

# 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).

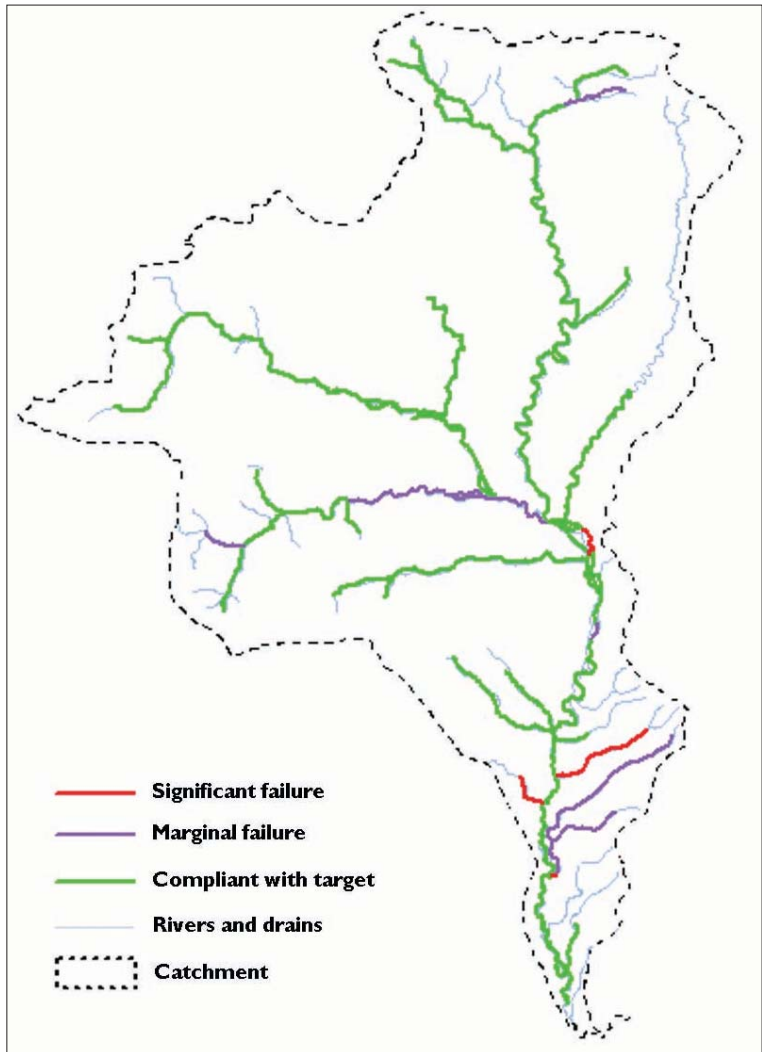


Figure D1. River Ecosystem (RE) class compliance 2001

### 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.

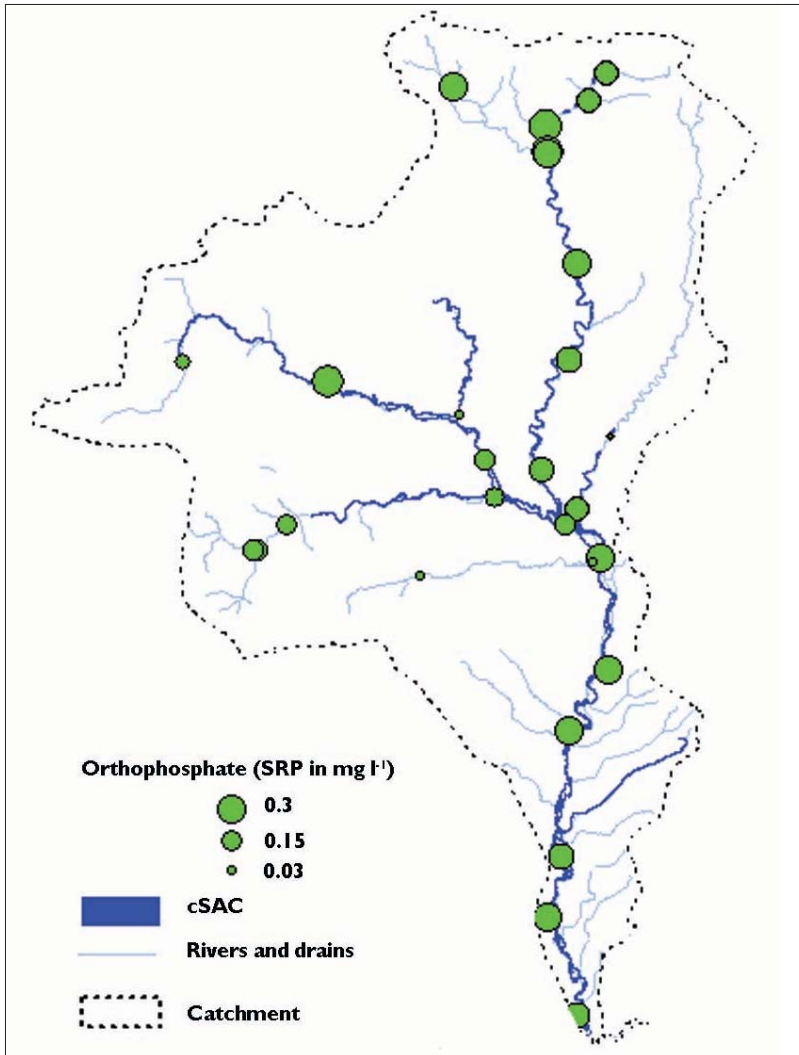
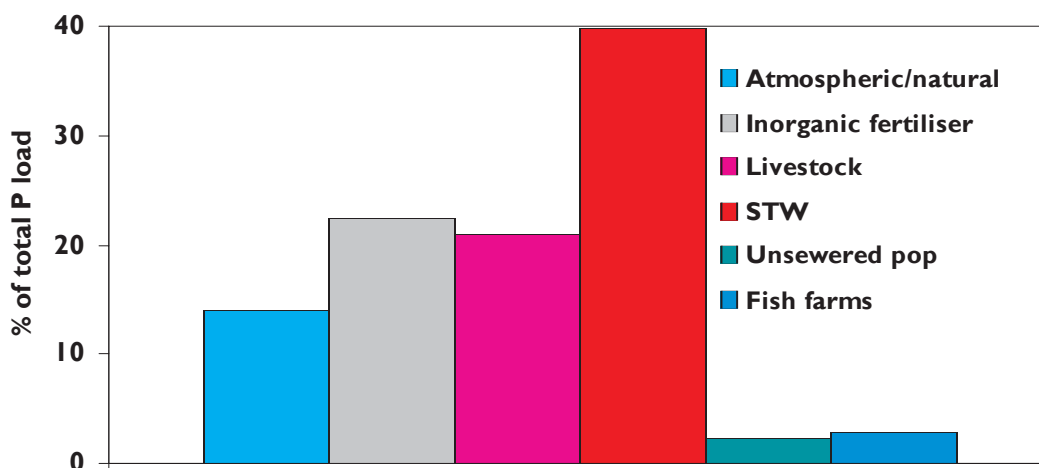


