response to past management practices and soil conditions. On the dry, sandy soils above the floodplain and on slightly elevated islands within the floodplain, pedunculate oak (*Quercus robur*) and birch (*Betula* spp.) dominate the woods. There are few shrubs in these woods and the ground flora is relatively impoverished, as is typical in woodlands on such acid soils. Where the floodplain and river terraces meet there are numerous springs, where alder woodland predominates. These woodlands tend to be of relatively recent origin and reflect a change in management (probably a

reduction in grazing pressure), in the early part of this century. They display a rich flora containing many fern and mire species indicative of the habitat from which the woodland has developed, including bog myrtle (*Myrica gale*), lesser pond sedge (*Carex acutiformis*) and marsh marigold. Numerous willow woods and thickets occur in the valley. Some are dominated by osier (*Salix viminalis*) and may have been derived from cultivated withy beds. Others contain an interesting range of wlllow species and their hybrids and include the uncommon purple willow (*Salix purpurea*).

The lower Avon Valley grasslands and the Blashford Lakes are of national and international importance for migratory wildfowl and wading birds. The valley grasslands act as winter feeding grounds for large flocks of European white-fronted geese, Bewick's swans, wigeon, teal, shoveler, golden plover and black-tailed godwits, while the Blashford Lakes attract large numbers of wintering gadwall, coot, and mute swans and are used as a crucial roosting site for the flocks of wildfowl that feed in the valley. The Avon herd of 200 or more Bewick's swans represents in excess of 1% of the species' world population and is considered to be of international importance. The valley regularly supports a winter flock of 400 or more European white-fronted geese. Although the numbers of this species wintering on the Avon have declined in recent years, their numbers still constitute over 6% of the UK wintering population and are of national importance. The wintering flock of gadwall using the Blashford Lakes averages over 330 birds and is of international importance, constituting nearly 3% of the northwest European population of this species. Numbers of wintering mute swan and coot in the lakes are of national importance. In addition, the floodplain within the SSSI may at times hold up to 8% of the European population of wintering black-tailed godwits, approximately 400 birds, as well as large flocks of ducks, mainly wigeon (over 6000) and teal (over 300), especially when the valley is partially flooded.

In spring the valley provides a nationally important breeding ground for wading birds dependent on wet grasslands, including redshank, snipe and lapwing. The numbers of wading birds breeding in wet grasslands have declined dramatically throughout Europe as a result of land drainage and intensification of agricultural use. The Avon Valley is considered to be one of the eight most important areas of lowland wet grassland for breeding wading birds in Britain and Ireland. The diversity of wetland habitat within the SSSI, particularly the areas of wet woodland, willow thickets, reedbeds and exposed river gravels, provides nesting sites for a nationally important assemblage of breeding wetland birds. This includes Cetti's warbler, kingfisher, yellow wagtail, sedge warbler, reed warbler, shelduck, and little ringed plover. Barn owl, buzzard and hobby are also known to breed in the valley.

The River Avon also supports a small population of European otter (*Lutra lutra*), the conservation of which depends on the maintenance of a diversity of river features, high water quality and, most importantly, control of disturbance.

The Avon Valley is also designated as a Ramsar site. Details can be found on the JNCC website, www.jncc.gov.uk.

Appendix B
Draft Favourable Condition Tables for the River Avon cSAC

Favourable Condition Table

The Favourable Condition Table (FCT) will be used by English Nature and other relevant authorities to determine if a site is in favourable condition. Favourable condition is achieved when the targets given below are met.

The FCT should inform the scope and nature of any 'appropriate assessment' under the Habitats Regulations, but an 'appropriate assessment' will also require consideration of issues specific to the individual plan or project. The FCT does not by itself provide a comprehensive basis on which to assess plans and projects as required under Regulations 20–21, 24, 48–50 and 54–85. The scope and content of an 'appropriate assessment' will depend upon the location, size and significance of the proposed project. English Nature will advise on a case-by-case basis.

Following an 'appropriate assessment', competent authorities are required to ascertain the effect on the integrity of the site. The integrity of the site is defined in Paragraph C10 of PPG9 as the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified. The determination of favourable condition is separate from the judgement of effect upon integrity. For example, there may be a time-lag between a plan or project being initiated and a consequent adverse effect upon integrity becoming manifest in the condition assessment. In such cases, a plan or project may have an adverse effect upon integrity even though the site remains in favourable condition.

Operational feature	Criteria features	Attribute	Measure	Targets	Comments
River	Water courses with floating formations of water crowfoot (*Ranunculus*) Atlantic salmon Bullhead Sea and brook lamprey	Flow	Limits on licensed abstractions after modelling impacts. Audit every six years, if possible via CAMS.	Flow regime should be characteristic of the river. As a guideline, at least 90% of the naturalised daily mean flow should be maintained throughout the year at all points in the river system. Residual flows at Knapp Mill should not fall below 9 cumecs (to protect the upstream migration of adult salmon)	River flow affects a range of habitat factors of critical importance to designated interest features, including current velocity, water depth, wetted area, substrate quality, dissolved oxygen levels and water temperature. The maintenance of both flushing flows and base flows, based on natural hydrological processes, is vital. Detailed investigations of habitat-flow relationships may indicate that a more or less stringent threshold may be appropriate for a specified reach. However, a precautionary approach would need to be taken to the use of less stringent values. Naturalised flow is defined as the flow in the absence of abstractions and discharges. The availability and reliability of data is patchy – long-term gauged data can be used until adequate naturalised data become available, although the impact of abstractions on historical flow records should be considered. Flows in the Avon system are known to be impacted by historical engineering works that have modified the channel, and by surface and groundwater abstractions. Springs are characteristic of chalk rivers and should be maintained. Headwater sections are particularly vulnerable to abstraction, and downstream migration of perennial heads, other than in drought conditions, is a sign of unfavourable condition.

Common targets for river habitat and selected species

Operational feature	Criteria features	Attribute	Measure	Targets	Comments
River	Watercourses with floating formations of water crowfoot (*Ranunculus*) Atlantic salmon Bullhead Sea and brook lamprey	Water quality	Biological class Environment Agency's General Quality Assessment scheme. Assess every five years.	Salmon 'a' Bullhead >='b' Lamprey species >='b' In addition, no drop in class from existing situation	Generally, water quality should not be injurious to any life stage. A wide range of water quality parameters can affect the status of interest features, but standard biological monitoring techniques provide a reasonable integrated picture in relation to many parameters. The Biological Module of the Environment Agency's General Quality Assessment scheme is based on assessment of the community. All classified reaches within the site that should contain the interest feature under conditions of high environmental quality should comply with the targets given.
			River Ecosystem class. Assess against Environment Agency monitoring results.	Salmon RE1 Bullhead >=RE2 Lamprey species >=RE2 In addition, no drop in class from existing situation (current status is shown in the LEAP 2000–2005)	The River Ecosystem Classification 1995 sets standards for dissolved oxygen, biochemical oxygen demand, total and un-ionised ammonia, pH, copper and zinc. It covers a number of water quality parameters which can cause problems within river systems. All classified reaches within the site that should contain the interest feature under conditions of high environmental quality should comply with the targets given.
			Suspended solids (annual average).	Salmon <=10mgl^{-1} check EA report Bullhead <=25 mgl^{-1} Lamprey species <=25 mgl^{-1}	Elevated levels of suspended solids can clog the respiratory structures of the listed species, with salmon being the most susceptible. Suspended solids measurements are also essential to the estimation of particulate loads within the river network (in combination with gauged flow data), which provides an indication of the risk of siltation problems. The target of 25mgl^{-1} is based on the EC Freshwater Fish Directive; a more precautionary figure has been used for salmon to help protect substrates used for salmon spawning. Elevated levels of suspended solids are thought to be entering the river through point-source (e.g. sewage) and diffuse (e.g. runoff from arable land/roads) discharges.

Operational feature	Criteria features	Attribute	Measure	Targets	Comments
River	Watercourses with floating formations of water crowfoot (*Ranunculus*) Atlantic salmon Bullhead Sea and brook lamprey	Water quality	Soluble reactive phosphorus (annual mean) (Total reactive phosphorus as measured by the Environment Agency is acceptable)	Targets dependent on river type. Shortly to be agreed by the Environment Agency and English Nature.	Elevated phosphorus levels interfere with competitive interactions between different higher plant species and between higher plants and algae, leading to the loss of characteristic higher plants and large diurnal sags in dissolved oxygen levels. *Ranunculus* habitat is extremely vulnerable. The respiration of artificially large growths of benthic algae may generate poor substrate conditions for species such as the lampreys (in the larval stage). The Avon system is considered to be impacted by elevated levels of phosphorus from point (mainly sewage) and diffuse (arable runoff/soil) discharges
		River substrate	Silt content (optimal form of measurement to be decided in consultation with the Environment Agency.)	Channels should be dominated by clean gravels. Maximum silt content: *Ranunculus* <20% in top 10cm of mid-channel gravels; Salmon <10% in top 30cm of spawning substrates; Lampreys – salmon target but with associated beds of aerated silt present; Bullhead – no excessive siltation on the surface of or within coarse substrates.	Siltation of riverine sediments, caused by high particulate loads (fines of <60 microns) and/or reduced scour within the channel, is a major threat to interest features. Elevated silt levels can interfere with the establishment of *Ranunculus* plants, and with egg and larval survival in salmon, lampreys and bullhead. The requirements of species vary depending upon use of the substrate. Some relate to the level of aeration within the substrate and some to the ability of the substrate to physically catch eggs or plant fragments in surface interstices. The target for salmon has been used for lamprey species in the absence of species-specific information (although it is recognised that lamprey utilise only the top few centimetres for spawning). Where there are upwelling springs within the river bed, the target for salmon can be revised upwards, due to increased substrate aeration. Sources of silt include run-off from arable land and land trampled by livestock, sewage, and fish farm discharges.

Common targets for river habitat and selected species

Operational feature	Criteria features	Attribute	Measure	Targets	Comments
River	Watercourses with floating formations of water crowfoot (*Ranunculus*) Atlantic salmon Bullhead Sea and brook lamprey	River form	Assess channel form by hydro-geomorphological survey; identify degraded stretches where restoration is required and would be practical. Audit progress with restoration every six years.	Channels should be generally characteristic of river type and appropriate to naturalised flow conditions.	Widening or deepening of channels, and extensive artificial reinforcement of banks, are likely to cause unfavourable condition. Headwater sections are particularly vulnerable to reprofiling. Where previous channel engineering is contributing to or causing unfavourable condition, appropriate restoration to a more characteristic state should be undertaken, where practical, within a strategic framework and using techniques that work with nature. This may include removal of existing structures within rivers, after individual assessment.

