

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 be 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 <i>Best Farming Practices: profiting from a good environment</i> 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 an 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, VTs	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