Environment Agency

the unseen threat to water quality

Diffuse water pollution in England and Wales report – May 2007

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Foreword

Clean rivers, lakes, groundwaters, estuaries and coastal waters are essential for a healthy water supply, recreation, fisheries and wildlife. Great strides have been taken in cleaning up major discharges from sewage treatment works and industry, and salmon have returned to our major rivers like the Tees and the Mersey. This work is not finished, but the progress is now highlighting the impacts of diffuse sources of pollution. These are pollutants from many small-scale sources carried into water bodies by rainwater run-off from urban and rural land.

Diffuse pollution is one reason why improvements in river quality are levelling off. One in seven urban rivers is still of poor quality. Eroded soils carrying surplus fertilisers and livestock manure are degrading many rural rivers and lakes. Underground water supplies are contaminated with fertilisers, pesticides and other chemicals, and this pollution flows into estuaries, bathing waters and the sea. The costs, in terms of treating drinking water supplies or lost wildlife and amenity, are substantial.

The Water Framework Directive, which is new legislation, has put diffuse pollution in the spotlight. Diffuse sources must be tackled if we are to achieve the objectives set. Some of the problems are complex and will take decades to resolve, but many of the solutions are known and could be put into practice now. Failure to do so will allow the problems to get worse and increase the future costs.

This report sets out the evidence for the impacts of diffuse pollution and what needs to be done about it. We will work with other organisations to gain a better understanding of the problem and to arrive at cost-effective solutions. Farmers and farm advisors, the water industry and businesses can make important contributions, but we all have a part to play. It is in everyone's interests to tackle diffuse pollution, and new ways of managing river catchments need to be embraced if the harm to the water environment is to be put right.

Tricia Henton Director of Environment Protection

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Executive summary

Diffuse water pollution is a serious problem in some parts of England and Wales. It is caused by many small or scattered sources. It represents a widespread and long-term threat to the ecology of lakes, rivers and coastal waters, and to the quality of groundwater and the costs of water supplies. Tackling diffuse pollution is essential if we are to ensure the sustainable use of this vital natural resource. It is important that diffuse water pollution features in major forward-looking exercises, such as the implementation of the Water Framework Directive and the water strategies being developed by Governments.

Our main concerns are:

- high levels of nutrients in rivers, lakes, estuaries and coastal waters, which can cause eutrophication;
- nitrate contamination of water used for drinking water;
- hazardous chemicals leaking into rivers, lakes and groundwater from industrial sites;
- pesticides and sheep dip from agriculture entering rivers, lakes and groundwater;
- oxygen depletion in water due to organic pollution from livestock manure;
- sediments from soil erosion smothering habitats in rivers, lakes and estuaries;
- bacteriological contamination of bathing waters and shellfish waters from farm waste and illegally connected sewers.

We need to take concerted action across many sectors. The European Water Framework Directive (WFD) is a significant new piece of environmental legislation that will help us do this. It requires all inland and coastal waters to be of good status by 2015. We are establishing river basin districts within which demanding environmental objectives will be set, including ecological targets for surface waters. As part of this, we are refocusing our monitoring to provide better information on the impacts of diffuse pollution so that we can develop targeted measures to improve water quality.

We need to tackle both urban and rural sources of pollution. In urban areas run-off from roads and other surfaces, foul drains wrongly connected to surface drains, leaking sewers and spilled chemicals, oil and fuel pollute rivers and groundwaters. We want sustainable drainage systems (SUDS) that intercept pollutants and reduce flood risk to become a common feature of urban design. We will work with central and local government to promote SUDS and reduce diffuse water pollution through land-use planning and remedial measures.

We are working with businesses to promote pollution prevention, for example through our Oil Care Campaign. We want to see all industry sectors take straightforward steps to prevent diffuse pollution.

Investment and regulation have improved sewage discharges and water quality over the past decade. The further measures that are needed include the safe storage of chemicals, better maintenance of pollution control equipment and more staff training to raise awareness about the risk of causing pollution. We also ask the general public to take care in disposing of used oil and chemicals, and to make sure that their foul

drains are correctly connected. We want building inspectors to check that foul drainage is not illegally connected into clean water sewers at new housing developments.

The Department for Environment, Food and Rural Affairs (Defra) and the Welsh Assembly Government (WAG) are reviewing non-agricultural sources of diffuse water pollution. They are working with us, industry sectors and others to prioritise the most urgent problems to address. They will assess the effectiveness of existing measures and determine what changes and additional measures are needed. An expert steering group has been set up to take the work forward and both governments have recently gone to public consultation on the issue.

Farming can be a significant source of diffuse pollution. Inorganic fertiliser use is significantly higher than 50 years ago and has contributed to elevated levels of nutrients in water. Run-off from agricultural land depletes oxygen in the water if animal manure or silage effluent are present. Bacteria washed out of manure spread to land can adversely affect bathing water quality. Soil erosion can be caused by inappropriate cultivation, trampling of riverbanks by livestock, construction and other land disturbance leading to sediment build-up in rivers and lakes.

We will work with farmers, the Natural England Partnership, Defra, WAG and others, to protect the water environment, using targeted advice, incentive schemes that reward good practice and regulation where it is necessary. Agri-environment schemes such as Environmental Stewardship projects in England and Tir Cynnal and Tir Gofal in Wales are now paying land managers to adopt resource protection measures such as nutrient and soil management and to introduce buffer strips. Special advisors are working with farmers in 40 river catchments in England and two in Wales to share advice and knowledge to reduce water pollution under the Catchment Sensitive Farming Delivery Initiative. As well as running workshops and farm demonstrations, advisors are working on a one-to-one basis with farmers, advising on, for example, the use of fertilisers and livestock densities. The catchment sensitive farming initiatives in England and Wales focus at the local level and pull together farmers, farm advisors, government agencies and other organisations.

To reduce urban and rural diffuse pollution further, we are likely to need new or improved legislative powers, for example to improve land management practices, and a combination of voluntary, regulatory and economic measures.