Figure D2. Soluble reactive phosphorus (SRP) levels 1995–1999

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<sup>-1</sup> for bullhead and lamprey but above the target of 10 mg l<sup>-1</sup> 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.

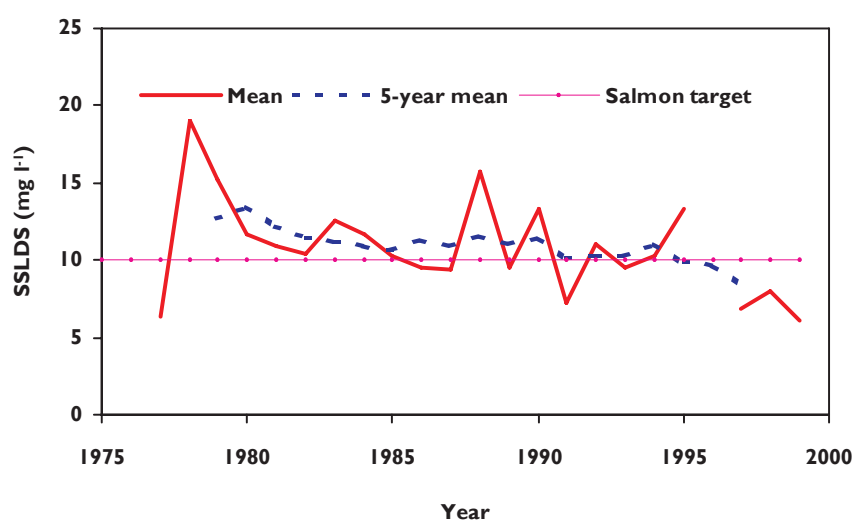


Figure D4. Historical suspended solids data.

