RIVER TONE
CATCHMENT MANAGEMENT PLAN
CONSULTATION REPORT

NRA

National Rivers Authority
South Western Region
September 1995

Published September 1995

Awarded for excellence

The NRA and the Environment Agency

The National Rivers Authority will form the major part of a new organisation which will have responsibilities for the environmental protection of water, land and air. The new Environment Agency starts its work of managing the environment in England and Wales on April 1 1996.

FOREWORD

This Catchment Management Plan Consultation Report covers the River Tone and all its tributaries. These drain to it from Exmoor and the Quantock Hills in the west and north and from the Blackdown Hills in the south and east. The report also includes the Bridgwater and Taunton Canal.

This report describes the physical features and factors such as geology and climate for the catchment. In particular, we set out the NRA's vision for the catchment. We describe:

- the activities in the catchment which affect the water environment and the uses made of water;
- the NRA's objectives and targets for the water environment, described under four headings - water quality, water quantity, physical features and flood defence;
- the state of the catchment in relation to the four categories of objectives.

From this comparison we identify issues which need to be addressed by the NRA and others. These issues are intended to be the focus for consultation.

We recognize the pressure that development puts on the water environment. The County and District Planning Authorities, through the preparation of Structure Plans, Minerals Plans, Waste Local Plans, District Wide Local Plans and the planning control system have a major role to play in helping to safeguard the water environment.

The Tone river catchment lies in an area of growth where the public water supply already relies on water being imported into the catchment in order to meet demand. Future increases in demand are expected to be met by an increase in water imported from other areas. Other abstractions, for example for agricultural purposes, also put pressure on water resources. These are expected to continue. The increased population will also place additional loads on sewerage systems. There are major new road schemes under consideration and these have the potential to adversely affect the water environment. The NRA will seek early discussion on all new proposals so that possible impacts on the water environment can be fully evaluated.

The Tone Catchment covers a wide variety of landscape, from hills and narrow valleys in the upper reaches, to the flat land of Curry Moor and Hay Moor at the downstream end. These moors which are part of the much larger Somerset Levels and Moors, are used for agriculture and have considerable conservation interest. The limited capacity of the river downstream of Taunton inevitably means that the moors act as flood storage areas in times of high river flow. This report details the NRA's continuing commitment towards maintaining and improving flood defence management in the catchment.

The report indicates that while we have identified some sites with the potential for habitat improvement, and wetland sites which could be enhanced, our knowledge of the conservation value of many of the smaller tributaries is limited. We look forward to developing, in conjunction with other agencies, action plans to maintain the populations of rare or important species such as the otter, water vole and kingfisher, which will help to safeguard the biodiversity of the river.

This Consultation Report is the first stage in the catchment management planning process for the catchment and provides a framework for consultation. We invite your comments and welcome your views on our treatment of the Catchment. If there are omissions from the list of issues please let us know. After a three month public consultation period we will prepare an Action Plan based on the issues arising from the report and the public consultation.

CHRIS BIRKS
AREA MANAGER

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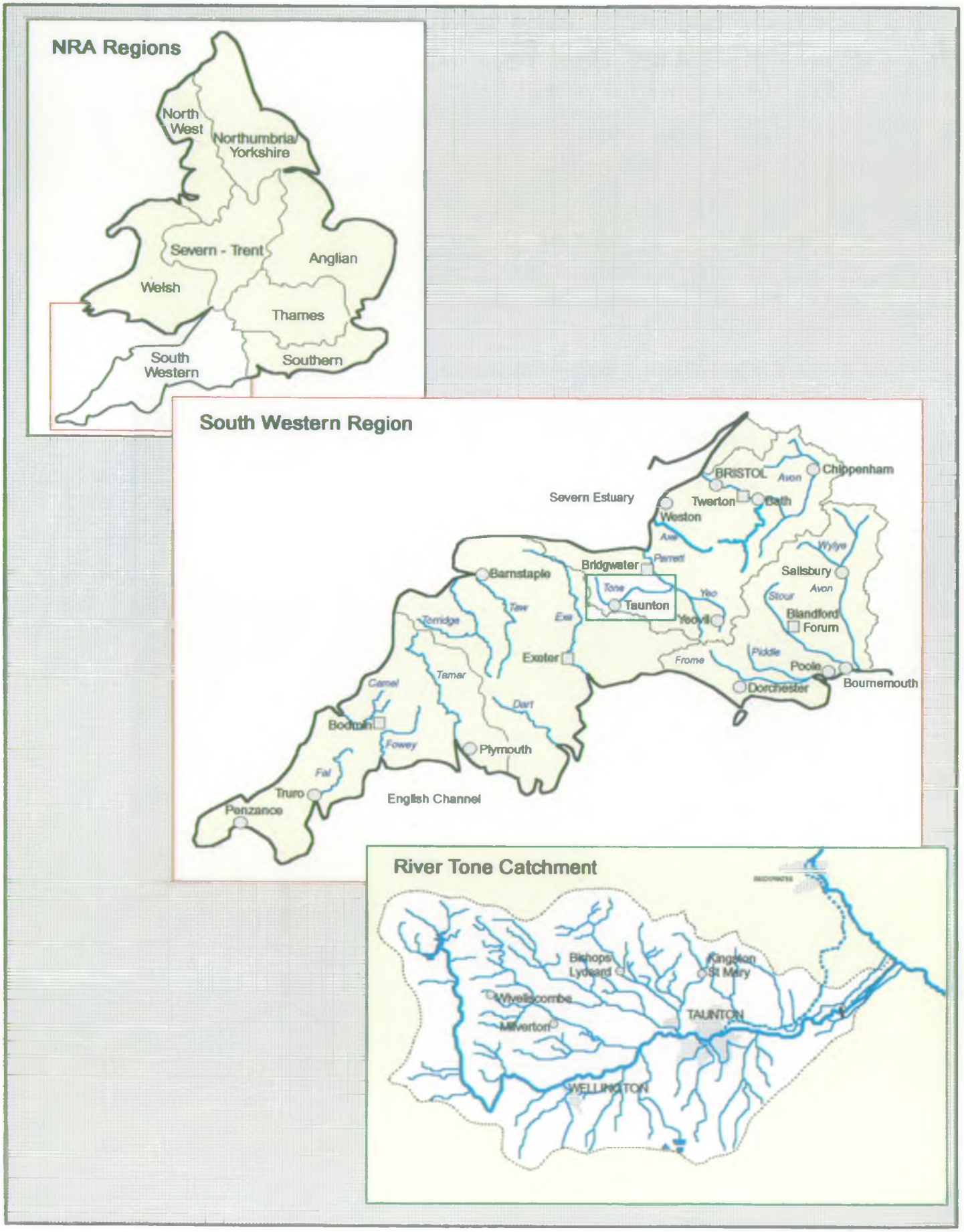


1 MISSION AND AIMS

The National Rivers Authority's (NRA) mission:

We will protect and improve the water environment by the effective management of water resources and by substantial reductions in pollution. We will aim to provide effective defence for people and property against flooding from rivers and the sea. In discharging our duties we will operate openly and balance the interest of all who benefit from and use rivers, groundwaters, estuaries, and coastal waters. We will be businesslike, efficient and caring towards our employees.

Our aims are to:

- Achieve a continuing overall improvement in the quality of rivers, estuaries and coastal waters, through the control of pollution.
- Manage water resources to achieve the right balance between the needs of the environment and those of the abstractors.
- Provide effective defence for people and property against flooding from rivers and the sea.
- Provide adequate arrangements for flood forecasting and warning.
- Maintain, improve and develop fisheries.
- Develop the amenity and recreational potential of inland and coastal waters and associated lands.
- Conserve and enhance wildlife, landscape and archaeological features associated with inland and coastal waters of England and Wales.
- Improve and maintain inland waters and their facilities for use by the public where the NRA is the navigation authority.
- Ensure that dischargers pay the costs of the consequences of their discharges, and, as far as possible, to recover the costs of water environment improvements from those who benefit.
- Improve public understanding of the water environment and the NRA's work.
- Improve efficiency in the exercise of the NRA's functions and to provide challenge and opportunity for employees and show concern for their welfare.

2 CATCHMENT VISION

- Most societies want to achieve economic development to secure a better quality of life, now and in the future.

- They also seek to protect their environment now and for their children.

Sustainable development tries to reconcile these two objectives - meeting the needs of the present without compromising the ability of future generations to meet their own needs.

To achieve this, judgements have to be made about the weight to be put on different factors in particular cases. Sometimes environmental costs have to be accepted as the price of economic development but on other occasions a site, or an ecosystem, or some other aspect of the environment has to be regarded as so valuable that it should be protected from exploitation. Such a site is the internationally important wetland - the Somerset Levels and Moors.

As Guardians of the Water Environment of the River Tone Catchment it is the role of the National Rivers Authority to present the case to protect the water environment from damage; sustaining and extending its environmental value and interest whilst commercial, industrial and recreational use continues to be made of it.

In an area of such high amenity and ecological value as the Tone the NRA's vision of the future is towards a catchment where:

- the aquatic biodiversity of the catchment is maintained and extended;

- improvements continue to be made to existing discharges, meeting the most stringent appropriate standards;

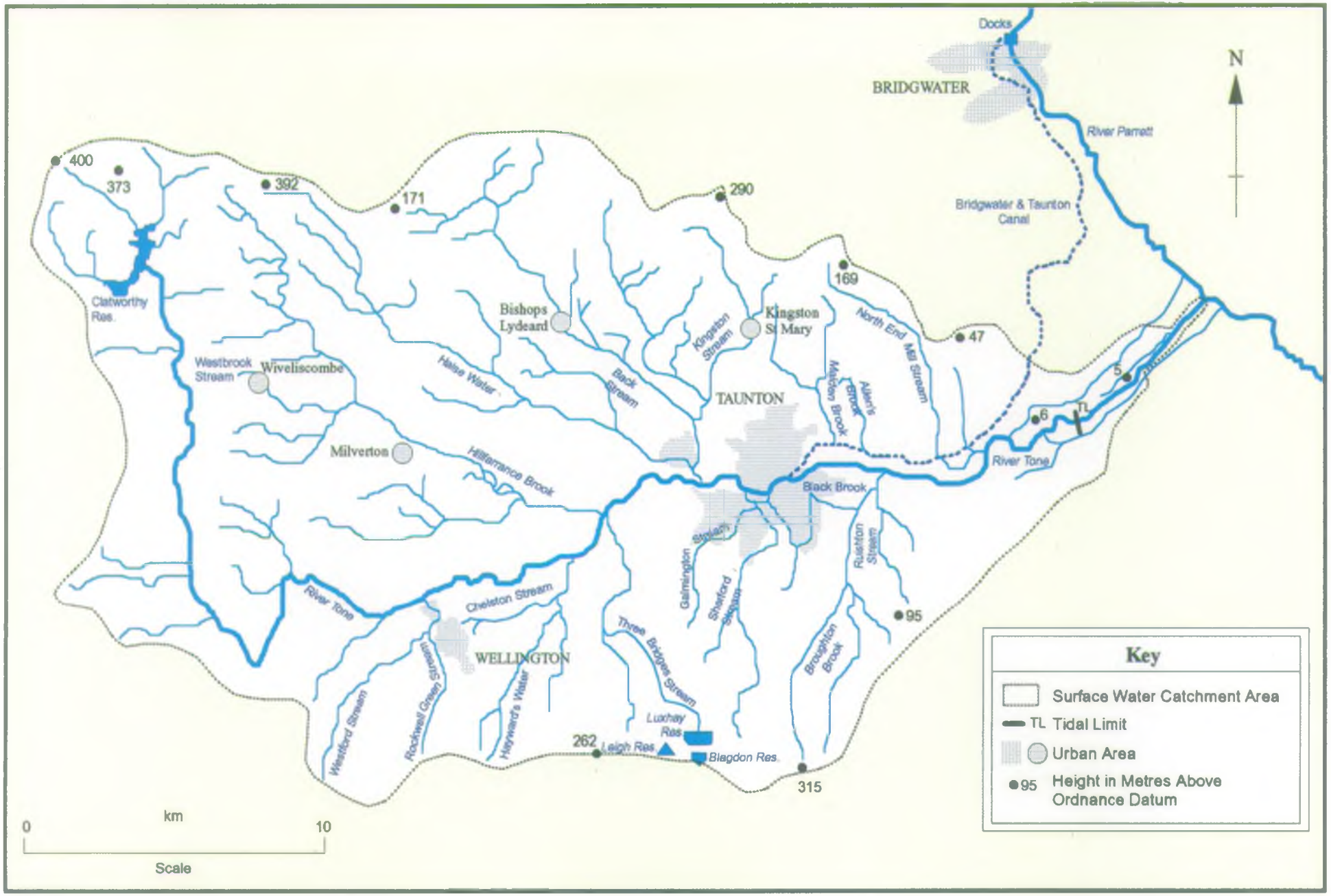
- the risk to the water environment from abandoned mine workings is eliminated;

- an agricultural and forestry system develops which reduces the risk of diffuse pollution and improves the physical habitat of the river system and wetlands for wildlife;

- the public's enjoyment and appreciation of the river system continues to grow;

- there is minimal risk to people and property from flooding.

Map 2 - The River Tone Catchment



Information correct as of June 1995

3 INTRODUCTION

This Catchment Management Plan Consultation Report:

- describes how the catchment is used;
- explains what we are doing to protect or restore the water environment.

Economic and political constraints will influence what we are able to do. For example, the amount of money that the water service companies spend on pollution control will make a difference to the extent of water quality improvements.

3.1 CATCHMENT MANAGEMENT PLANS AND DEVELOPMENT PLANS

While we can control some of the things which influence the quality of the water environment we have very little control over the way that land is developed. This is the responsibility of local planning authorities.

Local authorities prepare statutory development plans. The policies in these plans will guide the way that land is developed in the future. We advise and guide local planning authorities to encourage them to adopt policies which protect the water environment from harmful development. The NRA is a statutory consultee in the preparation of development plans in respect of flood defence issues and DoE Circular 30/92 states that planning authorities should always take account of flood defence considerations. Where we can we will reinforce these policies when we comment on planning matters or if we are making our own decisions.

This Report will highlight where we are concerned about development.

3.2 THE CONSULTATION REPORT

This Consultation Report includes the following sections:

Catchment Characteristics

Provides a brief and general introduction to the catchment describing its key characteristics.

Catchment Uses

In the catchment there are activities which use the water environment. They may either have an impact on, or have certain requirements of the water environment. These various activities are discussed under "use" headings. We include notes on our role and objectives in managing or promoting this use and comments on the local (catchment) perspective.

Targets and State of the Catchment

We assess the state of the catchment by looking at four aspects of the water environment:

- Water quality.
- Water quantity.
- Physical features.
- Flood defence.

We identify environmental quality targets where we can. Our success at reaching these targets is one way that we can comment on the state of the catchment.

Issues and Actions

Where we are not reaching targets or fulfilling our objectives we identify issues. Where possible we identify actions to resolve issues. This section summarizes these issues and proposed actions.

3.3 YOUR VIEWS

The River Tone Catchment Management Plan Consultation Report is the NRA's initial analysis of the issues facing the catchment. It is intended to form the basis for consultation between the NRA and all those with interests in the catchment.

We want to hear your views. You may wish to consider whether:

- we have identified all the issues;
- we have identified all the options for solutions;
- you have any comments on the issues and options listed.

If so, we would like to hear from you.

A Steering Group representing people and organisations with an interest in the catchment has been established to provide initial comments on the report. Comments arising from the Steering Group have been incorporated where possible and the NRA is extremely grateful for the useful suggestions received.

Comments on the River Tone Catchment Management Consultation Report should be sent in writing by 11 December 1995 to:

Alan Turner
North Wessex Area Catchment Planner
NRA South Western Region
Rivers House East Quay
BRIDGWATER Somerset TA6 4YS

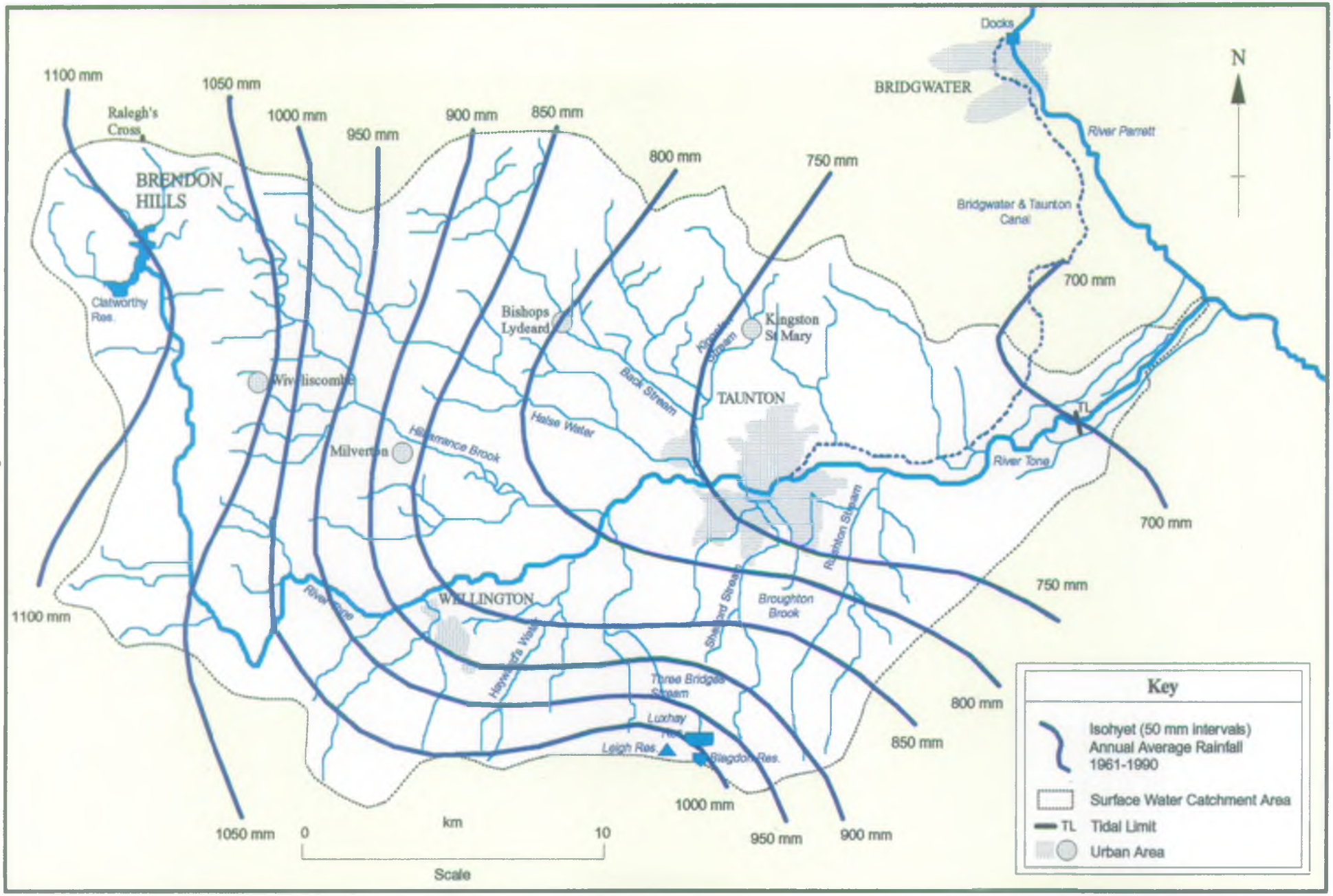
If you need further information please contact him at the above address or by telephone on 01278 457333.

This Consultation Report will not be rewritten.

3.4 THE ACTION PLAN

Following the consultation period all contributions received will be considered in preparing the next phase, the Action Plan. We will collate responses to this report and publish an Action Plan. Progress with the actions identified will be checked annually and a progress report published. Within five years of publishing the Action Plan we will do a major review of the progress we have made.

Map 3 - Distribution of Rainfall



Information correct as of June 1995

4.1 GENERAL

The River Tone Catchment covers an area of approximately 414 km^2 and has its source in the Brendon Hills near Ralegh's Cross. From its source to the confluence with the River Parrett it is about 33 km long and falls approximately 370 metres. Downstream of its origin, the Tone enters Clatworthy Reservoir. From the reservoir the river runs south towards the village of Greenham. It then does a U-turn, heading north for a short stretch, before turning east. The Tone skirts to the northern side of Wellington, then passes Bradford-on-Tone and Norton Fitzwarren, before entering Taunton. From Taunton, the river flows past Creech St. Michael, and becomes tidal at New Bridge Sluice before joining the Parrett at Burrowbridge.

The Bridgwater and Taunton Canal leaves the River Tone at Firepool Lock in Taunton. The canal enters Bridgwater at Hamp. Here, a weir allows excess water to run into the tidal River Parrett. Having passed through the outskirts of Bridgwater the canal ends at Bridgwater Docks, which it enters via a lock. The canal has an overall length of 24.5 km (approximately fifteen miles).

4.2 HYDROLOGY

The distribution of rainfall over the catchment is shown on the map opposite. The range varies from more than 1100 millimetres per year (mm/year) over the Brendon Hills in the west to less than 700 mm/year in the eastern lowlands. The catchment rainfall (1961-90 average) is estimated at 881.6 mm/year.

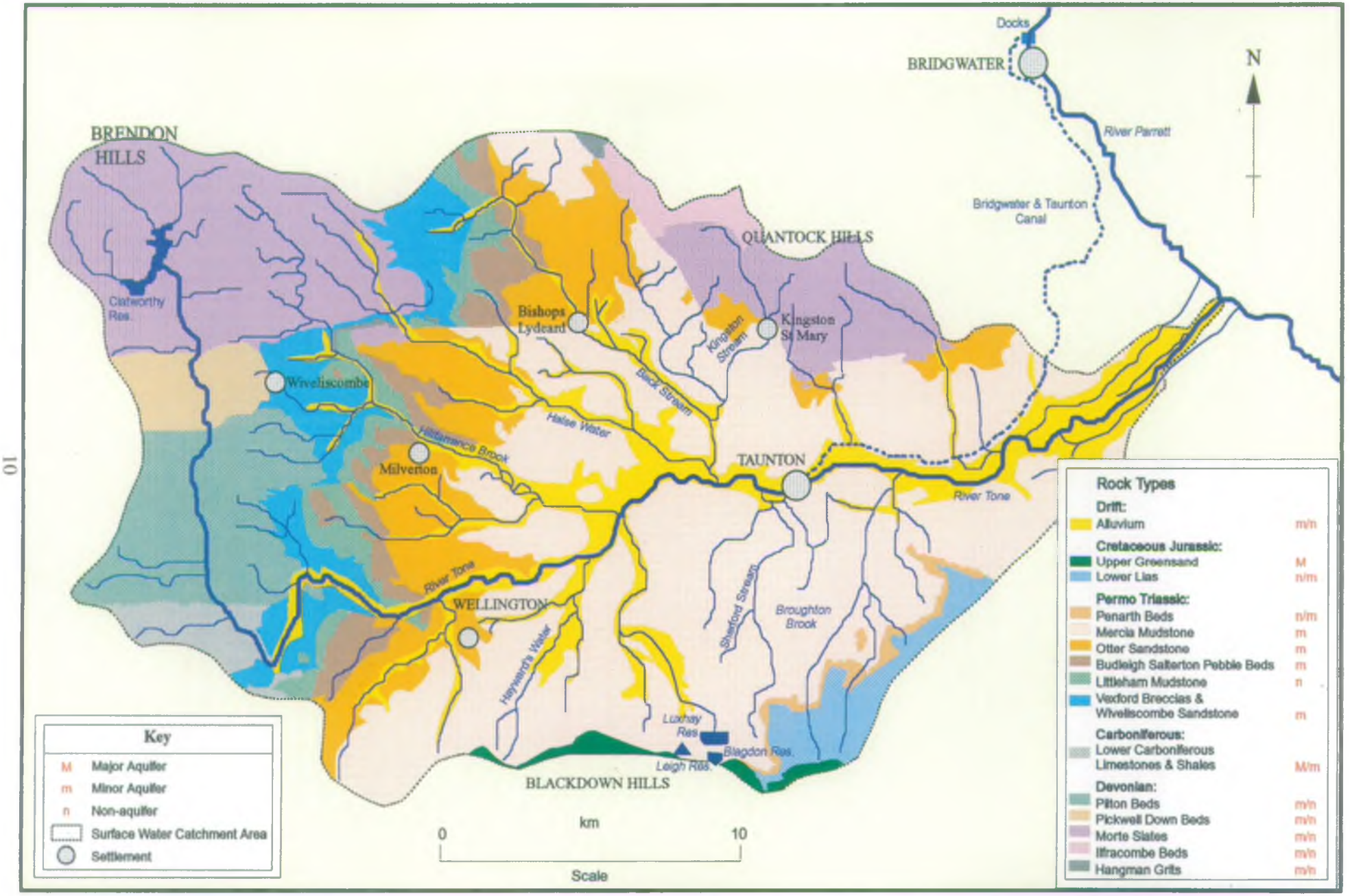
Discounting human influences the natural flow of water leaving the catchment is estimated at 411 million litres per day (Ml/d) on average. Looking down the river, on the left hand bank, the major inputs come from the Hillfarrance Brook and tributaries (58 Ml/d), and the Halse Water and tributaries (94 Ml/d). On the right bank the major tributaries are Haywards Water (20 Ml/d), the Three Bridges Stream Catchment and associated tributaries containing the Luxhay, Leigh and Blagdon reservoirs - (20 Ml/d), Sherford Stream (6 Ml/d), and the Broughton Brook (24 Ml/d).

During periods of low rainfall both surface water abstractions (see Section 5.13 Water Abstraction) and also discharges from major sewage treatment works such as Taunton (see Section 5.14 Effluent Disposal) have a significant effect on flows.

The relative impermeability of the rock underlying the catchment (see Section 4.3 Geology and Hydrogeology) has two major hydrological implications. Firstly, storm water runs off the land quickly and the river responds rapidly to rainfall. Secondly, baseflows are relatively small, and in dry weather river flows can reduce rapidly. Releases of compensation water from Clatworthy, and the smaller Luxhay reservoir, maintain low flows in dry periods. These reservoirs are not large enough to influence these rapid responses to rainfall except immediately downstream of the dams.

The water resources of the Tone Catchment are monitored using a network of four flow gauges, one river level gauge, three intensity and sixteen storage rain-gauges, and three groundwater observation sites. Maps detailing the monitoring network are provided in Appendices 11 and 12. Data from the network is stored mainly on computer systems at the NRA Area Office at Bridgwater, Somerset.

Map 4 - Geology and Hydrogeology



Information correct as of March 1995

4.3 GEOLOGY AND HYDROGEOLOGY

The geology and aquifer type are shown on the Geology and Hydrogeology Map - Map 4. The oldest rocks in the catchment outcrop to the north-east and west. Here, strongly faulted and folded Devonian (and Carboniferous) rocks form the southern and eastern extents of the Quantock and Brendon Hills respectively. They comprise thick sequences of hard sandstones, slates and shales, with subordinate limestone bands which are either non-aquifer or minor aquifers used for small, local supplies.

Later terrestrial deposits filled the basins both between the upland areas and further to the east. This Permo-Triassic sequence comprises sandstones, breccias, conglomerates and mudstones, often containing some limestone. Marine conditions returned with the deposition of thick Lower Lias marls (lime-rich mudstones) and clays. These now outcrop in the south below the Upper Greensand escarpment of the Blackdown Hills. Both the Permo-Triassic and Lower Lias rocks are non or minor aquifer.

Groundwater resources are available in two principal aquifers; the combined Otter Sandstone and Budleigh Salterton Pebble Beds aquifer and the combined Vexford Breccias and Wiveliscombe Sandstones aquifer (see Geology and Hydrogeology Map - Map 4).

Groundwater flow in these aquifers can be by both fissure and intergranular mechanisms, and they provide several public water supply spring and borehole sources.

The Upper Greensand also forms an important aquifer but is severely limited in outcrop within the catchment. It does, however, provide the source of many of the Tone's southern tributaries draining from the lower slopes of the Blackdown Hills.

Elsewhere within the catchment small local groundwater supplies may be obtained from fissures in the older, harder rocks, in thin sandstones in the Mercia Mudstone, and in River Valley Alluvium (sands, silts and gravel). Alluvial groundwaters are shallow and in hydraulic continuity with river water, and are vulnerable to pollution.

4.4 SOILS

The most widespread rock formation in the catchment, the Mercia Mudstone, also provides the most fertile soil. This mudstone weathers to a moisture-retaining lime-rich clayey loam that provides excellent dairy pasture and arable land (see Section 5.11 Farming for impact of different farming methods on the river environment). The other mudstones in the catchment, the Lower Lias clay and the Littleham Mudstone, also provide clayey loamy soils ideal for grassland.

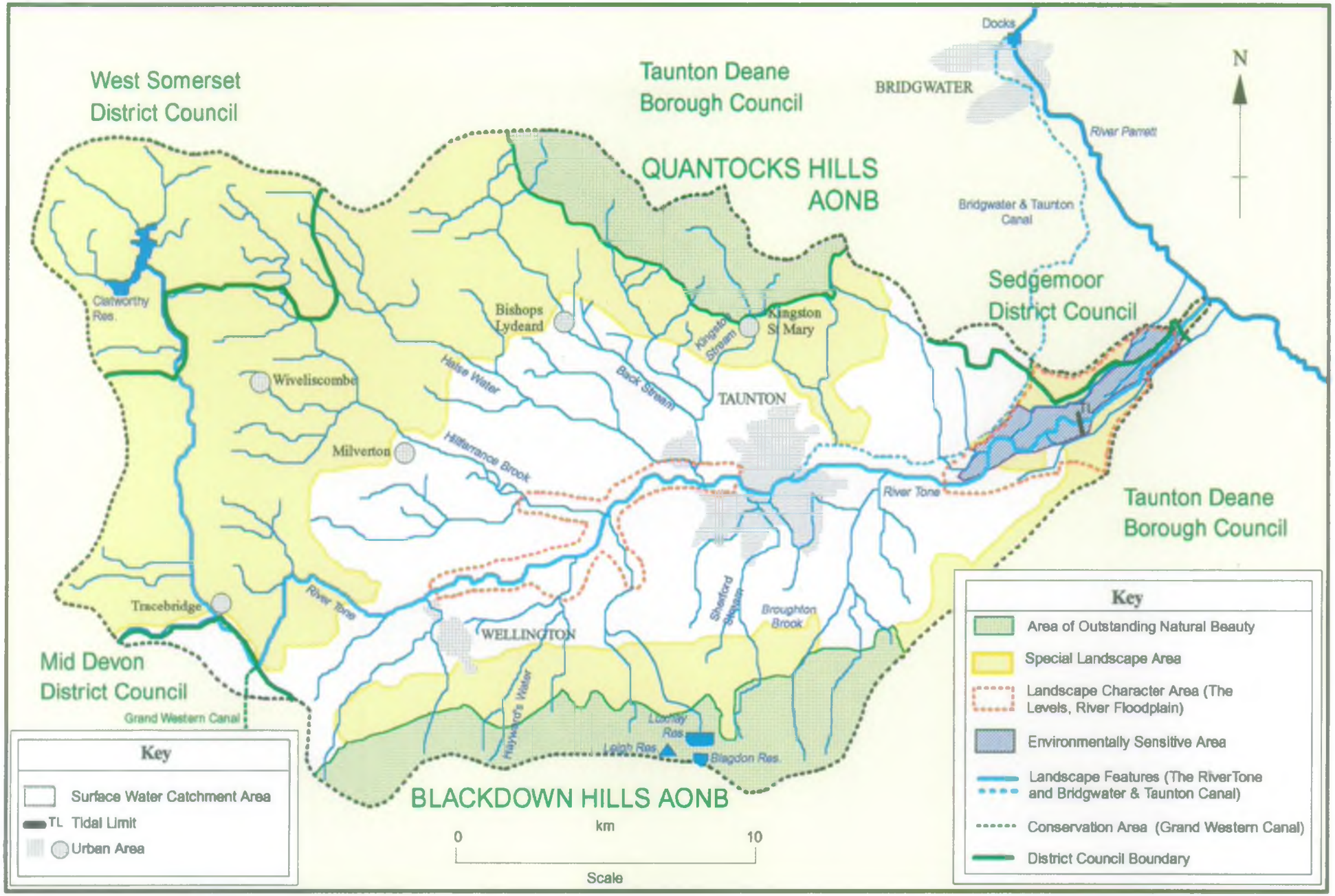
The breccia and conglomerate beds create free-draining stony sands suitable for pasture, whilst the sandy soils of the Wiveliscombe and Otter Sandstones can support cereal and root crops especially potatoes.

The slates of the Quantock Hills are covered by acid soils with poor drainage that are only suitable for sheep and cattle grazing.

4.5 POPULATION

The largest settlement in the area is Taunton, the County Town which with its immediate sub-urban area had a population of approximately 54,000 in 1991. Wellington is 6 miles to the west (population 11,300 in 1991). The total resident population of the catchment in 1991 approximated 91,600 and by 1995 the population is estimated to be 96,000.

Map 5 - Designated Areas



Information correct as of June 1995

5.1 LANDSCAPE, WILDLIFE AND ARCHAEOLOGY

We consider here how we protect and manage the natural environment and the historic built environment associated with rivers and wetlands.

Our Objectives

To ensure that these features are not degraded through neglect, mismanagement, or insensitive development and wherever we can we take measures to enhance them.

The Role of the NRA

Legislation tells us what we can and can't do to regulate work in rivers and floodplains. An important part of our work is to influence land use planners and land managers to look after rivers and wetlands sensitively.

We have duties and powers to:

- conserve and enhance landscape, wildlife and natural features especially in rivers and wetlands;
- protect and conserve buildings, sites and objects of archaeological, architectural or historic interest.

Our work involves a range of activities:

- We study river and wetland wildlife and we are developing better methods for doing this.
- We are developing standard ways of reviewing the effects of our work on wildlife.
- We are establishing a national database to store wildlife information.
- We are improving the way we consider and carry out Environmental Assessments.
- We encourage local planning authorities and developers to promote wildlife conservation on rivers and wetlands and we encourage the development of new river management techniques.

Local Perspective

Landscape

The designated landscapes in the catchment are shown on the Designated Areas Map - Map 5. They are: the Quantock Hills Area of Outstanding Natural Beauty (AONB), Blackdown Hills AONB, the Special Landscape Areas of the Brendon Hills, the Quantock and Blackdown Fringes and part of the Somerset Levels. In addition the river valleys of the Tone and its tributaries are valuable components of these landscapes, providing semi-natural corridors throughout the area.

The Tone is a river of great contrasts. Its valley landscapes vary in character from the steeply wooded sections in the fast flowing headwaters of the catchment, through the extremely mobile and meandering channel of the middle reaches, with a sudden transition to the slow and deep impounded and embanked section downstream of Taunton.

The river has been controlled and modified throughout its length. The headwaters are now dammed to store water for public water supply; and various weirs and leats were constructed to provide power for mills, although most of these are now disused. The mills vary in scale from the smaller ones constructed for agricultural purposes, to the immense semi-derelict industrial mill buildings of Wellington which bear witness to the decline of the wool textile industry. Walls control the river through Taunton, limiting flooding in the town. Downstream on the open and flood prone moors, intensively managed earth embankments define and contain the course of the river.

