



local environment agency plan

SEVERN VALE ENVIRONMENTAL OVERVIEW AUGUST 1999



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The Severn Vale Local Environment Agency Plan, public registers of environmental information, and a wide variety of publications on the work of the Environment Agency can be gained from our Lower Severn Area office, at the above address. You can also find us at www.environment-agency.gov.uk

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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE OF THE ENVIRONMENTAL OVERVIEW

This Environmental Overview has been prepared to provide supporting information to the Severn Vale Local Environment Agency Plan (LEAP). It is a factual description and analysis of the Severn Vale environment and the stresses and strains placed upon it. From this overview a series of issues have emerged which have been carried forward into the Severn Vale LEAP.

The scope of the Environmental Overview is confined to those aspects of the environment for which the Environment Agency has responsibility. These include, in summary: the water environment; land and habitats associated with rivers and coasts; some aspects of air quality; and waste management including contaminated land. This overview is not, therefore, intended to be a comprehensive assessment of the state of the Severn Vale environment. However, it has been prepared within the context of the Agency's overall aim to protect and enhance the whole environment, thus contributing to sustainable development. The Severn Vale LEAP is a strategic plan, addressing environmental issues that are of concern to the area as a whole or are of significant local concern.

1.2 STRUCTURE OF THE ENVIRONMENTAL OVERVIEW

The overview is divided into six main sections, or viewpoints, each providing information on the state of the environment in the Severn Vale. This framework for measuring the state of the environment has been derived from the Environment Agency publication '*Viewpoints on the Environment*'. The six viewpoints are as follows:

- **Land use and environmental resources** examines the quantity and nature of environmental resources which exist, including land and land use, air quality, water quantity and quality, and resources of conservation interest. Pressures on the Severn Vale environment are discussed in terms of stresses and strains placed upon those aspects of direct relevance to the Agency's responsibilities and activities.
- **Key biological populations, communities and biodiversity** examines the variety of life that exists and considers the number and extent of key wildlife habitats and species, where known.
- **Compliance with environmental standards, targets and strategies** details European and national legislation, targets embodied within government strategies and international agreements relating to the environment, and how these are being implemented in the Severn Vale. Incidents that pose a threat to the environment are also discussed.
- **The health of the environment** focuses on issues of concern in relation to the health of the environment, including air ozone, eutrophication, and diseases and invasive species which pose potential threats to the health and extent of key species.
- **Long-term reference sites** examines available data sets relating to the environment and considers integrated information on long-term trends at specific sites.
- **Aesthetic quality** centres on issues such as landscape, litter, and odour. Assessing the aesthetic qualities of the environment often requires new or subjective approaches, but relates to many quality of life issues deemed to be important by the general public.

Each of these sections examines the current state of the environment from that particular viewpoint. Where relevant, information is provided on the Agency's role with regard to protecting, restoring or enhancing the environment.

Through an examination of the current performance of the environment and the pressures placed upon it, areas have been identified where actions are required to restore or improve the environment to a sustainable condition. These issues were presented for consideration in the Consultation Draft of the Severn Vale LEAP during March to June 1999. The issues are grouped according to the Agency's principle concerns as set out in the Agency's strategy document '*An Environmental Strategy for the Millenium and Beyond*' (1997).

Principal Concerns of the Environment Agency

1. *Addressing Climate Change* – helping to meet national greenhouse gas emission targets
2. *Improving Air Quality* – ensuring that air is of a quality that is not impaired by releases from major industry;
3. *Managing Water Resources* – ensuring that water resources are properly managed to provide water for all reasonable needs without harming the environment;
4. *Conserving and Enhancing Biodiversity* – ensuring that wildlife is protected and their habitats improved;
5. *Managing Freshwater Fisheries* – ensuring that diverse and invaluable fisheries are protected and their habitats increased;
6. *Delivering Integrated River Basin Management* – ensuring that all waters are of a sustainable quality for their different uses; that land is protected from flooding in an economic and environmentally acceptable manner wherever practicable; and that opportunities to enjoy the water environment are conserved and enhanced;
7. *Conserving the Land* – ensuring that land resources are conserved and protected from contamination;
8. *Managing Waste* – ensuring that waste is managed safely and that sustainable waste management options are encouraged;
9. *Regulating Major Industries* – ensuring that adverse effects on air, land and water are minimised.

1.3 THE SEVERN VALE – KEY DETAILS

The Severn Vale LEAP covers the River Severn catchment from its confluence with the River Teme, just south of Worcester, to just below its tidal limit at Gloucester, as well as the Avonmouth and Severnside areas. The total area of the catchment and its Local Authority administrative boundaries are shown in Map 1.

Area and Population	Area	2022km ²
	Population	545,000
Topography	Minimum Level	<10m Above Ordnance Datum
	Maximum Level	425m Above Ordnance Datum
Tidal Range (Avonmouth)	Mean Spring Tides	12.3m
Administrative Details		
County Councils	Gloucestershire County Council Worcestershire County Council	
Unitary Councils	County of Herefordshire District Council South Gloucestershire Council City and County of Bristol	
District Councils	Cheltenham Borough Council Cotswold District Council Forest of Dean District Council Gloucester City Council Stroud District Council Tewkesbury Borough Council Malvern Hills District Council Wychavon District Council	
Ministry of Agriculture, Fisheries and Food	South Mercia Regional Service Wessex Regional Service	
Environment Agency	Midlands Region, Lower Severn Area South West Region, North Wessex Area	
Countryside Agency	Midlands Region South West Region	
English Nature	Three Counties Team Somerset Team	
Water Companies	Severn Trent Water plc Bristol Water Company plc Wessex Water plc	
Internal Drainage Boards	Longdon & Eldersfield IDB North Gloucestershire IDB West Gloucestershire IDB South Gloucestershire IDB	

Severn Vale Local
Environment Agency Plan
Map 1



Administrative Areas

KEY

- Plan boundary
- Main river
- Ordinary watercourse
- Canal
- Built up area
- - - County council/unitary authority boundary
- - - District/borough council boundary
- Land >400 feet

2.0 LAND USE AND ENVIRONMENTAL RESOURCES

This section examines the quantity and nature of environmental resources that exist, including land and land use, air quality, water quality and quantity, and resources of conservation interest. Those key stresses and strains upon environmental resources that are relevant to the Agency's duties and responsibilities are also discussed, comprising natural forces, abstractions, usages, releases and discharges, and waste arisings and disposals, as well as the all-embracing societal pressures related to, for example, population increase, new developments, and recreation. Although an explicit link has been made between these pressures and those environmental resources upon which they have a primary impact, many will have far reaching implications for a number of aspects of the environment.

2.1 ADMINISTRATIVE AREAS & LAND USE PLANNING

The location, extent and design of development can influence the degree to which it impacts upon the environment. The development of land and certain changes in the use of land is controlled by Local Planning Authorities under the Town and Country Planning Act 1990 as amended by the Planning and Compensation Act 1991. The 1990 Act sets out the requirement for the production and alteration of Development Plans and the procedure through which Planning Authorities determine applications for development. Where the two tier local government system still prevails, the plans produced at a County level are Structure Plans and Minerals and Waste Local Plans whilst at the District and Borough level, Local Plans are produced which reflect the policies and allocations within the County Structure Plan. In the case of Unitary Councils, their Plans provide a single comprehensive coverage of the area.

The local authorities responsible for land use planning and development control within the Severn Vale Area are shown in Table 1, and their boundaries are given in Map 1.

The Role of the Agency

Whilst the Agency has powers to regulate some processes and substances which can impact on the environment, its powers to control development are limited. In considering the impacts of new development, the Agency is therefore largely dependent on the Town & Country Planning system for the protection of the environment.

A high quality environment is crucial to achieving economic growth and regeneration and a better quality of life for local people. Achieving sustainable development involves finding ways to encourage environmentally compatible economic activity and controlling environmentally damaging activities. The Agency supports local authorities and others in developing land use planning policies to promote sustainable development and help secure the protection and enhancement of the environment. To this end the Agency provides significant input at all levels of the planning system. Input into land use planning and development control at the local level takes place through:

1. Advising on Development Plan Policies and Guidance. The Agency is a Statutory Consultee on all Development Plans;
2. Responding to requests for comments on planning applications. The Agency is a Statutory Consultee for certain planning applications and Local Planning Authorities have discretionary powers regarding the referral of others.

The Agency's basic objectives in advising on Development Plan Policies and Guidance are to:

- Promote policies which contribute towards sustainable development
- Balance the demands of development with the need to protect and enhance the environment
- Prevent (or control) the pollution of air, land and water
- Reduce the demand for water, making the best use of current resources
- Reduce the risk to people, the developed and natural environment from flooding
- Conserve and enhance biodiversity
- Promote the use of water and associated land for recreational purposes
- Achieve reductions in waste through minimisation, reuse and recycling and improved standards of disposal.

In assessing any planning application a detailed appraisal of the proposal is made by the Agency to identify potential impacts upon the environment. In particular, the following would be considered:

- Impact on flooding due to obstruction to watercourses, in-filling of floodplains and impedence to groundwater flow
- Implications for the integrity of watercourse channels and flood defences
- Impact on groundwater quality particularly where the site lies in a sensitive area with respect to groundwater protection
- Impact on surface water quality, including the washing of silt into a watercourse
- Possible derogation to spring fed watercourses, wetlands and water abstraction
- Impact on the conservation value of the natural water environment including wetlands and river corridors
- Flood risk to the new development from rivers and the sea
- Impact of increased surface water runoff from new development on flooding elsewhere
- Waste management implications including location of former landfill sites
- Implications of development on possible contaminated land
- Impact on sewage treatment facilities and sewerage systems.

2.1.1 Development Plans

Development Plans set out the main considerations on which planning applications are decided. Policies and proposals within them are of primary importance for shaping land use change, and provide an opportunity to safeguard and enhance the environment and prevent future problems arising as a result of development. Development Plans covering the Severn Vale are given in Table 1.

Table 1: Local Planning Authorities and Development Plans			
Local Authority	Percentage of Severn Vale Area	Population Estimated in Severn Vale Area	Development Plan and Current Status
Former Avon County Council	10%	32,900	Joint Replacement Structure Plan Public Inquiry March 1999
Bristol City Council (Unitary)	1%	6,580	Bristol Local Plan – Modifications.
South Gloucestershire Council (Unitary)	9%	26,300	South Gloucestershire Local Plan - Consultation Draft Minerals Local Plan – Consultation Draft.

Local Authority	Percentage of Severn Vale Area	Population Estimated in Severn Vale Area	Development Plan and Current Status
Gloucestershire County Council	69%	449,760	Structure Plan - Second Alteration. Modifications. Minerals Local Plan - Consultation Draft. Waste Local Plan - Project Brief.
Stroud District Council	23%	105,400	Stroud District Local Plan - Consultation Draft.
Gloucester City Council	1.5%	104,800	City of Gloucester (Pre and Post 1991 Boundary Extension) Local Plan - Modifications.
Cheltenham Borough Council	1.5%	106,700	Cheltenham Borough Local Plan - Adopted December 1997.
Cotswold District Council	7%	2,360	Cotswold District Local Plan - Modifications.
Forest of Dean District Council	26%	58,300	Forest of Dean Local Plan - Adopted 1996.
Tewkesbury Borough Council	10%	72,200	Deposit Draft.
Former Hereford & Worcester County Council	21%	62,360	Structure Plan - Second Alteration. Adopted March 1993. Minerals Local Plan - Adopted April 1997.
The County of Herefordshire District Council (Unitary)	1%	500	Unitary Plan - Project Brief
Worcestershire County Council	20%	61,860	Structure Plan - Consultation Draft
Malvern Hills District Council	20%	61,660	Malvern Hills District Local Plan Adopted January 1998.
Wychavon District Council	negligible	200	Wychavon District Local Plan. Adopted January 1998.
TOTAL	100%	545,000	

2.2 GEOLOGY AND TOPOGRAPHY

The Severn Vale area consists of five main areas of relief:

1. The Cotswold Hills form a ridge of high ground rising up to around 300m, with a steep scarp slope on their western side forming the eastern boundary of the Severn Vale area.
2. To the southwest the Forest of Dean, at between 100m and 200m above sea level, is a heavily wooded series of ridges and basins.
3. The Malvern Hills form a very localised prominent ridge rising to around 400m in the north west of the Vale.
4. The floodplain and upper estuary of the River Severn forms the central part of the Severn Vale area.
5. Gently undulating land is found either side of the River Leadon valley.

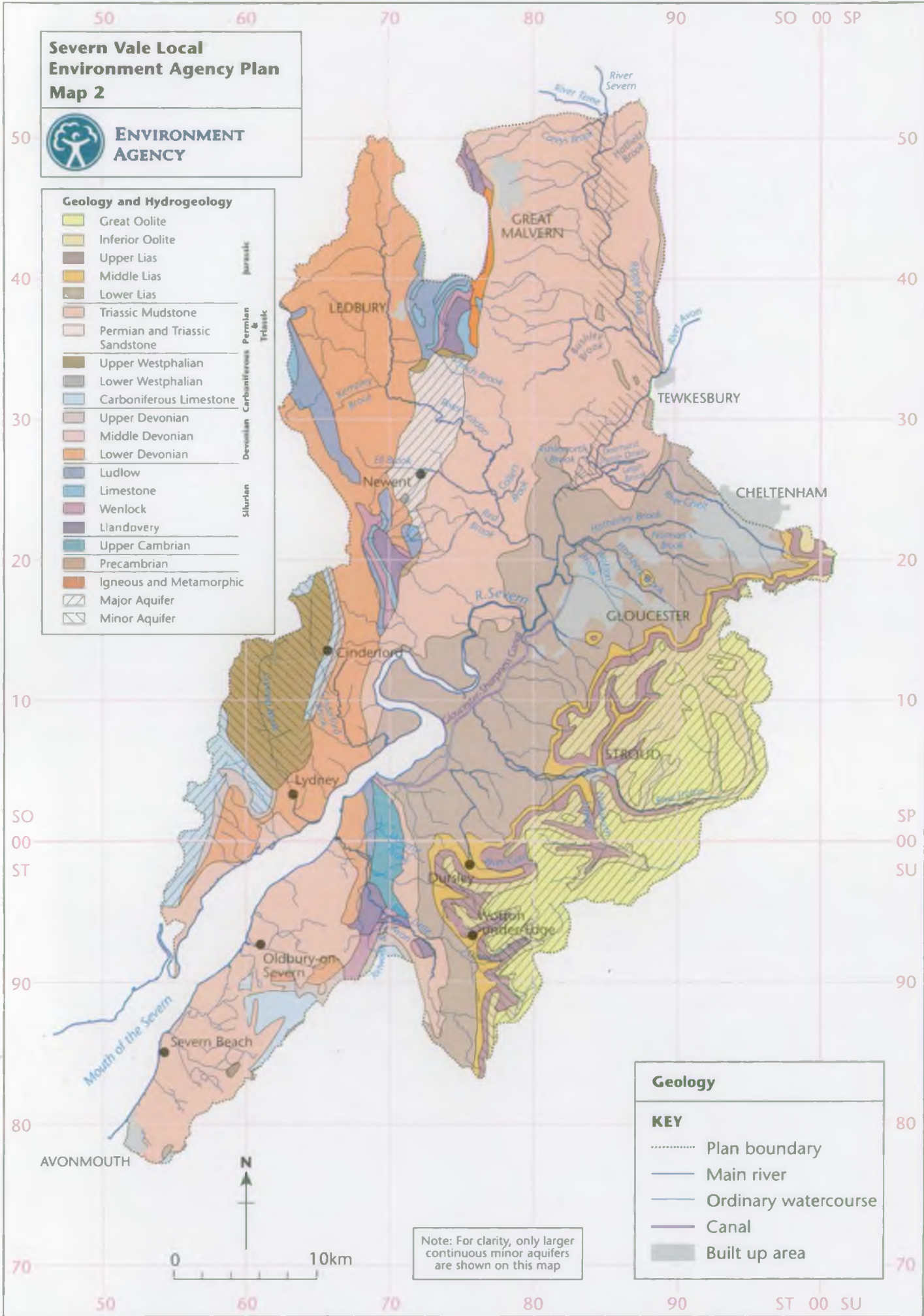
**Severn Vale Local Environment Agency Plan
Map 2**



ENVIRONMENT AGENCY

Geology and Hydrogeology

- | | | |
|--|--------------------------------|--------------------|
| | Great Oolite | Jurassic |
| | Inferior Oolite | |
| | Upper Lias | |
| | Middle Lias | |
| | Lower Lias | |
| | Triassic Mudstone | Permian & Triassic |
| | Permian and Triassic Sandstone | |
| | Upper Westphalian | Carboniferous |
| | Lower Westphalian | |
| | Carboniferous Limestone | |
| | Upper Devonian | Devonian |
| | Middle Devonian | |
| | Lower Devonian | |
| | Ludlow | Silurian |
| | Limestone | |
| | Wenlock | |
| | Llandovery | |
| | Upper Cambrian | |
| | Precambrian | |
| | Igneous and Metamorphic | |
| | Major Aquifer | |
| | Minor Aquifer | |

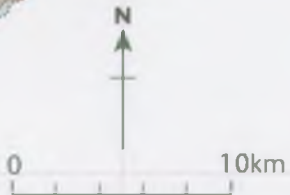


Geology

KEY

- Plan boundary
- Main river
- Ordinary watercourse
- Canal
- Built up area

Note: For clarity, only larger continuous minor aquifers are shown on this map



The upland areas in the west of the catchment (Forest of Dean and Malvern Hills) are formed of old, resistant Palaeozoic rocks. The Forest of Dean is composed of a series of Carboniferous strata consisting of limestones and cyclic sequences of shale, coal seams, sandstone and clays. Devonian Old Red Sandstone and Silurian limestones and shales exist as a narrow band along the western boundary between Ledbury and Ross-on-Wye. The Malvern Hills are formed of Pre-Cambrian volcanic rocks.

The Cotswold escarpment is composed of younger limestone. In between the Cotswolds and the uplands in the west, softer clays and mudstone dominate the low-lying area of the Severn Vale, forming a broad central band from Worcester southwards to Dursley and Avonmouth. These comprise 70% of the catchment. The River Leadon rises on Old Red Sandstone, flowing over Triassic Sandstones that outcrop in a narrow, fault-bounded block north of Newent. Quaternary deposits occur throughout the region, including glacial and fluvioglacial clays and gravels, terrace gravels and river deposits.

The underlying geology of the Severn Vale is shown in Map 2.

2.3 CLIMATE AND HYDROLOGY

The climate of the Severn Vale is largely equable with central England as a whole, with warm summers and mild winters. Temperatures range from a mean maximum of 22°C during the summer to a mean minimum of 2°C during the winter months.

The range in topography gives a slight variation in rainfall. The Cotswolds have a higher mean rainfall than the Severn floodplain and Leadon Catchment - the rainfall varies from 655 mm/year at Ledbury to 900 mm/year at Miserden. The mean rainfall for the entire Severn Vale catchment is 694 mm/year compared with a mean of 754mm/year for the Midlands as a whole. The mean July soil moisture deficit is about 100mm.

The River Severn is supported by Llyn Clywedog reservoir in Mid Wales and, in times of low flow, the Shropshire Groundwater Scheme. River flows, rainfall and groundwater levels are gauged as shown in Map 3. The minimum and maximum mean flows of the catchment's rivers (megalitres/day) are summarised in Table 2.

River (Gauging Station)	Monthly Mean Flows (ML/d)		Catchment Area of gauging stations (km ²)	Dry Weather Flow (ML/d)
	Min	Max		
R Severn (Saxons Lode)	2160	14,500	6850	1380
R Severn (Haw Bridge)	2765	18,130	9895	1712
Leadon (Wedderburn)	51	364	293	28
Frome (Ebley Mill)	105	371	198	78
Chelt (State Mill)	38	73	34.5	26
Cannop Brook (Parkend)	7.3	67	31.5	5.0

River (Gauging Station)	Monthly Mean Flows (MI/d)		Catchment Area of gauging stations (km ²)	Dry Weather Flow (MI/d)
	Min	Max		
Cannop Brook (Cannop Cross) a.k.a. R. Lyd	2.6	23	10.5	2.0
Little Avon (Berkeley)	14.3	302	134	20.2

River flows are influenced greatly by the type of soil cover and underlying geology within their catchment. This is reflected in the dry weather flows for several tributaries to the Severn. The dry weather flow per unit area is much greater in the limestone region of the Frome catchment (>0.4 MI/d/km²) than the mudstones of the Leadon and Chelt catchment (0.01-0.1 MI/d/km²). The flows also reflect the location of urban areas, tending to be greater where there are discharges from sewage treatment plant and urban run-off.

2.4 LAND USE

Map 4 shows the main types of land use within the Severn Vale. The Vale is predominantly rural, with the main land uses being grass 43%, arable 34%, woodland 12%, and the urban uses making up 8.3% of the total area.

2.4.1 Agriculture and Forestry

Soil Types

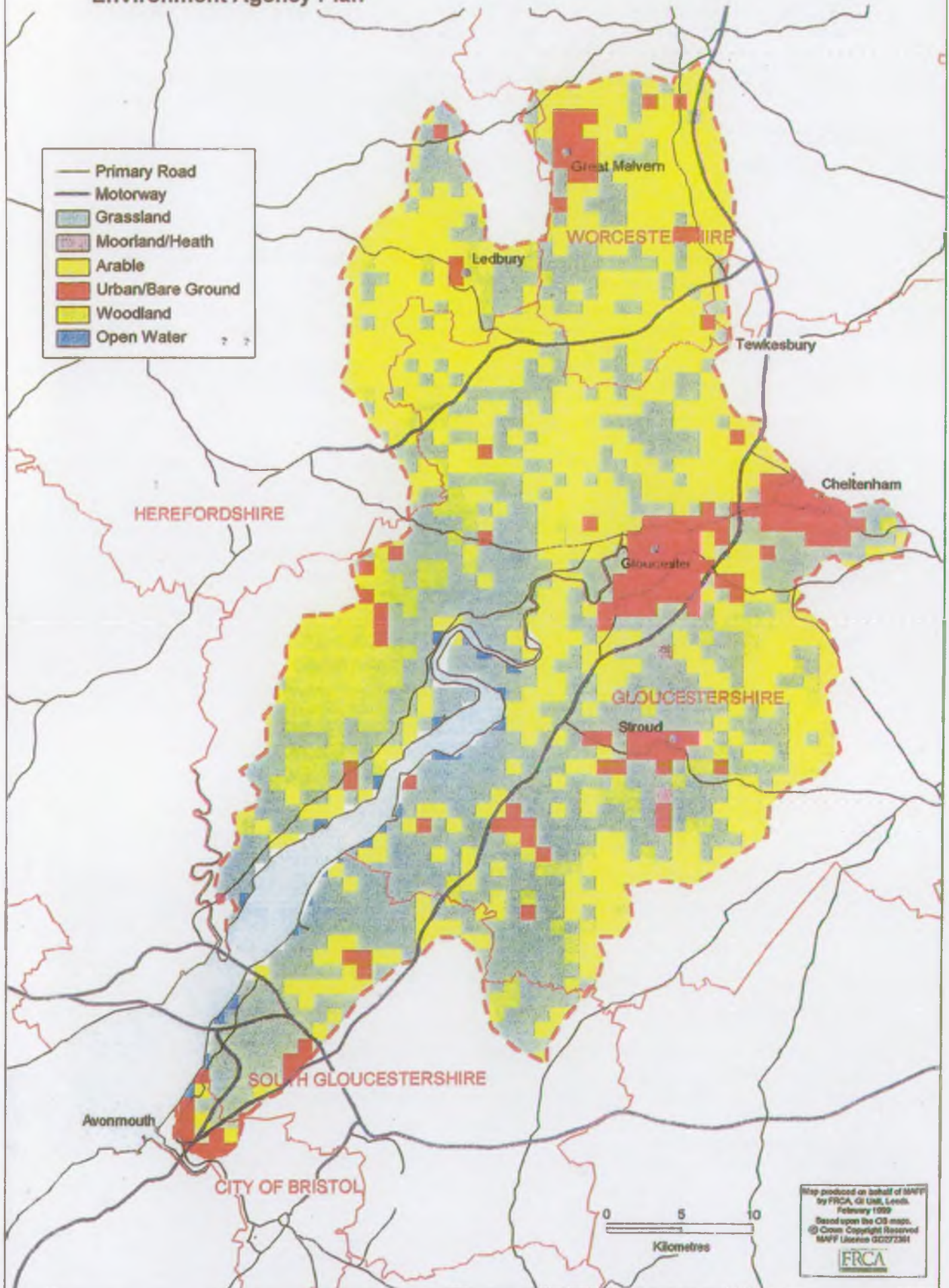
Soils are influenced by their underlying geology. The soils of the Cotswold plateau are shallow, being well drained over porous limestone, while in the valleys eroded material has formed calcareous slowly permeable soils. Similar poorly drained soils are found on the alluvium and Jurassic clay of the River Severn floodplain. There are also groundwater gleyed soils, and surface water gleyed soils, where mottling is prominent above 40cm. On the Triassic mudstone, reddish soils of the Worcester Association are found which may also have slowly permeable subsoils.

The Forest of Dean has a very complex distribution of soil types reflecting its interbedded geology. Generally the soils are of an upland nature including surface-water gley soils and podzolic soils where iron and aluminium have accumulated in the ochreous subsoils. The subsoils of the Malvern Hills are very similar in their generic type. The mudstone geology of the Leadon Valley and the foot-slopes of the Forest of Dean have developed into mainly well drained brown and reddish soils, although their drainage regime varies locally.

Agricultural Land Classification

The Agricultural Land Classification system classifies land according to the degree to which certain physical characteristics impose long term constraints on agricultural use. The main physical characteristics taken into account are

- climate – temperature and rainfall
- site – gradient, micro relief and flood risk
- soil – texture, structure, depth and stoniness



The system is classified into five grades with a two-fold sub-division of Grade 3:

Grade 1: land is described as excellent quality agricultural land with no or very minor limitations to agricultural use. A very wide range of agricultural and horticultural crops can be grown.

Grade 2: land is described as very good quality agricultural land with minor limitations that affect crop yield, cultivation or harvesting. A wide range of agricultural and horticultural crops can be grown.

Sub-grade 3a: land is good quality agricultural land capable of producing moderate to high yields of a narrow range of arable crops, especially cereals, grass, oilseed rape, potatoes, sugar beet and less demanding horticultural crops.

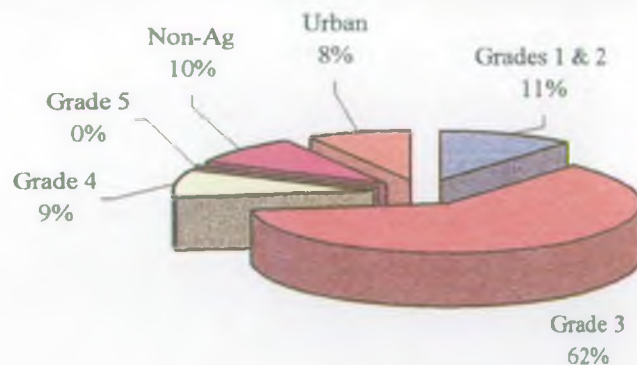
Sub grade 3b: land is moderate quality agricultural land capable of producing moderate yields of a narrow range of crops.

Grade 4: land is poor quality agricultural land with very severe limitations significantly restricting the range of crops and/or levels of yields.

Grade 5: land is very poor agricultural land with very severe limitations that restrict use to permanent pasture or rough grazing.

Figure 1 shows the proportion of each grade within the Severn Vale. Grade 1 land is found extensively to the north and south of Newent and in more restricted areas near Ledbury, Lydney and to the north west of Gloucester. Grade 2 land is also extensive around Newent and Ledbury and occurs in significant but localised areas of the River Severn floodplain where there are deposits of river gravels. Where the gradient of the land is steeper or there is poor drainage, Grade 4 dominates, while Grade 5 is limited to the Malvern Hills and the steepest slopes around Stroud.

Figure 1: Agricultural Land Classification



Agricultural Land Use

The total agricultural area within the Severn Vale was 124,225 ha in 1997 (a decline of 2.9% since 1987). Table 3 shows agricultural land use in the Severn Vale in hectares. Arable areas dominate the upper reaches of the Vale, particularly the Leadon catchment. The majority of woodland in the area is to be found in the Forest of Dean, and limited native beechwood exists along the Cotswold escarpment and Stroud valleys.

The area under crops and fallow has increased over the last decade, most significantly since 1992. At this time the Arable Area Payments Scheme (AAPS) was introduced as part of the reforms to the Common Agricultural Policy (CAP) to compensate farmers for reduction in support prices for cereals. The scheme takes the form of per hectare payments for cereals, oilseeds, protein crops and linseed and for land set aside. This could help to explain the increase in the area of crops grown. Although areas of wheat have remained relatively constant, the areas of crops such as linseed and maize have increased greatly.

Agricultural land Use	1987	1997	%Change 87-97
Grassland < 5 years	17,899 ha	16,019 ha	-10.5%
Grassland > 5 years	61,280 ha	53,938 ha	-12.0%
Rough grazing	3,125 ha	3,419 ha	9.4%
Crops and fallow	40,822 ha	42,066 ha	3.0%
Farm woodland	2,996 ha	3,665 ha	22.3%
Other land	1,779 ha	2,537 ha	42.6%
Set-aside	0 ha	2,581 ha	Incalculable
Total Agricultural Land	127,901 ha	124,225 ha	-2.9%

2.4.2 Industry and Commerce

The area has an extensive industrial history. Major industrial practices of the past include coal mining in the Forest of Dean (see Section 2.4.3 below) and the use of river systems for milling, notably wool on the River Frome and its tributaries. Today, the majority of industry and is concentrated in the Avonmouth area, ranging from pharmaceuticals to zinc smelting. Some industry and an increasing commerce sector are found in Gloucester and Cheltenham, including manufacturing for the aerospace industry, and advertising and printing.

Provisions for new industrial and commercial development in the Gloucestershire Structure Plan are for approximately 525 hectares of land for the development of employment opportunities. Strategic planning policy seeks to stimulate economic activity in the Severn Vale area through the growth of existing industry and commerce and attraction of new firms. South Gloucestershire have allocated one hundred acres of greenfield land for industrial and commercial development. Under Bristol City's provisions, the docks and industrial complex at Avonmouth are scheduled for continued development and rehabilitation.

Industries with the greatest potential to pollute the environment are regulated by the Agency under the Environmental Protection Act 1990, as discussed in section 4.3.4.

Industrial development can place a wide range of stresses and strains on the environment, including:

- Contamination of land (see Section 2.4.8)
- Impacts on air quality (see section 2.5)
- Impacts on water quality through regulated discharges (see Section 2.6.6), urban run-off (see Section 2.6.7), or accidental releases (see section 4.10.4)
- Impaired amenity value due to visual impact, noise or odours (see section 7.0)
- Production of solid wastes (see section 2.4.7)

- Loss of wildlife habitat and effects on species populations where barriers to migration prevent natural regeneration (see section 2.7.9)
- Loss of flood plain (see section 2.6.8)
- Increased energy consumption leading to climate change and sea level rise (section 2.6.5)
- Effects of surface water runoff on flooding and water resources (see section 2.6.7)

2.4.3 Minerals

The diverse geological base of the Severn Vale, comprised mainly of sedimentary rock types, provides significant mineral deposits of actual and potential economic utility. Amongst these, hard rocks (the solid geology) provide aggregates and natural building materials, coal and compacted clay. Varied superficial deposits (the 'drift' geology, comprising silts, clays, sands and gravels) intermittently but extensively overlie these rocks. They yield important sources of sand and gravel for the construction industry. A large amount of the area's mineral workings, both past and present, are to be found in the Forest of Dean, although other significant workings exist in South Gloucestershire.

It is the duty of all Minerals Planning Authorities (MPAs) to prepare a Minerals Local Plan as laid down by the Town and Country Planning Act 1990, amended by the Planning and Compensation Act 1991. MPAs are required to prepare a minerals plan for their area, formulating detailed policies to control and guide all future mineral development, including the winning and working of minerals and the deposit of mineral wastes.

Mineral resources are finite and the exploitation of such resources has a significant impact on the local environment, through the degradation of land resources, and impacts on landscape, wildlife, water resources and local amenity. However, the continued use of minerals is necessary for economic development. Although limestone, sand and gravel are not presently in short supply, current and forecast demand may not be sustainable in the longer term.

Past and present mineral working sites in the Severn Vale are shown in Map 5.

Limestone

Within the Carboniferous Limestone of the Forest of Dean there are two limestone horizons with substantial potential for modern aggregate production, Lower Limestone Shales and Lower Dolomite Limestone. Lower Dolomite, the more significant limestone resource, is found up to 120 metres in thickness with sufficient uniformity, quality and extent to be of considerable value. Currently reserves of Lower Dolomite are extracted from two quarries, those at Dayhouse and Drybrook.

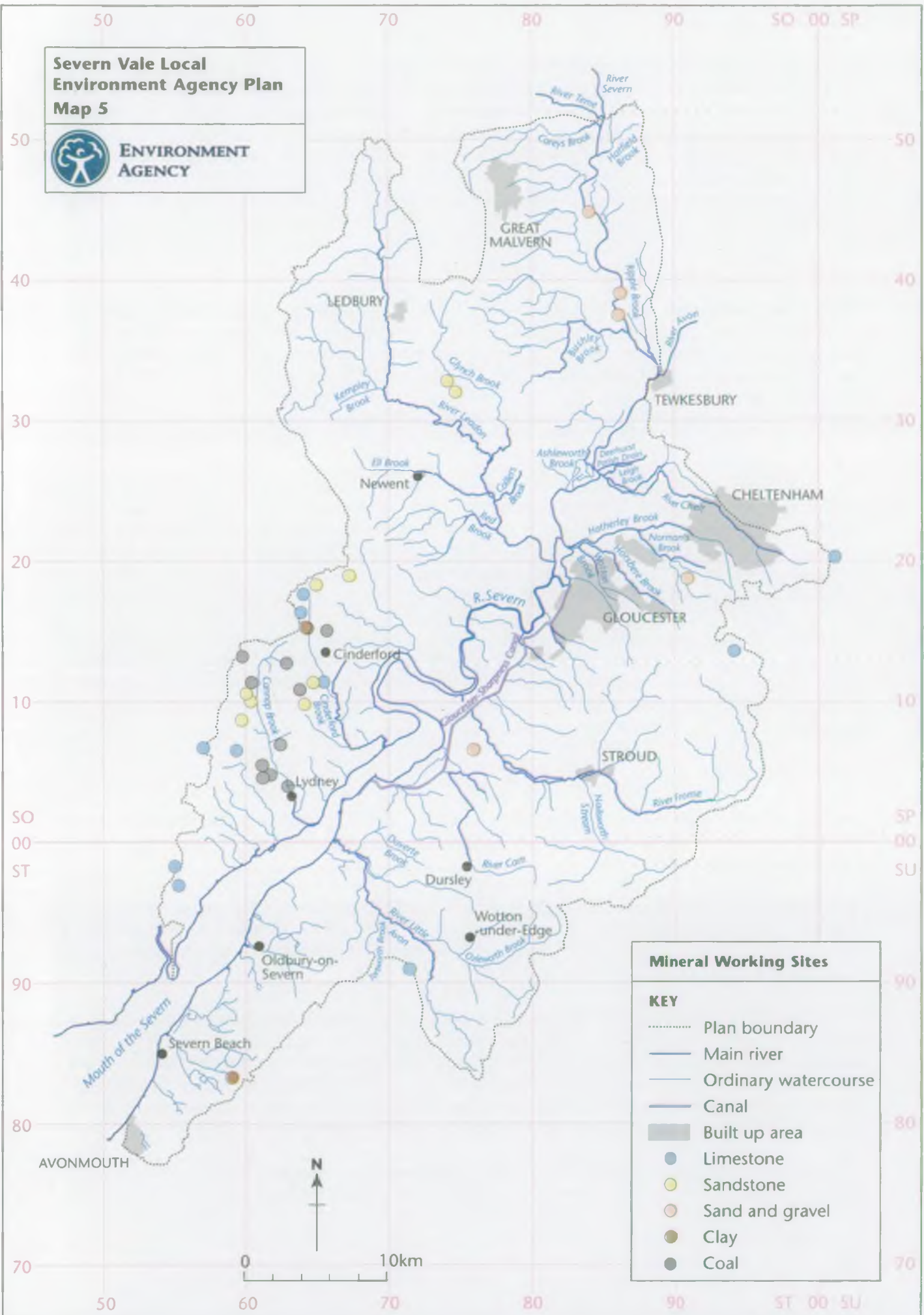
Natural Building Stone

In the Forest of Dean, Carboniferous sandstones and limestones, together with Devonian Old Red Sandstone are extracted as natural building stone in small measure. Some 10,000 tonnes are produced annually. Reserves of these materials are to be found at nine mainly small sites.

Iron Ore

The iron ores of the Forest of Dean have been worked since Roman times, and the manifestation of their working – the ancient outcrops known as "scowles" – forms part of the heritage of the area. However, by the beginning of the present century mining had virtually ceased with the exhaustion of workable reserves. The red and yellow earthy iron ore known as "ochre" has also been worked in several localities in the Forest of Dean for the manufacture of pigments and is still obtained in small quantities from the Clearwell Caves.

**Severn Vale Local
Environment Agency Plan
Map 5**



Mineral Working Sites

KEY

- Plan boundary
- Main river
- Ordinary watercourse
- Canal
- Built up area
- Limestone
- Sandstone
- Sand and gravel
- Clay
- Coal

Coal

Coal has probably been worked in the Forest of Dean since Roman times, though definite evidence of mining dates back to the 13th Century. Different methods of coal extraction have had varying degrees of impact on the environment. Shallow underground mining currently takes place with minimal environmental impact at a small number of locations. Deep mining ceased in the Forest of Dean many years ago but historically has had a significant impact on the landscape, including the creation of colliery spoil heaps. Extraction of coal by the opencast method can result in significant environmental impact unless carefully controlled. Currently, there are no opencast coal sites in the Forest of Dean Coalfield.

Sand and Gravel

Most sands and gravels are found in the Vale's major river valleys. In the 1960's significant production of sand and gravel took place at pits in the terrace deposits at Frampton-on-Severn. More recently there has been some production (mainly of sand) from three small pits at Frampton-on-Severn, Shurdington and Bromsberrow Heath. In Worcestershire, sand and gravel are extracted at Ripple and Ryall North.

Clay

The geological occurrence of clay is widespread and extensive, comprising principally the Lower Lias Clay deposits of the central Severn Vale and the Upper Coal Measures clays of the Forest of Dean coalfield. These clays have been used for a variety of purposes, including bulk fill, site cover at waste disposal sites, flood defence works and in the making of bricks. Clay extraction in South Gloucestershire is associated with the manufacture of bricks. There is an active claypit at Almondsbury supplying the Cattybrook Brickworks.

The Forest of Dean owes much of its unique landscape character and other important features to its industrial heritage including the extraction of minerals by various methods. Opportunities exist for enhancing the local environment and amenities by imaginative and innovative reclamation of worked areas, particularly in areas of derelict or degraded land, including land previously worked for minerals.

2.4.4 Housing

Around 545,000 people currently live within the Severn Vale. The main towns and settlements in the area are Gloucester, Cheltenham, Malvern, Avonmouth, Thornbury, Stroud, Tewkesbury, Ledbury, Cinderford, Lydney and Newent.

The Department of the Environment (now Department of the Environment, Transport and the Regions (DETR) Green Paper entitled *'Household Growth: where shall we live?'* (November 1996) stimulated debate over the latest population and household forecasts, which estimate a growth in households in England of 4.4 million by the year 2016.

This forecast for household growth is a major concern for planning authorities in assessing future development needs at all tiers of the planning process. It places pressure on the existing housing stock leading to its replacement, subdivision or extension, and increases pressure for new housing stock. Household growth at the levels suggested along with concomitant needs for employment, services and transport infrastructure would add to the stresses on the environment, as most development will lead to a fundamental change in the use of land that cannot easily be reversed.

Currently, the proposed modifications to the Gloucestershire Structure Plan allow for 50,000 dwellings between 1991 and 2011. By 1994 nearly 10,000 of these had been built, while over 14,000

dwelling are currently committed or allocated in Local Plans. In addition approximately 10,000 dwellings can be provided mainly through small-scale in-fillings and by re-developing, converting and sub-dividing properties.

Gloucestershire County Council is seeking to accommodate the remainder on fresh land development in locations that will serve to promote sustainability. As a result of the recent Examination in Public (EIP) of the Gloucestershire Structure Plan, the Government Inspectorate has recommended that the most suitable location is the central Severn Vale. Here, important communication routes, together with the existing employment base, are likely to continue to exert a strong pull in attracting new employment. Priority will be given to accommodating development in or around the major urban centre of Gloucester and Cheltenham.

At the southern end of the Severn Vale lie two small portions of Bristol City and South Gloucestershire. Bristol City's allocation for housing here is negligible. South Gloucestershire's proposed residential allocation is for 500-1000 dwellings on greenfield sites. The draft Local Plan allocates 600 dwellings with an 'option' for up to 1,750 subject to consultation. At present the council has no specific policy on brownfield development, though this will be addressed in the deposit draft.

In that part of the plan area falling within Worcestershire, the main thrust of development will continue to be centred on Malvern.

Allocations for housing in the emerging Structure Plans for Worcestershire, Gloucestershire and the former Avon County for the period 1991-2006 are firm, while those for 2006-2011 are subject to further review.

Planned increases in the number of households could mean the spread of urban areas. Both new and existing housing development can place a wide range of pressures on the environment, including:

- Production of solid wastes (see section 2.4.7)
- Waste water disposal (see section 2.6.6)
- Loss of wildlife habitat and effects on species populations where barriers to migration prevent natural regeneration (see section 2.7.9).
- Loss of flood plain (see section 2.6.8)
- Increased energy consumption leading to climate change and sea level rise (section 2.6.5)
- Effects of surface water runoff (see section 2.6.7)

2.4.5 Infrastructure

Five motorways cross the Severn Vale (see Map 6). The principal motorway is the M5, which conveys traffic north and southwards between Bristol and Birmingham. Four motorway arteries radiate from the M5; the M50 joins north of Tewkesbury taking traffic west towards Wales, the M48 directs traffic across the first Severn Bridge into Wales, the M4 joins north of Bristol and the M49 takes traffic from Avonmouth to the second Severn Bridge. These motorways are served by an extensive network of A and B roads.

Rail transport is concentrated on the lines to Bristol and Birmingham, Gloucester to Swindon via Stroud, Gloucester to South Wales either via the Severn tunnel or Chepstow, Filton to Avonmouth and Bristol to Severn Beach.

Transport has a wide range of environmental impacts. We are assessing these in detail through our National Centre for Risk Analysis and Options Appraisal, which builds on the work of others in this field, notably the the Royal Commission on Environmental Pollution's *'Report on Transport and the Environment'* (RCEP, 1994). An initial 'Risk profile' has already been produced (EA, 1997).

The construction and use of transport infrastructure can lead to:

- loss of habitat and barriers to species movement (see section 2.7.9)
- diffuse water pollution from runoff (see section 2.6.7)
- air pollution (see section 2.5.1)
- climate change including sea level rise (see section 2.6.5)
- increased flood risk (see sections 2.6.7 and 2.6.8)
- cumulative effects on land, air and water through related land uses such as petrol stations
- Increased use of raw materials, including aggregates and petroleum.
- Loss of landscape value and increased noise nuisance (see section 7.0)

The Agency has no formal remit regarding the planning or operation of the transport system, and is therefore limited in its ability to mitigate the majority of these impacts. New road infrastructure, including new bypasses, link roads and improvements to existing primary routes, is proposed by the DETR and Highway Authorities (County Councils) in order to cope with increased traffic demands, reduce traffic levels around residential areas and provide new or improved access to areas for redevelopment.

However, we do have a role as a statutory consultee on proposals for new or expanded transport infrastructure, as these may affect Agency interests. We also have powers to mitigate flood risk impacts through the Land Drainage Consent system (see section 4.7.1).

2.4.6 Waste Management Facilities

Facilities exist throughout the Severn Vale to manage the disposal of wastes that are produced by all sectors of society. The management of certain types of waste requires a waste management licence. Other types of waste may be exempt.

Licensed Facilities

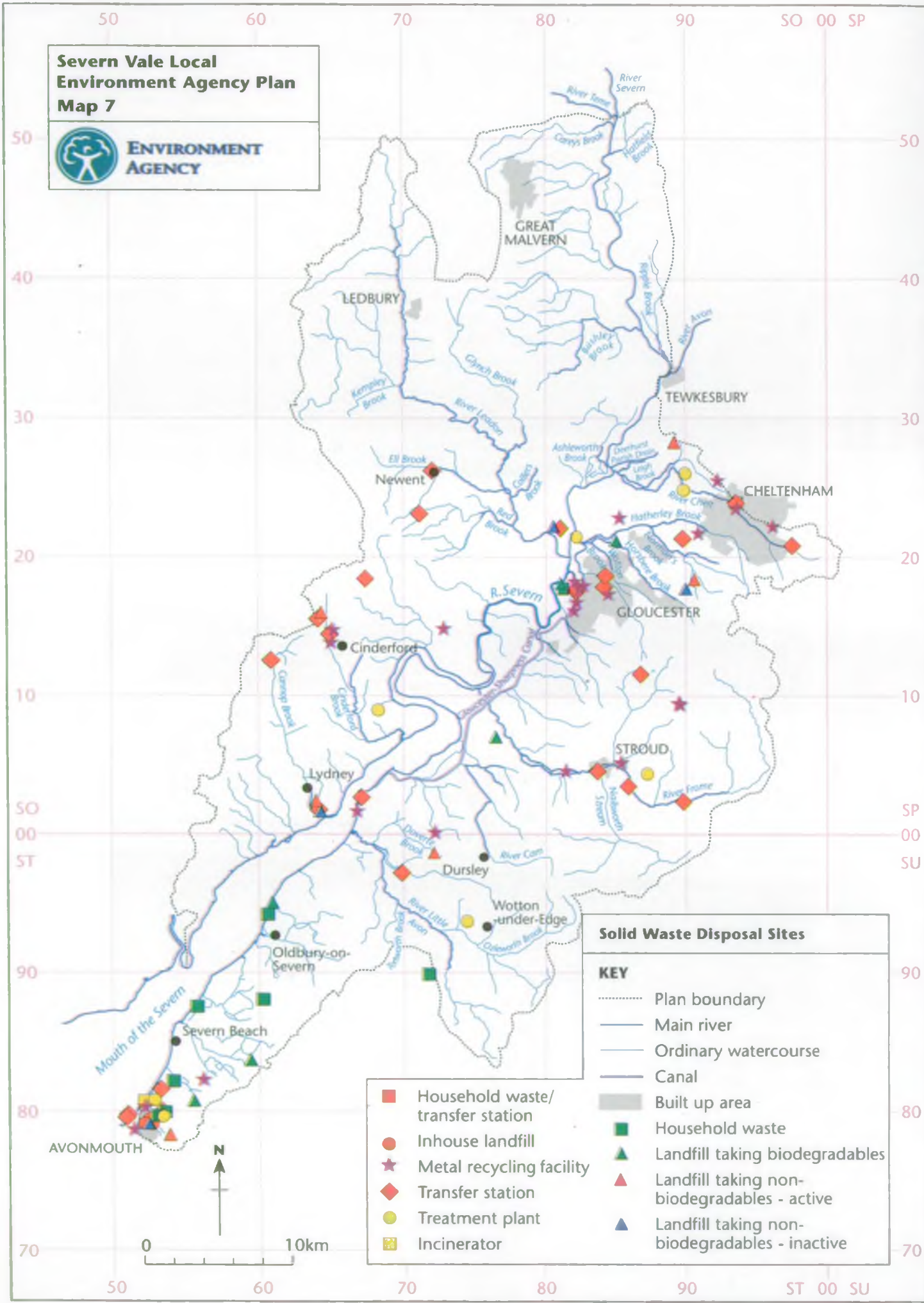
The Environmental Protection Act 1990 prohibits the keeping, treating or disposal of waste in or on land unless a waste management licence authorising the deposit is in force or the activity is exempt from licensing. It also prohibits the disposal of waste in a manner likely to cause pollution of the environment or harm to human health. The purpose of licensing is to ensure that the disposal, keeping or treatment of waste does not give rise to pollution of the environment, harm to human health or serious detriment to the amenities of the locality. Waste Management Licences are issued subject to conditions designed to ensure that the development and operation of a waste disposal, storage or treatment site should not cause any of these problems.