## 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 Wylfe 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		Wylfe Nadder

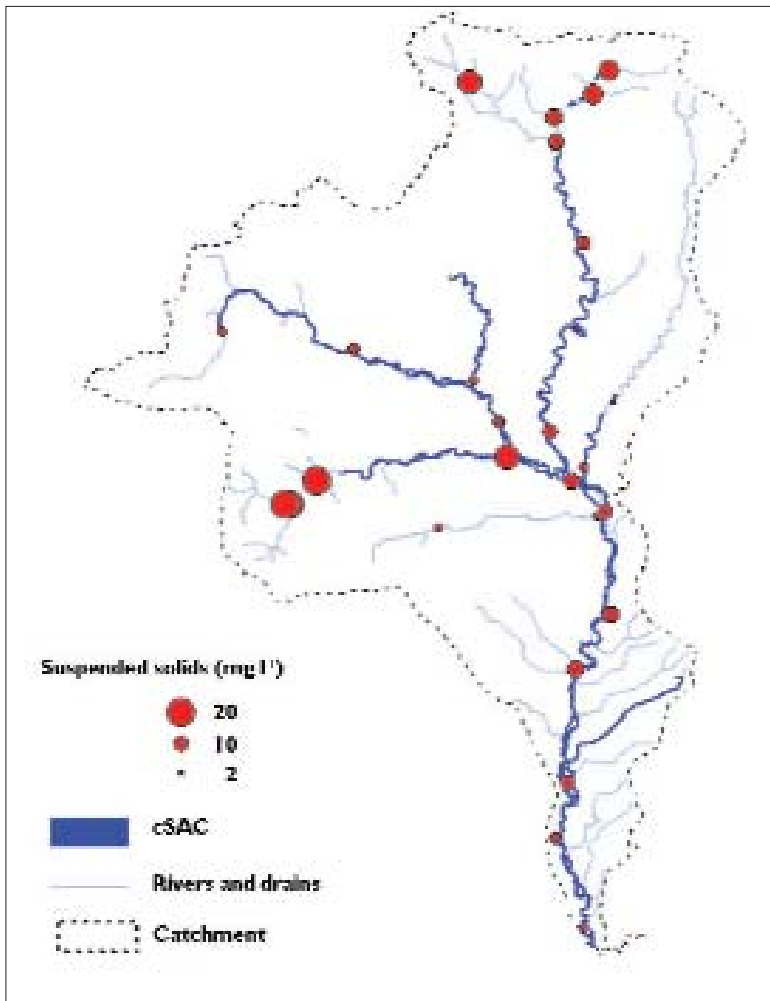


Figure D5. Suspended solids data 1995–1999.

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.

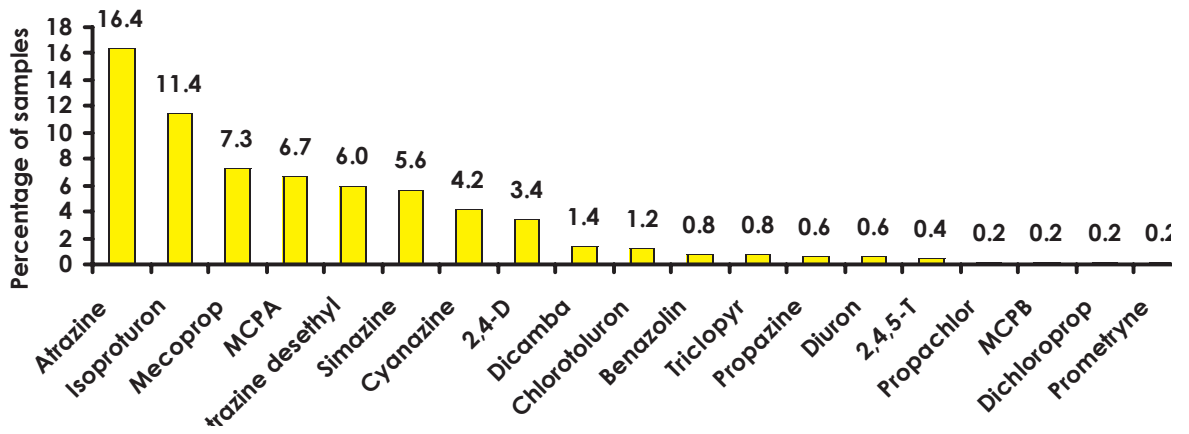


Figure D6. Pesticides detections in the Avon catchment 1997–2000.