A major overhead pylon line and a telephone line detract from the landscape for seven miles of river valley between Runnington and Taunton.

Future changes most likely to affect the value and character of the landscape are increasing agricultural intensification (principally a change from pasture grassland to arable cultivation), increasing urbanization and changes in river management.

Wildlife

The Tone is classified as a typical upland sandstone stream, with well-developed and relatively species-rich fringing herbaceous vegetation throughout the upper and middle reaches, (River Plants, Haslam 1978). Downstream of Taunton there is a sudden transition as the river enters the open floodplain. The marked decrease in velocity and increase in siltation is reflected in the change in aquatic plant communities to those species more tolerant of eutrophication (see Glossary Appendix 15). The Tone was historically used as a source of power for the milling industry and has been modified and impounded throughout its length forming deeper slower flowing sections which again cause a change in aquatic vegetation.

The upper reaches of the Tone are characterized by a relatively shallow, fast flowing and heavily shaded stream over bedrock or gravel substrate. Water crowfoot and water starwort are the principal aquatic plant species, and the river is frequented by dippers. The river is lined with trees, many of which have exposed root systems and add considerable organic debris to the system. The steep sided valley is wooded in parts, the principal land use being permanent pasture grazed by cattle and sheep. The topography is too varied for intensive agriculture, and the valley bottom fields tend to be small and wet with tussocky vegetation. There are six wetland County Wildlife Site (CWSs) but no wetland Sites of Special Scientific Interest (SSSIs) in the upper reaches.

From Tracebridge to Taunton channel movement is evident in the relatively wide river corridor where old oxbows or meanders now support willow scrub and tall herbs, providing excellent cover for otters. Himalayan balsam often forms single species stands in these locations. The lack of intensive river maintenance is also a factor in the formation of channel features, as trash dams and organic debris cause the formation of shoals and islands, and help to vary channel width and depth. A further important function is the holding back of flood water in these upper reaches and the slowing of flow. These different channel features provide a variety of habitat resulting in diverse wildlife.

Much of the floodplain is now agriculturally improved grassland, although remnants of wet marshy grassland and scrub do occur, most notably the Somerset Wildlife Trust Rewe Mead and Payton Marsh nature reserves at Harpford. These are extremely important reservoirs

for wetland species, which could provide a model and seed bank for future restoration work along the Tone.

Major flood defence works through Taunton have greatly modified the river, with realigned sections, embankments and training walls. In the past, development has been allowed up to the rivers edge in many places. The result is that some sections have virtually no wildlife habitats and in others the habitat diversity is drastically reduced. Regular maintenance work is now needed to prevent woody growth from damaging structures and reducing flood capacity through the town. This work has to be sensitively planned due to the use of the river by otters.

Downstream of Taunton, the Tone is wide, deep and slow flowing within a fixed channel defined by fairly uniform flood embankments. Variation in channel shape is lacking, with few areas of trees and shrubs. Consequently, there is a luxuriant growth of channel vegetation. The banks are regularly flailed and an annual weed cut is carried out. This limits the wildlife value of this section of the Tone.

Curry and Hay Moors SSSI act as flood storage areas to protect both Taunton and Bridgwater in times of extreme winter flood. The Moors were designated as SSSIs for their internationally important communities of wetland plants and animals in the rhynes and ditches; for breeding and wintering bird species; the wet grassland habitats and withy beds. These features are all dependant on sympathetic water level management. The details of NRA policy can be found in our Somerset Levels and Moors Strategy document (see Appendix 16), whereby the NRA recognizes the decline in wildlife interest and seeks to promote positive water level management to enhance the nature conservation value of the Levels and Moors.

A further issue is the quality of the water which feeds into the Moors. The Tone acts as a summer feed for Curry and Hay Moors, North Moor, Salt Moor and Stan Moor SSSIs all of which support nationally important species of flora and fauna. The water quality of the lower Tone is relatively poor and may be responsible for the recently observed reduction in the occurrence of notable species and increase in plant species which are adapted to eutrophic conditions (such as filamentous algae and enteromorpha), though this has not been investigated (see Section 6.1 State of Catchment Water Quality).

Tributaries

The NRA holds very little information on the conservation value of the many tributaries of the River Tone, as most are not main river and have therefore not been surveyed.

The Hillfarrance and Halse Water are largely semi-natural rivers which drain predominantly rural areas. They are fast flowing and heavily shaded by alders which line the banks. The lower reaches of Hillfarrance Brook have been altered by the recent construction of a golf course, which has resulted in several impoundments and removed much of the bankside vegetation.

The Brook is also adversely affected by abstraction and the river all but dried up in 1976, a particularly severe drought year. However, it is interesting to note that in the drought year of 1990 flows remained healthy (see Issue 12 - Water demand for spray irrigation). There are two wetland SSSIs and two CWSs associated with the Hillfarrance Brook, and two

wetland CWSs on the Halse Water (see Designated Sites of Special Scientific Interest and County Wildlife Sites Map - Map 6, page 19).

The tributaries flowing from the Blackdown Hills are relatively small and meandering rivers, heavily lined with trees and shrubs, and fast flowing over cobbly substrate, but with low dry weather flows. The rivers and associated vegetation are particularly valuable landscape features, contributing to the enclosed and well-treed feel of the area. The predominant land use is improved grassland and arable, and the catchment is essentially rural.

Sections of the Broughton Brook have been designated as a CWS, but the river is impacted upon by intensive farming, and was degraded by engineering works at the downstream end when the M5 was constructed.

Designated areas

There are four wetland SSSIs in the catchment: Holme Mead at Milverton, Langs Meadow at the confluence of the Hillfarrance and the Tone; Luxhay Reservoir; and Curry and Hay Moors (see Designated Sites SSSI and CWS Map - Map 6).

Wetland County Wildlife Sites are more numerous, particularly at the headwaters of the Blackdown tributaries and around Wellington. The River Tone and the Bridgwater and Taunton Canal are County Wildlife Sites, as are sections of the Broughton Brook.

The low number of wetland sites indicate that the vast majority of this catchment has been fairly effectively drained to enable more intensive agriculture. Those wetland habitats which remain, clearly require active conservation and positive management for nature conservation. The promotion of schemes which aim to restore floodplain habitats and create buffer zones adjacent to rivers would contribute towards the restoration of the conservation interest associated with the Tone catchment (see Section 6.3 Physical Features, page 109).

Rare species and County Notable Species

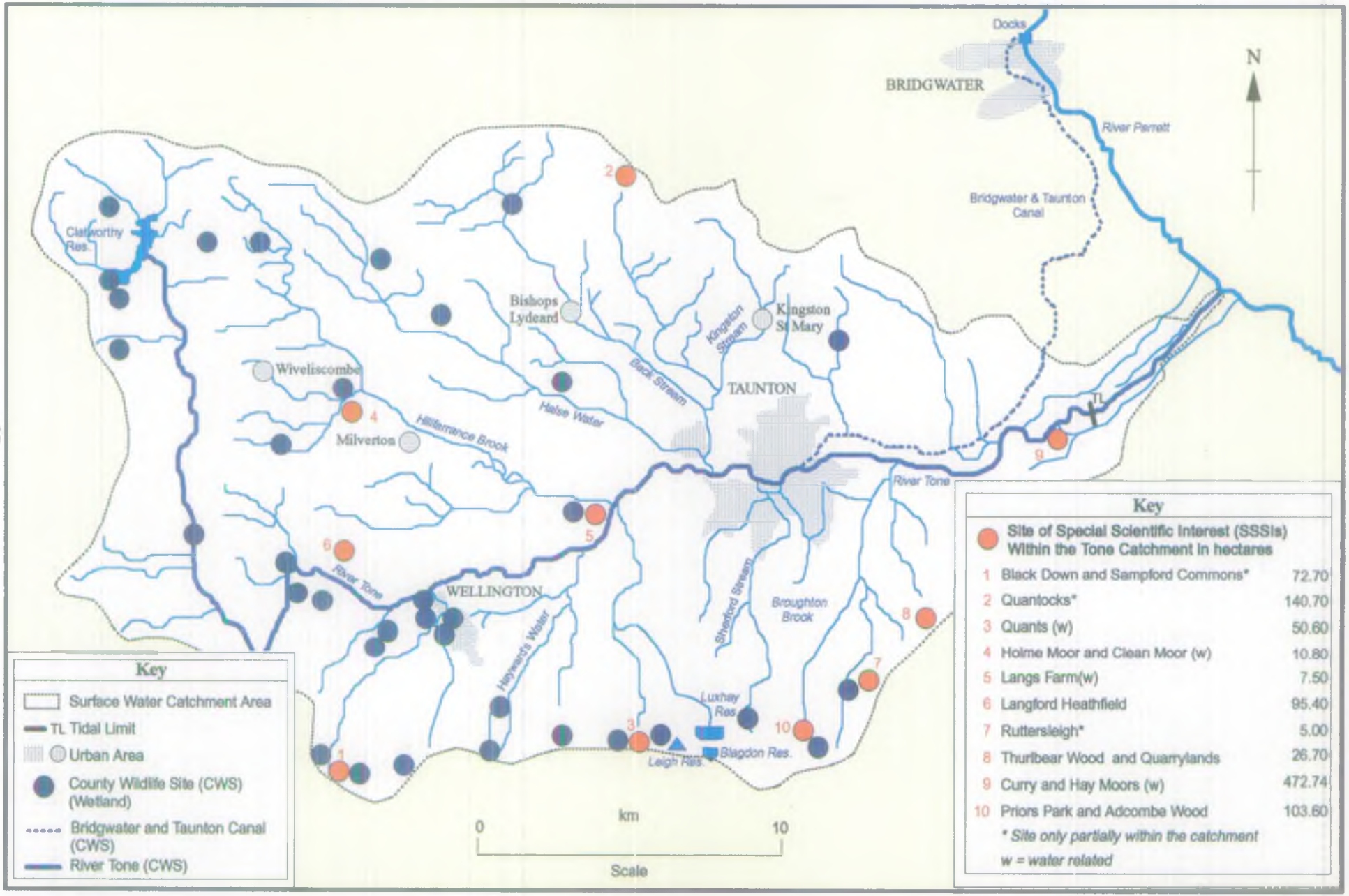
The River Tone and its tributaries are fairly typical rivers, therefore it is perhaps not surprising that few rare species occur within the catchment. Little is known about the status and distribution of some of these species.

Wetland birds listed on Schedule 1 of the Wildlife and Countryside Act 1981 (specially protected at all times) include the kingfisher, which breeds in steep eroded cliff-like banks. The Tone supports the greatest concentration of kingfishers in Somerset. Other notable bird species include important breeding populations of dippers, grey wagtail and heron; with little grebe, reed warbler and reed bunting also recorded in the catchment.

Curry and Hay Moors SSSI attract large flocks of wintering birds when flooded, and hold internationally important numbers of Bewick Swans, wigeon, teal and pochard in winter. The rare click beetle *(Synaptus filiformis)* occurs in areas near the confluence with the River Parrett. This is one of only a handful of locations for this insect in the UK.

The native white-clawed crayfish (*Austropotamobius pallipes*) occurs locally, and the catchment has been declared a Ministry of Agriculture, Fisheries and Food (MAFF)/English

Map 6 - Designated Sites of Special Scientific Interest and County Wildlife Sites



Information correct as of June 1995

Nature (EN) "no go" area for crayfish farming in an effort to prevent infection of the system by crayfish plague (see Section 5.2 Fisheries, page 23). Sadly however, some signal crayfish populations have recently been found in the catchment so the demise of the native crayfish is inevitable.

Plant species of note include fringed water lily (*Nymphoides peltata*), flowering rush (*Butomus umbellatus*), shining pondweed (*Potamogeton lucens*) and common reed (*Phragmites australis*). Corky fruited water dropwort (*Oenanthe pimpinelloides*) is recorded on Curry and Hay Moors and the rare sweet flag (*Acorus calamus*) was introduced at Nynehead. The rare grass (*Leersia oryzoides*) is recorded from the Bridgwater and Taunton Canal.

The Taunton Deane area is thought to be of national importance for the rare Black Poplar, with over 180 recorded specimens in Taunton Deane Borough Council's (TDBC) survey of 1994. These occur principally as mature to over-mature trees, many of which have been pollarded in the past, clustered around Bradford-on-Tone and along the tributaries, particularly on the slopes of the Blackdown Hills.

Somerset supports one of the highest otter populations in the South Western Region and the Tone is recognised as a stronghold within the county. Under the NRA otter strategy, this catchment is considered within the management action category: "monitor and protect existing stronghold by:

- ensuring current management practices maintain suitable conditions
- low-level monitoring of otter distribution"

Concern has been expressed that pesticides and heavy metals may be entering the food chain and could be having an effect on otters (see Section 6.1 Water Quality).

Invasive species

Himalayan balsam has become established and is a dominant component of the bankside flora in the middle reaches of the Tone. Japanese knotweed was recorded in one location during the 1994 River Corridor Survey.

Archaeology

The catchment area of the Tone encompasses a wealth of archaeological remains dating from Mesolithic times. A small proportion of this resource is protected as Scheduled Monuments but a lot still remains to be discovered especially in the lower Tone valley where the evidence is hidden under deep deposits of clay and peat.

Traces of early hunter gatherer societies are limited to small collections of flint tools. The advent of farming in the Neolithic is also mainly represented by isolated finds of flint and stone axes rather than evidence of settlement sites. One important hoard of several axes and over 100 arrowheads was found at Quaking House, Milverton.

The first known settlements occur in the area in the Bronze Age with pottery discovered from an enclosure at Norton Fitzwarren. However, it is still the evidence of isolated finds

and hoards of metalwork that provide the most evidence of activity from the period. A wealth of torcs, bracelets, pins and axes has come from such sources which are concentrated in the river valley, and metalwork produced in the Tone valley was exported into Dorset and Wiltshire.

In the Iron Age the best evidence for activity is derived from defended hillfort sites, notably Norton Fitzwarren, Clatworthy Camp, and the unfinished enclosure at Elworthy Barrows. Very little is known about activity lower down in the river valley.

During the prehistoric period much of the Tone valley below Taunton was a wetland reflected in the build up of peat deposits which are over four metres deep on Curry Moor and almost five metres thick on Stan Moor. This long narrow wetland would have been a barrier to communication and may therefore have been crossed by wooden trackways similar to those known further north in the Brue valley. Settlements may also have occurred here similar to those known from Glastonbury and Meare.

Little is known in the catchment from the Roman period in comparison to the wealth of evidence from the rest of Somerset. No roads or villas have been found but numerous large and small settlements testify to the agricultural wealth of the area.

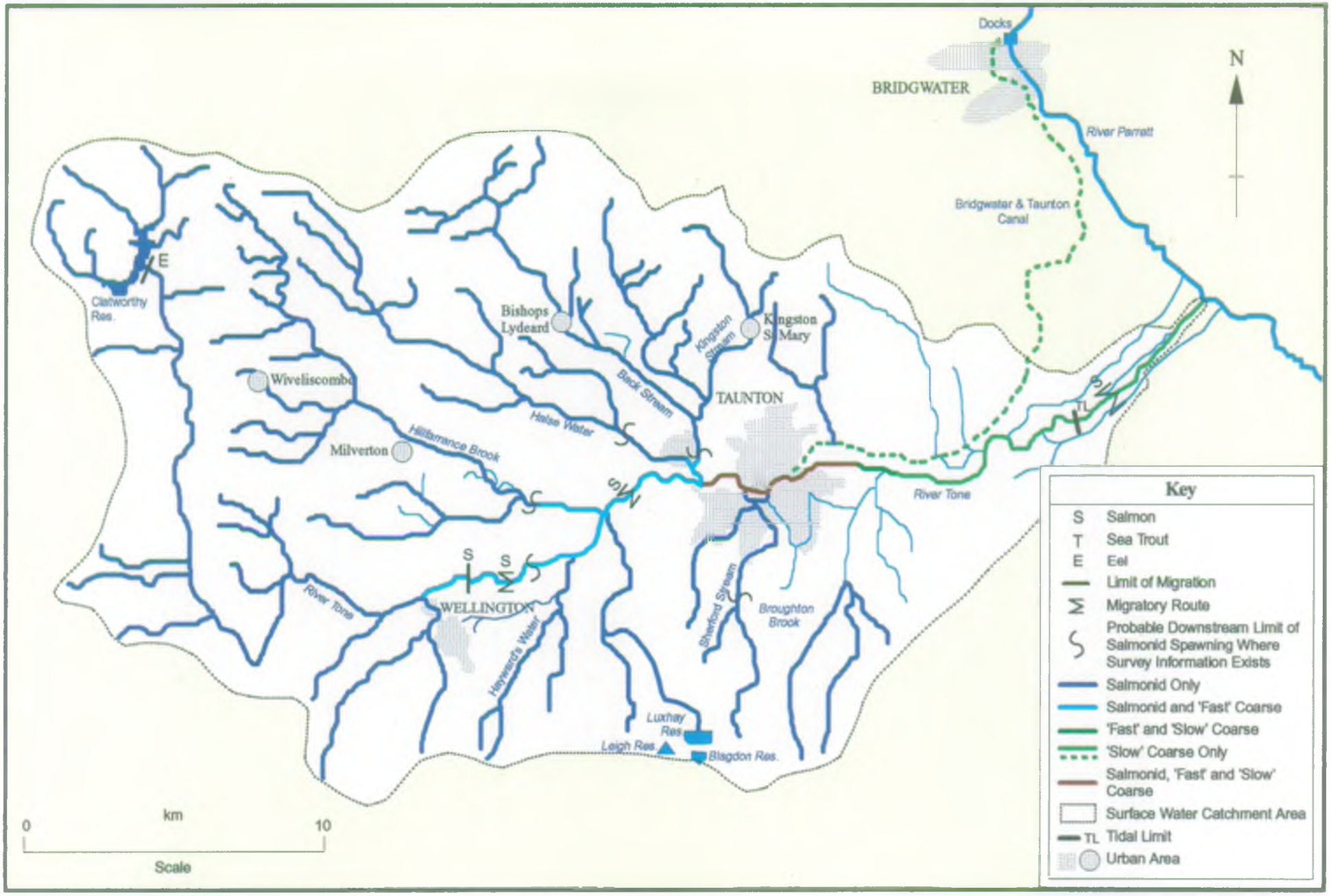
Evidence for most of the settlements which exist today can be seen in early Anglo-Saxon charters and in the Domesday records. Taunton was an early important urban and ecclesiastical centre with its own mint and Milverton was an important market centre. Saxon forts were also constructed at Athelney and Lyng and were connected by a wooden bridge. Athelney was also an important monastic centre with an Abbey thought to have been founded by King Alfred.

In the Medieval period several deserted settlement sites are known from the higher reaches of the catchment while some moated residences occurred lower down in the valley. Wellington, Wiveliscombe and Milverton were all towns but the major urban centre was at Taunton where the present town centre site developed in the twelfth and thirteenth centuries.

The Tone itself was an important Medieval communication route with boats bringing goods as far up as Bathpool just before Taunton. The waters were also harnessed to power numerous mills for grinding corn and fulling (wool/woollen cloth washing), and several fisheries existed on the river as early as the eleventh century, with eels being the main catch. Artificial weirs or 'gurgites' were employed in several places for fishing, often causing problems in times of flood.

The course of the Tone was considerably altered during this time from as early as 1154 AD when Balt Moor wall was built to prevent flooding of Higher Salt Moor. The course of the river was straightened in several places especially in the fourteenth and fifteenth centuries in attempts to reduce flooding and reclaim the wetlands. The result of this activity is several sinuous relic river channels such as Hay Moor Old Rhine, the watercourse followed by Crooked Drove, and the dry depression running through fields to the south of Athelney. Such former river channels could preserve evidence of fisheries, river craft, mills, bridges, and at their edges examples of early medieval flood defences, revetments and small rural landing places.

Map 7 - Fishery Type



Information correct as of June 1995

5.2 FISHERIES

Here we consider the conservation of river fish and their habitats together with the regulation of fishing by rod and line (angling) and by other methods.

Our Objectives

The NRA has are two principal objectives. The first objective is the protection of stocks of fish by:

- maintaining river bed and bank side diversity;
- maintaining adequate flow and depth;
- maintaining adequate water quality;
- maintaining the free passage of fish within a river system.

Wherever and whenever possible the NRA will work to enhance all the above to improve fisheries.

The second objective is the regulation of fishing using a licensing system and appropriate legislation and bylaws:

- to permit angling using responsible methods;
- to limit the exploitation of salmon, trout, eel, pike and grayling fisheries;
- to prevent the removal of all freshwater fish other than the above.

The NRA works to achieve these objectives by:

- undertaking fisheries survey work to assess what fish are present and in what numbers and to look for changes in populations over time and from place to place;

- examining the fisheries implications of NRA flood defence and other works;

- examining the fisheries implications of flood defence works undertaken by Drainage Boards and District Councils on non-main river (see Glossary Appendix 15). Under the Land Drainage Act these drainage authorities must have due regard to the interests of fisheries and must not prejudice or affect the NRA's duty to maintain, improve and develop fisheries;

- examining the fisheries implications of land drainage and discharge consents, abstraction applications and planning applications where these have been passed to the NRA for comment.

The NRA will, where appropriate, seek to incorporate measures to maintain or improve fisheries as part of its other works or as a condition imposed in granting a licence or consent by:

- making by-laws with the approval of MAFF to suit the local situation and support the aim of primary legislation;

- enforcing legislation and prosecuting offenders to prevent illegal angling and fishing.

To assist in achieving these objectives the NRA consults widely with anglers, fishery owners and others with an interest in fisheries. Some of this consultation is formal at both Regional and Local (Area) Fisheries Advisory Committees.

In carrying out the fishery objective the NRA works to ensure that there is no conflict with its other duties including its duty to further nature conservation.

The statutory role of the NRA

There are several statutes which define the fisheries role of the NRA. These include the Water Resources Act 1991, the Salmon Act 1986, the Salmon & Freshwater Fisheries Act 1975 and the Diseases of Fish Act 1937.

These statutes give the NRA duties and powers to maintain, improve and develop salmon, trout, freshwater fish and eel fisheries, and also to:

- establish and maintain fishery advisory committees;
- regulate fishing by a licensing system;
- prevent fishing by illegal methods;
- operate and enforce close seasons;
- maintain and improve the passage of migratory fish;
- prevent the sale of unclean and illegally taken fish;
- control the movement, introduction and removal of fish.

Local Perspective

EC Freshwater Fish Directive

Under the EC Freshwater Fish Directive (see Appendix 2) various stretches of water have been designated as suitable for supporting salmonids or cyprinids (see Glossary Appendix 15). These stretches are monitored for compliance with defined water quality criteria. (See Section 6.1 EC Directive Monitoring Map - Map 22, page 95).

Fish populations

Fish are good indicators of the overall health of our rivers. We use special survey equipment and information from catch returns, counters and fish traps to assess the health of fish populations.

The overall pattern of fish distribution in the River Tone Catchment is shown in the Fishery Type Map - Map 7, page 22.

Most of the Tone tributaries and the River Tone itself above Taunton are salmonid streams with a structure of alternating riffles and pools (see Glossary Appendix 15) and a resident self-sustaining population of brown trout. These streams also contain bullheads, stoneloach, brook lamprey, minnows, sticklebacks and eels though the distribution of these species varies. Most trout over one year old live in the pools but the riffle areas provide important cover for young trout, other fish and their invertebrate prey. Riffles are also used for spawning by salmonids which bury their eggs in gravel.

Some salmon enter the Tone and in 1994 a few salmon parr were found at Nynehead indicating that successful natural spawning had occurred.

Between Wellington and Taunton on the Tone, and in the lower reaches of the Hillfarrance Brook and the Halse Water brown trout live in association with grayling, dace, chub, minnows, stoneloach, bullhead, sticklebacks, eels and occasionally roach and pike. There is little evidence of successful trout spawning and there is a history of considerable brown trout stocking. Grayling were introduced to the river in this century and, based on the distribution of juveniles, spawn successfully in the lower reaches of the Hillfarrance Brook and Halse Water.

From just above Taunton through the town to Bathpool the river has been artificially constrained or realigned for flood defence reasons. In this reach the substrate (see Glossary Appendix 15) of the river is still diverse and almost every species of commonly occurring river fish occurs. Areas of the river with a stony substrate are likely to be used for spawning by dace and chub which both produce sticky eggs which adhere to the stones.

Below Bathpool the river follows a less artificial course though it is highly managed for flood defence with regular weed cutting and dredging (the dredging is not necessarily annual). The lower freshwater reaches and the tidal part of the river are contained within raised flood banks. In these lower reaches the Tone is a typical lowland coarse (see Glossary Appendix 15) fishery where the principal fish include roach, bream, pike, perch, tench, rudd, carp, dace, chub, gudgeon and eels. It is likely that the sunbleak recently discovered in the Bridgwater and Taunton Canal will have found its way into the Tone. Most of these lowland fish species spawn among plants depositing sticky eggs on submerged vegetation which grows abundantly in the lower Tone.

At Bathpool a small tributary of the Tone is believed to hold a small population of the rare spined loach.

In the tidal reach of the river downstream of New Bridge sluice freshwater fish may be found side by side with estuary fish such as mullet, flounders and occasionally bass.

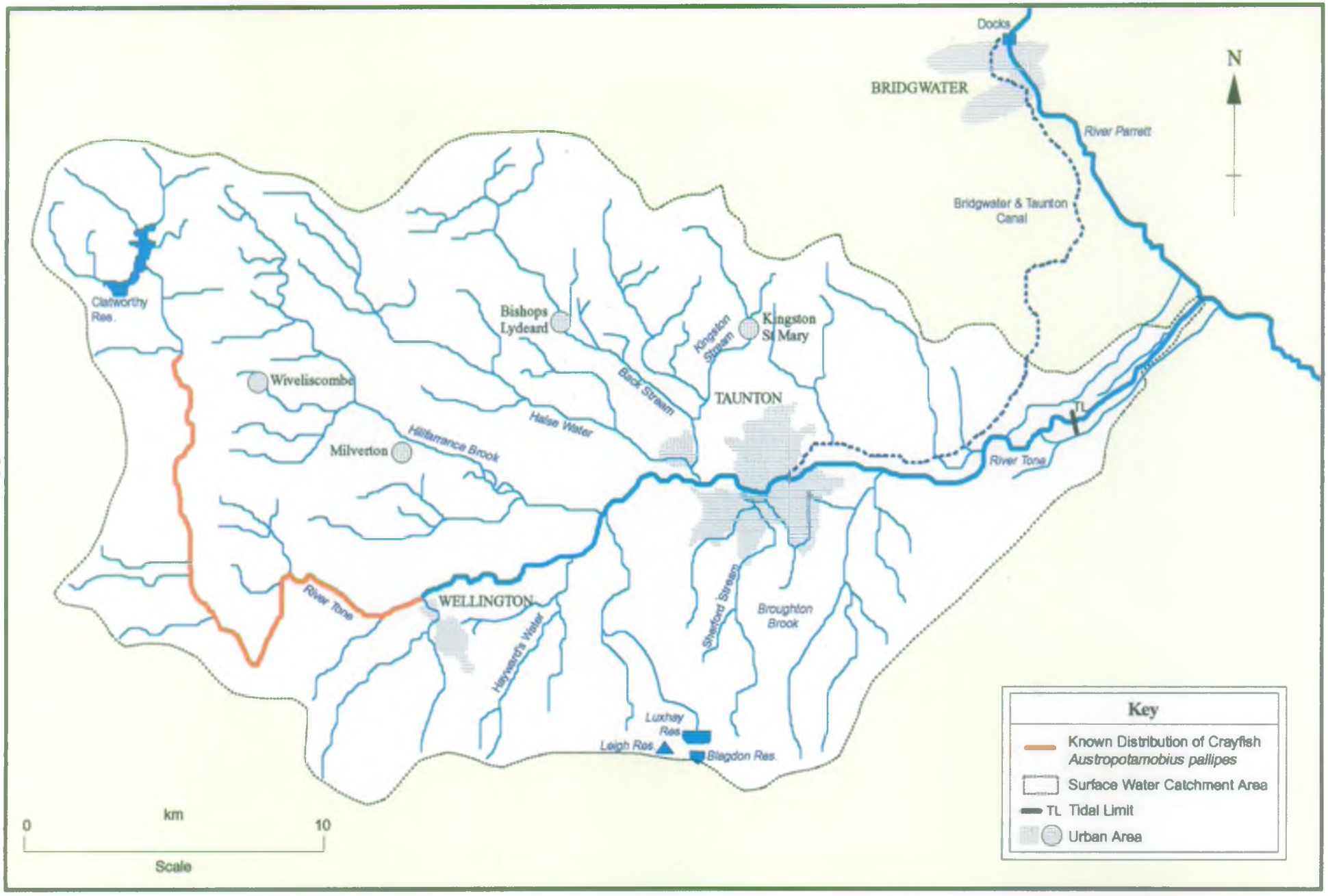
Throughout the Tone Catchment eels are common though Clatworthy dam prevents normal eel migration upstream.

Fisheries surveys on parts of the upper Tone Catchment were undertaken in 1984, 1986, 1990, 1994. Reports on all these surveys are available in the NRA regional library at Exeter. The lower Tone has not been surveyed successfully in recent years as netting is ineffective and until 1994 suitable electric fishing gear was not available.

The Bridgwater and Taunton Canal has all the fish species typical of a lowland fishery namely roach, bream, pike, tench, rudd, carp, gudgeon, dace and eels. As described above large numbers of sunbleak were also found here in 1994 throughout the waterway.

A fisheries survey of the Canal was undertaken in 1994 and a report is available in the NRA regional library.

Map 8 - Native Crayfish



Information correct as of June 1995

Crayfish

The native freshwater crayfish *Austropotamobius pallipes* occurs in the catchment in the length of the River Tone indicated in the Native Crayfish Map - Map 8, page 26.

The population of this species, which occurs naturally only in the British Isles and part of France, has been decimated in many of the rivers of the British Isles where it once occurred. The cause of the problem is a fungal disease known as crayfish plague which was introduced with imports of alien crayfish species many of which are immune to the disease.

In the south western region of the NRA a crayfish protection area had been proposed which would include the Tone Catchment. During 1995 the NRA has been informed that at least one introduction of alien crayfish has taken place.

Based on experience from elsewhere it seems inevitable that the native species will be eradicated as a result of disease, competition and predation.

Fisheries habitat, fish movement and significant fisheries problems

In the upper River Tone and its tributaries the physical habitat of the river is in a semi-natural state. The nature of the river bed is entirely natural with a riffle and pool structure occasionally disrupted by outcrops of bedrock. The banks are generally tree-lined with alder, ash and other tree and shrub species, which bind the banks and produce important areas of submerged (exposed tree roots) and overhanging cover for salmonids.

The influence of Clatworthy Reservoir may be significant as the refilling reservoir may delay and reduce scouring flows which would beneficially remove silt from the river gravels. Salmonids bury their eggs in gravel and silt can deter or prevent fish from spawning. Even if spawning occurs there is a further risk that silt will suffocate buried eggs. Especially between Wellington and Taunton the soils are easily eroded and there is consequently increased siltation of the gravel.

Through Taunton the river is artificially constrained and the banks are mainly man-made. Spot dredging takes place at Firepool but this has an overall benefit to fisheries enlarging an area for flood refuge.

In the past, problems with water quality due to Taunton (Ham) Sewage Treatment Works (STW) effluent and Priory storm overflow have prevented the lower reaches of the river from Ham STW outfall to the tidal limit at New Bridge being designated under the EC Freshwater Fish Directive. Recent improvement works have reduced the frequency of storm discharges and with further improvements there could eventually be a case for designation as a cyprinid fishery.

Downstream of Taunton the river is regularly dredged and the weed cut by the NRA for flood defence purposes. The majority of fish species present in this reach spawn on weed and do not use the bed substrate for spawning. Dredging here is unlikely to remove fish spawning sites as it might upstream, but weed cutting could disturb spawning fish or remove spawn and will reduce the cover for fry. Dredging in spring and summer could suffocate

eggs and fry. The timing of both dredging and weed cutting needs to be carefully considered to minimise harm to the fisheries.

Through Taunton and downstream high velocities in flood conditions are likely to affect fish populations unless there are suitable refuge areas. Over-wide reaches such as Firepool, low-level weirs as at Bathpool, bays and backwaters like those recently engineered at Hankridge Farm, and the confluence of streams such as the Black Brook provide valuable flood refuge areas. Some of these sites are also shallow and weedy in summer and often double as good spawning and nursery areas. The lower Tone probably has more features of this type than many of the other lowland coarse fisheries in Somerset.

High weirs can be beneficial by creating deep refuge areas but they obstruct the free passage of fish and can reduce the diversity of habitat available by reducing velocity and encouraging silt deposition. If the structure has been in place for some time its loss or removal is likely to have a dramatic effect on river regime. From a fisheries viewpoint the resulting erosion, downstream siltation and loss of cover which would follow removal or lowering normally justifies the retention of most established structures. Fish passes enable fish to overcome the obstruction posed by high weirs. There are passes on the Tone at New Bridge, Ham, Firepool, French Weir and Longaller Weir. Sluices which lift from the river bed as at New Bridge are a potential fisheries problem. When lifted the head of water results in high velocities under the sluice and a flow pattern which is different from that of a natural fall. Fish near the structure may be stranded or swept downstream and unable to return.

On the Bridgwater and Taunton Canal the only source of water is from the River Tone and the opportunity for pollution and flood associated problems is reduced. Dredging and weed cutting regularly occur and the timing of both can affect fisheries. The recent introduction of powered boating could have an impact on fisheries in the future. Evidence from the Midlands shows that regular powered boat use increases turbidity and reduces plant growth.

Lakes and ponds

There are several important water bodies which are important fisheries in the catchment and a small number of ponds which are used by angling clubs as a source of fish for restocking. The largest lake is the 53 hectare Clatworthy Reservoir which is stocked with both brown and rainbow trout.

Local By-laws

There are no by-laws which are unique to this catchment.

Enforcement

There are no notable enforcement problems in the freshwater part of the Tone Catchment. Most of the fisheries are natural brown trout and coarse fisheries. Where regular stocking does take place it only raises populations within the normal range found. As a result there are few incentives for organized poaching. Most enforcement involves rod licence checking. There are problem areas for evasion in the built-up areas of Wellington and Taunton in places like the Wellington Basins and the town section of the River Tone in Taunton. Both places are readily accessible and in neither case do the owners of the fishing rights attempt

to control fishing or issue permits, thus creating so-called "free fishing" where the only requirement is an NRA rod licence.

From January to May there is commercial fishing for elvers on the tidal River Tone where the use of illegal instruments and licence evasion are always potential problems (see Section 5.4 Commercial Fishing for Wild Fish Stocks, page 33).

The future

Adding the lower Tone to the list of waters designated under the EC Freshwater Fish Directive would help to protect an important coarse fishery and protect the migratory salmon entering the Tone.

