Snapshots of the Environment
The National Centre for Environmental Data and Surveillance
Environment Agency

Integrated River Basin Management

1.0 Introduction

1.1 The Snapshots of the Environment series explores some of the issues related to each of the nine Themes identified in the Environment Agency publication **'An Environmental Strategy for the Millennium and Beyond'** (Environment Agency,1997). Each Snapshot uses the **Viewpoints on the Environment** (Environment Agency,1997a) and the Stresses and Strains framework to look at some of the pressures on the environment. This fifth Snapshot focuses on Integrated River Basin Management.

1.2 Given the wide range of potential topics and the restricted space, these Snapshots can touch upon only some of the issues and cannot be a comprehensive review. As more information becomes available, or new issues develop, they will be covered in future Snapshots. An important aspect of the Snapshots is that they will look at issues that can be followed across the nine Themes covered in the series.

2.0 Integrated River Basin Management

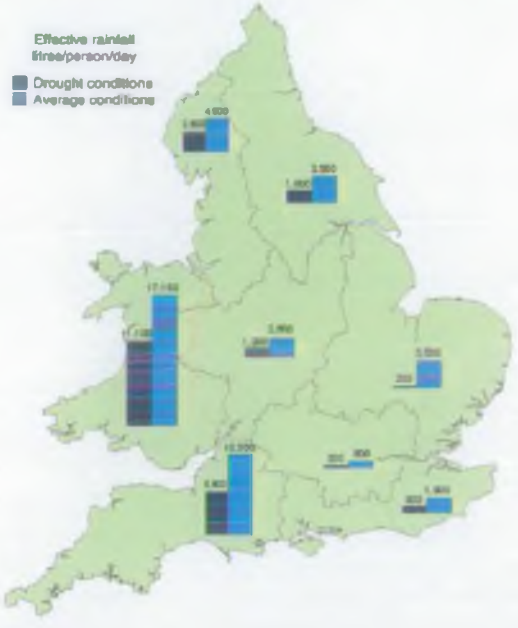
2.1 Water has many uses - industry, agriculture and public water supply. All place demands on this resource. Integrated River Basin Management is a way of balancing these demands whilst ensuring that the conservation and recreational needs of the catchment are taken into consideration. Both the physical, chemical and biological characteristics of the catchment affect the quality of the water flowing through it. Any changes within a catchment will have a potential impact on the water quality. Therefore, some indication of change to the physical, chemical and biological constituents can be gained by looking at both the quantity and quality of waters within that catchment.

3.0 Climate Change

3.1 Over the past 130 years, the global average temperature has risen approximately 0.6°C. This is well within the bounds of historic climate variability, but it may also reflect the effect of greenhouse gases on global warming. The increase in air temperatures could lead to higher rates of evapotranspiration which may lead to changes in river and groundwater flows. Climate change scenarios suggest that the south and east of England is likely to experience hotter and drier summers, which will increase the demand for water. In contrast the north west is likely to become wetter. As temperature increases and rain patterns change, natural habitats, wildlife and farming zones may steadily migrate northwards (if they are able to) by approximately 50 to 80km per decade (May, 1997). These climatic changes, coupled with others outlined below, will place greater strains on catchments especially on water resources and water quality.

4.0 Water Resources

4.1 Estimating usable freshwater stocks is difficult due to the temporal and spatial variability of the hydrological cycle and the effects of human activities such as abstraction of water and disposal of effluent. The renewable freshwater resource of England and Wales is the amount of water moving in rivers, lakes and aquifers, that originates from rainfall. The long-term average precipitation, minus losses due to evaporation, gives a measure of the natural runoff and infiltration, and hence freshwater stocks.



Source: Environment Agency
Average and drought effective rainfall in relation to regional population density, 1961 to 1990

4.2 There are 1,100km² of standing waters, with 12,500 of these having a surface area greater than 2hectares, and 600km² of running water in England and Wales. In average years there are 77,000Mm³ of available water stocks. However, in drought years this volume drops to 39,000Mm³. This gives an average 4,000 litres of water per person per day, but in drought this is reduced to 2,000 litres per person per day.