There are 80 operational licensed waste management facilities within the catchment. The locations of these are show on Map 7.

The Severn Vale catchment has:

- 15 operational landfill sites
- 8 treatment plants (2 incinerators)
- 23 operational waste transfer stations
- 8 civic amenity sites (household waste sites)
- 25 scrap yard sites (metal recycling facilities)
- 1 in-house landfill site

**Severn Vale Local
Environment Agency Plan
Map 7**



Solid Waste Disposal Sites

KEY

- Plan boundary
- Main river
- Ordinary watercourse
- Canal
- Built up area
- Household waste
- ▲ Landfill taking biodegradables
- ▲ Landfill taking non-biodegradables - active
- ▲ Landfill taking non-biodegradables - inactive

- Household waste/transfer station
- Inhouse landfill
- ★ Metal recycling facility
- ◆ Transfer station
- Treatment plant
- Incinerator

A description of the main types of licensed waste management facility is given below.

Biodegradable landfill sites – are landfill sites accepting wastes that will undergo biodegradation within the landfill environment to varying degrees, depending upon their physical and chemical composition. Biodegradation produces landfill gas and leachate.

Landfill sites accepting non biodegradable waste – are landfill sites that accept materials that will not physically or chemically react or undergo biodegradation within the landfill environment.

Transfer stations – are facilities where waste is unloaded and may be subject to sorting and compaction before being transported for re-use, recycling, further treatment or disposal.

Household waste sites – are facilities operated by the county or unitary council to which the public may deliver non-business waste and where a range of materials (e.g. metals, paper, glass, oil) are recovered for recycling.

Treatment plants – are used to apply physical, chemical or biological processes to controlled wastes in order to modify its properties, but excludes incineration.

Metal recycling facilities – treat scrap metal and break cars for re-use.

In house facilities – in this instance, refer to landfill sites within the boundaries of works, which are licensed to accept waste produced from that works only.

Incinerators – are used for two main purposes; to reduce the hazard inherent in some wastes streams (as with some clinical wastes) or to significantly reduce the amount of waste needing to be landfilled, (as with municipal waste), or a mixture of both. Most incinerators utilise the energy produced to generate electricity. Incinerators are authorized through integrated pollution control (IPC) by the Environment Agency (see section 4.3.4), or local authority air pollution control (LAAPC) by Local Authorities, depending on the quantity of waste they incinerate. The smaller incinerators, regulated by Local Authorities, also have waste management licences for on site storage of wastes.

Sites Exempt From Waste Management Licensing

Some sites managing waste are exempt from the requirements of Waste Management Licensing Regulations 1994. These include the storage of waste prior to re-use or recycling, the spreading of waste on land for beneficial use or agricultural improvement (subject to certain criteria), composting waste at the place where it is produced and manufacture of soil or soil substitutes.

Schedule 3 of the Waste Management Licensing Regulations 1994 require these activities to satisfy certain criteria laid down in the Regulations and to be registered with the Environment Agency.

However, there is considerable potential for exempt facilities to accept large volumes of waste, without the need to pay landfill tax, and with potentially less control over the quality of waste received and operational controls that exist at licensed sites. The Environment Agency is undertaking current studies to assess the extent of this problem.

2.4.7 Stresses and Strains: Waste Production

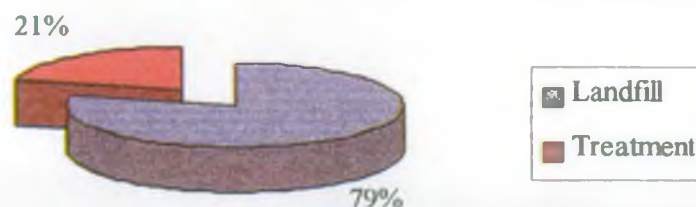
It is estimated that the average household produces approximately one tonne of refuse per year. This means that a vast amount of waste has to be re-used or disposed of from the Severn Vale. Information on waste production is collected using local authority boundaries, and not the river catchment boundaries on which LEAPs are based. Map 1 shows the local authorities with significant areas in the Severn Vale catchment.

It is estimated that the Severn Vale catchment produces 1.5 million tonnes of waste per year. This includes the main categories of industrial, commercial, household and construction and demolition wastes. It should be recognised that this is an estimate and that data will be improved upon as a result of the Agency's recently completed National Waste Survey, the results of which are yet to be published. This survey it will allow for more accurate figures on waste arisings from industry and commerce in the Severn Vale.

In 1997/8 approximately 1.3 million tonnes of industrial and commercial, household and construction and demolition wastes were sent to landfill sites or treatment plants (including incinerators) within the Severn Vale local authority areas. Figure 2 shows the proportion of the waste being sent to both types of site. Some of the wastes handled will represent wastes imported into the area for treatment or disposal. Some waste produced within the area will be exported for treatment or disposal outside the area.

More detailed information on waste production and the way waste is disposed of, including recycling rates, can be obtained from your local council.

Figure 2: Percentage of Waste sent to Landfill and Treatment Plants



Note: Treatment plants include incinerators

Section 4.1 discusses the way in which the Government is encouraging the use of strategies to reduce the quantity of waste being disposed to landfill.

2.4.8 Stresses and Strains: Contaminated Land

If harmful substances contaminate land, it may pose a risk to human health, surface and ground water, ecosystems, man-made structures and services, and may affect how the land can be used. The extent and nature of land contamination in any area is a legacy of its industrial and urban development. Urban areas generate the most solid waste, most of which has been, and is still, disposed of at landfill sites. In the past, industrial and waste disposal practices were subject to fewer controls than at present, leading to contamination of land. Land contamination has also occurred through accidental spillage.

'Contaminated land' is defined in Section 57 of the Environment Act 1995 as land that appears to the authority (local authority or the Agency) to be in such a condition that either:

- Significant harm is being caused to human health or to the environment, or there is a significant threat of such harm being caused; or
- Pollution of controlled waters is being caused or is likely to be caused.

For land to be identified as 'contaminated', pollutants must be shown to be causing significant harm to a specified 'target' of importance (either human health, certain designated nature conservation sites, buildings, crops, livestock, or controlled waters) via an identified pathway. This focuses attention onto sites that cause problems in their current use. Other sites could however pose contamination problems if re-developed, unless adequate care is taken.

Site inspections are yet to be carried out by local authorities to identify the full extent and nature of land contamination in the area, and so meet requirements under the Environment act 1995 (see section 4.2.2). Some of the contaminated land sites in the Severn Vale that are currently known to the Agency are discussed in section 4.2.4.

2.5 AIR QUALITY

Maps 8, 9 and 10 show air quality using limited data, for sulphur dioxide (SO₂), oxides of nitrogen (NO_x) and small particulate matter (PM¹⁰) in the Severn Vale. The impact of industrial processes is not noticeable from these maps. There is, however, a noticeable effect on concentrations of all three pollutants from the traffic travelling on the motorway network, as well as within urban areas. Air quality standards and regulation are discussed in Section 4.3.

The major sources of air pollutants are transport and industry. Releases from industry are minimal in the Severn Vale, apart from in South Gloucestershire and Avonmouth. Industrial emissions at these locations are not clearly represented on Maps 8, 9, and 10, whose data comes from the National Atmospheric Emissions Inventory monitoring sites, administered by the National Environmental Technology Centre (NETCEN). This network of sites seeks to provide a picture of background air quality, for the purpose of examining regional and national air quality trends over time, and is therefore inadequate for gaining an accurate picture of air quality at the local level. Gaining a better understanding of influences on poor air quality is addressed as an issue in the Severn Vale LEAP.

The major concern in the Severn Vale relates to the potential for breaches of National Air Quality Standard for NO_x in South Gloucestershire and Avonmouth. NO_x levels are of concern due to the likely increase in road traffic (see section 2.5.1), combined with proposals for new gas fired power stations at Avonmouth (see section 2.5.2).

2.5.1 Stresses and Strains: Emissions from Transport

Emissions from transport are a major cause of poor air quality (see Table 4). Air pollutants from transport can cause human health problems, such as PM¹⁰ which can cause bronchial diseases, lead, which is thought to cause brain damage (particularly in young children), and benzene, a known carcinogen. Under the correct circumstances, NO_x and volatile organic compounds (VOCs) can react with sunlight to produce low level ozone, which is damaging to human health, crops and buildings. SO₂ and NO_x can cause trans-boundary pollution problems associated with acid rain. Transport, particularly road transport, is also a major and rising source of carbon dioxide (CO₂) emissions, comprising 16% of the UK's global warming potential. Aircraft, shipping and diesel trains can also be major sources of air pollutants, particularly SO₂ and NO_x.

The reduction of emissions from transport is one of the greatest challenges facing the Government and consumers today. It will very much depend on the ability of EU driven legislation to ensure that car manufacturers introduce cleaner technology, and on the ability of the Government to provide viable alternatives to the motor car. The necessity of an integrated approach is demonstrated by the fact that NO_x emissions from road vehicles are set to fall until around 2010 due to the introduction of catalytic converters on cars and stricter controls on HGV emissions, but this will be negated as the projected level of vehicle use rises from 2010.

**Severn Vale
Local Environment Agency Plan
Map 8: Air Quality for SO₂**



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- Severn Vale Boundary
- Urban Areas
- SO₂ (ppb)
- 0 - 1
- 1 - 2
- 2 - 3
- 3 - 4
- 4 - 7
- No Data

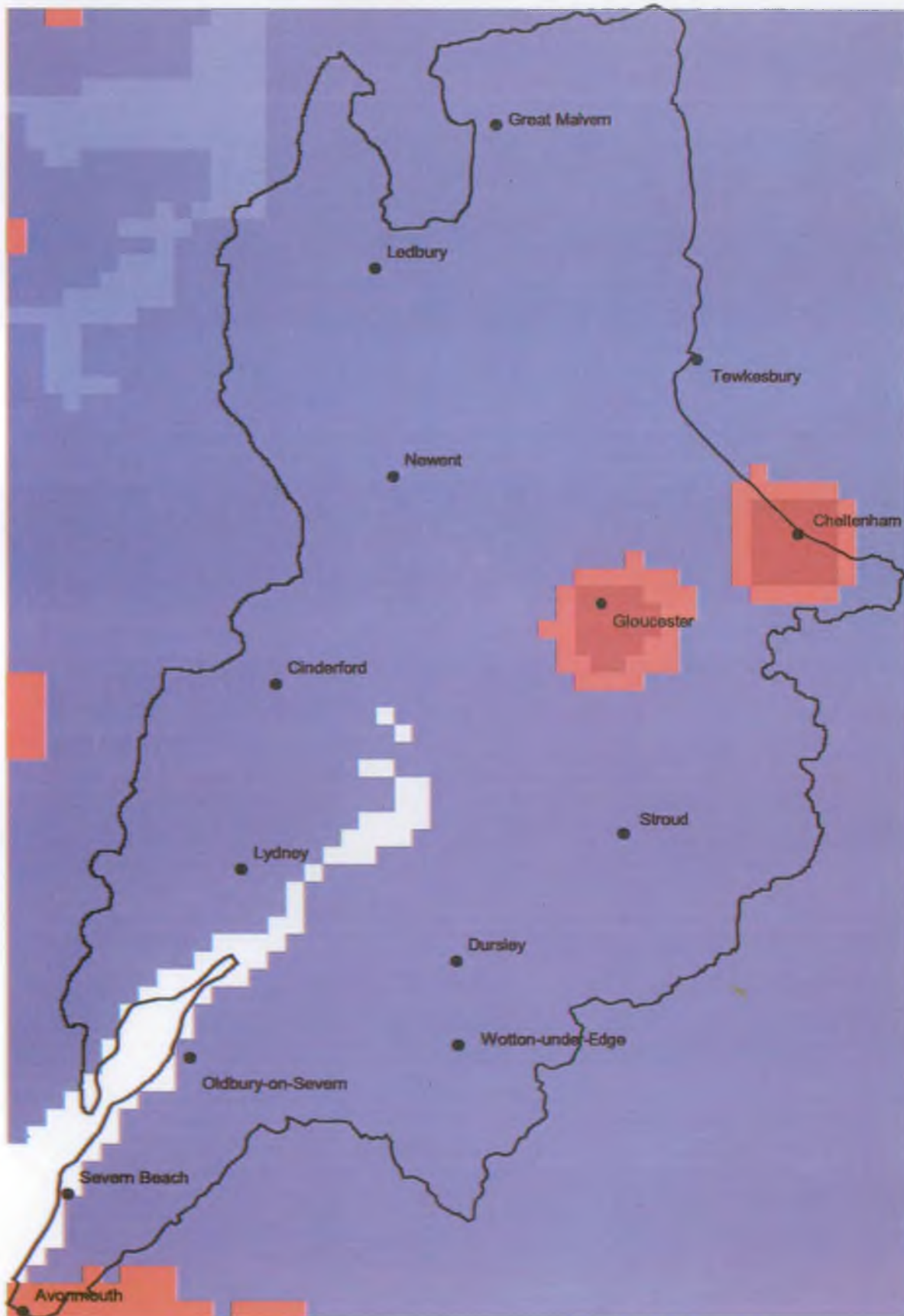
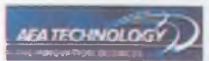
Summary Statistics:

Min: 1.8922

Max: 6.2684

Mean: 2.3923

SD: 0.3923



10 0 10 20 30 Kilometers



Severn Vale
Local Environment Agency Plan
Map 9: Air Quality for NO_x

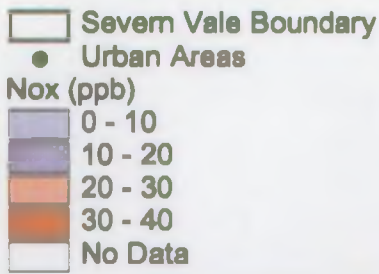


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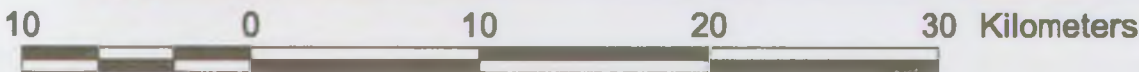
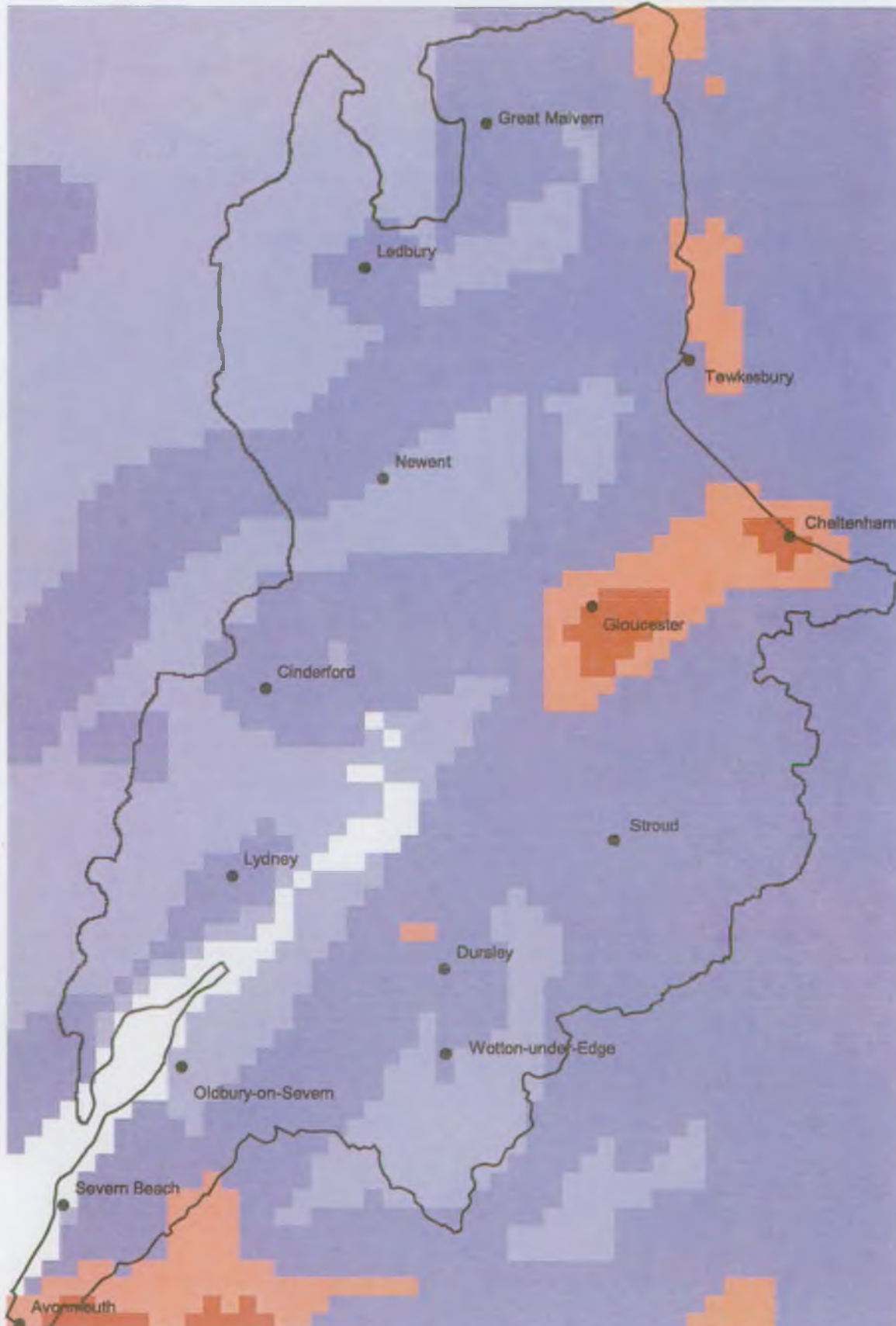
Summary Statistics:

Min: 8.0214

Max: 38.4812

Mean: 12.5494

SD: 4.5003



**Severn Vale
Local Environment Agency Plan**

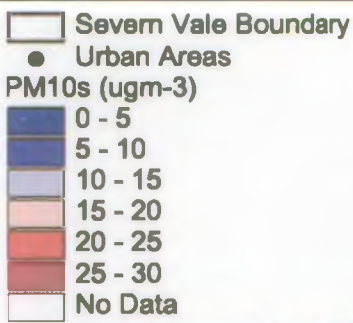
Map 10: Air Quality for PM¹⁰



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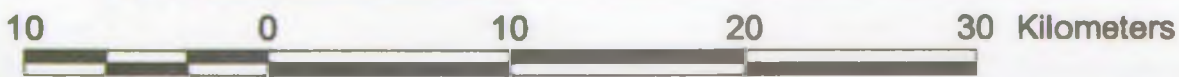
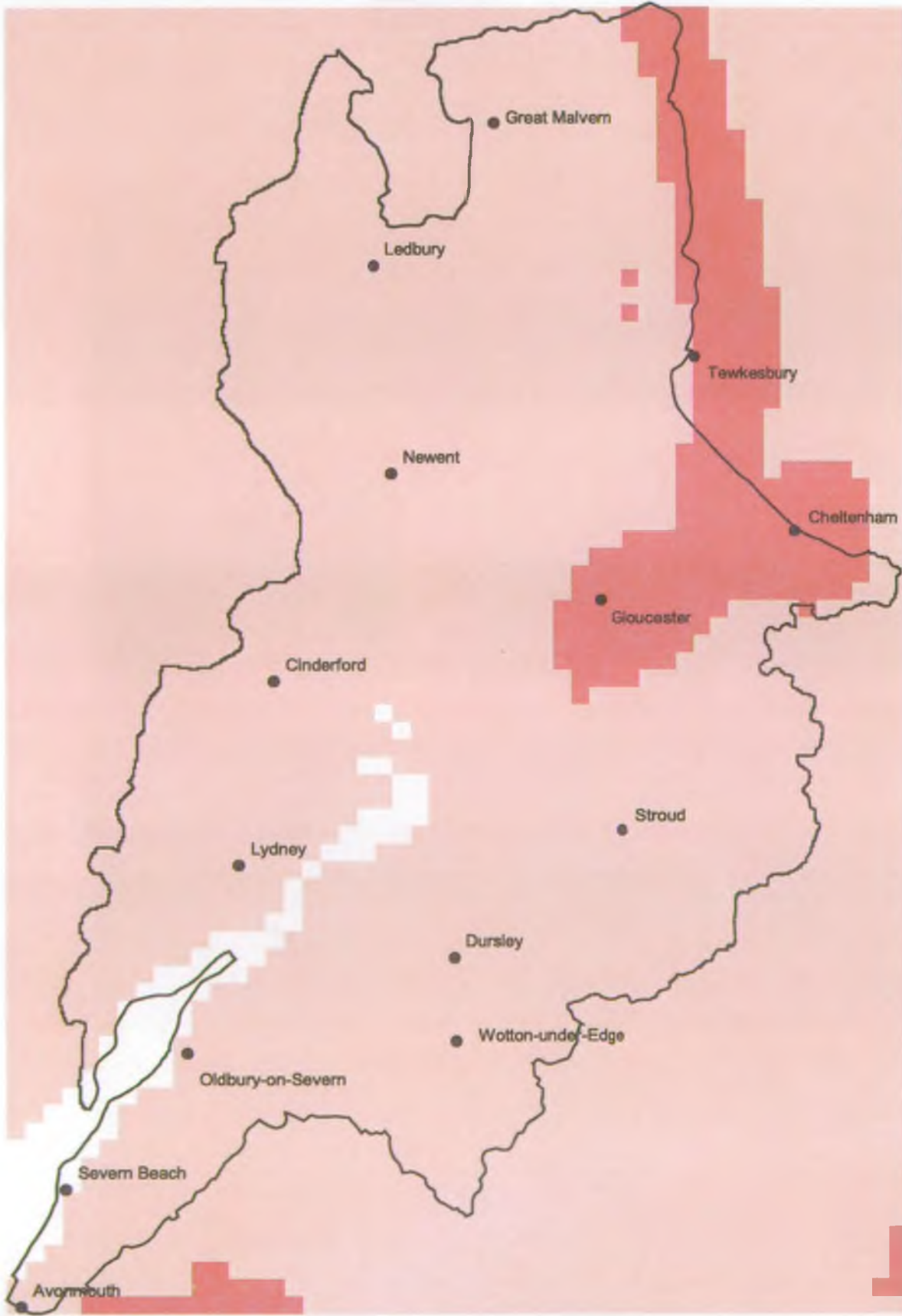
Summary Statistics:

Min: 18.6021

Max: 21.3459

Mean: 19.4161

SD: 0.4523



Pollutant	1995 Total National Emissions (kilotonnes)	1995 Emissions from Road Transport (kilotonnes)	Road Transport as % of National Emissions
Benzene	34.840	23.440	67
1,3 Butadiene	9.570	9.490	99
Carbon monoxide	5478	4112	75
Lead	1.492	1.068	72
Nitrogen oxides (NO _x)	2293	1062	46
Particulates (PM ₁₀)	232	59	25
Sulphur dioxide	2365	51	2
Volatile organic compounds	2257	690	31

(Source: *National Air Quality Strategy*, 1997)

The major contribution to NO_x levels in the Severn Vale is thought to be from traffic moving through the dense road system, particularly the M5 and the M4 at Bristol, along with major trunk roads connecting these. This is likely to increase in the near future in line with national projections. Traffic in the central Severn Vale is also likely to increase as new developments take place in and around Cheltenham and Gloucester.

2.5.2 Stresses and Strains: Power Generation

The increasing consumption of energy in our homes, industries and other buildings can place considerable burdens on the environment. Where power is generated from fossil fuels (principally coal, oil and gas), a number of substances that impact on human health or the environment may be produced, including SO₂, NO_x, PM¹⁰ and CO₂. In 1995, power generation was responsible for 30% of the UK's CO₂ emissions, 67% of SO₂ emissions, 22% of NO_x emissions and 15% of emissions of PM¹⁰. Power generation from nuclear fuels results in ongoing releases of low level radiation and the build up of more toxic radioactive wastes, which are held in storage while the feasibility of long-term disposal options is assessed. The proportion of electricity generated by fuel input is given in Table

Fuel	Proportion Of Electricity Generated, 1996
Coal	42%
Oil	4.5%
Gas	21%
Nuclear	28.5%
Hydro	0.5%
Other, including other renewables	1.5%
Imports	2%

(Source: *Digest of UK Energy Statistics*, 1997)

Within the Severn Vale area there are three power stations. Seabank operates a gas-fired power station at Hallen, near Bristol. Nuclear power stations exist at Oldbury and Berkeley (now being decommissioned). The Oldbury site is situated on the east bank of the River Severn estuary, just north of Oldbury-on-Severn. The station became operational in October 1967 and the reference power for each of the two units here is 217 MW. The Berkeley site is also situated on the east bank of the River Severn Estuary to the west of the village of Berkeley. The reactors at Berkeley were commissioned in 1962 and operated until 1989. Both Oldbury and Berkeley plants are owned and operated by Magnox Electric plc, now a subsidiary of British Nuclear Fuels plc.

Seabank power station is currently completing the commissioning of a twin turbine unit and a third unit is proposed. Seabank are also proposing two further gas-fired power stations at Avonmouth, to meet peak electricity demands in the Southwest. Where these and the existing gas-fired station start simultaneously during peak electricity demand, there is the potential for exceedence of National Air Quality Standards for NO_x.

There is some limited generation of hydropower at sites throughout the Cotswolds. Western Windpower operates a wind turbine at Nymphsfield. Power is also generated from landfill gas at several sites, including Hempsted at Gloucester and Stoke Orchard near Cheltenham.

Most forms of power generation come with some unwanted environmental impact. However, the Agency is keen to promote the use of renewable energy sources, in balance with its other duties and responsibilities. Renewable energy can help to reduce global warming potential and, where developed sensitively, does not bring with it the considerable environmental burdens posed by fossil fuel and nuclear power generation. The Agency is currently considering the potential for hydropower at several sites in the Severn Vale, and is promoting the conversion of waste to energy.

2.6 WATER QUANTITY AND QUALITY

Water is one of our most valuable resources and is fundamental for all forms of life. The Agency has a wide range of responsibilities relating to the water environment, which are discussed further in section 4.0.

Water resources are limited and cannot always be found where and when they are most needed. Demand for water is increasing and there is growing competition for available resources. The quality of controlled waters (including rivers, canals, lakes, groundwaters, estuaries and coastal waters) can be degraded through contamination by untreated waste water, accidental spillages of harmful substances, diffuse pollution from run-off, or natural occurrences. At times, rainfall or snowmelt results in more water than the river channels can accommodate and water flows out onto the natural floodplain. The resultant flooding of land, property and roads can cause danger and disruption to life.

Careful management of human activities that affect water quantity and quality is required. The management of stresses and strains on the water environment requires action from many people and organisations if it is to be successful.

2.6.1 Water Resources

Surface Water Resources

The River Severn is the major source of water in the Severn Vale area and supplies domestic and industrial users as far away as Coventry and Bristol. During dry weather the river is supported by making releases of water from Clywedog Reservoir and by pumping from groundwater controlled by the Shropshire Groundwater Scheme. A minimum flow of 850 Ml/day is maintained at Bewdley at all times throughout the year.

The Severn Vale is divided into five sub-catchments for the purpose of surface water abstraction management:

- The River Leadon;
- The Lower Mid Severn (from its confluence with the Teme below Worcester to its confluence with the Avon at Tewkesbury);
- Severnside (The River Severn downstream of Tewkesbury);

- The River Frome;
- The Little Avon River.

In the majority of these catchments, new licences are issued with restrictions, either tied to a local gauging station or where the licence holder has to maintain a prescribed flow downstream.

Groundwater Resources

Major and minor aquifers in the Severn Vale are shown on Map 11.

The eastern boundary of the Severn Vale area is the Cotswold escarpment slope. Here groundwater fed springs issue from the base of the Jurassic Limestone and Cotteswold Sands. These stratas are designated as major aquifers from which resources are available provided base flows are not affected and there are no local derogation problems.

To the west are the limestones of the Forest of Dean, which are also classified as Major Aquifers. These Carboniferous limestones produce variable yields and support surface watercourses. To the north, Devonian Old Red Sandstone and Silurian limestones that lie between Ledbury and Ross-on-Wye are classified as Minor Aquifers.

Between these two major aquifer blocks, in the lower lying valley of the Severn, the geology is mainly of softer clays and mudstones. Although these are classified as non-aquifer because of their low permeability, they nevertheless yield variable amounts of groundwater often suitable for small farms. The exception is the Triassic Sandstone, classified as a major aquifer, which outcrops in a fault bounded block around Newent. This unit is split into the Oxenhall unit, open to small licence applications, and the Bromsberrow unit (further north), which is shallower and is consequently now closed to further abstraction.

On top of the non-aquifer mudstones and clays are often found Quaternary deposits which are classified as minor aquifer. These can prove to be a useful source of groundwater, especially where they are in hydraulic continuity to the rivers in the area.

2.6.2 Water Abstraction

Licensed water abstractions are shown in Map 11.

The number of water abstraction licences within the area does not necessarily reflect the amount of water taken. Percentage use of abstracted water in the Severn Vale is shown in figure 3. Actual quantities of surface and groundwater abstracted under licence are given in Table 6.

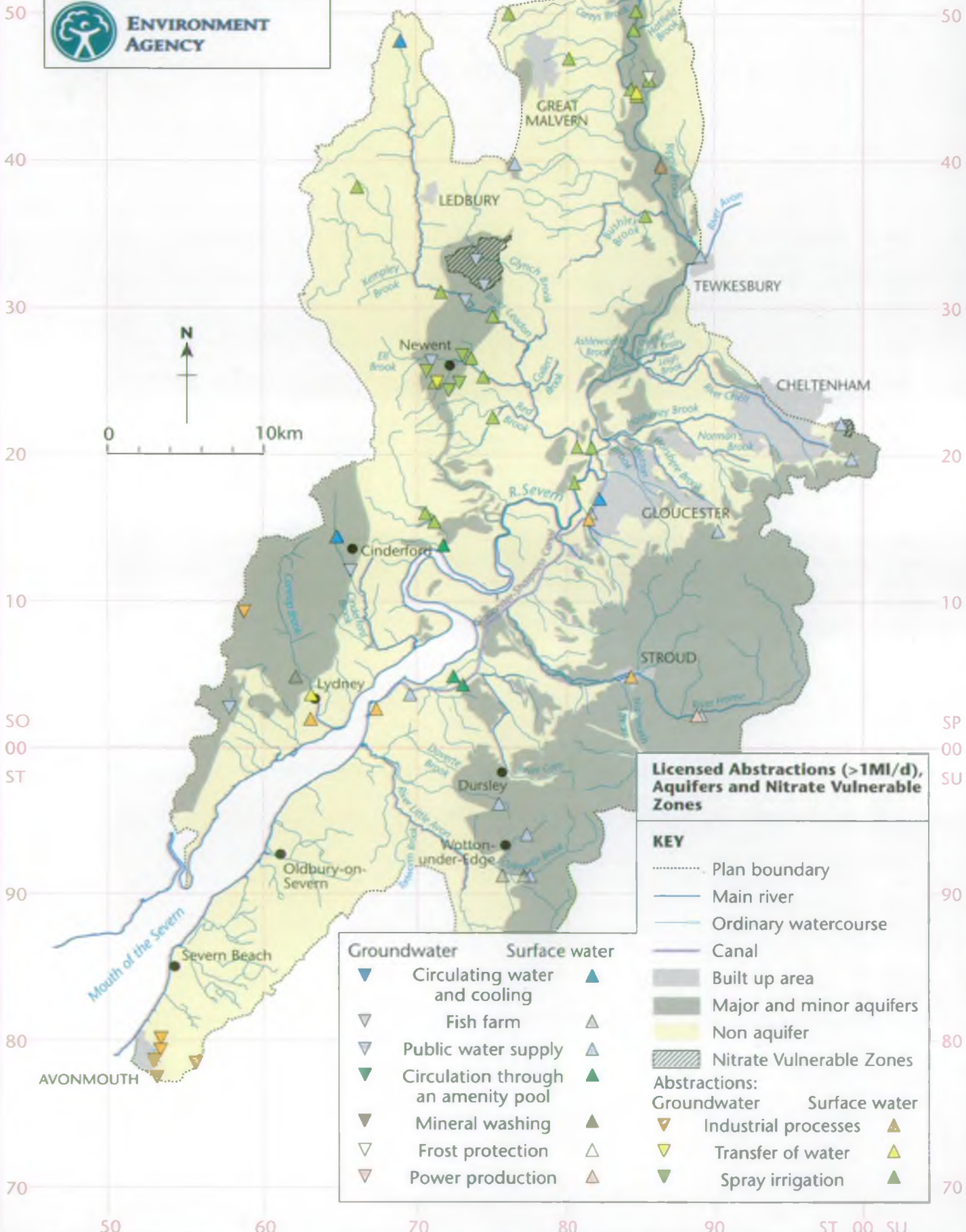
Public Water Supply

Approximately 67% of the water abstracted in the Severn Vale is for Public Water Supply. 61% of this water comes from the River Severn at Ripple near Upton upon Severn, at the Mythe, Tewkesbury and at Gloucester via the Gloucester-Sharpness Canal. The Ripple abstraction is 'exported' to Coventry via the Strensham Treatment Works. The majority of this water is returned to the River Severn via the River Avon by way of a discharge at Finham reclamation Works. The Tewkesbury abstraction provides a water supply for much of Gloucestershire. The abstraction at Gloucester, together with the River Frome, help to supply the Gloucester-Sharpness Canal with water, and some of this is abstracted again at Purton by Bristol Water for distribution throughout the Bristol Area.

**Severn Vale Local
Environment Agency Plan
Map 11**



**ENVIRONMENT
AGENCY**



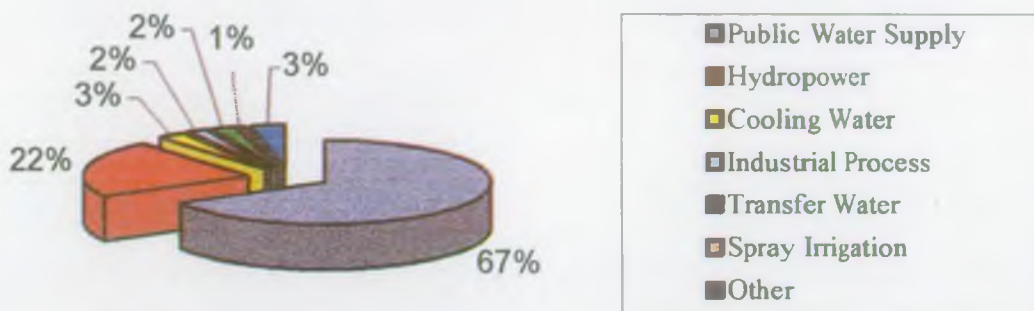
**Licensed Abstractions (>1MI/d),
Aquifers and Nitrate Vulnerable
Zones**

KEY	
.....	Plan boundary
— (thick blue)	Main river
— (thin blue)	Ordinary watercourse
— (purple)	Canal
■ (grey)	Built up area
■ (dark grey)	Major and minor aquifers
■ (yellow)	Non aquifer
■ (hatched)	Nitrate Vulnerable Zones
Abstractions:	
Groundwater	Surface water
▼ (blue)	▲ (blue)
▼ (grey)	▲ (grey)
▼ (purple)	▲ (purple)
▼ (green)	▲ (green)
▼ (brown)	▲ (brown)
▼ (white)	▲ (white)
▼ (red)	▲ (red)
▼ (yellow)	▲ (yellow)
▼ (dark green)	▲ (dark green)

Groundwater	Surface water
▼ (blue)	▲ (blue)
▼ (grey)	▲ (grey)
▼ (purple)	▲ (purple)
▼ (green)	▲ (green)
▼ (brown)	▲ (brown)
▼ (white)	▲ (white)
▼ (red)	▲ (red)
▼ (yellow)	▲ (yellow)
▼ (dark green)	▲ (dark green)

Type of abstraction	Surface water abstraction	Groundwater abstraction
	Abstraction MI/annum	Abstraction MI/annum
Public water supply	193,969	9162
Agriculture (other than spray irrigation)	96	363
Spray irrigation	2,722	671
Private water supply	125	55
Transfer	4,724	39
Fish Farm	149.75	-
Hydropower	646,60	-
Cooling water	7,873	-

Figure 3: Percentage Use of Licenced Water Abstraction



Agriculture

The majority of all licences are for agricultural and horticultural uses, but only amount to approximately 2% of the total water abstracted in the Severn Vale. There are approximately 150 spray irrigation licences and 174 general agricultural licences. The significance of these licences becomes evident during dry weather when the water is needed for irrigation, coinciding with low river flows. There are conditions on the more recently issued licences to stop abstractions at times of low flow. However, where licences for abstraction are predominantly Licences of Right (see section 4.6.5), the Agency is unable to restrict abstraction. This is the case around The Peacock Brook, which rises at the foot of May Hill and later joins the Ell Brook, and is prone to low flows in summer.

Hydropower

Almost one quarter of the water abstracted in the Severn Vale catchment is taken for hydropower but nearly all the water is returned to the watercourse immediately downstream of the abstraction point. There are five licences all located within the Cotswolds. Problems can occur when these licences are issued, because the turbines generating the power often rely on the whole of the flow in the watercourse. If a licence is issued for the whole of the flow, then no further licences can be issued upstream. In such cases, the river has become 'sterilised' as the hydropower licence holder can claim derogation if further abstractions are granted which reduce his or her output. Where all new hydropower licences are applied for, potential future uses must therefore be considered.

Other Uses

There are 35 licences for industrial use but the quantity amounts to only 2% of the total quantity of water abstracted in the Severn Vale area. Other uses include mineral washing, cooling water, circulation water through an amenity pool, fish farming and transfer water.

Exempt Uses

There are a number of uses of water where an abstraction licence is not required (see section 4.6.5). However, because of this the Agency does not have a comprehensive record of these abstractions.

2.6.2 Water Quality

The Agency's principal aim for water quality is to achieve a continued and overall improvement in the quality of controlled waters through the prevention and control of pollution. We aim to ensure that water is of a suitable quality to support and maintain diverse aquatic ecosystems. We therefore need to balance the many uses such as water abstraction, disposal of treated effluent, development of fisheries and a wide range of recreational uses.

The Agency carries out extensive monitoring on a routine basis to determine the quality of surface waters. The quality of water in the Severn Vale catchment is discussed in detail in Section 4.5. Major strains on water quality include wastewater disposal (see Section 2.6.6), and surface water run-off (see section 2.6.7).

2.6.3 Flood Defence

Rivers and flood plains are fundamental parts of the environment. Their existence is a result of natural forces and processes that must be respected. The river network carries surplus water from land to the sea as part of the natural water cycle. Rivers and watercourses can only cope with a certain maximum flow and when this is exceeded flooding occurs. Flooding can be caused by prolonged rainfall, thunderstorms or rapid snow melt. Some rivers are tidal, and high tides together with wind and atmospheric conditions can cause flooding. The peak flow of a flood is measured and expressed in terms of the frequency at which that flow is likely to occur, for example 1 in 100 years or a 1% chance of occurrence in any one year.

The inundation of floodplain areas is both natural and desirable - where it can occur without risk to human life. The effectiveness of rivers and floodplains to convey and store flood water, and minimise flood risk can be adversely affected by human activity, especially by development which physically changes the floodplain.

Individual watercourses will respond differently to the same rainfall conditions due to variations in catchment areas and land use. For example, an urbanised catchment with a high proportion of paved surfaces and drains will have rivers whose levels respond relatively quickly to rainfall. The more open countryside of a rural catchment will often allow more of the rain to soak into the ground and thus slow down run-off, so river levels here will rise less rapidly but remain at a higher level for longer.

Localised flooding may also occur where watercourses become blocked at particular points such as under bridges or in culverts. Debris gathering at these points often includes garden waste and other rubbish that has been deposited on river banks, and can be a major problem in urban areas. Flooding can also occur where surface water drains are unable to discharge into swollen watercourses, or further back in the surface water drainage system where their capacity is exceeded.

The Agency has an overall supervisory duty over flood defence matters under the Water Resources Act 1991. For the purposes of maintenance of river flow and flood defence the Agency and the

Ministry of Agriculture, Fisheries and Food (MAFF) classify all watercourses as either 'main river' or 'ordinary watercourse' (sometimes referred to as 'non-main river'). In broad terms main rivers are watercourses that contribute significantly to a catchment's drainage, although ordinary watercourses may be more significant locally. Proposed revisions to the extent of main river are dealt with through a consultation and advertising process with the final decision being made by MAFF. Main rivers in the Severn Vale are shown in Map 12.

Flooding Information

A detailed description of flooding problems in the catchment was first undertaken in 1980 using powers given under Section 24(5) of the Water Act 1973. The preparation of such surveys to define the nature and extent of flood risks is now a responsibility of the Agency under Section 105 of the Water Resources Act 1991. The original survey has been updated several times, with the most recent update in June 1997, and will continue to be updated regularly. The problems are too numerous to identify on a map but a breakdown by local authorities is given in Table 7. Further details can be obtained from the Agency's Area office at Tewkesbury.

Local Authority	Main River	Ordinary Watercourse	Other	Total
Bristol City Council	0	0	0	0
South Gloucestershire Council	2	20	3	25
Stroud District Council	4	38	3	45
Gloucester City Council	2	3	0	5
Cheltenham Borough Council	3	5	0	8
Cotswold District Council	0	0	0	0
Forest of Dean District Council	4	46	1	51
Tewkesbury Borough Council	19	32	0	51
Malvern Hills District Council	5	27	2	34
Wychavon District Council	0	1	0	1
County of Herefordshire District Council	1	2	1	4
Total	40	174	10	224

Parts of the Severn Vale were badly affected by the floods of Easter 1998. Following these floods the Agency commissioned an Independent Review to report on its handling of this natural but extreme flood event. The report (commonly referred to as the 'Bye Report' after the Chairman of the Review team) was published in September 1998. It recommended several actions to improve the service that the Agency and other organisations provide to the public, and to raise the public's awareness of flood risk and how they can help themselves. The Agency has implemented an Action plan to address the issues identified in the *Bye Report*.

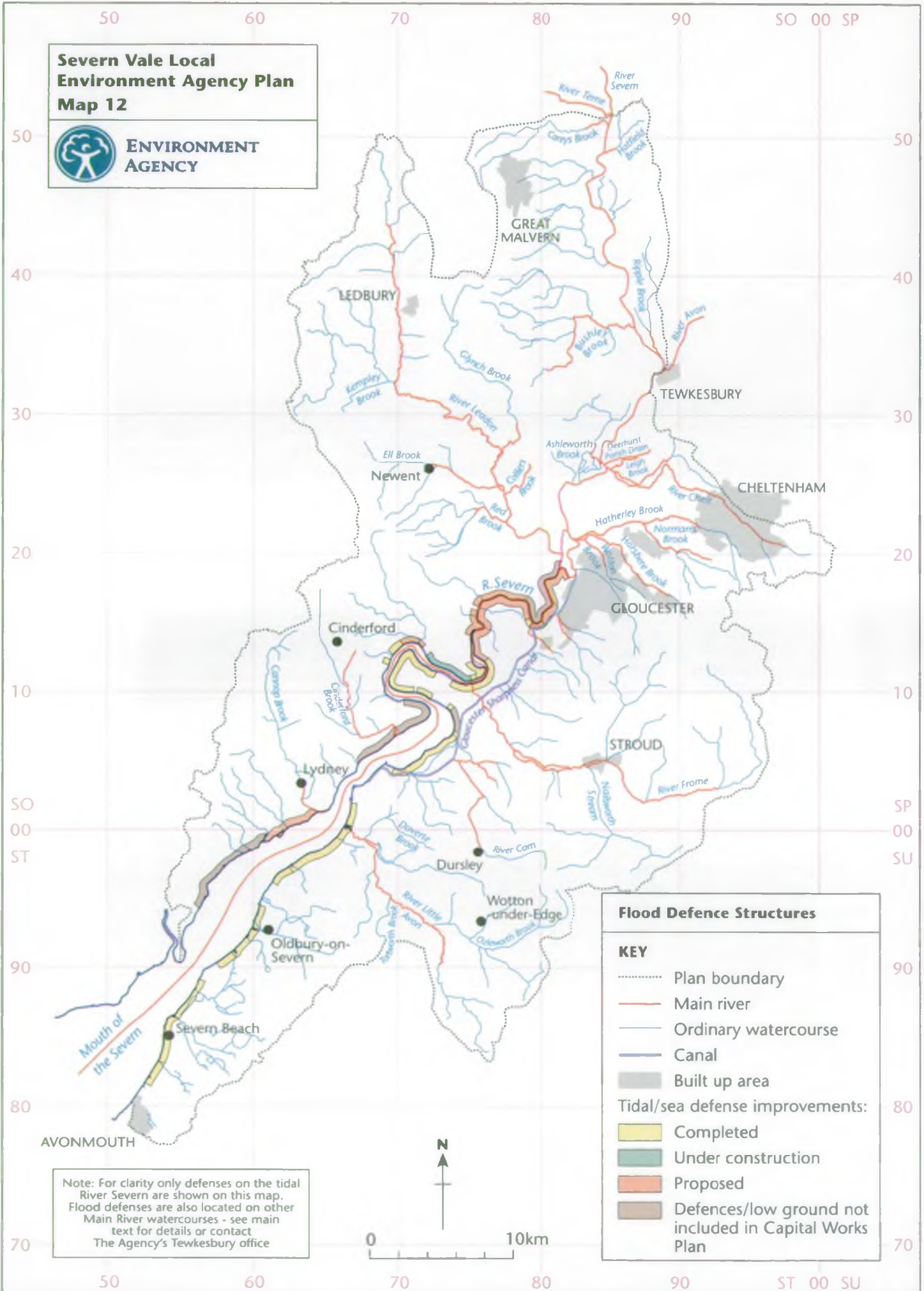
Flood Alleviation

The Severn Vale from Worcester to Tewkesbury has a total of 28 km of flood defence embankments, constructed by the Agency and its predecessors. These protect some 4600 ha of flood plain to a nominal 1 in 5 year standard. The remaining flood plain areas at Kempsey, Upton and Longdon Marsh still flood annually. All these flood plain areas provide essential protection or relief from flooding for property both in this reach of the river and downstream. Impounded navigation levels limit the drainage of low-lying areas.

**Severn Vale Local
Environment Agency Plan
Map 12**



**ENVIRONMENT
AGENCY**



Flood Defence Structures

KEY

- Plan boundary
- Main river
- Ordinary watercourse
- Canal
- Built up area
- Tidal/sea defence improvements:
- Completed
- Under construction
- Proposed
- Defences/low ground not included in Capital Works Plan

Note: For clarity only defences on the tidal River Sever are shown on this map. Flood defences are also located on other Main River watercourses - see main text for details or contact The Agency's Tewkesbury office



From Tewkesbury to Gloucester there are 34 km of embankments protecting some 5000 ha of flood plain to an annual standard. Unprotected areas around Tewkesbury and the Avon confluence flood more frequently.

The Avonmouth area contains most of the hard defences in the Severn Vale. The Estuary lowlands, from Gloucester to Beachley on the west and Avonmouth on the east, are protected by 100km of sea/tidal defences, with 15600 ha of land lying below high tide level. Drainage of these areas is a problem due to low ground levels, tide-lock, slack hydraulic gradients and water from the extensive uplands that drain into them. Map 12 shows the tidal flood defences in the Severn Vale which are being improved as part of our Capital Works Programme.