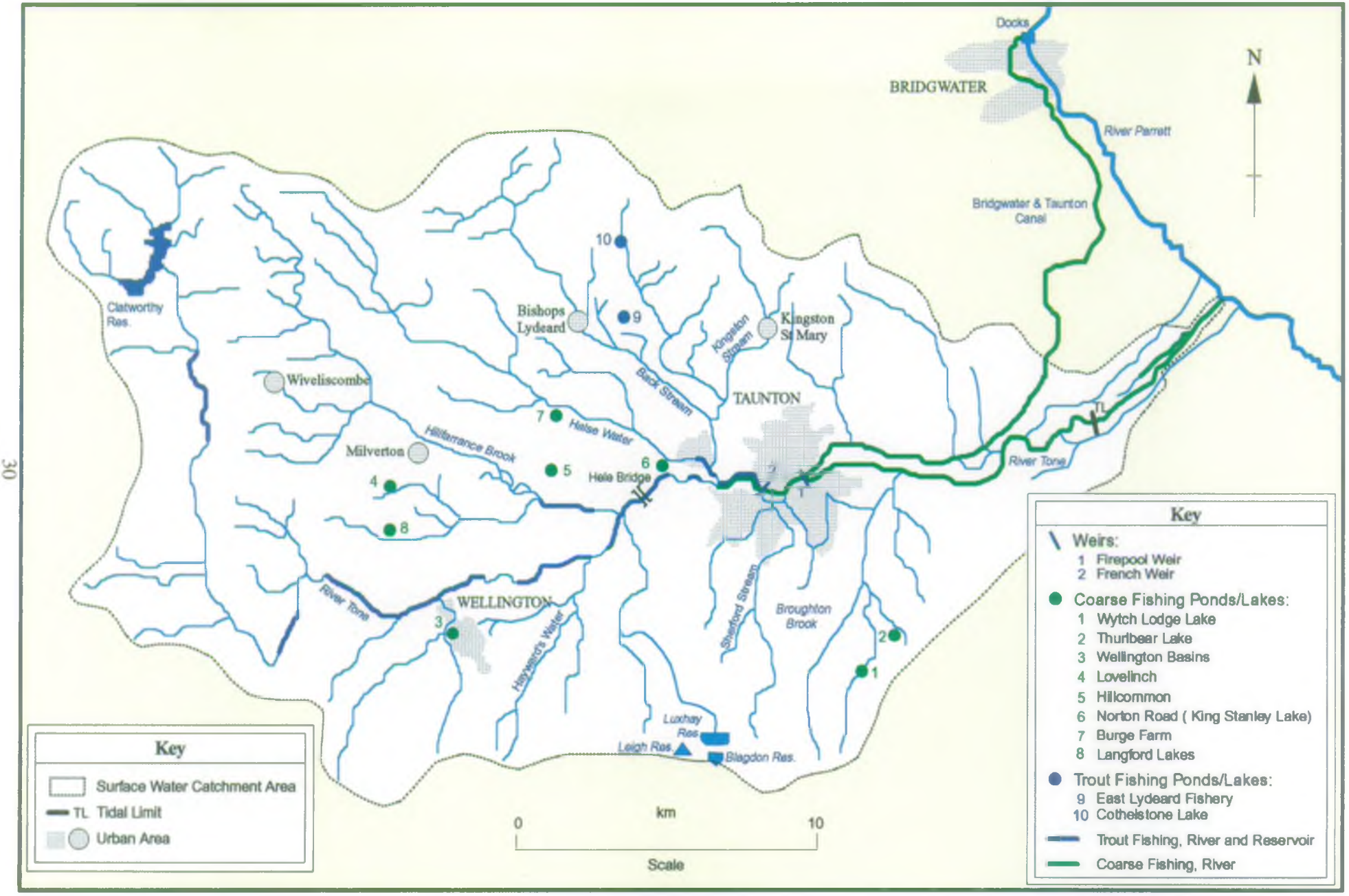
Raising the profile of fisheries through other bodies will help to protect habitats especially on non-main river.

Surveying fisheries in the catchment in the future will monitor progress and identify persisting shortfalls in fish population, habitat and water quality which could be improved.

Reviewing the impact of sluices and tidal doors to assess the damage to fisheries is a valuable long-term exercise which will potentially benefit many catchments.

Continuing to enforce fisheries legislation paying particular attention to known problem areas will reduce licence evasion and act as a deterrent to those who break the law.

Map 9 - Angling



Information correct as of June 1995

5.3 ANGLING

Here we consider fishing with rod and line. For protecting fish stocks see under Fisheries Section 5.2, page 23.

The main reaches of watercourses where angling occurs regularly are shown on the Angling Map together with the location of major lake and pond fisheries.

Our Objective

To maintain rivers so that anglers can continue to fish.

The Role of the NRA

We have duties and powers to:

- maintain, improve and develop fisheries;
- regulate fishing and raise money for fisheries management by issuing rod licences for freshwater angling;
- enforce regulations and by-laws to prevent illegal fishing.

Our work involves a range of activities:

- We encourage angling and publish leaflets for anglers.
- We protect and manage fish stocks with anglers in mind.
- We regularly seek the views of fisheries owners and angling bodies.

Watercourses

Most regular angling in the catchment takes place on the River Tone itself though there is some interest in the lower reaches of the Halse Water and the Hillfarrance Brook. The Bridgwater and Taunton Canal is also a popular and important angling water.

Above Hele Bridge significant stretches of the Tone and the lower part of the Hillfarrance Brook are fly fished for brown trout and for grayling where they occur. On the lower Halse Water and on the Tone at Wellington and between Hele Bridge and Taunton trout and other species can be caught with bait or by spinning. The fishing rights in this area are owned by or leased to two clubs with open membership.

In Taunton and downstream the river is regarded principally as a coarse fishery though trout may still be caught in and just below Taunton. The fishing between French Weir and Firepool Weir is "free fishing" as explained in the Fisheries Section 5.2. Below Firepool most of the fishing rights in the river are owned by the NRA and leased to a single club with open membership. The NRA ownership extends to the banks of the tidal river where the same club have been granted access by the NRA to the fishing in the tidal waters of the Tone. The lower reaches of the river are used not only for pleasure fishing but also for match fishing competitions.

The Bridgwater and Taunton Canal is another important coarse fishery used for pleasure and match fishing competitions. As a canal with a well-made towpath it is very accessible and

spinning for pike in the winter is especially easy and popular. When many rivers are unfishable due to floods the canal is often fishable though the water is highly coloured with silt after heavy rain. The fishing rights are leased by British Waterways Board to two local angling clubs with open membership.

Lakes and ponds

Clatworthy Reservoir owned by Wessex Water plc is a major Somerset still water trout fishery which is regularly stocked with both brown and rainbow trout. The reservoir is open for fly fishing with both season and day permits. The Blackdown reservoirs owned by Wessex Water, (Blagdon, Leigh and Luxhay), are not fished as there are restrictive covenants relating to access.

Wych Lodge Lake near Staple Fitzpaine and King Stanley Pond at Norton Fitzwarren are both popular coarse fisheries controlled by a local angling club.

At Milverton, Langford Budville and Hillcommon there are small fisheries which offer day tickets for coarse fishing.

At Wellington the two Basins are a popular water with "free fishing" for coarse fish.

At Tone Vale a small coarse fishing lake is leased to a company sports and social club and at Thurlbear a lake is leased to an angling club.

There are several lakes which are fished by owners, small syndicates or occasional guests. Cothelstone Lake and East Lydeard Fishery are typical examples.

5.4 COMMERCIAL FISHING FOR WILD FISH STOCKS

Here we consider the use of nets and other types of equipment to catch fish and shellfish. While fish can be caught commercially in freshwater with rod and line this is still considered as angling and covered by the rod licensing system.

Our Objective

To regulate the sustainable harvest of fish and shellfish.

The Role of the NRA

We have duties and powers to:

- maintain, improve and develop fisheries;
- regulate fishing by a system of licensing. This includes the control of commercial fishing by limiting the number of licences issued. With the approval of the Minister we may also make by-laws to regulate commercial fishing for example by restricting fishing methods and seasons;
- enforce regulations and by-laws to prevent illegal fishing;
- assume the role of the Sea Fisheries Authority if appropriate.

We are involved in a range of activities:

- We influence Sea Fisheries by-laws to protect salmon and trout by consulting with Sea Fisheries Committees. Where there is no Sea Fisheries Committee we make our own by-laws.
- We work with Sea Fisheries Committees to encourage the sustainable use of sea fish and shellfish.
- We try to ensure commercial fishing does not interfere with other legitimate uses of the water environment.
- We monitor fish stocks in the freshwater environment.

Local Perspective

There is no commercial fishing for wild fish stocks in the freshwater part of the catchment. From January to May there is commercial fishing for elvers on the tidal River Tone. Fishing activity is greatest during spring tides and during the hours of darkness; conditions which increase the numbers of elvers entering these tidal reaches.

It is difficult to quantify the impact of this commercial fishing particularly when serious gaps remain in our understanding of the eel's life history. Eels are believed to spawn in the Sargasso Sea but no mature eels have ever been caught. It is for this reason that the commercial catch of elvers is so valuable as elvers are a necessary starting point for the farming or growing on of eels.

There are few eel farms in the UK and most elvers are exported to the continent.

By-laws

A licence is required for elver fishing. The method of fishing and the instrument which can be used is defined by by-law. Nets must also be numbered with tags which are issued to persons who have purchased licences. Eel and elver fishermen are required to make an annual catch return.

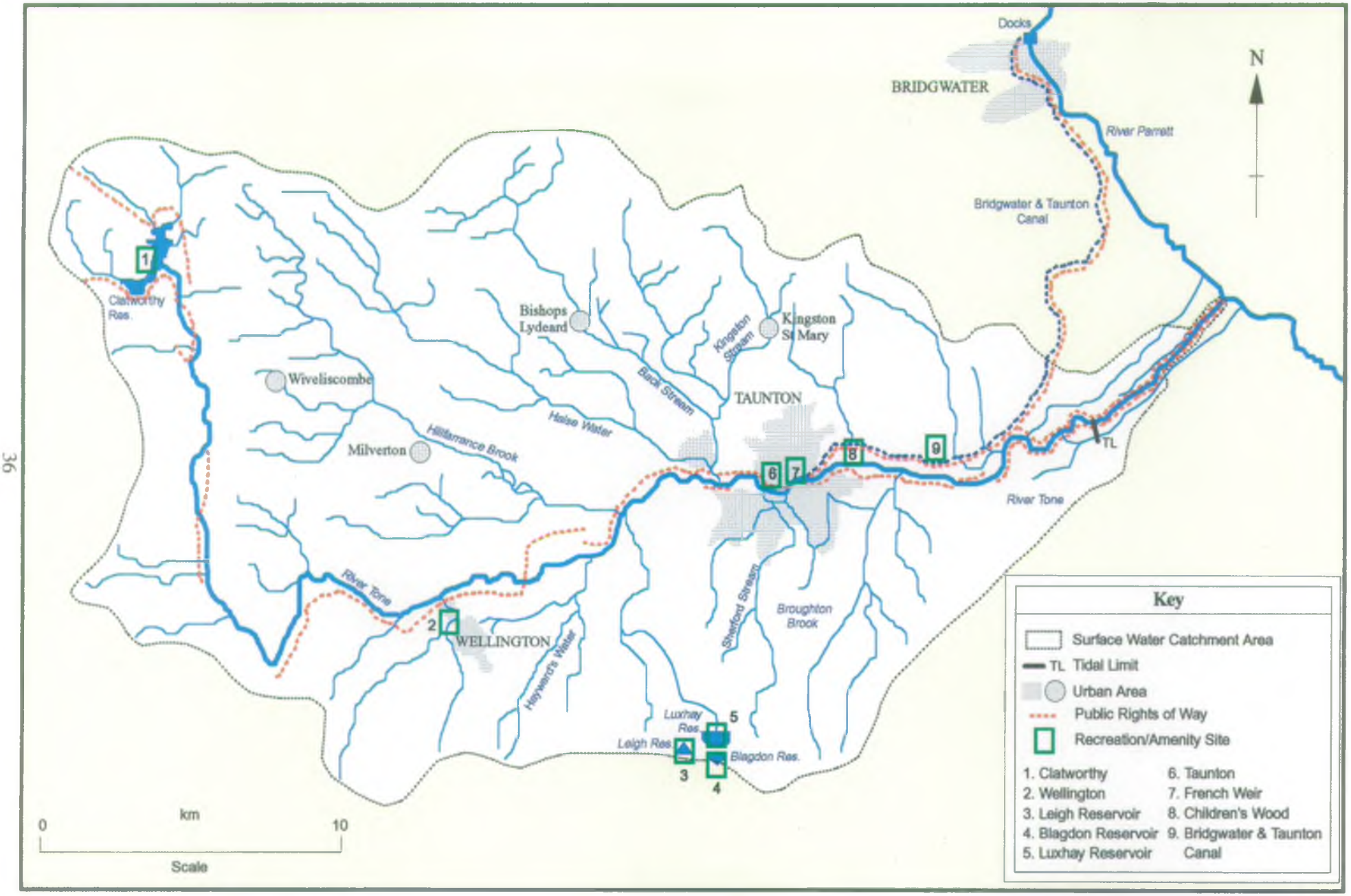
Enforcement

There are periodic problems with licence evasion and the use of illegal instruments.

The future

If it becomes evident that commercial fishing for elvers is having a measurable impact on local eel stocks there may be a case for imposing additional restrictions on fishing. There are only limited means to achieve this with current legislation. There is an urgent requirement for international research to discover more facts about the life history of the common eel in the open sea.

Map 10 - Water Based Recreation



Information correct as of June 1995

5.5 WATER-BASED RECREATION AND AMENITY

Many people spend their spare time enjoying our rivers and coasts. Where we can, we try to improve facilities for people but we must always safeguard the environment from the damage they might cause.

Our Objective

To develop the amenity and recreational potential of inland and coastal waters and associated land.

The Role of the NRA

We have duties and/or powers to:

- protect and maintain access to beautiful areas or special sites of interest;
- make sure that land and water under our control is made available for recreation and take into account the needs of the chronically sick or disabled;
- charge for facilities that we provide for recreation;
- make by-laws to regulate recreation.

We are involved in a range of activities:

- We work with other agencies such as planning authorities and sports associations to develop water related recreation facilities.
- We work with other organisations to develop plans and strategies for promoting recreation in the water environment.
- We provide water based recreation information.

Local Perspective

The Tone and its tributaries are highly regarded, good quality rivers that make a significant visual contribution to the landscape. It is not surprising, therefore, that the catchment is well used by people in search of quiet recreation, in both countryside and urban areas.

Land-based recreational use

Clatworthy Reservoir is a popular area for recreation, with a picnic site and view point, footpaths and a nature trail. The area is owned by Wessex Water, which manages the adjacent habitats and is currently reviewing its long term plans for the site.

Wessex Water also owns Luxhay, Leigh and Blagdon reservoirs but access to these is limited because of restrictive covenants.

Public footpaths and bridle-ways follow substantial sections of the Tone, particularly from Wellisford to Wellington, and East Nynehead to Taunton.

There is scope for greater public use and interpretation in the popular tourist area from Clatworthy to Waterrow.

Wellington Basin is an area of public open space which is managed by Taunton Deane Borough Council (TDBC), and is being enhanced for conservation and as a local amenity. The land lies between Wellington and Rockwell Green on the Westford Stream, and includes a complex system of ponds and leats historically used for washing wool.

Several areas of public open space abut the river through Taunton, including French Weir Gardens and Goodlands Gardens, where the opportunity may exist for enhancements along the riverside frontage. There is a lack of marginal cover through much of Taunton and a need to re-establish areas where this will not incur flood risk. One such site is Taunton Deane Borough Council's Children's Wood Project, designed to rehabilitate a straightened section of river which is owned by the NRA and was engineered for flood alleviation purposes. A riverside walk and cycle-way is planned in addition to in-channel improvements. Taunton Deane Borough Council and Somerset County Council have proposed a cycle-way from Hankridge Farm to the town centre (see Issue 28 Section 6.3.9).

Canoeing occurs in and around French Weir in Taunton, and this can cause problems on occasions, conflicting with anglers.

The Sherford Stream has a high amenity value especially as it flows through Vivary Park. This watercourse discharges into the mill stream in Goodlands Gardens where it is kept low by Taunton Deane Borough Council to provide storage in times of flood. As a consequence, the summer levels are minimal and amenity value here would be greatly enhanced by increased level. This is particularly important as there is an adjacent footpath, which is well used, and the stream looks unsightly during the summer months.

There is great potential for the development of a river corridor use and management strategy in collaboration with TDBC, to upgrade the riverside environment through Taunton, providing footpaths, cycle-ways and interpretation. Similarly, around Creech St Michael where the Tone is not embanked, there is potential to develop a circular walk along the river and back along the canal, with links to the Willows and Wetlands Centre at Stoke St Gregory.

Footpaths follow both banks of the Tone in its lower sections. Interpretive signboards erected by Somerset County Council (SCC)/NRA at Athelney and New Bridge have fallen into disrepair.

It should be noted that the NRA own substantial lengths of river bank from Taunton to Burrowbridge, and should seek to provide recreational opportunities on land in their ownership, where appropriate.

Water-based recreational use

Water-based recreational use is very limited on the majority of watercourses within the catchment, as the rivers are small and at present access agreements do not exist. Access agreements for canoeing are normally negotiated by the BCU, the local canoeing club and the riparian landowners.

Navigation

Navigation rights on the Tone were revoked in 1969, when the locks were removed by the Somerset River Authority whilst carrying out a major Flood Alleviation Scheme. Prior to that time, there were three channels at each lock - the river, the mill leat and the lock by-pass. The only example remaining is at Ham.

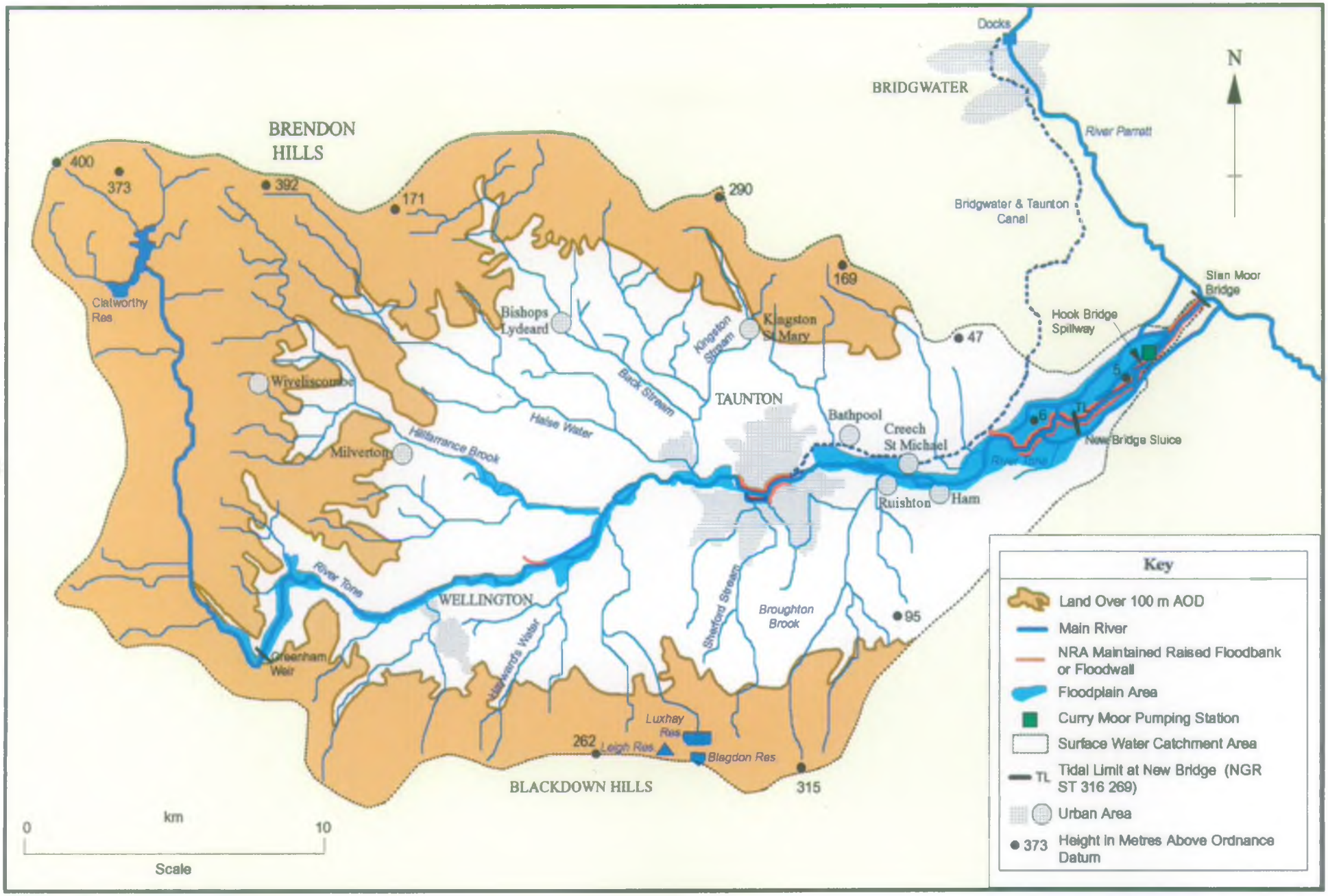
A section of navigation was not revoked and therefore still exists between Firepool Weir and Portland Street (100 metres downstream from French Weir). British Waterways Board (BWB) are the Navigation Authority.

Bridgwater and Taunton Canal

The canal offers considerable scope for recreation. Canoes and powered craft can use the waterway with a licence from British Waterways Board. Walking and cycling along the tow path are also possible, providing an attractive rural route between Bridgwater and Taunton.

Recreation and conservation on the canal are managed by BWB but pollution control is the responsibility of the NRA.

Map 11 - Floodplain



Information correct as of June 1995

5.6 FLOOD DEFENCE

Introduction

River flows vary widely and are affected by the weather, geology and land use. We manage flood risk from rivers and the sea using Flood Defence and Land Drainage powers.

Flood risk and land drainage have always affected the way we use land. By improving our control of water we have been able to make better use of river and coastal floodplain for farming or building towns. This control can take many forms: from simple channel alterations to major floodbanks and artificial washlands. Works constructed for other purposes, such as weirs, mills and bridges, have also altered the natural river system.

Better protection from floods and better land drainage has improved our quality of life. However, unless properly managed, these benefits may result in other problems such as increased downstream flows and a legacy of expensive works for future generations to maintain. Changes in land use, made possible through drainage and flood defence, may also cause significant environmental damage, particularly to wetlands.

Today we manage flood defences and land drainage to balance the needs of all river users with the needs of the environment.

Our Objectives

Our objectives are to provide effective defence for people and property against flooding from rivers and the sea; and to provide adequate arrangements for flood forecasting and warning.

The Role of the NRA

Legislation tells us what we can and cannot do. Our statutory flood defence committees make decisions on flood defence. All rivers are classified as either "main river" or "ordinary watercourse" (sometimes referred to as "non-main river"). We have a duty under the Water Resources Act 1991 to "exercise general supervision over all matters relating to flood defence" but have special powers to carry out or control work on main rivers and sea defences.

In some areas internal drainage boards are responsible for flood defence on ordinary watercourses. Local authorities have permissive powers to carry out or control work on ordinary watercourses.

We have permissive powers to:

- control certain works and advise planning authorities on flood defence;
- maintain and improve the flood defence system which is under our control;
- provide flood forecasts and warnings so that risk to life and damage to property is reduced during river and sea floods.

Day to day we are involved in a range of activities. Here are some of the things we do and principles we follow:

- We work closely with other agencies including the Ministry of Agriculture, Fisheries and Food (MAFF), local authorities, internal drainage boards, conservation and recreation bodies.

- We survey assets and flood risk areas to improve our management of flood defence.
- We are working on a Flood Defence Management Framework and related systems to ensure that flood defence assets are managed properly.
- We set and monitor specific targets to improve our performance.
- We support Research & Development and are developing best practices for our work.

Local Perspective

The Tone Catchment neatly divides at Taunton. To the west lies a predominantly rural area drained by rivers little altered by man, whereas through Taunton and down to the Parrett confluence at Burrowbridge the Tone has been almost entirely reconstructed over the last 600 years and little evidence of the natural channel remains.

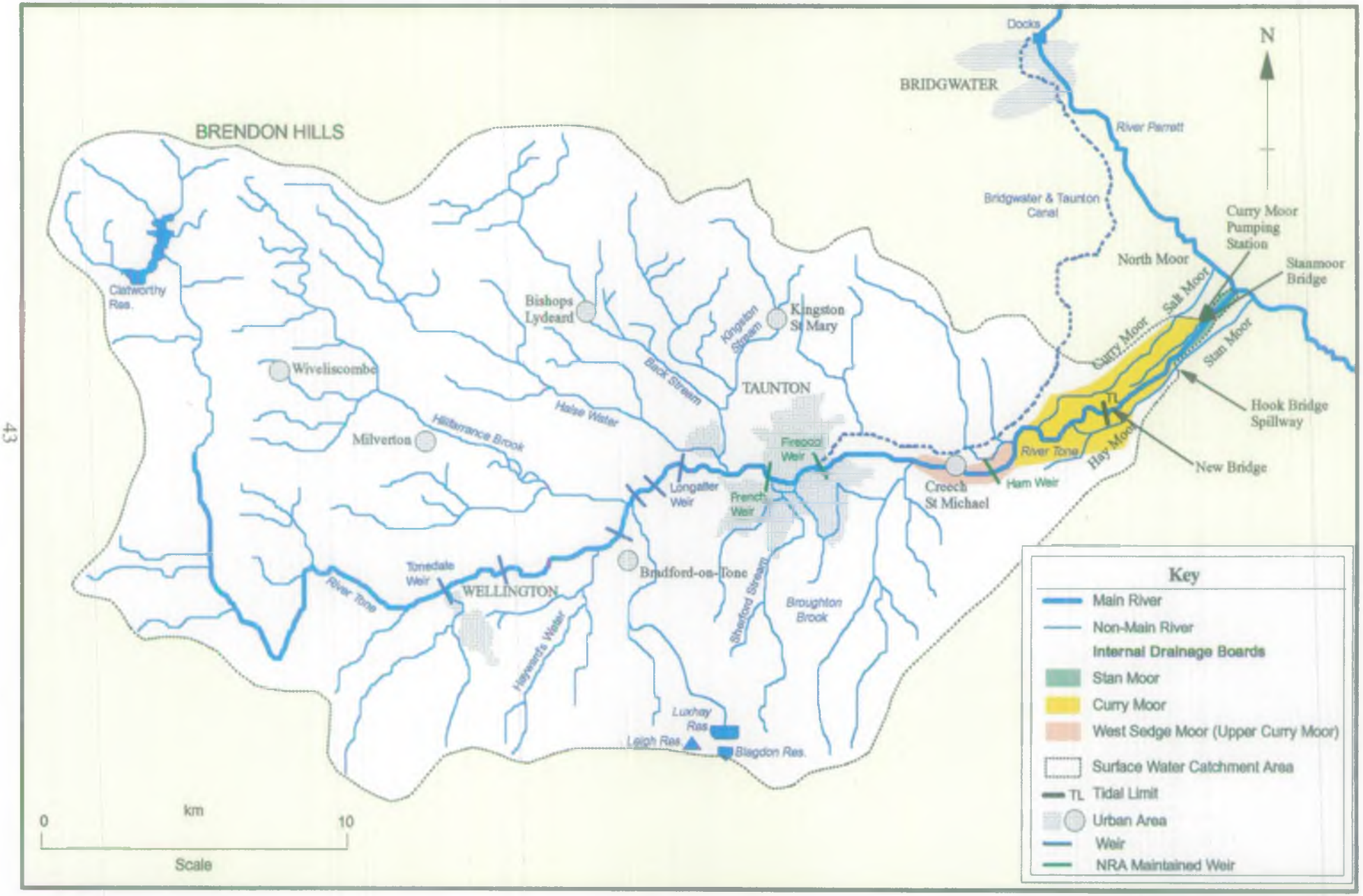
The River Tone rises in several streams in the Brendon Hills about 400 m above sea level and almost immediately runs through Clatworthy Reservoir. Between Greenham and the M5 the Blackdown Hills drain northwards to the Tone. The marl in this area combined with the short, steep streams gives rapid response to rainfall. In contrast the area north of the Tone along this length (served by the Hillfarrance Brook, Halse Water and Back Stream) responds more slowly owing to the flatter slopes and the sandstone and shale geology (see Geology and Hydrogeology Map - Map 4, page 10, page 10).

Flooding problems upstream of Taunton are mainly restricted to a few locations where minor roads or small groups of buildings are close to the rivers. Although more extensive flooding of farmland in the floodplain does occur this has not been frequent enough to justify major improvements to the NRA main rivers in the area and only isolated flood schemes have been carried out, notably at Bradford-on-Tone. Heavy tree growth is a feature of the river upstream of Taunton. Although these can usefully reinforce the predominantly sandy banks against erosion they can become over large and unstable, directly reducing the channel size or threatening to fall into the river during floods where they can cause serious obstructions at bridges or weirs.

In Taunton over 300 properties were seriously flooded in 1960. As a result the town was protected with a new enlarged channel and raised flood walls. A current scheme to bring the protection standard of these defences up to 200 year return period flood protection is nearing completion.

Downstream from Taunton the Tone runs across a flat alluvial plain. The eastern end of this forms part of the Somerset Moors and closely follows the boundaries of the local Internal Drainage Boards which have exercised drainage responsibilities in these levels since the last century (see Main River, Structures and Internal Drainage Boards Map - Map 12, page 43). The zones are coloured yellow, pink and green on the map to indicate the three boards concerned - Curry Moor District Drainage Board, West Sedge Moor District Drainage Board and Stan Moor District Drainage Board respectively. Because ground levels in the lower reaches lie as much as two metres below flood level the river has been embanked through the drainage board areas for at least the last 700 years. The line of the river has been altered in the past not only to improve drainage but also to avoid constructing embankments on the worst peaty ground. The last significant realignment was carried out in 1374 but since then many schemes to improve the embankments and increase the size of the channel have been implemented. In particular a major widening of the whole length was carried out at the time of the Taunton improvements in the 1960s, the spoil being used to strengthen the floodbanks.

Map 12 - Main River, Structures and Internal Drainage Boards



Information correct as of June 1995

Below New Bridge Sluice the Tone has a very flat gradient and is tidal, connecting to the Bristol Channel via the Parrett. The large tidal range and strong currents in the Bristol Channel cause heavy silt loads to be carried up to the Tone. The silt builds up rapidly, particularly in the reaches close to the tidal limit during summer (low flow) conditions. The silt deposits at the tidal limit seriously reduce the discharge capacity of the River Tone and re-siltation occurs so quickly close to the tidal limit that frequent dredging would not be able to keep up. For this reason, only bi-annual agitation is carried out.

At Stan Moor Bridge the Tone joins the Parrett. In flood conditions, high levels in the Parrett and Tone usually coincide and this further reduces the discharge capacity of both rivers.

The combined effect of these restrictions means that the discharge capacity of the Tone reduces all the way from Taunton to its confluence with the Parrett. Any floodwater which is thus unable to pass down the Tone runs over the floodbanks into the adjacent moors where it is stored until river levels drop and allow it to be returned to the river, either by pumping or gravitation. Such flooding is a regular occurrence. To guard against the possibility of the floodbanks being washed out by heavy overflow, Hook Bridge Spillway was formed in 1956. A 330 m length of bank was lowered and provided with an armoured crest and gentle back slope to carry the flood flows safely into Curry Moor. A tunnel under the river at this point connects the moors on either side to allow the maximum area to be used for storage.

Three rainfall events of significant duration resulted in flooding of extensive areas of Curry Moor in the winters of 1989/90, 1993/94 and 1994/95. Due to the severity of these events, studies are being undertaken into possible measures to lessen the impact of future events and to place the recent events in their historical context.

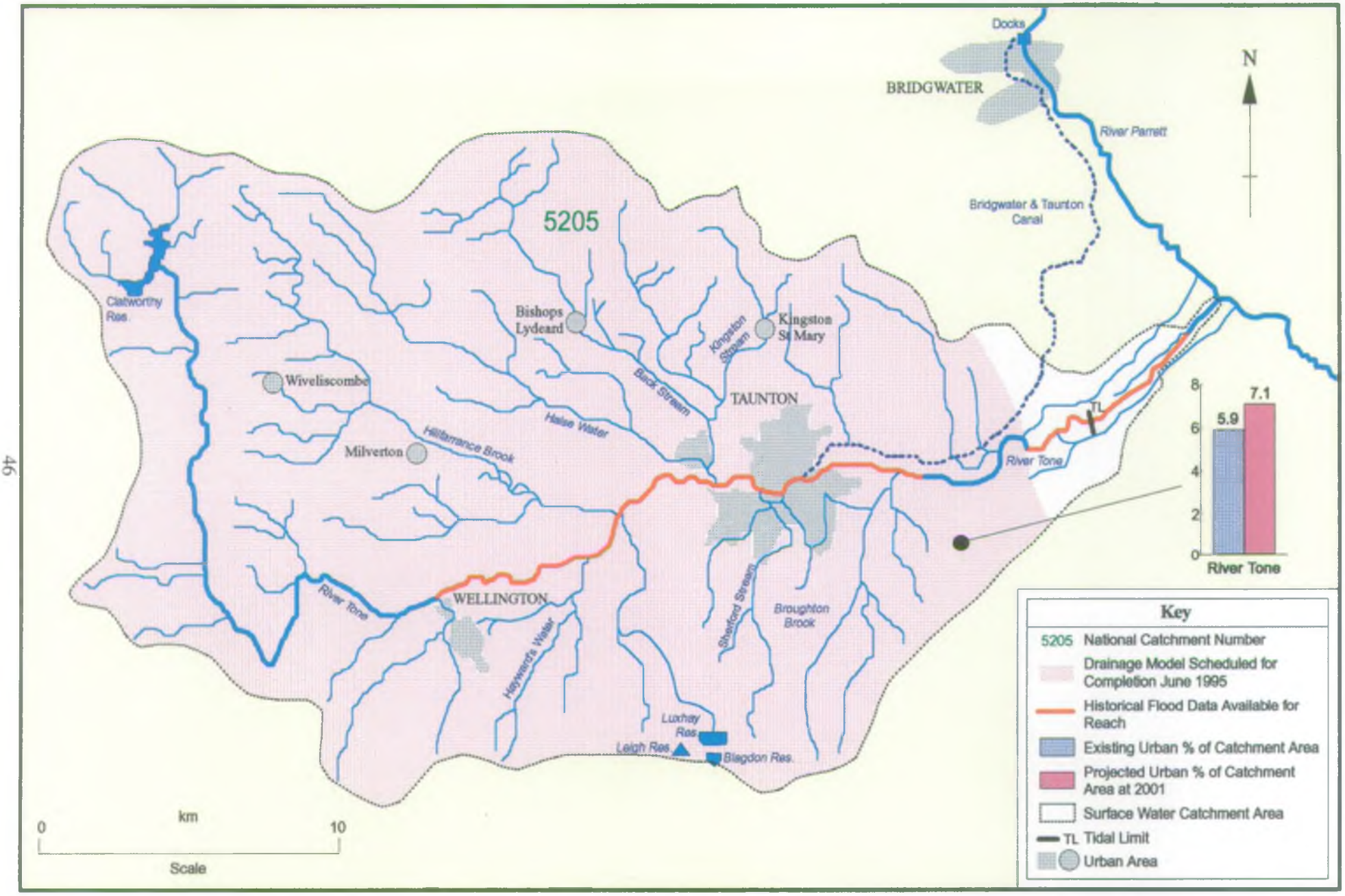
Curry Moor Pumping Station not only returns the floodwater to the Tone once river levels subside but also is the major control point for maintaining "summer penning" in the moors - the holding of an artificially high water level for agriculture and wildlife. The current station was built in 1955 and superseded an 1886 steam station of very limited capacity. Before this only gravity drainage was possible and this meant that prolonged winter flooding was expected every year - and after a particularly severe winter grazing could be delayed until mid-summer. At the time the new pumps were installed an extensive scheme was carried out to collect fresh water from the Tone upstream of the tidal limit at New Bridge for the summer feed, not only for the Tone Moors but also for Stan Moor, Salt Moor and North Moor. Before the scheme these lower areas often had to resort to using salt or brackish water to maintain their penning levels. The new arrangements for feed and drainage gave greatly improved conditions for dairy farmers and withy growers alike. The area is now managed according to the principles contained in the Somerset Levels and Moors Strategy (see Appendix 16).