Introduction

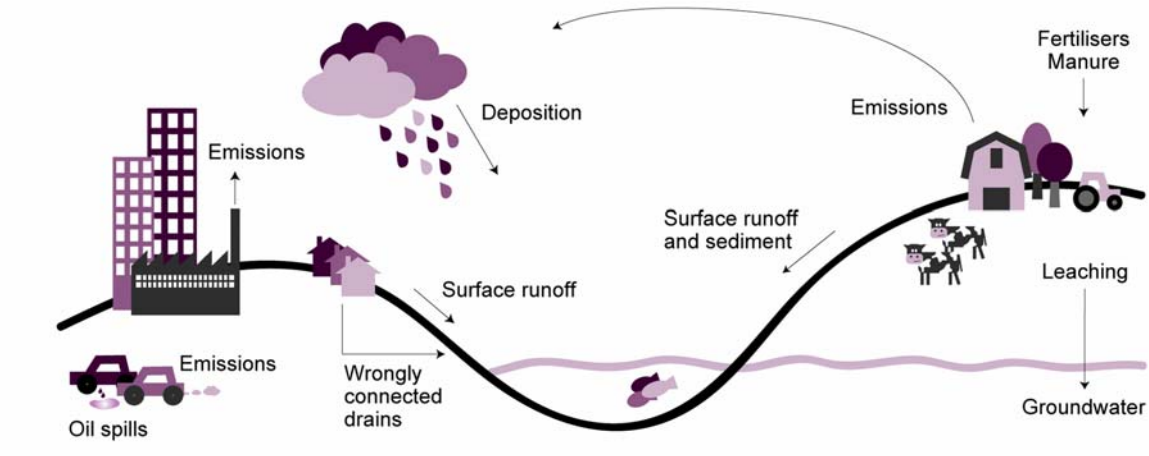
Our rivers and bathing waters have become a lot cleaner over the last decade, mainly thanks to the efforts of water companies and industry working under our regulation. But much remains to be done and diffuse pollution is halting progress. We think it is now a bigger threat to river water quality than point source pollution (see Table 1). Together with Defra, the Welsh Assembly Government (WAG) and others we have devoted significant efforts to understanding the scale of the problem.

In this report we summarise the impact that diffuse pollution has on rivers, lakes, groundwater and coastal waters. We describe the various sources of diffuse pollution and identify the main actions that are needed to tackle the problem. Diffuse pollution is sometimes complex so many organisations and individuals have an important part to play in reducing it. We aim here to help everyone reach a common understanding of the issues and what can be done to achieve a clean and sustainable water environment.

We start with a short account of what diffuse pollution is and then discuss the scale of the problem. We look at the impacts on water quality and wildlife for each of the main types of water body. We discuss the sources of diffuse water pollution and finally we say what initiatives are needed to address diffuse pollution. We identify where more action needs to be taken.

What is diffuse water pollution?
Water pollution can come from either diffuse or point sources. An example of point source pollution is treated sewage effluent discharged from a sewage treatment works. Point source pollution is controlled by regulation.

Figure 1
Common sources of diffuse pollution



Diffuse source pollution typically comes from unlicensed sources and dispersed land-use activities (Figure 1). It often occurs after rainfall and its composition is extremely variable. Common examples of diffuse water pollution include:

- contaminated run-off from roads
- drainage from housing estates
- accidental chemical and oil spills from transport and industrial sites
- surplus nutrients, pesticides and eroded soils from farmland.

Emissions of gases into the air from transport, industry and agriculture can also eventually cause diffuse water pollution.

On its own, each source of diffuse pollution may be of little significance. But when they occur together, for example in an urban area, they can create significant problems. By its nature, this kind of pollution is difficult to control.

The pathways by which pollutants reach surface and groundwater are often complex. Soluble pollutants, such as nitrate, can leach through the soil to the water table, eventually reaching rivers, groundwater, lakes or coastal waters. Other pollutants stay on or near the ground surface and can be washed overland or on soil particles into water. These processes are usually driven by rainfall but can take hours, days or years depending on local factors.

The way land is used and how it is managed is critical to the risk of water pollution. Soil disturbance near to watercourses increases the chance that erosion will cause pollution.

The timing of work such as ploughing and harvesting, for example in relation to rainfall, is important. In many circumstances reducing the risk of diffuse pollution can be achieved at little or no cost by adjusting the timing of these activities

The effects of diffuse pollution can be very long-term. Contaminants can persist in groundwaters or sediments for decades or centuries. Nutrient-enriched lakes and acidified waters may take many years to recover. It is far better and more cost effective to deal with the problem at source rather than try to treat the water once it has been polluted. The main solutions we advocate aim to stop pollutants reaching surface and groundwaters in the first place, by reducing the use of potential pollutants, storing and using chemicals safely, and modifying land management and drainage techniques.

The scale of the problem

The impacts of diffuse pollution depend on the amount of pollutants released, how easily these substances can reach water bodies and how sensitive the water environment is to pollution.

Our risk assessments for the Water Framework Directive (WFD) show that diffuse pollution is now a bigger risk than point source pollution for rivers, lakes and groundwaters (Table 1). These are estimates of risk, not proven impacts, but it is clear that diffuse pollution could be affecting a significant number of waterbodies (Figure 2).[1] We will refine these assessments and consult on our new findings.

Figure 2
RIver catchments at risk from diffuse source pollution pressures

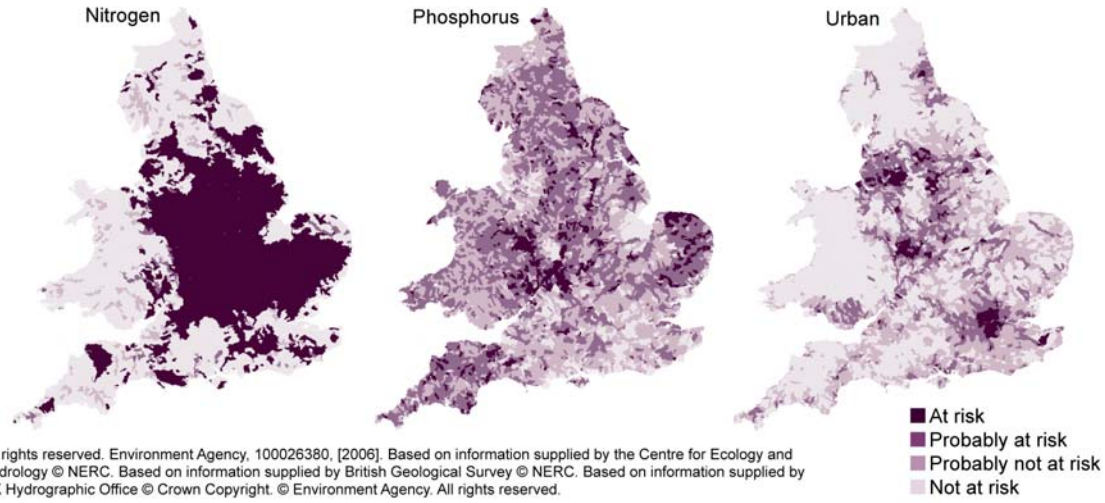


Table 1
Percentage of waterbodies at risk of not achieving WFD objectives[2]

Pressures	Rivers	Lakes	Estuaries	Coastal waters	Groundwater
Diffuse pollution	87	50	35	20	68
Point discharges	39	38	84	24	3
Abstraction	14	1	53	Not applicable	29
Physical changes	58	52	88	91	Not applicable
Alien species	34	20	87	61	Not applicable

Our main concerns are:

- high levels of nutrients in rivers, lakes, estuaries and coastal waters, which can cause eutrophication;
- nitrate contamination of water used for drinking water;
- hazardous chemicals leaking into rivers, lakes and groundwater from industrial sites;
- pesticides and sheep dip from agriculture entering rivers, lakes and groundwater;
- oxygen depletion in water due to organic pollution from livestock manure;
- sediments from soil erosion smothering habitats in rivers, lakes and estuaries;
- bacteriological contamination of bathing waters and shellfish waters from farm waste and illegally connected sewers.