Flood defence embankments also exist on some reaches of the following tributaries to the Severn:

- Chelt
- Frome
- Cam
- Wicksters Brook
- Little Avon
- Leadon
- Cinderford Brook
- Lyd

There are a host of other tributaries and lesser watercourses on which the drainage of the farthest parts of the catchment depends. Many of these are "ordinary watercourses" and as such are primarily the concern of District Councils. Over the winters of 1992-93 and 1993-94 and over Easter 1998 there was extensive local flooding on these minor drainage systems, which caused much alarm and distress to the property owners involved.

The Agency does not own watercourses except in a few specific locations, such as where flood defence structures have been constructed and their ownership retained. Ultimate responsibility for the upkeep of a watercourse rests with the person who owns the land adjacent to the river (also known as the riparian owner). Privately owned structures are common on watercourses, for a variety of traditional water uses such as operation of mills, creation of navigation channels and fish farming and amenity. By law these must be maintained and operated properly by their owners if they affect river levels and flows.

The Agency and our predecessor organisations have constructed a significant number of gates, weirs, pumping stations and other such structures to complement river channel improvements. In the Severn Vale the Cam and Wicksters Brook pumping station situated at Ryall's Lane in Cam, Gloucestershire, functions as part of the River Cam and Wicksters Brook flood alleviation scheme. The pumping station returns flood waters from the triangular storage area bounded by the River Cam, Wicksters Brook and A38, to the River Cam when the river level has receded. The purpose of the flood storage area is to facilitate the requirement of no increased discharge into the Gloucester and Sharpness Canal, following the improvement works to alleviate flooding caused by the River Cam and Wicksters Brook. The channels at this location have been designed to overspill into this triangular storage area when the designed discharge is exceeded.

The Agency has recently acquired ownership of Dowdeswell Reservoir (now known as Dowdeswell Water), and has carried out work to reduce the retained water level so that it can function as a floodwater balancing facility for the River Chelt.

2.6.4 Stresses and Strains: Water Demand

The Agency has a duty to conserve, redistribute, augment and ensure the proper use of water resources. Increased demand for water may come from the following uses, amongst others.

Public Water Supply

Demand for public water supply in southern England is predicted to increase by 12% between 1990 and 2021. The two most important processes influencing public water supply demand are:

- Per-capita increases in consumption
- Population growth and movement

As discussed in section 2.4.4, there are plans for substantial increases in housing within the Gloucestershire area. There is also an increasing expectation from the public with regard to the levels of service from the water companies. For example, the public does not regard hosepipe bans as acceptable where there is an expectation that leakage targets should be met. At the same time there is an increasing awareness of the need to protect and enhance the water environment. Recent consultation carried out by MORI for the Agency in connection with the AMP3 process indicates that the public are willing to pay for environmental improvement through their water bills.

Agriculture

Demands for spray irrigation in southern England are predicted to rise by 69% by 2021. Changes in agricultural practices and pressures associated with contracts and their deadlines have led to the need for even more irrigation in recent years. Unfortunately, irrigation is required at times when the flow in the rivers and the soil moisture deficit are at their lowest. The Agency must therefore encourage the more efficient use of water and may insist on winter storage reservoirs in some areas for subsequent irrigation. This inevitably costs money and therefore the price of protecting the environment effects the consumer.

2.6.5 Stresses and Strains: Climate Change including Sea Level Rise

Historical records show that the Earth's average surface air temperature has increased by 0.6°C over the last 130 years. Estimates of future rises are between 1.5°C and 4.5°C. Due to variability in data it is not yet possible to confirm the extent to which this variation is natural or due to human activities leading to the greenhouse effect.

It is extremely difficult to quantify potential changes in climate, whatever their cause. This is partly due to incomplete understanding of the complex nature of the climate system. The same is true of predictions relating to the impacts of any climate change on the natural or human environment. While some general predictions have been suggested for the UK as a whole (see below), the specific effects a more local level are impossible to accurately predict.

Impacts on Water Resources

In 1996, the UK Climate Change Impacts Review Group (CCIRG) defined a scenario (the 1996 CCIRG Scenario) of changing climate and sea level for the UK for the decades 2020s - 2050s. This assumed rates of increase in global greenhouse gas emissions consistent with the projections of the Intergovernmental Panel on Climate Change (IPCC) in 1991. The 1996 CCIRG scenario concluded the following implications for water resources:

- An increase in river flow in winter and a decrease, especially in the south of England, during summer. This would adversely affect abstractions of water from rivers in summer (for water supply, irrigation and cooling water) as well as in stream uses such as navigation, recreation and ecosystem maintenance. The effects of changes in the volume and timing of flow on managed water systems will depend significantly on the size and number of reservoirs and the extent to which different sewers are linked;

- Increased winter rainfall and wetter catchment conditions are likely to increase the frequency of riverine flooding;
- The benefits of increased groundwater recharge due to wetter winters may be negated as the recharge season could be shortened by increased autumn and spring evaporation. The overall effect may be that recharge is reduced;
- Climate change might add 5% onto the predicted increase in demand for public water supplies in southern England, largely due to increased usage in gardens. The increase in peak demands could be much greater. This has important implications for the reliability of supply to domestic consumers and may require the redesign of parts of the distribution network. Increased temperatures may also add a further 46% onto predicted demands for spray irrigation.

Impacts on Tidal Flood Defences

The future planning of sea and tidal flood defences must take into account possible sea level rise due to climate change. The Agency has agreed an approach with MAFF (who grant aid much of the Agency's flood defence work) to allow for sea level rise within scheme design. The IPCC predictions for sea level rise are used together with allowances for any land movement (tectonic changes). The net sea level rise estimates are then used to establish the anticipated effects over the life of a flood defence scheme. In the Severn Vale area the figures used for sea level rise are currently 5mm/year. Furthermore, schemes are designed so that, as sea level rise occurs, the defences can be raised without having to rebuild the whole structure. Changes to mean sea level are much smaller than the short-term changes that occur due to tides, surges and waves. However, even a slight rise in mean sea level will amplify the frequency of extreme water levels caused by storm surges.

Impacts on Water Quality

The impact of climate change on water quality may already be reflected in some stretches of water in the Severn Vale which are failing to meet their River Ecosystem Class (REC) Objectives (see Map 21). Although it is difficult to establish a single cause, it is felt that some of the low dissolved oxygen concentrations are partly attributable to low flow conditions (See Appendix 5).

2.6.6 Stresses and Strains: Waste Water Disposal

The disposal of household waste can contribute to pollution of the water environment. Approximately 80% of the water used by households is returned to rivers or estuaries through sewers and sewage treatment works (some water is lost through evaporation in garden use, and lost through leakage in supply pipes). Sewage treatment works (STWs) in the catchment that have a flow of over 100m³/d are shown on Map 13. There are also many more small sewage treatment works, which are either owned by water companies or by private individuals.

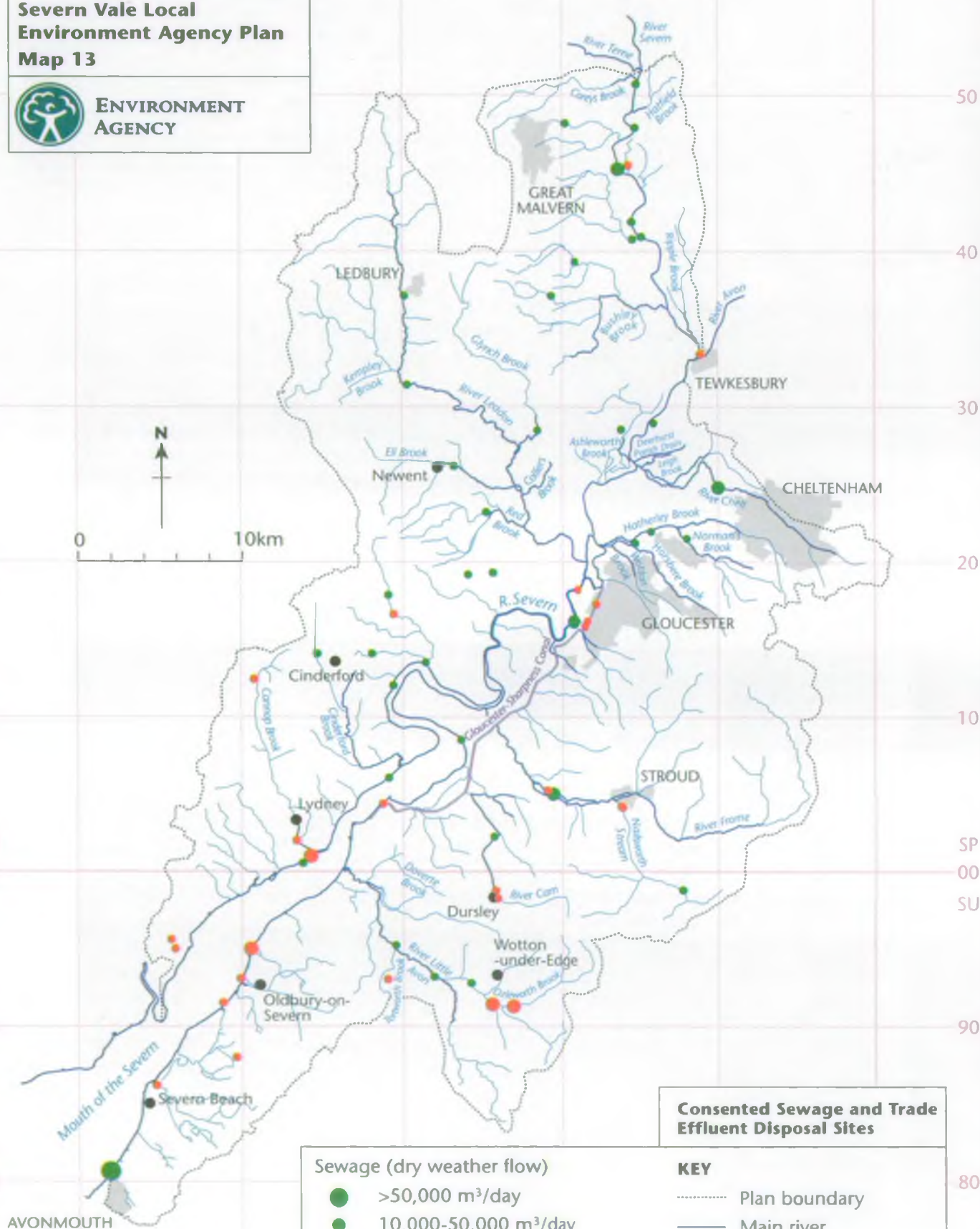
In addition to the direct effects of sewage itself, household products also have the potential to pollute. For example, most detergents contain phosphorus, although changing formulations have led to a decrease in their phosphorus content during the 1990s (Technical Committee on Detergents and the Environment, 1993). Toiletries, medicines and domestic cleaners contain a variety of substances including nickel, copper, lead, zinc and various pesticides. Dilution in sewers and at sewage treatment works normally reduces these substances to harmless levels, but it is not always known what these levels are.

The majority of discharges to controlled waters (i.e. those which do not come under the remit of IPC, as discussed in section 4.3.4) are regulated under The Water Resources Act 1991 (WRA91). This legislation provides the statutory basis for the Agency to control discharges to water.

**Severn Vale Local Environment Agency Plan
Map 13**



ENVIRONMENT AGENCY



Consented Sewage and Trade Effluent Disposal Sites

Sewage (dry weather flow)

- >50,000 m³/day
- 10,000-50,000 m³/day
- 100-10,000 m³/day

Trade effluent (maximum daily volume)

- 10,000-50,000 m³/day
- 100-10,000 m³/day

KEY

- Plan boundary
- Main river
- Ordinary watercourse
- Canal
- Built up area

Note: Effluent disposal regulated under Integrated Pollution Control (see section 4.5.4) is not shown on this map

It an offence under Section 85 of WRA91:

- To cause or knowingly permit "any poisonous, noxious or polluting matter or any solid waste matter to enter controlled waters".
- To cause or knowingly permit any trade effluent of sewage effluent into "controlled waters".

If the discharger makes a discharge in accordance with a consent granted by the Agency then no offence is committed. However, it is the responsibility of the discharger to obtain a consent to discharge from the Agency. The limits on the Consents are set to ensure there is no deterioration in the receiving watercourse and that the River Quality Objective (RQO) (see section 4.5.3) for that watercourse is met.

Water Company Sewage Treatment Works

There are over 545,000 people within the Severn Vale catchment. The sewage effluent generated by this large population and the many industrial users is discharged after treatment at Sewage Treatment Works (STWs).

The largest STW in the catchment discharges to the tidal River Severn at Avonmouth. It treats sewage and industrial effluent from a large area of North Bristol. In dry weather, the works discharge 160 million litres of treated effluent every day. That is enough to fill nearly 7767 road tankers every day.

Another major STW is located at Netheridge, Gloucester. Most of the city's waste water is served by this STW. In dry weather the STW discharges almost 43 million litres of treated effluent every day. Historically, the works provided only primary treatment with chemical settlement and produced an effluent with an average biochemical oxygen demand of 328mg/l. Under storm conditions, diluted untreated sewage was pumped into the estuary. There were also complaints from fishermen of a slime growth, which accumulated on their nets. At times of low flows the river had a distinct sewage smell.

In May 1991 the introduction of the Urban Waste Water Treatment Directive (UWWTD) meant that discharges serving populations greater than 15000 had to provide more than just basic settlement treatment by December 2000. The Agency's predecessor organisation, the National Rivers Authority, had highlighted the water quality problems in the upper estuary to the Water Company. As a result, Severn Trent Water Limited installed a temporary treatment plant at Netheridge in 1992, which was then replaced by a full treatment plant ahead of the requirements of the UWWTD. Other STW in the catchment that will undergo improvements as a result of the UWWTD are listed in section 4.5.2.

The mechanism for bringing about environmental improvements at Water Company STWs is known as the Periodic Review. This involves negotiations between the DETR, the Environment Agency, the Office of Water Services (OFWAT) and the Water Companies. So far there have been 2 rounds of Reviews, known as Asset Management Plans (AMPs), AMP1 (1990-1995) and AMP2 (1995-2000). The third, AMP3, is currently underway and will run from 2000-2005.

The Environment Agency has been reviewing, for agreement with the DETR, those sewage discharges where improvements are required. Some of the improvements are needed to meet existing EC Directives. Others are required because many of the Consents to Discharge were set before privatisation of the water industry and so do not reflect the standards that we now expect. Some of the reasons why we want to see improvements are set out in the Severn Vale LEAP. DETR have now considered our proposals and have translated these into detailed environmental obligations, and we expect the improvements to take place by 2005. The Water Companies are currently preparing their Strategic Business Plans which will confirm the delivery dates of these schemes.

In the Severn Vale catchment 28 STW's and 31 Combined Sewer Overflows (CSOs) have been identified for improvements.

Intermittent Discharges

Modern sewerage systems have two pipes – the foul sewer, which carries sewage and waste water from washing machines and sinks to the sewage treatment works, and the surface water sewer, which carries clean rain water to a nearby river. Any input to the latter will be untreated. Therefore, pollution will be caused by householders who wrongly connect washing machines, toilets etc. or who misuse road drains to dispose of oily residues.

Some of the older sewerage systems have only one pipe, which is called a combined sewer. This is the case in some areas of Cheltenham, Stroud and Gloucester. These systems were designed to overflow into watercourses for a short period during heavy rain, instead of backing up and causing foul flooding on people's properties. In this way, there will be enough dilution in the watercourse during the storm event to prevent a problem occurring. However, because some systems are very old and can no longer cope with an increased population, they overflow more often than they should, sometimes during dry weather conditions. This causes problems for the ecology of the watercourse. The Agency has identified 29 intermittent discharges in the Severn Vale catchment which need to be improved as part of the AMP3 project. For example, several have been identified in the Stroud area where improvements are required to prevent both aesthetic and water quality problems.

Rural Sewerage Issues

Although the towns and many of the villages in the catchment are served by public sewers, some of the rural areas are not connected to the foul sewer but are served by small privately owned treatment plants and septic plants that discharge to a watercourse or land. The overflow from such tanks is designed to drain into the soil via soakaways. In certain areas however, septic tanks may not be suitable due to poor ground conditions such as clay substrate. The effluent may not soak away properly and can result in septic effluents either pooling on the ground, or discharging to streams, causing amenity or water pollution problems. Examples of this are found in the following areas; the Forest of Dean at Rodney and Awre, Stroud area at Oakridge and Harescombe and the Tewkesbury area at Coombe Hill and Deerhurst. In areas such as these it would be preferable to provide public sewerage and convey the effluent to a STW operated by the Water Company for treatment.

The Environment Act 1995 introduced a new duty (Section 101A, Water Industry Act 1991). This requires sewerage undertakers to provide public sewers if it is shown that there are environmental or amenity problems arising from the existing systems and connection to the foul sewer is the most appropriate and cost effective action to take. This is discussed further in the Severn Vale LEAP under "The impacts of Inadequate Sewerage Facilities on Water Quality".

Industrial Discharges

The industries within the catchment will either discharge directly to sewers or after treatment discharge to rivers. There are approximately 110 consented discharges of trade effluent within the catchment. It is important to note that the volume of the discharge does not necessarily reflect its potential to pollute, which is dependant on toxic loading. Trade effluent discharge ranges in nature from run-off from car parking areas to major complex industrial effluents.

There are many large industrial sites such as Birds Eye Walls, Rank Zerox, Rhone Poulenc, Du Pont and CSG that discharge trade effluent to the public sewers. These are regulated by Severn Trent Water, who treat and discharge it as part of the sewage effluent from their STWs. The Agency will determine the Consent to Discharge for the STW based on the substances its catchment is liable to contain.

There are also discharges from abandoned mine workings in the Forest of Dean catchment. These discharge to neighbouring streams. The largest of these is located at Norchards Drift, discharging into the Cannop Brook. The National Coal Board abandoned this mine in 1966 and, after de-watering ceased, the outfall quickly became contaminated due to the passage of drainage water over the

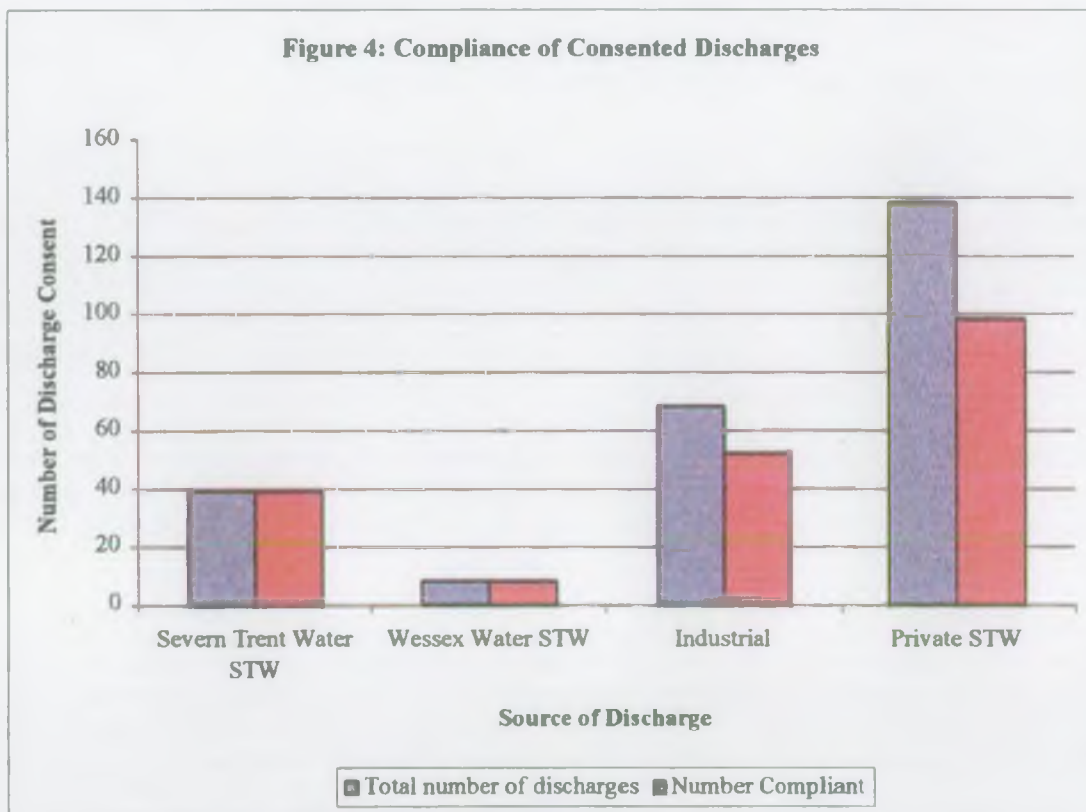
ironstone formations. The Agency and its predecessors have monitored the discharge since the closure. Iron concentrations have decreased significantly over the years, although they still seem to fluctuate during the summer months and have been as high as 13mg/l. The discharge is around 20 million litres per day.

There are also problems in the Forest of Dean catchment where abandoned mine shafts have been used in the past for the dumping of waste (see section 4.2.4).

Compliance with Discharge Consent Conditions

The Agency monitors at all consented discharges of trade effluent or effluent from STWs greater than 5m³/d. Compliance with the consent conditions for these discharges is then assessed. Figure 4 shows compliance for the water company, private STWs and industrial discharges in the catchment. As can be seen, the poorest compliance occurs with the small private STW. This is often because they are not maintained on a regular basis.

If a discharge repeatedly fails to comply with the conditions set in its Consent to Discharge, the Agency seeks to work with consent holders to solve the problem. However, if this is still unsuccessful the Agency will instigate formal action, which may result in court proceedings.



2.6.7 Stresses and strains: Surface Water Runoff

Surface water run-off tends to increase as a result of developments where impermeable surfaces, such as roads, roofs and pavements, are constructed to replace natural greenfield sites. Traditionally, drainage schemes on new development collect and channel the water through surface water sewers thus increasing the amount and flow rates of water reaching the rivers, transporting with it increasing amounts of pollution. Road runoff can be polluted both from accidents and spillage as well as compounds arising from exhaust emissions and tyre wear. Runoff can also lead to a greater risk of

flooding downstream and unnatural fluctuations in flow, which cause environmental damage. In addition, the potential for aquifer recharge will be reduced where impermeable surfaces restrict the movement of water into underground strata.

Technical solutions involving the use of soakaways, infiltration, storage ponds, swales, and other attenuation devices can be used in an attempt to minimise the impact of surface water run-off with varying degrees of success. The Agency is committed to improving the control of surface water run-off and water quality associated with new developments and is undertaking a number of initiatives to encourage Best Management Practices.

With respect to all existing and proposed developments, where the Agency is consulted, the active promotion of surface-water source control techniques will be encouraged where appropriate and practicable. This will include integrating methods of surface water disposal to be compatible with site layouts, roads, gardens, car parks and particularly open spaces. The incorporation of wetlands and reed beds into the drainage design has been proved beneficial for surface water control, as well as for water quality and wildlife, and will also be encouraged where practicable. Pollution from road runoff can also be mitigated through the use of oil interceptors on highway drainage close to watercourses.

The successful implementation of this strategy depends on a close working relationship especially for maintenance, between the organisations and firms involved, including the Agency, local authorities, Water Companies and developers.

2.6.8 Stresses and Strains: Development in the Flood Plain

Water flows onto the flood plain when the flow in a watercourse exceeds its capacity. These natural flood plains (which are as much a part of the river system as the channels which carry normal flows) provide extra capacity for the storage and passing downstream of flood water and are important for species dependent on seasonal flooding. Their flood capacity is reduced if significant areas of flood plain have been raised, embanked, or built upon. This can lead to higher river levels elsewhere and for this reason it is not possible (or desirable) to alleviate flooding in all areas. The priority for flood alleviation lies in urban areas, as undeveloped floodplains should be allowed to play their natural role as an essential part of the water cycle.

It is preferable to avoid increased risk from flooding through control of development than to have to carry out works to alleviate problems once they occur. The relevant authority for controlling development in the flood plain is not the Agency but the local planning authority under the Town and Country Planning Act 1990.

Local planning authorities and the Agency are required by the Department for the Environment, Transport and the Regions (DETR) ('*Circular 30/92 on Development and Flood Risk*'), to liaise closely on flooding and surface water run-off matters. The aim is to ensure that flooding risks that might arise from any development are recognised and considered in the decision making process undertaken by local planning authorities. Flooding and drainage issues are also to be taken into full account during the preparation of land use development plans.

The Agency's objectives here are to ensure that:

- Development should not take place which has an unacceptable risk of flooding, leading to danger to life, damage to property and wasteful expenditure on remedial works;
- Development should not create or exacerbate flooding elsewhere;
- Development should not take place which prejudices possible works to reduce flood risk;
- Development should not cause unacceptable detriment to the environment;
- Natural floodplain areas are retained and where practicable restored in order to fulfil their natural function.

2.7 CONSERVATION, LANDSCAPE & HERITAGE RESOURCES

2.7.1 Countryside Character Areas & Natural Areas

The character of the English countryside has been defined by the Countryside Commission and English Nature (with support from English Heritage), and split into 159 terrestrial 'Character Areas'. English Nature has identified a further 22 Marine Areas, bringing the total to 181. Character Areas describe the landscape character of each area, based on a detailed analysis of landscape character and the main forces for change.

English Nature also classifies 120 different 'Natural Areas', which are defined on the basis of local distinctiveness in geology, landscape character, wildlife habitats, historical influences and natural features. The framework integrates English Nature's national and local priorities and has been adopted to promote local delivery of the UK Biodiversity Action Plan (see Section 3.1). Profiles have been produced for each Natural Area, describing their characteristic wildlife and natural features and setting long term objectives and targets for their protection and enhancement. The Natural Areas often (but not always) correspond to the Countryside Commission Character Areas.

Countryside Character Areas and Natural Areas in the Severn Vale are shown in Map 14 and described in Table 8.

Character Area	Character Area Description (Key characteristics)	Natural Area	Natural Area Description (Key characteristics)
Severn & Avon Vales (106)	Diverse range of flat and gently undulating landscapes united by broad river valley character. Riverside landscape with little woodland, often very open. Variety of land uses from small pasture fields and commons in the west to intensive agriculture in the east. Distinct and contrasting vales: Berkeley, Gloucester, and Leadon. Many ancient towns and large villages along the rivers. Nucleated villages with timber frame and brick buildings. Prominent views of hills such as The Cotswolds, Bredon Hill and the Malverns.	Severn & Avon Vales (56)	Underlain mostly by marl and clay with some limestone, several rock features including river terracing, exposures and cliff series yield fossils and some limestone grassland. The rivers Severn and Avon and their tributaries regularly flood adjacent land where there are relict wetland features such as old pollards, wet pasture, ditches, tall hedges and seasonally flooded washplains. Wetlands of the Gordano Valley overlie peat deposits. Not heavily wooded. Grazing marsh, saltmarsh and mudflats in the south. Sand and gravel deposits with significant wildlife at flooded former gravel workings.
Cotswolds (107)	Defined by its underlying geology: a dramatic scarp rising above adjacent lowlands with steep combs, scarp foot villages and beech woodlands. Rolling, open high wold plateaux moulded by physical and human influences, with arable fields and large blocks of woodland, divided by small narrow valleys. Incised landscapes with deep wide valleys. Flat, open dip slope landscape with extensive arable farmland. Prominent outliers within the lowlands. Honey coloured Cotswold stone in walls, houses and churches. Attractive stone villages with a unity of design materials.	Cotswolds (55)	Band of limestone with escarpments and mass movement giving rise to scarp and emergent spring lines along scarp and river valleys with streams and rivers through dissected valleys. Lower Jurassic rocks in the north and clay rocks forming the floor of the Vale of Morton. Significant semi-natural habitats still exist in parts of farmed landscape but are often peripheral. 4% of Cotswolds supports semi-natural woodland. Small farm woodlands and shelter belts contrasting with large estate woodlands in some areas. Scrub forming mosaics with woodland and pasture along scarp.

<p>Bristol, Avon Valleys & Ridges (118)</p>	<p>A landscape of very mixed landform, geology and settlement pattern strongly influenced by the Avon Valley, Bristol at its centre, and by its industrial history. Low lying, shallow valleys which contrast with limestone ridges and scarps. Frequent, large villages and major conurbations, but also undisturbed rural areas. Wooded scarps – with ancient woodland – and high, open downland ridges. Legacy of coal industry evident in tips, settlement patterns and reclaimed areas. Waterside mills and other features of former rural industries. Frequent parks, mansions and manor houses.</p>	<p>Bristol, Avon Valleys & Ridges (62)</p>	<p>Great scenic and nature conservation diversity due to range of rock types, (sandstones, mudstones, clays, limestones, shales), complexity of erosion and earth movements and human activities. Some resultant habitats have significant wildlife interest including semi-natural woodland and reservoirs with pockets and corridors of wildlife within urban and industrial areas. Result is diverse rare and uncommon flora and fauna, internationally valuable habitat types along with more 'commonplace' habitats and species which all contribute to the area's biodiversity.</p>
<p>South Herefordshire and Over Severn (104)</p>	<p>Divided into three areas - Lower Wye, Woolhope & Over Severn, and Garway Hills. <u>Lower Wye:</u> Fertile, undulating farmland with extensive arable farming. Substantial red sandstone farmsteads. Large to medium fields, commonly low hedges and ageing hedgerow trees. Numerous churches and manor houses in small hamlets. Clusters of parkland trees. Narrow meandering floodplain with low hedges, ditches, scattered mature trees and pollarded willows. Contrasting steep wooded slopes and gentle riverside slip-off slopes. <u>Woolhope and Over Severn:</u> Very varied landforms including Woolhope Dome, ridges and valleys and wide rolling plain. Distinctive woodland and land-use pattern of the Woolhope Dome. Hamlets and large farmsteads. Intensive arable cultivation. Historic Parks. Orchards. Areas of small pasture fields. Varied older building materials and styles including Silurian limestone, brick and 'black and white' timber framed buildings. <u>Garway Hills:</u> Rounded old red sandstone hills. Enclosed valleys. Welsh character. Scattered farms and hamlets. Isolated churches. Small fields in pastoral use and strong hedgerow network in some areas. Arable cultivation and low hedges on less steep land.</p>	<p>Dean Plateau Wye Valley (61)</p>	<p>At a local scale, the natural area can be viewed as 5 distinct units: <u>Forest of Dean:</u> Statutory forest, surroundings having strong cultural identity. <u>Wye Valley:</u> Meandering section through farmland from Holme Lacy to Goodrich with incised valley and gorge dominated by river and woodlands below. <u>Marcle Ridge and Woolhope Dome:</u> Influenced by limestone geology, with daffodil woods and old orchards. <u>Over Severn:</u> 'Daffodil country' spanning well-wooded countryside of Gloucestershire-Herefordshire borders. <u>Garway Hills:</u> Well wooded, undulating land between Rivers Wye and Monnow.</p>

Forest of Dean and Lower Wye (105)	Well-wooded plateau of ridges and valleys contained by outer rim of more open landscape on limestone and sandstone ridges. Small scale varied industry and industrial artefacts intermixed with settlements and large broad-leaved and coniferous woodlands. A strong sense of identity through being remote and self contained. Ever present evidence of history, with artefacts and elements from many historic periods still visible. Scattered and sprawling settlements and smallholdings retaining the feel of clearances from the forest. Mixed building materials and sporadic development give amorphous and disorganised feel to settlements.		
Malvern Hills (103)	Narrow ridge of high, rounded hills rising abruptly from the Severn Vale. Prominent landmark from long distances. Open commons on hill summits and southeastern slopes, long and spectacular views from the hills in all directions. Densely wooded lower slopes. Below ridges there are enclosed remote landscapes of rolling hills with small pasture fields and abundant woodlands. Spa towns still retaining many Victorian and Edwardian buildings. Villas on eastern slopes. Many dramatically sited historic features.	Malvern Hills & Teme Valley (57)	The Malvern Hills are composed mainly of granite rock with thin acidic soils covered by acid grassland and small areas of heathland, merging into bracken, scrub and woodland on lower slopes. A series of roughly wooded hills separated by low lying intensively farmed lands and orchards. River Teme with steep sides and wooded dingle valleys cuts through Old Red Marl Sandstone with resulting deeper, neutral soils and has narrow flood plain supporting arable and pasture land. Calcareous soils occur on limestone ridges.
Herefordshire Lowlands (100)	Wide river valleys. Intensive arable farming and low hedges. Undulating valley sides. Steep wooded hills. Frequent orchards and hop yards. Historic parks. Old red sandstone and timber framed buildings. Large farmsteads and frequent hamlets.	Central Herefordshire (59)	Contains the flood plains of the River Wye and the River Lugg with the valleys of the Rivers Frome and Arrow also providing good wildlife habitat. Predominantly lowland, few isolated flat-topped hills and a plateau. Woodland often found where river sections run through steep sided valley. Mostly underlain by Old Red Sandstone made up of red and grey marls causing rich red soils. Very fertile soils formed from alluvial deposits along river valleys.
Severn Estuary (177)	Wide estuarine landscape with an immense tidal range that exposes sand and mud banks at low tide. Estuarine fringes with saltmarsh, reed beds and mud banks. Some areas of stone shoreline erosion protection.	Severn Estuary Maritime Area (116)	Immense tidal range leading to strong tidal streams, mobile sediments and high turbidity producing plant and animal communities characteristic of liquid mud and tide swept sand and rock. One of the largest inter-tidal zones in Britain. 5 major river outlets form sub-estuaries. Unique funnel shape of estuary contributes to the Severn Bore.

**Severn Vale Local Environment Agency Plan
Map 14**



English Nature Natural Areas:

- 55** Cotswolds
- 56** Severn and Avon Vales
- 62** Bristol, Avon Valleys and Ridges
- 61** Dean Plateau and Wye Valley
- 57** Malvern Hills and Teme Valley
- 59** Central Herefordshire

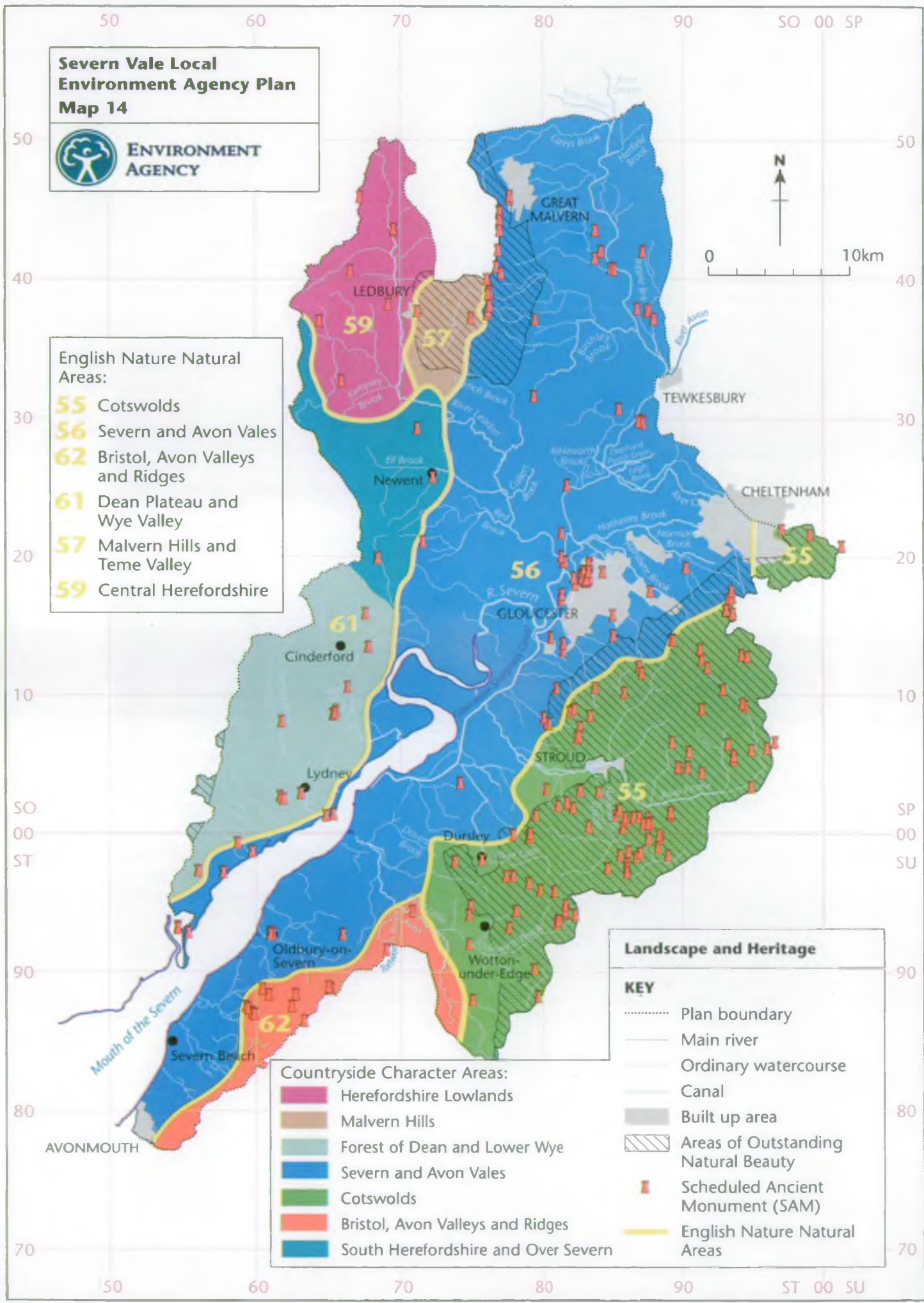
Landscape and Heritage

KEY

- Plan boundary
- Main river
- Ordinary watercourse
- Canal
- Built up area
- ▨ Areas of Outstanding Natural Beauty
- 🚩 Scheduled Ancient Monument (SAM)
- English Nature Natural Areas

Countryside Character Areas:

- Herefordshire Lowlands
- Malvern Hills
- Forest of Dean and Lower Wye
- Severn and Avon Vales
- Cotswolds
- Bristol, Avon Valleys and Ridges
- South Herefordshire and Over Severn



2.7.2 Landscape Designations

Areas of Outstanding Natural Beauty

Areas of Outstanding Natural Beauty (AONBs) are areas of landscape considered to be of national importance. Management of AONBs primarily rests with the county councils, with management plans either prepared or under preparation. The Agency works with AONB officers and others to play its part in securing the implementation of AONB management plans aimed at protecting and enhancing these nationally important landscapes. In particular the Agency's role relates to securing the visual and ecological quality of AONB river corridors by conserving, managing and extending the variety of native trees and grassland.

There are three Areas of Outstanding Natural Beauty in the Severn Vale area (see Map 14):

1. Cotswolds: Part of the Cotswold AONB extends into the eastern edge of the Severn Vale area between Cheltenham in the north and Wotton-under-Edge in the south.
2. Malvern Hills: Part of the Malvern Hills AONB extends into the northern edge of the Severn Vale area between Great Malvern and Ledbury.
3. Wye Valley: Small parts of the Wye Valley AONB extend into the western margins of the Severn Vale area to the west of Lydney.

Special Landscape Areas

Landscapes of county-wide importance are identified in Structure Plans and Local Plans. These areas are variously known as Special Landscape Areas, Areas of Great Landscape Value or Landscape Protection Areas, and are protected through planning policies. Local planning authorities give priority to conserving and enhancing the natural beauty of the landscape within their boundaries.

In Gloucestershire there are three Special Landscape Areas that lie within the Severn Vale area:

- Dean Forest Park which extends from Kilcot near Newent in the north to Boughspring near Chepstow in the south.
- South Gloucester between the Gloucester urban area and the Cotswold AONB including Robinswood Hill.
- An area to the west and south of Berkeley extending to the Estuary shoreline.

In Worcestershire there is one Area of Great Landscape Value that is partially in the Severn Vale area. This corresponds roughly with the Malvern Hills AONB.

In Herefordshire there are three Areas of Great Landscape Value that lie entirely or partially within the Severn Vale area:

- The Area that roughly corresponds to the Malvern Hills AONB, with an extension west of the river Leadon.
- An Area to the northwest of Ledbury.
- The eastern edge of an Area including the Wye River Valley.

In South Gloucestershire an Area of Great Landscape Value extending from Oldbury upon Severn and Thornbury in the north to Severn Beach in the south has been designated as the Forest of Avon.

2.7.4 Nature Conservation Designations

Sites of Special Scientific Interest (SSSIs)

The Site of Special Scientific Interest (SSSIs) designation forms the principal statutory framework for nature conservation efforts in the UK. SSSIs are sites considered to be of special interest for their flora, fauna or geological or physiographic features, and as such are deemed nationally important in terms of conservation value. There are 120 SSSIs in the Severn Vale Area (see Map 15). These are generally managed by private owner-occupiers, although some are managed by conservation groups as reserves. Most privately managed SSSIs are used for agriculture or other purposes, but agreements with English Nature require landowners to establish management practices that maintain and enhance SSSIs for their conservation value.

The condition of SSSIs has been broadly assessed by English Nature. There are a variety of land management practices that have led to some sites becoming of an 'unfavourable condition' status. In cases where the problems are water related, such as over-abstraction from a sensitive water table, the Environment Agency will work with English Nature to address these issues in order to restore the SSSIs to a 'favourable condition'.

For the purposes of this LEAP, the condition of water dependent SSSIs has been categorised as:

- Favourable – F
- Unfavourable improving – UI
- Unfavourable declining – UD
- Unfavourable stabilised – US

Table 9 below shows which water-dependent SSSIs in the Severn Vale are currently categorised as being of unfavourable condition.

Site Name	Condition	Reason for unfavourable status
Aston Ingham Meadows	US	Not water related
Castlemorton Common	UD	Not water related
Coombe Hill Canal & Meadows	UD	Water related
Cotswold Commons & Beechwoods	US	Not water related
Frampton Pools	US	Not water related
Hucclecote Meadows	UD	Not water related
Malvern Hills	UD	Not water related
May Hill	UI	Not water related
Minchinhampton Common	UF	Not water related
New Inn Meadows	US	Not water related
Old River Severn, Upper Lode	US	Water related
Poor's Allotment	UI	Not water related
Severn Ham, Tewkesbury	US	Water related
Soudley Ponds	UI	Not water related
Walmore Common	UD	Water related

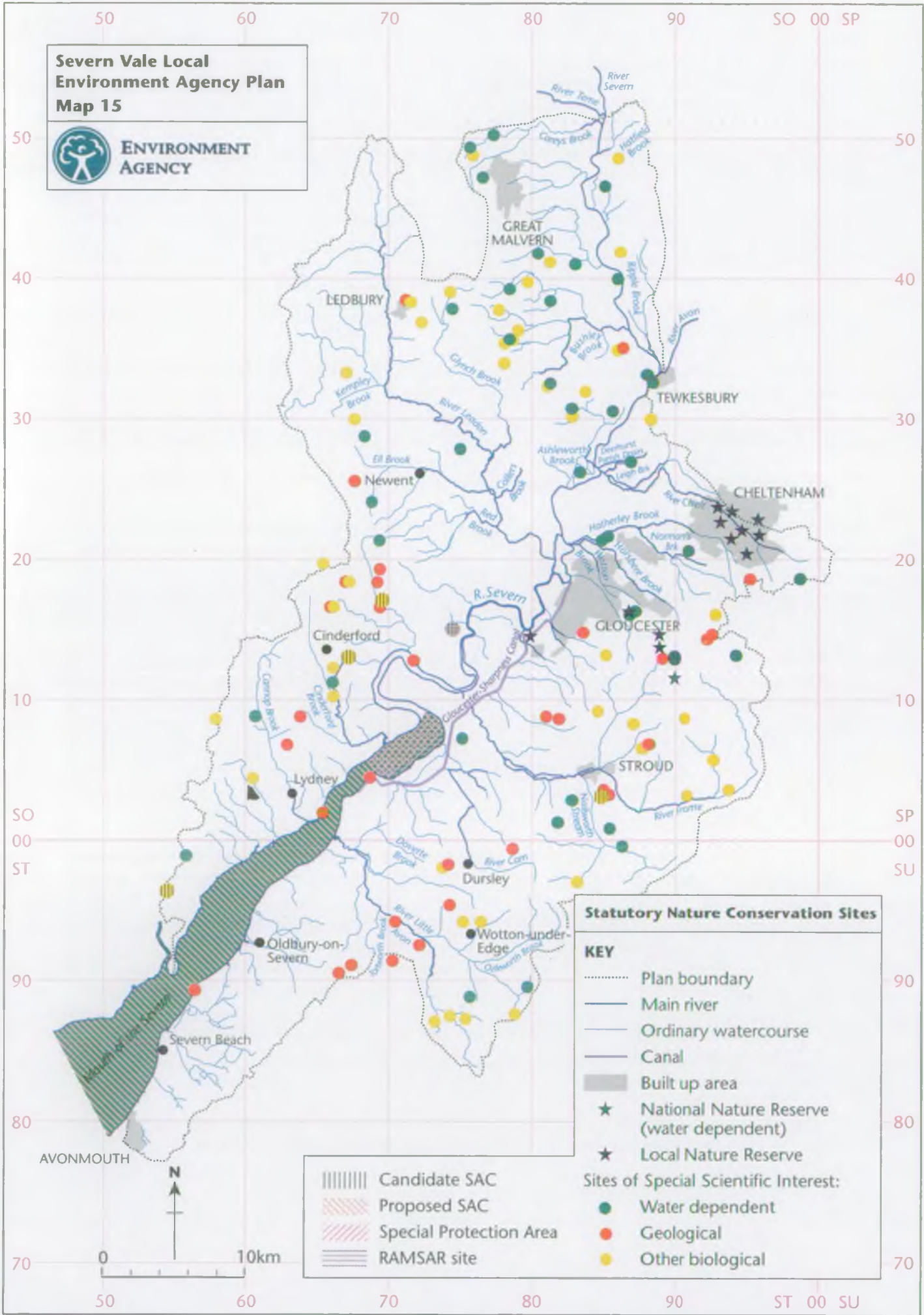
National Nature Reserves and Local Nature Reserves

National Nature Reserves (NNRs) are also sites of national importance for the conservation of wildlife or geological and natural features. NNRs tend to be drawn from the best SSSIs. The NNR is a

**Severn Vale Local
Environment Agency Plan
Map 15**



**ENVIRONMENT
AGENCY**



Statutory Nature Conservation Sites

- KEY**
- Plan boundary
 - Main river
 - Ordinary watercourse
 - Canal
 - Built up area
 - ★ National Nature Reserve (water dependent)
 - ★ Local Nature Reserve
- Sites of Special Scientific Interest:**
- Water dependent
 - Geological
 - Other biological

- ||||| Candidate SAC
- //// Proposed SAC
- XXXX Special Protection Area
- ==== RAMSAR site

statutory designation, over and above SSSI designation, providing those responsible with extra powers to manage the site for conservation purposes. To ensure the long-term continuity of this management, NNRs originally had to be owned or leased by one of the statutory conservation Agencies (English Nature or the Countryside Council for Wales). Recently, however, this has been relaxed so that other managing organisations (such as RSPB, the Wildlife Trusts, and even a few commercial companies) can be approved to run NNRs where this is deemed viable. There is also a strong emphasis on education and visitor access. There is one NNR in the Severn Vale, Cotswolds Commons and Beechwoods.

There are also eleven Local Nature Reserves (LNRs) in the Severn Vale area. LNRs are designated and managed by local authorities, although they have a statutory duty to consult English Nature or the Countryside Council for Wales in making these designations. LNRs are not considered nationally important, but may be of considerable value as a local ecological and educational resource.