The extensive works carried out through Taunton and down the Tone valley to the Parrett mean that this length of the river is almost entirely artificial. Man's influence has dramatically changed the landscape and land use of the valley over the last 700 years.

Regulation

- Future development proposals within the Taunton Deane District Local Plan are concentrated primarily within and around the existing urban areas of Taunton and Wellington.

Map 13 - Urbanisation and Drainage Model Availability



Information correct as of June 1995

The River Tone, a statutory main river under the control of the NRA, bisects Taunton and provides the main drainage and flood conveyance corridor for the area of the town.

In 1960 Taunton suffered severe flooding as a result of overtopping of the defences. Following a full hydraulic study of the River Tone the NRA has carried out a major uprating of the fluvial defences to the town giving a flood protection standard against a 1 in 200 year flood.

Ring bank defences to a lesser standard have been provided for Bathpool, Ruishton, Creech St Michael and Ham.

The drainage model for the Tone is now complete and we will use this to predict and manage the flows arising from new development (see Urbanisation and Drainage Model Availability Map - Map 13, page 46). There is a flood water detention reservoir at Westford on the Westford Stream.

Wellington is situated to the south of the River Tone which again provides drainage for the town. There are no direct flood risks to Wellington from the River Tone, although any northward pressure on development could be affected by flood risk.

In accordance with DoE Circular 30/92 'Development and Flood Risk' the NRA, as advisors to planning authorities, aims to ensure that new development is not affected by flood risk, and that existing development is not adversely affected by increased runoff from new development. The NRA's Development Control Department therefore negotiates with developers on behalf of the Local Planning Authority, to ensure that all necessary infrastructure works are provided as part of any development, to protect the development and third parties against flood risk to an agreed standard, whilst also safeguarding the ability of the watercourse to carry flood water and conserving it as an ecological corridor.

These aims have been achieved through Taunton in particular, with the provision of set back development and riverside works for the general public, e.g. Dellers Wharf Development.

Maintenance Practices

NRA maintenance and operational activities are concentrated on the stretch of river below Taunton.

Weed cutting is carried out twice yearly on the 11 km length of the Tone between Burrowbridge and Creech St Michael using a dragline excavator fitted with a special weed mowing bucket plus weed cutting launches as appropriate. Extensive weed control is also undertaken in the pump drains and feed rhynes in Curry Moor and Hay Moor, involving handwork and smaller machinery. Weed cutting is usually preceded by flail mowing, particularly where raised floodbanks are present.

Silt is dredged from the tidal length below New Bridge using the agitation method every other year. The remaining lengths being non-tidal require less attention and are dredged only when necessary - about every ten to fifteen years downstream of Creech but very rarely further upstream. The spoil is used to make up adjacent floodbanks where appropriate.

Curry Moor Pumping Station and the sluices at New Bridge and Taunton, as well as a number of minor water level control structures, receive regular attention to ensure that they are mechanically and structurally sound. Their operation is predominantly manual and most routine maintenance is carried out by the regular operators, but major mechanical and electrical work is usually entrusted to outside specialists.

Other maintenance work includes repairs to gaugeboards, fencing, gateways, accesses, bridges, floodbanks, floodwalls, revetments and buildings, plus tree work on the upper reaches and the jetting of outfalls.

Routine operations aim to provide controlled water levels in the rivers and moors balancing the needs of people living in the area with those of agriculture, fisheries, water quality, wildlife, navigation and amenity. Simplistically this involves draining surplus water in the winter and capturing Tone water for distribution in the summer, using the complex network of watercourses, sluices and pumping stations.

This is taken to include all flood and drought events, although in many cases the response will not involve more than the introduction of special measures or the escalation and continuation of normal operations outside normal working hours.

Emergency Response

In flood situations the NRA response is triggered by either a weather warning from the Meteorological Office or abnormal conditions identified by one of the NRA duty officers, who maintain a continuous watch on rainfall and river levels via our extensive network of gauging stations which report automatically to our control room.

Any response is twofold:

- the issue of flood warnings to the emergency services, to the general public (usually via the police) and to relevant local authorities;

- the management of the river systems to minimize any adverse effects. Comprehensive written procedures are maintained to ensure that even in emergencies or very unusual circumstances appropriate responses are made, and suitable training is given.

During drought conditions licensed abstractions may be restricted or curtailed as explained in Section 5.13. However the supply of summer water to the drainage board areas, so essential to agriculture and wildlife, is unlicensed and is organised and controlled by the NRA Flood Defence function. Low flows in the Tone can result in the introduction of special conservation measures and the rationing of supplies to the moors to ensure the most equitable distribution of available resources. Under extreme circumstances arrangements are made for farmers to obtain water for cattle from other rivers in the locality.

5.7 THE BUILT ENVIRONMENT AND DEVELOPMENT PLANS

Here we consider the built environment and the process of planning and regulating the construction of new development including roads, housing and industry.

County and district planning authorities plan and control development but they must consult the NRA. However they do not have to follow our advice.

Our Objectives

To protect the water environment from the harmful effects of development and to minimize flood risk.

The Role of the NRA

There are two main ways we can influence development:

- **planning.** We can assist local planning authorities to allocate land for development by commenting on local plans, identifying constraints and highlighting where the river environment can be enhanced through sympathetic development for recreation, amenity and the conservation of wildlife.

- **control.** We give formal and informal comments to planning authorities on planning applications and development guides. We can also control development using our own laws for example Land Drainage Consents.

We aim to ensure that prior to development proposals being formulated within the catchment area, developers and their professional advisers are aware of all relevant water environment issues and aspirations that must be addressed.

We are also active at a higher level informing strategic plan makers of our environmental concerns, for example rivers affected by over abstraction or water supplies threatened by major pollution hazards.

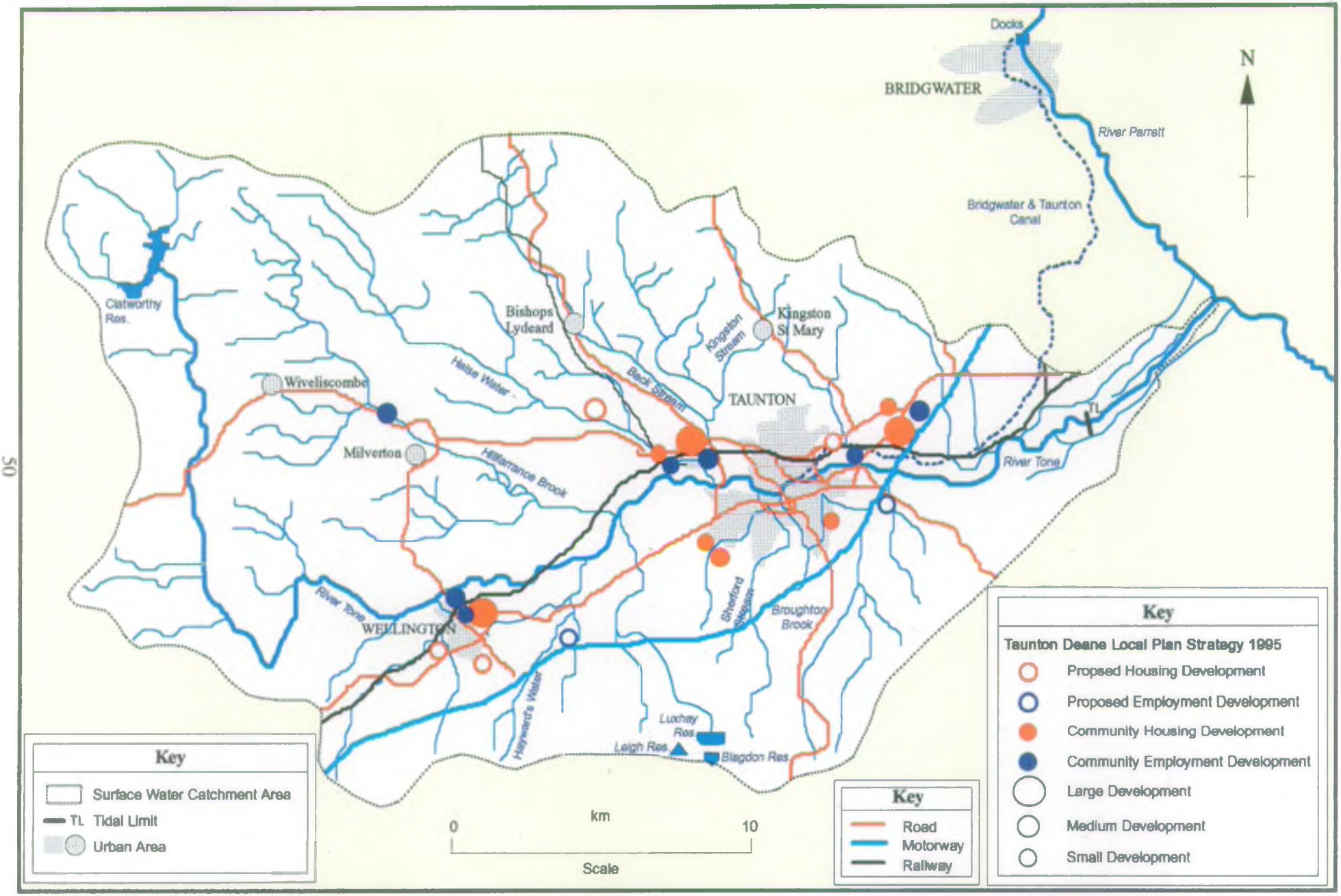
Local authorities prepare statutory development plans. In January 1994 the NRA published guidance notes for local planning authorities on ways of protecting and enhancing the water environment through development plans. The notes highlight matters that concern us and offer guidance on model policies.

We aim to ensure that future reviews of regional strategy, structure plans and local plans identifying residential and employment growth are drafted with full regard to the demands upon, and limitations of, water resources, sewage disposal facilities and other criteria necessary to maintain a satisfactory water environment.

Planning and Flood Risk

The Government view is that development should be guided away from areas that may be affected by flooding and should be restricted where it would increase the risk of flooding.

Map 14 - Development



Information correct as of June 1995

River Tone Catchment Management Plan

NRA South Western Region

To achieve this it expects local authorities to use their planning powers and the NRA to assist by providing advice on development and flood risk. The work that is underway now on preparing flood plans is an example of this advice. (For details see Flood Defence Section 5.6). The Urbanisation and Drainage Model Availability Map - Map 13 shows the % area urbanised now and that projected for 2001. The Drainage Model has recently been completed and will help us to assess the impact of new development on flood flows.

We aim to identify how, during the construction and engineering stages of planned developments:

a) flooding and pollution risks plus risks to habitats and wetland features can be effectively controlled;

b) where alterations to wetlands and riverine habitats are unavoidable, equivalent replacements can be created elsewhere such as Hankridge Farm, Taunton.

Local Perspective

Development Plans

The catchment is within the area of the Regional Planning Guidance for the South West prepared by the Secretary of State for the Environment and published in July 1994. Its aim is to provide advice for safeguarding the environment, maintaining the economy, achieving sustainable growth plus the infrastructure and transportation objectives for updating and reviewing development plans.

The Regional Planning Guidance indicates the need for protecting important landscape areas such as the Somerset Levels, the Blackdowns and the Quantocks and to take account of nature conservation interests. The local authorities are advised to work closely with the NRA; flood defence, water resources, sewerage issues, pollution prevention, water supply safeguards and capacities of existing and planned infrastructure are all seen as matters to be considered. It is recognised that the Region should be providing for new dwellings and Somerset should be catering for 2,500 new dwellings each year between 1991-2011 mainly in and around urban areas. The Somerset Structure Plan Review will be the vehicle that identifies the numbers to be provided for within the catchment which covers most of the Taunton Deane Borough Council area. The Guidance indicates that economic growth and business competitiveness needs encouragement at an appropriate scale.

The catchment includes most of the Taunton Deane Borough Council administrative area (excluding small rural areas on the Blackdowns and to the south east) plus small rural areas in West Somerset, Sedgemoor and Mid Devon districts (see Development Map - Map 14, page 50).

The majority of the catchment is within the area of the approved Somerset Structure Plan - Alteration No 2 adopted 1992, which contains the strategic Town & Country Planning Policies. Detailed planning policies are contained mainly in the local plans for Taunton Deane. These are for Taunton 1986/90, Wellington 1984/89, East Deane 1991 and West Deane to be adopted in 1995. A rural area in the north west of the catchment is covered by West Somerset - Dulverton Area Local Plan (West Somerset Parishes) 1984 and to the north east by the Bridgwater Area Local Plan 1990. A very small rural area near

Holcombe Rogus is within Devon; here the Devon County Structure Plan 1984 and the Mid Devon Local Plan (Deposit Draft 1995) apply.

A non-statutory strategy for the Somerset Levels and Moors was prepared by Somerset County Council in 1983. This aimed to achieve working relationships between interested bodies to secure the protection of the landscape, nature conservation, archaeology and other interests of this wetland area. The Levels and Moors Partnership meet has been established to consider current issues and problems.

Growth

Taunton Deane Borough Council are preparing a District Wide Local Plan for their area. An Issues and Options Report was published for consultation in February 1995. This seeks to establish the most acceptable pattern of development in Taunton Deane to 2006 having regard to the level of growth proposed in the County Structures Plan Review Consultation Draft published at the same time. The aim of the District Wide Local Plan is to promote an integrated land use and transportation strategy which is environmentally and economically sustainable.

The 1995 Consultation Draft - Somerset County Structure Plan Review Strategy (CSPR) sets the scene to secure sustainable development; it recognises the importance of securing the protection, conservation and enhancement of environmental resources. The distribution of growth is seen as having a strong bearing on achieving a sustainable pattern of development and economic prosperity.

The planned growth in this catchment is detailed below in the Housing and Employment section. The planned increase of 8,600 houses and 407.5 ha of employment land by 2006 will put an increasing strain on sewage treatment at Ham and Wellington STWs as well as creating a greater demand on water resources.

The Tone catchment forms part of the Somerset public water supply zone which is in deficit. This issue is dealt with in more detail in Section 5.13 "Water Abstraction and Supply, page 75 - subsection: Public Water Supply" and also in our Regional Water Resources Development Strategy 1995 publication - "Tomorrow's Water".

With regard to sewage treatment, Wessex Water plc have stated that there is sufficient spare capacity at Ham and Wellington STWs to cope with the predicted growth. They have to keep within the limits of their consent to discharge. If the volume increases above the consented maximum flow then the Water Company must apply for an increase in the permitted volume on the consent. The available dilution for the sewage effluent is taken into account when setting a consent. A low flow (normally Q.95 -see Glossary Appendix 15) is used in the calculations.

We would not normally grant such an increase without a corresponding tightening of the concentration standards. As a minimum the NRA would ensure that the pollution load on the river does not increase and the NRA may require a reduction in pollution load.

Further the Somerset County Structure Plan Alteration No. 2 contains two policies PU2 and PU4 which state:

PU2 The Local Planning Authorities will normally seek to locate new development where adequate water supplies, drainage, sewerage and sewage treatment facilities are available or may be readily provided in co-ordination with other services.

PU4 Development will not normally be permitted which will:

1 To an unacceptable degree, prejudice the quality, quantity and availability of water in surface and underground water sources, rivers, watercourses and other storage areas;

2 Increase the incidence of pollution of coastal and estuarine waters and associated coastlines.

The Somerset County Structure Plan Review Consultation Draft (1995) Polices 66 and 67 state:

Policy 66 New development and utilities

New development should be located where energy, water supply, drainage, sewerage and sewage treatment facilities and telecommunications are available and can be supplied concurrently with the development.

This policy seeks to ensure that development sites are selected and planned in conjunction with the infrastructure needed to supply utility services. In this way, the most efficient use can be made of existing and planned infrastructure provision. This is especially important when considering the implications for sewage treatment capacity which must be made available concurrently with development to ensure that high standards of sewage treatment are maintained.

Policy 67 Safeguarding water resources

Adequate protection will be afforded to all surface, underground and marine water resources from development which could harm their quantity or quality.

The protection of water resources and their conservation is controlled by the NRA under the Water Resources Act 1991. Nevertheless, the planning system has a pro-active role to play in preventing development that would cause material harm to the water environment. Detailed policies to effect this control are required in Local Plans.

These policies indicate that the local planning authority will take sewage treatment capacity and water resource availability into account before granting planning consent.

Wessex Water make a levy on every new house built for the provision of their services and the developers of new housing estates would normally be required to make a substantial contribution towards sewage treatment and water supply provision.

Housing and Employment

The CSPR's elements are to focus a higher proportion of growth in the principal centres and towns but allowing some development in rural areas to meet local housing needs and the diversification of the rural economy. The Strategy indicates that for the period 1991-2006, land should be provided in Taunton Deane for 120 ha of employment uses plus additional allocations for 10,000 new dwellings. Allowing for developments already completed and commitments, the Taunton Deane Local Plan Issues and Options Report 1995 (TDLP I&O) identifies new land allocations of 69 ha for employment and 166 ha for dwellings.

The TDLP I&O considers three development options and presents a Preferred Strategy. For housing the emphasis is upon larger sites; three on the fringes of Taunton for 2,650 dwellings and one at Wellington for 1,000 dwellings. The balance of need is made up by smaller sites in Taunton apart from 100 dwellings distributed elsewhere. For employment, land is identified for a 30 ha site at Taunton, a 20 ha site in Wellington plus other sites in Taunton and one at Wiveliscombe. This makes a total of 69 ha. Together with outstanding development sites the allocations will meet CSPR requirements.

The Development Map - Map 14 indicates the location of the major sites committed for development and where the Preferred Strategy suggests major allocations. The situation in 1995 as regards land for new development within the catchment is as set out below. It will be seen that between 1995 and 2006 some 439.5 ha could be urbanized by housing and employment developments. Additionally further major shopping might be needed during the plan period but no sites have been specifically promoted.

	HOUSING		**EMPLOYMENT**	**TOTAL LAND**
	Dwellings	**ha**	**ha**	**ha**
Committed				
Large sites	1400	60	19.5	79.5
Other sites	2900	109	16	125
Sub totals	(4300)	(169)	(35.5)	(204.5)
Preferred Strategy				
New large sites	3650	142	50	192
New other sites	650	24	19	43
Sub totals	(4300)	(166)	(69)	(235)
TOTALS FOR DEVELOPMENT 1995-2006	8,600 dwls	335 ha	104.5 ha	439.5 ha

Landscape

The CSPR recognizes the need to conserve the natural environment noting Somerset's varied landscape. Apart from lack of coast the catchment is synonymous to the landscape of Somerset containing hills, woodlands, pastoral lowland and river valleys. Features recognised by designation include the Quantock Hills and Blackdown Hills AONBs and the Special Landscape Areas of the Brendon Hills, Quantock and Blackdown fringes and part of the Somerset Levels and Moors. The Levels and Moors have also been made an Environmentally Sensitive Area, where government funds are available to secure management agreements to continue traditional pastoral farming methods so as to protect a nationally important wetland (see Section 5.1 Designated Areas Map - Map 5). The Tone catchment wetlands are also of historical and archaeological significance because they include the sites of a Saxon Fortress at Lyng and an abbey at Athelney developed by King Alfred in the ninth century AD.

Relevant policies of the CSPR are included to:

- Protect the peat soils of the Levels and Moors, and nature reserves - only development of overriding local or national need will be permitted also historic and archaeological heritage sites will be protected from inappropriate development.

- Give priority to preservation and conservation of the landscape of AONBs.

- Safeguard defined Special Landscape Areas by strict control on development and promotion of conservation, enhancement and management measures.

- Secure retention and management of trees, orchards and features of the Levels and Moors landscape. Taunton Deane Borough Council give guidance on such matters in their "Deane Tree Strategy" document.

The TDLP I&O identifies special landscape features, suggesting they be designated for their protection. These include the River Tone and the Bridgwater and Taunton Canal. Ten landscape character areas are proposed and of particular relevance are "The River Floodplain" from Wellington to North Curry and "The Levels" east of North Curry where it is proposed to publish planning guidance relating to design and layout for any new developments.

The Mid Devon Local Plan (Deposit Draft 1995) identifies a section of the Grand Western Canal as a Conservation Area to promote its protection as a natural habitat and landscape feature. A small section of this canal lies within the Tone Catchment.

Tourism and Recreation

The CSPR accepts the principle of developing tourism facilities and ensuring recreation and also new tourism initiatives to maintain the local economy. Safeguards are set to prevent harming the landscape and rural locations. The TDLP I&O identifies the Bridgwater and Taunton Canal as an under used resource for boating but controls are needed to prevent over-use. Current policies allow for touring caravan sites and the TDLP I&O identifies a site east of Taunton near Monkton Heathfield. Taunton Deane is currently revising its Tourism Strategy and aims to identify appropriate low key sustainable tourist opportunities.

Consideration may be given to the further promotion of navigation on the River and Canal, and to improved facilities for access by both cycle and horseback to and near attractions and places of interest and interpretation.

The West Somerset District Council is revising its local plans and a District Wide Local Plan Consultation Report 1995 places emphasis on achieving sustainable tourism with a need to protect wildlife, landscape and heritage sites.

We work with the local authorities to improve the protection and interpretation of areas of historic and archaeological interest associated with the riverine environment and the Somerset Levels and Moors.

5.8 MINERAL EXTRACTION

The extraction of minerals from quarries, mines and pits for sand, gravel or clay can adversely affect underground water resources and rivers and streams. The damaging effects of mineral extraction are often long term and sometimes permanent. The influence of a deep quarry may extend to many kilometres. Public water supplies and flows from springs that feed streams and rivers can be threatened when aquifers are either removed or disturbed.

Water is purified as it percolates through aquifers and surface layers of soil and rock. Removing these materials can degrade the quality of water in the aquifer and provide an easy route for pollution to reach groundwater.

The closure of a sub-water-table quarry does not mean that water resources will recover immediately. A large deep quarry may take years to fill with water to the point where springs that it dried up begin to flow again. Until that time pumping will usually be needed in dry weather to support river flows. Some springs may never recover because the stable lake surface in a flooded quarry may be below the highest levels of the sloping pre-quarry water table. Using an abandoned quarry for industry or housing introduces a new risk of contamination to water resources. The water in a quarry lake, being surface water, is liable to eutrophication and other pollution by living organisms that were absent from the pre-quarry groundwater.

Our Objectives

To minimize the damage that mineral extraction can do to water purity and to reserves of water held in the ground. Where possible we will steer mining and quarrying operations away from important aquifers.

The Role of the NRA

We have duties and powers to:

- control the quality of water discharged from mineral workings;
- prosecute offenders if they cause pollution;
- require reasonable measures to conserve water resources.

We are involved in a range of activities:

- We monitor the changes that existing mines, quarries and pits are causing to rivers, springs, wetlands and water supplies.
- Many existing quarries are not subject to modern planning conditions which are designed to protect water resources. We negotiate with mineral operators to improve situations where their operations are damaging or present a risk to surface water and groundwater.
- When new controls become available we work with planning authorities to obtain better standards and working practices.
- We advise planning authorities on the effects that proposals for new quarries and mines will have on water resources and the water environment. When a new

mineral working is proposed that will cause harm to water resources and the water environment we will object to it.

- When needed we provide expert witnesses at public inquiries into mineral extraction proposals.

Local Perspective

The mineral extraction sites for the Tone Catchment are shown on the Mineral Extraction Map - Map 15, page 59. In 1994 the only active mineral workings in the Tone Catchment were the Whiteball Sandpits. Other minerals have been worked in the past, some on a large scale.

The Whiteball Sandpits, about 4 km south-west of Wellington, produce sand and gravel from the Otter Sandstone, which is an important aquifer. It is a soft red sandstone of Triassic age (c. 220 million years old). The upper levels of the sandstone are weakened by weathering and disintegrate to form a useful building sand. Pebble beds in the sandstone are a source of gravel. The raw sand and gravel are cleaned by washing, producing much silt and mud which is settled out in lagoons. Production of sand and gravel is believed to be 100 to 200 thousand tonnes in an average year, but this cannot be confirmed.

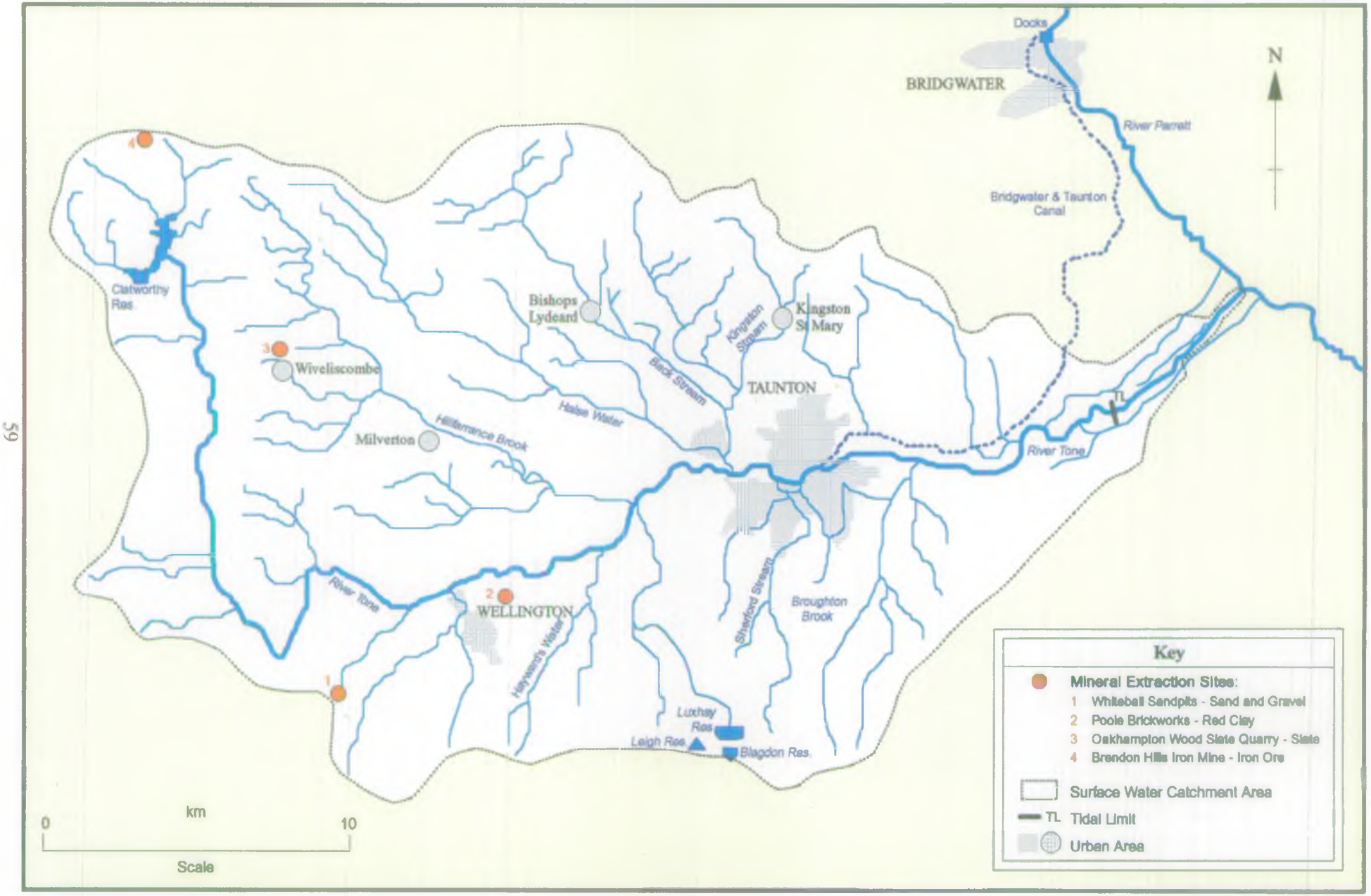
A large brickworks at Poole, 1 km east of Wellington, dug red clay from a large pit some 30 m deep in the Mercia Mudstones of Triassic age. In this locality the Mudstones are unusually free of marly beds, the lime in which can damage the bricks during the firing process. Extraction stopped in 1992 but has now restarted (1995).

Older quarries, abandoned for many decades, include the great Oakhampton Wood Slate Quarries, 2 km north of Wiveliscombe. During the 19th century they exploited a seam of slate, not of the best quality, in the Morte Slates formation during the 19th century.

The Morte Slates of the Brendon Hills were the scene of intensive mining for iron ore between 1840 and 1880. The veins extended for some 18 km in an east to west direction, the eastern end being in the Tone Catchment near Ralegh's Cross. The ore was siderite (iron carbonate). It was worked in steeply dipping veins to depths greater than 200 metres. Many of the abandoned mines are flooded and probably contain a significant water resource of variable quality.

Small quarries yielding stone for building were opened in many geological formations in the 18th and 19th centuries. Parts of Wiveliscombe and adjacent villages are built of the red Otter Sandstone. Near Milverton the Budleigh Salterton Pebble Beds were quarried for roadstone, and limestone pebbles were picked out and burned for lime. South-west of Wellington the Carboniferous Limestone was quarried for stone and lime in several small pits until the 1960s. Although these geological formations are minor aquifers the quarries have not been large enough to cause major losses to water resources.

Map 15 - Mineral Extraction



Information correct as of June 1995

5.9 WASTE DISPOSAL

Here we consider the disposal of waste to land. Some wastes can form very polluting liquids - known as leachate - as they break down. Leachate can pollute water both above and below ground.

Waste management sites are licensed by the County Waste Regulation Authority who make sure that sites do not endanger public health, cause pollution or spoil the local area. Waste regulation authorities consult us on all applications for waste management licences and we recommend ways of avoiding water pollution to them; we also advise the waste regulation authorities on the effects of some activities that are exempt from licensing controls. We have published our views on landfill in our Position Statement on Landfill and the Water Environment. In this statement we encourage waste minimization and recycling.

Some potentially polluting wastes can be spread on farmland to improve the soil. We advise the Waste Regulation Authority on ways of protecting the water environment from this activity.

Our Objectives

To prevent the pollution of ground and surface water or damage to wetlands caused by the disposal of waste to land.

The Role of the NRA

We have duties and powers to:

- monitor the quality of water around waste disposal sites;
- take enforcement action if pollution occurs.

Our work involves a range of activities:

- We advise planning authorities to make sure that new landfill sites are put where they will not cause pollution of water by commenting on waste local plans.
- We ensure that site operators make plans to monitor water and prevent pollution when they apply for a new site licence.
- We help to make sure that existing sites are maintained and operated properly.

Local Perspective

There are eighteen operational licensed waste management facilities within the catchment, five currently unlicensed metal scrapyards and thirty disused licensed facilities.

Poole Brickworks (Waste Management Licence (WML) 28/2 - ST 152 217) near Wellington, is the only currently operating domestic waste landfill in the catchment. This old clay pit is licensed to Wyvern Waste Services Ltd and is worked on a natural clay containment basis with active leachate extraction and disposal to public foul sewer. The site is scheduled to be completed in June 2004.

Priorswood landfill (WML 27 - ST 247 259) in Taunton closed for domestic waste disposal in August 1992. It is a 'dilute and disperse' site located on alluvium overlying Mercia Mudstone, there is a leachate collection system which discharges to the foul sewer. There is now a Waste Recycling Centre at both of the above sites.

Two of the closed licensed landfill sites (Tonedale, Wellington and Creech St Michael, Taunton) accepted trade and commercial wastes, but the remainder of the landfill sites in the catchment are or were licensed for inert or semi-inert wastes.

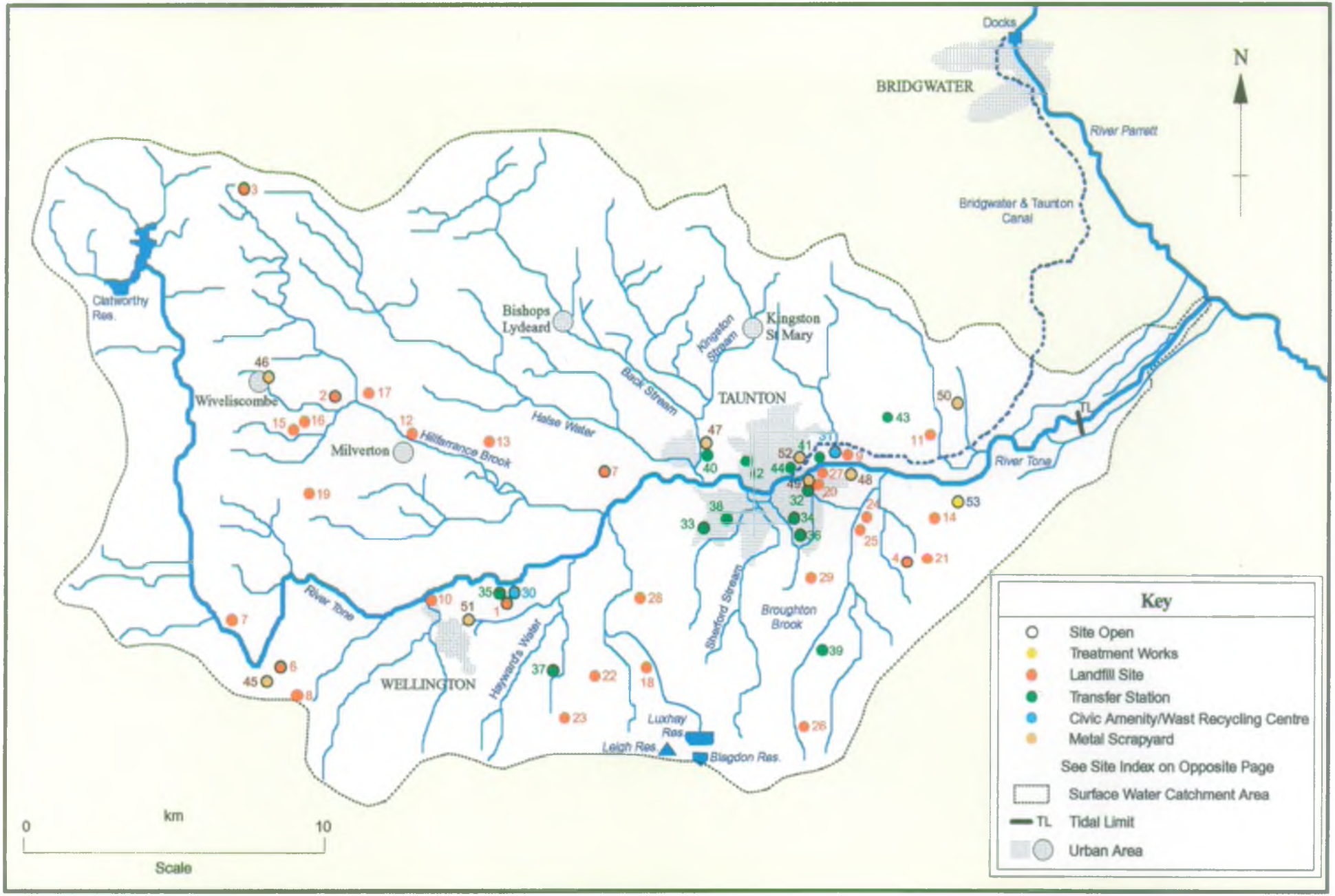
The nine operating transfer stations handle a wide variety of wastes, but two of the four closed transfer facilities were licensed for waste solvents.