Diffuse pollution also has social and indirect economic costs. Cleaning up rivers can turn them into natural focal points for business and leisure.[3] The poor quality of many urban rivers adds to social deprivation and deters business investment. Diffuse pollution impacts on fisheries and bathing waters, reducing angling opportunities and limiting recreation and tourism. The costs are difficult to measure but are likely to be substantial.

It costs the UK Water Industry several million pounds a year[4] to remove nitrates from drinking water abstracted from river and groundwater sources. In the mid 1970s groundwater required only minimal treatment; now almost half of groundwater used for public water supply requires fuller treatment due to pollution and tighter standards.[5]

In many areas, closing the gap between present and good water quality will require changes to activities that we do not directly regulate. This has been given fresh impetus by the WFD, which introduces new ways of assessing and managing the impacts of diffuse pollution.

Sources of diffuse water pollution
Common sources of diffuse pollution include:

- vehicle and plant maintenance in many small industrial areas leading to spills of oil and fuel;
- industrial sites storing and handling fuel and chemicals with leaking tanks and pipes;
- road surfaces and railways that are contaminated with lubricants, products of combustion, vehicle debris and herbicides;
- industrial and transport emissions into air leading to acid rain in upland areas;
- agricultural activities and construction sites releasing sediments to surface water;
- surplus inorganic nutrients, animal manure and pesticides washed off agricultural land;
- faecal or other pathogenic bacteria from livestock and wild animals;
- overloaded, leaking or wrongly connected sewerage systems.

Urban pollution
In urban areas run-off from roads and other surfaces, foul drains wrongly connected to surface drains, leaking sewers and spilled chemicals, oil and fuel pollute rivers, coastal waters and groundwater.

Towns and cities have a major impact on groundwater and surface water quality because of current or historical pollution. For example, in Nottingham up to 15 per cent of the nitrate in groundwater comes from the leaking sewerage system. There are over 300 sites in England and Wales that have contaminated land due to their industrial past. These sites can pose risks to health, and the pollutants may leak into groundwater and surface waters. The contamination has to be treated or contained, which is expensive, and is often only carried out when these sites are redeveloped.

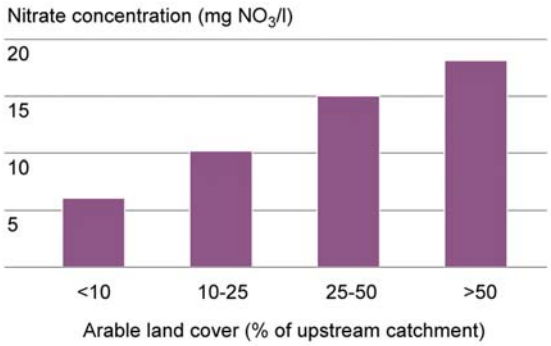
Pesticides used by local authorities, households and others to control weeds are found in surface water downstream of urban areas. River water quality can deteriorate following rainfall that washes bacteria from both urban and rural areas into rivers. Urban run-off contains oil, organic matter such as dog faeces, metals like lead and cadmium, and a wide range of chemicals from business and household use. After or during rainfall, the first flush of water carrying accumulated dust and dirt is often highly polluting and can be similar in strength to raw sewage, depleting rivers of oxygen.

Rural pollution

Farming is a major source of diffuse water pollution. The use of inorganic fertilisers and the spreading of animal manures to land can increase nutrient levels in water. Run-off from agricultural land depletes oxygen in the water if animal manure is present. Bacteria present in the manure is also having a significant impact on our efforts to improve bathing water quality. Soil erosion caused by inappropriate cultivation, trampling of riverbanks by livestock, construction and other land disturbance can lead to sediment build-up in rivers. Agricultural sources account for most of the silt entering water in England.[6]

Losses from agricultural land are estimated to account for 61% of nitrate which enters surface waters in England and Wales with sewage and other discharges accounting for the rest.[7] Nitrate concentrations in rivers are linked to the proportion of arable land in the catchment upstream (Figure 3).[8] Intensive livestock production is also a significant source.

Figure 3
Nitrate concentrations in rivers and the proportion of arable land in the upstream catchment in Europe



Source: European Environment Agency, 2004

Farming accounts for up to 40% of the phosphate load in rivers, although this varies between catchments.[9] Phosphate inputs to both lakes and rivers in England and Wales rose over the last century mainly as a result of expansions in cereal crop production and the increasing use of artificial fertilisers. Between the 1930s and 1990s, estimated phosphate losses to water from agriculture doubled.

Losses of agricultural pesticides to water are affected by the type of crop, the timing and quantity of applications and the weather conditions.

Sheep dip chemicals have caused pollution in upland streams in Wales and other upland areas and reduced levels of aquatic life. The marketing authorisation for one of these chemicals has been temporarily suspended to allow the manufacturers time to develop ways to manage the risks better.

Other sources of diffuse pollution

Tributyl tin (TBT) from anti-fouling paints is still being released from the hulls of larger marine vessels. Its use will be banned from 2008. We are concerned about TBT because of its direct effects on certain marine organisms. For instance, it has the potential to cause dog whelks to change sex.

Anodes that are made from zinc and suspended underneath boats and along marinas to reduce metal corrosion act as a diffuse source of zinc and have been shown to cause water quality problems in some estuaries.[10]

Oil discharges in UK waters from production platforms, refineries and other sites have been greatly reduced but illegal oil pollution from passing ships remains a concern.

The main source of pollutants that form acid rain are gaseous emissions of sulphur and nitrogen from transport, industry and the land spreading of animal manure. These enter the atmosphere but ultimately affect the water environment in certain sensitive locations. Usually upland areas with base-poor soils.

The impact of diffuse pollution

This section describes key impacts on each major type of receiving water (rivers, lakes, groundwaters and coastal waters).

Rivers and lakes

Over two-thirds of all rivers are now of good or very good biological and chemical quality[11] (Figure 4). However, 87 per cent of rivers are at risk from diffuse pollution and this is limiting further improvements. Half of all lakes are at risk from diffuse pollution.