Extra targets for watercourses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation

Operational feature	Criteria feature	Attribute	Measure	Targets	Comments
River	Water courses with floating formations of water crowfoot (*Ranunculus*) This feature is a habitat not a single species	Extent and composition	Mapping of representative sample stretches (to be identified) in June or July every three years.	Presence of characteristic plant species; absence of indicators of unfavourable condition.	The chalk river component of this plant community comprises *Ranunculus penicillatus* var *pseudofluitans*, associated in the channel with *Callitriche obtusangula* or *C. platycarpa,* rarely with *Oenanthe fluviatilis* or *Potamogeton lucens*, and up to 5% cover of *Myriophyllum spicatum*. In shallow bankside margins the following plants may be present: *Berula erecta*, *Apium nodiflorum*, *Rorippa nasturtium aquaticum*, *Myosotis scorpioides*, *Veronica anagallis-aquatica* and *Veronica beccabunga*. In-channel vegetation of the river should be dominated by this community. The absence of *Ranunculus* together with the presence of blanketweed and other algae, or the dominance of *Potamogeton pectinatus* are signs of unfavourable condition.
		Reproduction ***NB Ongoing EA R&D project on* Ranunculus *may lead to amendment of this limit***	Annual observations in June/July. Information will also be obtained from mapping of sample stretches for extent and composition. Audit Code of Practice every three years (Environment Agency and English Nature)	A significant proportion of *Ranunculus* and other characteristic species should be able to grow and reproduce naturally in suitable habitat. (i.e. *Ranunculus* flowering and seed set should take place before mid-July)	Any in-channel vegetation management should ensure that a significant proportion of the *Ranunculus* community is allowed to flower and set seed naturally. Management should therefore aim to leave a patchy distribution of *Ranunculus* at all points in its range within the river system (with a guideline of at least 25% allowed to flower in any 100m stretch). Practices which do not achieve this are likely to lead to unfavourable condition Use of herbicides should be avoided.

Extra targets for Atlantic salmon (*Salmo salar*)

Operational feature	Criteria features	Attribute	Measure	Targets	Comments
River	Atlantic salmon	Habitat structure	Distribution and area of spawning habitat. *(Form of assessment to be decided for measures in this column.)*	Maintain and where necessary restore (Hampshire Avon Salmon Action Plan shows salmon usage of the Avon System)	This habitat is defined as stable coarse substrate without an armoured layer, in the pebble to cobble size range (16–256mm) but with the majority being <150mm. Water depth during the spawning and incubation periods should be 15–75cm. Flow velocity should be within the range 50–90cm sec^{-1}
			Distribution and area of nursery habitat.	Maintain and where necessary restore	Fry habitat is indicated by water of less than 20cm deep and a gravel/pebble/cobble substrate. Parr habitat is indicated by water of 20-40 cm depth and similar substrate. Flow velocity should be within the range 25-40cm/sec
			Presence of adult holding areas.	Ensure that holding areas occur throughout the salmon range	Holding areas are defined as pools of at least 1.5 m depth, with cover from features such as undercut banks, vegetation, submerged objects and surface turbulence. They are not considered to be a critical feature on the Avon System, although river management should aim to maintain a number distributed throughout the river system.
			Extent of submerged and marginal plants	Maintain patchy cover	Submerged and marginal vegetation is used by juvenile salmon in chalk rivers. Cutting operations should aim to leave a proportion of this vegetation
			Extent of bankside tree cover with submerged tree root systems	Maintain to an extent characteristic of the river type (this feature is very limited on the Avon system, except the Nadder and the Dockens Water)	Overhanging trees provide valuable shade and food sources, whilst tree root systems provide important cover and flow refuge for juveniles. Historical management of the chalk stream stretches of the Avon and the water meadows in the floodplain has resulted in a very limited extent of this habitat feature.
			River form	Maintain and where necessary restore degraded reaches to a more varied form and semi-natural form.	A diversity of water depths, current velocities and substrate types necessary to fulfil the spawning, juvenile and migratory requirements of the species. Close proximity of different habitats facilitates movement to new preferred habitats with age. Operations that widen, deepen and/or straighten the channel reduce variations in habitat. New operations that would have this impact are not acceptable within the SAC, whilst restoration will be needed in some reaches.

Extra targets for Atlantic salmon (*Salmo salar*)

Operational feature	Criteria features	Attribute	Measure	Targets	Comments
River	Atlantic salmon	Access	Artificial obstructions (Baseline survey, then check every six years).	No artificial barriers significantly obstructing adults from reaching existing and historical spawning grounds, and smolts and kelts from reaching the sea.	Artificial barriers should not exceed 45cm unless sufficient depth exists below the obstruction to enable salmon to leap the barrier. Appropriate steps should be taken to ensure that migrating smolts and kelts are not significantly entrapped in off-takes from the river (such as fish-farm intakes or water meadow systems).
		Biological disturbance	Fish introductions	No stocking of salmon, unless agreed by English Nature to be in the best interests of the population.	The Avon population of Atlantic salmon is considered to be a pristine chalk stream form which has not been altered by stocking. Within the Avon system genetic differences may exist between the different tributaries. These differences may have adaptive significance and, therefore, need to be conserved. Population enhancement by habitat improvement and control of exploitation is the main nature conservation focus; stocking should only be considered as an emergency interim measure, and it is not currently considered to be in the best interests of the SAC.
				No stocking of other species at excessively high densities in salmon spawning and nursery areas.	The presence of artificially high densities of other salmonids creates unacceptably high levels of predatory and competitive pressure on juvenile salmon. Guidance will be produced on the definition of excessive in this context.
				Effective screening on all fish farm intakes and discharges.	Escapes from fish farms are a form of uncontrolled introduction and should be prevented.

Extra targets for Atlantic salmon (*Salmo salar*)

Operational feature	Criteria features	Attribute	Measure	Targets	Comments
River	Atlantic salmon	Biological disturbance	Exploitation (Application of voluntary agreements and Environment Agency byelaws.)	Steps taken to ensure that exploitation does not interfere significantly with the ability of the river to achieve its Minimum Biological Acceptable Limit	Where an SAC is not achieving its MBAL 4 years out of 5, river-specific controls on exploitation need to be put in place irrespective of the underlying causes of poor performance. These should consist of a package of measures operating over a period of 10 years, to be implemented as a matter of urgency (preferably within one year). The choice of exploitation controls depends on the degree of non-compliance with the MBAL and a range of river-specific considerations. The Avon is currently performing very poorly in relation to its MBAL, achieving only 35.1, 21.5 and 30.4% of the required level of spawning in 1997, 1998 and 1999 respectively. Controls on exploitation should cover migratory passage to the SAC within territorial waters, including estuarine and coastal net fisheries. Controls currently in place on the Avon are by voluntary agreement with nets in Mudeford Harbour to release all salmon and catch and release operated voluntarily by +/- all rods

Extra targets for bullhead (*Cottus gobio*)

Operational feature	Criteria feature	Attribute	Measure	Targets	Comments
River	Bullhead (*Cottus gobio*)	Habitat structure	Extent of gravel/pebble-dominated substrate.	Maintain and where necessary restore riffle habitats throughout range	Females lay sticky eggs on the underside of stones. Larger stones on a hard substrate, providing clear spaces between the stream bed and the underside of pebbles/cobbles are therefore important. There should be >5 cm water depth over riffles in the summer.
			Extent of refuges	Maintain and where necessary restore refuge features	Refuges are important for shelter against high flow conditions. Suitable refuges in the Avon System include cobbles*, side channels*, pools, woody debris, submerged tree root systems and marginal vegetation with >5cm water depth. (*EA studies showed these habitats are preferred)
			Extent of high canopy tree cover	Maintain intermittent cover where characteristic of the river system	The relative importance of shade compared to the provision of woody debris is unclear, but the maintenance of intermittent tree cover in conjunction with retention of woody debris ensures that habitat conditions are suitable. *In lowland reaches without any riparian trees, it may be desirable to introduce a limited amount of cover.*
			Extent of submerged higher plants	Maintain patchy cover where characteristic of the river/reach (<40% cover appears to be preferred on the Avon system, with <20% optimum)	The importance of submerged higher plants to bullhead survival is unclear, but it is likely that where such vegetation occurs it is used by the species for cover against predators. Cutting operations or other perturbing activities should aim to leave a significant proportion of vegetation in a mosaic with clean gravels.
			Extent of woody debris	Should be retained where characteristic of the river/reach	Bullheads are particularly associated with woody debris where it is likely that it provides an alternative source of cover and spawning substrate.
			River form	Maintain and, where necessary, restore the characteristic physical form of the river channel. Water depth in range 0–60cm (0–20cm is preferred in Avon system)	A diversity of water depths, current velocities and substrate types necessary to fulfill the spawning, juvenile and migratory requirements of the species. Close proximity of different habitats facilitates movement to new preferred habitats with age. Operations that widen, deepen and/or straighten the channel reduce variations in habitat. New operations that would have this impact are not acceptable within the SAC, whilst restoration is needed in some reaches.

Extra targets for bullhead (*Cottus gobio*)

Operational feature	Criteria feature	Attribute	Measure	Targets	Comments
River	Bullhead (*Cottus gobio*)	Access	Artificial obstructions	No significant impediment to essential fish movement between reaches. Where sluices/weirs etc present a potentially damaging barrier, alternative routes should be ensured (e.g. back channels, streams, ditches), or management ensured that allows access at important times of year.	Vertical drops of more than 18-20 cm are sufficient to prevent upstream movement of adult bullheads. They will therefore prevent recolonisation of upper reaches affected by lethal pollution episodes, and will also lead to constraints on genetic interactions that may have adverse consequences. There are many controlling structures on the Avon system and their significance in controlling bullhead movement is unclear. Assessments should be made in light of bullhead distribution, focussing on headwaters.
		Biological disturbance	Introductions	No stocking/transfers of bullhead unless agreed by English Nature to be in the best interests of the population.	Bullheads are relatively sedentary and interactions between populations in different parts of the catchment and in different catchments are likely to be limited, suggesting the existence of genetically discrete populations. Since they are of no angling interest, deliberate transfers between sites are unlikely to have been undertaken in the past, such that the genetic integrity of populations is likely to be intact.
				No stocking of other fish species at excessively high densities in bullhead spawning and nursery areas.	The presence of artificially high densities of salmonids and other fish will create unacceptably high levels of predatory and competitive pressure on juvenile and adult bullhead.
				Effective screening on all fish farm intakes and discharges	Escapes from fish farms are a form of uncontrolled introduction and should be prevented.
				Absence of non-native crayfish	Bullhead densities have been found to be negatively correlated with densities of non-native crayfish in the River Great Ouse, suggesting competitive and/or predator-prey interactions.

Extra targets for brook lamprey (*Lampetra planeri*) and sea lamprey (*Petromyzon marinus*)

Operational feature	Criteria feature	Attribute	Measure	Targets	Comments
River	Brook and sea lamprey	Habitat structure	Area of spawning habitat.	Maintain and where necessary restore	This habitat is defined as well-oxygenated gravel/pebble-dominated (1.5–11cm) substrate of at least 10cm depth, overlain by a range of water depths (0.2–1.5m). Typical spawning locations are upstream of riffles and downstream of weirs. Sea lamprey typically spawn in deeper water than brook lamprey, but in larger river reaches brook lamprey also spawn in deeper areas.
			Area of nursery habitat	Maintain and where necessary restore	This habitat is defined as open-structure, aerated, silty and sandy substrates, between 2 and 40cm depth, typically overlain by less than 0.5m of water. Slack-water channel margins are particularly important, whilst silt accumulations behind weirs can also be valuable in impounded sections. The requirements of the two species are similar and so they are often found in the same nursery beds, but in deeper water (up to 2.2m) sea lamprey are more likely to dominate.
			Area of emergent riparian vegetation	Maintain a high extent throughout the river system	Emergent vegetation within marginal nursery habitat stabilises the substrate and greatly increases habitat suitability.
			Extent of bankside tree cover	Maintain to an extent characteristic of the river type	This helps to provide temperature micro-gradients within the channel, which provides greater flexibility in habitat selection.
			River form	Maintain and where necessary restore the characteristic physical form of the river channel	Diversity of water depths, current velocities and substrate types is necessary to fulfil the spawning, juvenile and migratory requirements of the species. Proximity of different habitats facilitates movement to new preferred habitats with age. Operations that widen, deepen and/or straighten the channel reduce variations in habitat. New operations that would have this impact are not acceptable within the SAC, whilst restoration may be needed in some reaches.
		Access	Artificial obstructions	No artificial barriers significantly impairing adults from reaching existing and historical spawning grounds.	Lampreys can pass some potential barriers by attaching themselves to structures or river banks by their suctorial discs and creeping up or by strong bursts of swimming. The passability of barriers by different species and sizes of lampreys should be assessed on a site-specific basis, most sensibly by survey of the upstream limit of distribution of each species.