There are also seven operational metal scrapyards, and Ham Sewage Treatment Works has a licence permitting the treatment of industrial sludges and liquids.

Agricultural land in the catchment is extensively used for the disposal of various industrial waste liquids and sludges (such as blood, septic tank wastes and milk wastes) and sewage sludge from Wessex Water Services Ltd sewage treatment works. The main areas involved in this activity lie to the northwest and east of Taunton.

Strategic aspects of waste disposal in the catchment will be defined in plans prepared by Somerset County Council. The 'Draft for Consultation' of the Waste Local Plan, which deals with geographical, population and planning issues, will be published by the County Planning Authority in January 1996. The Waste Management Plan, which deals with such matters as waste arisings and available landfill capacity, will be issued, in draft, by the Waste Regulation Authority for public consultation in September/October 1995.

Map 16 - Waste Disposal



Information correct as of August 1995

WASTE DISPOSAL SITES - MAP 16

INDEX TO SITES

Key to Abbreviations (Waste types)

D	=	Household (Domestic)
T	=	Commercial/Industrial (Trade)
S	=	Semi-inert
I	=	Inert
CLIN	=	Clinical Wastes
SO	=	Solvents
LIQ/SLUDGES	=	Liquids/Effluents/Sludges

Current Status

Open	=	Site has current Licence OR is a scrapyard not yet licensed
Closed	=	Site Closed/Completed/Restored OR Licence surrendered

Open Landfill Sites

1	D, T	Poole Brickworks, Wellington
2	S	Croford Railway Cutting, Wiveliscombe
3	S	Parish Quarry Tip, Brompton Ralph
4	I	Stoke Hill, Stoke St Mary
5	I	The Railway Pit, Allerford
6	I	Gamlins Farm, Wellington

Closed Landfill Sites

7	S	Tracebridge Quarry, Stawley
8	I	Whiteball Sand Pit, Wellington - licence surrendered
9	D,T	Priorswood, Taunton
10	T	Tonedale, Wellington
11	S	Creech St Michael, Taunton
12	S	Milverton Quarry
13	S	Blagroves Tip, Milverton
14	S	Canal Farm, Thornfalcon
15	S	Nunnington Park Farm, Wiveliscombe
16	S	Nunnington Park Farm, Wiveliscombe
17	S	Croford Railway Cutting, Wiveliscombe
18	S	Taunton Deane Service Area, Taunton
19	S	Dairy House Farm, Bathealton
20	I	Creechbarrow Road, Taunton
21	I	Ashe Farm, Thornfalcon
22	I	Millers Farm, West Buckland

Closed Landfill Sites (continued)

23	I	Huntspath Manor Farm, West Buckland
24	I	Haydon Farm, Stoke St Mary
25	I	Haydon Farm, Stoke St Mary
26	I	Whitford Quarry, Corfe
27	I	Toneway, Taunton
28	I	Great Herswell Farm, West Buckland
29	I	Cornish Farm, Taunton

Waste Recycling Centres (WRC)

30	D	Poole Brickworks, Wellington
31	D	Priorswood, Taunton

Open Transfer Stations

32	D, S,	Priory Way, Taunton
33	D, T, S,	Galmington Trading Estate, Taunton
34	CLIN	South Street, Taunton
35	S	Poole Brickworks, Wellington
36	S	South Street Depot, Taunton
37	S	M5 (Chelston Depot), Wellington

Closed Transfer Stations

38	D	Musgrove Park Hospital, Taunton
39	S	Orchard Portman Depot, Taunton
40	I	Taunton Trading Estate
41	T, SO	Crown Industrial Estate, Taunton
42	T, SO	Staplegrove Road, Taunton
43	S	Hobb Lane, West Monkton
44	S	Priorswood Road, Taunton

Open Metal Scrapyards

45		Greenham Quarry, Wellington
46		Old Brewery, Wiveliscombe
47		Silk Mills Lane, Taunton
48		Old Mill, Bathpool, Taunton
49		Priory Way, Taunton
50		Walford Cross, Creech St Michael
51		Brookside, Chelston, Wellington
52		Woodland Road, Priorswood, Taunton

Open Treatment Works

53	T, LIQ/ SLUDGES	Ham Sewage Treatment Works, Taunton

5.10 CONTAMINATED LAND

Contaminated land is land that could be a hazard to health or cause pollution, for example derelict or existing factory sites or disused waste disposal sites. We are concerned about the water pollution risks from contaminated land.

Our Objective

To prevent the pollution of ground and surface water from contaminated land.

The Role of the NRA

Dealing with contaminated land is complicated. Often much work has to be done to understand the problem fully. Before we take action we have to be sure that what we recommend (which can be very costly) will have worthwhile and lasting benefits. We detail our priorities in our Contaminated Land and the Water Environment Report where we also describe some things we can do to tackle the problem. Planning authorities have powers that they can use. Derelict Land Grants are available from central government which can assist with the re-development of contaminated land sites. Here are some things we can do:

- Comment on planning applications and give advice on the best way to redevelop sites.
- Help to identify contaminated areas.
- Help to ensure that the worst sites are targeted for redevelopment and clean up plans prepared.
- Take enforcement action if contaminated land is causing pollution.

Local Perspective

The precise nature and full extent of contaminated land within any catchment is difficult to accurately define, since the contamination of many sites is only realised when they are redeveloped, or when pollution actually occurs.

All open and closed non-inert landfill sites are by definition contaminated sites, but other waste management activities may have the potential to cause contamination (see Section 5.9 Waste Disposal, page 61). Tonedale landfill in Wellington is an example of a redeveloped closed landfill site which is suspected to have affected the adjacent River Tone. The site was used for landfilling 'greasecake' from the wool scouring industry, and was subsequently redeveloped into an industrial estate. A number of remediation measures were undertaken prior to re-development, but various pesticides have been detected in the River Tone. It should be noted however that all pesticide levels in the River Tone are currently within Environmental Quality Standards and that inputs from other sources cannot be ruled out.

The other main potential cause of contamination within the catchment is industry, which is concentrated largely in Taunton and Wellington. However, it should not be forgotten that a large number of activities have the potential to cause contamination; for example agriculture, petrol filling stations or even domestic heating fuel tanks.

Sites of coal gas manufacture can be heavily contaminated with a wide range of polluting substances. These sites can therefore present a high risk to the water environment. Part of the Tangier Gasworks site in Taunton was redeveloped in the early 1990s into offices and riverside walkways. Various contaminants were found and remediation was carried out by the developer to ensure no adverse impact on the adjacent River Tone. Contamination was also confirmed at the Wellington Gasworks site early in 1994 during residential redevelopment. Completion of this development was subject to a scheme of remediation works agreed with the District Council Environmental Health Department and the NRA.

5.11 FARMING

Over 80% of the land in England and Wales is farm land. The way this land is used affects the quality of our water environment. We are concerned about the pollution of surface and groundwaters from animal wastes, fertilizers and pesticides. Soil erosion, land drainage and stock damage to river banks can also be a problem. A sustainable farming system that conserves the soil and minimizes and recycles wastes will reduce the risk of damage to the water environment.

Our Objectives

- to protect the water environment from potentially damaging farming activities
- to encourage agricultural practices that improve the water environment

The Role of the NRA

There is only a limited range of things we can do to influence the way farmers use land. Other agencies such as the Ministry of Agriculture, Fisheries and Food (MAFF) can encourage sensitive farming practices using financial incentives. However we can control and prevent pollution in the same way as we do with any other industry.

We have duties and powers to:

- prevent and control pollution;
- deal with pollution incidents;
- issue consents to discharge from farms. However we encourage farmers to dispose of farm wastes to land rather than discharging treated waste directly to rivers;
- regulate the abstraction of water for use on farms;
- supervise matters relating to flood defence.

Our work involves a range of activities:

- We assess the impact of farming on water quality, prioritizing our work where there are gaps in our knowledge.
- We promote the designation of water protection zones and stopping certain activities within them. Nitrate Sensitive Areas are an example of this.
- We target our pollution prevention work where it is needed most.
- We inspect farms so that pollution can be prevented.
- We are developing best practices to prevent pollution from the storage and disposal of farm wastes, and from the management of farmland. These best practices will include things like buffer zones or other schemes to prevent pollution and improve rivers and wetlands for wildlife.
- We educate farmers and the public about the pollution problems caused by farming.
- We work with other agencies such as MAFF to make the most of our pollution prevention work.
- We control certain works which may affect rivers.
- We maintain the river system to provide flood defence for agricultural land.
- We are developing Water Level Management Plans for environmentally important sites on main river.
- We provide flood warning to mitigate damage to property and risks to stock.

Local Perspective

The predominant land use in the upper reaches of the Tone Catchment is permanent pasture, with woodland (some ancient semi-natural) on the steeper valley sides.

As the valley widens in the middle reaches, land use becomes more intensive, with improved and reseeded grassland, maize cultivation and potatoes (principally in the Hillfarrance sub-catchment) which are regularly irrigated. Sheep and cattle grazing are common, with increasing numbers of horses.

In the lower reaches of the Tone, the floodplain is essentially open moorland with improved permanent pasture, reseeded grassland, withy beds and maize cultivation.

Land use in the catchments of the tributaries tends to be a mixture of improved grassland and arable, but is predominantly rural.

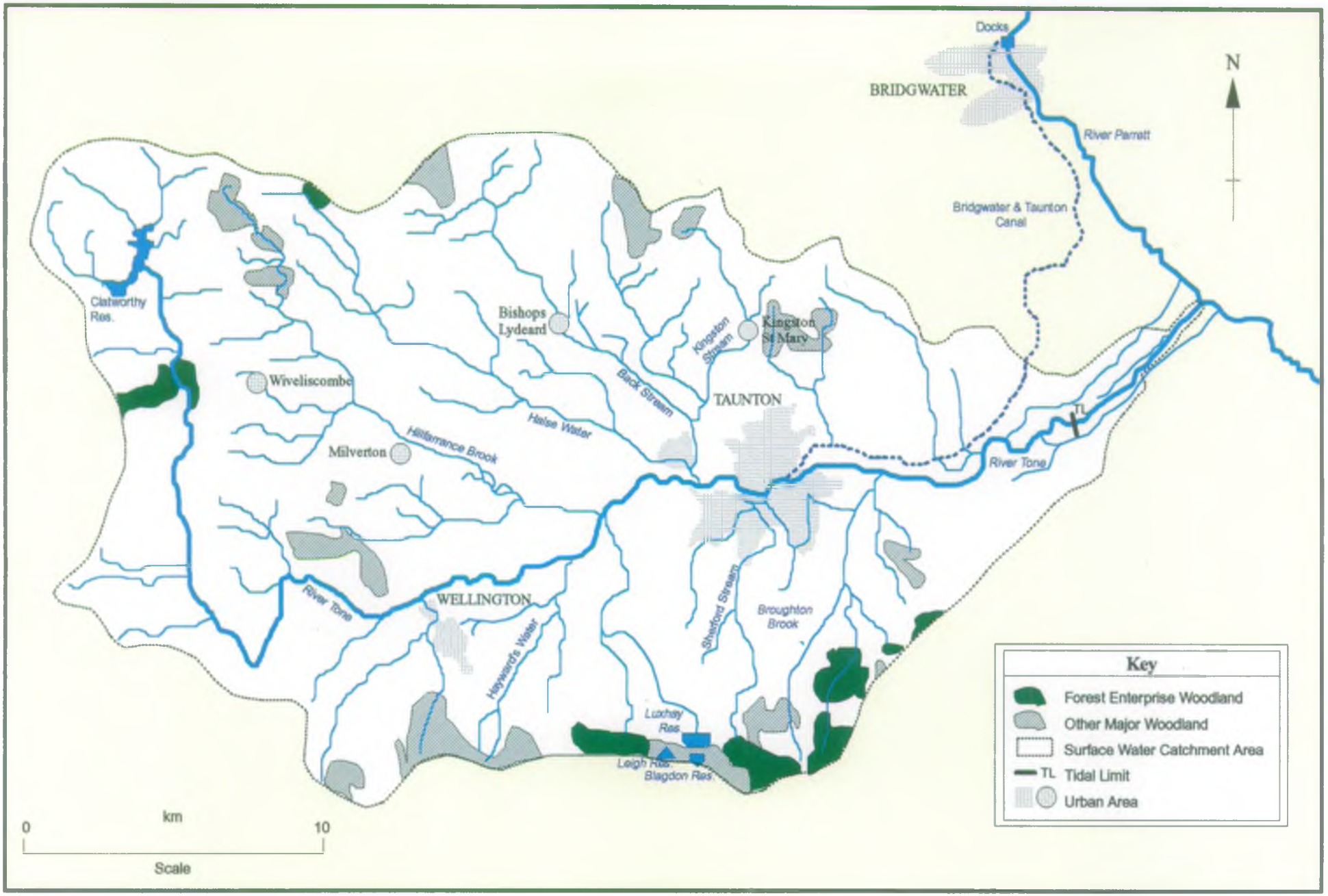
As agriculture intensifies, so the river corridor is "squeezed" and there is pressure from landowners to clear scrub and cut back overhanging trees, thus reducing the corridor further. The removal of bankside vegetation along the Tone often leads to problems with erosion. The principal need is to assess the extent of arable cultivation and work with MAFF and landowners to restore pasture in the floodplain.

Farm problems

The following types of problem are likely to occur either chronically or occasionally:

- Soil erosion - from cultivated fields, particularly sloping land in periods of intense rainfall. This increases the silt loading of the river and can lead to problems with the concretion of river bed gravels, the reduction of light for river plants and deleterious effects on fish and invertebrates.
- Runoff from riverside fields, especially after ploughing and after fertilizer application, often contains high levels of plant nutrients, in particular nitrate and phosphate. This may give rise to nutrient enrichment in the watercourse, leading to excessive plant growth and more frequent algal blooms (eutrophication). The creation of uncultivated strips of land next to the river - bio-buffers or buffer zones - helps to reduce the amount of silt and fertilizer runoff entering the watercourse.
- Water supplies - the catchment is heavily abstracted for crop irrigation, leading to problems with low flows on some tributaries.
- Pesticides - the lack of a buffer zone between arable land and watercourse can lead to pesticide residues being washed into rivers. Chemicals such as atrazine are commonly used on maize and are known to cause environmental problems in other parts of the country.

Map 17 - Forestry



Information correct as of June 1995

5.12 FORESTRY

Well managed forestry in the right places does not harm the water environment and will often bring benefits. However, in some circumstances forestry development and management can cause problems. Acidification, soil erosion, pollution, water yield and damage to wildlife habitats concern us in some parts of England and Wales but in South Western region the planting and management of new woodland does not usually cause problems for the water environment.

The Forestry Authority regulates forestry in the UK by licensing some operations using felling licences and providing grant aid through the Woodland Grant Scheme. The Forestry Authority has published a series of guidelines on forests and water, nature conservation, landscape design, archaeology and recreation. The Guidelines encourage environmentally sympathetic planting, management and harvesting. The Farm Woodland Premium Scheme operated by MAFF also provides grant aid for new woodlands on farms.

Our Objective

To protect the water environment from forestry activities.

The Role of the NRA

We have duties and powers to:

- regulate some forestry works using land drainage legislation;
- deal with pollution incidents.

Our work involves a range of activities:

- We work with the forestry authority and local authorities to ensure that the most significant forestry schemes consider effects on the water environment. We welcome the opportunity to comment on these schemes and on Indicative Forestry Strategies where they are being developed.
- We identify areas that might be sensitive to the planting of forests to the Forestry Authority, Forest Enterprise and local authorities.
- Significant planting within the 'main river' floodplain needs the consent of the NRA under land drainage by-laws. With the Forestry Authority we are looking at the prospects for new floodplain woodlands in the lowlands of England and Wales and considering their potential impact on flood storage.
- We are promoting the Forest and Water Guidelines with NRA staff and developing 'best practice' techniques further through our research and development programme.
- We are working with the Forestry Authority to improve the way we consider the environmental impact of proposed forestry schemes. At the moment only new planting schemes require an Environmental Impact Assessment but large scale woodland management activities can cause as much damage to the water environment as new planting schemes.

Local Perspective

Forestry is not a conspicuous land use within the catchment, with the exception of conifer plantations on the steeper slopes of the Blackdown and Quantock Hills. Semi-natural ancient woodlands are sparse within the catchment, with the majority of broadleaved woods concentrated in the upper reaches above Tracebridge.

Forestry is generally on a very small scale and covers a very low percentage of the catchment. Woodlands are virtually absent downstream of Wellington.

The generally tree-lined nature of the river corridors (with the exception of the Tone below Taunton) adds enormously to the diversity of landscape and habitat type as well as increasing the organic food source of the watercourses.

5.13 WATER ABSTRACTION AND SUPPLY

Here we consider the abstraction of water from the surface or below the ground for public supply, industry, and other uses.

Our Objective

To manage water resources to achieve the right balance between the needs of the environment and those of the abstractors.

The Role of the NRA

Our management of water resources is guided by European Union and UK legislation (Water Resources Act 1991). We have duties and powers to:

- ensure water is used properly, regulating abstractions using licences;
- conserve water supplies and protect them from pollution or over use.

Our work involves a range of activities:

- We plan for the sustainable development of water resources, developing criteria to assess the reasonable needs of abstractors and the environment.
- We are working on a system for mapping the availability of groundwater.
- We are studying rivers stressed by abstraction, reviewing how we can limit the environmental effects - for example "minimum acceptable flows".
- We are developing and implementing a consistent approach to determining licences.
- We are working on ways of setting Environmental Quality Standards to help us determine licences.
- We promote selective domestic metering where resources are stressed.
- We define source protection zones to protect resources from development and pollution risks.

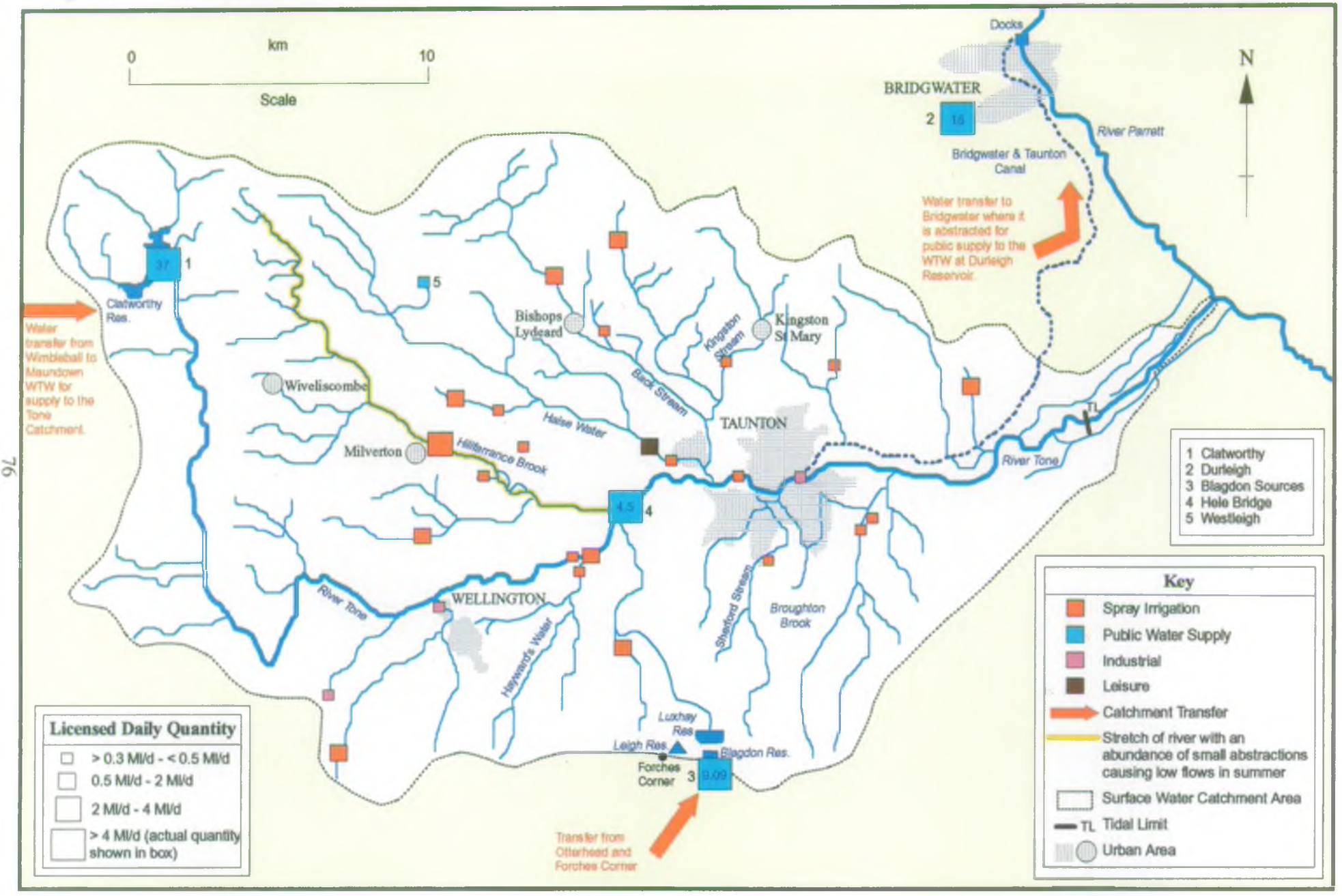
Local Perspective

The Surface Water Abstractions Map - Map 18 and the Groundwater Abstractions Map - Map 19 show the geographical distribution of all abstractions within the catchment greater than 1 Ml/d for groundwater and 0.3 Ml/d for surface water. Figures 1-4 show how the proportion of these licences are split between the various uses for both groundwater and surface water and the significance of each abstraction is indicated by the % each use represents of the total quantity.

Licensed abstractions fall into two basic loss categories. These are of consumptive use and non-consumptive use. Consumptive use generally involves the loss of a substantial proportion of the water abstracted, non consumptive use is that which returns all of the abstracted water back into the catchment.

Consumptive uses are generally recognized as having the greatest impact on the catchment and include uses such as spray irrigation, public water supply, intercatchment transfer and water bottling. Non-consumptive uses include fish farming, gravel washing and general amenity uses.

Map 18 - Surface Water Abstractions



Information correct as of June 1995

Within the River Tone Catchment there are currently 402 abstraction and impounding licences. Of these 86 are licensed as surface water sources and 316 as groundwater. The total quantity actually licensed for abstraction is 94 Ml/d and 16,888 Ml/a. A total of 14,903 Ml/a or 88.3% is licensed from surface waters and 1,985 Ml/a or 11.7% is licensed from groundwater sources.

The majority of the licensed water, 12,977.2 Ml/a, is for public water supply.

Surface Water Abstraction

Surface water abstractions form the largest proportion of all water abstracted within the Tone Catchment. Surface waters generally comprise rivers, canals, rhynes and impounding reservoirs. Public water supply by Wessex Water Services Ltd accounts for 12,169 Ml/a or 81.65% of the total surface water licensed annual quantity. Water for public supply largely comes from surface reservoirs which collect water during periods of high rainfall. During the summer compensation releases are made downstream of the reservoirs to ensure that environmental damage is not done to the watercourse. The largest reservoir in the catchment is at Clatworthy. Release of water from below Clatworthy reservoir contributes substantially to river flows under low flow conditions in the upper reaches of the catchment. The minimum compensation flow is 4.55 Ml/d. The other main reservoir is Durleigh near Bridgwater. Geographically this is outside of the Tone Catchment but has been included in the Tone plan because the majority of its water is supplied from the Tone Catchment via the Bridgwater and Taunton Canal. Water to fill the reservoir is abstracted from the Canal by Wessex Water under a licence held by the British Waterways Board. The canal itself is filled by water from the Tone at Firepool Weir in Taunton. This Wessex Water abstraction is conditional on sufficient flow in the River Tone and Halse Water as gauged at Bishops Hull.

Other smaller abstractions for public supply include the reservoirs of the Blackdown sources, at Luxhay, Leigh and Blagdon and Priors Park. These reservoirs are used together with an occasional conditional abstraction from the Tone at Hele Bridge, south-west of Taunton. The reservoirs are also supplemented by water from outside the catchment. Water may be abstracted from the Otter Valley at Otterhead for transfer to Luxhay Reservoir. Springs at Forches Corner also feed the reservoir group and enter the supply network.

Spray irrigation licences make up 61% of all surface licences and 30% of the daily quantity of water abstracted from surface water sources. Spray irrigation represents a high net loss of water with virtually none of the water being returned to the catchment as it is lost to the atmosphere by evaporation. Much of this water is abstracted in summer when resources are most under pressure and spray irrigation therefore is an important issue within the catchment. One major use of water is for potato growing. The Tone Catchment is the largest potato growing area within the South Western Region. Many licences were issued soon after the legislation was put in place as "licences of right" and are unconditional, allowing direct summer abstraction. New irrigation licences are now conditional; only allowing abstraction when flows are above a minimum prescribed flow or by limiting abstractions to the winter, storing the water in off stream storage reservoirs for subsequent summer use.

The Hillfarrance Brook has an abundance of small surface water direct spray irrigation licences along its length. Many of these have no conditions set as they were issued as

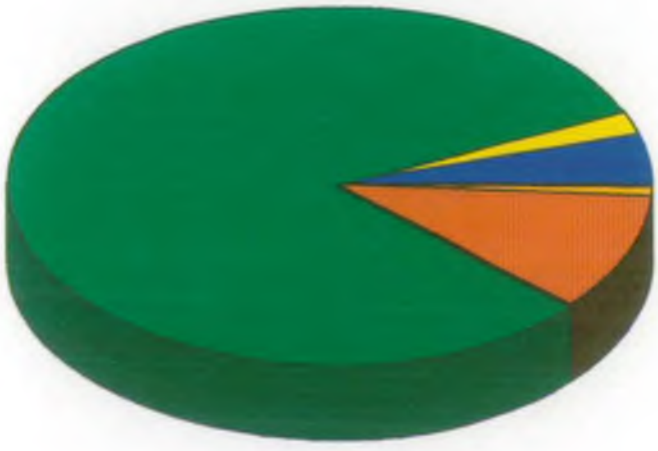
Figure 1

Number of Licences
Surface Water

Spray Irrigation 54	Industrial 7	Public Water Supply 4
Leisure 1	Other 12	General Farming 9

There are no commercial or private water supply licences in the Catchment

Figure 2



Surface Water
% of Abstractions

Spray Irrigation 4.6%	Industrial 2.2%	Public Water Supply 81.6%
Leisure 10.7%	Other 0.8%	General Farming 0.2%

Figure 3

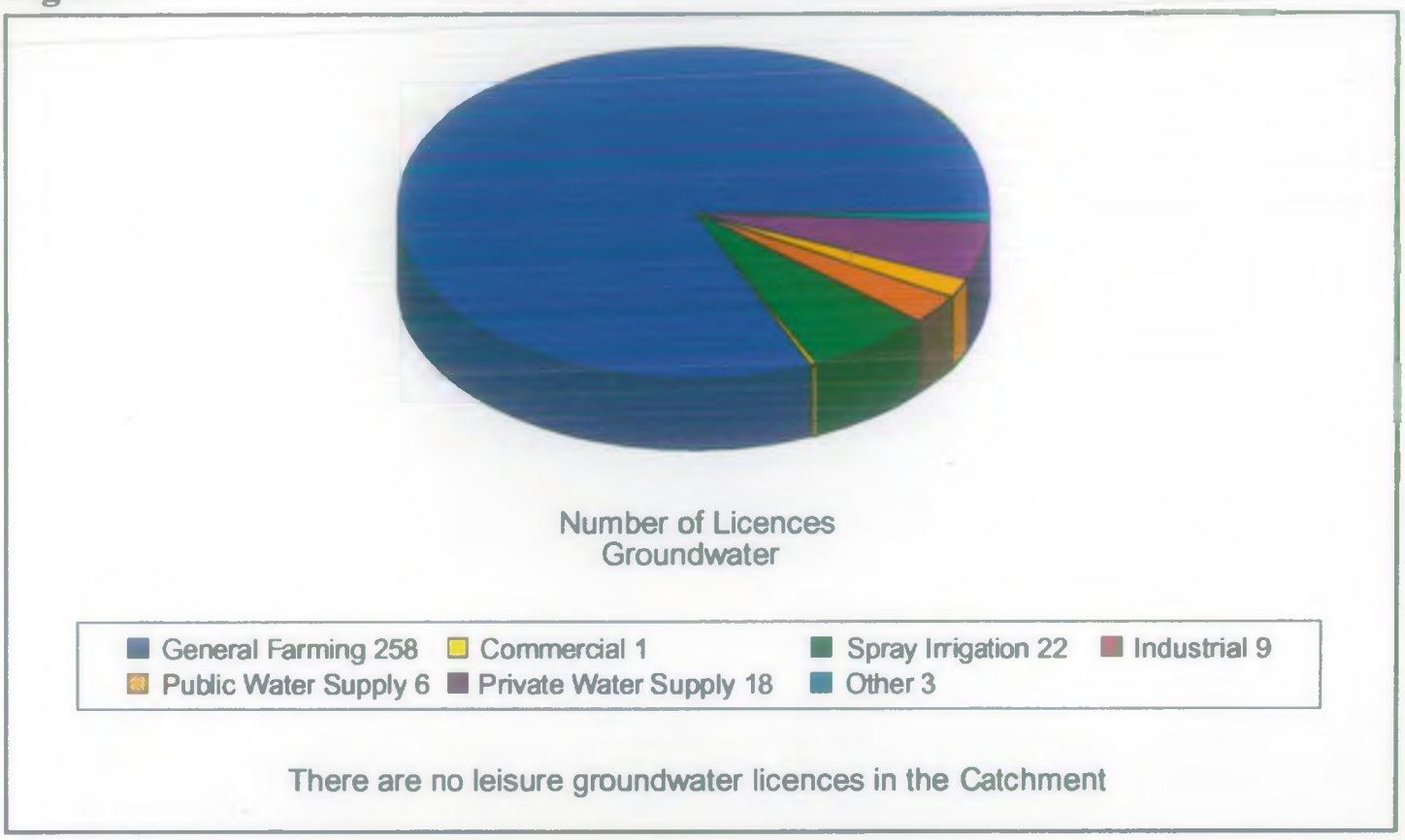
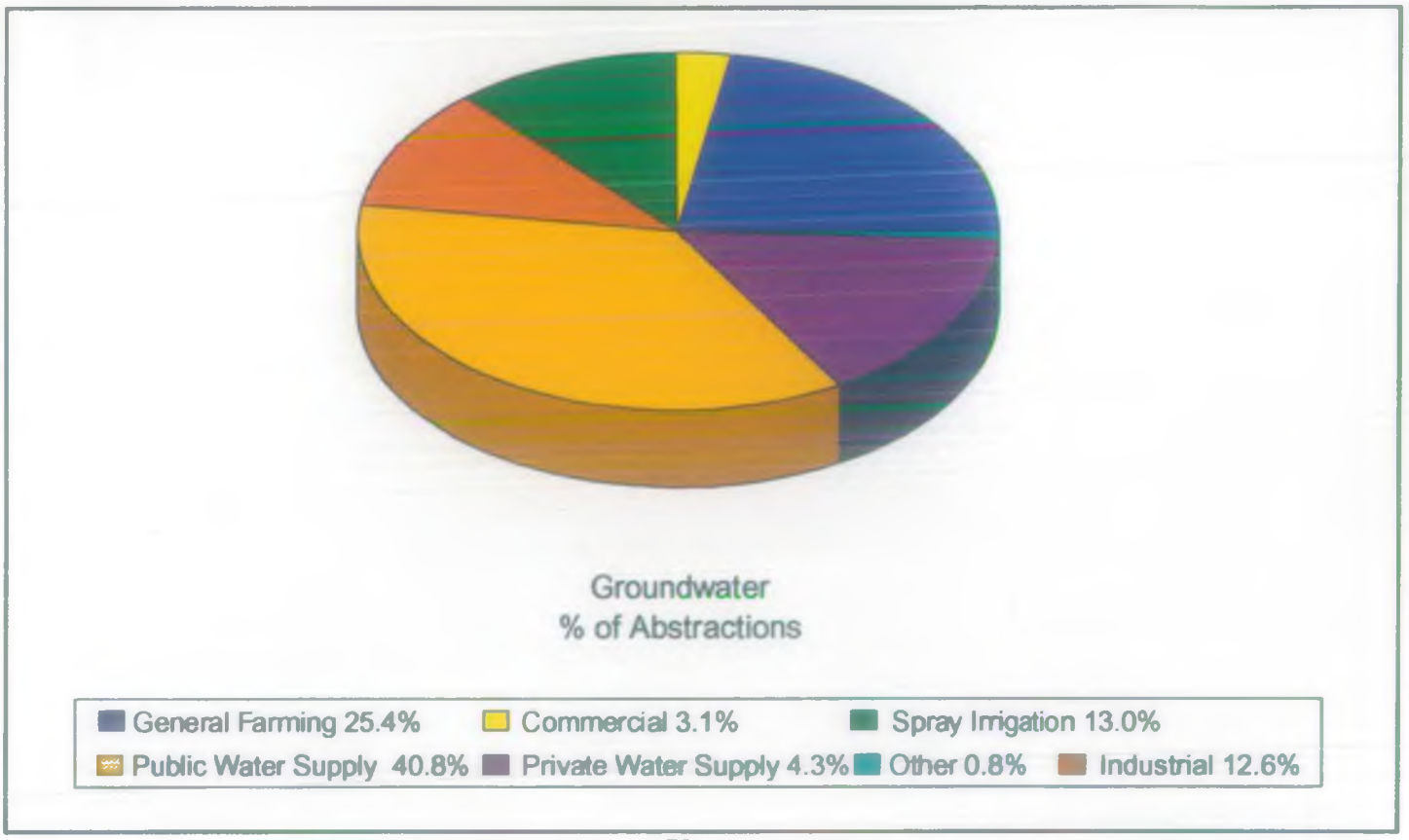
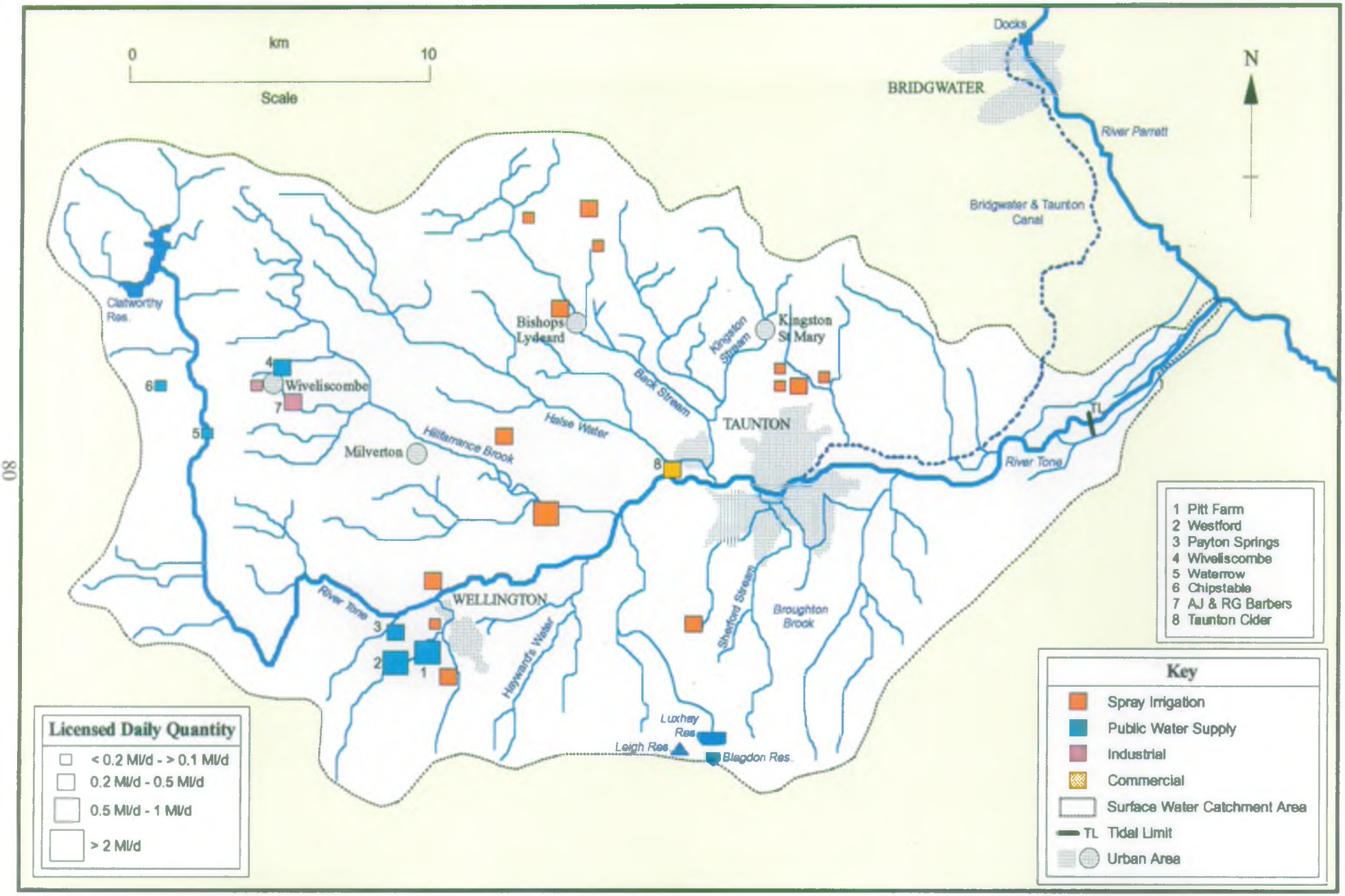


Figure 4



Map 19 - Groundwater Abstractions



Information correct as of June 1995

licences of right in the early 1960s. This can substantially contribute to low flow problems in the summer.