In urban areas one in seven rivers was of poor or bad chemical and biological quality in 2005, frequently made worse by inadequate sewers and private drainage. About one in five properties have foul drains illegally connected into surface water sewers that then discharge untreated sewage effluent into rivers.[12]

Over 22,000 hectares of Sites of Special Scientific Interest in England are in an unfavourable condition due principally to diffuse water pollution from agriculture. This includes rivers, lakes, ditch systems, freshwater and coastal wetlands, estuaries and coastal waters.[13]

Nutrients

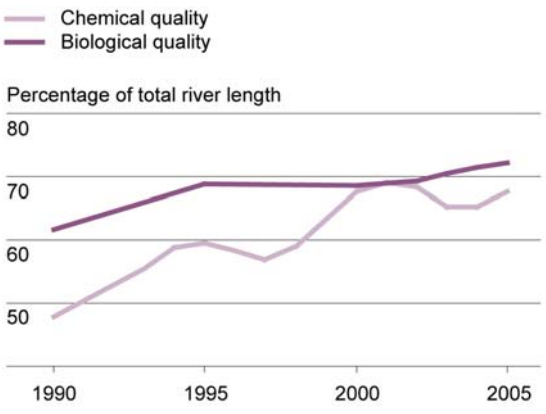
Forty-five per cent of rivers are at risk from high[14] nitrate concentrations and 50 per cent are at risk from high[15] concentrations of phosphate. High concentrations and rising trends in nitrates are causing extra costs in the supply of drinking water for a number of water companies and local abstractors, particularly in England.

In fresh and coastal waters high levels of nutrients can cause excessive plant growth (for example, algal blooms) that harms other wildlife, a process called eutrophication. In freshwater systems the amount of phosphate is usually the limiting factor for plant growth, although nitrate may be important in some situations. This is a greater problem in England than it is in Wales.

In 2005 just over half the rivers in England had high concentrations of phosphate, 12 per cent less than in 1990 (Figure 5). In 2005 28 per cent of rivers in England had high nitrate concentrations, much the same as in 1995 (30 per cent). Nutrient pollution is much less evident in Wales but there is a need to protect the ecology of sensitive low-nutrient Welsh water bodies.

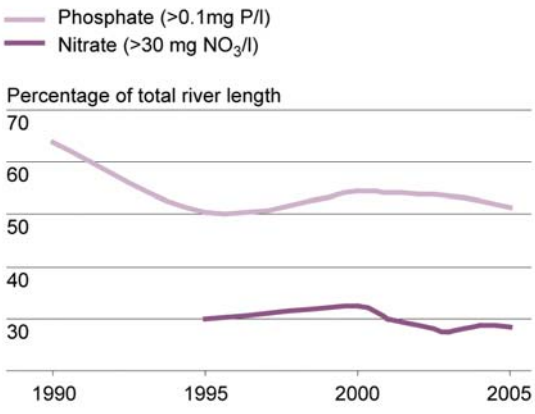
Our assessments for the Water Framework Directive indicate that a significant number of our lakes are at risk of not achieving good ecological status due to elevated phosphate

Figure 4
Rivers of good or very good quality in England and Wales



Source: Environment Agency

Figure 5
Rivers with high concentrations of nutrients in England and Wales



Source: Environment Agency

concentrations. In 2002 there were 30 major fish kills caused when the die-off of algal blooms led to a lack of oxygen in the water.[16] A study of 129 lakes in England and Wales found that 69 per cent had elevated concentrations of phosphate, indicating that most were nutrient-enriched.[17]

In Slapton Ley, the largest freshwater lake in south west England, the resulting eutro-phication made the water turbid and reduced the abundance of higher water plants. Other lakes have also been affected (Box 1).[18]

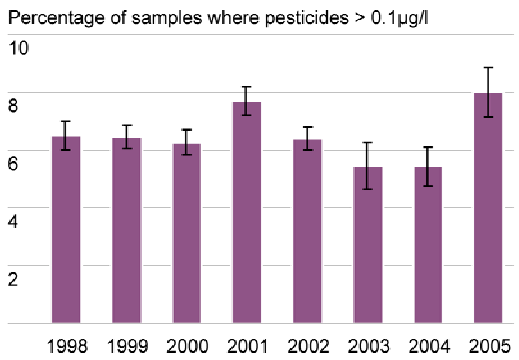
Box 1
Eutrophication of Bassenthwaite Lake

Relatively high levels of phosphate in Bassenthwaite Lake are causing a heavy growth of algae that smothers other plants and threatens animal life, including a rare fish, the Vendace. Since 1995 the local sewage works has had a phosphate removal plant, but phosphate including that contained in agricultural run-off has built up in the lake sediment and is still a problem. To tackle the problem the Lake District Still Waters Partnership has set up the Bassenthwaite Lake Restoration Programme. Options to control eutrophication are being assessed.

Pesticides

A fifth of rivers are at risk of failing the Water Framework Directive (WFD) standards from pesticides. Pesticides can harm aquatic life and must be removed from surface water or groundwater used for public supply if they exceed the drinking water standards. The WFD requires the concentrations of pesticides in water to at extremely low levels.

Figure 6
Pesticides exceeding the drinking water standards in surface waters in England and Wales



90% confidence intervals shown
Source: Environment Agency

In 2005 commonly used pesticides were found above the threshold value in about 8% of samples taken from rivers (Figure 6).[19] Pollution by sheep dipping chemicals has reduced aquatic life in small upland rivers, particularly in parts of Wales (Box 2).

Box 2
Sheep dip pollution in upland Wales

Sheep dip has caused problems in Wales in recent years. We have investigated and extensively monitored areas at high risk such as private drinking water supplies and salmon and trout nursery streams. This revealed that poor operational practices were widespread, including sheep having direct access to watercourses shortly after treatment, and occasionally the use of an arable formulation of a chemical for treating sheep instead of approved products. Targeted monitoring has revealed that similar problems exist in England as well. Such chemicals are highly poisonous to insect life such as stoneflies and mayflies, protected species such as crayfish are also affected. Surveys show that there were signs of pollution damage to 30km of the Afon Teifi. Recovery may take many years.

Sediments

Twenty-three per cent of rivers are at risk from high levels of sediment. Too much sediment blocks river-bed gravels and reduces the supply of oxygenated water to aquatic plants and animals. In 2004 half of rivers with salmon action plans[20] were at risk of missing their egg deposition targets, with siltation of spawning gravels a major factor. Across southern England in 2000, 28 out of 31 trout spawning beds studied contained enough fine sediments from soil to kill half the eggs and larvae.[21] Chalk streams are particularly at risk (Box 3).