Extra targets for brook lamprey (*Lampetra planeri*) and sea lamprey (*Petromyzon marinus*)

Operational feature	Criteria features	Attribute	Measure	Targets	Comments
River	Brook and sea lamprey	Biological disturbance	Introductions	No stocking/transfers of lampreys unless agreed by English Nature to be in the best interests of the population.	It is uncertain whether there are significant genetic differences between lamprey populations of the same species. Since they are of no angling interest, deliberate transfers between sites are unlikely to have been undertaken in the past, such that the natural genetic character of populations is likely to be intact. The degree of fidelity to natal spawning grounds in unclear. Any agreed introductions should involve local stock as a precaution.
			Exploitation	Zero exploitation until further notice	Lampreys have recently become popular in the UK as bait for pike-fishing. There are also indications that UK populations are sought after as a delicacy in Europe, where stocks are declining. Adult lampreys are usually caught by trapping, whilst juvenile lampreys can be removed by sieving, netting or digging out nursery habitat. Anecdotal evidence of adult trapping suggests heavy losses of fish on some rivers. In the absence of adequate knowledge of population dynamics and sustainable yields, exploitation is not acceptable within cSACs.

Extra targets for Desmoulin's whorl snail (*Vertigo moulinsiana*)

Operational Feature	Criteria Feature	Attribute	Measure	Target	Comments
Rivers	*Vertigo moulinsiana*	Structure and composition of marginal vegetation	Extent of habitat, comprising unbroken stands of appropriate vegetation.	Maintain overall extent of unbroken stands of *Glyceria maxima* and/or *Carex riparia* and/or *acutiformis* on river banks and drainage ditches, subject to natural change.	This includes existing known sites for *Vertigo m* but should also apply to all suitable habitat elsewhere in the cSAC
Fens/swamp	*Vertigo moulinsiana*	Structure and composition of tall fen and swamp vegetation	Area of stand of appropriate vegetation, as mapped in Avon Valley survey 1994–5, and Ian Killeen survey 1996	Maintain extent of suitable habitat including tall ungrazed blocks of *Glyceria maxima,* sparse *Phragmites* and/or *Carex riparia* and/or *acutiformis* extending in unbroken stands.	
Rivers Fens	*Vertigo moulinsiana*	Water table	1. Depth below ground level; 2 & 3. Vegetation indicators of drying out.	1. High water table throughout the year (wet to pressure all year); not deeply flooded in summer months. 2. Not more than occasional replacement of preferred dominant species by plants of drier conditions. e.g. nettles, *Epilobium hirsutum*, or by dense tall reed. 3. Not more than occasional replacement of tall monocots by plants preferring consistently wetter conditions, e.g. *Rorippa nasturtium-aquatilis*, *Apium nodiflorum* or *Berula erecta*.	*V. moulinsiana* requires highly humid conditions which are met by a high water table below the stands of vegetation in which it lives. Unfavourably wet conditions can result from prolonged flooding in summer or water penning too high.
		Vegetation height	height	Average height of the stands no less than 50cm when grown (May–Sept)	*V. moulinsiana* requires tall leaves on which it lives most of the year. Heavy grazing and mowing is detrimental if it removes most taller clumps.
		Shading by shrubs and trees (e.g. sallow, alder)	percentage of habitat with potential for supporting the snail.	Less than 10% of river system and adjacent Vertigo habitat in deep shade, less than **30%** in dappled shade, as characteristic for the river system	Shading vegetation should not be allowed to develop to the extent that it is becoming dominant or dries out ground.

Extra targets for Desmoulin's whorl snail (*Vertigo moulinsiana*)

Operational feature	Criteria features	Attribute	Measure	Targets	Comments
Rivers Fens	*Vertigo moulinsiana*	Water quality	Biological class - Environment Agency's General Quality Assessment scheme. Assess every five years River Ecosystem Class. Assess against Environment Agency monitoring results.	>= 'b' In addition, no drop in class from existing situation No drop in class from existing situation - all SSSI/cSAC river is RE1/RE2.	See comments in general targets issued for fish, etc. No values are given for suspended solids as this pollutant has no direct influence on the condition of the habitat of *V. moulinsiana*.
		Litter	approximate thickness	A thin layer resulting from normal winter die-back.	The snail overwinters in the litter.

Additional parameters to consider within appropriate assessments

A range of specific parameters may be relevant to the assessment of the likely impact of a plan or project in addition to those specified in the favourable condition table. This should not be considered as an exhaustive list but indicates some keys areas of concern.

Water column parameters

Consideration of the effects of heavy metals, herbicides, pesticides (particularly sheep dip chemicals) and hydrocarbons is essential. In particular, species such as white-clawed crayfish and salmon are highly susceptible to even very low concentrations of sheep dip. The risks of impact on *Ranunculus* habitat of riparian applications of atrazine and isoproturon on winter cereal and maize crops are also of particular concern.

Water hardness is a key issue on chalk river systems such as the Avon. The activity most likely to interfere with water hardness is the mass transfer of water from areas with different geologies.

Effects on temperature regime may have important consequences for a number of species. For instance, crayfish breeding is initiated by an extended period of water temperatures below 10°C during the autumn, and may be adversely affected by heated discharges.

Substrate quality

Elevated sediment phosphorus levels may lead to excessive growths of tolerant rooted-macrophytes and benthic algae, and may also result in enhanced release of soluble phosphorus to the water column.

Sediment oxygen levels are important to the survival of salmon eggs and fry, lamprey eggs and ammocoetes and probably juvenile pearl mussels. Inorganic silt can interfere with aeration within coarse substrate, but in both coarse and fine substrate the sediment oxygen demand is a key consideration, driven by the presence of degradable organic matter. In siltbeds, levels of organic matter that generate anoxia or near-anoxia will make the habitat unsuitable for lampreys.

Appendix C
Relevant Projects and Initiatives in the Avon Catchment

Asset Management Planning (AMP)

Every five years, the Director General of the Office of Water Services (OFWAT) sets the limit on the amount the water companies in England and Wales can charge their customers. This process is known as the Periodic Review. The Periodic Review for 2000–2005 achieved price cuts for customers and also set a programme for environmental improvements.

This programme for environmental improvements is known as the Asset Management Planning (AMP) process and will tackle water company sewage discharges and abstraction problems. Included in the current programme (AMP3) are schemes and investigations on 72 SSSIs. This constitutes a capital investment of £100 million.

The challenge now is for water companies to complete these schemes and investigations according to the timetable set. In addition, where investigations indicate that a public sewage discharge is causing a problem, remedial action must be taken without delay.

Biodiversity Action Plans

Action to conserve our nationally important habitats and species is largely taken at the local level through Local Biodiversity Action Plans (Local BAPs). The BAPs provide the specific objectives and targets against which progress is measured. These local plans are developed through cross-sectoral partnerships identifying who should do what, and where. In this way the plans are just as much a process as a product; the coming together of local groups committed to long-term action for biodiversity is a key outcome. As well as ensuring that national BAP targets are translated into effective action locally, BAPs have the following functions: to identify targets for locally significant and characteristic species and habitats, to reflect the values of local people and to raise local awareness of biodiversity.

The Wiltshire, Hampshire and Dorset BAPs have been published and should stimulate a more focused approach to biodiversity with opportunities for new projects.

Catch and Release

In addition to legislative measures, voluntary catch and release is promoted on the Avon as a tool to conserve salmon stocks. In the mid-1990s, Wessex Salmon and Rivers Trust negotiated a scheme sponsored by Tesco in which anglers who returned salmon received vouchers. The Trust also negotiated and sponsored a catch-and-release scheme with the Mudeford nets. In 2002, the net-catch-and-release scheme was sponsored by the Avon and Stour Rivers Association.

Catchment Abstraction Management Strategy (CAMS)

In March 1999, the government published a document detailing changes to the abstraction licensing system. Some of the changes required are achievable within the existing powers of the Environment Agency, and one of the proposals was the development of Catchment Abstraction Management Strategies (CAMS). CAMS aim to make more information on water resources allocation more publicly available

and allow the balance of needs between abstractors and the aquatic environment to be determined in consultation with interested parties (*Managing Water Abstraction: The catchment abstraction management strategy process*, Environment Agency 2001).

When considering a new application, or variation to an existing abstraction licence, the Environment Agency must ensure that river flows, groundwater levels and water levels in wetlands do not fall below the minimum ecologically acceptable level required to conserve the aquatic environment. However, the needs of existing protected rights and lawful uses of water must be met. CAMS aim to balance these needs in an open way, setting out a strategy for sustainable management of water resources at a catchment scale. CAMS should provide a consistent approach to the management of water resources (Environment Agency 2001). South Wessex CAMS will be based on four LEAP catchments. However, the process will not be applied to the River Avon until 2004.

Catchment Flood Management Plans (CFMP)

Catchment Flood Management Plans (CFMP) will be developed to consider the adequacy of existing infrastructure and options for managing flood flows on a catchment basis. A 50-year perspective will be considered including climate change and changes in land use. It is intended that CFMPs will influence local plans, particularly with regard to the assessment of flood risk.

CFMPs are programmed for completion by September 2004, although national guidance is still being developed. The Inception Phase started in early June 2002 and is due to be completed in 2003. Halcrow have been commissioned to prepare all 11 Inception documents for South West Region. It is planned to complete 13 CFMPs in the South West. One is under way as a pilot and another has already been started in-house. The consultation process is being developed, although the main aim is to assemble data and influence and begin to understand catchment interactions.

Countryside Stewardship

The Countryside Stewardship Scheme is the government's main scheme for the wider countryside, which aims, through the payment of grants, to improve the natural beauty and diversity of the countryside, maintain, enhance, and restore targeted landscapes, their wildlife habitats and archaeological/historic features, and to improve opportunities for public access where appropriate. It operates outside Environmentally Sensitive Areas.

Farmers and land managers enter 10-year agreements to manage land in an environmentally beneficial way in return for annual payments. Grants are also available towards capital works such as hedge laying and planting, repairing dry stone walls, etc.

Eutrophication Control Action Plans (ECAPS)

ECAPS form part of the Environment Agency's Eutrophication Management Strategy, which is an initiative aimed at establishing a more co-ordinated approach to the control of nutrient enrichment in England and Wales. The strategy identifies a range of actions relating to policy, science and operational activity. At a local level, ECAPs will provide a structured approach to addressing complex eutrophication issues.

Crucially, the Environment Agency's eutrophication strategy recognises the concept of ecological risk as a basis for action, in addition to observed impacts. The relevant Environment Agency National Centres recognise that an intrinsic part of ecological risk is the vulnerability of the receiving ecosystem, and therefore designated sites feature prominently in the pilot ECAPS.

For many sites, ECAPs will be a formalisation of work that is already being undertaken locally, with more of an emphasis on structured reporting against objectives. The initial draft guidance will be tested on 11 pilot sites, chosen to reflect ecological concerns in a range of water types where existing investigations can be built upon.