Other significant surface water abstractions include those for industrial purposes 333 Ml/a leisure (including fishing and amenity lakes) 1,500 Ml/a, general farming 22 Ml/a and military use 98 Ml/a. (See Surface Water Abstractions Map - Map 18 and pie charts).

Groundwater Abstractions

Groundwater abstractions account for only 11.7% of the total licensed quantity from the catchment. Abstraction generally takes place from boreholes, wells and springs. Groundwater makes an important contribution to the base flow of rivers, particularly in their upper reaches where, in dry weather, it provides a majority of the available flow.

The most important aquifers in the Tone Catchment are the combined Triassic Otter sandstones and Budleigh Salterton Pebble Beds as well as the combined Vexford Breccias and Wiveliscombe Sandstone aquifer. These predominate in the south and west of the catchment. (See Geology and Hydrogeology Map - Map 4 in Section 4.0).

Abstraction for public water supply is the dominant use of groundwater. Wessex Water is licensed to abstract 877 Ml/a or 44.2% of all groundwater abstractions.

The largest public supply borehole is at Pitt Farm, Wellington. However, this supply is little used at present. There are minor sources to the west of the catchment at Waterrow and Chipstable which are of local significance. (See Table Two).

The majority of groundwater licences are issued for general agricultural purposes. Of the 316 groundwater licences 258 are for general agricultural purposes. Most are sourced from local aquifers and are for very small quantities. This reflects the fact that many of the remote parts of the catchment are not serviced by public water supply. General farming accounts for 504 Ml/a of the total groundwater abstraction. Spray irrigation is licensed for 259 Ml/a, industry for 250 Ml/a. Private water supply and commercial uses are licensed for 84 Ml/a and 61 Ml/a respectively.

Private Water Supply

Private water supply abstractions include all abstractions from either groundwater or surface water sources other than public water supply. (See Table One).

The most significant group of private water supply licences in the Tone Catchment are those for spray irrigation. In the Tone Catchment there are seventy seven irrigation licences. Many of these licences are "licences of right" which allow direct abstraction from the River Tone and tributaries without restrictive conditions. The consumptive nature of spray irrigation abstractions and the need to use them at times of low flow mean they can have a substantial impact on river flows. The NRA's current policy is to encourage off-stream winter storage to alleviate this problem.

Small groundwater and surface water abstractions for domestic use only are exempt from licensing control as long as less than 0.02 Ml/d is being abstracted. This covers many independent domestic supplies located in the remoter parts of the region.

Similarly abstractions for general agricultural purposes are exempt under 0.02 Ml/d, but only for abstractions from surface waters.

TABLE ONE
ABSTRACTIONS OTHER THAN PUBLIC SUPPLY

Use	Authorized quantity Ml/a	% of abstraction not returned	Net resource Ml/a	Predicted Growth Rate per year	Demand in 2021	Comments
Non mains [1] domestic supply (Private supply)	84	25	21	-		In areas with low population density there may be difficulties in supplying mains water at reasonable cost, in such circumstances ground/surface water supplies provide a useful alternative.
Agriculture [2]	526.35	25	131.5	-		NRA's Regional Water Resources Development Strategy predicts little growth in this use.
Spray Irrigation	941.3	100	941.3	1.7% 1991-2001 1% 2002-2021 [3]	1270	Demand generally occurs at times of year when rivers are naturally low and impacts are generally high. In future such schemes will include the provision of winter storage.
Industry	580	30	174.8	0.75% [4]	702	Limited use, water is used for drink manufacture and in extractive industry. Constrained by recession.
Other including Commercial Public Service Fish Farms	343.5	25	41.75	-		This use includes offstream amenity ponds and fishing lakes as well as drinks manufacture.

(1) Many similar abstractions for this use are exempt from licensing by being less the 0.02 Ml/d for private domestic household use.

(2) Some of these supplies are exempt from licensing control being from surface water and less than 0.02 Ml/d.

(3) Growth rates are taken from NRA Regional Water Resources Development Strategy. It is emphasized that these are demand forecasts and that actual usage will be constrained by water availability.

(4) Growth rates are taken from the NRA Regional Water Resources Development Strategy. Currently recessionary pressures are stunting development in this area.

Public Water Supply

Wessex Water Services Ltd is the only supplier of mains water within the Tone catchment. They have eleven abstraction licences, five of which authorize abstraction from surface water sources and six are from groundwater sources. Public water supply represents 76% of all water abstracted within the catchment. Groundwater sources make up 44.2% of all groundwater abstractions and surface waters make up 81.65% of the surface water abstractions. The importance of surface water

abstraction is evident from these figures. Below is a summary table showing all public water supply licensed abstractions within the Tone Catchment.

TABLE TWO
PUBLIC SUPPLY ABSTRACTIONS

Source	Daily Licensed Quantity Ml	Annual Licensed Quantity Ml	Comments
Clatworthy	37	10,000	Major onstream impoundment. Headwaters of River Tone. Compensation release below impoundment. 4.55 Ml/d.
Bridgwater and Taunton Canal to supplement Durleigh	18 [1]	4,300	Abstraction from the Bridgwater and Taunton Canal conditional on the availability of flows at the combined gauging stations on the Halse Water and River Tone at Bishops Hull.
Blackdown Sources (B)	9.09	1,250	Reservoirs at Luxhay, Leigh, Blagdon and (Priors Park). Water collected from springs and adits as well as onstream impoundments.
Hele Bridge	4.5	850	Abstraction from the River Tone is conditional upon the combined flow at the Halse Water and Bishops Hull gauging station exceeding 70 Ml/d.
Westleigh	0.34	68.8	
Wiveliscombe	0.31	113.65	
Waterrow	0.036	9.092	
Chipstable	0.020	4.6	
Payton Springs	0.455	136.3	
Westford	0.546	181.84	
Pitt Farm	1.18	363.65	Presently disused.

(1) Abstraction from the Bridgwater and Taunton Canal is conditional upon the following:
(i) 18 Ml/d can be abstracted when aggregate flows in the Tone and Halse Water exceed 77.76 Ml/d.
(ii) 13 Ml/d can be abstracted when aggregate flows in Tone and Halse Water exceed 74.3 Ml/d.
(iii) 9 Ml/d at any other time.

A compensation release of 4.55 Ml/d must be released downstream of the Blackdown sources at all times. The reliable yield (42 Ml/d) of the above sources make up 35% of the total reliable resources (118 Ml/d) available in the Wessex Water Services Ltd's Somerset Supply Zone. The principal demand for water is in the main towns including Taunton, Wiveliscombe and Wellington. Water is supplied to these towns from a combination of groundwater and surface water sources. The largest surface water source Clatworthy, is used together with Wimbleball Reservoir in the neighbouring catchment (River Exe). The smaller groundwater sources are operated to meet local demands where access to the integrated water distribution network is not possible e.g. Chipstable and Waterrow.

Water Transfer in and out of Catchment

Four water transfer schemes operate for public supply. These are detailed in Table Three. (See Surface Water Abstractions Map - Map 18 for surface water abstractions).

TABLE THREE

Source	Supply	Comments
River Tone	Durleigh Reservoir (R. Parrett)	Water transfer from the River Tone via the BWB Bridgwater/Taunton Canal to Bridgwater. Wessex Water hold an abstraction licence to take water from the Canal to augment the yield of Durleigh reservoir.
Wimbleball (River Exe)	River Tone	Water abstracted from Wimbleball is transferred direct to Maundown WTW. From here it helps to supply the Tone Catchment.
Otterhead (River Otter)	River Tone	Wessex Water abstract at Otterhead in the River Otter Catchment. From here water transfers are made to the reservoirs of the Fulwood group (Luxhay, Leigh and Blagdon).
Forches Corner (Wiltown Valley)	River Tone	Water is abstracted from springs and adits and transferred to Luxhay reservoir by gravity.

The River Tone Catchment forms part of the Wessex Water Somerset Supply Zone. As a whole the Somerset Supply Zone has a current water resources deficit of 9 Ml/d. This deficit is currently met by cross catchment transfer but in future the deficit could grow to as much as 60 Ml/d by the year 2021 if no resource and demand management measures are implemented. This deficit could be delayed by improvements in demand management (metering and efficient water use), resource management (leakage control, operational improvements and conjunctive use of sources) and finally the careful development of new sources adopting a precautionary approach. Any development of new sources for the Somerset Supply Zone would not be within the Tone Catchment.

One option for the future is for Wessex Water Services Ltd to share in the increased yield from Wimbleball reservoir once the already licensed pumped storage scheme is in place. This has the potential to provide Wessex Water with between 5-10 Ml/d subject to satisfactory arrangements with South West Water Services Limited. (See the NRA South Western Regional Water Resources Development Strategy "Tomorrow's Water" 1995).

5.14 EFFLUENT DISPOSAL

Here we consider the disposal of effluent directly to rivers, estuaries, the sea or into the ground. Effluent includes sewage, industrial and farm wastes. We regulate the disposal of effluent by issuing consents to control discharges and taking action if a river is affected by a pollution incident.

Rivers have a natural ability to render the main constituents of many effluents harmless, providing that effluent disposal is properly controlled.

Our Objective

To protect the water environment from harm caused by the disposal of effluent and allow the widest possible use to be made of rivers.

The Role of the NRA

We have duties and powers to:

- authorize discharges through a system of consents. It is illegal to discharge sewage effluent or trade waste without the consent of the NRA. Before making a discharge it is necessary to apply for a consent. We look at the circumstances in each case. We can refuse a consent if a discharge will cause an unacceptable deterioration in water quality.
- check discharges to see if they comply with consent standards. We may prosecute dischargers if they exceed consent conditions.
- prevent illegal discharges.
- influence investment in sewerage and sewage treatment by the water companies in line with AMP2 guidelines (see section below on Improvements to Wessex Water Services Ltd (WWSL) Discharges).

We are involved in a range of activities:

- We work with planning authorities to control development where the sewerage or sewage treatment system is overloaded.
- We liaise with trade dischargers, farmers and WWSL, carry out regular site inspections and monitor discharge quality.
- We constantly review and develop our approach to water sampling.

Improvements to Wessex Water Services Ltd (WWSL) Discharges

Improvements to WWSL's discharges over the next ten to fifteen years are subject to available funding approved by OFWAT, the water industry's economic regulator. A Strategic Business Plan, (Asset Management Plan 2 (AMP2)), for these schemes was developed based on guidelines agreed between the NRA, Department of the Environment (DoE), Water Services Companies and OFWAT. The plan was submitted to OFWAT early in 1994.

In order of priority, schemes included are:

1 Schemes required to meet and maintain **current** EC and domestic statutory obligations.
2 Schemes required to meet and maintain **new** EC and domestic statutory obligations.
3 Schemes which already have been separately justified, required to maintain river quality relative to the 1990 NRA survey of water quality or to achieve river or marine improvements.

OFWAT declared the associated customer charging base in July 1994, and we are currently discussing the timing of funded schemes with WWSL.

Local Perspective

Discharge consents only apply to point source discharges, that is to say, specific, identifiable discharges of effluent from a known location. Diffuse sources of pollution, such as agricultural runoff, and pollution incidents, such as accidental spillages, are not authorized by discharge consents.

Three types of consented discharges are found in the catchment:

- **Continuous**: from sewage and trade wastes.
- **Intermittent**: from storm overflows and emergency overflows (rainfall dependent).
- **Discharges to Ground**: into soakaways in the ground.

Continuous Discharges

These are continuous discharges of sewage and trade effluent. Details of these are shown on the Effluent Disposal Map - Map 20.

In areas covered by main sewerage systems both trade effluents and sewage are normally treated at the local WWSL sewage treatment works (STW).

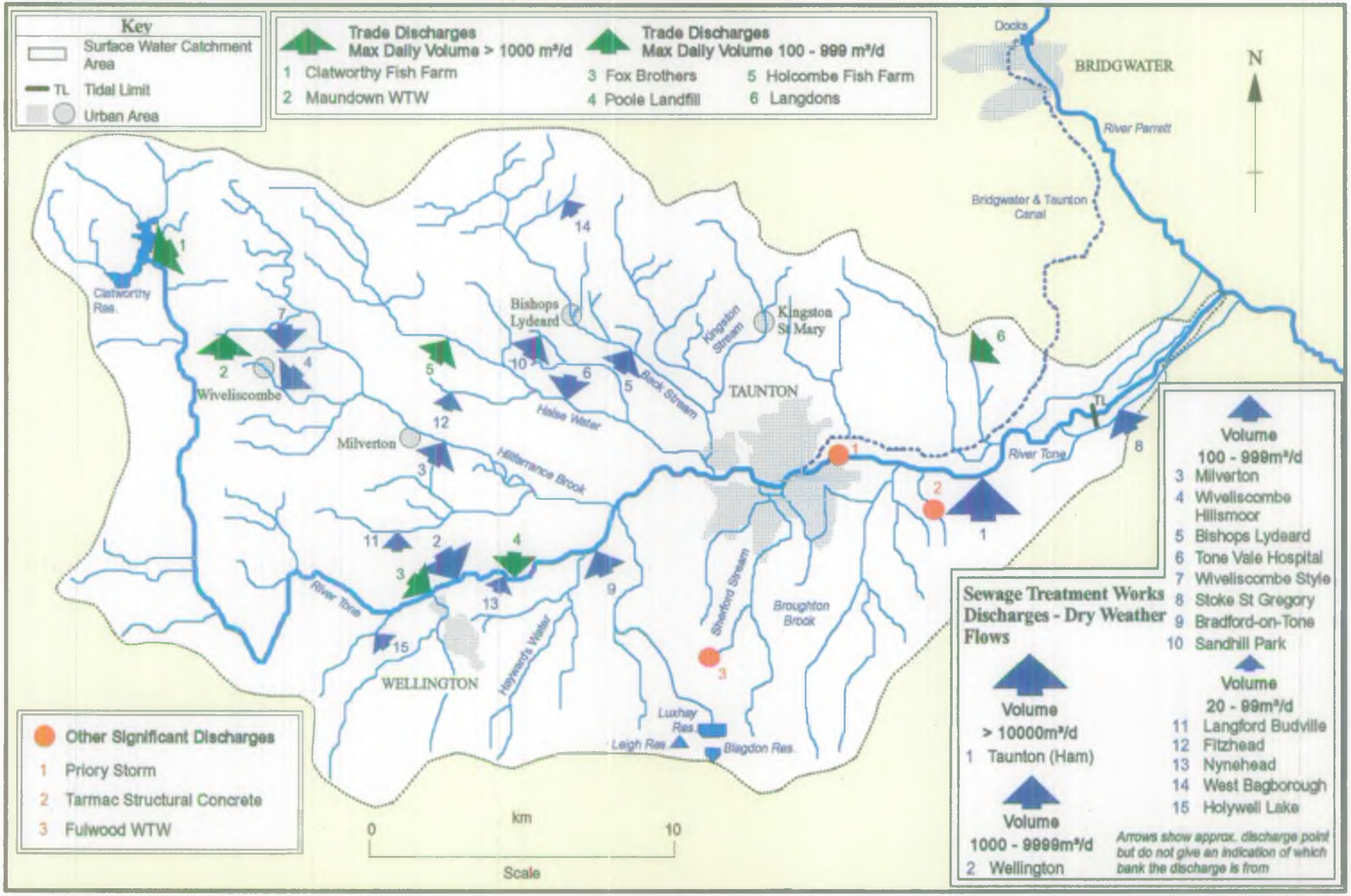
Rural catchments often have a high proportion of unsewered property. We have a national policy to discourage the proliferation of small private treatment plants in favour of mains connections where connection to the mains is reasonably practicable.

i) Sewage:

In this catchment there are fifteen sewage treatment works with a daily dry weather flow above 0.02 Ml/d. The largest is Taunton (Ham) STW which discharges directly to the River Tone.

Under AMP2 work at the following STWs has been identified: Taunton, Bishops Lydeard, Sandhill Park and Wellington. At Taunton STW work will be undertaken to ensure that the receiving water quality is maintained at 1990 levels; in addition, we are currently negotiating with WWSL to achieve improvements in water quality downstream of Taunton STW. The effluent load discharged from Bishops Lydeard STW is to be maintained at the consented levels as of 31 December 1993.

Map 20 - Effluent Disposal



Information correct as of June 1995

It is NRA policy to control, by means of consents all significant contributions of List I and List II substances. These are identified in the EC Dangerous Substances Directive. The only STW which is consented to discharge dangerous substances is Taunton. The cadmium discharged from Taunton STW is derived from trade discharges to sewer within the Taunton area (see Section 6.1.2 for the state of the catchment with regard to EC Dangerous Substances monitoring).

ii) Trade:

In this catchment there are six major trade discharges above 0.1 Ml/d. The two largest discharges are from sites owned by Wessex Water - Clatworthy Fish Farm and Maundown Water Treatment Works (WTW). Maundown WTW is covered by a deemed consent (see Glossary Appendix 15) which will be reviewed shortly. Of the other trade effluents the discharge from Poole landfill is of quarry drainage and that from Langdons comprises of treated sewage, site drainage and vehicle washwater. The discharge from Fox Brothers includes sewage and effluent from furniture stripping. This is the only site consented to discharge dangerous substances - the consent specifies a total pesticides limit.

It is likely that the consent will be reviewed shortly to reflect current operations on site.

There are no discharges in this catchment which are authorized by Her Majesty's Inspectorate of Pollution (HMIP) under Integrated Pollution Control.

Tarmac Structural Concrete has been included on the map as we are presently considering an application to cover their discharge of contaminated site drainage.

Intermittent Discharges

These include sewer storm overflows and pumping station emergency overflows, which are mainly associated with urban areas.

There are over twenty storm overflows in Taunton which have been identified by a Drainage Area Plan (DAP).

In a combined sewerage system a single pipe takes both sewage and surface water to the STW. In storm conditions the pipe will have insufficient capacity to carry the increased volumes and so a storm overflow is needed. In some cases properties may be at a lower level than the STW and so a pumped pipe called a rising main is used. If the pump fails due to an electrical or mechanical fault an emergency overflow is needed to protect properties against flooding with sewage.

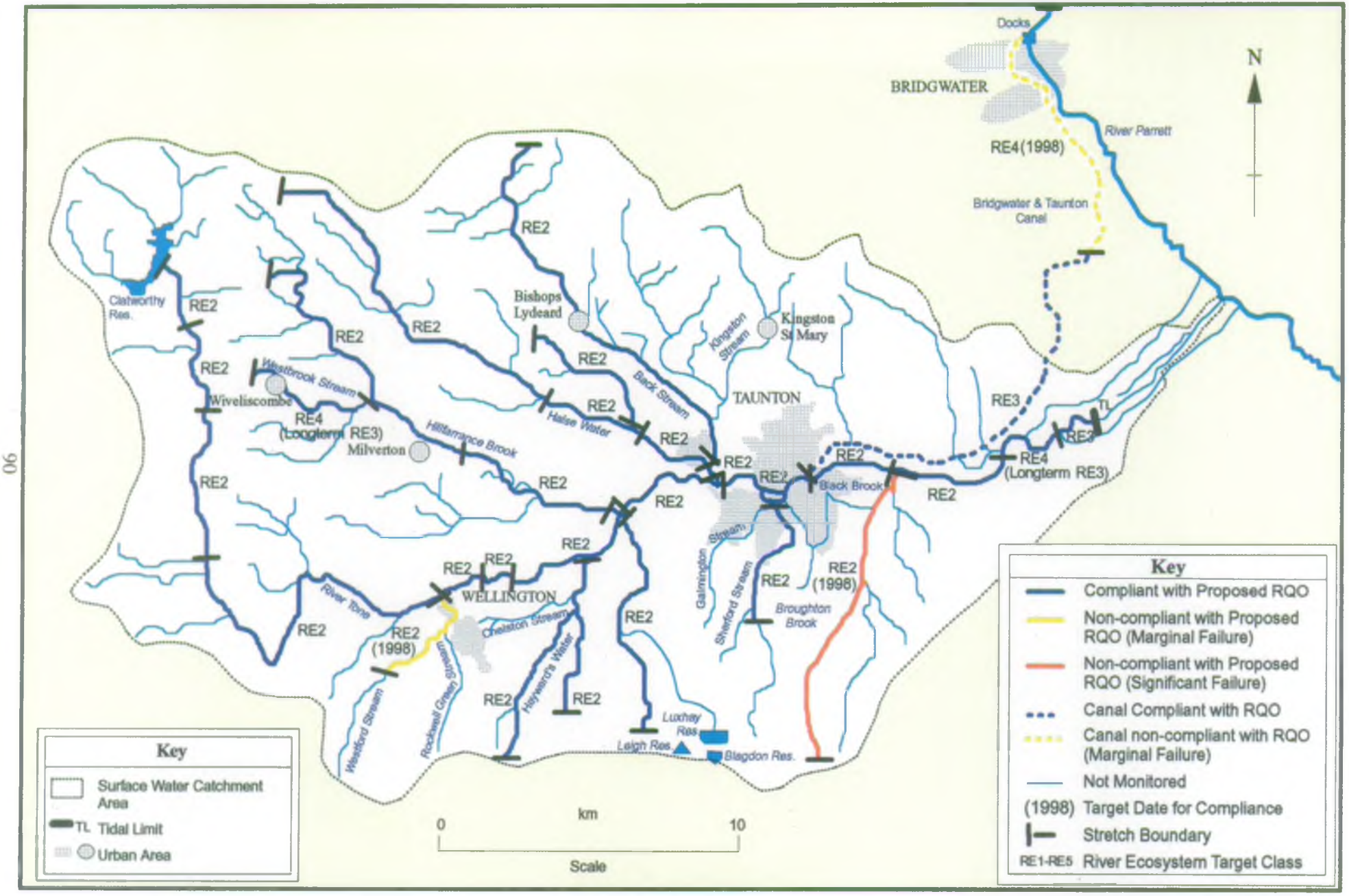
The major storm overflow in the catchment is from Priory Storm Tanks in Taunton. Improvement works have been carried out recently to minimize the frequency of overflows to the River Tone. Monitoring of the system is being undertaken to confirm whether further work is needed.

Discharges to Ground

Outlying farms and small villages are generally not served by a STW. In such locations septic tanks to soakaway, individual packaged treatment plants and cesspools (or cesspits) are commonly used. NRA Discharge Consent is not required for the use of a cesspool.

Problems with septic tanks and soakaways can arise in areas of heavy clay soil where soakaway drainage is poor. One such area in this catchment includes Blagdon Hill and Pitminster. A first time sewerage scheme has been proposed here.

Map 21 - Compliance with River Quality Objectives (River Ecosystem Classification) 1993



Information correct as of 1993

6.1 WATER QUALITY

We aim to maintain and improve where appropriate the quality of water for all those who use it. This is achieved by setting water quality targets for the catchment based on:

- River Quality Objectives to protect recognized uses.
- Standards laid down in EC Directives.
- International commitments to reduce the amount of Annex 1A substances (see Section 6.1.3) entering tidal waters.

In this chapter, the state of the catchment is compared to relevant water quality targets. We have identified issues where targets are not being achieved and action is needed to improve water quality. We have also identified other water quality issues in the catchment.

6.1.1 River Quality Objectives

The water quality targets that we use in all rivers are known as River Quality Objectives (RQOs). RQOs are used for managing water quality and are based on the River Ecosystem (RE) classification scheme. The River Ecosystem scheme is made up of five water quality classes (RE1 to RE5) (Appendix 1) which reflect the chemical quality needed by different types of river ecosystem, including the types of fishery they are able to support. The RE classification scheme replaces the National Water Council (NWC) system which was used by the NRA until 1 January 1994.

Target - RQOs for the Tone Catchment.

The RQOs based on the RE classification which we are proposing for the Tone Catchment are shown on the Compliance with River Quality Objectives (River Ecosystem Classification) 1993 Map - Map 21. These RQOs will apply from the date shown next to the class for example: RE2 (1996), means an RQO of RE Class 2 which must be achieved from 1 January 1996. For those stretches where no date is shown against them on the map RQOs will apply from 1 January 1995.

For certain stretches we have set new RE RQOs which are an improvement on the old NWC RQOs:

River Tone	Bridgwater and Taunton Canal - Confluence with Broughton Brook
River Tone	Confluence with Broughton Brook - Ruishton
River Tone	Ruishton - Ham

For certain stretches we have set new RE RQOs which represent a downgrading compared to the previous NWC RQOs. We have done this for stretches where the old RQOs were not achievable:

River Tone	Chipstable - West Bovey
River Tone	West Bovey - Stawley
River Tone	Stawley - Greenham
River Tone	Greenham - Runnington

Bridgwater and Taunton Canal	Crossing with Tone - Charlton
Bridgwater and Taunton Canal	Charlton - Crossing with Petherton Park Bk
Bridgwater and Taunton Canal	Crossing with Petherton Park Bk - Northfield

In addition we are proposing an undated "long-term" RQO of RE Class 3 for a stretch of the River Tone, Ham - Knapp. We are currently negotiating with Wessex Water Services Ltd to include improvements to Taunton Sewage Treatment Works (STW) in their Asset Management Plan 2 (AMP) programme subject to available funding.

We have also set an undated "long term" RQO of RE Class 3 for the Westbrook Stream, Source - Confluence with Hillfarrance Brook.

State of the Catchment

The Compliance with River Quality Objectives (River Ecosystem Classification) 1993 Map - Map 21 also shows where current water quality failed to meet its RQO. This assessment is based on three years of routine monitoring data from the Public Register collected between 1991 and 1993. We have shown failure to meet RQO as "significant" and "marginal" failures.. Significant failures are those where we are 95% certain that the river stretch has failed to meet its RQO. Marginal failures are those where we are between 50% and 95% certain that the stretch has failed to meet its RQO.

Of the twenty nine monitored river stretches in the Tone Catchment one stretch significantly fails to meet its RQO, and two other stretches marginally fail to meet their RQOs. The reasons for these failures are explained below.

Issue 1 - farming activity causing non-compliance with the RQO on the Broughton Brook.

The stretch Source - Confluence with Tone significantly fails to comply with its RQO of RE Class 2 due to high BOD, total ammonia and un-ionised ammonia concentrations, however the target date for compliance is not until 1998. A survey undertaken in autumn 1994 identified two farm discharges as contributing to causing the non-compliance.

The sampling point on the Broughton Brook has also been relocated as the brook at the old monitoring point is shallow and difficult to sample and is also considered unrepresentative of water quality in the brook as a whole.

Options for Action

NRA Water Quality Officers have recommended a programme of works at both farms to ensure that their discharges to the Broughton Brook are improved. The NRA is continuing to keep the Brook under surveillance. A total containment system at one of the farms is proposed to be installed in 1996.

Issue 2 - non-compliance with the RQO in the Bridgwater and Taunton Canal.

The lower stretch of the canal, Crossing with Petherton Park Brook - Bridgwater Dock, marginally fails to comply with its RQO of RE Class 4 due to low levels of dissolved

oxygen and high BOD. The lower half of the canal is subject to excessive algal growth. In July 1994 a potentially toxic blue-green algae was discovered in the Docks area. Not only a risk to bathers/water users, an extensive algal bloom can deplete oxygen from a body of water, causing distress to fish. There was concern that there would be a repeat in 1995 unless positive steps were taken by the NRA to locate and limit the source of nutrients and to undertake pollution preventative measures to limit the growth of the algae.

The problem only appears to manifest itself in the last few kilometres of the canal. This is because the lower reach is fairly stagnant as much of the flow is lost either to the River Parrett at Hamp Weir or at Albert Street via licensed abstraction for Wessex Water to supply Durleigh Reservoir.

Options for Action

An extensive water quality/hydrometric survey is currently being undertaken to gain a better understanding of nutrient flow patterns throughout the canal.

In addition British Waterways Board have recently repaired a sluice to improve the flow through the lower part of the canal which should result in an improvement in water quality. The NRA will assess the impact of this change.

The NRA will also continue to review the location of monitoring sites on the canal in order to more accurately reflect water quality of the whole canal.

Issue 3 - farming activity causing non-compliance with the RQO on the Westford Stream.

The Westford Stream, Beam Bridge - Confluence with Tone, marginally fails to comply with its RQO of RE Class 2 due to elevated levels of BOD, however the target date for compliance is not until 1998. The cause of the elevated BOD is unknown although the Westford Stream drains a farming area.

Options for Action

1 The NRA will investigate the cause of the high BOD levels.
2 The NRA Water Quality Officers will continue with their programme of farm visits to look for measures to reduce organic inputs to the stream.

Issue 4 - rural sewerage problems in the Sherford Stream.

Although the Sherford Stream complies with its RQO of RE Class 2 there is concern that this may not be achieved in the future. The villages of Blagdon Hill and Pitminster, located near the headwaters, have ineffective soakaways or direct discharges to watercourses. There has also been a proliferation of direct discharges from sewage treatment plants. Although this has so far only resulted in localized impacts, the NRA is concerned about the implications of future development if first time sewerage schemes are not implemented. The Sherford Stream has also suffered recently from two major pollutions. In April 1994 a ferric chloride spillage from Fulwood Water Treatment Works resulted in substantial fish and invertebrate mortalities in a tributary, and included fish mortalities in the Sherford Brook itself. Even more devastating, in September 1994 an estimated 25,000 gallons of

farm slurry was lost to the Brook at Pitminster which virtually wiped out all fish life for six kilometres. The Brook has since been restocked.

Options for Action

Pursue the implementation of the sewerage schemes with the Borough Council and WWSL.

Discourage further development until first time sewerage schemes have been implemented.

6.1.2 EC Directives

There are three EC Directives which currently apply to the Tone Catchment and the designated stretches and sites are shown on the EC Directive Monitoring Map - Map 22.

Target - EC Dangerous Substances Directive.

The Dangerous Substances Directive on pollution caused by certain substances discharged in the aquatic environment of the community, 76/464/EEC, protects the water environment by controlling discharges to rivers, estuaries and coastal waters which contain harmful substances.

This Directive describes two lists of compounds. List I contains substances 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 by Environmental Quality Standards (EQSs) issued through Daughter Directives (Appendix 3). List II contains substances which are considered to be less dangerous but which still can have a harmful effect on the water environment. Discharges of List II substances are controlled by EQSs set by the individual Member States (Appendix 3).