Box 3
Chalk stream malaise

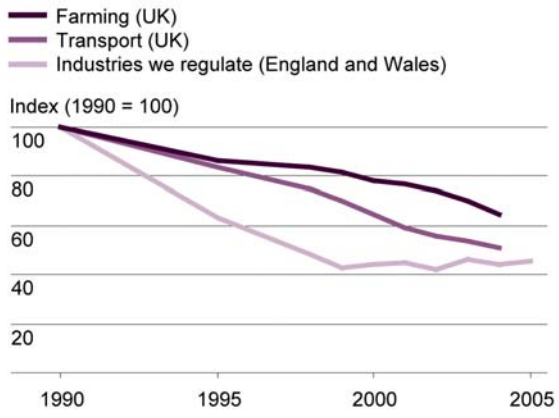
Chalk rivers are especially valued for their rich communities of plants and animals. There are 161 chalk rivers and streams across England but only 37 per cent achieve both very good biological and chemical quality. Excess silt is smothering river-bed gravels, harming aquatic plants and invertebrates as well as fish eggs. Only 23 per cent meet the guideline standard for phosphate concentrations (set for chalk rivers designated as Special Areas for Conservation). High phosphate inputs are causing algal growth to smother gravel habitats and plants such as water crowfoot, which is a feature of chalk rivers. This general deterioration caused by diffuse pollution from soil erosion and phosphate fertilisers, and made worse by low river flows, is known as 'chalk stream malaise'.[22]

Acid rain

About 16 per cent of lakes and 3 per cent of rivers are at risk from acidification. In some upland areas with sensitive geology, such as mid-Wales, the Pennines and Cumbria, thousands of kilometres of small streams and lakes have been affected by acid rain.[23] Acidified soils can release aluminium and other metals that are toxic to trout, salmon and other aquatic life.

Acid rain is caused by sulphur and nitrogen emissions. Since 1990 the emissions from industries we regulate and from road transport have declined substantially (Figure 7). Agricultural releases of nitrogen as ammonia, largely from animal waste spread to land, have fallen less sharply. The quality of upland waters is improving, but substantial recovery will take decades unless waters are treated (Box 4).

Figure 7
Emissions of nitrogen from industry, transport and farming



Source: Environment Agency and Netcen

Box 4
Treating an acidified river

In some cases it is possible to treat acidified waters. The Afon Tywi in Wales is a major salmon and sea trout river that suffers from acidification. Since 1991 the fishery has been restored by dosing the water with powdered limestone at an initial capital cost of £90,000 and £30,000 per year running costs. This has successfully restored river quality and increased fish populations, although it is not a practical or affordable solution for all rivers.

Groundwaters

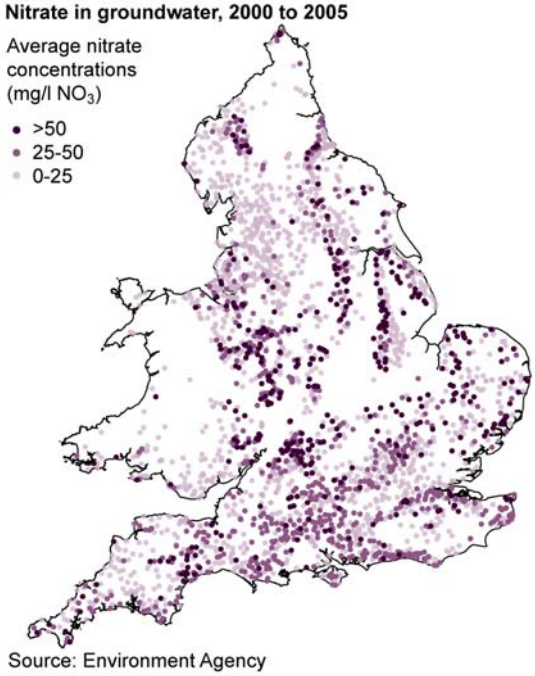
Over two-thirds of groundwaters are at risk from diffuse pollution and that diffuse pollution is the main cause of groundwater contamination. Diffuse pollution includes nutrients from fertilisers and manure, pesticides, oil and fuel.

Groundwater supplies one-third of drinking water in England and Wales; in parts of south-east England it is the only source of drinking water. It is also an important water source for industry. Water levels and flows in lakes, wetlands and rivers are maintained, especially in dry weather, by groundwater. Groundwater is particularly vulnerable to pollution. Contaminated groundwater may take decades or centuries to recover because chemicals can degrade very slowly and groundwater is flushed through at a very slow rate.

Nitrate

Forty-five per cent of groundwaters are at risk from high nitrate concentrations. In 2005 about 14 per cent of sites had an average nitrate concentration that exceeded the 50mg/l threshold value for the Nitrate Directive. Nitrate is the most widespread pollutant in groundwater, particularly in the south, east and midlands of England (Figure 8).

Figure 8
Nitrate in groundwater, 2000 to 2005



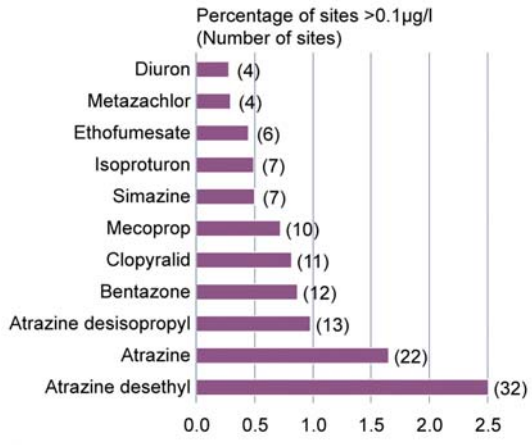
Source: Environment Agency

Pesticides

More than a fifth of groundwaters are at risk of failing their environmental objectives under the WFD as a result of pesticide contamination.

We detected pesticides in nearly a fifth of all the groundwater we monitored - in some cases the levels exceeded the limit for drinking water (Figure 9). There is some evidence in certain areas that pesticide concentrations in groundwater are declining.[24] This improvement may be the result of a shift to pesticides that are used at lower application rates, and safer use and disposal in response to tighter legislation.

Figure 9
Pesticides in groundwater in England and Wales, 2005



Source: Environment Agency

Atrazine has been a major problem, but since the non-agricultural use of it was banned in 1994, concentrations in groundwater have gradually declined. In some areas Atrazine levels in groundwater will continue to be a major problem for a long time. The use of atrazine will be banned completely after 2007.

Coastal waters

The main impacts of diffuse pollution are seen in estuaries and nearshore areas where contaminants are less diluted. Over a third of estuaries and a fifth of coastal waters are at risk from diffuse pollution.