High nutrient levels have been highlighted as an issue for many years on the Hampshire Avon catchment. However, isolated initiatives and piecemeal approaches have not yet demonstrated any marked improvement in the situation. The Hampshire Avon has been chosen as the chalkstream ECAP pilot.

The ECAP will include:

- An objective review of the problem and evidence;
- Development of appropriate nutrient objectives/targets;
- Development of an integrated control action plan (including consideration of socio-economic as well as environmental factors in a cost–benefit analysis).
- Consideration of resource planning for future control actions.

It is envisaged that this plan will be a dynamic document, evolving as knowledge improves, through an iterative planning-review process. This approach parallels requirements stemming from implementation of the Water Framework Directive. The ECAP will draw together existing local initiatives into an overarching framework, which will allow identification of future work priorities in order to address the problem of eutrophication in the Hampshire Avon.

A South Wessex Area project team drawing from various Environment Agency functions has already been set up, and three national centres will support the work of this team. The first Hampshire Avon ECAP is currently being drafted and should be circulated for consultation in early 2003.

The Avon Valley ESA scheme

The Avon Valley ESA Scheme aims to maintain, and where possible, enhance, the pastoral landscape character of the valley, its watercourses, and associated wildlife and historic resources. The scheme encourages a range of traditional grazing systems and other sympathetic land management to meet these aims.

Environmentally Sensitive Area Scheme

The Environmentally Sensitive Areas Scheme was introduced by the MAFF in 1987 to encourage farmers to help safeguard areas of the countryside where the landscape, wildlife or historic interest is of national importance. There are now 22 ESAs in England, covering some 10% of agricultural land.

Fisheries Action Plan (FAPS)

This following description is contained within the National Trout and Grayling Strategy, Consultation document (July 2001). The National Trout and Grayling Strategy defines policies for the Environment Agency to fulfil its statutory duty to maintain, develop, and improve trout and grayling fisheries in England and Wales. Implementation of the strategy will be through Fisheries Action Plans (FAPs), which will be subject to local consultation. FAPS will cover all types of fishery (including salmon, trout and other freshwater fish and eels). Locally the FAP will:

- Classify fisheries as wild, supported or put and take.
- Define salmon and trout nursery areas and other habitats to be protected from impacts of stocking.
- Assess local angling opportunities to identify where improvements in trout and grayling fisheries will generate greatest socio-economic benefits.
- Assess potential for the Environment Agency and others to improve angling opportunities and enhance conservation of wild stocks through habitat improvement projects.
- Identify appropriate sources of finance.

Hampshire Avon LEAP

The Hampshire Avon Local Environment Agency Plan (LEAP) details the local agenda of integrated action for environmental improvement. The LEAP enables the Environment Agency to identify, assess and solve environmental issues related to its functions and integrate action on all aspects of catchment management. The LEAP takes into account the views of other organisations and the public (Environment Agency 2000). A review of the actions is undertaken annually in order to maintain progress or modify actions where appropriate. The LEAP process came to an end in 2002, making the current LEAP the last one to be produced for the Avon catchment.

Landcare

The Landcare project was set up by the Environment Agency in 1997 in response to evidence that the River Avon was suffering from nutrient enrichment. A Landcare consortium was also set up comprising farming, government, councils, water companies and fishery groups in order to help support farmers improve management practices.

Landcare aims to reduce non-point pollution from agricultural activities through awareness raising and promotion of best agricultural practice. Several demonstration sites have been put in place to show the benefits (both economic and environmental) of best-management techniques. Another aspect of the project is to monitor land-use practices and farmer attitudes.

Restoring Sustainable Abstraction (RSA) Programme

The Environment Agency's Restoring Sustainable Abstractions (RSA) programme covers a diversity of sites that are, or are suspected of being, affected by abstraction. The RSA programme brings together investigations of abstractions thought to be impacting on rivers and the Review of Consents process. Under this programme, in 1997 the Environment Agency produced a list of sites for which it wanted to see water quality or quantity improvement schemes. One hundred and eighteen schemes to improve water quantity were included in the 2000–2005 OFWAT review, including schemes proposed for the Chitterne and Upper Wylye abstractions. (*Managing Water*, Environment Agency 2001)

Salmon Action Plan (SAP)

The Hampshire Avon Salmon Action Plan (SAP) (Environment Agency 1997) is the local mechanism by which to implement the Environment Agency National Strategy for management of salmon fisheries. The historical and current status of salmon stocks were described and a spawning target for the Avon stock was calculated. The current stock status was then examined in relation to the target. Limiting factors were identified, ranked and feasibility of measures to remove these factors assessed (Environment Agency 1997).

The SAP addresses monitoring of stocks, control of mortality in the fishery, improving key habitats including spawning medium, obstructions to migration, reduced flows and channel morphology. Actions designed to enable the spawning target to be achieved within five years were proposed, and a cost and overall benefit analysis carried out. This enabled prioritisation of the proposed actions and the production of funding scenarios.

In addition, the SAP identified issues with no feasible resolution: impact of legal Irish fisheries, competition for habitat from trout, piscivorous predation of fry and parr, and poor pre-fishery survival of smolts. The proposed actions to address issues considered to be impacting on spawning targets were limited to those issues for which a feasible solution was identified. Implementation of the proposed actions has been partial, due to lack of funding. The SAP will be reviewed in 2003.

Water in Hampshire Project

There is increasing concern over the substantial and increasing pressures that are being placed on Hampshire's water environment. Such pressures include new development, climate change, and domestic consumption.

In response, the 'Water in Hampshire' project was established in 1999. By forming a partnership of organisations from across the public, private and voluntary sectors, the project aims to raise the profile of water; gain a better understanding of the environmental, planning and management issues associated with the county's water environment; and to develop sustainable solutions. The project takes a holistic look at water issues, focuses predominantly on the county's freshwater resources, and appears to be the first of its kind in the UK.

The consultation draft of the Hampshire Water Strategy has been prepared by the project steering group, which is made up of representatives from nine diverse organisations. The strategy's overall aim is to ensure the long-term future of Hampshire's freshwater environment. Preparation of this document started with a stakeholder event, which formed the basis of a wider water partnership for Hampshire. Comments are now invited on the draft strategy. Further details can be found at www.hampshireswater.org.uk.

Water Framework Directive

The purpose of Directive 2000/60/EC, Establishing a Framework for Community Action in the Field of Water Policy (known as the Water Framework Directive), is "...to establish a framework for the protection of inland surface waters, transitional waters, coastal water and groundwater ...".

The directive requires significant changes to the way in which we currently manage our water. These include:

- A more integrated management of all natural waters, acknowledging the inter-dependency of different waterbodies.
- Assessment of water quality in terms of its ecological state as opposed to the traditional reliance on chemical monitoring.
- A more comprehensive suite of monitoring to include physico-chemical, biological, and hydromorphological parameters.
- The control of diffuse pollution.
- The production of plans outlining water quality objectives, and measures required to achieve these targets.
- Superseding relevant directives into one overall framework of legislation.

European member states are initially required to establish River Basin Districts (RBDs). These are areas made up of two or more neighbouring river basins making appropriate units of management. Within these RBDs, all significant water bodies will be defined (for example, rivers, transitional (estuarine), coastal, etc.). These waterbodies will be then be 'typed' according to certain physical characteristics. Once this typology has been assessed, ecological reference conditions will be established for the waterbody describing the ecological quality that would be expected in the absence of anthropogenic impacts. Pressures and impacts on the water bodies will then be reviewed and monitoring programmes will be established. Monitoring data will inform the classification of waterbodies as high, good, moderate, poor or bad ecological status. Finally, river basin management plans will be produced containing a programme measures aimed at ensuring that ecological targets are achieved.

WLMPs for the River Avon and Avon Valley

In order to produce an effective Water Level Management Plans (WLMPs) for the Avon Valley SPA/SSSI and River Avon cSAC/SSSI, a two-stage approach is being taken. The floodplain has been divided up into 30 hydrological units, for each of which a plan is being prepared, clearly defining conservation aims and features of importance, constraints, land use and hydrological and management objectives. The plans determine the water-level needs for each site and set out how these needs can be met.

The Environment Agency, with advice from English Nature is currently drafting WLMPS for the hydrological units in the upper River Avon System cSAC/SSSI, having completed most of the plans south of Salisbury in the Avon Valley SPA/SSSI. Once the Environment Agency and English Nature have agreed all the plans, implementation plans will be developed in conjunction with landowners and stakeholders including fishing clubs.

In some cases the WLMPs will only represent existing practices – often where there is no practical way to control water levels or to alter the existing management regime, or there may be no environmental or agricultural reason for doing so. Elsewhere, there may be agreement that raised water levels at particular times are desirable and would benefit the interests of the SPA/cSAC/SSSI. In this case any changes to the drainage system or drainage control would only be carried out after further detailed consultation and by agreement with the landowner. These works could include the construction or refurbishment of control structures and/or modifications to the existing drainage system, including weed cutting.

The main mechanism for implementing WLMPS will be agri-environment schemes, such as the Avon Valley ESA scheme (the Avon up to Netheravon) and elements of the Countryside Stewardship scheme (Wylye, Till, Bourne, Nadder and Avon upstream of Netheravon). A project officer has recently been appointed by the Environment Agency to oversee the consultation and implementation work and will work closely with the ESA and Stewardship officers.

The implementation of the WLMPs will involve meetings between the Environment Agency, English Nature and stakeholders within each hydrological unit. This will be the first time these interest groups have been formally brought together across the cSAC/SPA/SSSIs to decide how to integrate management for agriculture, flood defence and conservation. The resulting structure should be a useful mechanism for addressing future management issues in the river and valley.

Appendix D
Summary of Water Quality Data

River Ecosystem Class

River water quality is assessed using the River Ecosystem (RE) Classification. Figure D1 shows the Environment Agency RE class targets and performance for 2001 (2001b). Between 1997 and 2000 the River Avon was classed as 'very good', 82.7% (RE 1) and 'good', 17.3% (RE 2), representing an RE compliance of 92.6%. The significant RE class non-compliance was for the Nadder and is attributed to a raised BOD due to agricultural diffuse pollution (Environment Agency 2002). For information on RE class see the LEAP and the Landcare monitoring report (Environment Agency 2000 and 2001).