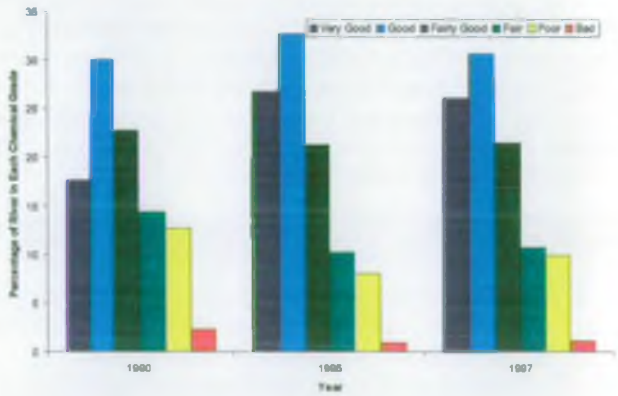
5.0 Water Quality and Pollution

5.1 Groundwater is monitored by the Agency at strategic locations around public and private supply sources and in areas where there are perceived problems. With the sampling programme carried out by the water companies approximately 1,500 sources are routinely monitored. Unlike surface waters, there is currently no legal requirement to monitor for specific substances in groundwater apart from nitrate. There has been limited national collation and assessment of groundwater data, but this is being addressed by the implementation of a national groundwater monitoring strategy.

Source: Institute of Hydrology
Location of aquifers in UK

5.2 A total of 251 groundwater abstractions were identified as being affected by 210 sources of pollution (Environment Agency,1996). An additional 368 public and private abstractions were considered at risk from existing point sources of pollution. Groundwater pollution is particularly serious because of its long-term nature. It can take decades for pollutants to move through the aquifer, and effective clean up of groundwater pollutants is difficult and costly. The Agency's Groundwater Protection Policy was formulated to protect groundwaters from pollution and over abstraction, not only for water supply but also to protect the streams, rivers and wetlands that rely on groundwater (Environment Agency, 1998).

5.3 The Agency classifies the water quality of rivers and canals using the General Quality Assessment scheme (GQA). The scheme provides several 'windows' to describe surface water quality. The Chemical GQA describes quality in terms of three chemical measurements, the Biology GQA uses monitoring of aquatic macroinvertebrates, and the Nutrient GQA monitors orthophosphate and nitrate. The the last Quinquennial Survey (1995) showed that 91per cent of rivers in England and Wales are Very Good to Fair according to the chemistry window and 93 per cent in terms of the biology. Eight per cent of rivers are Poor (five per cent in terms of biology) and one per cent are Bad (two per cent in the biological assessment). There was a net upgrading of rivers of 28 per cent (chemistry) and 26 per cent (biology) between 1990 and 1995 (Environment Agency, 1997b).



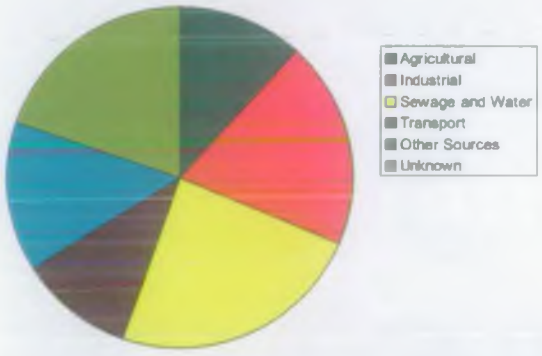
Source: Environment Agency
Water quality: General Quality Assessment 1990/95/97

5.4 Analysis of results covering the period 1995 to 1997 show that since 1990, there has been a net improvement in the chemical quality for 21 per cent of total length of monitored river and canal waters. The length of Poor to Bad quality rivers reduced from 15 per cent to 11 per cent of the total.

5.5 The Chemical GQA is based on monitoring for dissolved oxygen, ammonia and biochemical oxygen demand. These determinands are good indicators of organic pollution, for example from sewage treatment works, agriculture and some industrial processes. They are also used to monitor overall improvements due to changes in treatment of effluent from point sources. The Nutrient GQA is also useful for monitoring changes to point sources: the major input of orthophosphate is from sewage treatment works,

which mostly originates from households. The improvements seen in both the chemistry and biology windows between 1990 and 1995 have largely been attributed to better treatment of sewage effluents by the water industry. Biological quality is also affected by the GQA chemistry determinands, but there are other substances, for example, metals and pesticides, that impact on the fauna of the river. In some cases the water quality may be good but river sediments may be contaminated and may remain so for many years. The biology will reflect such contamination but the chemistry will not. The biology GQA therefore helps to give an integrated assessment of the effects of all pollutants.