Nutrients

Nine per cent of estuaries and five per cent of coastal waters are at risk from high nitrate concentrations due to diffuse pollution. High levels of nutrients can increase the size, frequency and persistence of algal blooms. In extreme cases algal blooms discolour large areas of th sea and may deoxygenate water. These are sometimes called ‘red tides’. This is not a common problem in coastal waters in England and Wales, but smaller-scale algal blooms do occur from time to time. The growth of green seaweed mats in shallow estuaries is more of a concern and can reduce the number of seabed invertebrates and prevent birds from feeding on them (Box 5). Toxins released from algal blooms in the water can lead to the closure of shellfisheries to avoid the risk to people of shellfish poisoning. The links between nutrient enrichment and algal blooms are not entirely clear.

Box 5
Coastal impacts of nutrients at Lindisfarne

At Lindisfarne (a Special Protection Area under the Wild Birds Directive) the heavy growth of the seaweed *Enteromorpha* has covered the intertidal mudflats, reducing the suitability of the site for feeding birds. A major factor is the supply of nutrients entering coastal waters from diffuse agricultural run-off into major rivers such as the Tweed.[25] The changes may also be due to a combination of other factors: changes in sedimentation and turbidity, a reduction in grazing invertebrates due to tributyl tin (TBT) pollution and milder winters. We are looking at all existing licences we issue to make sure that they comply with the Directive and those that are found to be causing damage to habitats will be amended or revoked.

With regard to nitrate inputs to UK coastal waters direct inputs from discharges have fallen significantly since 1990 but inputs via rivers show no such falling trend to date.

An assessment of eutrophication is underway for UK waters and other sea areas covered by the OSPAR Convention, an agreement to prevent pollution of the North East Atlantic seas. Ten estuaries in England and two in Wales have been found to be eutrophic or likely to become so.

Pesticides and other hazardous substances

Over 30 per cent of estuaries and 15 per cent of coastal waters are at risk from pesticides. Pesticides, other organic pollutants and heavy metals have accumulated in some estuarine sediments and are a source of diffuse pollution released by tidal movement. Concentrations of PCBs (polychlorinated biphenyls), PAHs (polycyclic aromatic hydrocarbons), mercury, cadmium and other heavy metals in sediment are above levels of concern for the protection of bottom-living animals in some areas. Estuaries like the Tees and Mersey are among the worst affected due to the legacy of industrial pollution. In some of these areas mussels contain high levels of contaminants and fish show signs of contamination.[26]

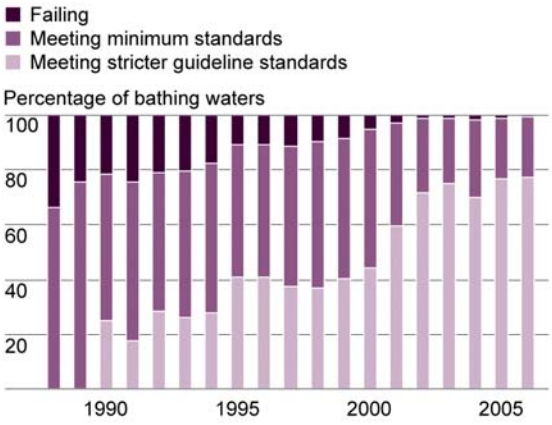
Our pesticides monitoring shows there is a widespread failure to comply with the standards for TBT. Paints containing the chemical TBT were used as an antifouling agent on leisure and commercial craft until they were banned in 1987. We are concerned about TBT because of its effects on marine organisms. It can cause adverse effects in molluscs, including dog whelks changing sex and oyster shells thickening abnormally. The use of TBT on smaller vessels led to a serious decline in dog whelk populations around the coast in the 1980s.[27] In many areas dog whelk populations are now starting to recover, but full recovery will take many years because TBT remains within the sediment. Larger vessels can still use TBT leading to continuing pollution particularly around docks.

Some waters that supply scallops, oysters and other shellfish are affected by metals, principally copper and zinc, and bacteria from diffuse sources. In 2005 about 13 per cent of shellfish sites failed to meet chemical standards for water quality.

Microbiological pollution

Bathing waters are the cleanest on record, but can be affected by diffuse pollution particularly from livestock farming.[28] For example, in South West England over a hundred bathing waters, about half of the region's total, are affected by diffuse pollution.[29] In 2006, a quarter of English bathing waters and one in nine Welsh bathing waters failed the strictest microbiological standards (Figure 10). In 2005, 90 per cent of shellfish beds achieved at least Class B[30] compared to just 72 per cent of beds in 2000. Reducing microbiological contamination is also needed to meet the Government's aim that all designated shellfish waters achieve at least Class B for shellfish hygiene[31] and to endeavour to meet guideline microbiological standards under the Shellfish Waters Directive.

Figure 10
Bathing water quality in England and Wales



Source: Environment Agency

Oil

Passing ships and urban run-off can cause oil pollution in the marine environment. Oil slicks in the sea around our coasts and in estuaries are a risk to wildlife. About 60 per cent of dead and dying sea birds washed up on UK beaches are oiled, although some may have been oiled after death from another cause.[32] There were almost 600 oil pollution incidents in 2004, of which the majority occurred in the open sea.[33] Although most of this oil is naturally dispersed and degraded, oil slicks are a risk to wildlife.

Initiatives to control diffuse water pollution

Diffuse pollution must be dealt with if the water environment is to be improved and the UK is to meet its existing national targets and international commitments.

These targets and commitments include:

- the Water Framework Directive (WFD) that requires all water bodies (with some exceptions) to achieve good ecological and chemical status;
- commitments to bring Sites of Special Scientific Interest into favourable condition;
- the Nitrate Directive that aims to reduce nitrate pollution from agriculture;
- the Groundwater Directive that aims to prevent or limit pollution from hazardous substances;
- the Bathing Water Directive that sets water quality standards which are currently being tightened;
- the Habitats and Birds Directives, and UK Biodiversity Action Plan, that require action to protect habitat quality;
- commitments under the North Sea Conference and OSPAR Convention that set targets to reduce marine pollution.

Reducing rural and urban diffuse pollution is likely to require a combination of voluntary and economic measures, and new regulatory powers such as the development of General Binding Rules (GBRs) to ensure that good practice in undertaken to reduce the risk of water pollution. A wide range of actions to tackle diffuse pollution is already being taken forward by Defra, WAG, ourselves and others.