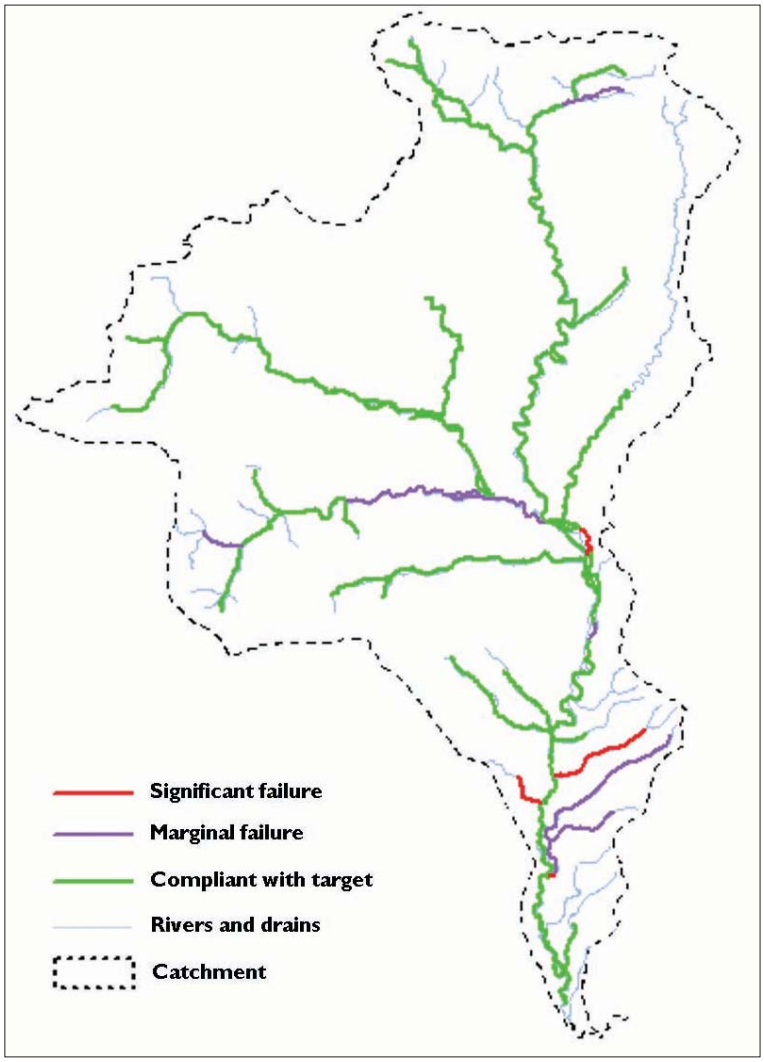


Figure D1. River Ecosystem (RE) class compliance 2001

Phosphate Levels

Eutrophication is the process of nutrient enrichment, and can have adverse effects on aquatic ecosystems. Nutrients in fresh waters originate from both point and diffuse sources and are dependent on a number of factors for dilution, including in-river flow. Phosphorus is typically in shortest supply in rivers and has the most potential to limit plant growth. Phosphorus enrichment can alter the composition of plant communities by affecting the competitive balance between species, including higher plants and algae. This is particularly relevant for the cSAC species and habitat, as explained in Section 2.

The Avon catchment has high phosphorus levels throughout, and trophic diatom analysis shows that the headwaters of the Nadder and Avon are moderately eutrophic (Environment Agency 2002). Comparison of monitoring data to the proposed favourable condition targets shows widespread non-compliance in the Avon cSAC. A detailed assessment of the compliance of SACs with phosphorus targets is underway, and is awaiting approval by the Environment Agency national water quality function. Figure D2 shows soluble reactive phosphorus levels recorded at Landcare sites in the Avon catchment between 1995 and 1999.

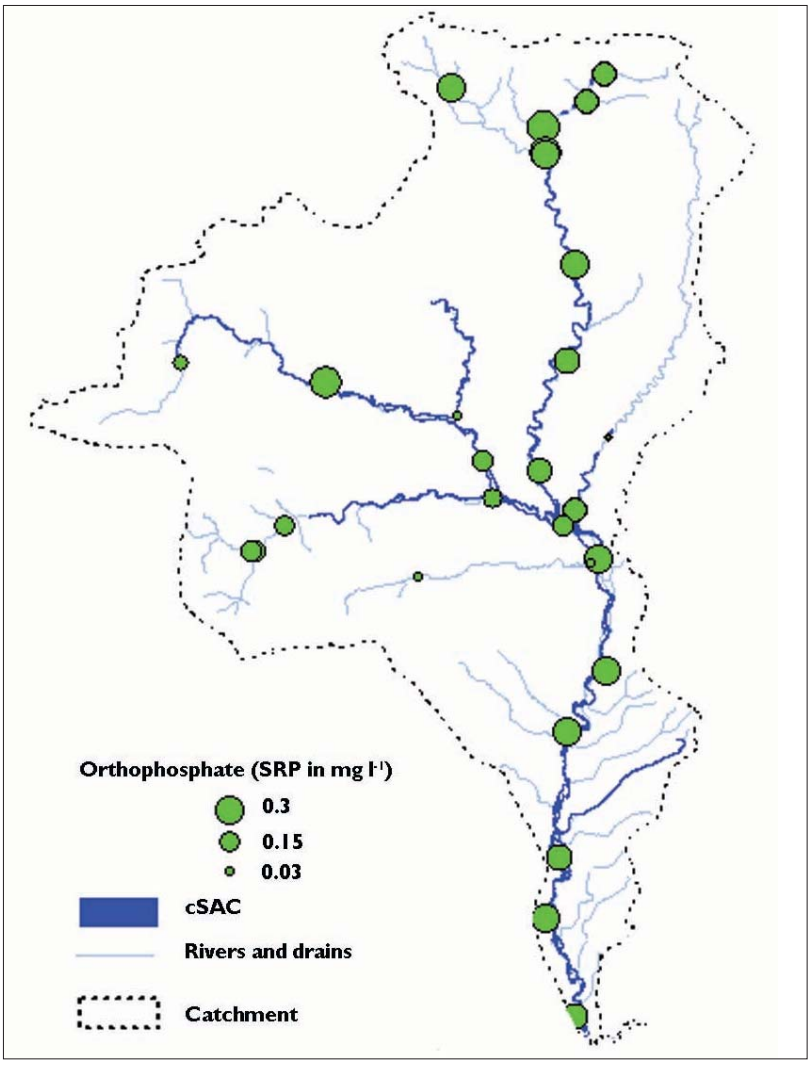
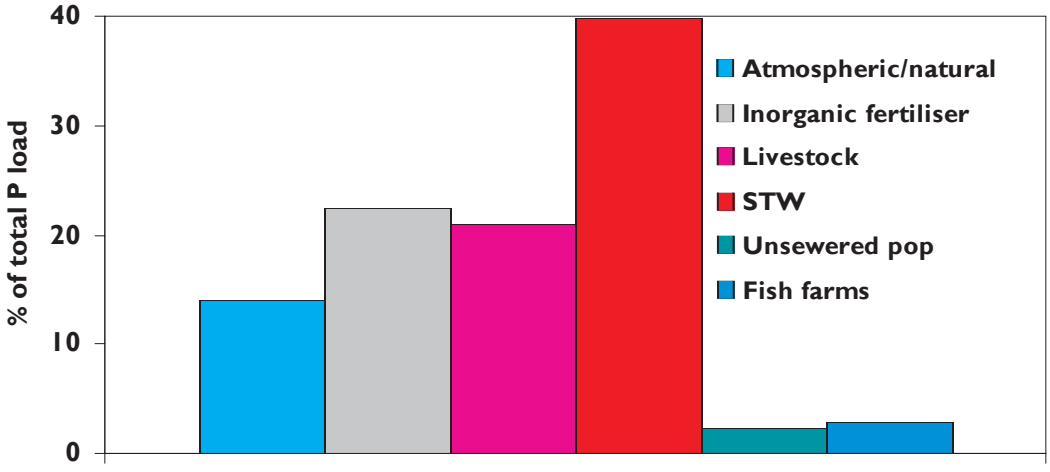


Figure D2. Soluble reactive phosphorus (SRP) levels 1995–1999

Parr *et al.* (1998) constructed an annual nutrient budget to estimate the input of phosphorus to the upper Avon from various sources. The results are summarised in Figure D3.

The study concluded that phosphorus from major sewage treatment works (STWs) is the most significant input during the growing season. These inputs are now being addressed through the periodic review process (see Section 3). Since this study was carried out, phosphorus removal has begun at several public STWs. However, smaller point sources, diffuse sources and sediment recycling of phosphorus will continue to contribute to elevated phosphorus levels in the future (Environment Agency 2000b). In order to reduce phosphorus levels, an integrated approach involving action on point and diffuse sources is required (Parr *et al.* 1998).



Atmosphere/ natural	Inorganic fertiliser	Livestock	Sewage treatment works	Unsewered population	Fish farms
14%	22.4%	21%	39.9%	2.3%	2.8%

Figure D3. Phosphorus budget for the upper Avon (from Parr *et al.* 1998).

Suspended Solids

Artificially elevated levels of fine particulates (silts) can have a major physical effect on the cSAC, as described in Section 2. Mean annual suspended sediment concentrations have been analysed at six locations in the Avon catchment and found to have remained fairly constant over the last 25 years (Environment Agency 2002b) as shown in Figure D4.

In general, concentrations were below the target of 25 mg l^{-1} for bullhead and lamprey but above the target of 10 mg l^{-1} for salmon. Figure D5 shows mean suspended solids levels recorded at Landcare sites in the Avon catchment between 1995 and 1999.

The Landcare monitoring project shows that, in general, suspended solid levels appear to be below the target levels, however fines in salmon redds are still considered an issue. This may be related to seasonal variations in suspended solids and the effect of fines on intra-gravel oxygen levels.

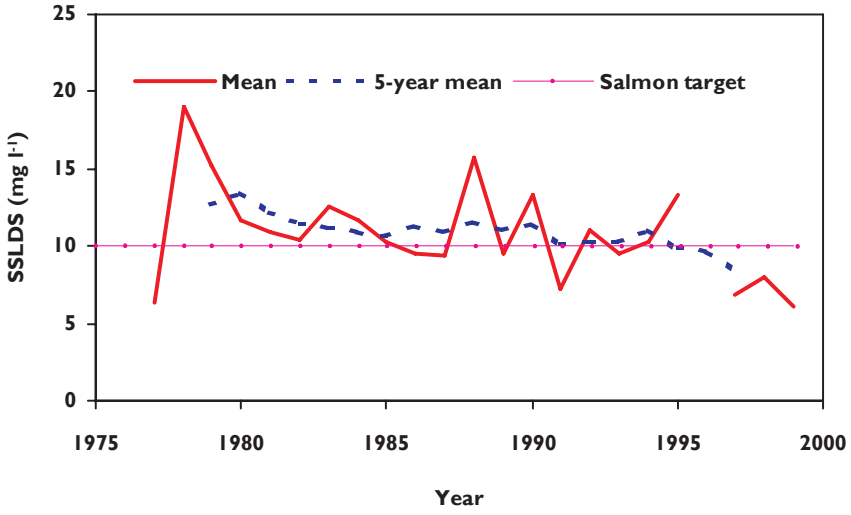


Figure D4. Historical suspended solids data.

Gravel Composition and Silt Content

Studies have shown that egg and alevin survival rates are affected by the presence of fines in spawning gravels. In 1993 an investigation of salmon spawning gravels by the Institute of Freshwater Ecology concluded that the Avon was on the limits of fine sediment loading (IFE 1993). Subsequent studies have found varying levels of fines in gravels, as summarised in Table D1.

Increased levels of fine sediment are thought to be impacting on the success of salmon spawning in the Avon cSAC. It is difficult to draw conclusions from the studies of sedimentation due to differences in sample size, flow regimes and use of different monitoring techniques. However, the studies did record levels of fine sediments in gravels approaching or above the draft favourable condition target for salmon.

Table D1. Summary of gravel composition studies.