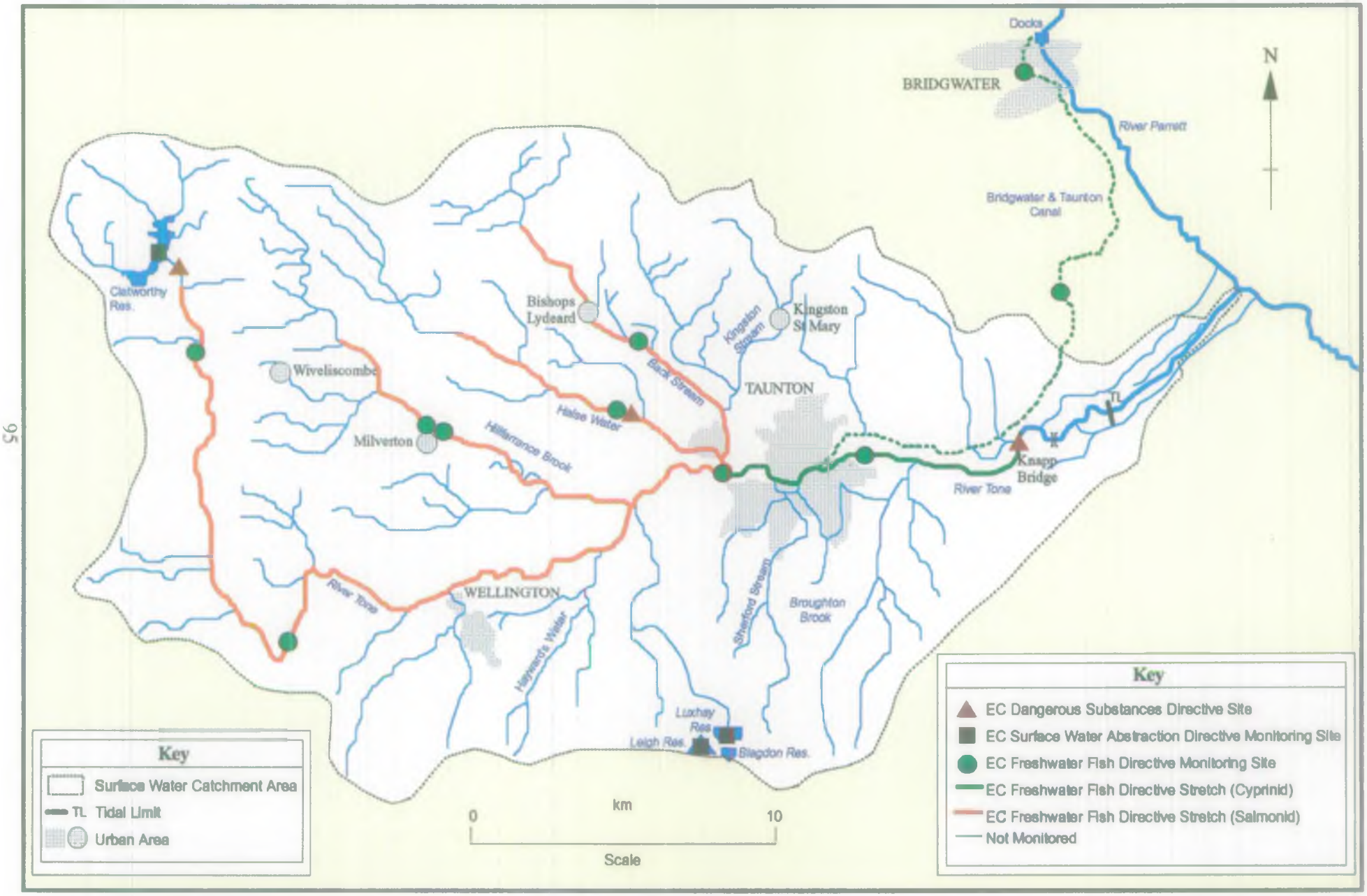
We are responsible for monitoring the quality of waters which receive discharges containing Dangerous Substances and reporting the results to DoE who decide whether the standards in the Directive have been met. Where the requirements of this Directive are not met, we are responsible for identifying sources of pollution and making sure that improvements are made.

State of the Catchment

There is a National Network site on the River Tone at Knapp Bridge which is monitored for List I substances; the EQSs for these substances have been met for the period 1991-1993. Cadmium is also monitored in the water of the River Tone downstream of Taunton STW. The EQS for cadmium has been met for the period 1991-1993.

List II substances are monitored in the Halse Water downstream of Holcombe Fish Farm and in the River Tone downstream of Clatworthy Fish Farm. The EQSs for these substances have been met for the period 1991-1993.

Map 22 - EC Directive Monitoring



Information correct as of April 1995

Target - EC Freshwater Fish Directive.

The Freshwater Fish Directive on the quality of waters needing protection or improvement in order to support fish life, 78/659/EEC, ensures that water quality in designated stretches of water is suitable for supporting certain types of fish.

This Directive contains two sets of quality standards. One set of standards protects cyprinid fish or coarse fish populations. The other set of standards which are stricter, protects salmonid fish populations for example, salmon and trout.

There are two sets of standards for each fishery type, imperative standards, which must be achieved and guideline standards which Member States should aim to achieve.

We are responsible for monitoring the quality of identified fisheries and reporting the results to DoE who decide whether the standards in the Directive have been met. Where the requirements of this Directive are not met, we are responsible for identifying sources of pollution and making sure that improvements are made.

State of the Catchment

Stretches of the River Tone, Halse Water, Back Stream and Hillfarrance Brook have been designated as salmonid fishery. The EC Freshwater Fish Directive imperative standards have been met for 1991 to 1993 except for the particular sites listed below.

In 1992 the monitoring site Washbattle Bridge on the River Tone failed to meet the imperative standard for dissolved oxygen, the reason for this failure was unknown despite investigation by the NRA and it appears to be an isolated occurrence. Also on the River Tone the monitoring site at Greenham failed to meet the imperative standard for total ammonia in 1992; this was caused by farm slurry, and the NRA took enforcement action which resulted in improvements being made to the relevant farm waste handling system.

Two monitoring sites on the Hillfarrance Brook, upstream and downstream of Milverton STW failed to meet the imperative standard for dissolved oxygen in 1993. The reason for the low dissolved oxygen at both sites is unknown.

Stretches of the River Tone and Bridgwater and Taunton Canal have been designated as cyprinid fishery. The EC Freshwater Fish Directive imperative standards have been met for 1991 to 1993 except at Albert Street on the Bridgwater and Taunton Canal in 1991. The monitoring site at Albert Street did not meet the imperative standard for dissolved oxygen, the reason for this is possibly due to low water flow coupled with a heavy growth of weed and algae (see Issue 2).

Issue 5 - non-compliance with the EC Freshwater Fish Directive on the Hillfarrance Brook.

Options for Action

Subsequent investigations on the Hillfarrance Brook have recorded dissolved oxygen levels greater than the required standard but the NRA is continuing surveillance.

Issue 6 - non-compliance with EC Freshwater Fish Directive on the Bridgwater and Taunton Canal.

Options for Action

The NRA will continue to review the location of monitoring sites on the canal in order to more accurately reflect water quality of the whole of the canal. British Waterways Board has recently taken action to improve flow through the lower part of the canal which should result in an improvement in water quality. An extensive water quality and hydrometric survey is currently being undertaken to gain a better understanding of nutrient flow patterns throughout the canal so that pollution preventative measures to limit the growth of algal and weed growth can be undertaken.

Target - EC Surface Water Abstraction Directive.

The Directive concerning the quality required of surface water intended for the abstraction of drinking water in the Member States (75/440/EEC), protects the quality of surface water used for public supply. This Directive ensures that water abstracted for public supply meets certain quality standards, and is given adequate treatment before entering public water supplies.

We are responsible for monitoring the quality of designated surface water abstractions and reporting the results to DoE who decide whether the standards in the Directive have been met. Where the requirements of this Directive are not met, we are responsible for identifying sources of pollution and making sure that improvements are made.

State of the Catchment

There are three identified surface water abstraction sites in the Tone Catchment: Clatworthy Reservoir, Leigh Reservoir and Luxhay Reservoir. 1993 was the first year for reporting monitoring results, unfortunately incorrect analytical groups were used for the samples from these reservoirs in 1993 therefore no data is available for the period covered by this plan (1991-3). The Action Plan and subsequent Annual Reviews will report on any non-compliance which arises after 1993.

6.1.3 Other International Commitments

Target - Annex 1A Reduction Programme.

At the second and third North Sea Conferences, the UK Government made a commitment to reduce the loadings (concentrations x flow) of certain substances known as 'Annex 1A' substances (Appendix 6) entering tidal waters from rivers and direct discharges. Annex 1A substances are those which are toxic, persistent and/or bio-accumulative. Loads of most Annex 1A substances are to be reduced by 50%, but loads of mercury, cadmium and lead are to be reduced by 70%. Reductions are to be achieved by 1995 compared to a 1985 baseline or a 1991/1992 baseline where data for 1985 is unavailable.

We are responsible for carrying out monitoring and identifying significant sources of these substances. We do this by ranking loads of Annex 1A substances in rivers and direct discharges according to their size. Those loads which contribute to 95% of the total load

are said to be significant. In accordance with DoE guidelines we identify where reductions can be made.

State of the catchment

The River Tone at Knapp Bridge is monitored for Annex 1A purposes. Significant loads of copper, arsenic, total hexachlorocyclohexane, gamma hexachlorocyclohexane, dieldrin, atrazine, trichloroethylene and trichloroethane have been recorded for this site during the period 1991-1993.

Issue 7 - significant loads of Annex 1A substances in the River Tone at Knapp Bridge.

Options for Action

We will carry out investigations as to the sources of these substances when we have received guidance from the DoE following the 4th North Sea Conference held in June 1995.

6.1.4 Additional Monitoring

As well as the work we carry out to meet the requirements of RQOs, EC Directives and other international commitments, we carry out additional monitoring which helps us to determine the state of water quality in the Tone Catchment.

Target - Freshwater Biological Monitoring.

We monitor the ecological quality of rivers by sampling benthic macroinvertebrates. These are small animals which live in river sediments. They are unable to move far and so are affected by long term conditions in the river.

We collect samples from the river during the spring, summer and autumn and make a list of the different families (taxa) of macroinvertebrates present. We compare the range of families found to what we would expect to find in a similar unpolluted river using the River Invertebrate Prediction and Classification System (RIVPACS). We use this information to classify rivers as follows:

Biological Class	Description
A	Good
B	Moderate
C	Poor
D	Very poor

State of the Catchment

Of the thirty nine sites monitored in the Tone Catchment, in 1994, twenty nine had biological quality of Class A. The biological classification indicated that there is good water quality throughout the lower Tone, Hillfarrance Brook and Haywards Water, indicating that the water quality problems highlighted in the 1984 and 1986 biological surveys have improved.

On the River Tone, sites at Nynehead and East Nynehead had biological quality of Class B and traces of sewage fungus were found on the substrate at both sites indicating organic enrichment. These two sites are located downstream of Wellington and could be affected by various discharges from the town; an investigation downstream of Wellington STW indicated that there was only a slight decrease in biological diversity. The Westford/Rockwell Green/Wrangway stream complex could be a source of organic inputs to the River Tone just upstream of Tone Bridge. The water quality at Frieze Hill on the River Tone had borderline biological quality between Class A and Class B.

The Holywell Lake Stream (a tributary of the upper Tone) at Harpford Farm had biological quality of Class B. The restricted biological diversity could be due to the fact that the lower part of the stream is heavily overgrown.

Sites at Westford and Tonedale, on the Westford Stream, and Rockwell Green, on the Rockwell Green Stream, had biological quality of Class B. All of the sites showed traces of sewage fungus on the substrate and had quite an extensive coverage of algal growth indicating organic enrichment.

Possible sources of contamination include a scrap metal dealer and the industrial estate at Chelston and surface water discharges from Poole landfill site.

The Galmington Stream at the A38 Road Bridge had biological quality on the borderline of Class A and Class B. The fauna was fairly diverse especially considering that the stream flows through an extensive urban area.

The Black Brook at Ruishton had biological quality of Class B. The brook flows through the suburbs of Taunton and is probably affected by surface water discharges.

Additional biological quality monitoring was undertaken downstream of a number of STWs. Only Wiveliscombe (Hillsmoor) STW, which discharges to the Westbrook Stream (a tributary of the Hillfarrance Brook), had a moderate impact on biological quality.

Issue 8 - poor biological quality (Class C) on the Chelston Stream.

Options for Action

Poole landfill site discharges are now subject to strict consent conditions and are monitored on a regular basis. Water Quality staff are concerned about discharges of oil particularly from the Chelston Industrial Estate. Following a survey several areas requiring improvement were identified and the necessary works have now been carried out. Corresponding improvements in biological quality are expected.

State of the Catchment

The Authority has become concerned at the frequency of oil pollutions originating from the Galmington Trading Estate, Taunton, which discharges through a surface water culvert into the River Tone just downstream of Bishops Hull. It is clear that oil is finding its way into the surface water system causing regular pollutions which are sometimes significant.

Attempts over the years to find the cause have been unsuccessful, due to the complex nature of the site, although visits to all the units has resulted in a noticeable improvement.

Issue 9 - oil pollution from Galmington Trading Estate, Taunton.

Options of Action

Water Quality staff intend to undertake a detailed pollution prevention survey in the autumn of 1995 to improve the situation further.

6.1.5 Groundwater Quality

Target - Groundwater Quality.

Groundwater stored in water bearing rocks (aquifers) is a valuable resource for future generations. In many places it is the principal source of public and private drinking water and is also used for industrial agricultural purposes. Groundwater also provides spring flow to streams and rivers maintaining flows in dry summer conditions.

If groundwater becomes polluted it is not easy to detect and is very difficult and expensive to clean up again. So it is better to prevent or reduce the risk of groundwater contamination in the first place rather than deal with the consequences. We have a target to protect groundwater from pollution.

In 1992 we published our Policy and Practice for the Protection of Groundwater. This is a national policy which ensures that there is a consistent approach to the prevention of groundwater pollution. The policy document sets out why we must safeguard the quality and flow of water in aquifers and outlines how the NRA with the co-operation of other organisations and individuals will work to reduce risk of groundwater pollution. Catchment management plans need to address the importance of pollution prevention planning in achieving and maintaining future groundwater quality. A golden rule is that prevention is better that cure.

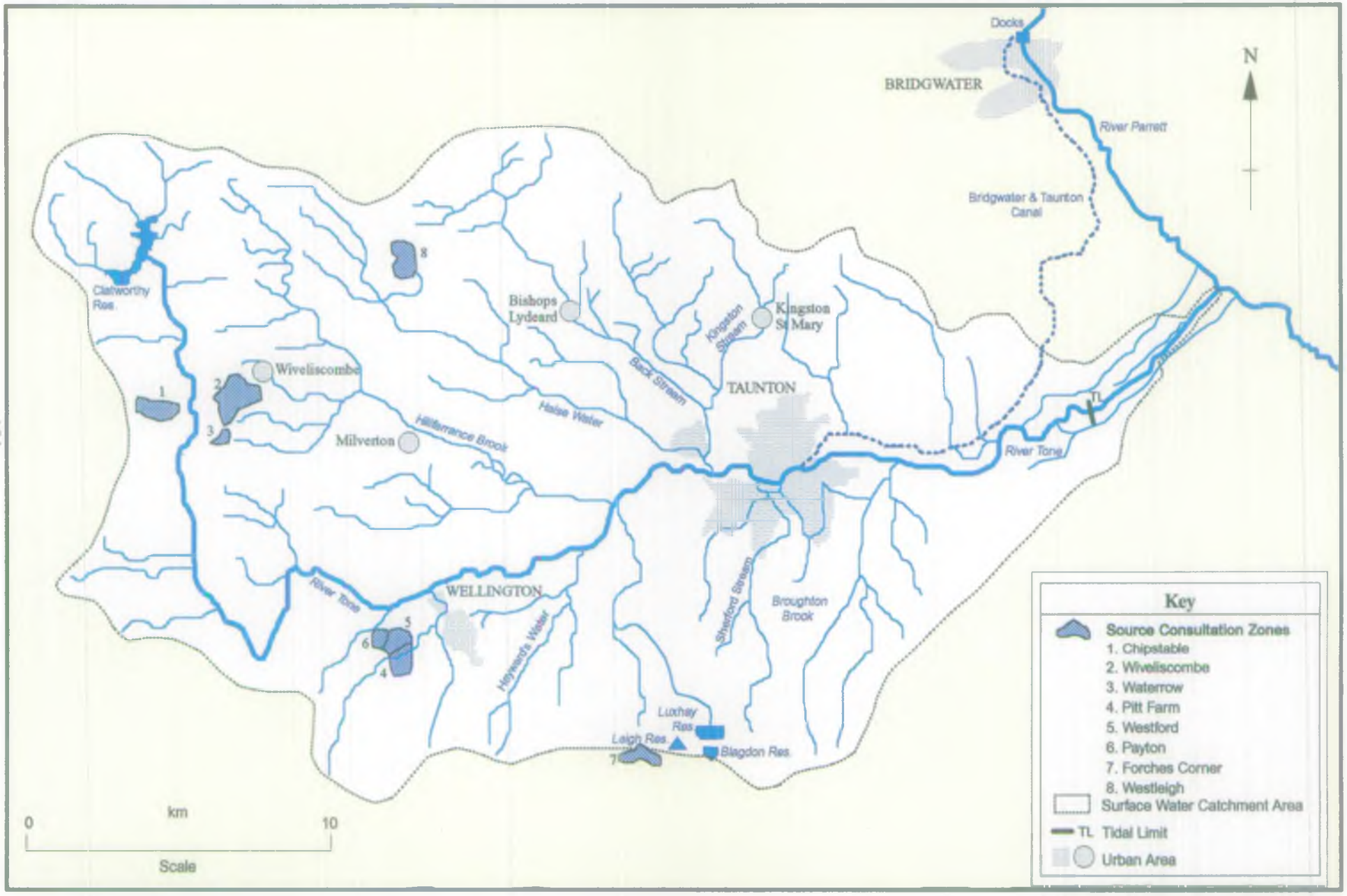
Our Policy document contains policy statements on the following:

- Control of groundwater abstractions.
- Physical disturbance of aquifers affecting quality and quantity.
- Waste disposal to land.
- Contaminated land.
- Disposal of sludges and slurries to land.
- Discharges to underground strata.
- Diffuse pollution.
- Other threats to groundwater quality.

The full Policy document is available from HMSO. A summary guide outlining NRA concerns and how they may be addressed is shown in Appendix 13.

The policy pays particular attention to protecting groundwater used for public water supply and the NRA is working on defining three zones of decreasing risk around points of abstraction. This should be completed by 1998. In the meantime we are also defining

Map 23 - Source Consultation Zones



Information correct as of June 1995

'Consultation Zones' around such sources and will ask planning authorities to refer certain types of development proposals to us.

Another key element to assist the protection of groundwater generally is identifying areas which are particularly vulnerable according to properties of the soil cover and the underlying rocks. A programme of Groundwater Vulnerability mapping is well underway and will assist in future pollution prevention planning.

State of the Catchment

The Source Consultation Zones Map - Map 23 shows public groundwater supply 'Consultation Zones' within the catchment. The NRA carries out only limited groundwater quality monitoring itself although a national monitoring strategy is being developed. Public groundwater supplies are monitored by water companies with data being made available to the NRA. Private groundwater supplies are monitored by district councils.

There are no Nitrate Advisory Areas, Nitrate Sensitive Areas or Nitrate Vulnerable Zones currently designated or proposed within the catchment.

There are no known diffuse or point source groundwater pollution problems within the catchment.

The various sites mentioned in Section 5.9 (Waste Disposal) and Section 5.10 (Contaminated Land) are not believed to have caused offsite contamination of groundwater.

However, the closed Tonedale landfill is believed to have contributed to raised levels of certain pesticides found in the River Tone downstream of Wellington (see Section 5.10).

6.2 WATER QUANTITY

The Water Resources Development Strategy sets out how we would like to see water resources developed and managed in the future. Our Strategy follows the principles of sustainable development with proper safeguards for the environment.

We will:

- encourage the efficient use of water;
- expect abstractors to use existing sources efficiently before new sources are developed;
- approve developments that cause the minimum problems for the environment;
- solve existing environmental problems caused by abstraction where funds can be found.

6.2.1 Public Water Supply

Target - to secure supplies in the Somerset Supply Zone.

State of the Catchment

The Tone Catchment is part of Wessex Water's Somerset Supply Zone which extends from Porlock and the upper reaches of the River Exe Catchment in the west to Bruton in the east and Yeovil in the south. Resources within the zone are insufficient to meet demand and consequently there is currently a nominal deficit of 9 Ml/d. The abstraction from Wimbleball Lake supplemented by an inter supply zone transfer from groundwater sources in Wiltshire has delayed the onset of the deficit.

Issue 10 - securing future public water supplies.

Options for Action

Wessex Water has two immediate options for resource development once satisfactory demand and resource management is in place. One option is the abstraction from Wimbleball is increased subject to negotiations with South West Water Services Limited and their allocation of resources derived from the recently approved Wimbleball pumped storage scheme. The other option is the development of the Newton Meadows abstraction from the Bristol Avon.

State of the Catchment

Wessex Water operate licensed abstractions from the impounded headwaters of the River Otter at Otterhead lakes, for input to the Somerset Supply Zone.

These lakes supply the reservoirs of the Fulwood group (Luxhay, Leigh and Blagdon). Other sources in the Blackdown Hills also supply the Fulwood group which has a reliable yield of 5.5 Ml/d.

The water which is abstracted from the Otterhead Lakes would normally flow down the River Otter. However, abstraction to Fulwood removes water to the Tone. The Authority

is conducting an investigation into flows in the Otter and will be presenting the results in the summer of 1995. Should the conclusions show that the Otterhead abstractions are causing environmental stress in the Otter, the Authority will consider appropriate remedial action.

Issue 11 - the potential future loss of Otterhead as a resource for the Somerset Supply Zone demand.

Options for Action

Complete the flow investigation in the Otter and evaluate any remedial action shown to be necessary.

6.2.2 Spray Irrigation

Target - to control abstraction, especially that for spray irrigation to ensure a fair use of the available resource without causing harm to the ecology of the river.

State of the Catchment

The Tone is the biggest potato growing area in the Region, and spray irrigation is needed to provide both quality and yield. For other crops, lack of irrigation water can result in total loss of the crop.

Spray irrigators have a high net use of water, with virtually none being returned to the catchment. In addition the season of highest need for spray irrigation is between May and September. This coincides with the period when water resources are most limited, and environmental needs are highest.

In the Tone Catchment there are seventy six spray irrigation licences of which 21 are tied to a prescribed flow at a gauging station, and 12 are tied to a local flow restriction. The remainder are mainly licences of right, and do not contain conditions based on river flows to limit the abstraction.

Some tributaries of the Tone, for example the Hillfarrance Brook, face problems of severe water shortage arising from holders of licences of right. On the Hillfarrance the estimated natural dry weather flow amounts to 11.75 Ml/d. In summer, if the authorized licence holders were to abstract their daily quantities in an eight hour period the total abstraction rate would amount to 11.4 Ml/d, and the Hillfarrance Brook could dry up. This actually happened to parts of the Brook in 1976, but the effects were alleviated by introducing, with the abstractors consent, a pumping rota.

Issue 12 - water demand for spray irrigation.

Options for Action

The Authority's policy, set out in the recently launched Water Resources Development Strategy - "Tomorrows Water", aims to achieve a more efficient use of water by encouraging winter abstraction, with bank side or off-stream lined storage. Although the

capital cost of building storage reservoirs may be high, they have advantages of security of supply, abstraction charges may be lower, and many have a conservation or recreational use.

At times of low flows, licence holders with abstraction conditions linked to prescribed flows or levels may be required to cease abstraction. If river flows are very low a total ban on irrigation can be imposed, affecting all spray irrigation licence holders.

At times of critical low flows, to ensure the optimal use of available resources, the NRA will encourage local abstraction rotas such as the one instituted on the Hillfarrance Brook in 1976. Rota schemes require a high degree of cooperation between the NRA, National Farmers Union (NFU) and local abstractors.

In order to protect the rights of licence holders, and the water environment, the Authority will continue to monitor and enforce conditions of abstraction licences through a programme of licence inspections. During critical low flows inspection activity will be increased and supplemented with additional monitoring and enforcement techniques such as aerial surveillance and publicity campaigns.

6.2.3 Bridgwater and Taunton Canal

Target - to establish more efficient management of the Bridgwater and Taunton Canal's water resources, taking into account all interests, to ensure that only the minimum amount of water necessary is abstracted from the River Tone at Firepool.

State of the Catchment

Water from the River Tone is abstracted into the Bridgwater and Taunton Canal at Firepool Weir in Taunton. The water leaves the River Tone via a system of weirs and sluices and enters the canal through a brick lined culvert. The water is required:

1 for navigation purposes;
2 to supplement public water supply abstraction from the canal into Durleigh Reservoir;
3 to support an EC Designated Cyprinid Fishery and a County Wildlife Site.

Water also passes through the canal and is returned to the tidal River Parrett at Hamp Weir in the centre of Bridgwater. Currently there is no formal control on the abstraction from the Tone because it is exempt from the licensing regulations. This is because abstractions for "navigation purposes" are exempt as defined in Section 221 of the Water Resources Act 1991. The British Waterways Board is therefore entitled to abstract without a licence for the purpose of transferring water from one inland water to another in the course of, or resulting from, any operations carried out in exercise of its functions as a Navigation Authority under the provisions of Section 26(1) of the Water Resources Act 1991.

The perceived problem with this abstraction is that unregulated removal of water from the River Tone into the canal contributes substantially to low flow problems in the Tone downstream of Firepool Weir. The counter argument to this is that during the summer the canal also suffers from poor water quality especially beyond Hamp Weir where some of the abstracted water is discharged to the River Parrett in Bridgwater. To avoid stagnation and to preserve canal water quality a small "sweetening" flow should be maintained.

Water is also abstracted by British Waterways Board for Wessex Water from the canal to supplement available resources at Durleigh Reservoir. Abstractions greater than 9 Ml/d are controlled by prescribed flow conditions measured at the NRA's gauging stations on the River Tone and the Halse Water near Bishops Hull. The licence is already related to flow availability on the Tone and is therefore not a key factor in this issue.

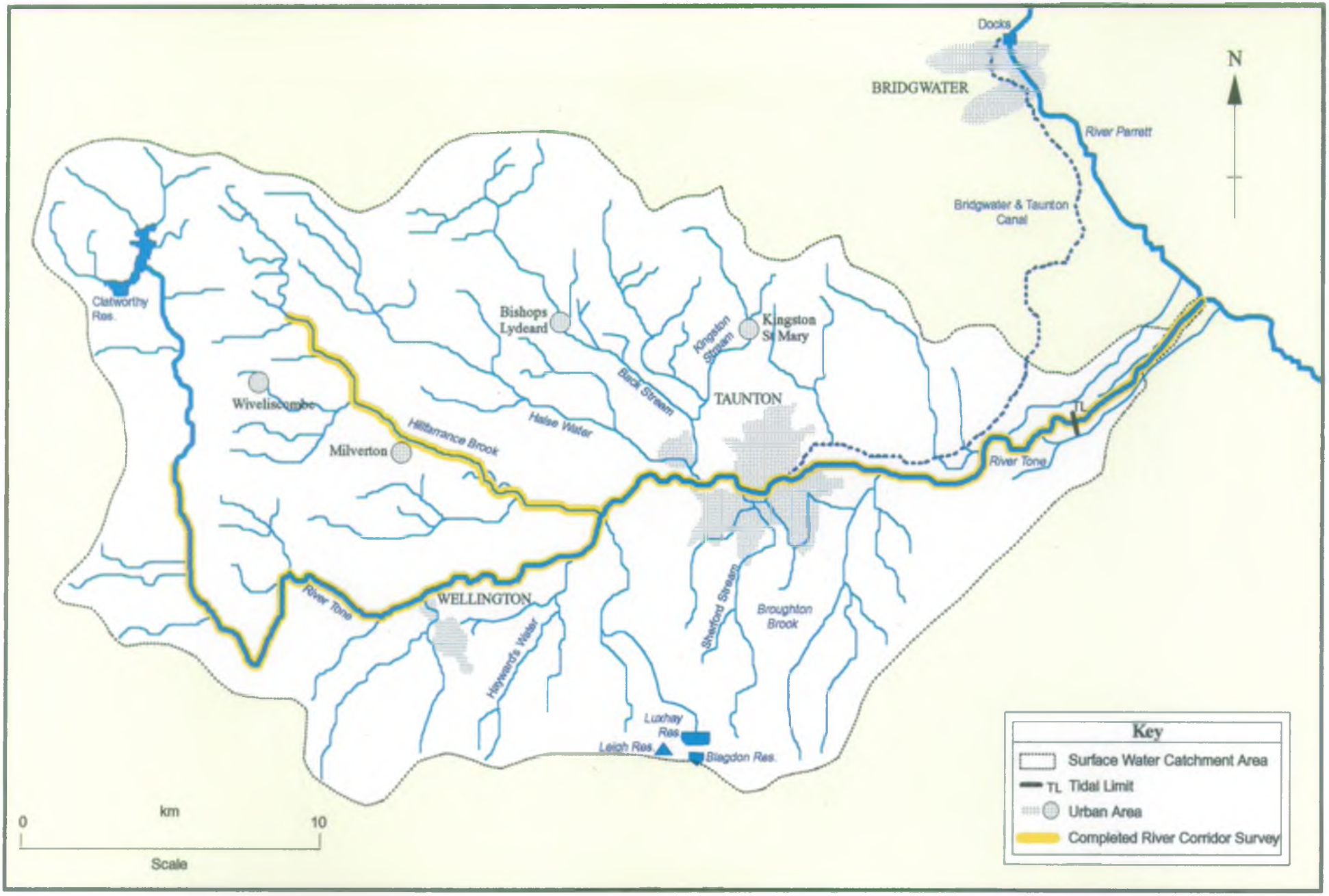
Issue 13 - management of water abstracted to the Bridgwater and Taunton Canal.

Options for Action

As yet not enough information is available about the relationship between the flows into the canal from the River Tone. The flow of water into the canal is gauged very infrequently. Therefore the extent of water lost from the Tone downstream of Firepool Weir is not fully appreciated. Consideration should be given to installing a continuous flow measurement station to measure the flow abstracted from the Tone.

Abstraction into the canal is exempt from licensing control. One option available to control the abstraction - once more information is known - would be to enter into a works agreement with British Waterways Board under Section 158 of the Water Resources Act 1991. The agreement would detail an appropriate operational mechanism for the abstraction, taking into account all direct interests.

Map 24 - River Corridor Survey



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Information correct as of August 1994

6.3 PHYSICAL FEATURES

6.3.1 River Restoration

Target - to restore river reaches that have been degraded.

State of the Catchment

Agricultural improvement, land drainage work, water abstraction and channel modifications for a variety of purposes have compromised the ecological and amenity potential of rivers and wetlands within the catchment.

The NRA has considered the potential for river restoration nationally and a number of schemes are underway in various parts of England and Wales. Sections of the River Tone, Hillfarrance Brook and Broughton Brook would benefit from significant habitat rehabilitation, but no information is available for the other tributaries.

The River Corridor Survey Map - Map 24 shows the extent of conservation surveys in the catchment. The Tone was surveyed in 1994 from head of main river at Waterrow to the Parrett confluence. Because of concerns regarding low flows the Hillfarrance Brook was also surveyed in 1993.

Many of the rivers of the catchment would benefit from relatively minor improvements to the river corridor which would increase ecological value by increasing the channel width. Such measures could include:

- creation of buffer zones, particularly where the river flows through intensively managed grassland or arable. This action alone would have benefits for water quality, conservation and fishery interests.
- sympathetic tree and shrub maintenance or planting, to maintain variety of form (pollard, coppice, maiden) and age.
- moving existing fence lines back from the rivers edge.
- reducing grazing pressure on bankside vegetation.
- creation of pond, marsh or wet woodland habitats in the floodplain.
- relaxation of maintenance downstream of Taunton so that only one bank is flailed each year and a narrow fringe of marginal emergent vegetation is allowed to develop along one bank.

There is an overhead pylon line following the river valley from Runnington to Taunton (approximately 20 km) which has a deleterious impact on the landscape and has implications for the management of river corridor vegetation. Regular clearance is carried out without consultation with the NRA. A management agreement with National Grid could ensure that clearance was carried out in a manner sympathetic to the river corridor.

Issue 14 - river restoration projects.

Options for Action

Work with landowners to promote river restoration schemes and prepare action plans for selected river reaches.

Work with Taunton Deane Borough Council and Somerset County Council to enhance the river corridor through Taunton.

Develop a management agreement with National Grid for vegetation management under the pylon line.

6.3.2 Wetland Conservation and Enhancement

Target - to identify specific areas where wetland enhancement and extensions might be feasible and work with other agencies and landowners to develop schemes.

State of the Catchment

It is evident from the lack of designated wetland habitats that much has been lost over recent years, principally to land drainage. The re-establishment of river side vegetation buffer zones are important in the control of bank erosion and the reduction of silt and fertiliZer loading. Functioning floodplain wetlands have a number of major advantages, including flood water storage, aquifer recharge, pollutant and sediment trapping. They also have intrinsic value as landscapes and habitats of quality.

The management of water levels on Curry and Hay Moors is dealt with in Section 6.4.5.

Issue 15 - identification of wetland sites for conservation and enhancement.

Options for Action

Survey the catchment to identify suitable sites for wetland enhancement.

6.3.3 Biodiversity

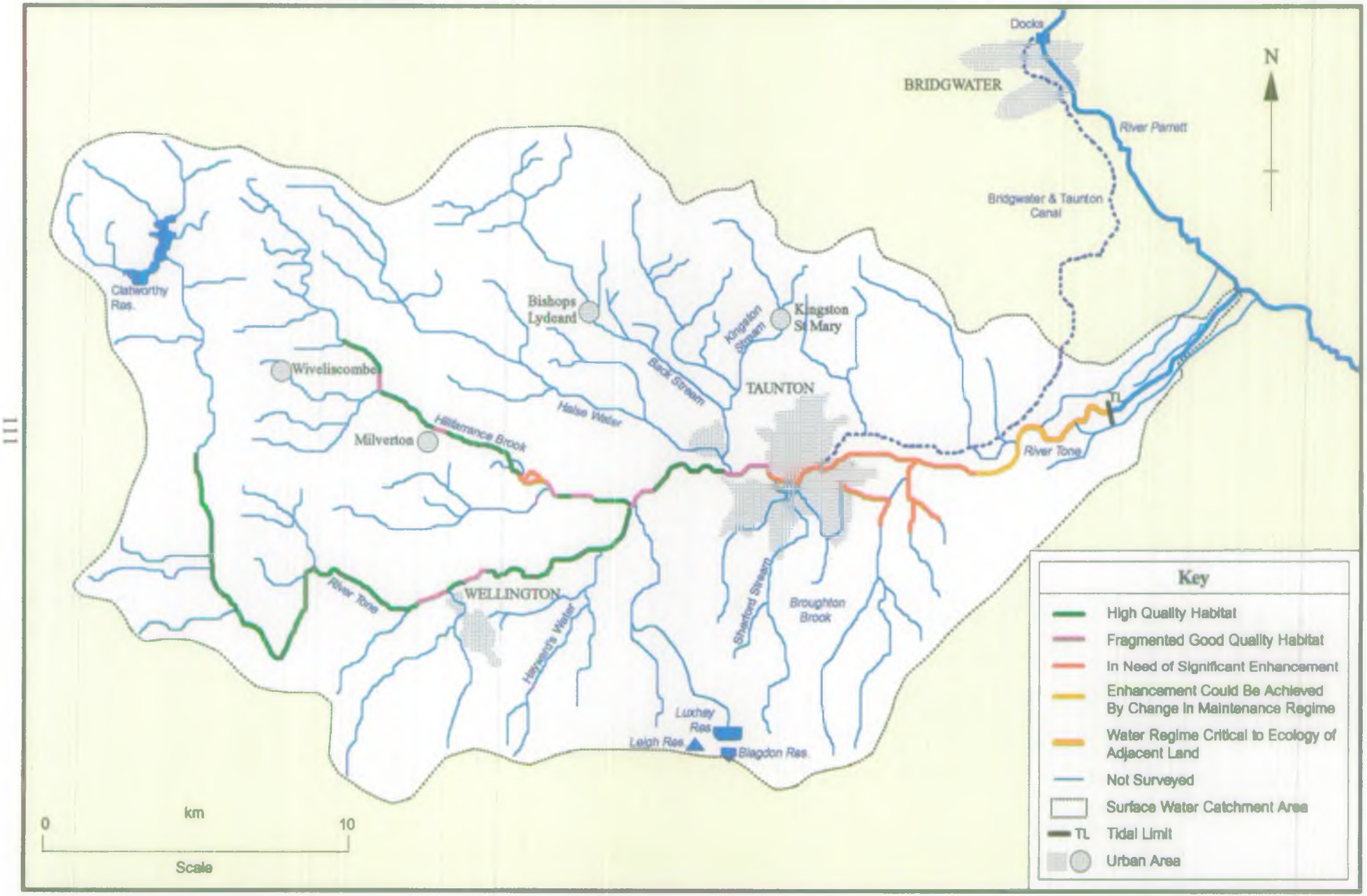
Target - to develop, with English Nature and other organisations, species and habitat action plans for riverine species and wetlands in the catchment.