Sites of European or International Importance

Several sites in the Severn Vale are of European or international importance and have one or more of the following designations (see Map 15):

- RAMSAR sites:
- Specially Protected Areas:
- Special Conservation Areas (proposed or candidate):

RAMSAR sites are wetlands of international importance, particularly as waterfowl habitat, and are designated under the Ramsar Convention 1971. The UK was a signatory in 1973 and therefore accepted a commitment to promote both the conservation of particular sites and the wise use of wetlands within its territory. Walmore Common and part of the Severn Estuary are designated RAMSAR sites due to the internationally important numbers of wildfowl that use them, in particular Bewick's swans.

Special Protection Areas (SPAs) are designated under the European Community Directive on the Conservation of Wild Birds (79/409/EC), also known as the Birds Directive. The Directive requires member states to take special measures to conserve the habitats of certain rare and vulnerable birds listed in Annex 1 and all regularly occurring migratory species. Walmore Common and part of the Severn Estuary are also designated as SPAs. The boundaries of these SPAs are coincident with the RAMSAR boundaries and the internationally important species and numbers of birds that qualify them for this status are similar to those cited in the RAMSAR convention.

Special Areas of Conservation (SACs) were designated under the EC Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EC) also known as the Habitats Directive. The Habitats Directive complements the 1979 Birds Directive. Areas designated under both directives have been termed the Nature 2000 network: a network of special areas which are rare, endangered or vulnerable in the European community. The Severn Estuary is also a proposed SAC (pSAC). The boundary of the Severn Estuary SAC is more extensive than its RAMSAR and SPA boundary as it includes a wider range of features including Atlantic salt marsh, a variety of mudflats and geomorphological processes. Three candidate SACs (cSACs) exist in the Forest of Dean, whose interest lies in their supporting breeding roost sites for lesser and greater horseshoe bats, The unimproved limestone grassland of Rodborough Common and the beech woodland of the Cotswold Beechwoods are also cSACs.

Walmore Common represents valuable lowland wetland habitat. Issues relating to its water dependency are being addressed through the West Gloucestershire Internal Drainage Board's Water Level Management Plan for the site. Some of the issues facing the wildlife of the Estuary are being addressed through the Severn Estuary Strategy.

The implications of the Habitats Directive are discussed further in section 4.8.2.

Non-statutory Nature Conservation Sites

Non-statutory nature conservation sites of county-wide importance are defined in Local Plans with the objective of protecting and where possible enhancing those sites of ecological and geological interest that fall outside of statutory protection. Various terms are used for non-statutory ecological sites (e.g. Sites of Importance for Nature Conservation, County Wildlife Sites, Key Wildlife Sites), which represent the best remaining areas of semi-natural habitat at county level. Those of geological interest are termed Regionally Important Geological Sites (RIGS).

Approximately 796 such sites of ecological interest occur within the catchment. So far 44 RIGS have been designated, but this will increase as the Herefordshire and Worcestershire RIGS group complete their designations. The Agency continues to work with English Nature and other bodies to conserve and enhance those non-statutory sites in the wider countryside that have a wetland interest or are vulnerable to activities licensed by the Agency, such as water abstractions or discharges.

2.7.6 Agricultural Incentive Schemes

A number of Government initiatives have been established in order to encourage farmers to take land out of production and manage it for conservation purposes. These schemes are largely a result of changes to the Common Agricultural Policy (CAP), and seek to curb the over-production of agricultural commodities that took place under the CAP during the 1980s, while at the same time improving the conservation and recreation value of the wider countryside.

Environmentally Sensitive Areas (ESAs) were first introduced in 1987 to encourage farmers to help safeguard areas of the countryside where the landscape, wildlife and historic interest is of national importance. It is a voluntary scheme and farmers who wish to participate agree to enter into a 10-year management agreement with MAFF. There are currently 22 ESAs in England including the Cotswold Hills ESA, part of which is situated within the Severn Vale area.

Other MAFF schemes to encourage environmental improvements include the Countryside Stewardship, Countryside Access, Farm Woodland Premium and Organic Aid Schemes. In addition, The Forestry Authority administers the Woodland Grant Scheme.

2.7.7 Archaeology and Cultural Heritage

The Severn Vale represents a unique historic and prehistoric landscape, rich in archaeological remains. The Severn and its tributaries have throughout history served as a principal arterial route into the heart of Britain. As such, the archaeological remains along side it represents a rich and varied heritage. There are nearly 237 Scheduled Ancient Monuments (SAMs) in the Severn Vale Area (see Map 14), defined and protected by English Heritage as monuments of national importance. A number of key sites, described below, demonstrate the intensive historical use of the Severn and its tributaries.

The bridgehead at Upton upon Severn and the quay at Hanley Castle demonstrate how the control of a crossing point, together with use of the Severn for industry, trade and commerce, led to the development of important settlements.

Commercial centres close to rivers thrived by using them as a means of transportation. Lydney Docks illustrates the once important use of the Severn as a commercial transport route for products often manufactured inland. Historically, villages such as Kempsey used the Severn for defensive purposes as well as trade and commerce.

The use of the Severn and its tributaries both as a power source and to supply fish through weirs and ponds is also represented at a number of sites along the river, where mills and fish pools are familiar sights. One example of this exists at Longdon Heath where weirs, a mill and fishponds straddle Longdon Brook, near to Eastington Hall. A local conservation group has restored the pond at Arundel mill in Stroud.

The political importance of control of the river is demonstrated by Iron Age hillforts, such as that at Wall Hills overlooking Leadon, Roman Forts at Ripple and Kempsey, and the Medieval Castle at Hanley Castle. These and other sites were strategically positioned to control the Severn for defensive and economic reasons. The Civil War Battlefield at Powick also demonstrates this strategic control of a river, where the bridge was fought over in the struggle for control of the City of Worcester.

The Agency co-operates with English Heritage and Local Authorities in the protection and management of significant historic features and sites with a wetland interest, and in the enhancement of their historic interest. Areas of high archaeological potential along the coast have been identified by English Heritage particularly along the Severn Estuary. These areas may contain extensive prehistoric landscapes and evidence of past environments, archaeological evidence of coastal human settlements, sea defences and other developments, and wrecks. They include sites that have been submerged by rising sea levels since the last ice age or buried in the inter-tidal zone.

2.7.8 Stresses and Strains: Development in Areas of Heritage Interest

Work carried out as part of any management programme for the Severn can have profound effects on the archaeological heritage of the area. For example, new building works, including flood defences, abstractions of water which change the water table, landscaping of banks and fishponds, and dumping on areas of earthworks can result in the destruction of, or damage to, archaeological deposits.

Wetlands can contain important archaeological and palaeoecological evidence within the alluvium of the marshes. Their preservation is dependent on the anaerobic conditions maintained by high groundwater levels, and is thus threatened by abstractions or drainage. Proposals for development on wetland sites also have implications for the archaeological resource of the area, as do proposals relating to sea defence schemes and managed retreat in response to rising sea levels.

The Agency strives to take full account of these issues in the preparation of Water Level Management Plans. Archaeological heritage has also been considered in the preparation of the Severn Estuary Shoreline Management Plan. The Agency also undertakes an extensive environmental impact assessment prior to any new engineering works.

2.7.9 Stresses and Strains: Habitat Loss and Barriers to Species Movement

Habitat loss, and the realistic potential for its reversal, must be considered in the context of the historical evolution of land use. Historically a large proportion of the Severn floodplain would have consisted of a wide diversity of natural wetland habitats with a succession from deep open water to wet woodlands. These habitats have, like the rest of the UK, undergone continued modification for human use. Since the clearance of the wet woodlands in Roman times, the Severn Vale has become ever more dominated by grassland. Although many important wetlands remain within the area these represent small remnants of their former extent. Most have been lost as a result of navigational improvements, flood defence, drainage schemes and more recently, through agricultural practices including ditching, field drainage, re-seeding and the use of artificial fertilisers and herbicides.

River Engineering and Land Drainage

Successive river engineering, land drainage and reclamation have reduced the extent of wetland within the natural area. Information is incomplete but is likely that many land drainage and flood prevention

schemes in the 18th century were particularly significant. One of the last large wetland areas to be lost was Longdon Marsh. Previously, the nutrient rich silt from winter floods was an important component of the annual farming cycle, and species rich habitats thrived where flooding was allowed. However, the use of modern fertilisers is now preferred as a more efficient farming method. Moreover, winter flooding prevents the use of land by stock in winter and can delay farming operations in spring. As a result, many original flood meadows have now been protected to some degree by flood embankments. Although most of these do not provide complete protection they have reduced the frequency of flooding with consequent loss and changes to the hydrology and ecology of floodplain wetlands.

The Severn was slowly improved for navigation in the 19th century and now has a large number of locks and weirs. Tidal influences have been substantially reduced and there has been a permanent low of brackish wetland habitats and maritime plant species above Gloucester. It has also been repeatedly dredged over the last three centuries.

The Reservoirs higher up the Severn Catchment, in particular the construction of lake Vernwy and other reservoirs in central Wales have reduced spring and summer floods which were previously common and probably contributed to high floodplain groundwater levels.

In addition to the effects of historic and large-scale river engineering and drainage schemes (see section 2.6.3) many wet grassland sites have been degraded or lost as a result of recent agricultural improvement. This includes the deepening, rationalisation and clearance of ditches, installation of field drains, fertilisation re-seeding, use of herbicides and a switch from hay cropping and grazing systems to silage production. Thus, although wet grasslands continue to flood in winter, their characteristic communities have been lost.

Fragmentation of Habitats

Agricultural intensification, urban development and activities such as waste disposal have all led to the fragmentation of habitats. Management of sites that are effectively islands becomes more difficult and less cost effective. For example water management may need to be artificially manipulated.

Due to the loss of, for example, ponds through infilling or neglect, individual sites have become isolated and there is loss of species dependent on larger habitat units. For example a cluster of ponds can sustain more viable populations. There is limited colonisation potential when sites are remote. Isolated populations of, for example, water voles, with a narrow genetic base may offer less resistance to disease, predation, changes in the environment or competition from invasive non-native species (see section 5.5.1).

Sites or corridors of semi-natural habitat are under increasing pressure from development and unsympathetic management of land buffering these areas. Lack of terrestrial habitat around ponds causes problems for species such as great crested newts as most of their life cycle is spent on land. Even informal, apparently low impact recreational activities can have significant impacts on wildlife, as these are concentrated in a decreasing number of sensitive sites as more of the local less sensitive sites are lost to housing. For example dog walking can cause considerable disturbance to ground nesting birds such as waders.

Watercourses that drain increasingly urban catchments are subject to more intense management and maintenance for flood defence purposes, with a consequent loss in habitat diversity be it river gravels, bank profile or bankside vegetation.

Barriers to the Movement of Wildlife

Inhospitable or hostile habitat can be an obstruction to the movement of wildlife. A watercourse that is piped or culverted underground can create a barrier to the movement of wildlife through the water or along its banks as it has with limited potential for aeration, a uniform fast flow over an often

unnatural bed, and often has a step upstream and/or downstream. The impact can be reduced if the bottom or invert of the culvert is set at or above bed level and a dry ledge or pipe is included in the design.

Weirs have prevented fish from reaching historic spawning grounds resulting in a reduction of numbers in the next generation. Even fish passes designed for salmonids are not appropriate for shad, as they prefer a smooth laminar flow.

Polluted rivers can also restrict species movement to areas for recolonisation or reproduction, due to for example lack of oxygen, light or insufficient prey.

Over-abstraction and Alterations to Natural Water regimes

Wetland habitats in the Severn Vale area, including rivers and streams, are dependent on inputs from surface water, ground water or rainfall to varying degrees (see sections 2.7.4 and 2.6.7).

2.8 RECREATION

This section discusses the wide variety of recreational pursuits associated with waterways, as the principal activities for which the Agency has responsibilities.

The main recreational facilities associated with waterways in the Severn Vale are shown in Map 16.

The Role of the Agency

The Agency is principally concerned with water-related recreation, which not only includes active water sports, but also informal recreation adjacent to water bodies. It thus includes those tourism facilities which depend on water or are located by water.

The Agency's responsibilities towards recreation are detailed in '*An Action Plan for Recreation*' (1998) and may be summarised as follows:

- To promote the enhancement of the natural beauty and amenity of inland and coastal waters, and to promote the use of water and associated land for recreational purposes;
- To undertake that promotion whilst paying regard to environmental and socio-economic factors;
- To maintain and improve access to places of natural beauty and other sites;
- To make best recreational use of land or water in the Agency's control, including locations where the Agency is the navigation, harbour or conservancy authority;
- To take account of the needs of the sick and disabled.

In order to discharge these duties, the Agency's main role is to promote a healthy aquatic environment. Improvements to recreational facilities may come through the Agency's other activities, such as the creation of flood alleviation schemes. We can comment on planning applications that impact upon the water environment, ensuring that existing facilities are safeguarded and promoting opportunities for further developing such recreational facilities. We can actually provide such facilities on sites within our ownership, and are looking to enhance access to these.

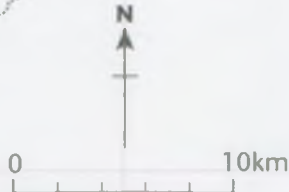
**Severn Vale Local Environment Agency Plan
Map 16**



Recreation

KEY

- Plan boundary
- Main river
- Ordinary watercourse
- Canal
- Built up area
- Regular angling
- Navigable canal
- ★ Focal access point
- ⚓ Boat clubs
- ★ Marinas
- MR Moorings
- Long distance footpaths:
 - The Severn Way
 - The Cotswold Way



AVONMOUTH

Mouth of the Severn

Oldbury-on-Severn

Wotton-under-Edge

Dursley

Lydney

Cinderford

Newent

GLOUCESTER

STROUD

CHELTENHAM

TEWKESBURY

GREAT MALVERN

LEDBURY

50

60

70

80

90

SO

00

SP

50

40

30

20

10

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ST

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2.8.1 Boating and Navigation

Within the LEAP area, the River Severn navigation falls under the jurisdiction of the Bristol Port Company from its confluence with the Bristol Avon to Chittening Warth, just below Severn Beach. The navigable distance here is 3.1 nautical miles.

Contact: Bristol Port Company, 0117 9820000.

The River Severn navigation also falls under the jurisdiction of Gloucester Harbour Trustees (GHT), from Gloucester to the Seaward boundary of the harbour. It is navigable from the GHT boundary with Bristol Port Company, to Gloucester, with an approximate distance of 33.5 nautical miles.

Between the Second Severn Crossing and Sharpness a number of navigation aids are installed which mark the main channel in this part of the harbour. All commercial vessels and most motor-driven pleasure craft use this channel when inbound or outbound from Sharpness Port. Above Sharpness Point, the channel becomes ill defined, flowing through drying sandbanks and drying out in places. Because of this, it is generally only used by small craft with local knowledge and experience, while larger craft use the Gloucester to Sharpness Canal (see below).

Contact: Gloucester Harbour Trustees, 01453 811913.

The stretch of the River Severn between Gloucester and the Gladder Brook confluence upstream of Stourport is under the jurisdiction of British Waterways (BW). This is navigable in its entirety and the stretch covered by this LEAP from Gloucester up to the confluence with the River Teme is approximately 16.5 nautical miles. British Waterways are also responsible for the Gloucester to Sharpness Canal, which is navigable along the whole of its 16 nautical mile stretch.

Contact: British Waterways, 01923 201115.

Details of established boat clubs, marinas and leisure cruises on any of the above stretches can be obtained from British Waterways.

Local canal trusts are promoting the restoration of two canals. Cotswold Canals Trust is seeking to re-establish the Severn-Thames link by restoring both the Stroudwater navigation and the Severn and Thames Canal. The Herefordshire and Gloucestershire Canal Trust are seeking to restore that canal from Hereford to Over on the Severn.

Contact: Cotswold Canal Trust, 01285 643440; Herefordshire and Gloucestershire Canal Trust, 01432 820420.

2.8.2 Canoeing

In the Severn Vale, The British Canoe Union (BCU) is administered by the Southwest and the Midlands branches, with the boundary between the two occurring at Tewkesbury. Stretches of regular use include:

- Downstream of Alney Island to Avonmouth: challenging water for the more experienced canoeists and sea canoeists. The Severn Bore is also run by canoeists from across the UK.
- Gloucester Area (Gloucester Docks, Sharpness Canal, and the River Severn): used by Gloucester Canoe Club and the ADJ Canoe Club for training and recreation in various disciplines such as slalom, wild water racing, marathon racing and touring.
- Sharpness canal and the River Severn upstream of Gloucester to Worcester: used for training, recreation and touring by the Canoe Clubs and paddlers from a wider area, together with youth organisations such as the Sea Cadets and Scouts.

Contact: South West BCU, on 01452 531218; West Midlands BCU, on 0121 356 7619.

2.8.3 Fishing

Recreational fishing, or angling, remains among Britain's most popular sports. The Environment Agency has a duty to maintain, improve and develop those salmon, trout, freshwater fish and eel fisheries under its jurisdiction, and to regulate and protect fisheries as defined in the Salmon and Freshwater Fisheries Act 1975 and the Salmon Act 1986. Anglers require an Agency licence when fishing. This income funds much of the Agency's fisheries research and practical work.

Details of the stretches of rivers which have been designated under EC Directives as Cyprinid (coarse) and Salmonid (game) fisheries are shown on Map 18. The status of fisheries in the Severn Vale is discussed in section 3.4.

2.8.4 Access to Waterways

Access routes to and alongside waterways are used by a wide variety of groups including anglers, walkers, cyclists, horse riders, and canoeists. Long distance footpaths in the Severn Vale are shown in Map 16. Although the Agency has a general responsibility to promote the use of waters and to make land available, where appropriate, for recreational purposes, it is not generally responsible for the establishment, upkeep or marking of rights of way (although it can establish and manage routes on its own land). In most cases, these responsibilities fall to the Highways Authority (usually the county councils), although this is sometimes delegated to the district council. The Countryside Commission may also fund nationally important or regionally important routes.

The Severn Way allows public access to waterways. Ordnance Survey 'Landranger' maps cover the entire route and enable easy identification of the varied landscape covered, which includes steep paths and scrambles as well as stretches of peaceful easy walking. A large network of rights of way including footpaths, bridleways and roads used as public paths, also enables access to many other waterways in the Severn Vale.

The Cotswold Way covers a small section of the Severn Vale. Developed over 25 years, the route now has international recognition. A management group is being set up to bring the Cotswold Way up to the standard of a National Trail. This will involve realignment and practical work to make the path safer and improve the standard whilst retaining its unique character. National Trail status will ensure long term protection of the path as a walking route.

3.0 STATUS OF KEY BIOLOGICAL POPULATIONS, COMMUNITIES AND BIODIVERSITY

This section of the Overview examines the variety of life that exists, or biodiversity, in the Severn Vale. It considers, where known, the number and extent of some of the key wildlife habitats and species for which the Agency has a role in protecting and enhancing. Where such knowledge is incomplete, this highlights the need for further work.

3.1 BIODIVERSITY ACTION PLANS

At the 1992 United Nations Earth Summit, the UK, amongst other countries, signed an international Convention on Biodiversity. This included a commitment to the rehabilitation and restoration of degraded ecosystems and the promotion of recovery of threatened species, through the development and implementation of biodiversity plans. The UK response to this commitment was the document '*Biodiversity: The UK Action Plan*'.

This national biodiversity action planning process also recognised that biodiversity is ultimately lost or conserved at the local level. The development and implementation of Local Biodiversity Action Plans (BAPs) is therefore considered essential in maintaining and enhancing biodiversity, and is the key vehicle through which national biodiversity targets will be met. Worcestershire's BAP was published in April 1999. BAPs for Herefordshire, Gloucestershire, South Gloucestershire and Bristol are currently being drafted.

3.1.1 The Role of the Environment Agency

Within the BAP process, the Environment Agency is the National Contact Point for two habitats and several species, and thus has a key role in ensuring that Habitat Action Plans (HAPs) and Species Action Plans (SAPs) are taken forward. We will do this by stimulating action to achieve targets, monitoring results and reporting progress to the National Biodiversity Steering Group.

There are a number of other habitats and species for which the Environment Agency also has a role to play with respect to proposed actions. As lead partner for species such as Allis and Twaite Shad, we will prepare and implement detailed work plans that direct resources to achieve such actions. The Agency is also responsible for over 100 actions, in whole or in partnership with others in 60 different plans primarily relating to the aquatic environment.

Habitats and species of particular relevance to the Agency in the Severn Vale are discussed below.

3.2 HABITATS

Habitats are those assemblages of physical and ecological components that make up the optimum conditions for particular species to live in. Whether natural, semi-natural or urban, they are fundamental to the diversity of life. However, this century has seen acceleration in the pace and scale of human intervention in the natural environment. Agricultural, industrial and other development pressures have brought about the loss of a variety of habitats, with a consequent loss of biodiversity (see section 2.7.9).

'*Biodiversity: The UK Action Plan*' identified a number of key habitats and species for which a Habitat Action Plan (HAP) has been written and where conservation efforts are to be focused. Key habitats are those meeting one or more of the following criteria:

- Habitats for which the United Kingdom has international obligations;
- Habitats at risk such as those with a high rate of decline;
- Habitats important for key species; and
- Habitats which may be critical to species inhabiting wider areas

3.2.1 Habitats for Which the Environment Agency is the National Contact

Eutrophic Standing Waters

These are found throughout the Severn Vale on lowland areas, although their extent and quality have not been quantified. Eutrophic standing waters are productive water bodies most typical of hard water. Most water bodies in this LEAP area are naturally eutrophic and, other than those in Forest of Dean which have certain properties due to their underlying geology, are likely to fall into this category. In many, such as Frampton Pool and Hartbury Lake, eutrophication has been exacerbated

3.2.2 Other Key Habitats for Which the Environment Agency has a Role to Play

Other habitats for which for which the Agency has a role to play with respect to actions laid out in Habitat Action Plans include the following.

Wet Woodland

In the Severn Vale, wet woodland is limited to small areas along watercourses or around wetland sites. It is found on poorly drained or seasonally wet soils, usually with alder, birch and willow as the predominant tree species.

Reedbeds

Reedbeds are wetlands dominated by stands of the common reed (*Phragmites australis*), wherein the water table is at or above ground level for most of the year. They tend to incorporate areas of open water and ditches, and small areas of wet grassland and carr woodland may be associated with them. Reedbeds are amongst the most important habitats for birds in the UK. Five nationally rare invertebrates are also closely associated with reedbeds. Reed beds are not common or extensive in the Severn Vale although there are a few areas found as narrow fringes along rivers, canals and ditches.

Fens

Fens are peatlands that receive water and nutrients from the soil, rock and ground water as well as from rainfall. Fen habitats support a diversity of plant and animal communities. Some can contain up to 550 species of higher plants and a third of our native plant species; up to and occasionally more than half the UK's species of dragonflies; and several thousand other insect species, as well as being an important habitat for a range of aquatic beetles. Areas of marsh and fen would once have been common throughout the Severn Vale on low-lying flood plains. Now only small remnant fen communities remain. For example, along the whole length of the Severn Valley is a series of disused brick pits created in the last century, many of which have developed a fen community.

Coastal and Floodplain Grazing Marsh (also known as Lowland Wet Grassland)

Grazing marsh is defined as periodically inundated pasture or meadow, with ditches (which maintain the water levels) containing standing brackish or fresh water. The ditches may be especially rich in plants and invertebrates. Almost all areas are grazed and some are cut for hay or silage. Sites may contain seasonal water-filled hollows and permanent ponds with emergent swamp communities, but not extensive areas of tall fen species like reeds (although they may be abundant with fen and reed

swamp communities). Grazing marshes are particularly important for the number of breeding waders such as snipe, lapwing and curlew they support. The low lying grasslands of the alluvial floodplain of the Severn once flooded more regularly in winter, creating a mosaic landscape with extensive wet grasslands. While many areas retain the potential for this habitat only a few of SSSI status remain such as Walmore common, Upton Ham, Upham Meadow and Summer Leasow.

Severn & Avon Vales Wetland Re-creation Project

Co-ordinated by the Environment Agency, English Nature and the Royal Society for the Protection of Birds, the Severn & Avon Vales Wetland Re-creation Project seeks to investigate the potential for re-creating wetlands in the Severn and Avon Vales. Phase 1 of this study has identified 18 candidate sites; 13 in the Severn Vale LEAP area including Longdon Marsh which has been chosen as a pilot study for the next phase of the project. The feasibility of wetland re-creation in the Longdon Marsh area will be determined against a range of factors: topography, current land-use, hydrogeology, soil suitability, water availability and size. Consultations with landowners and other interested parties will be carried out to assess the socio-economic implications of various wetland re-creation options and to measure support or opposition to potential schemes. Possible funding options will also be identified.

3.2.3 Habitats for Which at Present There Is No National Action Plan

Several habitats do not currently have a national action plan. However, '*Biodiversity: The UK Action Plan*' includes habitat statements for the following habitats, which include a 'conservation direction' for each. Moreover, these habitats are all considered to be of local importance and have had or are having habitat action plans written for them at a local level

Rivers and Streams

Few rivers in the UK have avoided physical modification by humans. Those that have represent a very valuable conservation resource. In their natural state, rivers are dynamic systems, continually modifying in form. However, in many cases their ability to rejuvenate and create new habitat has been reduced or arrested by flood defence structures and impoundment. This is true of the River Severn and several of its tributaries. Canalisation and the removal of tree cover in historic times have caused erosion of banks. Such activities have resulted in changes in the frequency and magnitude of flooding, altering seasonal patterns of flows. In addition, flow regulation has altered patterns of sediment transport and nutrient exchange in river systems. Any resulting eutrophication can have detrimental effects on floodplain habitat that still retains some connection with the main river.

The wide variety of features found in rivers and streams supports a diverse range of plants and animals. For example, riffles and pools support aquatic species, and exposed sediments such as shingle beds and sandbars provide important habitats for a range of invertebrates, notably ground beetles, spiders and craneflies. Marginal and bankside vegetation supports an array of wild flowers and animals. Rivers and streams often provide a wildlife corridor link between fragmented habitats in intensively farmed areas such as that of the Severn floodplain.

We know a certain amount about the condition of river and streams in the Severn Vale through the many river corridor surveys that have been carried out over the last 10 or more years. However, the river habitat survey methodology is being used increasingly to describe the state of this resource in conservation terms.

River Habitat Survey (RHS)

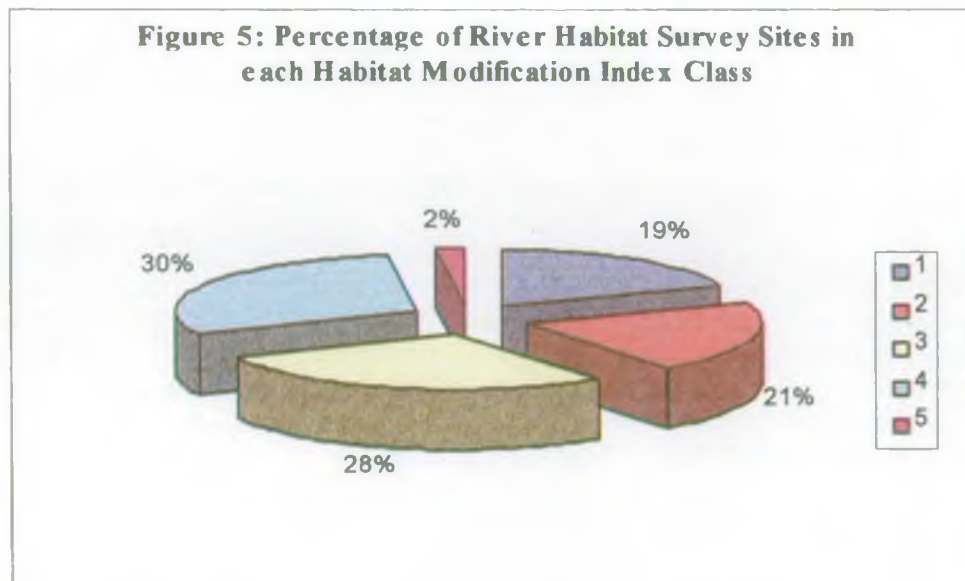
River Habitat Survey (RHS) is a system devised by the Environment Agency for assessing the character and quality of rivers based on their physical structure. It involves a standard site survey method, a method for assessing habitat quality, and a method for describing the extent of artificial channel modification, the Habitat Modification Index (HMI). HMI scores are classified as shown in Table 10 below.

Habitat Modification Index Score	Habitat Modification Index Classification	Descriptive category of channel
0 (1)	1	Pristine
0-2	1	Semi-natural
3-8	2	Predominantly unmodified
9-20	3	Obviously modified
21-44	4	Significantly modified
45 or more	5	Severely modified

NB: The semi-natural category includes pristine channels.

Habitat quality is strongly influenced by the type and extent of artificial modification. This might include, for example: reinforcement or revetment with concrete, steel piling, gabions or rip-rap; resectioning or re-profiling through dredging of the bed and banks; or regulation of flow by impounding structures. Such modifications can influence habitat features for a considerable distance downstream or even upstream.

So far we hold data on 53 RHS sites within the Severn Vale. These were selected as part of a national reference dataset. HMI classifications for these sites are shown on Map 17. Figure 5 shows the proportion of these sites under the various classifications.



We are working to further the application of the RHS methodology. Planned RHS work in the Severn Vale should help to identify those sites best suited to remedial measures such as river rehabilitation.

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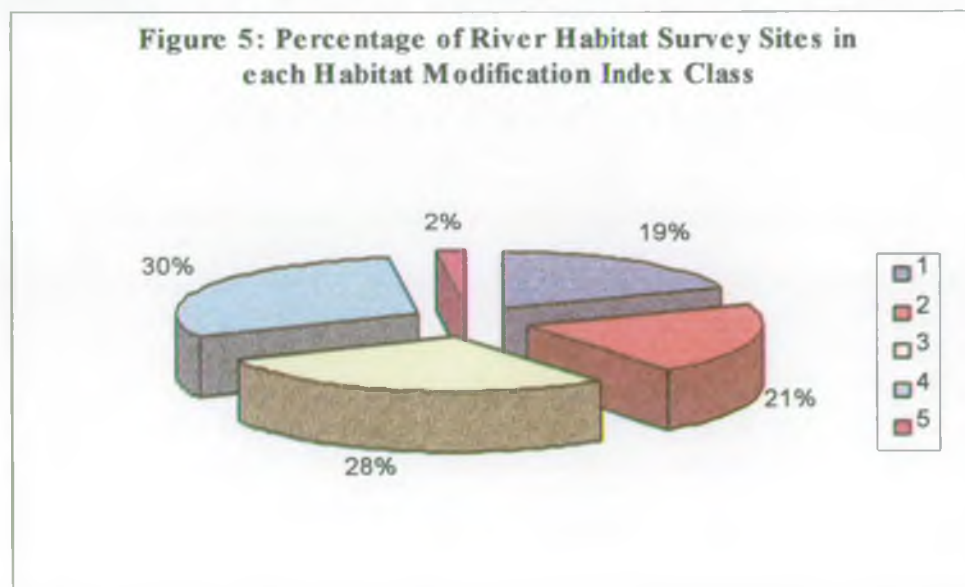
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Canals

Canals provide important habitats for wildlife. Those which no longer carry heavy boat traffic, or are no longer watered (such as the Herefordshire Canal), often support highly diverse assemblages of plants and animals, and may support scarce species such as the floating water-plantain (*Luronium natans*) and grass-wrack pondweed (*Potamogeton compressus*). The wetland habitats are inter-related with the margins, towpath and hedge or other boundary features, which also contribute shelter and emergence sites for aquatic animals. Examples of this can also be found on the Stroudwater and Gloucester-Sharpness canals.

Standing Open Water

Standing open waters include natural systems such as lakes, meres and pools, as well as man-made waters such as reservoirs, ponds and gravel pits. The open water zone lies beyond the limits of swamp vegetation, but may contain submerged, free-floating or floating-leaved vegetation. Standing waters are usually classified according to their nutrient status, and this can change naturally over time. There are three main types of standing waters: oligotrophic (nutrient poor), eutrophic (nutrient rich) and mesotrophic (an intermediate). Many small ponds in the Severn Vale fall into this category.

Urban Habitat

Urban habitat relates to green spaces and the associated ecological niches that are found within built up areas. Green spaces can be divided into four distinct categories:

- Remnants of semi- natural systems such as woodland, wetland, freshwater and estuarine, for example Alney Island in Gloucester;
- Pre-industrial rural landscapes with arable land, meadows, heathland, grazing marshes and villages.
- Managed green spaces. These include town parks, pocket parks, amenity grassland, private gardens and planted shrubbery.
- Naturally seeded urban areas or industrial sites such as demolition sites, disused railway lands or unexploited industrial land.

3.3 SPECIES

Species for which Species Action Plans (SAP) have been prepared for '*Biodiversity: The UK Action Plan*', are those meeting one or more of the following criteria:

- Species whose number or range have declined substantially in recent years;
- Species that are endemic;
- Species that are under a high degree of international threat;
- Species that are covered by relevant conventions, Directives or legislation.

3.3.1 Species for which the Environment Agency is the National Contact Point

Water Vole (Arvicola terrestris)

The water vole is found throughout Britain, but is confined mainly to lowland areas near water. Once common and widespread, this species has suffered a significant decline in numbers and distribution. A national survey in 1989-90 failed to find signs of voles in 67% of sites where they were previously recorded and it is estimated that this will rise to 94% by the turn of the century. As the lower reaches

of rivers become unsuitable for habitation, the distribution of water voles becomes fragmented and existing sites become isolated and vulnerable.

There is little information on the ecology or conservation requirements of this species as it was formerly common throughout the UK and thus attracted little study. Factors causing loss or decline include loss and fragmentation of habitats; disturbance of riparian habitats; predation by mink; pollution of watercourses and poisoning by rodenticides. Since April 1998 the water vole has received limited legal protection through its inclusion on Schedule 5 of the Wildlife and Countryside Act 1981(WCA81) (as amended) in respect of Section (4) only which protects the water voles places of shelter or protection.

Of the 462km of rivers and streams in Gloucestershire surveyed by the Gloucestershire Wildlife Trust in 1978, 75km had evidence of water voles. 32km of these stretches were surveyed again by Gloucestershire Wildlife Trust and Wildfowl and Wetland Trust volunteers during 1998, supported by the Agency. Unfortunately only 7km still supported water voles. The Gloucestershire Wildlife Trust are producing a report summarising the findings of this survey. The remaining 43km will be surveyed between 1999 and 2000.

There are relatively few records for Water Voles over the last 20 years in the part of the Severn Vale that falls within Worcestershire. In the spring and summer of 1999, the Agency, in partnership with the Worcestershire Wildlife Trust, began a strategic survey of Water Voles along the watercourses of Worcestershire in order to determine their status and distribution.

The Avonmouth Water Vole Project, supported by the Agency, has found an isolated water vole population surviving in the Rhines (partly saline linear bodies of water) of an area allocated for industrial development. In identifying water vole strongholds and possible habitat improvements, planning applications have been dealt with more effectively and opportunities for mitigation and enhancement have been undertaken with water voles in mind.

The Agency was involved in building the experimental compound at the Wildfowl and Wetlands Reserve, Slimbridge, as a holding area for water voles temporarily displaced from the Kennet and Avon Canal while repairs took place. Our *Water Vole Conservation Handbook*, providing advice on water vole conservation, has recently been published.

Otter (Lutra Lutra)

Formerly widespread throughout the UK, the otter underwent a rapid decline in numbers from the 1950s to 1970s and was effectively lost from the Midland counties by the 1980s. The decline now seems to have halted and sightings are being reported in former habitats. Factors causing loss of decline include pollution of watercourses (especially by PCBs); insufficient prey associated with poor water quality; impoverishment of bankside habitat features needed for breeding and resting; and incidental mortality, primarily by road deaths and drowning in eel traps. The otter is listed as an endangered species under Appendix I of CITES (The Convention on International Trade in Endangered Species), Appendix II of the Bern Convention and Annexes II and IV of the Habitats Directive. In the UK it is protected under Schedule 5 of WCA81 and Schedule 2 of the Conservation (Natural Habitats, etc.) Regulations 1994 (Regulation 38).

Otters are top predators in aquatic ecosystems and so occur naturally at low densities. Otters are shy, reclusive and largely nocturnal in England. In the Severn Vale, a male otter's home range may extend over 15-20km (females 10-15km), and each otter will travel around this home range over a period of days or weeks. It is therefore impossible to make accurate or meaningful conclusions about the number of individuals present in the area. Otter surveys involve searching for field signs that allow an assessment of otter activity. These surveys can only confirm the presence of otters, and are thus inadequate in detecting their absence.

The recolonisation of the Severn Vale by otters has been part of a natural expansion of animals down the River Severn catchment, from their strongholds in the upper reaches of the Severn and River Teme, where remnant populations held on during the worst period of the population crash. Recolonising otters reached the outskirts of Worcester in the early 1990s and have since expanded downstream. To date, no otter signs have been found south of the River Frome catchment or in the Forest of Dean.

In general, the population of otters in the Severn Vale remains low and their distribution remains sparse at best. As might be expected, returning otters are selecting the best available habitat to form their new territories. Together with partner organisations including Gloucestershire Wildlife Trust, the Agency has an ongoing programme of habitat creation, restoring river and wetland habitats, which should benefit otter populations.

White-clawed Crayfish (Austropotamobius pallipes)

In Europe, the White-clawed Crayfish was formerly widespread in France, Spain and Italy, but populations are now confined to a diminishing number of areas. It is the only species of freshwater crayfish that is native to the UK. It remains widespread in clean, calcareous streams, river and lakes in England and Wales, but many populations have been lost since the 1970s. The species is listed on Appendix III of the Bern Convention and Annexes II and V of the EC Habitats Directive. It is protected under schedule 5 of WCA81, in respect of taking from the wild and sale. Much of the decline has been caused by crayfish plague, a disease caused by the fungus *Aphanomyces astaci*, which is carried by introduced species such as North American crayfish, including the signal crayfish (*Pacifastacus leniusculus*). Spores from the fungus can also be transmitted by a variety of other means, including water, fish and damp equipment. Other factors causing loss or decline include direct competition for food and habitat from non-native crayfish; habitat modification and management of water-bodies; and pollution, particularly from pesticides and sewage.

In the Severn Vale there are records of native white clawed crayfish, which still persist in many stream and rivers in the Frome catchment, Hatherly Brook and the River Chelt. There are also 7 records of Signal Crayfish. However, this data has not been collected as part of any systematic survey, so the true distribution of both species and the progress of the signal crayfish is not known.

Depressed River Mussel (Pseudodontia complanta)

Although this species has only been positively identified in the Teme around Powick, it may be present elsewhere on the Severn catchment.

Ribbon Leafed Water Plantain (Alisma gramineum)

In the Midlands region, the Ribbon Leafed Water Plantain is only found at one lake in Worcestershire where the population is thought to be secure.

True Fox Sedge (Carex vulpina)

Current records show that, within the Midlands region True Fox Sedge is found only in Gloucestershire. This species likes wet ditches and pond sides, mainly on chalk or limestone and often in standing water.

Tassel Stonewort (Tolypella intricata)

Within the Severn Vale, the stronghold for this species is the Little Avon catchment. The Tassel Stonewort is found in alkaline water in pools, canals, ditches, poached edges of ponds and wheel ruts.

3.3.2 Other Key Species for Which the Agency has a Role to Play

Other species for which the Agency has a role to play with respect to actions laid out in Species Action Plans include the following.

Twaite Shad (Alosa fallax) and Allis Shad (Alosa alosa)

Twaite shad and Allis shad are anadromous (i.e. they reproduce in fresh water and grow in the sea) members of the herring family. Both species occur along the western coast of Europe, from southern Norway to Morocco and along the eastern Mediterranean. The species are classified as rare and are listed on Appendix III of the Bern Convention and Annexes II and V of the EC Habitats Directive.

Twaite Shad has been recorded in 37 UK rivers although there are only four known spawning populations, one of which is in the Severn. There are two known spawning sites in the Severn, including that at Powick Weir.

Allis Shad have been recorded in 26 UK rivers but there are no known spawning populations in the UK, although records indicate that historically Allis Shad spawned in the Severn. It is known that hybridisation between Twaite and Allis shad occurs in the Severn.

Factors causing loss or decline of shad populations include pollution; river and estuary barriers; habitat destruction and over exploitation.

Great Crested Newt (Triturus cristatus)

The British population of great crested newts is amongst the largest in Europe and is an important stronghold for this threatened species. It is listed on Annexes II and IV of the Habitats Directive and appendix II of the Bern Convention. Although great crested newts are still quite widespread in Britain and may even be numerous locally, over the last 50 years their numbers have plummeted. For example a recent report suggests that 42% of the great crested newt populations in the London area have been lost in the past 20 years. A similar decline is expected to have occurred in the Severn Vale, although further survey work needs to be undertaken. In 1998, the Agency funded a survey of 70 ponds in Worcestershire and Gloucestershire to determine the presence of Great Crested Newt. Great Crested Newt were present in 49 of these.

Marsh Fritillary (Eurodryas aurinia)

The UK is believed to be one of the major European strongholds for Marsh Fritillary. Nevertheless, its range has reduced by 62% over the last 150 years. In the Midlands region it is now reduced to a few known sites, mainly in the Avon and Severn catchments. It breeds in damp neutral or acid grassland and dry chalk and limestone grasslands, such as those of the Cotswolds.

Aquatic Warbler (Acrocephalus paludicola)

The Aquatic warbler is a globally threatened species, which passes through the UK during migration in autumn between Eastern Europe and Africa. It is not known what proportion of the world population passes through the UK, but it may be significant at greater than 10%. It is found as a vagrant within the Severn Vale.

Bittern (Botaurus stellaris)

The Bittern has declined by over 50% in the past 25 years. Although there have been breeding pairs in the past, there are none currently breeding in the Severn Vale.

Reed Bunting (Emberiza schoeniclus)

Although this species is not of conservation concern elsewhere in Europe, it has decreased in range by around 13% between the last two Breeding Bird Atlas periods (1968-72 and 1988-91). It is still a breeding species in the Severn Vale.

Common Scooter (Melanitta nigra)

The UK breeding population of Common Scooter has declined by more than 50% in the last 25 years. They appear in small numbers across the Severn Vale as a wintering species on inland lakes, reservoirs and gravel pits.

Other Key Bird Populations

The number of successful breeding waders across the Severn Vale is a good indication of the extent of floodplain grassland still existing in the area, as these birds require wet ground conditions in spring and early summer for successful nesting. Snipe and Redshank are indicators of wet grassland and Curlew and Lapwing indicate fairly wet grassland. The Royal Society for the Protection of Birds (RSPB) and the Agency's predecessor (the National Rivers Authority) funded a 1995 survey of Breeding Waders in the Severn Vale. The work was carried out by the Wildfowl and Wetlands Trust (WWT), based at Slimbridge. Excluding Oystercatchers, a total of 227 pairs of waders were recorded in the 1995 survey. Of these, Lapwing were the most abundant and Snipe were almost completely absent, with only a single territory found on a site not normally associated with the species.

Comparisons of the 1995 data with data collected in a national breeding wader survey in 1982 give an indication of the decline in breeding waders (see Table 11). 28 sites were surveyed in both the 1982 and 1995 surveys. There has been active management for breeding waders at the WWT, Slimbridge, where the numbers have increased from 5 pairs in 1982 to 38 in 1995. Excluding these figures, the total number of pairs of breeding waders counted in the Severn Vale in 1982 was 120, compared with 80 pairs in 1995. This shows a 33% reduction in pairs of wild birds.

Breeding Wader Species	Total no. pairs recorded 1982 (excluding Slimbridge)	Total no. pairs recorded 1995 (excluding Slimbridge)	% decrease
Lapwing	56	36	56
Redshank	35	23	34
Curlew	24	20	17
Snipe	5	1	80

(Source: Smith, K.W., 1983, *The Status and Distribution of Waders Breeding on Wet Lowland Grasslands in England and Wales*. *Bird Study* 30:177-192; Royal Society for the Protection of Birds, Wildfowl and Wetlands Trust and National Rivers Authority, *Severn Vale Breeding Wader Survey 1995*).

The total number of waders found in this survey is probably close to the actual population size in the Severn Vale as a whole (certainly for Redshank and Snipe), as the sites selected were those known to have breeding wader interest.

The survey also showed that land use changes have had important effects on the populations. Most noticeable was the relative scarcity of rough unimproved pasture, with semi-improved pasture now the single most widespread type of land use. Tussocky grass is essential for breeding Snipe and often

Redshank. Just 3.7% of the grassland surveyed was classified as having a tussocky nature. Once common, wet unimproved tussocky grassland is now a rare habitat of the Severn Vale.

The Breeding Wader Survey report indicated that conservation of current breeding wader populations should be possible by management on a site by site basis, together with close liaison with landowners. Recommendations for all sites were distributed by the RSPB to all landowners in 1995. A repeat survey is now required to assess the current status of populations, and the Environment Agency is hoping to part fund this.

Black Poplar (Populus Nigra)

There are a number of recorded sties containing black poplar in the Severn Vale. Of the trees at these sites, trees only 3 are female. The scarcity of female trees and lack of suitable ground conditions for germination make it impossible for the trees to reproduce without artificial propagation.

3.4 FISHERIES

Fisheries in the Severn Vale maintain a broad variety of fish species. These range from resident coarse fish of interest to the rod and line angler, through game fish, such as the resident brown trout and migratory salmon, to other migratory species such as the eel, river and sea lamprey, flounder and Twaite Shad. Some of the migratory fish such as lamprey and shad come into the river to spawn whilst others, notably the eel, return to the sea to breed.

Within the Severn Vale, there are 40.6 km of river designated under the EC Fisheries Directive (91/67/EC) as salmonid fishery and 76.3 km of river and canal designated as cyprinid (coarse) fishery. These stretches exist on the Rivers Severn, Leadon, Frome and Little Avon, and on the Gloucester to Sharpness Canal (see Map 18).

Fish populations are very much dependent on the quality and quantity of water present, and on the variety and quality of the habitat. The control of demand for water and the maintenance of water quality standards are, therefore, of paramount importance to fisheries. Low flows have been identified as a problem at various locations within the catchment (see section 2.6.2) and long term solutions are needed to alleviate these problems.

Fishery habitat has been degraded in the past by the construction of weirs, the use of the Severn, Frome and Lyd for navigational purposes, and bankside and channel works for flood alleviation purposes. Some resident coarse fish spawn on submerged aquatic plants, others over or in gravel. Those spawning in or over gravel, such as salmon, trout, lamprey and shad, need satisfactory access to the gravel. Most of the salmon spawning gravels are outside the Severn Vale, but other spawning and nursery areas within the catchment need to be protected from disturbance at critical times of the year.

Commercial eel and elver fishing is carried out using licensed elver nets, putcheons, fyke and eel nets. Commercial salmon fishing is practised mainly in the estuary, although rod and line fishing for salmon takes place upstream, mainly at Upper Lode Weir, Tewkesbury.

Several tributaries of the River Severn, such as the Leadon, Frome, Cam, Little Avon and streams of the Forest of Dean, contain stable, mature wild brown trout populations, especially in their middle and upper reaches. Some rod and line fishing for these trout is carried out, but the majority of trout anglers are to be found on still waters in the catchment. Reservoirs and lakes of suitable quality, such as Witcombe Reservoirs near Gloucester, can be stocked with trout (often rainbow trout) and make popular trout fishing venues.

During the 1998/99 season, 18 angling clubs were known to lease, rent or own water on the main River Severn within the LEAP area. Most fishing rights are in private ownership, although the

Agency does control the rights on two sections of the River Severn, at Upton and Ripple. Fishing on these two waters is made available, free of charge, to individual licence holders and leased to clubs for matches. Angling is fairly good, and many nationally important contests are held in this part of the river. Upstream of Tewkesbury the Severn is gaining a reputation for large barbel and this is now popular with specimen anglers.

In the Forest of Dean there is coarse angling through Lydney Angling Club and game angling on the pond chain known as Soudley Ponds. There is also angling at Lydney Park Lake.