Study	**Main purpose**	**Fraction** (% of sample)		**Location**
		<1mm	<0.064mm	
IFE study (1993)	Fine sediment levels in pre-spawning beds	>15 <15		Combined strata Top 100mm
NRA infiltration baskets (1996)	Measure sediment build up rate and composition		5–11 24 20	Nadder, Avon, Bourne Wylye Till
Game Conservancy Council (1995/96)	Comparison of gravel before and after cleaning	16-19%		Bisterne
M Heywood (ongoing PhD)	Build-up of fine sediment in salmonid redds	8 10		Wylye Nadder

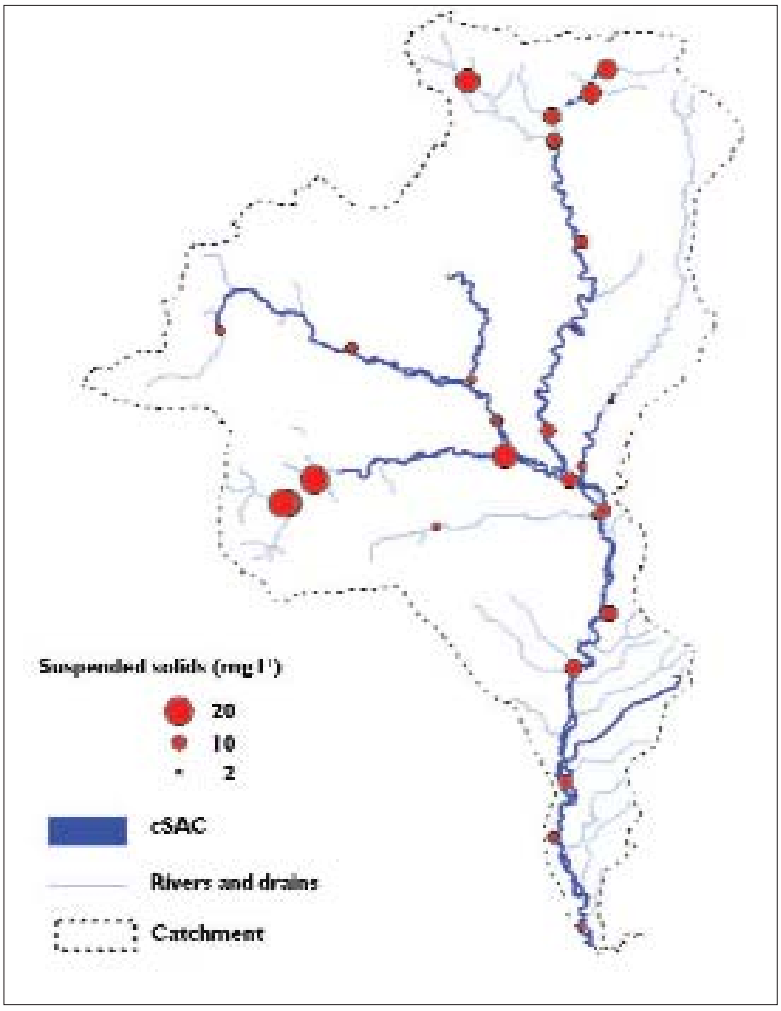


Figure D5. Suspended solids data 1995–1999.

Data on gravel composition and suspended solids are not routinely monitored, and have only been collected in recent years as part of special projects on the Avon. Methods for monitoring silts and suspended solids are being assessed, and a standard methodology will be produced as part of **Life in UK Rivers**. The monitoring strategy for the River Avon cSAC will consider monitoring of suspended solids and sediment further.

Other Pollutants

There is increasing concern about biologically active substances that can affect bullhead, lamprey and salmon even at very low levels, by disrupting their endocrine systems (Environment Agency 2000). These pollutants are known as endocrine disrupters and include some pesticides and oestrogens. In addition, some of these substances are directly toxic to aquatic species.

Certain substances, both natural and synthetic, can affect the normal functioning of the endocrine (hormone) system in animals. The main concern about endocrine-disrupting substances has so far centred around their effect on reproductive processes, but other effects are also under investigation.

Of 29 pesticides routinely monitored throughout the catchment since 1997, 19 have been detected on one or more occasion, and of these, 16 were at levels above the EC drinking water standard, as shown in Figure D6. The Environment Agency has formulated actions to tackle several potential endocrine-disrupting substances, including Atrazine and Simazine, which feature in pesticides detected on the Avon. Widespread uptake of best farming practice (see Section 3) is required in order to reduce the level and frequency of pesticide detection.

Detections of pesticides and exceedences of the drinking water standard were most common in the eastern and western arms of the Avon and the Nadder (Environment Agency 2002a). The exact level at which pesticides will impact the cSAC features are not well defined, but the number and level of pesticides detected is of concern.

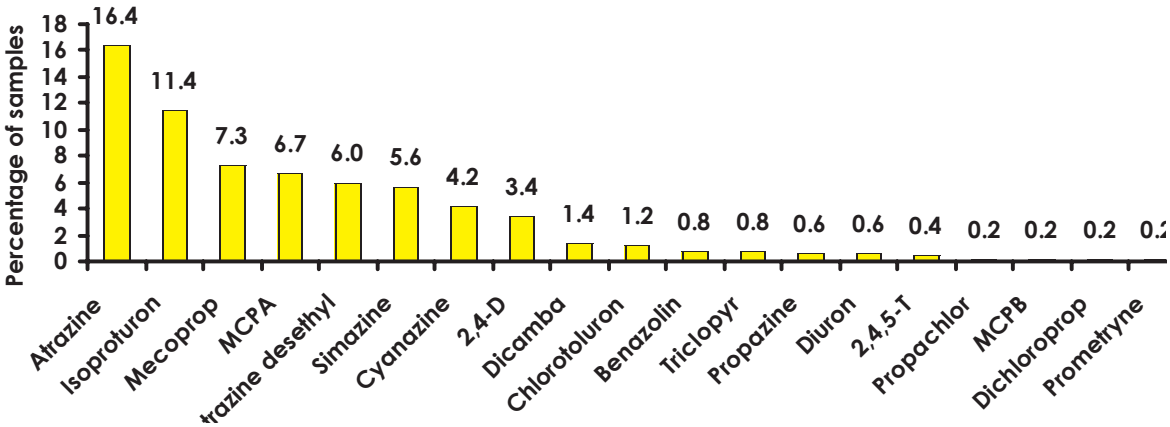


Figure D6. Pesticides detections in the Avon catchment 1997–2000.

Appendix E
Draft Weed-cutting Protocol

Weed-cutting criteria, combined with the Environment Agency's weed-cutting maps and a cutting vs flow diagram, form the foundation of a draft consenting protocol between English Nature and the Environment Agency. The protocol enables the organisations to discharge their respective legal duties, and compliance is compulsory. The draft protocol has been developed in the light of experience and will be reviewed at the end of each weed-cutting season. The protocol will be distributed at the start of every year to ensure the information reaches all those who need it to plan their management of the river and land.

The decision-making framework for weed cutting is shown in Figure E1. The DEFRA ESA project officer will primarily be involved in reviewing the process rather than in individual consents.

Draft weed-cutting criteria

The 'criteria for cutting' describe the circumstances under which the Environment Agency will carry out a cut, as the environmental impacts in the cSAC are outweighed by the overall environmental benefit to the area that cutting will affect (SPA, ESA and SAC).

Criteria that will be used are:

- Saturated topsoil
- Rate of rise of river leading to saturated topsoils in two weeks
- Severe poaching due to high groundwater levels even where stocking rates are appropriate to the ESA and Avon Valley SSSI management agreements
- To allow compliance with ESA and SSSI management agreements (for example, stocking rates and haymaking) at appropriate times.

Consideration of impact on the Avon Valley ESA and SSSI will guide Environment Agency decisions with respect to impact on any reach where those areas exist. The guiding requirements for wetness in the ESA and SSSI are:

- Before end of April; 10%, surface water by area
- Before end of May; 5%, surface water by area
- Before end of June; wet ditches with water levels not greater than 0.3 m from ground level.

Criteria not to be used for cutting (reasons that do not justify a cut) are as follows:

- Cultivation
- Silage machinery access
- Maintenance of access
- To allow owners to breach ESA agreements
- Temporary high river levels due to storm water

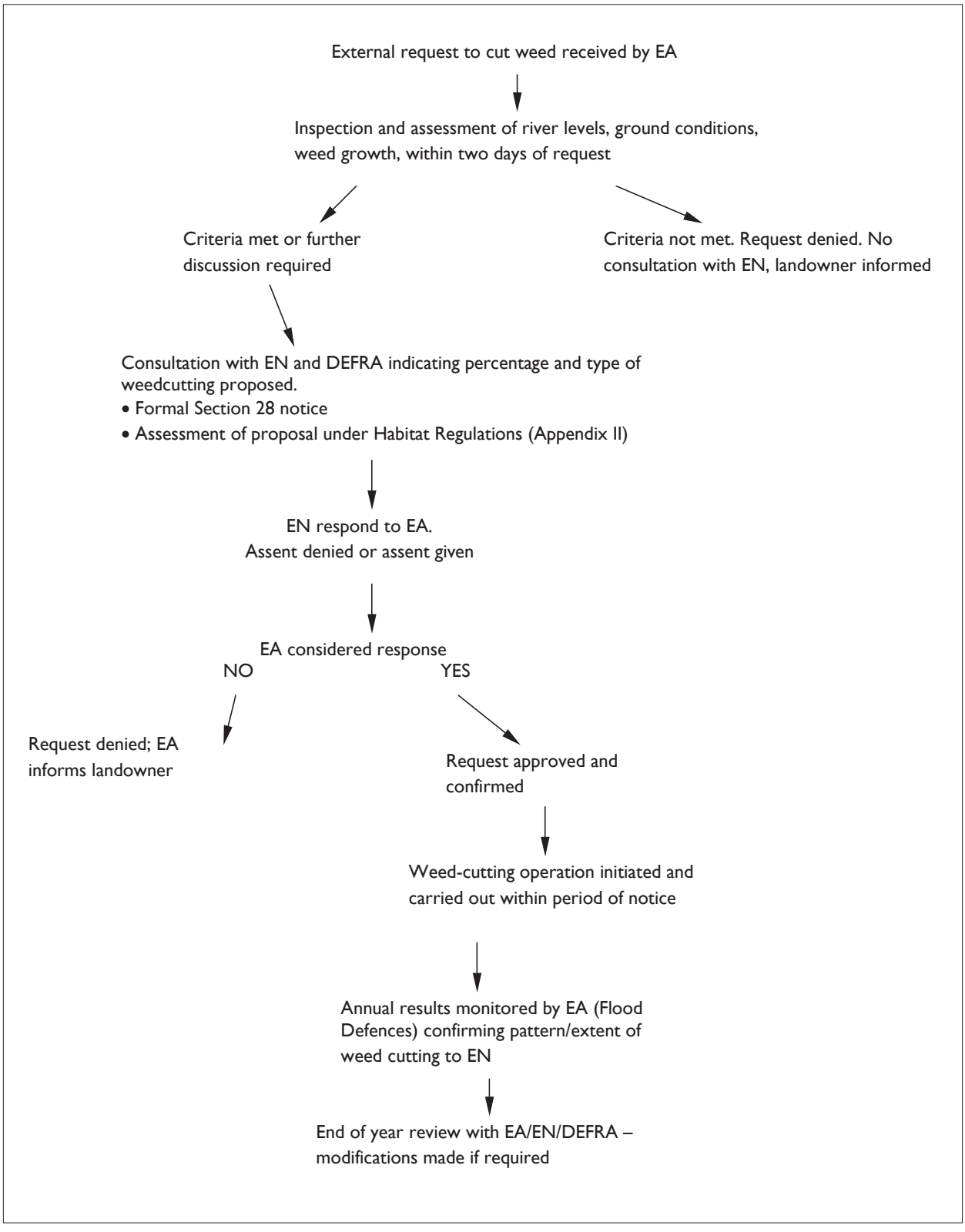


Figure E1. Draft decision-making flow chart for weed cutting.

Appendix F
Flood-defence Schemes

There are currently five flood-defence schemes under development in the Avon Valley. These are:

- Salisbury, including Wilton and Harnham
- Downton
- Fordingbridge
- Ringwood
- Christchurch Harbour and riverside
- Salisbury/ Wilton/ West Harnham.