The main initiatives to control diffuse sources are outlined below. Controlling the production and use of certain hazardous chemicals to stop the pollution at source is a key part of the approach.[34] Soil protection is also central to reducing diffuse water pollution because soils are the route by which many pollutants reach water.[35]

A new approach to water protection

To deal effectively with pollution and other environmental problems we need to look across whole water catchments at all the factors affecting water quality.[36] This is the approach set out in the WFD, which requires all inland and coastal waterbodies to reach good status by 2015. We are looking at the impacts and risks to all water bodies to develop a programme of measures where change is needed to meet environmental standards in England and Wales. The WFD sets out to reduce and eventually to eliminate pollution from priority hazardous substances; limits are currently being set by the European Commission. New environmental quality standards will be introduced for these chemicals and to achieve them we will have to control diffuse pollution. We are also refocusing our monitoring to provide better information on the impacts of diffuse pollution.

Defra will consult on the measures needed to meet the WFD's objectives. The methods used to reduce diffuse pollution are likely to include negotiated agreements, economic instruments, educational projects and promoting more environmentally friendly practices (such as those described below), as well as regulation. We will be combining these measures into action plans by 2009, with the aim of meeting the demanding environmental objectives by 2015.

Preventing urban pollution

In urban areas the problems of diffuse pollution are complex and are only just beginning to be measured. Defra and WAG have published a consultation document on non-agricultural diffuse water pollution. They are working with us, industry sectors,

local authorities and others to prioritise the most urgent problems. They will assess the effectiveness of existing measures and determine what additional measures and changes are needed. An expert steering group has been set up to take work forward in this area.

To stop pollutants reaching watercourses in built-up areas we want to see run-off managed by a range of techniques known as sustainable drainage systems (SUDS) (Box 7). This approach recreates a more natural pattern of run-off, slowing down the flow of rainwater so that more passes through the soil where pollutants are retained and broken down. Relatively clean water is then returned to rivers or groundwater. SUDS include rainwater re-use, soakaways, permeable surfaces, ponds and wetlands. To incorporate SUDS into urban design, developers, planners and the water industry need to work together.[37]

Box 7
Sustainable drainage systems: the Bourne Stream Partnership

At Bournemouth beach, bathing water quality used to be badly affected by diffuse pollution from the Bourne Stream, particularly after dry weather when the first flush of rain led to high levels of bacterial contamination. The 7km stream flows through built-up areas and enters the sea near the pier.

The Bourne Stream Partnership is tackling diffuse pollution by sustainable methods, including pollution prevention and promoting SUDS. Features such as ponds and wetlands have been installed to slow the stream's flow, allowing sediment to settle out and pollutants to degrade naturally. The partnership is working to raise awareness of water pollution and good environmental practice. Bathing water quality has improved and meets the requirements of the Bathing Water Quality Directive.

Tackling other sources of diffuse pollution
In both urban and rural areas preventing pollution at source depends to a large extent on simple precautions being taken by businesses and individuals. Many of these actions are explained in our pollution prevention guidance notes and voluntary codes of good practice (available from www.environment-agency.gov.uk). Using regulation, advice and campaigns such as Oil Care, our strategy for small and medium sized businesses and NetRegs, we are working with businesses to promote pollution prevention. Examples include:

- using oil and chemicals safely, with bunded storage and handling areas;
- disposing of waste oil and chemicals safely;
- using minimal volumes of herbicides to control weeds in public areas;
- choosing chemicals with a lower impact on the environment;
- disposing of wash water to the foul sewer, not to surface drains;
- avoiding the illegal connection of foul sewage to surface water drains (Box 8);
- cleaning up dog fouling.

Box 8
Are you well-connected?

One in five properties have incorrectly connected drains. Resolving the problem of foul drains wrongly connected to surface water sewers requires homeowners, builders and plumbers to take more care, and the building regulations to be enforced. Wrong connections are dealt with by the water and sewerage companies, with our support, but tracking them down is extremely time consuming. If the proposal to include checks for wrong connections in the new house seller's pack is accepted, this would help to raise awareness of the problem and reduce its impact.

All sectors will have to make further cuts in emissions to air to meet the targets of the National Emissions Ceilings Directive by 2010 and the WFD.[38] Diffuse sources of air pollution will need to be tackled. Emissions of gases into the air from a large number of sources such as transport, industry and agriculture can also eventually cause water pollution through being washed out in rainfall.

Reducing pollution from farming
Agriculture is changing. The latest reform of the EU Common Agricultural Policy (CAP) in 2003 broke the link between financial support and production. CAP support is now tied to compliance with EU standards for the environment, public and animal health. Farmers will also have to maintain land in good agricultural and environmental condition. In addition, new agri-environment schemes in England and Wales will reward farmers for actively maintaining and improving the environment. Farmers will be

encouraged to select these options in priority catchments. Environmental Stewardship in England and Tir Cynnal and Tir Gofal in Wales are now paying land managers to adopt resource protection measures like nutrient and soil management, and the introduction of buffer strips.

Direct regulation also has a part to play in reducing diffuse pollution from agriculture. To reduce inputs of nitrate from agriculture Nitrate Vulnerable Zones (NVZs) have been designated across 55 per cent of England and 3 per cent of Wales. The rules that govern the application of manure and fertilisers to land in these areas have been in place since 2002. As yet there is no evidence that nitrate levels are declining. For groundwater we expect any changes to take time but we would expect to see some reduction of nitrate levels in rivers. The current rules are being revised and both Defra and WAG are going to public consultation on revised proposals this summer.

Further action will be needed in many catchments to achieve national objectives for surface and groundwaters.[39] These are being developed by Defra and WAG under the Catchment Sensitive Farming Programme, which will tailor solutions to local environmental circumstances through farm planning (Box 9).

We have been working successfully with farmers to control the diffuse pollution of bathing waters, for example as part of the Green Seas initiative in Wales.

We visited nearly 10,000 farms last year, to advise farmers how to comply with controls on fertilisers and manure. We have signed an accord with the National Farmer's Union and Water UK, committing us all to working in partnership to tackle diffuse pollution.

To bring about effective change we also believe that new approaches such as co-operative agreements and economic instruments should be considered. For example, the Voluntary Initiative is an alternative to a tax on pesticide use. It aims to minimise the environmental impacts of pesticide use and achieve environmental improvements. The programme is led by the Crop Protection Association with the support of other agricultural industry bodies including the National Farmers Union, conservation bodies and ourselves. The initiative has had some success but there is still much to do.

Box 9
Catchment Sensitive Farming Delivery Initiative

Catchment sensitive farming requires a partnership between farmers, regulators (such as ourselves and Natural England) and others. Farmers and their advisers will need to increase their understanding of pollution risks and prevention. At problem sites they may have to improve dirty water storage and manage soil and chemical use to limit losses of pollutants to water. This approach will be promoted through advice, incentive schemes, and regulation where it is needed.

With Defra, we are funding a network of catchment officers to help farmers reduce diffuse pollution in priority river catchments. Local projects, like Landcare on the Hampshire Avon, have shown that this approach can work.