Angling on the River Frome is predominantly coarse. Some trout are found, but the numbers are not significant. Local clubs fish the section from Ebley to Wheathurst in the main, and to a lesser extent up to Chalford. There is no angling of any note on the tributaries. There are no still waters of significance for angling in the Frome catchment other than that at Frampton-on-Severn.

On the Cam there is a limited amount of coarse angling confined to the length downstream of the A38.

In the Little Avon sub-catchment there is some coarse angling with some game downstream, from Charfield to Stone, which is controlled by local clubs. A few small, still waters are fished by local clubs.

There are a number of problems facing fisheries in the area:

- Low river flows, with consequent low levels of dissolved oxygen threatening the health of fish and, in the case of migratory fish, poor water quality in river mouths and estuarine areas preventing access to spawning grounds. Low levels of flow also inhibit the development of game fishing upstream, particularly in the east of the area. The maintenance of strong coarse fisheries is also dependent on adequate flows.
- Loss of natural spawning areas, often through siltation. Game fish, in particular, need to spawn over clean gravel.
- Blockage of some rivers by weed. This has not only made it difficult fish to move upstream, but in some cases has reduced oxygenation of waters. Cutting and removal of weed, particularly of exotic species, is therefore to be encouraged;

Barriers to fish migration may prevent populations breeding in areas of high quality habitat. The industrial heritage of the area has left weirs along the river, some of which are impassable to fish species under certain flow conditions. Many of the weirs are listed structures, however various designs of fish pass are available and can be fitted without significantly affecting a weir's other uses.

There has been concern in recent years over the decline in elver catches as compared, for example with catches taken in the 1970's. The price of elvers also rose significantly in the UK in the mid 90's when the Japanese Eel fishery collapsed and buyers from the Far East became interested in the European Eel elver as a substitute. These reduced catches and higher prices increased the pressure on the fishery. Prices did, however, re-adjust somewhat in 1999.

The situation with Atlantic Salmon is also one of concern over reduced catches but in this case fewer adult salmon in the rivers appears to be the result of poorer survival at sea. The situation in relation to 'spring' salmon became so bad nationally in 1998 that the Minister introduced emergency by-laws, which came into force in England & Wales on 15th April 1999. The thrust of these by-laws was to delay the start of the commercial season until 1st June & to require rod anglers to return all salmon caught before 16th June, whilst restricting the methods used to that of 'catch & release'.

4.0 COMPLIANCE WITH ENVIRONMENTAL QUALITY STANDARDS, TARGETS AND STRATEGIES

This section of the Overview outlines the standards set by European and national legislation, and the targets embodied within government strategies and international agreements relating to waste disposal, air quality, radioactive substance disposal, water quality, water resources, flood defence and flood warning, fisheries and biodiversity. Where known, compliance with these standards and targets within the Severn Vale are also discussed. Where this information is not available, or where standards, targets or strategies are relatively new, the Agency's current activities and future plans for ensuring compliance are discussed.

4.1 WASTE MANAGEMENT

Waste described in this section is as defined in the European Framework Directive on Waste (91/156/EC), which is incorporated into UK law under the Waste Management Licensing Regulations 1994. In general terms, it includes any substances or objects discarded from any household, or commercial or industrial business. Therefore, in this section the term 'waste' is used to imply 'directive waste'.

4.1.1 The Key Players

The Environment Agency regulates the collection, treatment and disposal of waste; collects information on waste arisings and deposits and advises the Secretary of State on the National Waste Strategy.

County and Unitary Councils are responsible for the letting and monitoring of contracts for the disposal of waste collected by the district and borough councils. They are also responsible for the land use aspects of waste management, preparing Structure Plans and Waste Local Plans, determining planning applications and enforcing planning controls on sites.

District, Borough and Unitary Councils collect household wastes and some commercial wastes from, for example, shops and restaurants. They produce Recycling Plans outlining the scope for recycling household waste in their area, the quantities currently recycled along with recycling targets and future initiatives to achieve these targets.

Operators of waste disposal facilities must gain a licence for carrying out waste disposal activities, under the Waste Management Licensing Regulations 1994. The license lays out strict operating procedures. Failure to comply with these procedures can result in prosecution.

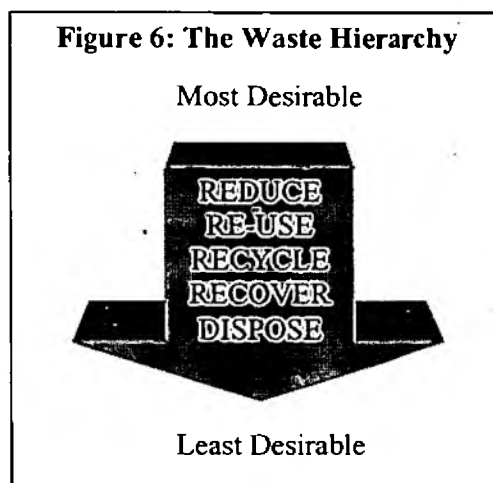
4.1.2 National Waste Management Strategy

The Government's objectives for waste management given in the 1995 White Paper *'Making Waste Work – A Strategy for Sustainable Waste Management in England and Wales'* are:

- To reduce the amount of waste that society produces
- To make best use of the waste that society produces
- To minimise the risks of immediate and future pollution and harm to human health
- To increase the proportion of waste managed by those options towards the top of the waste hierarchy (see below).

As shown in Figure 6, waste management options can be ranked into a waste hierarchy that gives a broad indication of their potential risk to the environment. The overall aim for achieving sustainable

waste management is to increase the proportion of waste managed towards the top of the waste hierarchy. However, it is emphasised that the Best Practicable Environmental Option (BPEO) should be chosen for each waste stream and that all waste hierarchy options have a place in a sustainable waste strategy. For example landfill, although at the bottom of the hierarchy, may represent the BPEO for certain wastes in certain locations.



The White Paper proposes the following targets to help move the emphasis in our waste management practices further up the waste hierarchy:

Primary targets

- To reduce the proportion of controlled waste going to landfill to 60% by 2005
- To recover 40% of municipal waste by 2005

Secondary targets

To assist in achieving the existing target to recycle or compost 25% of household waste by the year 2000 the following secondary targets have been set:

- Encourage 40% of domestic properties with a garden to carry out composting by 2000
- Have in place easily accessible recycling facilities for 80% of households by the 2000
- Compost one million tonnes of organic household waste per annum by 2001

The objectives and targets set out above will only be achieved if the appropriate mechanisms are in place and action is taken to ensure that they are delivered. This will be achieved through the regulatory approach (i.e. under the Environmental Protection Act 1990 and Waste Management Licensing Regulations 1994) and the use of economic instruments and non-regulatory tools. The non-regulatory approach will include influencing public and business attitudes to waste management issues through information, education and influencing planning policies relating to waste management facilities.

Since the publication of *'Making Waste Work'* the Government has published a consultation paper on waste strategy for England and Wales entitled *'Less Waste, More Value'* (June 1998). The paper builds upon the objectives of the previous paper and has the following national key commitments:

- Substantial increases in recycling and energy recovery
- Engagement of the public in increased reuse and recycling of household waste
- A long term framework with challenging targets underpinned by realistic programmes

- A strong emphasis on waste minimisation
- Using the waste hierarchy as a guide, not a prescriptive set of rules
- Creative use of economic incentives, such as the landfill tax
- Increased public involvement in decision making

The consultation paper highlights the lack of reliable information on size and composition of various waste streams. It emphasises the need to increase our understanding of types and quantities of waste we produce in England and Wales. One of the Environment Agency's main objectives has been to provide information and guidance on the national waste strategy. As a result, the Environment Agency has recently completed the first-ever National Waste Production Survey, which will provide estimates of controlled waste arisings from industry and commerce. Previous estimates have placed this waste stream at 122 million tonnes, however accurate figures will be available in early 2000.

'Less waste, More Value' continues to encourage legislation that places the environmental costs of waste production on the producer of the waste. An example of the use of an economic instrument used to influence waste producers is the Landfill Tax. The Landfill Tax works on the principle that by increasing disposal costs, waste minimisation, reuse, recycling and recovery will become more attractive waste management options.

In addition, the principle of *'producer responsibility'* places the emphasis on the producer of the waste using environmental legislation. The Producer Responsibility Obligations (Packaging Waste) Regulations 1997 are the first in a set of Regulations which place obligations on companies that handle specific types of goods. These goods (including packaging, electrical and electronic equipment, tyres and vehicles), when no longer of use represent problematic waste streams or large waste streams that are primarily disposed of to landfill. The Packaging Waste Regulations, as they are known, place an obligation on companies to recover and recycle specific amounts of waste packaging, calculated from the amounts of packaging they handle. Not only does this approach enforce increased recycling and recovery it encourages companies to reduce the amount of packaging they use. The less packaging companies handle, the less onerous and costly achieving their obligations become.

Currently, the Environment Agency is promoting its recently developed *'Life Cycle Assessment'* waste management tool. This computer model can be used to inform local authorities of the environmental impact of different waste management options.

At the time of writing this document the Government produced *'A Way with Waste: A Draft Waste Strategy for England & Wales'*. This strategy was published in response to comments regarding the consultation paper *'Less Waste More Value'* and describes the change needed in the way we in the UK both think about and manage waste. This document can be obtained by contacting The Department of the Environment, Transport and the Regions (DETR) on 0870 1226 236.

4.1.3 Waste Management in the Severn Vale

Waste Management in the Severn Vale draws upon national policies to encourage more sustainable waste management. This section describes the Environment Agency's objectives for waste management, how waste management activities are monitored, and local initiatives to reduce or manage wastes in more sustainable ways.

The Environment Agency's objectives for waste management in the Severn Vale catchment, based on its Environmental Strategy, are to:

- Ensure achievement of national waste strategy targets for the reduction of waste disposed of to landfill;
- Develop an overall database of waste production and disposal;

- Measure the effectiveness of taxation aimed at reducing waste and encouraging its re-use and recycling;
- Ensure achievement of national targets for recovery, recycling and composting of municipal waste;
- Encourage and inspire industry to develop new improved techniques for the management of special and other industrial wastes;
- Implement the producer responsibility regulations;
- Provide a high quality waste regulation service;
- Obtain information on fly-tipping and devise means of combating it.

In recent months the Environment Agency has had a significant involvement in Gloucestershire County Council's Waste Management Strategy and pending Waste Local Plan. Agency officers have attended meetings to discuss issues relating to promoting the objectives of the national waste strategy. The Agency has also liaise with local authorities in the production of their recycling plans.

Monitoring Licensed Activities

Details of the number and type of waste management facilities within the Severn Vale can be found in section 2.4.6, and are shown in Map 7. The Environment Agency inspects and monitors waste management activities and takes enforcement action to ensure that licensed activities do not cause pollution of the environment, or harm to human health. If a licensee fails to comply with a licensed condition the Agency can serve a notice specifying the steps which must be taken to put things right. In addition, the Agency may prosecute a licensee for failing to comply with licensed conditions.

The Environment Agency has recently introduced a national risk-based procedure relating to the monitoring and inspection of licensed waste management facilities (as well as those major industrial processes we regulate). The procedure is entitled Operator and Pollution Risk Appraisal (OPRA). This appraisal allows for an objective and consistent assessment of the inspection regime that is to be undertaken, thus targeting inspection resources depending upon the risk that each site poses to the environment.

The Duty of Care

The Environmental Protection Act 1990 imposes a Duty of Care on people who import, produce, carry, keep, treat or dispose of waste or who as brokers have control of such waste. There are several exemptions from the Duty of Care, for example, householders with regard to their domestic waste. Scrap metal became subject to the Duty of Care on 1 October 1995.

The Duty of Care legislation requires persons who produce, import, keep, store, transport, treat or dispose of waste to take reasonable steps to keep waste safe and prevent it causing pollution or harm to anyone. When waste is passed from one person to another, the person taking the waste must be authorised by the Environment Agency and the waste must be accompanied by a transfer note which describes the nature of the waste and is signed by both persons involved in the transfer.

Achieving More Sustainable Local Waste Management

Many organisations involved in waste management are seeking ways to encourage more sustainable waste management (see the Severn Vale LEAP). There are two specific initiatives that the Agency is involved with in the Severn Vale catchment, as discussed below.

The Environment Agency has produced a guide entitled '*Waste Minimisation – An Environmental Good Practice Guide for Industry*'. The guide offers step by step assistance to industry in reducing

production costs through the development of a practical plan to minimise waste generation and to improve the handling and disposal of waste.

Gloucestershire Waste Minimisation Initiative

The Gloucestershire Waste Minimisation Initiative was developed to provide guidance and assistance to industry on the ways in which resources can be managed in a more sustainable manner. The aims were to reduce the quantity of waste produced, pollution of the environment and harm to human health and the need for regulatory action. The first phase of this successful project involved four small to medium sized enterprises in 1997/8. Using the above guide, each company was required to:

- Map the company's individual processes to identify where resources are consumed and where wastes are generated
- Identify the quantity and costs of materials, utilities and wastes at each stage in the process
- Determine the true cost of producing waste for each process
- Prioritise areas for reducing wastage and increasing resource efficiency
- Identify and implement opportunities for waste minimisation

This project has demonstrated that improved environmental management makes good business sense and can result in significant financial benefits to industries' bottom line, as well as to the environment.

In the first year companies identified combined annual savings in excess of £100,000. As a result, 250 tonnes of waste per annum will no longer go to landfill and carbon dioxide emissions to the atmosphere have been reduced by 550 tonnes per annum. The programme has clearly shown that self-help waste minimisation groups are a cost-effective way of encouraging good practice and bringing about a culture change amongst local businesses. To receive a copy of the first year report, contact the Agency's Tewkesbury office.

The second phase of this initiative, now co-funded by the Environment Agency, Business Link (Gloucestershire), Cheltenham & Gloucester College of Higher Education and other partners, started in 1999. It follows the same process as the pilot, but now involves 8 local companies. The ultimate aim is to establish an industry led waste minimisation club in Gloucestershire to promote both the business and environmental benefits of waste minimisation.

Worcestershire Waste Minimisation Project

The latest phase of the Worcestershire Waste Minimisation Project was launched in January 1999 with Business Link Hereford and Worcester, The Environment Agency, The Environmental Technology Best Practice Programme and Severn Waste being major sponsors. Twenty-one companies have signed up to a series of five meetings which take them through a step by step self help programme to implementing waste minimisation within their company, using the Agency's waste minimisation guide. The aim of the programme is to help the companies achieve cost savings and improve process efficiency whilst raising the environmental awareness of staff.

For details of companies and organisations in the Severn Vale that recover and recycle wastes please contact the Agency's Tewkesbury office.

4.2 CONTAMINATED LAND

4.2.1 The Key Players

The Environment Agency currently has little control over contaminated land unless pollution of ground or surface waters is occurring, in which case we have powers under the Water Resources Act 1991 to serve Notices requiring landowners to carry out remediation works. We can also prevent or control contamination of land as the regulator of waste management sites (see Section 2.4.6), and of major industrial sites (see Section 4.3.4). Under the forthcoming Contaminated Land Regulations, the Agency will be responsible for ensuring the remediation of Special Sites (see below). The Agency will also be responsible for providing information and advice to local authorities on land contamination, carrying out technical research, and reporting nationally on the state of contaminated land.

Local Authorities currently have powers to require developers to clean-up contamination of land that is causing environmental problems, through their powers relating to statutory nuisances. Under the Contaminated Land Regulations, Local Authorities will be required to inspect land within their boundaries so as to identify that which is contaminated, and where necessary ensure remediation of such land.

The Department for the Environment, Transport and the Regions (DETR) awards funds to local authorities to help deal with contaminated land problems at sites in their ownership or under their responsibility, through Supplementary Credit Approvals.

Developers and landowners are responsible for providing information on whether land subject to a planning application is contaminated. The Agency therefore seeks to ensure, where contamination of a site is suspected or known, that prospective developers provide adequate information on land contamination issues.

4.2.2 The Contaminated Land Regulations

The Contaminated Land Regulations are to be introduced under Section 57 of the Environment Act 1995. Implementation of this new legal framework will lead to the identification of contaminated land on a more systematic basis than at present. It will involve the designation of Special Sites (sites contaminated with specified substances, occupied by the Ministry of Defence, or used for specific purposes) by Local Authorities in consultation with the Agency. The Agency will be responsible for remediation of Special Sites. Details of Special Sites will be kept on a public register.

However, these regulations have not yet been implemented, and delays announced by the Government mean that implementation is not now expected before March 2000. Until this happens, the Agency will continue to work with local authorities, landowners, developers, Government departments, and others to identify sites in need of remediation and act accordingly.

Currently, Government guidance in *Planning Policy Guidance note 23* (DOE, 1994) states that a 'suitable for use' approach should be taken when considering redevelopment of contaminated sites for beneficial use. This means that remediation of such sites is generally required only to a state necessary for the new use. This principle is likely to be incorporated into the new regulations. In light of this, resources will be targeted at sites which are causing significant problems at present, and those where redevelopment is proposed.

4.2.3 Environment Agency National Contaminated Land Strategy

Bringing previously used and contaminated land into beneficial use is an important part of achieving sustainable development, as it conserves land as a resource and should reduce pressure to develop on

greenfield sites. It may also be essential in ensuring the prevention of pollution of water resources. The Agency's vision for conserving the land, as set out in our *'Environmental Strategy for the Millennium and Beyond'*, is "to see more contaminated land made safe and brought into beneficial use", and to ensure "an integrated approach to preventing and controlling new land contamination".

In our *'Action Plan for Land Quality'*, the Agency has set itself the challenging target of instigating, with other organisations, a remediation programme for 800 'serious risk' contaminated sites across England and Wales over a five-year period to 2001/02. However, due to delays in the implementation of the above regulations, these targets may need to be put back accordingly. As a priority, we are establishing management and liaison arrangements with others, and preparing guidance at a national level, while awaiting the new regulatory regime. We aim to prepare a *'State of Contaminated Land'* report by the year 2000.

Land contamination is a material planning consideration. The Agency seeks to promote the remediation of contaminated land through input into development plans and consultation on planning applications. We are a statutory consultee for planning applications that fall within 250m of any landfill site operational within the last 30 years. We will continue to respond to planning applications relating to contaminated land on a case-by-case basis, and to work with local planning authorities to ensure that appropriate remediation of contaminated sites is required in planning permissions. We will also apply our Groundwater Protection Policy through Groundwater Regulations Notices, waste management licensing and consultation on planning applications, to ensure that in future activities that may contaminate land will only be sited where the geology is appropriate and the risk of pollution is minimal.

4.2.4 Contaminated Land Management in the Severn Vale

The Agency is aware of several areas of contaminated land in the Severn Vale, including closed landfill sites, old gas works, and former industrial sites. Some of these exist in sensitive locations, such as land adjacent to rivers. However, until site inspections are carried out by local authorities to identify the full extent and nature of land contamination, only a general picture of contaminated land in the Severn Vale can be given from existing sources of information, as follows.

We are advising on the remediation of a factory and airfield site at Gloucester Trading Estate. In Cheltenham, a flood alleviation scheme will involve engineering work on contaminated land. The Agency is working to ensure that the risk of pollution occurring here is minimal. At Indalex, another site in Cheltenham, the Agency is liaising with developers to ensure contaminated land and groundwater are effectively dealt with to prevent pollution from historic contamination.

In the past, a number of landfill sites in the Severn Vale have been sited above major aquifers thereby creating a potential risk of pollution of groundwater. We are working with Environmental Health Departments of District Councils to identify and act on problem closed landfill sites.

In the Forest of Dean, past practices have led to the build up of toxic and known or suspected carcinogenic substances at New Dun mineshaft. A number of bodies are currently involved in proposals for remediation of the site (see the Severn Vale LEAP). New Dun is likely to be designated a Special Site under the above regulations. DETR funding has been applied for to tackle the problems there.

Several partnerships exist within the Severn Vale area between local authorities, developers and other bodies, which aim to promote economic regeneration by restoring derelict and other previously used land to a state fit for new uses. An example of this is the Lydney Docks Partnership, comprising representatives from the Agency, Gloucestershire County Council, Forest of Dean District Council, Lydney Town Council and English Heritage. The Partnership is formulating a strategy for the regeneration of the dock area.

The Government has confirmed through its document entitled *'Planning for the Communities of the Future'*, and its consultation paper on the *'Future of Regional Planning Guidance'*, that 60% of new

housing developments and conversions should be on 'brownfield' or previously developed sites. This is supported in development plans covering the Severn Vale.

4.3 AIR QUALITY

4.3.1 The Key Players

The Environment Agency, under the Environmental Protection Act 1990 (EPA90) as amended by the Environment Act 1995 (EA95), is responsible for regulating air emissions (as well as waste disposal and effluent discharges) from some major industrial processes (see section 4.3.4). The Agency carries out routine monitoring of substances discharged to air (and water) from these processes in order to support and check monitoring carried out by the operator as required by an authorisation. We also work in close co-operation with local authorities on tackling local air quality issues arising from major industrial processes.

Local Authorities are responsible for implementing and reporting to the Department for the Environment, Transport and the Regions (DETR) on the 'UK National Air Quality Strategy' (see section 4.3.3). Under EPA90, local authorities are also responsible for controlling those less polluting industrial processes and managing local air quality issues, such as traffic emissions.

Industrial Operators are required to gain an authorisation from the Agency or local authority, depending on the type and size of their operation. They must monitor emissions from the site and abide by the requirements of the authorisation. Breach of an authorisation may result in prosecution.

4.3.2 International and European Standards

There is a plethora of international agreements and European Directives aimed at controlling emissions of harmful substances to the atmosphere. A few of the milestone legislation and agreements are outlined below. The majority of the air quality standards enshrined in these and several others will be met through the 'UK National Air Quality Strategy' (see section 4.3.3). The Agency will contribute to meeting these standards through effective regulation of the processes under its control (including major industrial processes and waste management facilities), promoting efficiency measures in industry, and in its advisory capacity to national and local government.

As outlined in our 'Environmental Strategy for the Millennium and Beyond', the Agency is committed to addressing climate change and improving air quality. This includes reduction targets for carbon dioxide (CO₂), sulphur dioxide (SO₂), oxides of nitrogen (NO_x), small particulate matter (PM¹⁰), carbon monoxide (CO), dioxins, lead, non-ferrous metals, volatile organic compounds (VOCs) (excluding methane), ozone-depleting substances and other greenhouse gases.

The Montreal Protocol on Substances that Deplete the Ozone Layer, 1987

Ozone found at high levels in the stratosphere forms a protective 'ozone layer' which controls the amount of ultra-violet radiation reaching the Earth's surface. Destruction of the ozone layer may lead to excessive amounts of ultra violet (UV) radiation, which can be harmful to all forms of life. Over 100 countries including the UK have now ratified the Montreal Protocol on Substances that Deplete the Ozone Layer (1987). It aims to reduce and eliminate the use and emission of ozone-depleting substances, which are used in the refrigeration, air conditioning, aerosol, foam and fire protection industries. The Environment Agency has regulatory responsibility for implementing and reporting on the Montreal Protocol.

The UN Framework Convention on Climate Change, 1993

The emission of 'greenhouse gases' as a result of human activities has increased substantially since the industrial revolution, enhancing the natural greenhouse effect and leading to 'global warming' and climate change. The principal greenhouse gases (in terms of volume emitted from human activities) which contribute to global warming are CO₂, followed by methane (CH₄), NO_x, Chloro-fluorocarbons (CFCs) (also ozone-depleting substances), and ground level ozone (O₃). The burning of fossil fuels for power generation is a major cause of increased atmospheric concentrations of CO₂.

The UN Framework Convention on Climate Change, 1993, forms the basis for international action to address the problem of climate change and includes phased targets to reduce emissions of greenhouse gases to 1990 levels by the year 2000. In 1997 it was anticipated that CO₂ emissions from the UK would be between 4 and 8% below 1990 levels, CH₄ emissions 22% below 1990 levels, and nitrogen dioxide (NO₂) emissions 62% below 1990 levels by 2000. At the 1998 Kyoto Climate Change Summit, the UK Government made further commitments to reduce emissions of CO₂ and other greenhouse gases by 5% overall from 1990 levels by 2008-2012.

The UN Economic Commission for Europe (UNECE) Geneva Convention on Long-Range Trans-boundary Air Pollution, 1979

In the troposphere at or near ground level, ozone is a secondary pollutant, formed through a series of photochemical reactions involving sunlight and air polluted with NO₂ and VOCs. In recent years, ground level ozone has been a pollution problem across large areas of Europe, with levels in excess of air quality standards frequently forming in the summer months.

SO₂ and NO_x are acidic gases whose effects on the acidification of land, water and ecosystems is of regional concern in Europe and elsewhere.

The UK is a signatory to the UN Economic Commission for Europe (UNECE) Geneva Convention on Long-Range Trans-boundary Air Pollution (LRTAP), 1979, which provides for the exchange of information and development of policies to combat air pollution. International agreements under this convention include protocols on sulphur dioxide, nitrogen oxides and VOCs, and a programme of evaluation and monitoring.

Large Combustion Plant Directive (88/609/EC)

Following the above agreement, and as a result of specific concern over acid deposition within certain parts of the Community, the EU initiated measures aimed at reducing emissions of pollutants that cause acid rain. In 1988, agreement was reached on the Large Combustion Plant Directive, which commits Member States to reductions in SO₂ and NO_x from fossil fuel burning plant of 50 MW or more – mainly power stations.

Limits for the total annual emissions of SO₂ and NO_x have been set for large power generators by the Agency under a sulphur strategy and national plan to comply with the requirements of the Large Combustion Plant Directive. The Agency has set emission limits for individual power stations through Integrated Pollution Control (see section 4.3.4), which comply with these overall limits. These commitments have led to the fitting of desulphurisation equipment to coal-fired power stations, and to the move away from coal as a fuel towards natural gas, which involves lower emissions of NO_x and minimal SO₂ emissions. Draft revisions to the Directive are set to require further reductions in emissions of acid gases from a 1990 baseline, and bring gas-fired power stations within the scope of the Directive for the first time.

The Integrated Pollution Prevention and Control (IPPC) Directive (96/61/EC)

The Integrated Pollution Prevention and Control (IPPC) Directive will require an integrated approach to the control of polluting discharges to air, water and land from a wider variety of industrial and waste disposal processes than those currently regulated by the Agency and local authorities. The Integrated Pollution Prevention and Control Act becomes statute in the UK On 1st November 1999, and will necessitate greater liaison between the Agency and local authorities on a variety of concerns including air quality.

The Directive represents a holistic approach towards the reduction of the impacts of industry on the environment. It will provide the Agency and local authorities with a powerful tool to not only ensure that the polluting potential of releases are limited, but that problems associated with energy efficiency, materials use, and site remediation are brought under stricter control.

4.3.3 UK National Air Quality Strategy

The 'UK National Air Quality Strategy' (1997) sets out a framework for improving air quality through standards and objectives relating to seven key pollutants, which implements requirements under the Environment Act 1995. Table 12 presents the proposed standards and objectives of the strategy. These are currently under review.

Pollutant	Standard		Objective
	Concentration	Measured as	
Benzene	5 ppb	Running annual mean	100% compliance by 2005
1,3 Butadiene	1 ppb	Running annual mean	100% compliance by 2005
Carbon monoxide	10 ppm	running 8-hour mean	100% compliance by 2005
Lead	0.5µg/m ³	annual mean	100% compliance by 2005
Nitrogen dioxide	150 ppb	1 hour mean	100% compliance by 2005
	21 ppb	annual mean	
Ozone	50µg/m ³	Running 24-hour mean	50µg/m ³ measured as 99% by 2005
	50 ppb	Measured as the 97 th percentile of daily max 8hr running mean	
Sulphur dioxide	100ppb	15 minute mean	100ppb, measured as 99.9% by 2005
Small particulates	50µg/m ³	Running 24-hour mean	

The standards given represent limits in concentrations of pollutants and are designed to protect human health. The Strategy also provides guidelines, which represent longer-term objectives to protect health and the environment. The Government intends to set standards for polycyclic aromatic hydrocarbons (PAHs) in the near future. Combustion processes, such as waste incineration, wood and coal burning, are major sources of toxic organic micro-pollutants (TOMPs), such as dioxins and PAHs. The standards and objectives aim to ensure compliance with international and European commitments for national emissions.

4.3.4 Integrated Pollution Control

The Environmental Protection Act 1990 (EPA90) as amended by the Environment Act 1995 (EA95) introduced the systems of Integrated Pollution Control (IPC) and Local Authority Air Pollution Control (LAAPC). The Environment Agency is responsible for implementing IPC. IPC is concerned with regulating the most technically complex and potentially most polluting industrial processes, or Part A processes as defined under EPA90, including:

- fuel production, combustion and associated processes
- metal production and processing
- mineral industries
- chemical industries
- some waste disposal (e.g. incineration) and recycling
- other industries

IPC is concerned with the prevention and control of emissions to all three media of the environment: air, land and water. The industrial processes regulated under this system are those with the potential for cross-media pollution. The operator must gain IPC authorisation if the prescribed process involves a release into the environment of one of the prescribed substances.

Less polluting processes (Part B processes) are authorised and regulated by local authorities under LAAPC. Capacity is a factor in determining whether a process is Part A or Part B, for example, combustion processes for energy production and waste incineration are Part A when rated above a certain throughput or design capacity and Part B when rated lower.

The IPC system requires that prescribed processes should use the principle of best available techniques not entailing excessive cost (BATNEEC) to prevent or minimise the release of polluting substances, and render all released substances harmless. Regulators and operators should also have regard to the best practicable environmental option (BPEO) for the releases. The principles of BATNEEC and BPEO ensure that the needs of industry are appropriately balanced with the costs and benefits of environmental protection.

The Agency and Business in the Environment developed the 3Es (Emissions, Efficiency, Economics) methodology as a structured technique to achieve improved environmental performance through process optimisation. The Agency has also developed an Operator and Pollution Risk Appraisal (OPRA) Scheme to provide an objective and consistent assessment of the risk from IPC processes for the purposes of targeting compliance inspections.

The operator of a Part A prescribed process is required to possess an IPC authorisation, which is formally reviewed at least every 4 years. The IPC authorisation includes:

- release limits
- reporting requirements
- operating conditions
- improvement programmes

Non-compliance with the conditions of an authorisation can result in Enforcement or Prohibition Notices.

There are 36 IPC authorisations within the Severn Vale (see Table 13). A number of these relate to different processes at the same site. Map 19 shows the location of the IPC authorised sites in the Severn Vale.

Table 13: Processes Regulated under Integrated Pollution Control		
Site	Location	Type Of Process
Albright & Wilson Ltd (4)*	Avonmouth, Bristol	Inorganic chemical processes
BG Plc	Avonmouth, Bristol	Gasification and associated processes
Nu-Pro Surface Treatments Ltd	Thrupp, Stroud	Inorganic chemical processes
Blagden Packaging	Avonmouth, Bristol	Incineration
Bristol City Council	Avonmouth, Bristol	Incineration
Britannia Zinc	Avonmouth, Bristol	Non-ferrous metals
Chemical Recoveries	Avonmouth, Bristol	Recovery processes
Contract Chemicals (3)*	Gloucester	Inorganic chemical processes
Engelhard Ltd	Cinderford, Forest of Dean	Processes involving halogens
Engelhard Ltd	Cinderford, Forest of Dean	Incineration
Engelhard Ltd	Cinderford, Forest of Dean	Non-ferrous metals
Messier-Dowty Ltd	Staverton, Gloucester	Inorganic chemical processes
Purton Carbons	Purton, Berkeley, Stroud	Recovery processes
Rhodia Organique Fine Ltd (3)*	Avonmouth, Bristol	Manufacture and use of organic chemicals
Rhodia Organique Fine Ltd (4)*	Avonmouth, Bristol	Processes involving halogens
Rugby Joinery	Gloucester	Timber processes
RW Davies & Son	Sharpness Docks	Coating processes and printing
Seabank Power Ltd, Bristol	Avonmouth, Bristol	Combustion processes
Sevalco Ltd, Bristol	Avonmouth, Bristol	Carbonisation and associated processes
Surcotech International Ltd	Newent	Inorganic chemical processes
Terra Nitrogen (UK) Ltd	Avonmouth, Bristol	Chemical fertiliser production
Transco	Wormington	Combustion process
Zeneca Ltd (5)*	Avonmouth, Bristol	Manufacture and use of organic chemicals

* Figures in brackets refers to number of authorisations for the site.

There are significant discharges of SO₂ and NO_x from the industrial complex at Avonmouth where there are a number of processes controlled under IPC. Authorised processes within the remainder of the Severn Vale include plating works, precious metal recovery and specialist chemical manufacture.

Details of IPC authorisations are held on the Public Register at the Agency's offices at Kidderminster and Bridgewater. Emissions data are collected by the Agency and published through the Pollution Inventory, which can be found on our website at www.environment-agency.gov.uk. A comprehensive guide to IPC regulated industries at Avonmouth entitled '*Industry in Avonmouth – a public guide to pollution management*' can be obtained from the Agency's Bridgewater office.

4.3.5 Local Air Quality Management

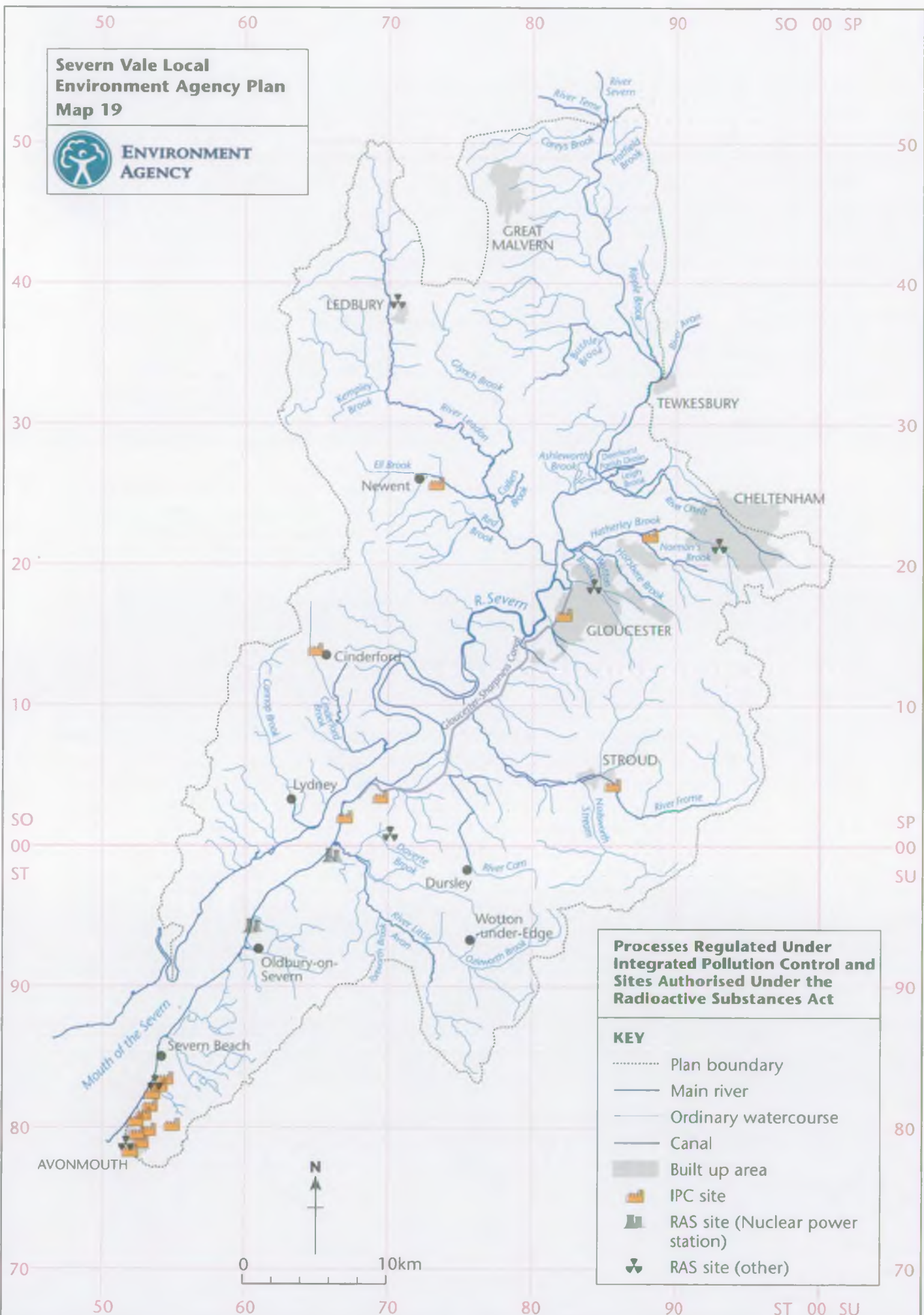
The Environment Act 1995 introduced the system of Local Air Quality Management (LAQM). Under LAQM, local authorities have a statutory responsibility to carry out periodic Air Quality Review and Assessments in their areas. The first of these must be completed by December 1999. Each Air Quality Review and Assessment is a three-stage process:

Stage I: Identification of sites that may have a significant impact on air quality

Stage II: Analysis of quantity of substances released and possible effect on air quality

Stage III: Designation of Air Quality Management Areas (AQMA) where the standard of a specific pollutant is likely to be exceeded in 2005.

**Severn Vale Local
Environment Agency Plan
Map 19**



**Processes Regulated Under
Integrated Pollution Control and
Sites Authorised Under the
Radioactive Substances Act**

KEY

- Plan boundary
- Main river
- Ordinary watercourse
- Canal
- Built up area
- IPC site
- RAS site (Nuclear power station)
- ☼ RAS site (other)

The Agency is providing that information to local authorities relating to the impact on air quality of sites regulated under IPC and is acting as a statutory consultee.

Local authorities within Gloucestershire have progressed to Stage II Review and Assessment for the pollutants NO₂ and PM¹⁰ (Gloucestershire Pollution Group, '*Air Quality Review and Assessment - First Stage Consultation Draft*', 1998). Generally there is no cause for concern in Gloucestershire, although the NO₂ standard was exceeded at Tewkesbury Cross where the annual mean in 1997 was ~23ppb. Increases in background concentrations of NO₂ and PM₁₀ have been attributed largely to road traffic and additional monitoring will be carried out within the county to further assess whether the NO₂ and PM¹⁰ standards are likely to be exceeded in 2005. IPC processes are unlikely to have a significant impact on air quality within the districts and boroughs of Gloucestershire. Background air quality pollutant maps indicate that overall air quality is good in Severn Vale (see Maps 8, 9 and 10).

South Gloucestershire have just published their Stage I Review and Assessment. The document concludes that the most significant sources of air pollution are road transport and certain industrial processes. The pollutants of most concern are NO₂ and PM¹⁰. The review states that these will be assessed in much greater detail to determine the likelihood of the objectives for these pollutants being exceeded in 2005.

Government anticipates that in most areas, existing national policies will deliver the air quality objective for carbon monoxide. South Gloucestershire will undertake further work to ensure that this is delivered in the areas most at risk, i.e. in residential areas close to the motorway network and the A4174 at Hambrook. Further work will be undertaken close to industrial processes where there may be a risk of exposure of individuals to lead and SO₂ emissions.

Bristol City Council published its '*First Stage Review and Assessment of Air Quality for Bristol*', July 1999. The summary of this document states that the Council will need to move to Stage III of the LAQM process 'due to the number and nature of pollution sources in the city'. Bristol City Council is now undertaking advanced modelling of NO_x, PM¹⁰, SO₂ and lead associated with traffic movements and industrial processes.

Levels of NO_x in the Bristol area are a matter of concern to both Bristol City Council and South Gloucestershire Council. The major contribution to NO_x levels in the area is thought to be from traffic, due to the density of the road system and the M4 and M5. Industry also makes a contribution, particularly Britannia Zinc and Terra (UK) at Avonmouth. Over the next few years however there could be an increasing contribution from new gas turbine power stations (see section 2.5.2).

4.4 RADIOACTIVE SUBSTANCES

4.4.1 The Key Players

The Environment Agency is responsible for issuing registrations for the keeping of radioactive sources as well as authorising the disposal of radioactive waste.

The Health and Safety Executive is responsible for ensuring adequate control of radioactive materials in the workplace and minimising the impact on worker health and safety.

Operators of sites where radioactive substances are used require a registration and those sites needing to store and dispose of radioactive wastes must gain an authorisation and ensure that the requirements of the authorisation are adhered to. Breach of the registration or authorisation may result in prosecution.

4.4.2 The Radioactive Substances Act 1993

The International Committee on Radiological Protection (ICRP) is the major international authority providing recommendations on radiological protection to those responsible for formulating national regulations. In the UK the National Radiological Protection Board considers the advice of ICRP and forms recommendations for radiological protection.

All discharges of radioactivity or disposal of solid radioactive waste in the UK must be in conformity with a legal document referred to as an authorisation. Authorisations are issued, regulated and regularly reviewed by the Environment Agency under the Radioactive Substances Act 1993.

4.4.3 Radioactive Substance Regulation

There are 8 sites in the Severn Vale which are authorised under the Radioactive Substances Act 1993 (RAS sites), as shown in Map 19. At the majority of these sites, radioactive substances are associated with agricultural, pharmaceutical or research purposes. However, an operational nuclear power station exists at Oldbury, and a decommissioned nuclear power station at Berkeley.

In the case of an operating power station such as Oldbury, the continuing operation results in the ongoing release of controlled amounts of airborne radioactivity to the atmosphere and liquid effluent to water. Numerical conditions, which limit the quantity of radioactivity that can be discharged to the environment, are specified in the authorisation. In addition an authorisation will include qualitative conditions, such as the requirement to ensure the application of BPEO to maintain discharges well below the numerical limits wherever practicable. Any new authorisation will also include a schedule with specific improvements that will be required as part of an ongoing programme of improvements.

Radioactivity is created in the production of power from a nuclear power station and some of this will remain after a power station is no longer in use. The majority of this radioactivity is associated with the uranium fuel. In the UK, spent uranium fuel from nuclear power stations is sent to BNFP/pc Sellafield for reprocessing, and the amount of radioactivity remaining at the site is relatively small, as is the case at Berkeley.

The recent change of ownership of the Magnox power stations to BNF plc has necessitated the review of all the Magnox authorisations, including Oldbury and Berkeley. This review is due to be completed in the next 6 months and is likely to result in a significant reduction of several numerical limits in the current authorisations.

4.5 WATER QUALITY

4.5.1 The Key Players

The Environment Agency is responsible for monitoring water quality at sites throughout the Severn Vale in order to assess compliance with a variety of European Directives, and to assess progress towards national water quality standards set by the Agency. Where standards are not met, we are responsible for identifying sources of pollution and making sure that improvements are made.

The Department for the Environment, Transport and the Regions (DETR) receives the results of the water quality monitoring from the Agency and reports them to the European Union.

4.5.2 European Directives

There are several EU Directives that contain water quality standards. Those relevant to the Severn Vale area are discussed in turn below.

Surface Water Abstraction Directive (75/440/EEC)

This Directive sets standards that are required for surface water intended for the abstraction of drinking water. This Directive ensures that water abstracted for public supply meets certain quality standards and is given adequate treatment before entering public water supplies.

In the Severn Vale catchment, nearly all water used for domestic supply is from surface water sources. This is abstracted from three sites: River Severn at Strensham and Mythe by Severn Trent Water Limited, and the Gloucester Sharpness Canal at Purton by Bristol Water Company. Until recently, water was also abstracted occasionally from Dowdeswell reservoir in Cheltenham, but this has now ceased and the reservoir is to be used as a balancing lake as part of the River Chelt flood alleviation scheme.

The protection of water used for public supply is a prime issue for the Agency. Water can be contaminated from many different sources such as industry, agriculture, road accidents or failures of sewage treatment plants. In addition to the extensive monitoring programme undertaken to ensure compliance with the Surface Water Abstraction Directive, many of the day to day tasks of Agency officers are undertaken to prevent pollution of surface water supplies. This is discussed more fully in section 4.10.4 and in the Severn Vale LEAP.

Water Companies must comply with the standards set out within the Drinking Water Directive and so it is they who ultimately are responsible for the quality of the water in our taps. This means that if there are problems with the water that is abstracted, they have to find alternative supplies or install costly treatment to ensure that the quality for the consumer is safeguarded.

Compliance at each of the sites monitored is shown in Table 14.

Abstraction	Location	Class	WTW	Compliance
Purton	Intake to works from Gloucester/Sharpness Canal	2	Purton	Compliant 1995, 1997. Non-compliant 1996 for Hydrocarbons ⁽¹⁾ .
Mythe	R. Severn at Mythe intake	2	Mythe	Compliant 1995, 1996, 1997.
Strensham	R. Severn at Strensham intake (known as Upton)	2	Strensham	Compliant 1995, 1996, 1997.
Dowdeswell	Draw-off at Dowdeswell Reservoir	1	Dowdeswell	Compliant 1995. Non compliant 1996 for Phenols ⁽²⁾ & Hydrocarbons ⁽³⁾ ; 1997 for Phenols ⁽⁴⁾ .

1) This was a marginal failure. It was possibly due to boat traffic, but there was no visible oil present when the sample was taken. No action was warranted.

2) This was a marginal failure and the source was not identified. No practical action can be taken.

3) The nearby road may be the source of oil, however there was no visible oil present when the sample was taken. Therefore no action was warranted. There have been no failures since.

4) The catchment upstream of this site is rural and there is no obvious reason for a failure to occur.

Freshwater Fisheries Directive (78/659/EEC)

This Directive sets standards to protect waters that are capable of supporting fish life. It ensures that water quality in designated stretches of watercourse is suitable for supporting certain types of fish.

The Freshwater Fisheries Directive contains two sets of quality standards. One set of standards protects cyprinid or coarse fish populations, for example, roach and chub. The other set of more strict standards protects salmonid populations, for example salmon and trout.

The freshwater reaches of rivers in the Severn Vale that are designated to protect fish life are indicated on Map 18.

There are 31 stretches in the Severn Vale area designated as EC Freshwater Fisheries stretches. Those that have been non-compliant during 1995-1997 are shown in Table 15.

Water	Stretch	Length	Class	Compliance
River Leadon	Stores Brook to A438 New Mills	1.8	Salmonid	Compliant 1995, 1996. Non compliant 1997 for DO ⁽¹⁾ .
River Leadon	M50 Bridge to road bridge at Ketford	1.2	Salmonid	Compliant 1995, 1997. Non compliant 1996 for DO ⁽²⁾ .
Little Avon	Downstream of Wickwar-Confluence with Ozleworth Brook	3.5	Salmonid	Compliant 1995, 1996. Non-compliant 1997 for DO ⁽³⁾ .
Little Avon	Confluence with Ozleworth Brook-Sea	10.1	Salmonid	Compliant 1995, 1996. Non compliant 1997 for DO ⁽³⁾ .

1) This site suffers from eutrophication and low flows, which leads to a lack of aeration. The River Leadon was designated as a Sensitive Area (Eutrophic) in 1998, which means that phosphorous removal will be installed at Ledbury STWs in the future (see the section on the Urban Waste Water Treatment Directive below).

2) This is a slow flowing and shady stretch of the River Leadon leading to low dissolved oxygen concentrations. The River Leadon was designated as a Sensitive Area (Eutrophic) in 1998.

3) Non-compliance is likely to be the result of a faulty DO meter - DO at all sites sampled on the same day in June was depressed, there were no reported pollution incidents and all sites have been compliant since. No action is warranted; however improvements are being made to our water quality data management systems to improve our response to sampling anomalies.

Bathing Waters Directive (76/160/EEC)

This Directive seeks to protect public health and the amenity value of popular bathing waters by reducing pollution. It contains standards for nineteen microbiological, physical and chemical parameters to assess bathing water quality. DETR assess compliance, mainly by testing against standards for faecal indicator bacteria.

There are no identified EC Bathing Waters in the Severn Vale area. However, improvements at Avonmouth Sewage Treatment Works (STW) are required as this STW impacts upon bathing water quality further downstream in the Severn Estuary. Avonmouth STW will be provided with secondary treatment by December 1999, under AMP2. We expect an increase in the volume of sewage to be treated, following improvements funded under AMP3, by 2003.