Schemes were completed for both Wilton and West Harnham in 1991. In Wilton, 15 properties were protected by the construction of raised earth embankments along the rivers Nadder and Wylye, including a floodgate on the Nadder. West Harnham saw 400 m of raised earth banks incorporating a hydrobank to the south of the River Nadder, with automated sluice gates at Harnham Mill, protecting over 25 properties. These defences were tested in winter 2000, when the whole area was affected by flooding from the rivers Avon and Nadder.

As a result of this flooding, it was decided that a study was required to assess the effectiveness of these recent schemes, and also for possible improvements throughout the Salisbury area. This study is currently at the investigation stage, and has identified a further 200 properties that could be protected if the proposed improvement scheme goes ahead. This is now planned for 2004/5 in two phases, the first being Salisbury west walk and town centre, and the second being at Harnham.

Improvements throughout the area are being evaluated along both the Avon and the Nadder. Catchment-wide alleviation schemes being considered include:

- Increasing river channel capacity by enlarging/ improving flow characteristics
- Upstream storage of flood waters.

Downton Flood Alleviation Scheme

During winter 2000, over 40 properties in Downton were flooded, and vital road connections were flooded for several weeks. This was caused by a number of different sources: the main River Avon, ordinary watercourses such as the New Court Carrier and Bunny, plus highway drains, sewers and groundwater.

Following liaison between Salisbury District Council and the Environment Agency (EA), the best course of action was decided to divert floodwater away from the village as fast as possible. Work in advance of the main scheme was conducted in winter 2001 to clear river channels of debris, plant growth and silt. Culverts were checked and cleared, and some re-profiling of fields was undertaken to allow floodwater to flow freely. In all, 17 separate schemes were identified. The main scheme for the area involves:

- Creating flood banks through the area, along the Avon
- Creating a two-stage channel on the River Avon
- Collector drains and surface water pumping
- Improving water channels
- Defences to the west of Newcourt Carrier.

The project is currently undergoing the design stages. Construction work is due to take place during 2003 and 2004, with the project to be completed by 2005 at a total cost of £1.5 million.

Fordingbridge

Fordingbridge saw flooding in 1995 and 1999, but most severely in winter 2000, when it was affected by a combination of fluvial flooding and overland flow caused by the River Avon, Swetsford Water and Ashford Water, as well as surface runoff and subcharged sewers. Almost 60 of properties were affected, the A338 Southampton Road was dramatically flooded and properties along it suffered severe flooding.

The project for the area is currently at the option appraisal stage, with consideration being given to:

- Improvements to the East Mills Gauging Station, building due for 2003
- Construction of earthbanks
- Dredging and channel works
- Flood berms
- Reservoir storage.

The project passed through the design stages in 2002, with construction due to start during 2003, continuing throughout 2004 and beyond to a total cost of approximately £1 million.

Ringwood

The winter floods of 2000 were the worst the area had seen in 72 years. Previous flood events in 1995 and 1999 were eclipsed, with over 25 properties being affected by flooding. The causes were the River Avon and Bickerley Mill stream, as well as surface water runoff and subcharged sewers.

Following liaison between New Forest District Council, Hampshire District council and the EA, the best course of action was decided to be a combination of several flood defence options to include:

- Building of floodbanks and walls
- Reducing the flow of water into the Bickerley Mill stream.

Initial approval for the project was given in August 2001, design stages took place during 2002, and construction will commence in 2003/4.

Christchurch Harbour (Sailing Club) and Riverside

The Lower Stour Flood Alleviation Scheme was completed in 1992/93, with over 900 properties protected by 5.3 km of improvements, including the dredging of silt from channels, clearing bridge arches and the construction of 1.7 km of flood walls and 2.3 km of earth banks. This was followed in 1998 by the Lower Avon scheme, protecting over 100 more properties with 300 m of flood walls.

Due to technical difficulties and landowner resistance at the time the schemes were completed, the area around Christchurch Harbour Sailing Club and Riverside Park were left unprotected and are still prone to flooding. Winter 2000 flooding saw over 10 properties affected. This was caused primarily by the River Stour, the River Stour Estuary and tidal flooding.

This scheme is currently at the early stages and is undergoing investigation. At present the area surrounding the sailing club has no major schemes planned. Some local improvements have been suggested but are unlikely. The area of Riverside Park is due for further investigation.

Appendix G
Development Schemes

There are two areas where major development is currently planned in the Avon catchment; Amesbury and Allenby/Connaught.

Amesbury

Over the next five years, considerable development is planned in or near Amesbury, currently a small market town on the edge of Salisbury Plain. The number and scale of the proposals, coupled with the dynamic nature of river systems, are resulting in a demanding and complex appropriate assessment of the plans alone and in combination with each other. The proposals include:

- Housing and business park development allocated under the current Salisbury District Local Plan
- Amesbury Business Park
- Housing developments
- Improvements to the A303 (the Stonehenge and Winterbourne Stoke bypasses)
- A new Stonehenge Visitor Centre.

A proposal for military and commercial development at nearby Boscombe Down was submitted last year, but ultimately withdrawn. However, it is possible that further plans for this site may be made in future.

Allenby/Connaught

The Ministry of Defence (MOD) is intending to develop housing and facilities for military personnel at Allenby and Connaught in order to accommodate an increase in troop numbers on Salisbury Plain. It is proposed to implement efficiency measures to ensure there is no resultant demand for water resources.

Issues

The major proposed developments have considerable potential to impact on the designated sites, in particular the River Avon cSAC. The main concerns are:

- Runoff, spillage, leakage, etc., during construction
- Runoff during operation/use of the developments
- Increased demand on water resources in the area from the increased resident, working and visitor populations
- Increased sewage disposal, possible requiring construction works at the two nearby sewage treatment works.

These could result in:

- Reduced water quality (contaminated water, elevated levels of suspended solids, chronic inputs of road traffic products)
- Loss of habitat and reduced habitat quality (sedimentation of the riverbed)

- Altered hydrology, leading to reduced flow in the river system
- Disturbance to wildlife and habitat.

All developments will require authorisation from the Environment Agency, principally discharge consents. Wessex Water also has a formal role in respect of water supply and sewage treatment and disposal.

Road Schemes

A number of proposed road schemes in Wiltshire have had government funding either approved or earmarked through the recent Local Transport Plan settlement. The county council will need to ensure that each scheme receives the requisite environmental assessment, taking into account sites with nature conservation designations, protected species and recognised biodiversity interests, using the most up-to-date methodology. Schemes of relevance to the cSAC are described briefly below.

Brunel Link/Harnham Relief Road, Salisbury

English Nature considers that the Brunel Link element is likely to have a significant impact on the River Avon cSAC, and therefore an Appropriate Assessment is required in addition to the wider Environmental Assessment. The Harnham relief road is thought to carry much less risk than the Brunel Link. However, a full Environmental Assessment must be carried out, which may identify ecological issues not yet known.

The main issues of concern are:

- Direct loss of habitat
- Pollution of the river system during construction and operation of the road (sediment ingress is of particular concern)
- Indirect pressures on the river system if floodplain dynamics are altered.

English Nature considers that the Salisbury Local Transport Strategy has not fully assessed the potential impacts of the Brunel Link on the cSAC or SSSI, nor demonstrated that alternatives have been considered. Alternatives (including 'no road' options) need to be fully explored, and must be assessed in relation to River Avon cSAC under the Habitats Regulations. There are also likely to be impacts on the wider interests of the River Avon System SSSI, and on protected species.

A350 Westbury Bypass

This scheme has progressed well and funding is confirmed. Two routes are currently under consideration, an eastern route and a variation on the original far-western route. Both start at the same point at Yarnbrook, close to Picket and Clanger Woods SSSI. English Nature has been consulted at various stages, and objects to the option that would damage Picket and Clanger Woods SSSI.

There are issues of concern regarding the eastern route in relation to the River Avon cSAC. Impacts on water resources will need to be assessed, especially if alternative source(s) of water are required that could may result in an increased demand on the River Wylye.

A36 Wylye Valley Relief Road

Two route options are being worked up in detail. Both would cross the floodplain of the River Wylye (other options could cross the River Till as well). The river crossings are likely to have a significant impact on the River Avon cSAC, and an Appropriate Assessment must be carried out in addition to the wider Environmental Assessment. The issues are largely the same as for the Brunel Link.

Wiltshire County Council is hoping to consult on the Preferred Route in mid-2002, with the planning application being submitted in late 2002/early 2003.

English Nature considers that the Salisbury Local Transport Strategy has not fully assessed the potential impacts of the A36 Wylye relief road on the cSAC or SSSI, nor demonstrated that alternatives have been

considered. Alternatives (including 'no road' options) need to be fully explored, and must be assessed in relation to River Avon cSAC under the Habitats Regulations. There are also likely to be impacts on the wider interests of the River Avon System SSSI, and on protected species

Codford to Heytesbury

The proposed bypassing of Codford and Heytesbury is an old scheme resurrected due to earmarked funding (subject to design), but now reduced to single carriageway. The route would run along Wylye Valley, but to the north outside of the floodplain. As Codford and Heytesury are already bypassed, the need for this road would have to be demonstrated. The Environment Agency has expressed concerns about potential impacts on water resources in relation to public water supply.

Blashford Lakes

There are several recreation proposals, mineral extraction and water supply issues at Blashford Lakes in Hampshire. The potential effects are likely to be related to the Avon Valley SPA/Ramsar, rather than the River Avon cSAC. However, the complex hydrological issues will require assessment, including impacts on the Dockens Water and River Avon. The Blashford Lakes Management Plan and Strategy is currently being reviewed. The Review of Consents is a key part of this process, and in particular those consents under review by Hampshire County Council. Consideration should also be given to the alien plant and bird species present, including Canada geese, goosander, Himalayan balsam and Australian swamp stonecrop.

Avon Common

There is a proposal for large-scale gravel extraction and landfill at Avon Common, which is adjacent to the Avon Valley SPA and Dorset Heaths cSAC. The work would include laying a pipeline across the Avon Valley to permanently drain down the site directly into the River Avon. Any such proposal would be subject to an Appropriate Assessment to determine the likely effect on all the relevant Natura 2000 sites. Concern has been expressed regarding water quality impacts, including changes in pH levels.

Appendix H
Summary of Physical Habitat Data

The most appropriate method of assessing habitat quality for the SAC's features has yet to be determined and is the subject of research within **Life in UK Rivers**. However, there are several sources of useful information that can be used to gain an overview of physical habitat in the River Avon cSAC in the absence of a formal evaluation technique.

River Habitat Survey

River Habitat Survey (RHS) is a method that has been developed for assessing the physical character and quality of river habitats based on results from a standard field survey. The main types of channel modifications recorded during RHS survey are reinforcement, re-sectioning and regulation of flow by impounding structures. The RHS data collected in the field can be used to express the degree of modification of the riverbed and banks (Environment Agency 2002).

RHS has been carried out throughout the Avon catchment, covering approximately a quarter of the river length. The results of these surveys can be obtained from the Environment Agency in Blandford.

The degree of habitat modification for the River Avon and main tributaries (including the Ebble) are summarised in Figure H1 (note that the Ebble is not within the cSAC). The majority of sites surveyed (65%) were pristine/semi-natural or predominantly unmodified, with the remainder being classed as either obviously or severely modified.