5.6 In 1997 the Agency responded to 30,699 reports of water pollution. A total of 64 per cent (19,571) of incidents were substantiated on investigation. This is a fall of 3 per cent over the 1996 figures. By source, the sewage and water industry accounted for the largest proportion of incidents (27 per cent). From the industrial sector (19 per cent) the construction industry was the most frequently identified source (15 per cent). Agriculture accounted for 10 per cent of incidents with dairy farming the major source. The second largest agricultural source was sheep farming with the disposal and use of sheep dip causing concern. Pollution from domestic and residential sources accounted for 7 per cent of all incidents (Environment Agency, 1998a)



Source: Environment Agency
Category 1 Substantiated Pollution Incidents by Source (1996)

6.0 Urbanisation

6.1 Changes to the use of land within a catchment will impact on both water quality and availability. In 1981 just over 10 per cent of the land in England was in urban use. By the year 2016, this figure is expected to reach about 12 per cent. This equates to 169,000 hectares of land changing from rural to urban use (DoE, 1996). This change will not occur evenly over the country, but will tend to be concentrated in areas that already have high population densities. Much of this change is driven by a need for new housing and an estimated 4.4 million new homes in England and 233,000 in Wales between 1991 and 2016. This need reflects changing lifestyles and increased longevity of the population in general. Much of the housing needs will be accommodated in the south west and eastern regions where a 29 per cent increase in households is predicted (DoE, 1996b).

6.2 New developments have many potential effects on a catchment. Changes in drainage may occur as greater areas are given over to impervious surfaces such as roads and car parks. This increases the rate of runoff from the land into the river system, producing a faster response to rain events and increasing the risk of flooding to areas downstream. There are also the problems incurred when development encroaches on to the flood plain. This causes a reduction in the holding capacity of the flood plain, which can have a dramatic effect on the movement of flood waters. An estimated 10,683km² of land is at risk of flooding from a 1 in a 100-year event. Of this, 611km² (5.7 per cent) is in built up areas (IoH, 1996). Any increase in the development of flood plains will lead to more property being put at risk.

6.3 New developments also put a strain on water resources in other ways. An increase in the number of households will require an increase in the volume of water to be supplied. Households use about 40 per cent of all water abstracted, and each household uses about 380 litres of water per day. With the majority of new developments being targeted in the south there is the additional problem with low river flows and depleted aquifers. The location of a new development may also affect the recharge of any associated aquifers, and the riparian zones of rivers by acting as an impervious cap over the area.

6.4 The impact of diffuse pollution from built up areas is becoming more apparent as pollution from point source discharges are reduced. Many urban areas with poor water quality are affected by storm overflows from the sewerage systems. The contaminants discharged from storm overflows vary in a complex way due to variations in weather. These intermittent discharges may be a major factor in preventing the recovery of fish populations in some rivers (Environment Agency, 1998).

7.0 Agriculture

7.1 Agricultural practices and land management have significant impacts on water quality. Reducing the levels of pollutants reaching the aquatic environment is critical if improvements are to be made in water quality. Pesticides and fertilisers can enter the water cycle from agricultural activity. Agriculture has been highlighted as a major source of nitrate pollution since the 1970s. Attempts have been made to reduce nitrate from agriculture by changing the timing of crop planting and fertiliser application. Typical application rates in 1996 were 125kg N/ha,

this value has reduced from around 145kg N/ha in 1985 (FMA, 1997). Nitrate Vulnerable Zones (NVZs) have been set up in order to reduce the load of agriculturally derived nitrate entering both surface and groundwaters. Currently there are 68 NVZs in England and Wales, covering an area of 600,000hectares, of which six are surface water zones comprising nine river catchments. The rest are groundwater zones in which there are over 140 boreholes used for abstraction. In December 1998 the Action Programme for Nitrate Vulnerable Zones (England and Wales) Regulations 1998, came into force. The Ministry of Agriculture, Fisheries and Food has produced "Guidelines for Farmers in NVZs" (MAFF, 1998). While the Action Programme measures are only compulsory within NVZs, they are based on good agricultural practice and are recommended for use on all farms. This would reduce the risk of pollution and may save some farmers money.

Source: Ministry of Agriculture, Fisheries and Food
Location of Nitrate Vulnerable Zones

7.2 Water-induced soil erosion occurs over a large area of the country and affects a wide range of soil types. Particularly at risk are sandy and silty soils. Studies by MAFF on 12 catchments between 1989 and 1994 recorded water erosion of soil in 39 per cent of the fields monitored. The greatest volume of erosion (79 per cent) took place on sites that had been planted with winter wheat (RCEP, 1996). The consequence of this type of erosion is the contamination of surface waters by phosphate, pesticides and other contaminants adhering to soil particles. Together with substances in solution, this will be carried into the watercourse and may eventually enter the sea. To give an idea of the scale of the problem, it was estimated that after one severe storm event in 1989, 1.6 to 2.0 tonnes of phosphorus and 1,120 to 2,140m³ of top soil entered the Exe Estuary in Devon; this originated from four fields under winter wheat. Crop production is not the only route for soil erosion. Higher stocking ratios may be causing overgrazing which has lead to increased soil erosion in some parts of the country.