Conclusions

Diffuse water pollution is an increasingly important issue. We want to reduce the social, economic and environmental costs of contaminated water sources, degraded urban rivers, and declining biodiversity and fisheries. High quality waters are vital to rural economies and are at the centre of urban regeneration.

The Water Framework Directive (WFD) requires much better control of diffuse pollution in order to improve water quality. Our initial assessment for the WFD shows that many groundwaters, rivers, lakes and coastal waters are at risk of not achieving good status. We will refine this assessment and consult on our new findings.

Adjusting land management and taking steps to prevent pollution can often be inexpensive, although changing habitual practices will take time. We will be working with farmers to bring about catchment sensitive farming. We will be working with planners, architects and developers to design diffuse pollution out of urban waterways. In some cases, further resources will be needed. It is not always clear who should pay, but the potential benefits are likely to greatly outweigh the costs.

To tackle diffuse pollution we all need to explore new ways of managing both land and water. We should look at potential pollutants from cradle to grave. Finding the best solutions for the environment will require new thinking, better information and action. By working with other organisations and interests we can agree cost-effective solutions. By looking at whole river basins we can target the main problems. Much can be achieved through voluntary measures and the right advice based on local knowledge. Regulation can then be directed to where it is needed most.

References and endnotes

[1] Environment Agency website, www.environment-agency.gov.uk/business/444217/444663/955573
[2] Percentage of the total length or area of each waterbody type. Waterbodies can be at risk from more than one pressure.
[3] Environment Agency (2002) *Our urban future.* Environment Agency, Bristol. 25pp.
[4] 2004/05 prices including investments between year 1989/90 and 2004/05 for all nitrate reduction costs.
[5]United Kingdom Water Research Limited (UKWIR) (2004) *UKWIR news*, Issue 33, November 2004. London.
[6] Defra (2004) *Developing measures to promote catchment-sensitive farming*. A joint Defra-HM Treasury consultation. Defra, London, 77pp.
[7] Defra (2004) *Updating an estimate of the source apportionment of nitrogen to waters in England and Wales - phase 2 report to the Department for Environment, Food and Rural Affairs.* London, 34pp.
[8] European Environment Agency (2004). *Signals: A European Environment Agency update on selected issues*. The European Environment Agency, Luxembourg, 36 pp.
[9] Defra (2004) *Developing measures to promote catchment-sensitive farming*. A joint Defra-HM Treasury Consultation. Defra publications, London. 77 pp.
[10] National Rivers Authority (1995) *Zinc in estuaries*. National Rivers Authority, Bristol. 48pp
[11] As shown by our general quality assessment.
[12] Petts, G, Heathcote, J and Martin, D (2002) *Urban rivers: our inheritance and future*. IWA Publishing, UK. 117 pp.
[13] English Nature website. www.english-nature.org.uk/special/sssi/report.cfm?category=N
[14] Above 30 mg NO_3/l.
[15] Above 0.1 mg P/l.
[16] Environment Agency (2004) *Our nation's fisheries. The migratory and freshwater fisheries of England and Wales - a snapshot.* Bristol. 51pp.
[17] Foy RH and Bailey-Watt AE (1998) Observations on the spatial and temporal variation in the phosphorus status of lakes in the British Isles. *Soil management* 14, 131-138.
[18] Johnes P, Curtis C, Moss B, Whitehead P, Bennion H and Patrick S (2000) *Trial classification of lake water quality in England and Wales: a proposed approach*. Environment Agency, Bristol, R&D Technical report E53, 80pp.
[19] Environment Agency (2006) *Pesticide report 2005.* www.environment-agency.gov.uk/yourenv/eff/1190084/business_industry/agri/pests/
[20] The Government requires Salmon Action Plans for all 63 principal salmon rivers to implement the National Salmon Strategy.
[21] Milan DJ, Petts GE and Sambrook H (2000). *Regional variations in the sediment structure of trout streams in southern England : benchmark data for siltation assessment and restoration*. Aquatic Conservation: Marine and Freshwater Ecosystems 10, 407–420.
[22] Environment Agency (2004) *The state of England's chalk rivers: summary report by the UK Biodiversity Action Plan Steering Group for Chalk Rivers*. Environment Agency, Bristol. 16 pp.
[23] National Expert Group on Transboundary Air Pollution (NEGTAP) (2001) *Transboundary air pollution: acidification, eutrophication and ground-level ozone in the UK*. Centre for Ecology and Hydrology and Defra, London. 314pp.
[24] Worrall, F, Besien, T, and Garthwaite, D (in prep). Pesticides in the groundwater of Southern England 1992-2000. *Journal of hydrology*.
[25] Covey, R and Laffoley, D d'A (2002) *Maritime state of nature report for England: getting onto an even keel*. English Nature, Peterborough. 48 pp.
[26] Marine Environment Monitoring Group (2004) *UK National Marine Monitoring Programme – second report (1999-2001)*. CEFAS, Lowestoft. 136pp.
[27] Environment Agency (1999) *The state of the environment of England and Wales: coasts*. Bristol. 201 pp.
[28] Defra (2005) Press release 9th November 2005.
[29] Environment Agency pers comm.
[30] A measure of shellfish quality. Class B shellfish can be sold for human consumption after treatment in a purification centre. Class A shellfish needs no treatment.
[31] Defra (2004) *Developing measures to promote catchment-sensitive farming*. A joint Defra-HM Treasury Consultation. Defra publications, London, UK. 77 pp.
[32] Marine Conservation Society (2004) *Factsheet on marine oil pollution*. MCS, Ross-on-Wye.
[33] Advisory Committee on Protection of the Sea (2005) *Annual survey of reported discharges attributed to vessels and offshore oil & gas installations operating in the United Kingdom pollution control zone 2004*. ACOPS, Maritime and Coastguard Agency, London. 48pp.
[34] Environment Agency (2003) *Managing chemicals for a better environment. The Environment Agency's strategy*. Environment Agency, Bristol. 41pp
[35] Environment Agency (2004) *The state of soils in England and Wales*. Environment Agency, Bristol. 32 pp.
[36] Environment Agency website, www.environment-agency.gov.uk/business/444217/444663/955573
[37] National SUDS Working Group (2004) *Interim code of practice for sustainable drainage systems*. National SUDS Working Group for ODPM, Defra and Welsh Assembly Government, 58pp, www.ciria.org/suds/icop.htm
[38] National Expert Group on Transboundary Air Pollution (NEGTAP) (2001) *Transboundary Air Pollution: acidification, eutrophication and ground-level ozone in the UK*. Centre for Ecology and Hydrology and Defra, London. 314pp.
[39] GFA-RACE Partners Ltd & IEEP (2003) *The potential environmental impacts of the CAP reform agreement*. Defra, London.

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