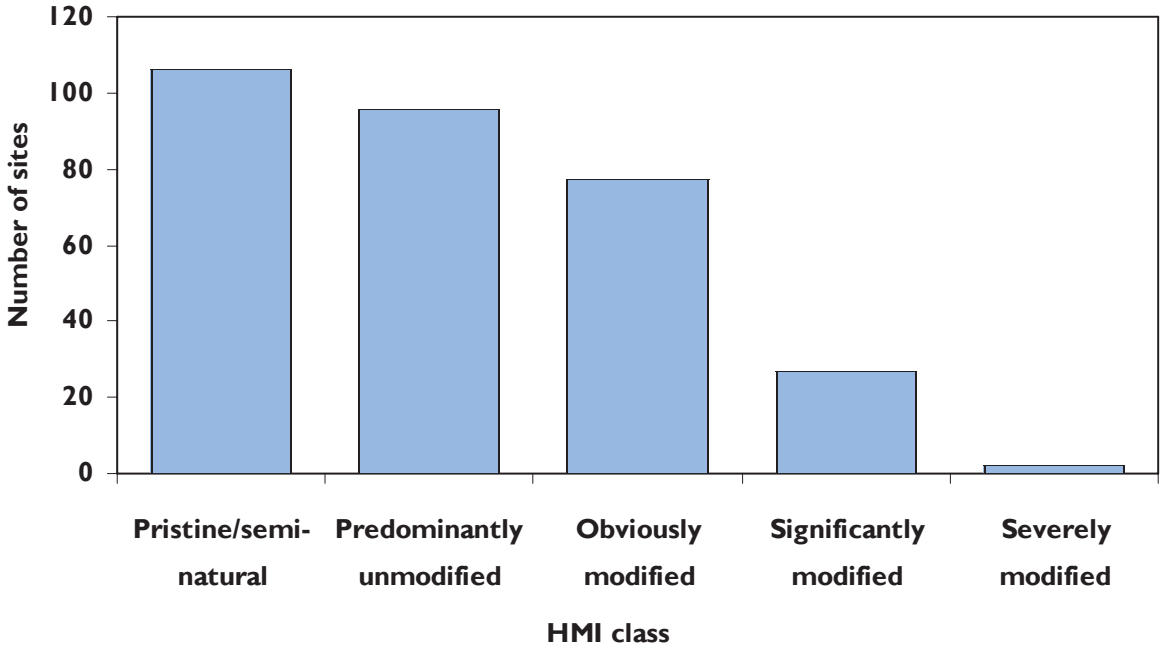


Figure H1. Habitat Modification in the River Avon cSAC and River Ebble.

The degree of modification varies throughout the catchment, with the rivers Wylye and Bourne being most modified, and the Nadder and Ebble least so.

Habitat quality can also be assessed using RHS, giving a broad measure of the diversity and naturalness of a stretch of river. Habitat quality is determined by the presence and extent of features of known wildlife interest such as natural channel substrate, mid-channel islands, exposed tree roots etc.

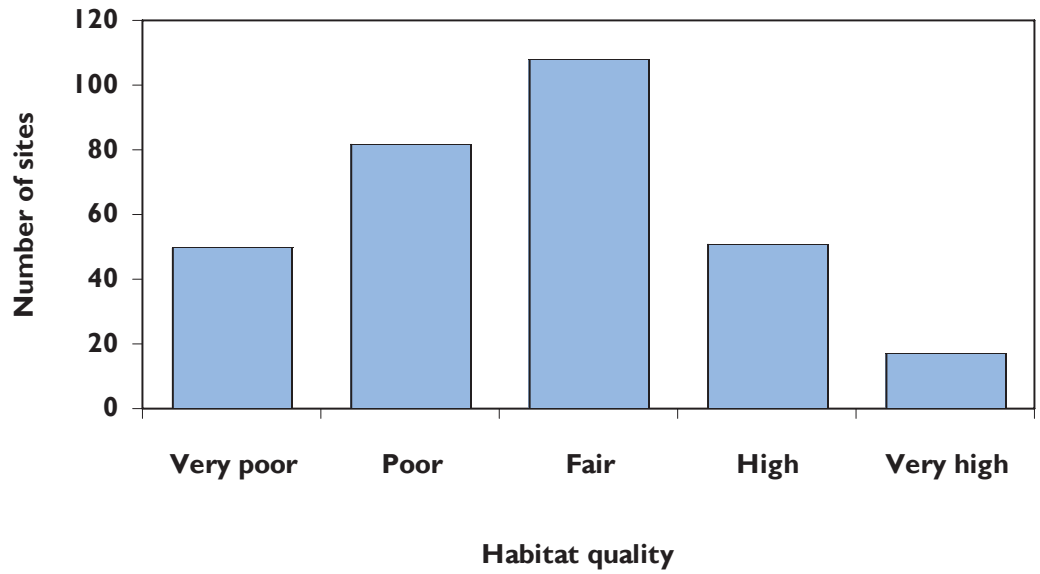


Figure H2. Habitat quality in the River Avon cSAC and River Ebble.

Habitat quality for the River Avon and main tributaries is summarised in Figure H2.

Only 22% of the sites surveyed were of high or very high habitat quality. Habitat quality varies throughout the catchment, with the rivers Avon, Bourne and Wylye having the worst habitat quality and the Ebble and Nadder the best.

The results in Figure H2 appear to contradict the habitat modification results. However, a full habitat quality analysis might show that the sites are of better quality than the preliminary analysis suggests, particularly in comparison with other chalk rivers. Full analysis and comparison with other rivers is very time-consuming and is unlikely to be carried out for all sites within the catchment.

Further analysis has been undertaken on RHS data for the Nine Mile River. It was found that the river has a very low degree of modification and high level of habitat quality, probably due to its rural nature and position within MOD land (Cullis 2002b). Both the Nine Mile River and the River Ebble are not currently SSSIs or within the cSAC boundary.

Geomorphological audit of the River Wylye

As part of **Life in UK Rivers**, a full geomorphological audit of the River Wylye has been undertaken. The main objective of the project is to develop an understanding of the physical processes in the river and to examine the impact of existing river rehabilitation projects and the link between geomorphology, salmon and *Ranunculus* communities. The study also identifies sediment supply, storage and transport in the Wylye catchment and how these relate to past and present management at a catchment and river channel scale (Geodata 2002).

The geomorphological audit is a fluvial geomorphological assessment technique. Details of this and related techniques can be found in *River Geomorphology: a practical guide*, *Guidance Note 18, R +D 661 (*1988), Universities of Nottingham, Newcastle and Southampton.

The geomorphological audit of the Wylye was carried out in several stages:

- Desk study. Historical maps, records of past and present management and interviews with local Environment Agency and river users provided information regarding the history of change on the catchment and its management.

- Field investigations to determine the present geomorphological situation.
- Identification of catchment trends.
- Geomorphological dynamics assessment to investigate natural and rehabilitated reaches to determine their potential as habitats for key species.

The main outputs of the project are as follows:

- A map of the historical and current management regime.
- Geomorphology study showing channel processes.
- Initial assessment of a small number of existing rehabilitation schemes and their effect on geomorphology.
- Indications of the links between channel process and form, salmon and *Ranunculus* (as a substitute for *Ranunculus* communities).

The outputs from the study are intended to provide the foundation for future sustainable rehabilitation, river channel and bank management on the River Wylye. The definition of geomorphological processes should ultimately enable identification and assessment of management problems. Along with RHS data, the geomorphological audit could provide a strategy for planning future in-channel rehabilitation works. It may also be a useful tool for assessing the impact of fisheries and flood-defence works on the cSAC.

Acknowledgments

This strategy was developed by key organisations and individuals involved in management of the River Avon candidate Special Area of Conservation. Their contribution was central to the development of the Strategy and is gratefully acknowledged. The group responsible for steering the process consisted of the following representatives, under the chairmanship of Chris Rothwell:

Chair	Chris Rothwell
Avon and Stour Rivers Association	Robin Radclyffe
Bournemouth and West Hants Water	Angela Garcia
Christchurch Borough Council	Judith Plumley
Dorset Wildlife Trust	Bronwen Bruce
Department for the Environment, Food and Rural Affairs	Andrew Fielder
English Nature	Sue Burton, Rue Ekins, Dagmar Junghanns, Helen Powell
Environment Agency	Paul Bryson, Allan Frake
Hampshire County Council	Mike Bridgeman
Hampshire Wildlife Trust	Alison Fowler, Debbie Wicks, Jess Pain
Kennet District Council	Will Harley
New Forest District Council	Julia Norman
Salisbury District Council	Amanda Mathews, John Meeker
Thames Water	Mike Crafer
Wessex Water	Fiona Bowles, Andrew House
West Wiltshire District Council	Julia Evans, Linda Jennings
Wiltshire Wildlife Trust	Harry Barton, Georgina Terry
Wiltshire County Council	Jenny Ford
Wiltshire Fishery Association	Tony Wells

In addition, the following organisations and individuals contributed to discussions on particular issues:

- Christchurch Anglers
- Dorset County Council
- Farming and Wildlife Advisory Group
- The Game Conservancy Trust
- Hengistbury Head Advisory Group
- Mr Peter Harding
- Mr Reginald Stones
- Mudeford Netsmen
- National Farmers Union
- Royal Society for the Protection of Birds
- Wessex Salmon and Rivers Trust

The circulation of the draft strategy was based on the list of organisations and individuals above, with the addition of the following organisations;

- Country Land and Business Association
- Countryside Agency
- Defence Estates
- Forestry Commission
- Water Voice

Responses were received from the majority of consultees. This final version was prepared following detailed consideration of all comments received.

Conserving Natura 2000 Rivers

Ecology Series

1 Ecology of the White-clawed Crayfish, *Austropotamobius pallipes*
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4 Ecology of the Bullhead, *Cottus gobio*
5 Ecology of the River, Brook and Sea Lamprey, *Lampetra fluviatilis*, *L. planeri* and *Petromyzon marinus*
6 Ecology of Desmoulin's Whorl Snail, *Vertigo moulinsiana*
7 Ecology of the Atlantic Salmon, *Salmo salar*
8 Ecology of the Southern Damselfly, *Coenagrion mercuriale*
9 Ecology of the Floating Water-plantain, *Luronium natans*
10 Ecology of the European Otter, *Lutra lutra*
11 Ecology of Watercourses Characterised by *Ranunculion fluitantis* and *Callitricho-Batrachion* Vegetation

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These publications can be obtained from:

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They can also be downloaded from the project website: www.riverlife.org.uk

The Life in UK Rivers project was established to develop methods for conserving the wildlife and habitats of rivers within the Natura 2000 network of protected European sites.

Set up by the UK statutory conservation bodies and the European Commission's LIFE Nature programme, the project has sought to identify the ecological requirements of key plants and animals supported by river Special Areas of Conservation.

In addition, monitoring techniques and conservation strategies have been developed as practical tools for assessing and maintaining these internationally important species and habitats.

The River Avon is one of the most biologically diverse chalk streams in the UK, and its importance to our natural heritage has been recognized under European legislation by its designations as a candidate Special Area of Conservation (cSAC).

The River Avon cSAC Conservation Strategy aims to identify issues affecting the ecology of the river, to assess the effectiveness of mechanisms already in place to tackle these isesues, and to highlight further action that may be required in future.

This strategy has been developed by individuals and organisations involved in the management of the river, and it will guide their work over the next 10 years.

Information on Conserving Natura 2000 Rivers and the Life in UK Rivers project can be found at **www.riverlife.org.uk**

This document was produced with the support of the European Commission's LIFE Nature Programme and published by the Life in UK Rivers project - a joint venture involving English Nature, the Countryside Council for Wales, the Environment Agency, the Scottish Environment Protection Agency, Scottish Natural Heritage and the Scotland and Northern Ireland Forum for Environmental Research.