7.3 Apart from the input of chemicals, the additional load of suspended solids can lead to increased rates of siltation. This is particularly problematic in the spawning grounds of salmonid fish where sedimentation intrusion can reduce successful spawning (Theurer *et al.*, in press). Sedimentation can cause loss of navigation which then requires dredging and other work to maintain navigation to over 4,000 km of inland waters for which the Agency is responsible. Siltation also affects water supply reservoirs. Sedimentation of reservoirs occurs naturally, and it is not known how much changing farming practices have contributed to this (Environment Agency, 1998).

8.0 Recreation

8.1 In 1996, 180 million day visits were attributed to freshwater recreation. This consisted mostly of walking, angling and water sports. While enjoyment of the environment contributes to the quality of life, recreation itself can create pressures, especially on and around freshwater sites. Recreational users have different needs and there can be conflicts with the needs of others.

Source Environment Agency
Local Environment Agency Plans coverage in England and Wales

8.2 With a continued growth in recreational activity expected, there is a need for more positive planning to ensure that the needs of all users are catered for without increasing the pressures on the catchment and its freshwater resources. Integrated river basin management allows an holistic approach to ensure that all the needs of a catchment are identified and that a sustainable approach is made to managing water resources. This requires management of catchments to be aimed at local issues and problems. The Local Environment Agency Plans (LEAPs)

provide a means of reconciling the conflicting demands placed on surface and groundwaters. By the year 2000 there will be LEAPs covering England and Wales on the basis of river basins. Each LEAP is subject to extensive local consultation and seeks to lay out those environmental problems that the Agency will be able to address.

9.0 The Future

9.1 The proposed European Union Water Framework Directive is a major legislative initiative intended to replace European water legislation which has been developed since 1975. The proposal will require the application of river basin management techniques in order to achieve "good status" in all surface and groundwaters. The Directive will impose a requirement on all Member States to assign their land areas to "River Basin Districts". The competent authority for England and Wales is most likely to be the Environment Agency and will be responsible for the preparation of River Basin Management Plans covering the period 2009 to 2033.

9.2 The main elements of the proposed Directive include:
i) A requirement to prepare six yearly River Basin Management Plans (the first will be for the period 2009 - 2015);
ii) The environmental objectives for surface waters are both chemical and ecological in nature;
iii) The adoption of a combined approach to control of dangerous substances where both Environmental Quality Standards and Emission Limit Values are applied;
iv) A protocol for the selection of dangerous substances and the setting of European wide standards.

9.3 The environmental objectives will apply to all surface fresh waters, to all groundwaters, and to saline waters up to one nautical mile from the coastal baseline.

Bibliography

DoE, 1996. Indicators of Sustainable Development for the UK. HMSO, London.

DoE, 1996. Household Growth: where shall we live. HMSO, London.

Environment Agency, 1996. Groundwater Pollution: evaluation of the extent and character of groundwater pollution from point sources in England and Wales. HMSO, London.

Environment Agency, 1997. An Environmental Strategy for the Millennium and Beyond. Environment Agency, Bristol.

Environment Agency, 1997a. Viewpoints on the Environment. Environment Agency, Bristol.

Environment Agency, 1997b. The Quality of Rivers and Canals in England and Wales 1995. Environment Agency, Bristol.

Environment Agency, 1998. The State of the Environment of England and Wales: Fresh Waters. Stationary Office.

Environment Agency, 1998a. Water Pollution Incidents in England and Wales 1997. The Stationery Office, London.

Fertiliser Manufactures Association, 1997. The Fertiliser Review. Fertiliser Manufactures Association, Peterborough

Theurer, F.D., Harrod, T.R. and M. Theurer. In press. Sedimentation and Salmonids in England and Wales. Report.

MAFF, 1998. Guidelines for Farmers in Nitrate Vulnerable Zones. MAFF, London.

May, R., 1997. Climate Change. A note by the UK Chief Scientific Adviser. Office of Science and Technology, London.

Royal Commission on Environmental Pollution, 1996. Sustainable use of soils. Royal Commission on Environmental Pollution 19th Report. HMSO, London.

For further information contact:

The Environment Agency
National Centre for Environmental Data and Surveillance
Lower Bristol Road
Bath, BA2 9ES

Tel: 01278 457333
GTN: 7244223
Fax: 01225 469939

E-mail david.palmer@environment-agency.gov.uk

Website http://www.environment-agency.gov.uk

Other Snapshots in the series:

Snapshot 1: A new environmental approach
Snapshot 2: Conserving the land
Snapshot 3: Enhancing biodiversity
Snapshot 4: Managing Fresh Water Fisheries