Dangerous Substances Directive (76/464/EEC)

This Directive sets out a framework to control water pollution by dangerous substances. The Directive does not list limit values for substances itself - they are covered in 'daughter' directives. The types of substances are split into two categories: List I and List II.

List I substances are regarded as particularly dangerous because they are toxic, they persist in the environment and they bio-accumulate. Discharges containing List I substances must be controlled to ensure that the receiving water meets specified Environmental Quality Standards (EQSs). These EQSs are specified in the Daughter Directives.

List II substances are considered to be less dangerous but may have a harmful effect on the water environment. Discharges of List II substances are controlled to ensure that the receiving water meets EQSs. These EQSs are not specified in the Daughter Directives, but are set by the individual Member States.

The Agency is responsible for monitoring all discharges which are liable to contain List I or List II substances. The discharge itself and a suitable point downstream are monitored as part of the Agency's statutory programme of environmental monitoring.

The Agency monitors 39 designated sites for List I and List II substances in the Severn Vale area. Non-compliance for the years from 1995 to 1997 is shown in Table 16.

Receiving Water	Discharge	List I substances monitored	List II substances monitored	Compliance
Severn Estuary (off Holesmouth)	Avonmouth STW	Cadmium, HCH ⁽¹⁾ , Mercury	Chromium, Copper, Lead, Nickel, Zinc, Arsenic	Borderline exceedence for Zinc, 1995 ⁽²⁾ . Compliant 1996, 1997.

1) HCH = Hexachlorocyclohexane
2) The Severn Estuary off Holesmouth exceeded the EQS for zinc in 1995. Avonmouth STW contributed only a small amount of the total zinc measured; the main contribution was from historically contaminated land. The exceedence was marginal and is not considered an issue.

Urban Waste Water Treatment Directive (91/271/EEC)

This Directive specifies certain treatment standards for sewage treatment and sewage collection systems. The level of treatment is dependent upon the type and sensitivity of the receiving water and upon the discharge size. The Directive specifies that secondary treatment is the norm and must be provided for all discharges serving populations greater than 2,000 to inland waters and estuaries, and greater than 10,000 to coastal waters. Discharges below these population thresholds should receive appropriate treatment.

The Agency is responsible for making sure that discharges receive the appropriate level of treatment specified in this Directive.

Under the Urban Waste Water Treatment Directive, more stringent treatment is required at the following sewage treatment works (This is being carried out under the AMP2 programme, 1995 - 2000):

- Lydney, Blakeney, Cinderford, Frampton, Newnham and Broadoak, Castlemoreton, Cheltenham, Gloucester Netheridge, Malvern and Upton on Severn.
- Avonmouth STW. Improvements are being carried out in 2 phases under AMP2 (fine screening has already been installed and secondary treatment will be provided by December 2000).
- Outfall relocation is required at Aust and Thornbury STW. This is being sought at both STWs under AMP3 and will be carried out subject to available funding being approved.

The Directive also requires more stringent treatment for discharges to Sensitive Areas. Sensitive Areas are areas that are, or may become, eutrophic if protective action is not taken. They apply to freshwaters and estuarine waters that receive discharges from works serving population equivalents of greater than 10,000.

The DETR decide if a watercourse should be identified as a Sensitive Area (Eutrophic). The Environment Agency carries out monitoring and provides information to DETR, as well as ensuring that qualifying discharges to Sensitive Areas receive a higher level of treatment for Total Phosphorus and/or Total Nitrogen if justified.

Under the UWWTD, it has already been confirmed that phosphorus removal is required at the following sewage treatment works in the Severn Vale catchment:

- Ledbury discharging to the River Leadon Sensitive Area (Eutrophic)
- Coaley discharging to the River Cam Sensitive Area (Eutrophic)
- Stanley Downton (Stroud) discharging to the River Frome Sensitive Area (Eutrophic)

This will be done under the AMP 3 period (2000- 2005).

A decision also needs to be made by the Agency as to whether phosphorus removal will also be required at Cheltenham Sewage Treatment Works. The River Chelt, downstream of Cheltenham STW, has also been designated as a Sensitive Area (Eutrophic), but we need to prove whether phosphorus removal would have a positive benefit on the level of eutrophication in the river downstream of the sewage treatment works. This subject is debatable because Cheltenham STW is a large STW discharging to a river with limited dilution. It may therefore be that reducing the concentration of phosphorus, to the levels required in the Directive, will have no positive benefit to the ecology since high concentrations will still exist in the watercourse.

Nitrates Directive (92/676/EEC)

This EU Directive aims to reduce nitrate pollution from agricultural sources to surface and groundwaters, and prevent further pollution. Where a watercourse or groundwater source is identified by the Agency as 'polluted' under this Directive, its catchment must be designated as a Nitrate Vulnerable Zone (NVZ). Reviews of NVZ's are carried out every 4 years.

The UK Government has issued two sets of Regulations that implement the Directive in England and Wales. The first of these, The Protection of Water Against Agricultural Nitrate Pollution (England and Wales) Regulation 1996, designated 68 NVZs in England and Wales.

Of these 68, 2 groundwater NVZs fall within the Severn Vale catchment. The largest of these is the area around Bromsberrow in Worcestershire. A smaller area of NVZ forms part of the Cotswold spring system supporting the Hewlett Reservoir, although this actually drains into the River Chelt. There are currently no surface water NVZs within the Severn Vale catchment.

In May 1998, a second set of Regulations, The Action Programme for Nitrate Vulnerable Zones (England and Wales) Regulations 1998, were issued. These Regulations established rules, based on

the Code of Good Agricultural Practice, which control the timing and rate of fertiliser and manure application, with due regard to soil characteristics, weather and topography. From 19th December 1998, anyone farming within an NVZ, either as a tenant or an owner, is required to follow these rules.

The Agency has the role of ensuring that farmers within NVZs are complying with these Regulations. This will be done through pre-arranged farm visits by Agency staff, during which the main requirements will be discussed with the farmer, relevant records examined and a tour of the site undertaken.

For farmers with NVZs within their land, there are grants available of up to 25% towards the costs of improving their waste storage and handling facilities. Details of the Scheme are given in the MAFF booklet '*Farm Waste Grant Scheme in Nitrate Vulnerable Zones*'.

Groundwater Directive (80/68/EEC)

The EU Groundwater Directive was issued to prohibit the discharge of the most toxic chemicals (substances defined in List I of the Directive) to groundwater and to limit the release of less toxic substances (substances defined in List II of the Directive) to groundwater. Regulations were introduced in 1994 relating to landfill sites in order to prevent any contaminants from these migrating to surrounding strata (Regulation 15 of the Waste Management Licensing Regulations 1994). In addition, consents issued under the Water Resources Act 1991 control certain discharges onto or into ground or groundwater.

However some discharges (such as the disposal of spent sheep dip, pesticide washings and the spreading of sewage sludge to land) were not covered. These are to be controlled by the new Groundwater Regulations, under which the Agency has a duty to authorise all such discharges. In areas where the underlying geology is very porous or fractured, like the limestone of the Cotswold escarpment around the River Frome, there is potential for even small discharges of chemicals to contaminate the groundwater. The Sandstones around Newent, being a major aquifer used for public water supply and a farming area, are also susceptible to contamination from disposal of waste farm products. The Groundwater Regulations also give the Agency the power to issue Notices to prevent pollution by Listed Substances. These can be issued to require improvements such as the bunding of tanks for the storage of chemicals.

There are no statutory standards for the quality of groundwater, and because of the difficulties in obtaining and interpreting groundwater information the Agency has only limited data on the impacts of human activity on groundwater quality to date.

The Proposed EU Water Framework Directive

A proposed EU Water Framework Directive is currently being negotiated. The Directive represents an important step forward for water management in Europe. It will introduce a more integrated, structured approach to water quality and quantity issues, and will include provisions that apply to all inland surface waters, ground waters, transitional water (including estuaries and coastal lagoons) and coastal waters (to one nautical mile from the baseline). In this way it will require the use of River Basin Management Planning throughout Europe.

The Directive is aimed at rationalising and updating existing water management legislation. It prescribes an EU wide objective based approach to maintaining and driving improvements in current standards. For water quality issues, it will utilise ecological and chemical standards and objectives. Once enacted this Directive will replace a number of existing water quality Directives that are core to the business of the Agency, including the Dangerous Substances Directive.

4.5.3 UK Water Quality Objectives

The Environment Agency manages water quality by setting targets for rivers and canals. These targets are called River Quality Objectives (RQOs). They are intended to protect current water quality and future use, and we use them as a basis for setting consents for new discharges and planning future water quality improvements. They are based on a classification scheme, which describes the chemical quality required to support different ecosystems. This is known as the River Ecosystem Classification Scheme (the RE scheme).

The RE scheme comprises five quality classes, which reflect the chemical water quality requirement of different types of river ecosystem. These are shown in Table 17.

Class	Description of River Quality
RE1	Water of very good quality suitable for all fish species
RE2	Water of good quality suitable for all fish species
RE3	Water of fair quality suitable for high-class coarse fish populations.
RE4	Water of fair quality suitable for coarse fish populations.
RE5	Water of poor quality, which is likely to limit coarse fish populations.
NB: Some rivers are not classified by the Agency. They are not included on the monitored network as they do not meet the minimum flow requirements.	

(Source: *The Surface Waters (River Ecosystem Classifications) Regulations, 1994*)

The rivers within the Severn Vale catchment are divided into stretches. Each stretch has a sample point associated with it, which is used to monitor the water quality of that stretch. Each stretch has a Long Term River Quality Objective expressed in terms of the Rivers Ecosystem Classification Scheme. These are shown on Map 20.

The Agency assesses compliance with River Quality Objectives every year by using a three-year dataset. If stretches are failing their objective, the Agency will seek improvements in water quality where practicable. Compliance with Long Term River Quality Objectives for watercourses in the Severn Vale is shown in Map 21.

In 1997, there were 18 stretches of watercourse in the Severn Vale catchment which, significantly failed to meet their River Quality Objectives. The reasons for these failures are included in Appendix 5. They included the impact of low flows, eutrophication, sewage or industrial effluents, and agricultural pollution. As part of their day-to-day role, Agency officers work to attempt to solve these failures. This can be done through pollution prevention advice to industry, farmers and the general public, or by reviewing discharge consents to ensure that they meet the River Quality Objective.

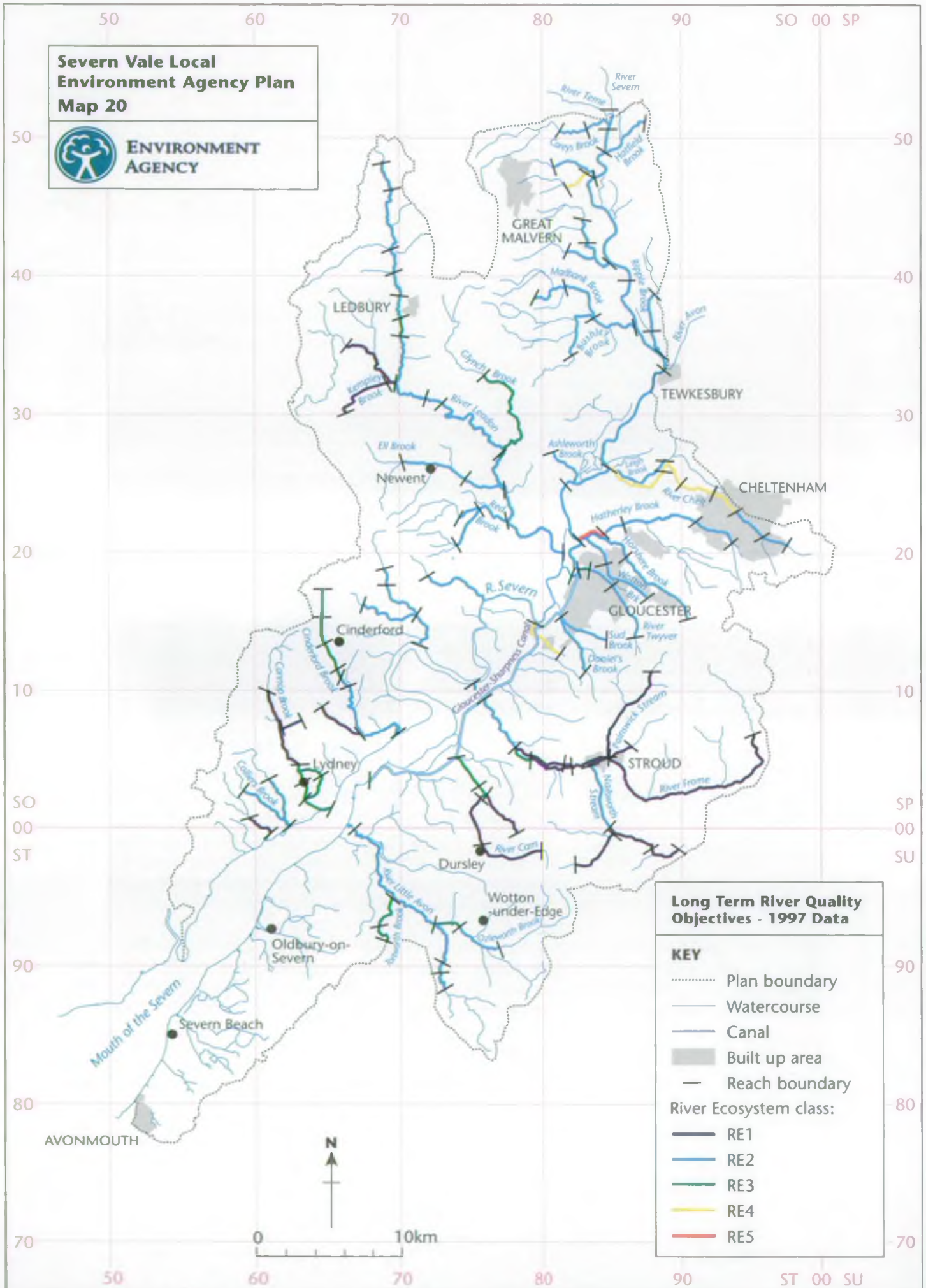
The Agency also carries out regular routine monitoring of rivers and canals to determine whether water quality is getting better or worse. This data is assessed using a classification system known as the General Quality Assessment (GQA). The GQA system considers four aspects of river quality: chemical, biological, nutrients and aesthetics. This allows the Agency to build up an overall picture of the different aspects of river quality. A classification scheme for lakes is also under development. At present the Agency only reports on the chemical and biological quality of rivers and canals.

Each year, the Agency reviews water quality data using the GQA Scheme. Again, the rivers are split into stretches and each stretch has a sample point associated with it. The river is then classified into one of six bands, A through F. Table 18 shows the GQA classification scheme. The GQA classification grades for the Severn Vale are shown in Maps 22 and 23.

**Severn Vale Local
Environment Agency Plan
Map 20**



**ENVIRONMENT
AGENCY**



**Long Term River Quality
Objectives - 1997 Data**

KEY

- Plan boundary
- Watercourse
- Canal
- Built up area
- Reach boundary

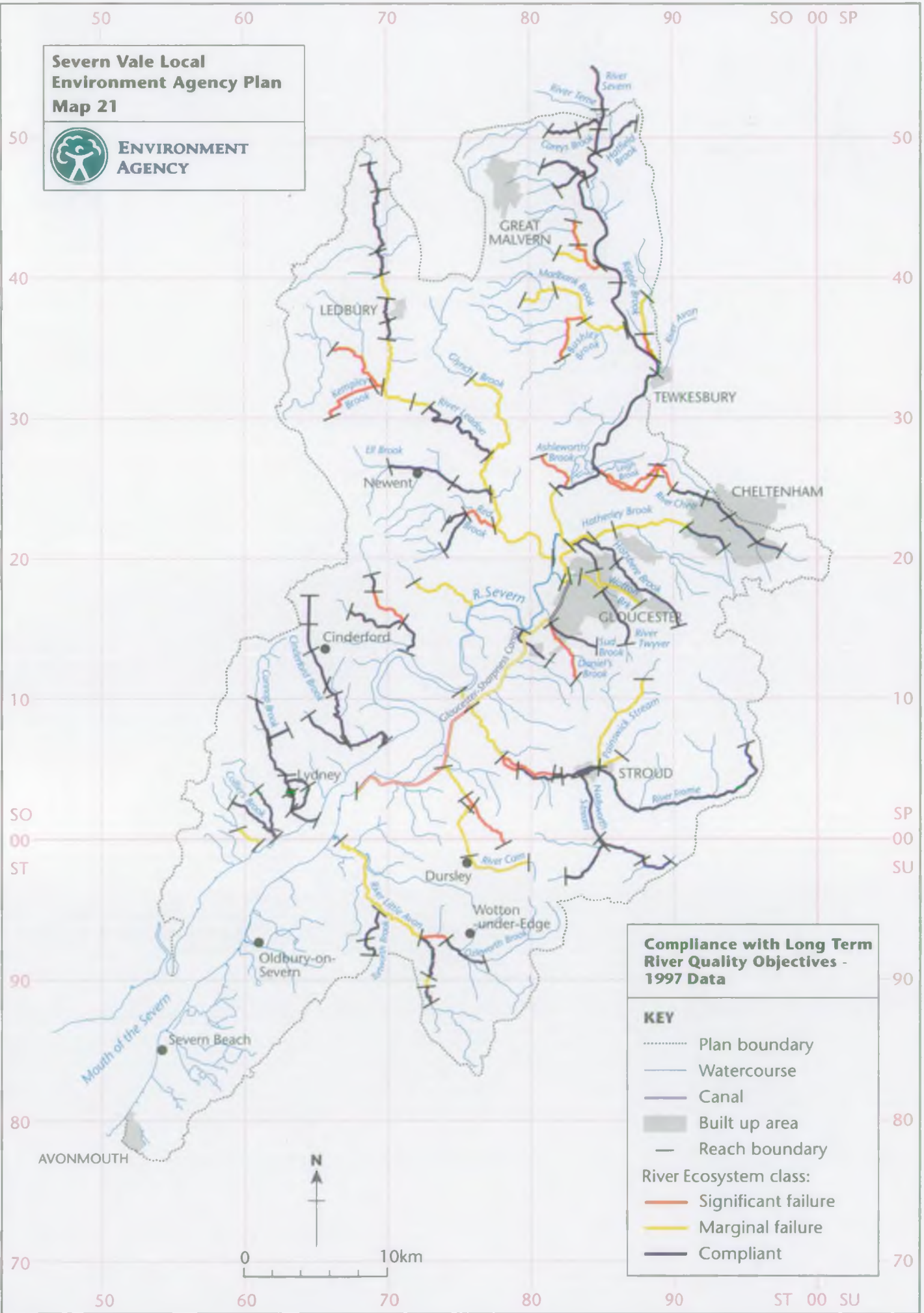
River Ecosystem class:

- RE1
- RE2
- RE3
- RE4
- RE5

Severn Vale Local
Environment Agency Plan
Map 21



ENVIRONMENT
AGENCY



**Compliance with Long Term
River Quality Objectives -
1997 Data**

KEY

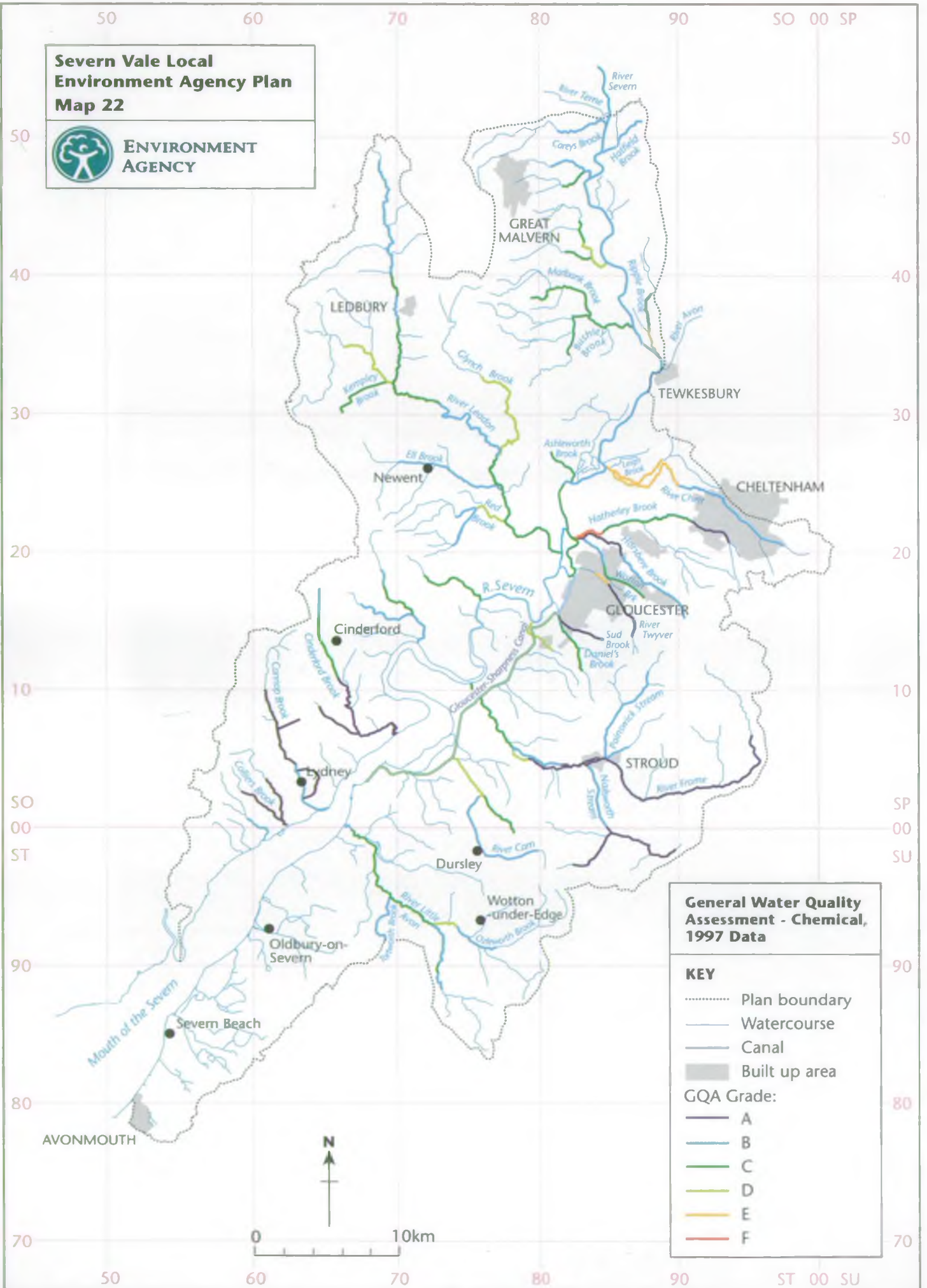
- Plan boundary
- Watercourse
- Canal
- Built up area
- Reach boundary

- River Ecosystem class:
- Significant failure
 - Marginal failure
 - Compliant

**Severn Vale Local
Environment Agency Plan
Map 22**



**ENVIRONMENT
AGENCY**



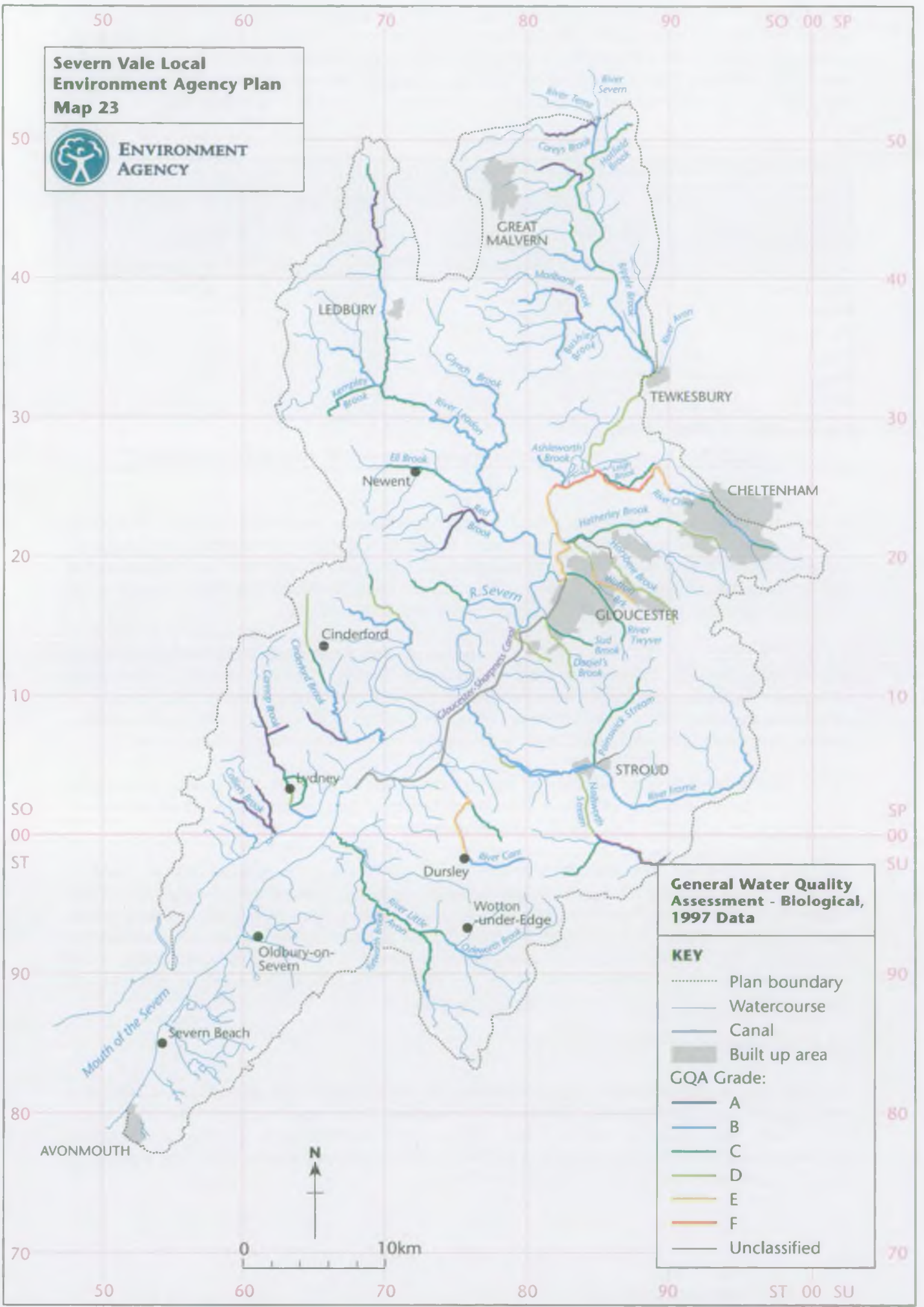
AVONMOUTH

N

0 10km

50 60 70 80 90 ST 00 SU

Severn Vale Local
Environment Agency Plan
Map 23



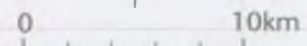
General Water Quality Assessment - Biological, 1997 Data

KEY

- Plan boundary
- Watercourse
- Canal
- Built up area

CQA Grade:

- A
- B
- C
- D
- E
- F
- Unclassified



In the Severn Vale catchment the chemical GQA quality is generally fair to good. In 1997, from a total of 460.15km of watercourse, only 16.75km were described as poor and 2.5km were described as being of bad quality. In comparison, 87.4km were of very good quality and 175.1km were of good quality. Improvements are planned, where feasible, to upgrade the water quality. The best quality is often found in the headwaters of catchments such as the Frome, Chelt and Cannop Brook.

Table 18: GQA Classification Scheme (Chemical)

Water Quality	Grade	Dissolved Oxygen	BOD (ATU) ¹	Ammonia
Measured at		(% saturation) 10-percentile	(mg/l) 90-percentile	(mgN/l) 90-percentile
Very Good	A	80	2.5	0.25
Good	B	70	4	0.6
Fairly good	C	60	6	1.3
Fair	D	50	8	2.5
Poor	E	20	15	9.0
Bad	F2			

¹ as suppressed by adding allyl thio-urea
² i.e. quality which does not meet the requirements of grade E in respect of one or more determinands.

Whereas the Chemistry GQA grades reflect degrees of pollution at the time of sampling, the Biology GQA assesses the health of river stretches through the diversity of macro-invertebrates that inhabit the sediments at the bottom of rivers. These animals have to respond to, and so reflect, influences that may be continuous or intermittent in nature. They include insect larvae, such as those of mayflies and caddis flies, together with snails, shrimps, worms and other creatures.

If a river or stream is polluted, even for a short period of time, some or all of the macro-invertebrate animals may die. The recovery of these communities may take several months. Consequently biological monitoring provides pollution information that may have been missed by solely employing chemical monitoring. As with the Chemistry GQA, the Biology GQA applies a water quality grading scheme comprising six grades based upon the diversity of macro-invertebrate families present.

The GQA (Biology) Scheme is likely to form a component of the ecological quality assessments required by the forthcoming EU Water Framework Directive (see section 4.3.2), which is likely to require all rivers to be of at least "good" ecological quality.

The Nutrient GQA and Aesthetics GQA are still under consideration. The Nutrient GQA will address levels of certain nutrients which are present in rivers, including nitrogen and phosphorous. These simple chemical substances used by plant life can cause excessive plant growth when present in high concentrations. This may result in algal blooms and could give rise to problems of eutrophication (see section 5.3). The Aesthetics GQA will take account of the public perception of water quality, which is mainly influenced by appearance and odour (see section 7.1 on the aesthetic quality of the aquatic environment).

4.5.4 Groundwater Protection

The protection of groundwater is of great importance as, once contaminated, groundwater is difficult to remediate to a satisfactory quality. The Agency's document '*Policy and Practice for the Protection of Groundwater*' advises on activities that may cause a risk of contamination. The Agency applies its policies through its own authorisations and the local authority planning process, where the Agency has the role of statutory consultee to all Development Plans.

To support the Agency's policies, Groundwater Vulnerability Maps have been produced nationally showing the location of major and minor aquifers and their vulnerability according to the soil types and underlying strata. These maps help planners, developers and regulators make informed judgements when considering the location of potentially polluting activities in vulnerable areas.

To further aid planning decisions, Source Protection Zone maps will be published by the Agency for all public water supply boreholes. These will show the catchment area for each borehole subdivided into three zones:

- The inner zone being the calculated area for which water has a travel time of 50 days to the borehole;
- The outer zone indicating a 400 days travel time for water;
- The total catchment zone.

4.6 WATER RESOURCES

The ongoing availability of water resources (quantities of water) is of major concern for the ecological and economic sustainability of any area. Water is abstracted from surface water bodies and aquifers for domestic, agricultural and industrial use. Water abstraction and the pressures on water resources in the Severn Vale are discussed in section 2.6.

4.6.1 The Key Players

The Environment Agency is responsible, under the Water Resources Act 1991, as amended by the Environment Act 1995, for ensuring that water resources are managed effectively and for the benefit of everyone and the environment. We do this by regulating the abstraction and impoundment of water. We also seek to influence the effective management of water resources (including demand management) through input into the Government's water resources strategy and the Water Company's Water Resources Plans, and through our own national and regional strategies, which guide the way we regulate water abstraction.

Water companies, under the Water Industries Act 1991 (WIA91) are required to supply water to meet all existing and new domestic demands (regardless of the availability of water resources) if requested by landowners, occupiers or the local planning authority. WIA91 also requires water companies to plan effectively to provide water supplies in their areas in the future, and to protect and enhance the natural environment in carrying out their functions.

Holders of Abstraction Licences are responsible for compliance with the conditions imposed on the licence. Regular enforcement work is carried out by the Agency to ensure that these conditions are met and the abstractor is required to make returns of the amount of water taken on a regular basis.

4.6.2 The UK Water Resources Action Plan

In May 1997, the Government presented a 10-point action plan aimed at securing reliable, efficient and environmentally sustainable water supplies. This builds upon the previous Government's framework strategy entitled *Water Resources and Supply: Agenda for Action*. The 10-point action plan advocates the following:

- Reviews on water charging and the water abstraction licensing system;
- New regulations to improve water efficiency;
- Mandatory targets on water company leakage;
- Leakage control as a vital element of demand management.

New mandatory leakage targets for the Water Companies for 1998-99 were announced by OFWAT in October 1997. Severn Trent Water has reduced the amount of water supply lost through leakage in its supply infrastructure from 21.3% of supply in 1995/6 to 13.1% in 1998/9.

The Government's 10-point plan acknowledged the significant time necessary for the planning process to advance new water resource developments. The Water Companies Association (WCA), representing 17 water-only companies, presented the Eleventh Point which requests a formal requirement for planning authorities to consider water resources in strategic plans and for Water Companies to be made statutory consultees in the planning process. This was supported by environmental groups, including the Royal Society for the Protection of Birds, World Wide Fund for Nature, Friends of the Earth, and the Wildlife Trusts, who have also been challenging Government to address the impacts of over-abstraction of water on wildlife and the countryside.

4.6.3 Environment Agency National Water Resources Strategy

The Agency's *National Water Resources Strategy* is directed towards two key objectives:

- Securing a sustainable balance between water use and environmental requirements.
- Achieving a progressive enhancement of the water environment where past development has proved detrimental to the natural balance of resources.

The strategy embodies three principles:

- Sustainable Development
- Precautionary Principle
- Demand Management

It incorporates specific policies with an emphasis on initiatives that produce net environmental benefits and make use of under-utilised resources.

4.6.4 Water Resources Plans

The publication of the Government's 10-point action plan took place at the same time as initiation of the new Periodic Review of Water Company price limits to operate from 1st April 2000 to 2005 (under AMP3). The programme is continuing and water companies have recently submitted Business Plans to Ofwat.

The Agency's objectives for the Periodic Review are as follows:

- To identify the statutory (eg EU Directives) environmental obligations which must be met by Water Companies (and therefore need to be funded).
- To ensure Water Companies prepare and submit Water Resource Plans on a consistent basis.
- To prepare an integrated, prioritised programme of non-statutory (eg Alleviation of Low Flows, over-abstractions) obligations, the National Environment Programme, to deliver water quality improvements and sustainable levels of abstraction to be funded within affordable price limits.

In August 1997 the Agency issued its *Water Resources Planning Guideline* to the Water Companies to assist them in the development of Water Resources Plans. The Guideline outlines specific obligations to be achieved in respect of water resources. Water resources Plans will be used to update the Agency's regional strategies, will facilitate a consistent input to the Periodic Review, and will also enable the Agency to advise Government and others on the overall state of our resources.

The Guideline gives guidance on methods, such as assessing the potential impact of climate change on the supply/demand balance, costs, and planning scenarios. The Agency will not publish individual submissions from Water Companies but they are encouraged to publish their Water Resources Plans so that there can be increased transparency and openness in the water planning process.

4.6.5 Regulating Water Abstraction

Abstraction Licensing

Most abstractions of water require a licence under the Water Resources Act 1991, with certain limited exemptions. A licence gives someone the right to take water from a stated source every year, until it expires or they give up that right. It guarantees that no one else requiring a licence can take that share of water already allocated to the existing abstractor. A licence does not guarantee that the quality is suitable for its purpose or that the quantity will always be available. The quantities and uses of water abstracted under licence in the Severn Vale are given in Table 6 and Figure 3 (section 2.6.2).

Many licences have conditions imposed, restricting abstraction when the flow in the river drops to a specific level known as the 'prescribed flow'. The Agency is reviewing the method for setting prescribed flows, taking into account the use of the river, water quality targets and the needs of fisheries and water dependent habitats. The new policies will be implemented as Local Abstraction Management Strategies (LAMS) which are currently being piloted in four areas within England and Wales.

Without licences, persistent over abstraction could lead to:

- Shortages in water supply;
- Increased river pollution (by reducing the dilution of pollutants);
- Damage to fisheries and wildlife habitats;
- Loss of rivers for our recreation and enjoyment.

Licences enable the Agency to control abstractions by setting limits on the amount that may be taken and the purposes for which the water may be used, and setting any necessary conditions to protect the environment and the rights of other users. Licences are now being issued with time limits to allow for regular reviews. An abstraction licence is issued by the Agency subject to there being sufficient water available and that need for the water is justified.

Details of abstraction licences for the catchment are held on a public register at the Environment Agency's Tewkesbury office. Inspections of abstraction licences are carried out on a regular basis to ensure licence holders understand and comply with the terms and conditions therein.

Surface water licences are usually issued with conditions to restrict abstraction at times of low flows and groundwater licences are issued following a comprehensive pumping test to assess the potential impact on the environment and other users. The demand for water is reviewed regularly relative to the catchment and aquifer the water is taken from.

Legislation Review

The Government together with the DETR and the Environment Agency is undertaking a detailed review of the legislation covering abstraction licences. It is hoped that when the proposals have been passed by Parliament the Agency will be able to manage demand in a more effective way and some of the current restraints will be lifted.

Exemptions from Abstraction Licensing

Some abstractions do not need a licence. The most common exemptions cover:

- Abstractions from surface and groundwater for the abstractors own private domestic use, where the abstraction of water is less than 20 cubic metres per day
- Agricultural use (except spray irrigation) from contiguous surface water where quantities do not exceed 20 cubic metres per day
- Fire fighting
- Navigation
- Flood irrigation and warping

Within the Severn Vale area to the north west of the Leadon catchment, lies an area which is part of the Severn River Authority (Exceptions from Control) Order 1967, which exempts abstractions from groundwater, for whatever purpose, from licensing requirements. The Order is currently being reviewed as part of the review of licence legislation.

Licences of Right

Under the Water Resources Act 1963, water users taking water 5 years prior to 1963 were granted Licences of Right. These licences were granted without meaningful investigation into the true environmental impacts of this, because the Act gave tight time constraints for the licences to be issued. As a result, the long-term impacts include low groundwater levels and low flows in rivers and streams in some areas. The Agency is required to compensate abstractors if we vary or revoke a Licence of Right but as there is limited funding for this, it is rare that any action is taken. The current review of the abstraction licensing system is addressing the problem of the legacy of Licences of Right.

Drought Orders and Drought Permits

At times of extreme water shortage, water companies may apply to the DETR for a Drought Order to relax their abstraction licence conditions and/or the level of service they provide to their customers. This may allow for the temporary reduction in mains pressure or even periodic closure of the supply. The terms of a Drought Order will also usually require the Water Company to introduce demand reduction measures, such as hosepipe bans. Drought Orders are granted by the Secretary of State, usually on the application of a water company but sometimes on the application of the Agency.

The Environment Act 1995 allows the Agency to issue Drought Permits. The pre-requisite for both drought permits and drought orders is an exceptional shortage of rain, where this means that a serious deficiency of water supplies exists or is threatened. They provide a means by which water companies can take water from new sources or enforce restrictions on taking water from existing sources. In both cases the risks associated with potential lack of supply must be given appropriate weight against other interests.

4.7 FLOODING

4.7.1 The Key Players

The Environment Agency has permissive powers to provide effective defence and warning systems to protect people and property against flooding from rivers and the sea, under the Water Resources Act 1991, as amended by the Environment Act 1995. We are also a statutory consultee of the planning authorities and use this role to influence new development in order to manage flood risk.

Under the Water Resources Act 1991, supplemented by local Byelaws, the Agency's consent is required for works on or near the bank of a main river. This includes construction in, over, under or within 8 metres of the watercourse including such activities as the planting of trees and mineral extraction. Under the Land Drainage Act 1991 consent is required on ordinary watercourses for building or altering any structures that would affect the flow within the watercourses. Access along river banks for staff and equipment needs to be preserved wherever possible especially for emergency works. To ensure this access is kept clear the Agency will not grant a consent to any development within 8 metres of a main river watercourse or within 8 metres of the landward toe of a flood defence that would compromise the Agency's ability to maintain these features.

These powers are used to ensure that people both upstream and downstream of proposed works are not exposed to an increased risk of flooding. It should be noted that the granting of planning permission does not normally negate the need for a Land Drainage consent. In deciding whether to issue a consent the Agency will also take into account whether the proposed works conserve and enhance the environment.

The Agency also has permissive powers relating to main rivers to undertake works and a duty to exercise its powers in this respect according to available resources and priorities. The Agency has programmes of maintenance and improvement works for main river. Planned improvement works for 1999 to 2005 are given in Section 4.7.2 below.

District and Borough Councils, under the Land Drainage Act 1991, have permissive powers to carry out flood defence works and maintain river flow on ordinary watercourses. Under the Coast Protection Act 1949, they have powers to protect the coast from erosion by the sea. They also have permissive powers to offer assistance to owners and occupiers during floods. As Local Planning Authorities they have control over development including that in the flood plain.

Internal Drainage Boards, similar to local authorities, have permissive powers to carry out flood defence works and maintain river flow on ordinary watercourses within their area under The Land Drainage Act 1991.

Highways Authorities (County Councils and Local Unitary Authorities) are responsible for public highways and deal with any flooding problems associated with road drainage.

The Fire and Rescue Services provide help in flood emergencies if they are able to do so.

4.7.2 Flood Defence

Flood Defence Standards of Service (SOS)

Under the Water Resources Act 1991, as amended by the Environment Act 1995, the Environment Agency has permissive powers to carry out works to alleviate the risk of flooding from main rivers and the sea. Any works undertaken must be shown to be technically feasible, economically viable and environmentally desirable and sustainable.

Flooding can never be eliminated but the risk can be reduced. The "acceptable" risk of flooding differs with land use. The acceptable risk is defined as the standard of service (SOS) for the watercourse. Table 19 shows the proportion of main river watercourses in the Severn Vale that have 'acceptable' or 'above,' standards of service.

Where main river watercourses in the Severn Vale are below the appropriate standard of service targets the Agency assesses the feasibility of works to reduce the risk of flooding. Works are programmed to bring the watercourses up to standard where this is practicable and desirable.

Table 19: Compliance With Flood Defence Standards Of Service

Land Use Band	Description Of Typical Land Use	Standard of Service ¹ (return period) ²	Length Of Watercourse in Band ³ (Km)	% Of Total Length Of Watercourse In Catchment	% at acceptable or above Standard
A	High density urban areas containing significant amounts of both residential and commercial property at risk	1 in 50 – 1 in 100 years	42	6	17
B	Medium density urban areas, some parks and open spaces, or high grade agricultural use at risk	1 in 25 – 1 in 50 years	47	7	11
C	Low density urban areas or rural communities. Typically large areas of high grade agricultural land with some properties also at risk from flooding	1 in 5 – 1 in 25 years	131	20	21
D	Generally farmland with occasional properties at risk. Medium productivity agriculture which may also be prone to the effects of waterlogging	1 in 1 year – 1 in 5 years	147	22	63
E	Typically low grade agricultural land or public open space, often grassland or scrub, with very few properties at risk	1 in 6 months – 1 in 1 year	234	36	85
X	Length of watercourse where no standards of service data exist at present.	N/A	58	9	N/A

1) Standards given here are for fluvial watercourses only. Standards for tidal rivers are generally double these, as tidal flooding causes greater damage and it's onset is often more sudden.

2) Return period is a measure of the likelihood of a flood occurring. A return period of 1 in 100 years means a flood that occurs statistically once every 100 years i.e. the flood has a 1% chance of occurring every year.

3) Length of watercourse is the total combined length of left and right banks.

Programme of Capital Works

The Agency supervises all flood defence matters but has permissive powers to carry out or control work on main rivers and sea defences according to available resources and priorities. The Government's highest priority is to reduce the risk of flooding to urban areas, but all schemes must be technically, economically and environmentally sound. All Agency operational activities, whether capital or maintenance, are subject to environmental impact assessment. The Agency has a programme of Capital Works and those in the Severn Vale are given in Table 20. These works are subject to detailed feasibility studies and their inclusion in the table does not necessarily mean that they will take place. In addition the timing of schemes may alter due to the availability of resources and other factors.

Table 20: Capital Works Programme 1999-2005

Location	Programmed Date
Westbury Cell	2001 - 02
Cone Pill to Lydney Cell	1999 - 01
Longney Cell	2003 - 04
Hempsted Cell	2001 - 03
Rodley Cell	1999 - 01
Noards Point Cell	2000 - 01
Walmore Cell	2002 - 03
Oakle Street Cell	2001 - 03
Kempsey FAS	2002 - 03
Esso Depot Avonmouth FAS	2003 - 05
River Chelt FAS	1999 - 09

NB: The dates given for the above schemes may change due to financial circumstances and inclusion of any projects arising from the Easter 1998 floods. FAS = Flood Alleviation Scheme.

Routine Maintenance Regime

Regular maintenance is essential if the river system and defences are to operate properly at times of high water levels. Such maintenance works include vegetation control, repairs to earth embankments and other flood defences, removal of obstructions and blockages, and dredging. Maintenance can contribute significantly to reducing the risk of flooding.

On ordinary watercourses local authorities have similar powers to those exercised by the Environment Agency for carrying out maintenance and flood alleviation works and for enforcing the removal of obstructions. Most use these powers where they can but are limited by financial constraints.

Flood Emergency Response

At times of high water levels, in addition to our flood warning role, the Agency's operational priorities are to patrol the defences, check and operate flood defence structures, remove blockages and carry out any emergency repairs needed.

District councils have permissive powers to offer assistance to the public during floods. This may include placing sandbags, moving possessions and evacuating people. Each Council has a policy on the type and amount of help they give.

The fire and rescue services may provide some help during flooding. The local fire station will be able to advise the public on what help is, or is likely to be, available and whether or not a charge will be made.

County Councils and Local Unitary Authorities are responsible for public highways and would deal with any flooding problems associated with road drainage. All County Councils and Unitary Authorities have Emergency Planning Officers who may become actively involved in more serious flood events.

4.7.3 Flood Warning

The Agency issues flood warnings because it is not possible to provide absolute flood protection due to the unpredictable nature of the environment.

A major change in this service was introduced on 1st September 1996, when responsibility for dissemination of flood warnings was transferred to the Agency from the Police. The Agency now

issues warnings direct to flood wardens or individuals at risk by means of pre-recorded telephone, fax or pager messages. Further information about conditions in individual reaches is available on a telephone voice bank system called FLOODCALL. Local radio, Teletext, AA Roadwatch and weather forecasts broadcast more general information. Information on flood warning for particular areas is published in a series of free leaflets available from the Agency.

Having successfully established the new warning system, the Agency will improve the accuracy and reliability of flood forecasts and provide a service to more areas where this proves practicable. We have developed communication systems which aim to provide flood warnings to those members of the public most at risk, and a strategy which details how the procedures operate called the 'Flood Warning Dissemination Plan'.

The Agency uses colour codes to describe the flood warnings that it issues, as shown in Table 21.

Colour Code	Predicted Flooding/Impacts
Yellow	Agricultural land and minor roads are likely to be flooded, but flooding of property is not expected; in the tidal situation, wind blown spray is likely to overtop sea-walls and beaches
Amber	Extensive agricultural areas and isolated properties are likely to be flooded; rivers are likely to overtop banks and waves are likely to overtop sea walls and beaches; flooding of a number of roads is forecast
Red	Residential and commercial properties are likely to be flooded; possible overtopping of river floodbanks and flood defences

In the Severn Vale we provide a flood warning service on the fluvial River Severn from Worcester to Gloucester together with the Severn Estuary at Severn Beach near to Avonmouth. The fluvial River Severn is split into flood warning reaches as shown in Table 22. In addition, a very limited service is provided for the lower reaches of the River Frome, which is principally for the benefit of British Waterways in controlling water levels on the Gloucester & Sharpness Canal.

As can be seen in Table 22, 56% of flood warnings issued along the fluvial Severn over the last 5 years were yellow warnings, 29% were amber warnings and just 15% were red warnings. However, by their nature, severe events occur infrequently and their timing is unpredictable, so it is critical that an efficient flood warning system is maintained at all times.

Flood Warning Reach	Yellow	Amber	Red	Total
Reach S10: River Severn between Worcester and Tewkesbury	23	16	4	43
Reach S11: River Severn from Tewkesbury to upstream of Gloucester	55*	18	1	74
Reach S12: River Severn at Gloucester	29	28	25	82
Severn Beach	41	15	9	65
Total	148	77	39	264

* includes 31 local flood warnings for the Severn Ham at Tewkesbury

Following a recommendation in the 'Bye Report' the system of warnings is to be changed with effect from September 2000. Amongst other changes the colour code system will be replaced. Details will be given to the general public and to those directly affected by flooding nearer that time.

4.8 NATURE CONSERVATION

4.8.1 The Key Players

The Environment Agency has a statutory duty to promote and enhance conservation in all its activities. The Agency is a Relevant Authority in relation to marine areas and European marine sites under the Nature Conservation (Natural Habitats, & c.) 1994 Regulations (Regulation 5). All relevant authorities in or around marine sites are required to exercise existing powers to secure the protection of sites through the development of a management scheme.

The Agency is also a competent Authority under regulation 6(1) of the above regulations. Amongst other important statutory obligations this means the Agency must review all its existing authorisations, consents, licences and other permissions which may affect Special Protection Areas (SPAs) and Special Area of Conservation (SACs).

English Nature is the statutory advisor to Government on nature conservation in England and promotes the conservation of England's wildlife and natural features. Its work includes the selection, establishment and management of National Nature Reserves and Marine Nature Reserves; the identification and notification of Sites of Special Scientific Interest; the provision of advice and information about nature conservation; and the support and conduct of research relevant to these functions. English Nature are required to advise other relevant authorities as to the conservation objectives of European marine sites and guide them in developing the management scheme for these.

Local Planning Authorities are advised by the DETR on matters relating to conservation through Planning Policy Guidance Notes (PPGS). PPG9 provides the fullest interpretation of nature conservation policy at present including the implications of the Habitats Directive. PPG9 indicates that nature conservation issues should be included in local plan surveys and considered for any development proposals in the plan. This requires a thorough understanding of the nature conservation resource of the area and is a strong endorsement of the use of state of the environment reports and nature conservation strategies.

Moreover, PPG9 indicates that development plans shall include policies encouraging the management of features of the landscape that are important for wild flora and fauna. The Habitats Directive states that such features are those, which by virtue of linear and continuous structure (such as river banks or the traditional systems for marking field boundaries) or their functions as stepping stones (such as ponds or small woods), are essential for the migration, dispersal and genetic exchange of wild species.

The presence of a protected species is a material consideration when a local planning authority is considering a development proposal that, if carried out, would be likely to result in harm to the species or its habitat. Lists of protected species are found in, for example, the Wildlife and Countryside Act 1981 and the Birds and Habitats Directives.

Non Governmental Conservation Organisations such as the Wildlife Trusts and RSPB play a vital role in influencing and advising statutory organisations for example with respect to site management, development control policy, Biodiversity Action Planning and other activities that affect wildlife. Much of what is known about the status and distribution of species and habitats is as a result of immense volunteer effort over many years.

These organisations also own or manage a large number of sites for nature conservation

All of the above, and many other organisations, including commercial companies, have roles to play in implementing Biodiversity Action Plans (BAPs). The purpose of BAPs and the Agency's responsibilities relating to these are outlined in section 3.1.

4.8.2 Habitats Directive (92/43/EC)

Implementation of the EC Habitats Directive through the Conservation (Natural Habitats, &c.) Regulations 1994 is the most significant piece of nature conservation legislation since the Wildlife and Countryside Act 1981.

Its main aim is to improve biodiversity through the conservation of natural habitats and of wild fauna and flora in European member states. It defines and lists habitats and species and makes provision for identifying a series of Sites of Community Importance within which they are represented. This series of sites is known as Nature 2000, and includes all Special Protection Areas (SPAs) and Special Area of Conservation (SACs). The measures in the Habitats Directive are intended to maintain at or restore to 'favourable conservation status' certain endangered natural habitats and species.

The Habitats Directive requires all plans or projects that are not directly connected with or necessary to the to the management of sites but are likely to have a significant effect thereon, to be subject to an appropriate assessment of their implications for the site. The appropriate assessment is undertaken by a competent Authority, which includes any ministerial Government Department, public or statutory undertaker.

4.8.2 Biodiversity Action Plan Objectives and Targets

A key vehicle for the conservation, restoration and enhancement of threatened habitats and species in the UK is the National Biodiversity Action Plan, entitled '*Biodiversity: The UK Action Plan*' (see section 3.1). This will implement action to meet commitments made by the UK under the UNCED Convention on Biodiversity. The National Biodiversity Action Plan is to be delivered through Local Biodiversity Action Plans (BAPs). Within the Severn Vale, these are:

- Worcestershire BAP, published in April 1999 by Worcestershire Biodiversity Partnership
- Herefordshire BAP, being produced by a number of partners
- Gloucestershire BAP, currently being produced by Gloucestershire Biodiversity Partnership
- South Gloucestershire BAP and Bristol BAP are being produced by the relevant unitary authorities.

The reader is referred to these documents and '*Biodiversity: The UK Action Plan*' for the extensive list of objectives and actions relating to each species and habitat.

The Environment Agency is the national contact point for a variety of aquatic and wetland habitats and species, and thus has particular responsibilities for their conservation. There are a variety of other habitats and species for which the Environment Agency has a role to play with respect to proposed actions. Some non-wetland habitats and species may also require actions by the Agency. These will be addressed as they become apparent.

Habitats and species for which the Agency is the national contact point, as well as those for which the Agency has another role in conserving, are listed in sections 3.2 and 3.3. Where known, the current extent of these species and habitats is outlined. However, due to lack of funding for nature conservation in the past, relatively few surveys of these have been carried out, and knowledge of the extent of several species and habitats in the Severn vale remains incomplete. Where species are concerned, their rarity and often elusive behaviour compounds this state of affairs.

These factors, combined with the very recent introduction of the BAPs make it difficult and inappropriate to assess the extent to which BAP objectives have been achieved to date.

4.8.3 Other Conservation Objectives

Principal and subsidiary objectives identified in English Nature's Natural Area Profiles that are of relevance to the work of the Agency include:

- Preventing any avoidable loss in 'critical natural capital', including protected sites, and other inter-tidal and sub-tidal habitats, and offsetting any loss through habitat creation and enhancement;
- Maintaining, and where practicable increasing, the range and population size of species considered endangered or vulnerable;
- Retaining and expanding all existing wetlands (ditches, pools, gravel pits, reedbeds), safeguarding their water quality, avoiding disturbance, and ensuring suitable management;
- Maintaining and enhancing estuarine habitats, where possible extending wildlife corridors to prevent fragmentation;
- Sensitive management of rivers and streams, to maintain and enhance wildlife interest;
- Increasing the area and quality of traditional grazing marshes in the valleys and coastal areas by encouraging less intensive farming practices;
- Maintaining and enhancing water supply and quality, through water level management plans (see below), in grazing marshes and shingle areas;
- Ensuring sustainable management of a wide range of marsh ditch habitats through appropriate grazing regimes;
- Enhancing the management of existing reedbeds and increasing the total area of reedbeds;
- Appropriate management of ponds and replacement of losses;
- Ensuring a sustainable approach to shoreline management by maintaining natural processes, and minimising or compensating for damage due to sea defence schemes through Estuary Management Plans and Shoreline Management Plans;
- Minimising risk of disturbance to coastal and other wetland wildlife and habitats from recreation.

Many of these objectives are of relevance to the work of Agency in partnership with statutory and other bodies on Water Level Management Plans and Countryside Management Projects. The Agency will continue to work with English Nature and the Countryside Commission to further the objectives of the Countryside Character and Natural Areas, and consider the impact of its existing and proposed operations on the landscape and its ecological character.

A Water Level Management Plan (WLMP) is a means by which the water level requirements for a range of activities in a particular area, including agriculture, flood defence and conservation, can be balanced and integrated. WLMPs are devised particularly for Sites of Special Scientific Interest or other areas of high ecological or landscape importance. The Agency, where it is the operating authority, liaises with English Nature to prepare WLMPs and so ensure appropriate key water levels are safeguarded. Within the Severn Vale, WLMPs have been prepared in Draft for the following sites:

- Upton Ham SSSI, Upton-upon-Severn;
- Severn Ham SSSI, Tewkesbury;
- Old River Severn SSSI, Tewkesbury; and
- Coombe Hill Canal SSSI.

4.9 FISHERIES

4.9.1 The Key Players

The Environment Agency has a general duty to maintain, improve and develop fisheries. It does this through advise to fishery owners and other interested parties, regulation, enforcement of legislation (as discussed in section 4.10.6), and practical fisheries management, including fisheries surveys (currently carried out every 5 years).

Owners of fishing rights may manage their own fisheries within legislative constraints. In rivers, fishing rights tend to go with land ownership and extend to the mid point of the river unless there is evidence to the contrary. Ownership of fishing rights in still waters also goes with land ownership but can, in certain circumstances, be quite complex when there is multiple ownership of land around any lake. Most canal fisheries are under the ownership of the navigation authority. Consequently, British Waterways is a key player.

Fishing is a major sport and there are many angling clubs with either large ownership or lease holdings. The Agency consults with anglers and net fishermen through the Severn Fisheries Consultative Council as well as through the statutory Fisheries, Ecology & Recreation Committee.

In tidal waters, the Severn Fisheries (Nets & Fixed Engine Fishermen's) Association is able to speak for its members who fish for salmon using draft, lave or fixed engines.

English Nature and the Wildlife Trusts have an interest in fish populations and also in the impact that fisheries management activity or fishing might have on other flora and fauna.

4.9.2 National Legislation

Under the Environment Act 1995 the Agency has a general duty to maintain, improve and develop salmon, trout, freshwater fish and eel fisheries. Other relevant legislation includes the Salmon & Freshwater Fisheries Act 1975, the Water Resources Act 1991, the Salmon Act 1986, Import of Live Fish Act 1980, Wildlife & Countryside Act 1981, and The Severn Fisheries Provisional Order (1910) Confirmation Act 1911. Order and byelaw making powers enable local variations on statutory provisions.

4.9.3 Fisheries Management Strategies

The Agency's vision is that all waters of England and Wales will be capable of sustaining healthy and thriving fish populations and everyone will have the opportunity to experience a diverse range of good quality fishing.

In February 1996, the '*National Salmon Management Strategy*' was adopted by the National Rivers Authority and was subsequently endorsed by the Environment Agency. The main aim of the strategy was to safeguard salmon stocks in England and Wales by identifying sustainable management options which seek to maximise economic as well as social benefits.

Part of that strategy advocated the adoption of Salmon Action Plans for the principal salmon rivers in England and Wales, with all 63 being produced by 2002. A Ministerial Directive, effective from 1st September 1999, has since made this a duty for the Agency.

A '*Coarse Fish Strategy Consultation Document*' has recently been published through the Agency's National Coarse Fisheries Centre at Kidderminster with a consultation period open until 1st September 1999. It is expected that the strategy and its implementation ('*Coarse Fish Action Plan*') will continue

to evolve over a number of years, led by the Centre. Similar Trout and Eel Strategies are under active development.

4.9.4 The River Severn Salmon Action Plan

The 'River Severn Salmon Action Plan' has completed its consultation phase and the Action Plan is due to be published in the autumn of 1999. A further Salmon Action Plan covering the Severn Estuary is in the initial stage of preparation with an Action Plan due in 2001. The Severn Estuary SAP will cover such issues as heritage fisheries, the management of mixed stocks, and the harmonisation of byelaws and enforcement efforts between the Southwest, Welsh and Midlands Regions.

4.10 ENVIRONMENTAL INCIDENTS

The Agency is committed to responding effectively and efficiently to all incidents (specific events) which:

- Are brought to the attention of the Agency
- Are within the Agency's areas of responsibility
- May have an environmental and/or operational impact.

The Agency responds to incidents within target timescales. For example, for incidents of water pollution this is within 2 hours during working hours and within 4 hours outside working hours.

In 1999, the Agency introduced a Common Incident Classification System (CICS) aimed at classifying all incidents that we respond to in a common manner, based upon the physical response required to deal with the incident and the risk posed to the environment.

Sections 4.10.2 to 4.10.6 details the types of incident that the Agency responds to. Where shown, the figures for these incidents are those gathered prior to the introduction of CICS. The Agency's response to incidents of flooding is discussed under section 4.7.

4.10.1 Enforcement and Prosecution Policy

The Agency's enforcement policy seeks to ensure that preventative or remedial action is taken to protect the environment or to secure compliance within the regulatory system. The extent of the enforcement action required will depend on the nature of the incident. However, if a criminal offence has occurred then the responsible party could face prosecution.

In responding to incidents, whether involving land, air or water, the Agency's enforcement and prosecution Policy is guided by four principles. These are:

- *Proportionality.* Our response will be in proportion to the risks posed to the environment or human health and the seriousness of any breach of the law.
- *Consistency of approach.* The response we make and enforcement actions we take will be similar in similar circumstances, across geographical regions and the Agency's functions.
- *Transparency.* We will help those involved understand what is expected of them and what they can expect from the Agency, and the reasons for any enforcement action.
- *Targeting.* The majority of our actions are directed at those who, by their actions could cause, or potentially cause, serious environmental damage.

Whether a criminal offence has occurred or not, the Agency has powers to:

- Issue Enforcement Notices (requiring steps to be taken to remedy or prevent non-compliance with an authorisation or licence)
- Issue Works Notices (requiring the carrying out of anti-pollution works).
- Issue prohibition notices (where there is an immediate risk of serious environmental damage)
- Suspend licences or authorisations, or revoke conditions in them
- Require the polluter to carry out remedial work.

For cases dealt with by the Magistrates Court, the maximum penalty for causing a serious environmental incident is a fine of £20,000 and/or six months imprisonment on indictment. For cases dealt with by the Crown Court, an unlimited fine and up to five years imprisonment can be given.

4.10.2 Unauthorised Waste Activities

Some waste management occurs without the necessary authorisation – for example, sites operating without a licence or without being registered exempt, or sites not complying with licensed conditions. The majority of such incidents can be resolved through negotiation. However, there are occasions when more formal enforcement action is required through statutory notices or prosecution. Fly-tipping - unauthorised tipping of which the landowner is unaware – is also of concern to the Agency.

The Key Players

The Environment Agency is the main regulatory body in England and Wales with statutory powers and duties to deal with unauthorised waste activities. The majority of our enforcement activities relating to waste are targeted at licensed facilities through inspection visits. The Agency also achieves its responsibilities through co-operation and partnership with the organisations below.

Local Authorities and the Agency have agreed a Protocol on Fly-tipping. The Protocol sets out which organisation (Local Authority or Environment Agency) will respond to fly-tipping incidents depending on their type and scale. In most circumstances the Local Authority will investigate and the Agency will take formal action. Removal of litter, unless posing a potential flooding problem, is solely the responsibility of the Local Authority

Licensed Waste Management Facility Operators are required to refrain from undertaking unauthorised waste activities on the licensed area. The Agency also relies on operators to ensure that any fly-tipped waste immediately outside their site is properly dealt with.

The Police can provide useful information and assistance in dealing with fly-tipping, particularly where there may be evidence for prosecution or enforcement.

Landowners are required under the Duty of Care to ensure that all waste arising from and arriving on their land is disposed of in a legal and appropriate manner. Landowners can also help to combat fly-tipping by reporting incidents and gathering evidence. A number of landowner organisations are members of the Fly-tipping Stakeholders Forum (see below).

Fly Tipping

Illegal tipping, or “fly-tipping” is a widespread problem which occurs from rural moorland to inner city estates. It detracts from the visual appeal of the environment and in some cases can cause serious pollution of land and water. In 1998 there were 53 incidents of fly-tipping reported to the Agency in the Severn Vale.

Fly-tipping occurs where those responsible wish to avoid paying disposal charges. There is concern that the number of incidents of fly-tipping is increasing. This may, in part, be a result of the Landfill Tax, which was introduced in October 1996.

Often fly-tipping incidents involve household wastes that can easily be disposed of free of charge, either by the waste collection authorities or through household amenity sites. The materials most commonly fly-tipped are household and construction wastes. However, there are occasions when industrial and commercial wastes such as tyres, drums and "Special Waste" (for example, asbestos) are tipped. Unfortunately, there are certain waste types that are now being routinely tipped in the same area.

The Agency has Environmental Protection Officers who carry out investigations, and where necessary surveillance, to identify and prosecute offenders. However, it is often difficult to identify and find culprits and, as a result, in many cases the tipping is cleared at considerable expense by the local authority or landowners.

The Flytipping Stakeholders Forum

In recent months a 'Fly-tipping Stakeholders' Forum' has been set up forming a partnership between The Country Landowners Association, The National Farmers Union, The Federation of Small Businesses, Railtrack, British Waterways, The National Trust, Tidy Britain Group, The Local Government Association, The Scottish Environmental Protection Agency and the Environment Agency.

These organisations have collaborated to develop a co-ordinated approach to the problem of fly-tipping by providing guidance to help landowners, managers and members of the public combat fly-tipping. The guidance centres on:

- Gathering evidence of fly-tipping incidents
- How local authorities and the Agency can help tackle the problem
- How to deal with different types of incident
- The steps that can be taken to reduce the risk of becoming a victim of fly-tipping
- The relevant legal powers and duties of Local Authorities, the Environment Agency and the police.

4.10.3 Air Pollution

Plant failures, operator error or on-site accidents may cause accidental releases to air from industrial processes. Where a major incident occurs at a site authorised by the Environment Agency under integrated pollution control (see section 4.3.4), the following organisations would be involved.

The Key Players

The Environment Agency would provide advice to the emergency services on the details of the site and the effects which substances released may have on the environment. We would also be involved in incident investigations, sometimes in co-operation with the Health and Safety Executive.

Fire and Rescue Services would be called in where fire fighting and rescue is needed.

The Police deal with issuing warnings and information to the local population as well as organising safe areas.

The Health and Safety Executive (HSE) would provide advice on the health effects of substances emitted as well as follow-up investigative work.

County Councils co-ordinate off-site emergency plans, which are drawn up in conjunction with the company and possibly the HSE.

Incidents in the Severn Vale

In 1997 there were 6 justified reports of air pollution from IPC authorised sites in the Severn Vale, and in 1998 there were 7. All of these were for odour or for black smoke.

The Control of Major Accidents and Hazards (COMAH) Regulations 1999

In order to meet requirements under the EC Directive on the Control of Major Accidents and Hazards (96/82/EEC), the UK will introduce the Control of Major Accidents and Hazards (COMAH) Regulations over a three year period, beginning in April 1999. Under COMAH all operators of sites with dangerous substances above specified quantities must take measures to prevent major accidents or in the event of such accidents limit the effect on people and the environment. The Environment Agency and Health and Safety Executive will jointly enforce the regulations.

4.10.4 Water Pollution

The Key Players

The Environment Agency is the main regulatory body in England and Wales with statutory powers and duties to deal with pollution of controlled waters, under the Water Resources Act 1991 (WRA91), as amended by the Environment Act 1995. We are responsible for attending pollution incidents and initiating prosecutions. Moreover, much of the Agency's routine work is concerned with reducing pollution of controlled waters and natural incidents that may affect the aquatic environment. This is done through:

- The control of industrial and domestic discharges to watercourses by means of Discharge Consents (see section 2.6.6)
- Providing advice on matters of pollution prevention to industry, farmers and the public;
- Routine monitoring of rivers and streams
- As consultees on planning applications which may have an influence on the aquatic environment.

Under WRA 1991, where an incident poses a threat of water pollution, the Agency can seek to recover the full costs from the responsible party for any remedial work we carry out as the result of an incident.

Local Authorities assist in tracing problems arising from drains under their control. They also help to prevent pollution through the planning system.

The Ministry of Agriculture, Fisheries and Food (MAFF) and Agricultural Development and Advisory Service (ADAS) advise farmers on pollution prevention matters and occasionally consult with the Agency on these.

British Waterways often report pollution problems on the Canal Systems and also help the Agency with pollution clean-ups on these. They are responsible for maintaining the banks of canals, and co-

operate with the Agency with regards to pesticide spraying and other potentially polluting bank-side activities.

Operators with consents to discharge to a watercourse are responsible for maintaining their own sections of river banks, and co-operating with regard to pollution incidents that may arise from their activities.

Fire and Rescue Services have their own Pollution Control Units and are frequently the first to respond to potentially polluting Road Traffic Accidents (RTAs) and fire situations. They are fully equipped to deal with nearly all such situations, and the Agency pays them for the materials they use. Some of the units are also available to help the Agency in situations not connected with Fire Service activities, such as oil or chemical spills.

Causes of Water Pollution Incidents

Incidents of water pollution can result from a wide variety of activities; even legally permitted discharges can cause pollution if they exceed their consented limits. Common sources of water pollution incidents include:

- Industry, agriculture, construction and even leisure activities such as boating. Pollution Prevention Guidance Notes (PPGN) are available to the public to help ensure all these activities are carried out with minimum risk to the environment.
- Accidents such as road traffic accidents, which can result in oil or chemical spillage.
- Acts of vandalism or break-ins. In such instances the occupier of the land will have a duty to ensure that spillage is contained, and so may be liable to prosecution.
- Deliberate actions such as the dumping of waste
- Natural events such as toxic blue green algae, which can cause a serious fish kill.

Incidents in the Severn Vale

The recording system used prior to 1999 employed a three-tier classification, determined solely on the environmental impact of each incident. This ranged from class 1 (major impact) to class 3 (minor impact). A breakdown of substantiated water pollution incidents in 1997 and 1998 is shown in Table 23.

Class of Incident	1997	1998
Class 1	1	0
Class 2	26	14
Class 3	439	363
Total	466	377

Class 1 Incident at Gloucester-Sharpness Canal

The class one incident in 1997 is an example of where a major response was required to prevent a serious incident from occurring. On 14th January 1997, fish were reported to be in distress on the Gloucester-Sharpness canal at Slimbridge due to high ammonia concentrations in the water. The source of the problem was traced to a sewage treatment works which, due to very cold weather conditions was not functioning properly. A surface water intake supplying the north of Bristol is located approximately 4km downstream at Purton. To avoid problems with treatment, water was diverted from the River Frome to the River Severn. The quantity of water abstracted from the River Severn at Gloucester was also increased to maintain levels in the canal.

Figures 7 and 8 show the breakdown of water pollution incidents in 1997 and 1998 into different types. As can be seen, the largest number of pollution incidents was attributable to oil. The Agency is currently considering the promotion of its nationally run Oil Care campaign as a more focused local campaign within the Severn Vale. This would involve a partnership between local distributors of oil fuel products and the Agency, where users of oil fuels would receive pollution prevention advice during deliveries or through distributors invoicing systems. The scheme is to be piloted in Coventry.

Figure 7: Substantiated Water Pollution Incidents by Type, 1997

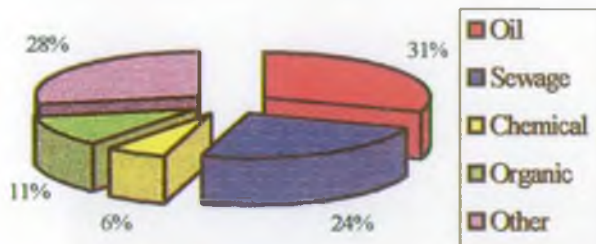
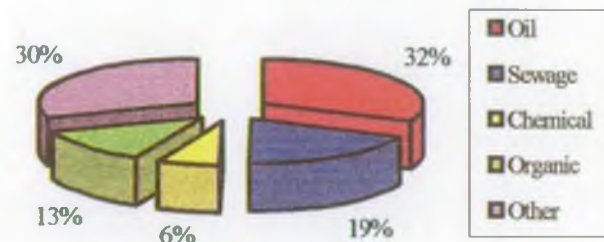


Figure 8: Substantiated Water Pollution Incidents by Type, 1998



4.10.5 Water Resources

The Key Players

The Environment Agency is responsible for investigating, enforcing and prosecuting against illegal water abstraction and impoundment. Where low flows result from natural causes, such as droughts, the Agency would be required to investigate the causes of this and implement remedial action.

British Waterways would be involved in investigations of incidents relating to canals

English Nature would be involved in investigations of low flows or illegal activities that lead to damage of water-dependant SSSIs.

The Causes of Water Resource Incidents

Water Resource Incidents generally constitute low flows arising from natural causes or unlawful activity. This may include:

- Contravention of licence conditions
- Illegal abstractions
- Illegal impoundment , temporary obstructions or misuse of sluice gates
- Springs drying up
- Illegal drilling of boreholes
- Rising groundwater
- Other contraventions to the Water Resources Act 1991

4.10.6 Fisheries

Incidents may threaten the health of fisheries. These generally fall under the categories of illegal fishing and problems relating to fish diseases or health.

The Key Players

The Environment Agency is the main regulatory body in England and Wales with statutory powers to deal with illegal fishing in inland waters. The bulk of the powers are contained in the 1975 Salmon & Freshwater Fisheries Act (SAFFA) and its byelaws, with some powers in the 1986 Salmon Act and the 1995 Environment Act. The Agency also controls the movement of fish under the Section 30 of the Salmon & Freshwater Fisheries Act (1975), primarily for the purpose of controlling fish disease and the introduction of non-native species. We also advise on problems relating to the health of native fish in the wild (but not, for example, on ornamental fish in garden ponds).

Ministry of Agriculture Fisheries & Food are responsible for the issue of import licences for fish from abroad, under the Import of Live Fish (England and Wales) Act 1980; the granting of licences to introduce non-native fish, under the Wildlife & Countryside Act 1981; and the granting of licences to keep or release non-native fish, under the Prohibition of Keeping or Release of Live Fish (Specified Species) Order 1998. MAFF also enforces the Diseases of Fish Acts 1937 & 1983, which deals, amongst other things, with 'notifiable' fish diseases.

The owner of fishing rights (often the riparian owner) in water that is private property or in which the fishing rights are privately owned may invoke the 1968 Theft Act and take proceedings under the Act. The owner of fishing rights is the legal owner of fish that have been caught in their water. They are therefore responsible for the removal and disposal of carcasses, should this be necessary.

The Police have powers to deal with cases involving the theft of fish (poaching), a criminal offence under the 1968 Theft Act.

Types of Fisheries Incidents

Various categories of illegal fishing occur, the main ones being:

- Fishing without a licence
- Fishing with an unlicensed or illegal instrument
- Fishing without a permit and/or permission (Theft Act Offences)
- Various offences related to equipment, methods, timing, and or location of fishing, including byelaw offences.

Fish health problems often relate to fish diseases and parasites, and to fish in distress due to poor water quality resulting from pollution or natural causes such as plant or algal activity.

Incidents in the Severn Vale

In the Lower Severn Area (covering the Severn Vale and Warwickshire Avon) there were 280 prosecutions by the Agency against people fishing illegally in 1997 and 173 prosecutions in 1998.

There were 5 instances of fish disease problems involving more than 5 dead fish in 1997 and 16 occurrences in 1998 in the Lower Severn Area.

5.0 THE HEALTH OF THE ENVIRONMENT

This section examines new approaches to measuring the state of the environment and focuses on issues of particular concern in relation to the health of the environment. This includes air ozone, eutrophication, and diseases and invasive species that pose a threat to the health of key species.

5.1 MEASURING THE HEALTH OF THE ENVIRONMENT

Traditional methods of assessing environmental quality have relied heavily on the taking of measurements with respect to certain physico-chemical parameters. As a consequence, data have accumulated over the years on the levels of certain substances in the environment. Assessments of the state of the environment have frequently been made on the basis of whether the levels of substances in the environment are considered to be acceptable or not, rather than by direct measurement of their impact on the environment itself. There are good reasons why this has been so. Methods for sampling and analysis are well developed for many substances, allowing for convenient, quantitative standards to be identified and legislated for, and to be monitored, controlled and regulated against.

An example of this is the extensive use of the Biochemical Oxygen Demand (BOD) parameter in water quality assessment. BOD is a measure of the combined oxygen-consuming potential of different substances and is often used as an indicator of the level of organic pollution. Its actual impact on the dissolved oxygen levels available for aquatic life will however depend on all sorts of factors such as temperature, river flow, turbulence and so on. Thus, although it is a useful water quality indicator, it is only a surrogate measure of the "health" of the water environment. However nearly all aqueous discharge consents are based on BOD, so it is likely to be employed for many years to come.

Developments in the science of ecotoxicology are opening new avenues for more direct assessment of environmental health. Common ecotoxicological method focuses on the movement or 'pathway' of toxic substances through the environment, on how they accumulate in the environment, and on those aspects of the environment or 'receptors' which are adversely affected by them. Ecotoxicological techniques show considerable potential not only in providing direct measures of ecological condition, but also in making the important link between the observed effects and their causes. A challenge for the future is the development of techniques that allow direct measurement of ecological health "symptoms" and are sufficiently robust and reliable for incorporation into national monitoring programmes.

Although some progress has been made in the development of ecological indicators there is still much to be done to improve our understanding of the health of the environment and how it is changing in response to the pressures placed upon it.

The impact of endocrine (hormone) disrupting chemicals and their control is the subject of current Agency research projects and appropriate control strategies are being developed. The development of toxicity based control methods may assist in their regulation, particularly of complex mixtures of pollutants.

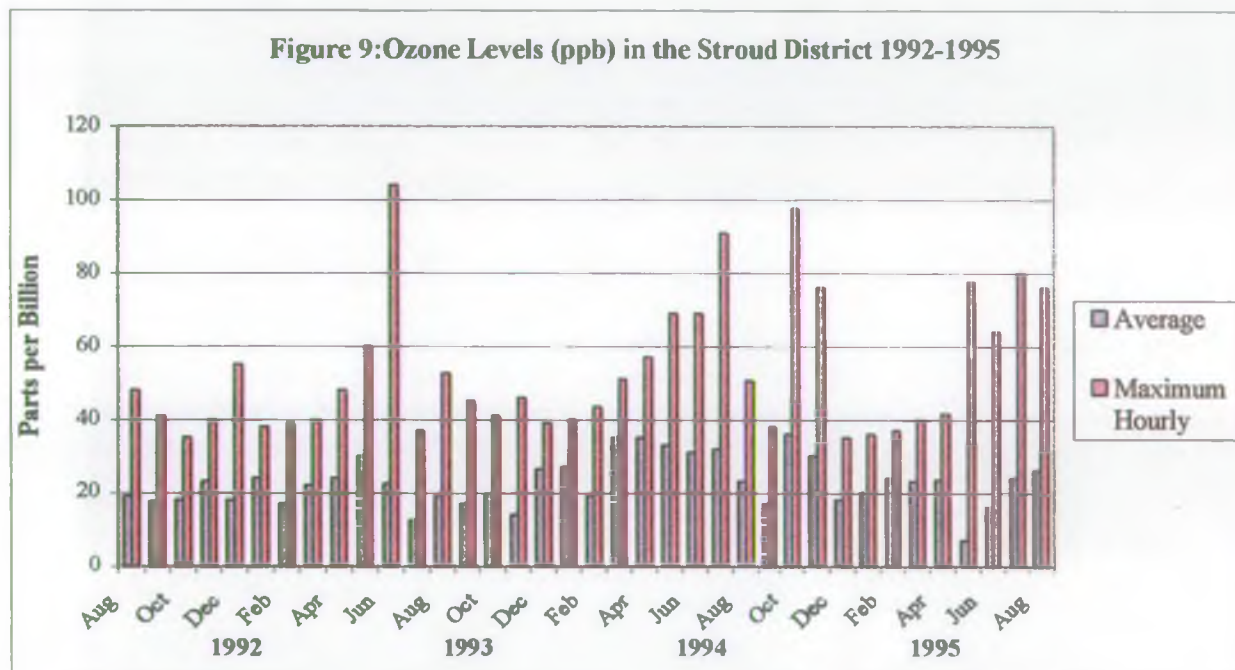
While further development of techniques is required in this area (e.g. use of remote sensing to provide information on the condition of habitats, not only their extent), this section reviews some topics which give a preliminary indication of the health of the Severn Vale environment.

5.2 AIR OZONE

In the stratosphere, the ozone layer shields us from the harmful effects of the sun, but nearer the ground, as a component of photochemical smog, ozone is a damaging pollutant. Ground level ozone,

in high concentrations, can damage certain materials, crops and trees, and can be harmful to human health. For example, individuals may experience respiratory problems while taking vigorous exercise out of doors. Ground level ozone is produced by the action of sunlight on a mixture of pollutants, which are mainly emitted from motor vehicles, power stations and industry. Its formation requires sunlight so it is mainly a summer pollutant. Ozone levels in the United Kingdom tend to be highest in rural and upland areas and lowest in busy city streets where ozone may actually be destroyed by some components of motor vehicle exhaust.

Ground level ozone is a trans-boundary pollutant; many of the high levels of ozone recorded in the south of England result from polluted air drifting in from the continent. Action to reduce ground level ozone is therefore being taken internationally and the UK is contributing fully to these efforts. For example, there are controls on the emission of volatile organic compounds (VOCs) from the storage and transport of petrol (Directive 94/63/EC) and it is now mandatory for new cars to have a catalytic convertor and carbon canister fitted. In the Severn Vale, Stroud District Council monitors ground level ozone in the Stroud District. Results for 1992 – 1995 are shown in Figure 9.



(Source: Gloucestershire County Council (1996): *Gloucestershire's Environment 1996*.)

5.3 EUTROPHICATION

Eutrophication is the presence of excess nutrients in aquatic systems and can occur in both freshwater and marine environments. Eutrophic waters are susceptible to blooms of toxic blue-green algae and excessive growth of other algae or other aquatic plants. These blooms can cause a number of problems such as clogging of waterways and sluices, reducing the enjoyment of water sports, deoxygenation of the water and fish kills. In some cases the blooms of toxic blue-green algae can produce large amounts of scum that is often blown to the shoreline, where the algae may cause illness or death of wild, farm and domestic animals. While high nutrient levels indicate the potential for eutrophication, other environmental factors such as river flow dictate whether elevated nutrient levels are translated into algal growth.

Phosphate (principally from sewage treatment works) and nitrates (from agricultural fertilizer) tends to promote algal growth with phosphates being the limiting factor in freshwater and nitrates in the

marine environment. The agricultural nature of the catchment combined with the presence of several large sewage treatment works (STWs) mean that eutrophication is increasingly becoming more of a problem in the Severn Vale. The changing nature of farming over the years has led to an increased use of fertilisers, and the use of modern machinery can lead in certain catchments to sediment entering surface waters. This sediment often contains high concentrations of phosphorus. The increasing human population has led to a rise in the quantities of sewage effluent entering our rivers, which contains phosphorus from detergents used in the household.

Table 24 shows the sites in the Severn Vale area that have been reported to the Agency as having blue-green algae present over the last three years.

Year	Location	Species
1996	Rhydd Pool, Malvern	<i>Oscillatoria</i> spp
1997	Wotton Brook – Barnwood Lake	<i>Oscillatoria</i> spp
	Pirton Fishing Lake	Not known
	Longdon	<i>Oscillatoria</i> spp
	Much Marcle	<i>Microcystis</i> spp
	Farm pool, Dymock	<i>Oscillatoria</i> spp
	Leigh Sinton, small pool	<i>Oscillatoria</i> spp
	Betula Water, Much Marcle	<i>Oscillatoria</i> spp
	Staunton court pool	<i>Oscillatoria</i> spp
1998	Hartbury College fishing lake	<i>Aphanizomenon flos-aquae</i>
	Staunton court lakes	<i>Oscillatoria</i> spp
	Eastnor Estate, stock ponds	<i>Aphanizomenon</i> spp

Sensitive Areas (Eutrophic) can be designated under the Urban Waste Water Treatment Directive (see section 4.5.2). Where these are identified there is a requirement for nutrient (usually phosphorus) reduction in discharges from sewage works exceeding 10,000-population equivalence, unless it can be shown that this will have no benefit to the receiving watercourse.

5.4 ALDER DISEASE

A Phytophthora fungus causes the lethal disease of the native riverside Alder (*A. glutinosa*). In mid to late summer leaves of diseased trees are abnormally small, yellow and sparse, frequently falling prematurely to leave the tree bare. Tarry or rusty spots at the base of the tree indicate that the bark is dead and the tree will eventually fall. This is a concern as Alders have great conservation value and their root systems help stabilise the river bank.

A national survey carried out by the Forestry Commission has found the disease to be widespread throughout the UK. The research has strongly suggested that the disease is spread between trees via water. Water pollution (total oxidised nitrogen) is highlighted as a possible contributing factor. The disease is extensive throughout the Severn Vale but occurrence is appreciably lower on smaller brooks.

The Environment Agency and Forestry Commission would therefore welcome information relating to alder disease along watercourses, particularly those below two metres in width. Please report any of the above symptoms in the Severn Vale to the conservation department at the Agency's Tewkesbury office.

5.5 INVASIVE SPECIES

The extent of alien or non-native species in a habitat can provide an indication of its relative health. Some habitats or species that are already under stress are particularly vulnerable to the adverse impacts of introduced species. For example water vole populations in isolated and degraded habitats are less likely to withstand or recover from predation by the North American mink. Native crayfish in suboptimal habitats with respect to water quality and habitat are more vulnerable to crayfish plague and competition from alien crayfish species (see section 3.3.1). River banks where the native plant community is already under pressure from poor water quality and unnatural variation in water levels are more vulnerable to invasion from species such as Himalayan Balsam and Japanese Knotweed. The presence of introduced species can be sufficient stress on its own to impact significantly on the existing native communities. This is the case for species such as Australian stonecrop, which has extremely effective reproductive strategies and few predators.

5.5.1 Invasive Plant Species

Many foreign plants were introduced to Britain in the 19th Century, mainly for ornamental reasons. A few have become aggressively dominant, creating serious problems in some areas. Their spread is primarily the result of human activities which aid their dispersal along linear corridors such as railway tracks, rivers and road verges. By forming dense stands they can drive out native plants and reduce wildlife interest. Three such invasive plants which commonly cause such problems are Japanese Knotweed (*Fallopia japonica*), Himalayan Balsam (*Impatiens glandulifera*) and Giant Hogweed (*Heracleum mantegazzianum*).

These three invasive plants are a problem because they:

- Grow extremely densely and shade out native plants
- Provide poor habitats for insects, birds and mammals
- Devalue the natural landscape
- Increase the risk of bank erosion when they die back in the autumn
- Create a potential flood hazard if dead stems fall into and clog up watercourses.

In addition, Giant Hogweed poses a serious health hazard.

The Wildlife and Countryside Act 1981 makes it an offence to plant or cause Japanese Knotweed, and Giant Hogweed to grow in the wild. No legislation currently exists for Himalayan Balsam but all three species are aggressive invaders with fast rates of reproduction allowing for rapid colonisation of new habitats. These species are successful at establishing themselves in native ecosystems and apparently successful in disturbed habitats.

Invasive water plants now occur in waterways and ponds throughout Britain, such as Australian Swamp Stonecrop (*Crassula helmsii*), Parrot Feather (*Myriophyllum aquaticum*), European Pennywort (*Hydrocotyle ranunculoides*), Small-leaved Duckweed (*Lemna minuta*) and Water Fern (*Azolla filiculoides*).

Controlling weeds is difficult due to their life cycle, growth habit, location or resistance. The Environment Agency has recently launched two documents entitled 'Best Practice: Aquatic Weed Control Operation' and 'Best Practice: Disposal of Cut-Vegetation' (drawn from research carried out by the Centre for Aquatic Plant Management) to promote control over the spread of invasive water plants. These seek to enable land owners and managers to make informed decisions regarding weed control options which are the least damaging to the environment whilst paying heed to economic considerations. Summary booklets are available and refer to the 'invasive weeds' listed in Table 25 as well as all plants associated with those watercourses and ponds requiring regular management.

This year, the Agency is undertaking control of Giant Hogweed with Himalayan Balsam and Japanese Knotweed to be controlled on an ad-hoc basis.

Table 25: Recorded Species of Invasive Plant	
Invasive Plant	Known Sites Within The Severn Vale
Japanese Knotweed <i>Fallopia japonica</i>	River Lyd, Cone Brook (extensive), Nailsworth Stream.
Himalayan Balsam <i>Impatiens glandulifera</i>	River Twyver, Ell Brook, Little Avon, Severn, Whiteacres Brook.
Giant Hogweed <i>Heracleum mantegazzianum</i>	Ham Brook,
Swamp Stonecrop <i>Crassula Helmsi</i>	Arle Court Lake at Cheltenham, Hoopers Pond, Coleford, Jugshole Pool, near Coleford Dean.
Parrot's Feather <i>Myriophyllum aquaticum</i>	None known
Floating Pennywort <i>Hydrocotyle ranunculoides</i>	None known
Water Fern <i>Azolla filiculoides</i>	6 records
Duckweed <i>Lemna minuta</i>	3 records

6.0 LONG TERM REFERENCE SITES

Achieving sustainable development requires a long-term perspective. Many environmental processes, such as climate change and water quality improvements take place over timescales of many years. They can only be properly assessed through long-term time series measurement. The following long-term monitoring programmes are currently in place.

6.1 AIR QUALITY MONITORING

Air quality monitoring networks are structured to meet specific objectives (see section 4.3). Continuous automatic monitoring gives instantaneous measurements of air pollution concentrations; non-automatic equipment provides measurements daily or monthly.

The Department for the Environment, Transport and the Regions (DETR) funds three automated monitoring networks across the country: the Automatic Urban Network (AUN), Automatic Rural Network (ARN), and Hydrocarbon Network. There are no automated air quality monitoring sites in the Severn Vale, the nearest one being in Bristol City centre, operated by Bristol City Council.

Non-automatic networks include the Basic Urban Network (BUN) for SO₂ and others for NO₂ and Toxic Organic Micropollutants (TOMPs). There are several non-automatic sites in the Severn Vale.

The National Environmental Technology Centre (NETCEN) compiles the National Atmospheric Emissions Inventory (NAEI) for the DETR from data from the above networks, statistical estimates and research on emission factors. NETCEN seeks to provide a picture of background air quality, for the purpose of examining regional and national air quality trends over time. Maps 8, 9 and 10 (section 2.5) show air quality for key pollutants in the Severn Vale compiled from NAEI data.

Air Quality information is available to the public via telephone on free phone 0800 556677, CEE Fax (page 410-417) and TELETEXT (page 106). A national Air Quality Archive has been established on the INTERNET with data from the above networks. This can be found at <http://www.environment.detr.gov.uk/airq/aqinfo.htm>

6.2 RAINFALL AND RIVER FLOWS

The Agency manages a rainfall monitoring network, which includes 17 rain gauge sites in the Severn Vale area (see Map 3). These enable the long-term mean, and variations from it, to be calculated. This information is used for strategic water resources planning.

There is also a network of fifteen river gauging stations, which provide information on river flows and levels throughout the area. These are used to produce flow statistics both on a long-term and annual timescale. Most of the river gauging and river level sites and six rain gauges are connected to the Regional Telemetry System, which allows up-to-the-minute information to be gathered by computers at Agency offices. This information is used for flood warning purposes.

Following recommendations of the 'Bye Report' into the floods of Easter 1998, the Agency is proposing to extend the network of river and rainfall gauges.

6.3 ENVIRONMENTAL CHANGE NETWORK

The Environmental Change Network (ECN) is a long-term integrated monitoring network established in 1993 and managed by the Natural Environmental Research Council (NERC). It seeks to obtain comparable long-term data to identify and quantify environmental changes by distinguishing man-made changes from natural variations. The ECN monitors indicators that reflect environmental changes, together with measures of the responses of ecosystems to those changes, including direct responses (e.g. climatic effects on reproduction) and indirect responses (e.g. cumulative effects of air pollution on soil and water quality).

There are no ECN sites in the Severn Vale.

6.4 HARMONISED MONITORING SITES

The Harmonised Monitoring Scheme was set up in 1974 to provide a network of sites at which river quality data could be collected and analysed in a nationally consistent way. The scheme allows for measurement of the loading of materials that are carried down river catchments into estuaries, providing data that can be used to assess long-term trends.

The complete list of determinands measured by the network is diverse and extensive, covering some 115 parameters, including biochemical oxygen demand (BOD), ammonia, phosphate, nitrate and dissolved oxygen. Instantaneous and mean flows are also measured at each site to allow for calculation of loads. Data gathered for the Harmonised Monitoring Scheme is reported to the Department of the Environment, Transport and the Regions every six months.

There are 230 harmonised monitoring sample points in Great Britain. In the Severn Vale there is a site at Haw Bridge on the River Severn. Figure 10 shows phosphorus loading of the River Severn at Haw Bridge. It is difficult to distinguish any significant trends. However, the general increase of phosphorus in the Severn during the 1980s may be due to increasing number of households with washing machines, and therefore more sewage with a high phosphorus content being discharged to the foul sewer. The slight decrease during the 1990s may be due to introduction of 'green' detergents, which don't contain phosphorus.

Figure 11 shows ammonia loading in the Severn at Haw Bridge. The slight decrease in recent years may be due to improvements in sewage treatment works upstream. General pollution prevention work may also have a role to play in this.

Figure 10: Phosphorus Load (kg/d) at River Severn, Haw Bridge

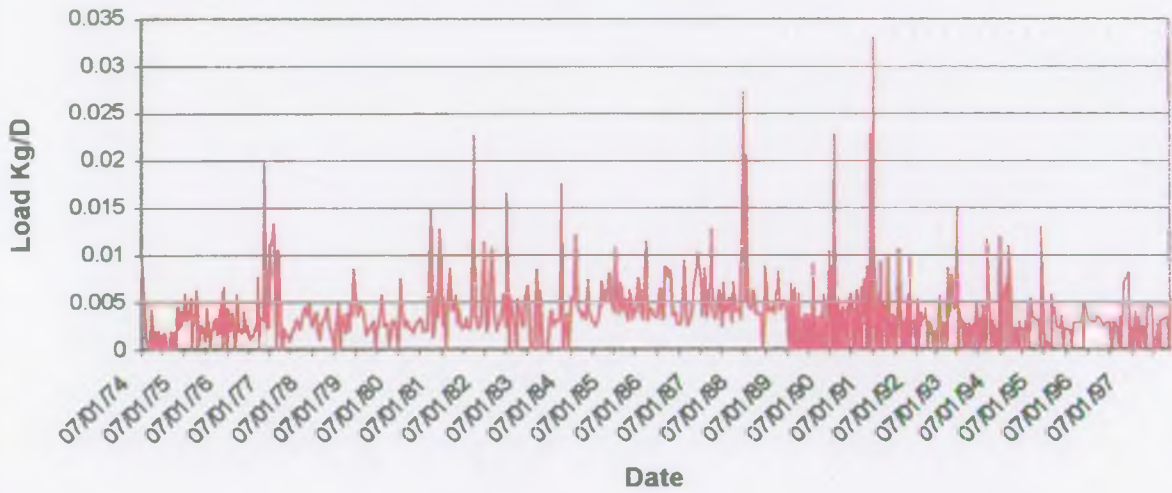
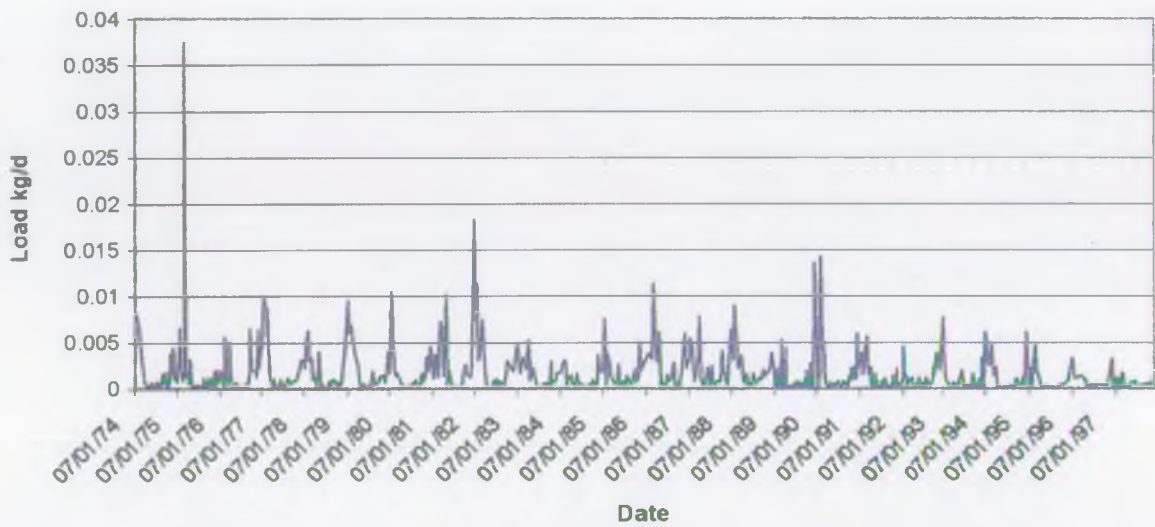


Figure 11: Ammonia Load (kg/d) at River Severn, Haw Bridge



7.0 AESTHETIC QUALITY

The environment surrounds us and forms an integral part of our everyday lives. It represents the places we all live, work, and often enjoy our leisure time. The aesthetic state of the environment therefore influences our quality of life profoundly. Assessing the aesthetic qualities of the environment often requires new or subjective approaches. This section of the Overview examines issues such as landscape, litter, noise, and odour.

7.1 THE AQUATIC ENVIRONMENT

The appearance of the river environment affects how it is valued. Litter, discoloured water, and the presence of sewage scum or foam are obviously unattractive, and people are less likely to visit such sites for recreational purposes. Recreation can benefit the local economy, even where no direct charge is made. It is important, therefore, that the amenity value of the environment is maximised. Large parts of the Severn Vale are popular with visitors because of their attractiveness, and these should be conserved and enhanced. However it is predominantly the urban areas that are affected by aesthetic problems.

Despite the considerable importance that the general public attaches to the aesthetic qualities of the environment, there are relatively few national programmes to assess progress and performance in bringing about improvements over time. The aesthetics component of the General Quality Assessment scheme (see section 4.5.3 for an explanation of this scheme) is under development and proposed measures of aesthetic quality include litter, dog faeces, colour, odour, oil, foam, surface sumps, sewage fungus and ochreous deposits. These will be rated as either percentage cover or actual quantity (in the case of dog faeces and litter).

Aesthetic problems can also arise due to the natural geology of an area. This is the case in the Forest of Dean area where deposits of iron oxide from abandoned mine discharges may discolour stream beds.

7.1.1 Litter

Litter generally relates to the placing, by intent or otherwise, of materials in an illegal or unwarranted location by the public. Where large quantities are involved this will constitute a fly-tipping offence. Litter can arise from the following sources:

- Sewer outfalls with little screening or macerating, releasing faeces or other matter into rivers or the sea and thence being deposited on river banks or the sea shore
- Discharge of material at sea
- Fly tipping (see section 4.10.2)
- Accidental spreads of material from licensed waste management sites
- Incremental collection of material dropped by individuals in the countryside.

The Agency is concerned with the impact of litter on the environment because:

- A build up of litter can block drainage channels and lead to a danger of flooding;
- Accumulated litter can comprise a fire risk, which in turn is detrimental to air quality;
- Certain types of litter can, if left, pose a potential water pollution problem;
- Litter is aesthetically unpleasant, and can reduce people's enjoyment of recreation on or adjacent to water features, or even deter them from visiting such sites;
- Litter can pose a health and safety risk.

It should be noted that responsibility for removal of litter in general lies with the District Councils or Unitary Authorities. Responsibility for the removal of litter from watercourses is shared between these bodies and the riparian owner (owner of the land adjacent to the watercourse). The Agency will only act to remove litter from a main river where this poses a significant flooding danger.

Despite campaigns to raise public awareness and local (mainly voluntary) efforts to improve the situation, problems of litter in the aquatic environment persist and are increasingly reported. A wide range of litter items can be found strewn along bankside vegetation and caught in tree branches, having been deposited after periods of high river flow. One of the most common litter types is plastic. The non-biodegradable nature of this material means it may persist indefinitely and this is probably one explanation for its abundance. The Agency will give advice, seek to educate, and if necessary undertake enforcement at sites where the storage or collection of waste may result in the littering of watercourses. Litter problems have been reported in the past in the Stroudwater Canal, the River Frome at Stroud and the River Lyd at Lydney.

Sewage litter entering watercourses through combined sewer overflows (CSOs) is a particularly unsightly problem. Litter discharged from the sewer system during periods of high rainfall becomes entrained in bankside foliage and often gives rise to public complaint. As part of the next Water Company's Asset Management Plan, covering investment for the years 2000 - 2005 (AMP3), surveys will be carried out in all sewerage drainage areas where there is a perceived aesthetics or water quality problem relating to CSOs.

Improvements are expected at around 29 unsatisfactory intermittent discharges under the AMP3 programme. Such schemes will include, where feasible, removal of overflows by complete re-sewering or the installation of structures designed to minimise the discharge of litter to watercourses.

7.2 TRANQUIL AREAS

An indication of the aesthetic quality of England at a strategic level has been derived by the Council for the Protection of Rural England (CPRE), working in conjunction with the Countryside Commission. CPRE have mapped "tranquil areas" as places "which are sufficiently far away from visual or noise intrusion of development or traffic to be considered unspoiled by urban influences." A tranquil area lies:

- 4 km from the largest power stations;
- 3 km from highly trafficked roads and from major towns;
- 2 km from other motorways and trunk roads and from the edge of smaller towns;
- 1 km from medium disturbance roads and some railways;
- Beyond the noise zones of military bases and civil airfields.

The CPRE maps indicate a reduction in Tranquil Areas in the Severn Vale since the 1960s.

7.3 LANDSCAPE ASSESSMENTS

The Agency encourages the preparation of landscape assessments of river corridors in order to determine the character of such areas and to help in the assessment of potential impacts of new development proposals.

Since the Planning and Compensation Act 1991, local authorities have been required to include policies in their development plans in respect of conservation of the natural beauty and amenity of the land, as specified in PPG 12. Some authorities have prepared county-wide landscape assessments,

and others can be expected to follow. Both Worcestershire County Council and Forest of Dean District Council completed landscape assessment for their areas.

The Government and the Countryside Commission are keen to emphasise the need to conserve local character. This principle applies whether or not the landscape has been designated for its national importance. To promote that objective, The Countryside Commission, with others, has assessed the landscape of the whole of England and divided the country into a series of Countryside Character Areas. While these areas are too broad to be used for development control purposes, and the Commission advocates more detailed landscape assessments at the local plan level, its assessment is very appropriate for the strategic planning at Structure Plan and LEAP scale.

Summaries of the descriptions of the Countryside Character Areas are given in Section 2.7.1, and their location is shown on Map 14.

7.4 NOISE AND ODOUR

Noise and odour can cause considerable discomfort to the public and to animals. Both may arise from a variety of sources, including:

- industrial processes
- animal husbandry
- construction sites
- waste disposal
- domestic premises

Ensuring that human health is safeguarded against noise and odour is the responsibility of the environmental health departments of local authorities. The Environment Agency is unable to respond to incidents of noise or odour, unless these arise from a waste disposal site where conditions relating to noise or odour exist within the waste management licence.

9.0 CONCLUSION

This Environmental Overview has briefly described the current state of the environment in the Severn Vale from six viewpoints. It has shown that human influences within the Severn Vale place significant pressure on both the local and the global environment. These pressures include the abstraction and use of natural resources, such as minerals and water, the destruction of wildlife habitats, and the release or discharge of polluting wastes into the environment. Such activities affect the quality of different environmental media (air, land, and water) and amenity and recreational features (including landscape and heritage), and the availability of natural resources for future generations. Natural forces, including flooding, also place pressure on the environment and affect the livelihood of many people living in the area.

The environmental issues affecting the Severn Vale are complex and diverse. The Severn Vale LEAP Consultation Draft listed the major issues facing the area that the Agency has power and duties to deal with, and proposed actions that could be taken to start addressing them. These issues are listed below.

Issues Presented in the Severn Vale LEAP Consultation Draft, March 1999

Managing Waste

1. Making Waste Work in the Severn Vale area
2. Waste minimisation in the Severn Vale area
3. Pollution, health and amenity risks from existing inadequate waste management licences.
4. Public concern about the regulation of land spreading of materials for agricultural purposes in particular the spreading of abattoir waste on land.

Improving Air Quality

5. Managing Air Quality – strategies and information.
6. The impact of the Cleansing Services Group site on local air quality

Regulating Major Industries

7. Proposals to build additional gas power stations at Avonmouth and their potential impact on air quality
8. The Control of Major Accident Hazards involving Dangerous Substances (COMAH)

Addressing Climate Change

9. Climate change leading to increased flood risk:
10. Potential for non-fossil fuel energy from hydropower and waste to energy

Managing Water Resources

11. Maintaining River Severn flows to the estuary
12. Low river flows
13. The need for improvements to the gauging station on the Little Avon at Berkeley.

Delivering Integrated River Basin Management

14. The impact of changing land use practice on the water environment, especially the Leadon Catchment
15. Pollution of surface water intended for public water supply
16. The impacts of inadequate sewerage facilities on water quality
17. The Effects of nutrients on the catchment
18. Failure to comply with River Quality Objectives
19. Review of River Quality Objectives.
20. Managed surface water drainage from developed areas.

Issues Presented in the Severn Vale LEAP Consultation Draft, March 1999

21. Managing flood risk and floodplains
22. Recreational use of, and access to, the river corridor

Conserving the Land

23. Implementation of the Contaminated Land Regulations including the potential to developing partnerships between the Agency and local authorities
24. The impact of contaminated mines on the surrounding environment in the Forest of Dean

Enhancing Biodiversity

25. Managing SSSIs, RAMSAR sites , SPA and the proposed SAC
26. Enhancing Biodiversity

Managing Freshwater Fisheries

27. Elver fishery: management of the fish stocks and operation of the fishery
28. Climate change and salmon survival leading to concerns regarding the small populations of salmon in the River Severn catchment.

Managing the Environment in Partnership

29. Lydney Dock development.
30. Managing environmental information - air quality, biodiversity and waste management.
31. Promoting environmental awareness and understanding.

The views of other organisations and the general public were expressed during the period of public consultation, between 1st April and 30th June 1999. These have been taken into consideration in the Severn Vale Action Plan, to be published in December 1999. The Action Plan will contain a prioritised list of actions that take account of costs and benefits, identifying timescales and the participation of other key players alongside the Agency. Agreed actions will be incorporated into the Agency's annual business plans.

However, the involvement of the general public and other partners does not stop following consultation. Many of the actions embodied in the LEAP will require real commitment and effort from all those involved. Moreover, Local Environment Agency Plans embody issues and actions that relate to the interests of the Agency and it's key partners. Financial constraints mean that not all the issues we would like to tackle can be. Making progress on broader societal issues, such as reducing the amount of energy we use or waste we produce, and taking more care of our local environment, will require the involvement and support of all sectors of society, including the general public and businesses.

The Overview has also shown that indicators measuring some aspects of the state of the environment already exist, involving national programmes and periodic reporting arrangements. However, there are still important gaps that need to be filled, if our understanding of the local environment is to be more complete. The Agency is investigating how the efficiency of existing programmes can be improved so that resources can be diverted towards monitoring that addresses new priorities. Effective collaboration between the Agency and other organisations, including Government departments, local authorities, nature conservation and countryside bodies, and research organisations, will be critical to the future success of improved environmental monitoring programmes.

APPENDIX 1: ABBREVIATIONS AND ACRONYMS

AMP	Asset Management Plan
AONB	Area of Outstanding Natural Beauty
AQMA	Air Quality Management Area
BAP	Biodiversity Action Plan
BATNEEC	Best Available Techniques not Entailing Excessive Cost
BOD	Bio-chemical Oxygen Demand
BPEO	Best Practicable Environmental Option
CAP	Common Agricultural Policy
CCIRG	Climate Change Impacts Review Group
CFCs	Chloro-fluorocarbons
CH₄	Methane
CICS	Common Incident Classification System
CITES	Convention on International Trade in Endangered Species
CO	Carbon Monoxide
CO₂	Carbon Dioxide
CSO	Combined Sewer Overflow
DO	Dissolved Oxygen
DWI	Drinking Water Inspectorate
DETR	Department of Environment, Transport and Regions
EIP	Examination in Public
ESA	Environmentally Sensitive Area
GQA	General Quality Assessment
GWT	Gloucestershire Wildlife Trust
HAP	Habitat Action Plan
HSE	Health and Safety Executive
IDB	Internal Drainage Board
IPC	Integrated Pollution Control
IPCC	Intergovernmental Panel on Climate Change
IPPC	Integrated Pollution Prevention and Control
Kg/d	Kilogrammes per day
LAAPC	Local Authority Air Pollution Control
LAMS	Local Abstraction Management Strategy
LAQM	Local Air Quality Management
LEAP	Local Environment Agency Plan
LNR	Local Nature Reserve

LPA	Local Planning Authority
Mg/l	Milligrammes per litre
MgN/l	Milligrammes of Nitrogen (ammoniacal) per litre
MI/d/km²	Megalitres per day per square kilometre
MAFF	Ministry of Agriculture, Fisheries and Food.
MORI	Market and Opinion Research Institute
MPA	Minerals Planning Authority
NAEI	National Atmospheric Emissions Inventory
NETCEN	National Environmental Technology Centre
NNR	National Nature Reserve
NO	Nitric Oxide
NO₂	Nitrogen Dioxide
NO_x	Oxides of Nitrogen (NO and NO ₂)
NVZ	Nitrate Vulnerable Zone
O₃	Ozone
OFWAT	Office of Water Services
OPRA	Operator and Pollution Risk Appraisal
PAH	Polycyclic Aromatic Hydrocarbon
PCBs	Polychlorinated Biphenyls
ppb	Parts per billion
PPGs	Planning Policy Guidance Notes
PPGNs	Pollution Prevention Guidance Notes
ppm	Parts per million
RQO	River Quality Objective
RSPB	Royal Society for the Protection of Birds
SAC	Special Area for Conservation (proposed or candidate)
SAM	Scheduled Ancient Monument
SAP	Species Action Plan
SME	Small and medium sized enterprises
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
STW	Sewage Treatment Works
TOMPs	Toxic Organic Micro-Pollutants
UWWTD	Urban Waste Water Treatment Directive
VOC	Volatile Organic Compound
WLMP	Water Level Management Plan
WWT	Wildfowl and Wetlands Trust

APPENDIX 2: GLOSSARY

Abstract	To remove water from any source, either permanently or temporarily.
Abstraction	The removal of water from any source, either permanently or temporarily.
Abstraction Licence	An authorisation granted by the Agency under section 38 of the Water Resources Act 1991 to allow the removal of water from a source.
Algae	Microscopic (sometimes larger) plants, which may be floating or attached. Algae occur in still and flowing water.
Algal Blooms	Rapid growth of phytoplankton in marine and freshwater which may colour the water and may accumulate on the surface as a green scum.
Ammonia	A chemical compound found in water often as a result of pollution by sewage and farm effluents. It is widely used to determine water quality. Ammonia can be toxic to fish.
Aquatic	Pertaining to the water environment.
Aquifer	A water bearing-stratum situated below ground level. The water contained in aquifers is known as groundwater.
Asset Management Plan	Water Companies Strategic Business Plans - initiated by OFWAT as part of the periodic review of water company charges.
Asset Survey	A periodic survey of flood defences on Main Rivers undertaken by the Environment Agency.
Augmentation	The addition of water to a watercourse under artificial control. Usually to "top up" low flows in summer by either groundwater pumping or via reservoir release.
Authorisation	A legal licence issued by the Environment Agency under the Environmental Protection Act 1990 for industrial processes that use or produce potentially polluting substances in significant amounts.
Bioaccumulation	The concentration biologically of toxic compounds present in small quantities.
Carbon Dioxide	Gas present in the atmosphere and formed during respiration, the decomposition and combustion of organic compounds (eg fossil fuels, wood etc). A greenhouse gas.
Catchment	The total area from which a single river collects surface run-off.
Coarse Fish	Freshwater fish other than salmon and trout.
Combined Sewer	Structure which carries both foul and surface water discharge
Confluence	The point at which two rivers meet.
Consent To Discharge	A licence granted by the Agency to discharge effluent of specified quality and volume. Statutory; Schedule 10 Water Resources Act 1991.
Controlled Waste	Industrial, household and commercial waste, as defined in UK legislation. Controlled waste specifically excludes mine and quarry waste, wastes from premises used for agriculture, some sewage sludge and radioactive waste.
Controlled Water	All rivers, canals, lakes, groundwaters, estuaries and coastal waters to 3 nautical miles from the shore, including bed and channel which may for the time being be dry.

Culvert	Channel carrying water across or under a road, canal etc.
Cyprinid Fish	Coarse fish belonging to the carp family, like roach, dace and bream.
Diffuse Pollution	Pollution from widespread activities with no one discrete source.
Discharge Consent	See Consent to Discharge.
Ecosystem	A functioning, interacting system composed of one or more living organisms and their effective environment, in a biological, chemical and physical sense.
Ecotoxicology	The study of substances and preparations which present or may present immediate or delayed risks for one or more sectors of the environment.
Effluent	Liquid waste from industrial, agricultural or sewage plants.
Eutrophication	The biological effects of an increase in plant nutrients - nitrates and phosphates - on aquatic ecosystems.
Fauna	Animal life.
Floodplain	Land adjacent to a watercourse that is subject to flooding.
Flora	Plant life.
General Quality Assessment	Classification system for the quality of watercourses.
Gauging Station	A site where the flow of a river is measured.
Groundwater	Water which saturates a porous soil or rock substratum (or aquifer). Water held in storage below ground level.
Habitat	The locality or environment in which a plant or animal species lives.
Inert	Chemically un-reactive
Infiltration Drainage	A drainage system which allows water to seep into the ground rather than run-off the surface.
Internal Drainage Board	Local Sovereign authority for drainage.
Landfill	Site used for waste disposal into/onto land.
Main River	The watercourse shown on the statutory 'Main River maps' held by Environment Agency and MAFF. The Agency has permissive powers to carry out works of maintenance and improvement on these rivers.
Nitrate Vulnerable Zone	An area where nitrate concentrations in sources of public drinking water exceed, or are at risk of exceeding the limit of 50 mg/l laid down in the 1980 EC Nitrate Directive, where farmers are required to limit the application of nitrates to levels laid down in the Code of Good Agricultural Practice (MAFF).
Nutrient	A chemical essential for life.
Ordinary Watercourse	A watercourse not designated a Main River.
Oxides of Nitrogen	Air pollutants produced by traffic and industry. Associated with respiratory illness and acid rain.
Part A Processes	Complex industrial processes with the potential to cause pollution, regulated through Integrated Pollution Control by the Environment Agency.
Part B Processes	Less complexed processes where emissions to air are regulated by local

	authorities.
Percentile	The values that divide the area under a probability curve into 100 equal parts.
Pesticides	Substances used to kill pests, weeds, insects, fungi, rodents, etc which can have significant harmful environmental effects.
Phosphate	Salt of phosphoric acid used as fertilizer and in washing powders.
Prescribed flow	A flow set to protect lawful downstream users and the aquatic environment.
Ramsar Site	A wetland of international importance for its conservation value, designated as such under the Ramsar Convention 1971.
Reach	A length of river.
Recharge	Water which percolates downward from the surface into groundwater.
Renewable energy	Energy produced from resources that are unlimited or can be rapidly replenished eg. wind, water, sunlight, wave power or waste.
Riparian Owner	Owner of land adjacent to the river.
River Corridor	A stretch of river, its banks, and a varying amount of adjacent land that is affected by the presence of the river.
Salmonid fish	Game fish of the Salmon family, for example, trout and salmon.
Sewage	Liquid waste from homes, businesses etc which is normally collected and conveyed in sewers for treatment and/or discharge to the environment.
Sewage Effluent	A liquid waste from sewage treatment works.
Sewerage	Means of conveying foul or surface water.
Source Control	A collective term to describe the management of run-off at or near the point of impact of rainfall and before it reaches the traditional piped drainage and sewer system of urban areas.
Spray Irrigation	The watering of crops by spraying. Can have a high impact on water resources.
Sites of Special Scientific Interest	The best examples of the national heritage of wildlife habitats, geological features and landforms, designated by English nature and the Countryside Council for Wales. Statutory; notified under the Wildlife and Countryside Act 1981.
Sulphur Dioxide	A gas which dissolves in water to give an acidic solution. It is an irritant when inhaled and may cause breathing difficulties. Emissions of SO ₂ can lead to acid rain, affecting ecosystems and water quality. A target pollutant in the UK National Air Quality Strategy.
Threshold	The point at which a pollutant produces an observable effect. In toxicological studies, this usually relates to health effects on the subjects being studied.
Trade effluent	Any effluent, except domestic sewage produced in the course of trade or industry, including agriculture, horticulture and research. Surface water run-off that is significantly contaminated by site activities constitutes trade effluent.
Wetland	An area of low lying land where the water table is at or near the surface for most of the time, leading to characteristic habitats.

APPENDIX 3: DUTIES, POWERS AND INTERESTS OF THE ENVIRONMENT AGENCY

The Environment Agency has a wide range of interests in the areas of water management, waste management and pollution prevention and control. Whilst many of these interests are supported by statutory duties and powers, much of our work is advisory, with the relevant powers resting with other bodies such as local authorities, for example we are not responsible for:

- noise problems (except if it is to do with our work)
- litter (unless it is restricting the flow of a river)
- air pollution arising from vehicles, household areas, small businesses and small industry
- collecting waste in your local area
- planning permission
- environmental health
- food hygiene

These are all dealt with by local authorities, who will contact us if necessary. We are not responsible for the quality or supply of drinking water at the tap or for treating sewage waste, although we regulate discharges from sewers and sewage treatment works.

The following table summarises our duties, powers and interests.

Water Resources: The Agency has a duty to conserve, redistribute, augment and secure the proper use of water resources.		
The Agency has powers to:	The Agency has an interest (but no powers) in:	Partnership
<ul style="list-style-type: none"> • Grant or vary water abstraction and impoundment licences on application. • Revoke or vary existing licences to reinstate flows or levels to surface-waters or groundwater which have become depleted as a result of abstraction, and are subject to a liability for compensation. • Secure the proper use of water resources through its role in water-resources planning, the assessment of reasonable need for abstractions and promotion of more efficient use of water resources. • Monitor and enforce abstraction and impoundment licence conditions. 	<ul style="list-style-type: none"> • The more efficient use of water by water companies, developers industry, agriculture and the public and the introduction of water-efficiency measures and suitable design and layout of the infrastructure. 	<p>The Agency is committed to water-demand management and will work closely with water companies and developers, local authorities and others to promote the efficient use of water. The Agency acknowledges that new resources may be needed in the future and supports a twin-track approach of planning for water resource development alongside the promotion of demand-management measures. The Agency seeks to influence planning decisions for new development by encouraging the inclusion of water-conservation measures in new properties, particularly in areas where water resources are under stress, and by ensuring that planning authorities allow for the lead time for resource development.</p>
Flood Defence: The Agency has a duty to exercise general supervision over all matters relating to flood defence throughout each catchment.		
<ul style="list-style-type: none"> • Control, through Land Drainage consents, development or construction of a structure that would affect the flow of an ordinary watercourse (Water Resources Act, 1991 Section 109, Land Drainage Act, 1991 Section 23). • Produce flood risk maps for all main rivers under S105 of Water Resources Act 1991. • Undertake works to main rivers using permissive powers. • Issue flood warning relating to main river to the public, local authorities and the police. • Consent mineral workings within 16 metres of main rivers. 	<ul style="list-style-type: none"> • Granting of planning permission throughout a catchment but especially floodplains where development can significantly increase flood risk. This permission is granted by Local Planning Authorities. • Installation of surface water source control measures e.g. flood attenuation structures. • Supervising the maintenance of ordinary watercourses which is a Local Authority remit, but may impact on main rivers. • Installation of buffer zones which reduce flood risk and have significant environmental benefits. • Urban and rural land use and measures that can reduce flood risk or the need for watercourse maintenance. 	<p>As a statutory consultee on planning applications within main-river floodplains, the Agency offers advice based on knowledge of flood risk. It also advises on the environmental impacts or proposed floodplain development.</p> <p>The Agency will encourage best practice, including source-control measures and common standards, among Local Authorities and riparian owners to protect and enhance the environment. The Agency works with the civil authorities to prepare flood-warning dissemination plans and supports their endeavours to protect communities at risk.</p>

<p>Water Quality: The Agency has a duty to monitor, protect, manage and, where possible, enhance the quality of all controlled waters including rivers, groundwaters, lakes, canals, estuaries and coastal waters through the prevention and control of pollution.</p>		
<p>The Agency has powers to:</p>	<p>The Agency has an interest (but no powers) in:</p>	<p>Partnership</p>
<ul style="list-style-type: none"> • Issue discharge consents to control pollution loads in controlled waters. • Regulate discharges to controlled waters in respect of water quality through the issue and enforcement of discharge consents. • Prosecute polluters and recover the costs of clean-up operations. 	<ul style="list-style-type: none"> • The control of runoff from roads and highways. This is a Highway Agency duty. • The greater use of source-control measures to reduce pollution by surface-water runoff. • Prevention and education campaigns to reduce pollution incidents. 	<p>The Agency will liaise with Local Authorities, developers, the Highways Agency, industry and agriculture to promote pollution prevention and the adoption of source-control measures. As a statutory consultee on planning applications, the Agency will advise Local Planning Authorities on the water-quality impact of proposed developments.</p>
<p>Air Quality: The Agency has a duty to implement Part I of the Environment Protection Act 1990.</p>		
<ul style="list-style-type: none"> • Regulate the largest technically complex and potentially most polluting prescribed industrial processes such as refineries, chemical works and power stations including enforcement of, and guidance on, BATNEEC and BPEO. • Have regard to the government's National Air Quality Strategy when setting standards for the releases to air from industrial processes. 	<ul style="list-style-type: none"> • The vast number of smaller industrial processes which are controlled by Local Authorities. • Control over vehicular emissions and transport planning. 	<p>The Agency provides data on IPC processes and advice on planning applications to Local Authorities. The Agency is willing to offer its technical experience to Local Authorities on the control of air pollution</p> <p>The Agency wishes to liaise with Local Authorities in the production of their Air Quality Management Plans.</p> <p>The Agency will advise and contribute to the government's National Air Quality Strategy</p>
<p>Radioactive Substances: The Agency has a duty under the Radioactive Substances Act 1993 to regulate the use of radioactive materials and the disposal of radioactive waste.</p>		
<ul style="list-style-type: none"> • To issue certificates to users of radioactive materials and disposers of radioactive waste, with an overall objective of protecting members of the public. 	<ul style="list-style-type: none"> • The health effects of radiation. 	<p>The Agency will work with users of the radioactive materials to ensure that radioactive wastes are not unnecessarily created, and that they are safely and appropriately disposed of. The Agency will work with MAFF to ensure that the disposal of radioactive waste creates no unacceptable effects on the food chain. The Agency will work with the Nuclear Installations Inspectorate to ensure adequate protection of workers and the public at nuclear sites. The Agency will work with the HSE on worker-protection issues at non-nuclear sites.</p>
<p>Waste Management: The Agency has a duty to regulate the management of waste, including the treatment, storage, transport and disposal of controlled waste, to prevent pollution of the environment, harm to public health or detriment to local amenities.</p>		
<ul style="list-style-type: none"> • Vary waste management licence conditions. • Suspended and revoke licences. • Investigate and prosecute illegal waste management operations 	<ul style="list-style-type: none"> • The siting and granting of planning permission for waste management facilities. This is conducted by the waste industry and Local Planning Authorities. The Agency, as a statutory consultee on planning applications, can advise on such matters. 	<p>The Agency will work with waste producers, the waste-management industry and local authorities to reduce the amount of waste produced, increase reuse and recycling and improve standards of disposal.</p>
<p>Contaminated Land: The Agency has a duty to develop an integrated approach to the prevention and control of land contamination ensuring that remediation is proportionate to risks and cost-effective in terms of the economy and environment.</p>		
<ul style="list-style-type: none"> • Regulate the remediation of contaminated land designated as special sites. • Prevent future land contamination by means of its IPC, Water Quality and other statutory powers. • Report on the state of contaminated land. 	<ul style="list-style-type: none"> • Securing with others, including Local Authorities, landowners and developers, the safe remediation of contaminated land. 	<p>The Agency supports land remediation and will promote this with developers and Local Authorities and other stakeholders.</p>

<p>Conservation: The Agency will further conservation, wherever possible, when carrying out water-management functions; have regard to conservation when carrying out pollution-control functions; and promote the conservation of flora and fauna which are dependent on an aquatic environment.</p>		
<p>The Agency has powers to:</p>	<p>The Agency has an interest (but no powers) in:</p>	<p>Partnership</p>
<ul style="list-style-type: none"> • The Agency has no direct conservation powers, but uses its powers with regard to water management and pollution control to exploit opportunities for furthering and promoting conservation. 	<ul style="list-style-type: none"> • The conservation impacts of new development. These are controlled by Local Planning Authorities. • Protection of specific sites or species, which is a function of English Nature. The Agency does, however, provide advice to Local Authorities and developers to protect the integrity of such sites or species. • Implementation of the UK Biodiversity Plan for which it is the contact point for 12 species and one habitat. 	<p>The Agency supports action to sustain or improve natural and man-made assets so that they are made available for the benefit of present and future generations. Many development schemes have significant implications for conservation. The Agency will work with developers, Local Authorities, conservation bodies and landowners to conserve and enhance biodiversity.</p>
<p>Landscape: The Agency will further landscape conservation and enhancement when carrying out water-management functions; have regard to the landscape when carrying out pollution-control functions; and promote the conservation and enhancement of the natural beauty of rivers and associated land.</p>		
<ul style="list-style-type: none"> • The Agency must further the conservation and enhancement of natural beauty when exercising its water-management powers and have regard to the landscape in exercising its pollution-control powers. 	<ul style="list-style-type: none"> • The landscape impact of new development, particularly within river corridors. This is controlled by Local Planning Authorities. 	<p>The Agency produces River Landscape Assessments and Design Guidelines which it uses when working with Local Authorities and developers to conserve and enhance diverse river landscapes.</p>
<p>Archaeology: The Agency has a duty to consider the impact of all of its regulatory, operational and advising activities upon archaeology and heritage, and implement mitigation and enhancement measures where appropriate.</p>		
<ul style="list-style-type: none"> • The Agency must promote its archaeological objectives through the exercise of its water-management and pollution-control powers and duties. 	<ul style="list-style-type: none"> • Direct protection or management of sites or archaeological or heritage interest. This is carried out by LPAs, County Archaeologists and English Heritage. 	<p>The Agency will liaise with those organisations that have direct control over archaeological and heritage issues to assist in the conservation and enhancement of these interests.</p>
<p>Fisheries: The Agency has a duty to maintain, improve and develop salmon, trout, freshwater and eel fisheries.</p>		
<ul style="list-style-type: none"> • Regulate fisheries by a system of licensing. • Make and enforce fisheries byelaws to prevent illegal fishing. • Promote the free passage of fish and consent fish passes. • Monitor fisheries and enforce measures to prevent fish-entrainment in abstractions. • Promote its fisheries duty by means of land-drainage consents, water abstraction applications and discharge applications. 	<ul style="list-style-type: none"> • The determination of planning applications which could affect fisheries. 	<p>Many development schemes have significant implications for fisheries. The Agency will work with anglers, riparian owners, developers and Local Authorities to protect fisheries.</p>
<p>Recreation: The Agency has a duty to promote rivers and water space for recreational use.</p>		
<ul style="list-style-type: none"> • The Agency contributes towards its recreation duty through the exercise of its statutory powers and duties in water management. 	<ul style="list-style-type: none"> • Promotion of water sports. This is carried out by the Sports Council and other sports bodies. 	<p>The Agency will work with the Countryside Commission, the Sports Council, British Waterways and other recreational and amenity organisations to optimise recreational use of the water environment.</p>
<p>Navigation: The Agency has a duty to maintain and improve navigation.</p>		
<ul style="list-style-type: none"> • Maintain river navigation. • Maintain and operate locks and associated weirs and sluices whilst providing access to these sites. • Provide services such as moorings and pump-out facilities. • Maintain navigation by a system of licensing. • Enforce navigation legislation. 	<ul style="list-style-type: none"> • The management and operation of British Waterways navigations and other navigations within the region. 	<p>The Agency will work with British Waterways, navigation authorities and navigation users to improve navigations generally as valuable environmental, recreational, commercial and heritage resources.</p>

APPENDIX 4: ROUTINE WORK CARRIED OUT BY THE ENVIRONMENT AGENCY

The Environment Agency has a number of roles and responsibilities that it fulfils to protect and improve the environment. These include:

Water Quality:

- consenting to and charging for discharges to rivers
- responding to pollution incidents
- prosecuting polluters
- sampling water quality
- carrying out biological and bacteriological surveys
- setting water quality targets
- protecting groundwater quality

Flood Defence:

- maintaining free passage of water by dredging, bank trimming and rubbish clearance
- identifying and constructing flood defence works
- forecasting and warning of flood situations

Water Resources:

- measuring rainfall, river flows and groundwater resources
- licensing water abstractions
- promoting water efficiency and conservation measures

Fisheries, Conservation and Recreation:

- surveying the health and numbers of fish populations
- rescuing fish in emergency situations
- regulating fisheries licences
- protecting and enhancing natural riverine habitats, including banks and floodplains
- promoting public access to rivers and the general enjoyment of the riverside

Planning:

- responding to planning application consultations
- promoting policies to protect and enhance the water environment in development plans
- ensuring that all development in or near rivers protects and enhances the water environment by issuing Land Drainage consents
- producing LEAPs to integrate the Environment Agency's work with activities being under taken by other organisations

Integrated Pollution Control:

- regulating air quality by operating Integrated Pollution Control (IPC) for certain industrial processes
- authorising prescribed processes and ensuring operators comply with the pollution prevention and control standards laid down
- making appropriate checks to ensure IPC authorisations are being complied with, investigating any complains and attending to serious pollution events
- regulating the holding, use and disposal of radioactive substances

Waste Regulation:

- licensing of waste management activities through the imposition of appropriate conditions
- supervision of licensed activities and the operation of enforcement procedures
- regulating and monitoring the movement of Special Waste i.e. those that are considered dangerous to life and require cradle to grave monitoring
- the Registration of Waste Carriers, Waste Brokers and activities exempt from licensing
- collecting of information about waste arisings and the preparation of a waste disposal plan
- promotion of Duty of Care

General:

- promoting rivers as valuable natural assets
- making information available through the Environment Agency's Public Register
- monitoring and enforcement action to ensure that all the above are implemented and complied with.

APPENDIX 5: RIVER QUALITY OBJECTIVE SIGNIFICANT FAILURES 1997

River Name	Stretch Name	RE CLASS (1997)	LTRQO (RE)	1997 Comments	Actions
Gloucester Sharpness Canal	River Frome to Sharpness Docks	RE3	RE2	Due to the effects of eutrophication in the canal.	The Gloucester Sharpness Canal was designated as a Sensitive Area (Eutrophic) in 1997. Phosphorus removal is required at Stanley Downton and Coaley STW by 2004.
Longhope Bk	Longhope STW to conf. with Westbury Bk	RE4	RE2	Poor quality recorded in 1995 due to very low river flows combined with the impact of the STW.	Longhope STW was included in the Area AMP3 submission.
Frome (North arm)	Ebley to conf. south arm	RE2	RE1	Due to the impact of Dairy Crest effluent.	Large discharge entering a RE1 stretch. Need to review the consent and the RQO.
Frome (Southern arm)	Stanley Downton STW to conf. north arm	RE4	RE3	Due to the impact of the discharge from Stanley Downton STW.	Stanley Downton STW to be improved in the AMP2 programme and also included in the area submission for improvements under AMP3.
Red Bk	Conf. with Huntley Bk to R. Leadon	RE4	RE2	Failure thought to be due to low flows.	Continue to monitor. Biological quality was grade a.
Preston Bk	Fb at Laddin Farm to R. Leadon	RE4	RE1	DO thought to be due to low flows.	Continue to monitor. Biological quality was GQA Grade B.
Kempley Bk	Whittocks End to conf. with Preston Bk.	RE4	RE1	Farm problems suspected.	A series of farm visits have been undertaken which will hopefully lead to improved farm practices and improved water quality.
Cam R	Coaley STW outfall to Waterend Farm	RE4	RE3	Due to Coaley STW discharge upstream.	Coaley STW identified as part of our AMP3 submission.
Coaley Bk	Tickshill-Hydegate Br to River Cam	RE3	RE1	Due to effect of farm run-off and discharges.	A series of farm visits to be undertaken.
Ashleworth Bk	Wick Ridge St. to R. Severn	RE3	RE2	Suspect poor DO due to low flows	Continue to monitor.
Chelt R	Fb nr. Becketts Farm to R. Severn	RE5	RE4	Failure due to Cheltenham (Hayden) STW.	Improvements under AMP2 were finished in Autumn 1998.
Chelt R	M5 culvert to fb nr. Becketts Farm	RE5	RE4	Failures due to Cheltenham STW.	Improvements under AMP2 were finished in Autumn 1998.
Leigh Bk	Coombe Hill to R. Chelt	RE5	RE2	Failure due to low flows, eutrophication and lack of dilution for effluents.	Continue to monitor.
Ripple Bk	Bow Bridge to R. Severn	RE5	RE2	This site is located in a ponded section of the Ripple Bk and so there is little movement of water, hence the low DO's. The site supports good biology.	No action planned.
Bushley Bk	0.5km ds of Horse Bridge to Mill Bk	RE3	RE2	Suspect intermittent farm pollutions, eutrophication and low flows.	To be investigated.
Pool Bk	B4209 bridge, Hanley Swan to R. Severn	RE4	RE2	Failure thought to be due to low flows.	Continue to monitor.
Pool Bk	Hanley Castle to B4209 br Hanley Swan	RE4	RE2	Due to a serious farm pollution incident.	Pollution prevention advice given.
Daniels Brook	U/S Brookthorpe to Glos./Sharpness Canal	RE3	RE2	This BOD failure only seems to occur in winter months. It may be due to intermittent farm pollutions	Carry out inspections to determine cause of pollutions

APPENDIX 6: NATIONAL AND EUROPEAN LEGISLATION

The Environment Agency's ability to act to maintain and, where necessary, improve the environment is dictated by National and European (EC) Legislation. The legislation imposes duties on the Agency that it must carry out. Other provisions take the form of powers that the Agency uses to fulfil its duties and meet its aims. Some of this legislation is supplemented by local or regional byelaws. This combination of duties and powers determines the broad allocation of effort and resource.

National Legislation

A summary of the most relevant legislation is given below:

- Contaminated Land Regulations
- Integrated Pollution Prevention and Control Act 1999
- Control of Major Accidents and Hazard (COMAH) Regulations 1999
- Producer Responsibility Obligations (Packaging Waste) Regulations 1997 (PROPWR97)
- Air Quality Regulations 1997
- Special Waste Regulations 1996
- Environment Act 1995 (EA95)
- Waste Management Licensing Regulations 1994
- Conservation (Natural Habitats, &c.) Regulations 1994
- Surface Waters (River Ecosystem Classifications) Regulations 1994
- Radioactive Substances Act 1993 (RSA93)
- Water Resources Act 1991 (WRA91)
- Land Drainage Act 1991 (LDA91)
- Water Industry Act 1991 (WIA91)
- Environmental Protection Act 1990 (EPA90)
- Town and Country Planning Act 1990 (TCPA90)
- Control of Pollution (Amendment) Act 1989 (COPA89)
- Police Act 1964 and the Police and Criminal Evidence Act 1984
- Wildlife and Countryside Act 1981 (WCA81)
- Salmon and Freshwater Fisheries Act 1975 (SAFFA75)

European Legislation

The Agency is responsible for enforcing some EC Directives. A directive is an item of legislation that is legally binding on Member States. However, Member States will ensure that a Directive is met through the introduction of national legislation. A summary of the most relevant directives is given below:

- Control of Major Accidents and Hazard (COMAH) Directive (96/82/EC)
- Dangerous Substances Directive (76/464/EEC)
- Freshwater Fisheries Directive (78/659/EEC)
- Surface Water Abstraction Directive (75/440/EEC)

- Bathing waters directive (76/464/EEC)
- Urban Waste Water Treatment Directive (91/271/EEC)
- Nitrate Directive (91/676/EEC)
- Groundwater Directive (80/68/EEC)
- Disposal of Waste Oils Directive (75/439/EEC)
- Adapting to Technical Progress Directive (94/62/EEC)
- Packaging and Packaging Waste Directive (94/62/EEC)
- Incineration of Hazardous Waste Directive (94/67/EEC)
- List of Hazardous Waste Directive (94/67/EEC)
- Habitats Directive (92/43/EEC)
- Framework Directive on Waste (91/156/EEC)
- Large Combustion Plant Directive (88/609/EEC)

APPENDIX 7: ENVIRONMENT AGENCY LEAFLETS AND PUBLICATIONS

Addressing the Causes and Effects of Climate Change	
Climate Change In The Garden (Water Tolerant Plants)	
Regulating Major Industry	
Regulating Major Industries	General Fact Sheet On Our Duties
Integrated Pollution Control – Introductory Guide	How to avoid it - pollution series
Integrated Pollution Control And You	Industry in Avonmouth – a public guide to pollution management
Improving Air Quality	
Solvent Pollution – How to avoid it.	
Managing Waste	
What A Waste	Duty Of Care
Special Waste Regulations – How They Affect You	New Packaging Regulations – How Do They Affect You?
Classification Of Special Waste	Producer Responsibility Obligations
Use Of The Consignment Note	The Registration Of Waste Carriers
Obtaining And Sending Consignment Notes	Clinical Waste
Waste Minimisation – An Environmental Good Practice Guide for Industry	Money For Nothing Your Waste Tips For Free
Waste Regulation And You	
Managing Water Resources	
Water Resources Fact sheet	Spray Irrigation
Water Wise Are You Pouring Money Down The Drain?	Making The Most Of Your Spray Irrigation Abstraction Licence
Water Abstraction Charges	Groundwater - Protecting The Hidden Asset
Water Abstraction Can Cause River Pollution	Groundwater Protection Zones
Abstraction Licensing And Water Resources	Policy and Practice for the Protection of Groundwater
Water Alert – Campaign For Water Conservation	Saving Water – on the right track
Dowdeswell Water – A New Lease Of Life For The Reservoir	
Delivering Integrated River-Basin Management	
Leaps – Severn Vale And Warwickshire Avon	Managing Maize
How To Avoid It Pollution Series	Masonry Bunds For Oil Storage Tanks
Farm Waste Management Plans	Pollution Prevent Pays
Farm Waste Minimisation	Nature's Way
Oil Care Code	What's In The Water
Pollution Prevention Guidelines (PPGs) 1-21	Water Quality Fact Sheet
Building A Cleaner Future	Bathing Water Quality
Water Pollution Incidents In England And Wales – Report Summary	Quality Of Rivers And Canals In England & Wales 1995
Recovering The Cost Of Pollution	Recreation Sites (Midlands)
Accreditation Scheme For Spill Response Contractors	Have Fun Have A Care – Information For Canoeists

Assessing Water Quality	Enjoy Your Garden - Care For Our Environment
Use Of Licences To Prevent Pollution	The Severn Way
Ground Water Protection Zones	The Severn Bore And Trent Aegir

Conserving the Land	
Flood Warning Information - What To Do If Your Property Is A Risk	Towards Urban Drainage Best Management Practice (SEPA)
Flood Warning Information Hotline 0645 88 11 88	Urban Redevelopment for Industrial And Commercial Uses
Schedule Of Main Rivers - Midlands Region	Protecting The Quality Of Our Environment - A Guide To Sustainable Development
Living On The Edge - A Guide For Riverside Owners	Defying The Disaster
Flood Defence Information Sheets 1 To 23	Safeguard The Environment - A Guide For Developers
Flood Defence Fact Sheet	Policy And Practice For The Protection Of Floodplains
Be Flood Aware (Poster)	Understanding Riverbank Erosion
Application For Consent For Works Affecting Watercourses And/Or Flood Defence - Explanatory Notes	Contaminated Land Remediation
Land Drainage Bye-laws	Environment Agency Policy Regarding Culverts

Managing Freshwater Fisheries	
Anglers And The Agency	Rod Fisheries Bye-laws
Rod Licences	Useful Information For Angling Clubs
Fishing Guide for Midlands Region	Fisheries Habitat Improvement
Fisheries News (produced monthly)	Environments For Fish
Buyers Beware - Your Guide To Stocking Fish	Water Plants Their Function & Management
Freshwater Fisheries & Wildlife Conservation - Good Practice Guide	Management Of Specialist Stillwater Coarse Fisheries
A Guide To Careful Salmon Handling	Salmon Management Strategy
Coarse Fisheries Strategy Consultation Document	River Severn Salmon Action Plan

Enhancing Biodiversity	
Rivers And Wetlands - Best Practice Guide	River Severn Otter Project
Conservation - Work In The Midlands Region	Ponds And Conservation
Mink	Pond Heaven - How To Create Your Own
River Sowe Rehabilitation Project	Identifying Freshwater Invertebrates
Conservation Designations	Blue-Green Algae
Guidance For The Control Of Invasive Plants Near Watercourses	Hormone Disruption In Wildlife
Wetland Creation/Management (3 Posters)	Phytophthora Disease Of Alder
Understanding Buffer Strips	River Life From Source To The Sea
Water Vole Conservation Handbook	Best Practice: Aquatic Weed Control Operation
Best practice: Disposal of Cut Vegetation	

Business Development	
Warwickshire Avon LEAP	Severn Estuary Strategy
Severn Vale LEAP	Planning & Acting For A Better Environment

An Environmental Strategy For The Millennium And Beyond	A Snapshot - Environment Of England And Wales – April 1996
Customer Charter	Complaints And Commendations
A Guide To Information Available To The Public	Partnership In Environmental Protection
Charging For Information	Recruitment Information
A Better Environment For England And Wales	Action Plans For Each Of The Above Themes
Emergency Hotline Card 0800 80 70 60	Environmental Services Directory
Corporate Plan Summary Annual Report And Accounts	Environmental Policy For The Agency's Own Activities
Agency Internet Site - Information Leaflet www.environment-agency.gov.uk	Managing Environmental Impacts Of The Agency's Own Activities
Viewpoints on the Environment	

Education	
Activity Book For Primary Schools	Environmental Research Challenge (CREST award scheme)
Earthworks Comic – 7 to 12 year olds	River Severn Newspaper Insert
The Living Water Pack (Key stages 2 & 3)	Education Resources Pack (Key Stages 1 & 2)
Pollution Prevention Pays Pack (Industry)	Building A Cleaner Future Pack (Industry)
Green Shoots – The Agency Education Strategy	Animal Masks

Regional and Area Facts	
Midlands Region Map	Our Midlands Environment
Midlands Environmental Reference Book	Area Maps And Fact Sheets
Severn Bore And Trent Aegir	Regional Review And Forward Look - Midlands
Environmental Issues In The Midlands	

MANAGEMENT AND CONTACTS:

The Environment Agency delivers a service to its customers, with the emphasis on authority and accountability at the most local level possible. It aims to be cost-effective and efficient and to offer the best service and value for money.

Head Office is responsible for overall policy and relationships with national bodies including Government.

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For general enquiries please call your local Environment Agency office. If you are unsure who to contact, or which is your local office, please call our general enquiry line.

ENVIRONMENT AGENCY
GENERAL ENQUIRY LINE

0645 333 111

The 24-hour emergency hotline number for reporting all environmental incidents relating to air, land and water.

ENVIRONMENT AGENCY
EMERGENCY HOTLINE

0800 80 70 60



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