State of the Catchment

To achieve environmental sustainability in the water environment, we need to maintain biodiversity in the catchment. The NRA is committed to the concept of developing biodiversity targets for river catchments. Species and habitat action plans have not yet been developed for the Tone Catchment, but are likely to hinge on the maintenance of populations of important species by ensuring the river corridor habitats, water quality, quantity and prey species are adequate to support these species. In addition, the NRA will seek opportunities to enhance river corridors for these groups.

The EC Habitats Directive will be implemented through the Conservation (Natural Habitats etc) 1994 UK legislation, by the designation of key sites to protect the best examples of European habitats. Precise site and species details are not yet known. Some species listed in the Directive occur in the catchment, including the otter and white-clawed crayfish.

Map 25 - Habitat Evaluation



Information correct as of June 1995

English Nature will play a lead role in developing UK-wide species and habitat action plans following commitments by the UK Government in the Biodiversity Action Plan, along with other agencies. Species in the Tone Catchment which could feature in such action plans include:

Otters - otters have been recorded at a number of locations along the Tone, (Wessex Otter Conservation Project (1990-1993). The Tone has been classed as Otter Management Category "monitor and protect stronghold". Concern has been expressed that pesticides and heavy metals could be entering the food chain and having an impact on otters, although there is little evidence to support this at the present time. Road casualties make up a significant percentage of otter fatalities. We advise planning authorities on the need for otter tunnels when new road schemes are considered.

Water voles - are very rare in the catchment, the current distribution is largely unknown but one or two sites have been identified.

Kingfishers - the kingfisher is protected under Schedule 1 of the Wildlife and Countryside Act (1981) - the River Tone supports the greatest concentration of kingfishers in Somerset.

Native Crayfish - native crayfish cannot survive in conjunction with alien species which carry the crayfish plague. The Tone is a stronghold of the native species, but some signal crayfish have been found so the native population is endangered.

Black poplar - this nationally scarce species has a stronghold population in the Catchment.

Alien plant species - Japanese Knotweed was recorded from only one location on the River Tone and control should thus be easily achieved, but failure to do so will result in further spread.

Himalayan balsam is widespread in the middle reaches of the catchment, and control will be a more difficult and lengthy process. There is insufficient information to make a judgement on whether it is currently a problem.

Giant Hogweed is uncommon and where it occurs it should be eliminated.

Issue 16 - promotion of biodiversity in the catchment.

Options for Action

In conjunction with English Nature and other agencies develop habitat and species action plans to promote biodiversity in the catchment.

The NRA will control invasive plants where other work is taking place and elsewhere advise riparian owners and other landowners on methods of control.

To assist with this, NRA Officers will distribute the NRA leaflet "Guidance for the Control of Invasive Plants Near Watercourses" where and when appropriate.

6.3.4 Eutrophication

Target - ensure suitable water quality in the SSSIs on the Somerset Levels and Moors.

State of the Catchment

The Tone provides summer water feed to Curry and Hay Moor, North Moor, Salt Moor and Stan Moor, all of which support important communities of plants and animals in the rhynes and ditches. English Nature (EN) and other organisations have expressed concern over recent increases in plant species which thrive in eutrophic conditions as a result of nutrient enrichment, which may in part be attributable to poor water quality in the summer feed. This may compromise the value of the SSSIs.

The NRA is currently undertaking an investigation into water quality within the Somerset Levels and Moors SSSIs to establish a baseline of data on prevailing conditions. However, the NRA has no duty or powers to ensure water quality in SSSIs.

Issue 17 - nutrient enrichment in the summer feed from the Tone to the Levels and Moors.

Options for Action

Analyse results at the end of the survey period and correlate with recent ditch flora and fauna studies carried out by English Nature. Repeat the survey in three to five years time to assess the link between changes in water quality and the aquatic plant and animal communities. If a link is established any improvements would be only as a result of future collaboration.

Work with organisations such as EN and MAFF to prevent any further deterioration through less intensive agriculture and increased buffering (via buffer zones (bio-buffers) - see Glossary, Appendix 15).

6.3.5 Archaeology

Target - to protect from damage any archaeological features found when carrying out NRA functions.

State of the Catchment

Archaeological features are at risk from direct damage by NRA work e.g. river maintenance and dredging, and indirectly through the drying out of organic remains caused by lowered water-tables and the deposition of spoil on sites of historic interest.

Work is already screened for the presence of scheduled archaeological sites but we do not have a complete knowledge of all sites in the catchment.

Issue 18 - the need to protect archaeological features and obtain more information about their location.

Options for Action

The NRA will protect features of known archaeological interest and identify opportunities for increasing our knowledge of them within river valleys. An evaluation of all the river valleys pinpointing key locations where archaeological interest is likely to be high, would assist in the screening process for NRA works and consents.

6.3.6 Recreation

Target - to evaluate the scope for improving public access, including the disabled, to river banks in NRA ownership for informal recreation and educational purposes.

State of the Catchment

The NRA owns relatively little land by the river but has not developed the full potential of the land it does own.

Issue 19 - the provision of public access to the river on NRA owned land and the development of educational facilities, and improved amenity where appropriate.

Options for Action

Conduct a survey of NRA owned land within the catchment to assess its recreation and educational potential and improve access to the river.

There is considerable scope for the NRA to work with Taunton Deane Borough Council (TDBC) and Somerset County Council to improve river corridor management and public access for recreation (including a cycle-way from Hankridge Farm retail development to Taunton Town Centre - the A38 road bridge is a major obstruction to this proposed riverside cycle-way) providing this does not compromise flood carrying capacity of channel. Work with TDBC with regard to amenity water levels in the Sherford Stream.

Clatworthy to Waterrow - develop paths/interpretation with Somerset County Council and landowners.

Evaluate the deployment of educational use/interpretative signboards (e.g. the Obridge section in Taunton, Athelney and New Bridge).

6.3.7 Fisheries

Target - to improve access to the upper reaches for migratory salmon and aid the movement of brown trout.

State of the Catchment

At present the upstream limit to migration is Hornshay Weir just north of Wellington. Salmon parr have been found just below this weir whilst upstream are good gravel beds suitable for spawning. However a fish pass costs into the tens of thousands of pounds and funds are difficult to find.

Issue 20 - the lack of access to the upper Tone for migratory salmon and the barrier to movement of brown trout due to there being no fish passes at Hornshay Weir and Wellington.

Options for Action

When funds allow, provide new fish passes at Hornshay Weir near Nynehead, and at Wellington.

Target - to reduce the siltation of spawning gravels.

State of the Catchment

Game fish require clean gravels for spawning but some farming practices are resulting in the gravels silting up.

Issue 21 - the siltation of spawning gravels in the upper Tone.

Options for Action

Preventing bank erosion and field runoff in the upper River Tone and tributaries would benefit fisheries by reducing the siltation of spawning gravels. Useful initiatives include:

- preventing livestock access to the river by fencing including the use of temporary fencing;
- encouraging the planting and cultivation of riverside trees and shrubs;
- the retention or creation of an uncultivated buffer zone adjacent to the river particularly in areas of arable land use.

These could be promoted through ADAS, the Farming and Wildlife Advisory Group (FWAG), the National Farmers Union (NFU) the Countryside Stewardship Scheme (CSS) and local authorities.

6.3.8 Planning

The earlier lack of Local Plan to consider elements to achieve sustainability meant there were no policies to define, protect and enhance the water environment or river corridors, particularly through town centres and commercial areas. This led in the past to environmental degradation, with many developments backing on to and obscuring the river. Flood alleviation schemes of the past, carried out when environmental awareness and legislative duties were less stringent, in general tended to exacerbate the situation. However since then, greater understanding of environmental problems have lead to improvements in the design and sensitivity of recent schemes in Taunton. There remains a great deal of scope for comprehensive programmes of work to enhance and restore the wildlife and recreational potential of the urbanised and engineered river corridor through Taunton and its environs.

Taunton has a dominant role in Somerset and the south west. Its commercial economic prosperity and growth has been associated with its geographical location and more recently by its relationship to the M5. Its future prosperity and character depends on achieving a

transportation strategy associated with economic investment and seizing opportunities to maintain and improve the qualities of the town particularly in the centre. The River Tone is a functional as well as a characteristic feature and continued riverine enhancement must boost the quality of life and attractiveness of the town. An Action Plan to identify problems and opportunities along the whole length of the river in the Deane would have many advantages. It would be an appropriate vehicle for setting a strategy for implementation by many Agencies; identifying proposals for access, enhancement, restoration, protection and controlling development and other Policies of the emerging Local Plan for the Borough.

The rural surroundings of Taunton and Wellington have in the past been protected because of lack of development pressures. There has been no suggestion of a Green Belt Policy. In recent years economic success has placed pressures upon the urban fringes including the floodplain. Large scale development schemes have altered the character of the Tone and its floodplain even though environmental safeguards and features have been included. The rural river environment, with all its interests, including floodplain and wetlands are a finite resource and need to be protected for their own sake. Continued large scale commercial, recreational and urban fringe uses including highway schemes into the river environment will be an anathema to the rurality of the River Tone. The recognition of "Landscape Character Areas" and Landscape Features for the "River", "The Floodplain" and "The Levels", provided there are strong policies for their protection, will be a desirable addition to the Local Plan.

Target - to protect the River Tone from adverse development by means of the local authority planning process.

State of the Catchment

As discussed in Section 5.7 the Tone Catchment is an area of development growth which will require both an increase in water supply and impose additional load on sewage treatment and sewerage systems. There are in addition major road schemes currently under consideration and development within the catchment. These include:

- Taunton Inner Relief Road - Castle Street/North Street.
- Northern Relief Road.
- Taunton Town Centre Northern Relief Road.
- Taunton Southern Relief Road.
- Silk Mills Bridge and Norton Fitzwarren By Pass.
- Major Road Proposals associated with development at Wellington, Comeytrowe and Monkton Heathfield.

Issue 22 - the adverse impact of new road schemes.

New road schemes can have a variety of adverse impacts on the water environment. During the construction phase there is a threat to water quality from e.g. silt, oil, fuel and tar. There is the possibility of increased flood risk from runoff, the loss of floodplain storage, risk to groundwater and surface water through discharge of roadside drainage especially from spillage after accidents. Additionally there are adverse effects on the ecology of the river corridor through direct shading and modification to banks. There is also the possible loss of floodplain habitat through the construction of embankments.

Options for Action

The NRA will seek increased involvement at the earliest stages of Local Authority Development Plan preparation.

The NRA will seek early discussion of proposed new road schemes so that the possible impacts on the water environment can be fully evaluated and any necessary modifications obtained. With regard to water quality requirements, all new road schemes and road enhancements are reviewed to determine the appropriate level of protection required for watercourses and the design of the drainage system is agreed with the design engineers. The use of reed bed filtration should be considered to slow the flow and improve water quality. Where necessary the NRA can exert statutory control over these water quality matters by serving a prohibition notice.

The NRA will press for a change of legislation to make it a requirement that the developers of new road schemes should be required to undertake full environmental assessments.

6.4 FLOOD DEFENCE AND LAND DRAINAGE

6.4.1 Flood Defence Targets - Introduction

Targets for flood defence may be prescribed (e.g. the time allowed to determine a flood defence consent), indicative (e.g. relating to the level of flood protection appropriate to a particular land use), or business (e.g. a commitment which the NRA has imposed upon itself to improve efficiency or cost effectiveness).

Serious floods occur less often than minor floods. The term return period describes how often a flood might occur. For example a 10 year return period flood will be equalled or exceeded on average once every 10 years, or a more serious flood once every 100 years.

The standard of flood protection at a location is the worst flood (expressed as a return period) which can be withstood without significant flooding. Flood defence schemes only alleviate flooding up to the design standard, a more serious flood may still occur.

We manage flood defence by setting target standards, measuring existing standards, and addressing the difference.

6.4.2 General Target

Target - to manage flood defence by prioritizing shortcomings through the Flood Defence Management System by 1997.

State of the Catchment

The management framework has been agreed, and the techniques are being piloted. Management of the River Tone cannot be divorced from the River Parrett.

Issue 23 - a fully integrated Flood Defence Management Manual and supporting system are required to improve targeting of resources to the greatest needs.

Options for Action

A Flood Defence Management System will be introduced into the Region during 1996. Data collection is programmed for completion by March 1996. An existing model of the Tone and Parrett system will be calibrated and developed further to identify future requirements.

6.4.3 Regulation

We advise planning authorities on flood defence matters. We also issue consents and by-law approvals for certain works which are likely to affect the flow of water or impede any drainage work.

The NRA has undertaken an hydraulic analysis of the River Tone through Taunton and specific design flood level data is made available to the public where requested.

The Authority is currently undertaking a full catchment drainage model study of the River Tone Catchment, from the tidal limit at New Bridge Sluice. The model will be available to determine the effects of urban development on the River Tone Catchment and to develop appropriate drainage policies for surface water disposal. It is anticipated that the study will have been completed by August 1995.

Target - standards of flood defence. In accordance with DoE Circular 30/92 'Development and Flood Risk', the NRA recommend a minimum level of flood protection for urban development against a 1 in 100 year flood event. It is of course the responsibility of the Local Planning Authority (LPA) to set higher standards of flood protection if they so wish. Within Taunton it has been agreed between the LPA and the NRA that the standard of flood protection to new and existing development would be set at the 1 in 200 year flood.

State of the Catchment

To ensure that planning officers are aware of the services offered by the NRA with respect to Town and Country Planning issues and flood risk, the NRA has regular officer to officer contacts for each District Council LPA on a daily or weekly basis.

More formal contact is maintained via programmed visits to planning authorities and seminars held at the NRA offices relating to S105 Surveys, NRA support services etc.

Target - Consents. In accordance with the Water Resources Act 1991 and Land Drainage Act 1991, the NRA has a period of two months to determine a land drainage consent application.

State of the Catchment

To date 98.7% of all land drainage consent applications are processed within the two month target period. Within the Somerset area the NRA consents an average of seventy applications per year. Within the River Tone Catchment the NRA consents an average of ten consents per year.

Target - to ensure that consented works are carried out in accordance with the consent.

State of the Catchment

By-laws/Consent Audit. As part of the documentation issued with land drainage consents the NRA provides notification cards by which the Consentee notifies the Authority of the start and completion of the consented works. These cards are sent to the NRA's Operations Engineers who visit the sites to ensure that works are carried out as per the issued consent.

Issue 24 - the need for an audit of land drainage works.

Options for Action

Flood Defence will be employing consultancy services to carry out representative audits of land drainage consents and carry out enforcement action for unconsented works. A budget is to be made available in 1996/97.

Target - to ensure that the planning authorities incorporate relevant planning policies on sustainable development relating to flood risk and surface water disposal within their statutory plans.

State of the Catchment

The NRA is fully committed to the Local Plan process and as a statutory consultee within the process takes a full and active role negotiating with the local planning authorities. Taunton Deane District Wide Local Plan is currently in the consultation phase and the NRA,

with the aid of the latest modelling tools, such as the River Tone Catchment Drainage Model, provides balanced advice on the suitability of proposed sites for incorporation into the development plan.

Where called upon to do so the NRA, through its Development Control Engineers will provide expert witness evidence to support these views at public examination.

6.4.4 Maintenance

We maintain rivers and flood defence structures to minimize the risk of flooding.

Target - to apply a consistent approach to flood defence maintenance, with work targeted at areas of greatest need.

State of the Catchment

We try to focus our work where it is needed most. We work out how best to concentrate our efforts using the Flood Defence Management System (FDMS). We have only just started to use this technique and are busy collecting the information we need to make it work. On the Somerset Levels and Moors this involves prioritizing maintenance needs by considering the extent of damage and its risk of occurring if maintenance is not undertaken. Upstream from the tidal limit at Newbridge a simplified matter of Standards of Service (SoS) can be applied within the FDMS. The SoS methodology is being introduced to upland rivers, and the benefits of maintenance are being analysed for the Levels and Moors.

Issue 25 - we need to improve the efficiency and effectiveness of our flood defence work.

Options for Action

Asset surveys are being undertaken in 1995/6. Upland river reaches will be classified in accordance with the SoS methodology by July 1995, whilst the Levels and Moors analysis will be completed by April 1996.

Target standards will be compared to the current state, and differences addressed by 1997.

6.4.5 Conservation, and Water Management

We have a duty to conserve wildlife when we carry out flood defence work.

Target - to implement the Somerset Levels and Moors Strategy within the Moors reach of the River Tone.

State of the Catchment

See Appendix 16 for the Summary of the Somerset Levels and Moors Strategy

Although the Levels and Moors have retained much of their unique character, the cumulative effects of drainage and changes in land management over the past fifty years are becoming apparent. Most of the wildlife interest is now confined to the Sites of Special Scientific Interest (SSSIs) where there has been a dramatic decline in breeding waders over the past ten to fifteen years. Indeed in certain areas some species of wading birds have already become extinct. Other aspects are giving cause for concern; in particular the average numbers of wintering birds has decreased while the botanical interest of some areas is undergoing a rapid change. These losses are attributed by the major conservation bodies

to the drying out of the Moors as a result of the continued maintenance of low water-tables. Concern has also been expressed that this drying out process will damage sites of archaeological interest.

Wet grassland raised water level areas (RWLAs) are being developed in association with the Ministry of Agriculture Fisheries and Food (MAFF), and its Environmentally Sensitive Area (ESA) scheme.

The promotion of RWLAs is funded through the NRA flood defence capital programme and through grant from MAFF as works in association with main river. In summary: 984 hectares (2303 acres) of wet grassland RWLA now exists as a result of nine individual schemes.

Issue 26 - the need to reverse the decline in botanical interest and improve populations of breeding waders and over-wintering birds on the Somerset Moors within the catchment.

Options for Action

There is significant additional demand for these RWLAs into the foreseeable future. A programme for the year 1995/96 has been agreed with MAFF and English Nature (EN) and has also been approved by the Somerset Local Flood Defence Committee.

The review of flood defence procedures was commenced in January 1994 and was established with a clearly defined and staged programme.

Stage 1	a)	To produce a summary explanation of the operation of the Levels and Moors Catchments and
	b)	To investigate and document in detail the operation of each of the priority SSSIs identified under the strategy and to undertake topographical survey of these areas.
Stage 2		To determine how the current situation differs from "Optimal Conditions" for wetland wildlife.
Stage 3		To identify methods that might be employed to improve the wetland conditions on a site by site basis.
Stage 4		To consider the implications of Stage 3 on the duties and functions of the Authority and where possible to negotiate changes in water level management for the benefit of nature conservation.

(Stage 1b is substantially complete).

Target - to manage water levels properly for farming, flood defence and wildlife particularly in special sites.

State of the Catchment

There is one SSSI within the catchment where English Nature (EN) have identified a Water Level Management Plan, in accordance with Ministry of Agriculture, Fisheries & Food (MAFF) guidelines.

Issue 27 - Water Level Management Plans are required for those Sites of Special Scientific Interest where we control water levels, by 1998.

Options for Action

Curry and Hay Moors Water Level Management Plans will be prepared by Curry Moor Internal Drainage Board with input by the NRA as an interested Party. The NRA will prepare an interim statement on its influence by April 1996.

The NRA is committed to preparing a Water Level Management Plan for Northmoor following completion of recent pumping station improvements.

Target - to return the River Tone banks adjacent to Hay Moor, Curry Moor and Stan Moor to their original design standards, including Hook Bridge spillway.

State of the Catchment

The winter of 1994-5 saw the highest flood levels since 1960 reached on Curry Moor and North Moor. This was a very wet winter with 511 mm of rain falling on the Tone Catchment between September and December 1994. This was 1.44 times the long term average (LTA). Then in January 1995, 190 mm (2.2 times the LTA). In February 1995 1.4 times the LTA fell in the catchment and 90% of the January and February rain ran off straight into the river causing the major flooding. A total of ten properties were affected - either flooded or protected by sand bagging. The A361 Bridgwater to Glastonbury road was flooded for approximately two weeks. Large areas of agricultural land on the Moors were affected.

Following the major flooding, our surveys of the floodbanks in the lower reaches of the River Tone showed varying amounts of settlement of between 50 mm and 230 mm.

Issue 28 - the NRA's main concern is overtopping, but the residents of properties against the bank are concerned with seepage which could increase if levels are raised. The NRA is also concerned with seepage where it threatens the structural integrity of the bank.

Options for Action

The NRA will restore the design standards of Hay Moor and Curry Moor banks this year (1995). Temporary raising of low spots on Stan Moor Bank will be carried out pending a full investigation into options, for raising bank levels, and their effects on seepage. To balance any rise in river level due to bank raising over the next two years a 2 km length of the River Parrett below Burrowbridge is being dredged giving lower levels in the River Tone in most circumstances. Finally, Hook Bridge spillway will be returned to design level.

6.4.6 Improvements

Target - to identify and investigate all flood risk locations.

State of the Catchment

We can build new flood defences if flooding is a serious problem in a particular area. Nowadays we usually only build new defences to protect built-up areas from flooding. All schemes must be technically, economically and environmentally sound. We keep a list of schemes called a Programme of Capital Works which helps us to plan for the future.

Different types of land and property need different levels of protection. We use the following indicative standards (return period in years) to design schemes:

Current Land Use	Flooding from: Sea	River
Urban areas and villages	200	100
Isolated properties. Highly productive agricultural land	50	50
Agricultural land (mainly arable)	25	25
Agricultural land (mainly pasture)	15	15
Floodplain	-	5

Indicative standards are only a guide; they may not always be appropriate.

We maintain a register of flood problems and we are developing a Long Term Plan of Needs.

Issue 29 - the need to identify flood problem locations within the catchment.

Options for Action

Continue the programme to review flood problems. The introduction of the Flood Defence Management Framework identifies the relative priority of schemes to alleviate flooding problems.

Target - to provide properly appraised flood defence schemes.

State of the Catchment

We undertake a programme of capital works as per our Medium Term Plan which is derived from the Long Term Plan of Needs.

Issue 30 - flood problems have been identified at Hillfarrance and on the Tone upstream of Taunton.

Options for Action

The Hillfarrance scheme is at the appraisal stage and work is planned to begin in 1996 if the appraisal identifies a viable scheme the Hillfarrance Brook will need to be designated as a main river first. The Tone upstream of Taunton has been investigated but there are no proposals to undertake capital improvements.

6.4.7 Emergency Response

Absolute flood protection is not possible. Because of this we need to warn people when there is a danger of flooding. We have a strategy (ERLOS) which details how these procedures operate and which we use to improve our emergency response.

Target - where possible, to issue a warning at least two hours in advance of flooding.

State of the Catchment

The flow gauge at Greenham gives six hours warning of flooding problems in Taunton and downstream of the main River Tone in most circumstances. The effects of additional inflow downstream of Greenham can be identified at the Bishops Hull gauge, but with two to three hours advance warning for Taunton. Flood prediction models are being developed to improve the forecasting at Bishops Hull.

Issue 31 - no arrangements exist for providing Flood Warning on ordinary (non-main river) watercourses such as flow through Hillfarrance and Bathpool.

Options for Action

The suitability of Milverton flow gauge to provide flood warnings for Hillfarrance is being investigated.

ISSUES LIST

APPENDIX 1

STANDARDS FOR THE FIVE RIVER ECOSYSTEM USE CLASSES

Use Class	DO % sat 10%ile	BOD (ATU) mg/l 90%ile	Total Ammonia mgN/l 90%ile	Un-ionised Ammonia mgN/l 95%ile	pH 5%ile & 95%ile	Hardness mg/l $CaCO_3$	Dissolved Copper µg/l 95%ile	Total Zinc µg/l 95%ile	Class Description
1	80	2.5	0.25	0.021	6.0 - 9.0	≤10 >10 and ≤50 >50 and ≤100 >100	5 22 40 112	30 200 300 500	Water of very good quality suitable for all fish species
2	70	4.0	0.6	0.021	6.0 - 9.0	≤10 >10 and ≤50 >50 and ≤100 >100	5 22 40 112	30 200 300 500	Water of good quality suitable for all fish species
3	60	6.0	1.3	0.021	6.0 - 9.0	≤10 >10 and ≤50 >50 and ≤100 >100	5 22 40 112	300 700 1000 2000	Water of fair quality suitable for high class coarse fish populations
4	50	8.0	2.5	-	6.0 - 9.0	≤10 >10 and ≤50 >50 and ≤100 >100	5 22 40 112	300 700 1000 2000	Water of fair quality suitable for coarse fish populations
5	20	15.0	9.0	-	-	-	-	-	Water of poor quality which is likely to limit coarse fish populations

EC DIRECTIVE ON THE QUALITY OF FRESHWATERS NEEDING PROTECTING OR IMPROVEMENT IN ORDER TO SUPPORT FISH LIFE (78/659/EEC)

DETERMINAND		SALMONID WATERS 'G'	SALMONID WATERS 'I'	CYPRINID WATERS 'G'	CYPRINID WATERS 'I'
Dissolved Oxygen as mg/l 0_2 [*a]		100% > 7	50% > 9	100% > 5	50% > 7
pH as pH units		-	6.0-9.0	-	6.0-9.0
Suspended Solids at mg/l [*b]		25	-	25	-
BOD (Total) as mg/l 0_2		5	-	8	-
Nitrite as mg/l N		0.150	-	0.460	-
Non-ionised Ammonia as mg/l N		0.004	0.021	0.004	0.021
Ammonia (Total) as mg/l N		0.030	0.780	0.160	0.780
Total Residual Chlorine as mg/l HOCl		-	0.005	-	0.005
Zinc (Total) as mg/l Zn					
Water Hardness	0-50	-	0.03	-	0.30
(mg/l $CaCO_3$)	50-100	-	0.20	-	0.70
	100-250	-	0.30	-	1.00
	>250	-	0.50	-	2.00
Copper (Dissolved) as mg/l Cu					
Water Hardness	0-50	0.005	-	0.005	-
(mg/l $CaCO_3$)	50-100	0.022	-	0.022	-
	100-250	0.040	-	0.040	-
	>250	0.112	-	0.112	-

[*a] For dissolved oxygen, 50% median and 100% minimum standard.
[*b] For suspended solids, the 'G' value is an annual average concentration.

For application of these standards, reference must be made to Article 6 and the Annexes of the Directive, and the appropriate DoE Implementation Guidelines.

'G' = Guideline

'I' = Imperative

EC DANGEROUS SUBSTANCES DIRECTIVE ON POLLUTION CAUSED BY CERTAIN SUBSTANCES DISCHARGED IN THE AQUATIC ENVIRONMENT OF THE COMMUNITY, (76/464/EEC)

EQSs FOR LIST I SUBSTANCES (INLAND WATERS)

Parameter	Units	Value	Status (1)
Mercury	µg Hg/l	1.0	AA,T
Cadmium (2)	µg Cd/l	5.0 1.0	AA,T AA,T,B (4)
Hexachlorocyclohexane (HCH) (2)	µg/l	0.1 0.05	AA,T AA,T,B (4)
Tetrachloromethane (CTC)	µg/l	12	AA,T
DDT (para-para DDT isomer) (2)	µg/l	0.01	AA,T
Total DDT (2)	µg/l	0.025	AA,T
Pentachlorophenol (PCP) (2)	µg/l	2	AA,T
'The Drins' (from 1 Jan 1989)	µg/l	0.03 (3)	AA,T
Aldrin (from 1 Jan 1994)	µg/l	0.01	AA,T
Dieldrin (from 1 Jan 1994)	µg/l	0.01	AA,T
Endrin (from 1 Jan 1994)	µg/l	0.005	AA,T
Isodrin (from 1 Jan 1994)	µg/l	0.005	AA,T
Hexachlorobenzene (HCB) (2)	µg/l	0.03	AA,T
Hexachlorobutadiene (HCBD) (2)	µg/l	0.1	AA,T
Chloroform	µg/l	12	AA,T
1,2-dichloroethane	µg/l	10	AA,T
Trichloroethylene	µg/l	10	AA,T
Perchloroethylene	µg/l	10	AA,T
Trichlorobenzene(TCB)	µg/l	0.4	AA,T

EQSs FOR LIST I SUBSTANCES (TIDAL WATERS)

Parameter	Units	Value	Status (1)
Mercury (2)	μg Hg/l	0.3	AA,D
Cadmium (2)	μg Cd/l	2.5	AA,D
Hexachlorocyclohexane (HCH) (2)	μg/l	0.02	AA,T
Tetrachloromethane (CTC)	μg/l	12	AA
DDT (para-para DDT isomer) (2)	μg/l	0.01	AA
Total DDT (2)	μg/l	0.025	AA
Pentachlorophenol (PCP) (2)	μg/l	2	AA
'The Drins' (from 1 Jan 1989)	μg/l	0.03 (3)	AA,T
Aldrin (from 1 Jan 1994)	μg/l	0.01	AA
Dieldrin (from 1 Jan 1994)	μg/l	0.01	AA
Endrin (from 1 Jan 1994)	μg/l	0.005	AA
Isodrin (from 1 Jan 1994)	μg/l	0.005	AA
Hexachlorobenzene (HCB) (2)	μg/l	0.03	AA
Hexachlorobutadiene (HCBD) (2)	μg/l	0.1	AA
Chloroform	μg/l	12	AA
1,2-dichloroethane	μg/l	5	AA
Trichloroethylene	μg/l	10	AA
Perchloroethylene	μg/l	10	AA
Trichlorobenzene(TCB)	μg/l	0.4	AA

Proposals have been published for the following List I substances but these have not, so far, been adopted:

Trifluralin, endosulphan, simazine, triorganotin compounds (tributyltin oxide, triphenyltin acetate, triphenyltin oxide, triphenyltin hydroxide), atrazine, organophosphorus substances (azinphos-methyl, azinphos-ethyl, fenitrothion, fenthion, malathion, parathion and parathion-methyl, dichlorvos).

Notes: (1) AA=Annual Average, T=Total, B=Background Monitoring, D= Dissolved
(2) A 'standstill' provision exists for concentrations in sediments and/or shellfish and/or fish
(3) Maximum of 0.005 for Endrin
(4) B=Background Monitoring: only applies at designated end of catchment sites

EQSs FOR LIST II SUBSTANCES (INLAND WATERS) (1)

Parameter	Units	Value (3)		Hardness (mg $CaCO_3$/l)	Status (2)
		A Std	B Std		
Lead	µg Pb/l	4	50	0 to 50	AA,D
		10	125	50 to 100	
		10	125	100 to 150	
		20	250	150 to 200	
		20	250	200 to 250	
		20	250	>250	
Chromium	µg Cr/l	5	150	0 to 50	AA,D
		10	175	50 to 100	
		20	200	100 to 150	
		20	200	150 to 200	
		50	250	200 to 250	
		50	250	>250	
Zinc	µg Zn/l	8	75	0 to 50	AA,T
		50	175	50 to 100	
		75	250	100 to 150	
		75	250	150 to 200	
		75	250	200 to 250	
		125	500	>250	
Copper	µg Cu/l	1	1	0 to 50	AA,D
		6	6	50 to 100	
		10	10	100 to 150	
		10	10	150 to 200	
		10	10	200 to 250	
		28	28	>250	
Nickel	µg Ni/l	50	50	0 to 50	AA,D
		100	100	50 to 100	
		150	150	100 to 150	
		150	150	150 to 200	
		200	200	200 to 250	
		200	200	>250	
Arsenic	µg As/l	50		All	AA,D
Boron	µg B/l	2000		All	AA,T
Iron	µg Fe/l	1000		All	AA,D
pH	pH values	6 to 9		All	95% of samples
Vanadium	µg V/l	20	20	0 to 200	AA,T
		60	60	200+	
Tributyltin	µg/l	0.02		All	M,T
Triphenyltin	µg/l	0.02		All	M,T
Polychlorochlormethyl-sulphonamidodiphenyl ether (PCSDs)	µg/l	0.05		All	T, 95% of samples
Sulcofuron	µg/l	25		All	T, 95% of samples
Flucofuron	µg/l	1.0		All	T, 95% of samples
Permethrin	µg/l	0.01		All	T, 95% of samples
Cyfluthrin	µg/l	0.001		All	T, 95% of samples

EQSs FOR LIST II SUBSTANCES (TIDAL WATERS)

Parameter	Units	Value (1)	Status
Lead	μg Pb/l	25	AA,D
Chromium	μg Cr/l	15	AA,D
Zinc	μg Zn/l	40	AA,D
Copper	μg Cu/l	5	AA,D
Nickel	μg Ni/l	30	AA,D
Arsenic	μg As/l	25	AA,D
Boron	μg B/l	7000	AA,D
Iron	μg Fe/l	1000	AA,D
pH	pH values	6 to 8.5 (3)	95% of samples
Vanadium	μg V/l	100	AA,T
Tributyltin	μg/l	0.002	M,T
Triphenyltin	μg/l	0.008	M,T
Polychlorochlormethyl-sulphonamidodiphenyl ether (PCSDs)	μg/l	0.05	T, 95% of samples
Sulcofuron	μg/l	25	T, 95% of samples
Flucofuron	μg/l	1.0	T, 95% of samples
Permethrin	μg/l	0.01	T, 95% of samples
Cyfluthrin	μg/l	0.001	T, 95% of samples

Notes:

(1) National environmental quality standards recommended for the UK.

(2) AA = Annual Average; D = Dissolved; T = Total;
M = Maximum Allowable Concentration

(3) A Std denotes standards for the protection of sensitive aquatic life
B Std denotes standards for the protection of other aquatic life

EC DIRECTIVES CONCERNING URBAN WASTEWATER TREATMENT (91/271/EEC) AND CONCERNING THE PROTECTION OF WATERS AGAINST POLLUTION CAUSED BY NITRATES FROM AGRICULTURAL SOURCES (91/676/EEC)

Indicative standards for the identification of Sensitive Waters (Eutrophic) and Polluted Waters (Eutrophic)

INLAND WATERS

Determinand	Indicative Standard		Notes[2]
	Running Water	Still Water	
Orthophosphate (µg P/l)	>100	>50	AA
Nitrate (µg NO_3/l)	>50	>50	P, At major public water supply abstractions
Dissolved oxygen (% saturation)	>150 daytime < 50 night-time	Excessive supersaturation in surface layers, depletion in hypolimnion	
Chlorophyll a (µg/l)	>25	>30	
Algal Biomass	>100 g/m^2	-	Excessive growth of attached algae esp. *Cladophora*
Water Clarity (m)	-	<3, predominantly green colour	AA, Secchi Disc
Water Retention Time (days)	>5	-	Sufficient retention time for algal multiplication
Effects on fauna	Reduction in abundance of fish and invertebrate fauna		Attributed to nutrient enrichment
Effects on macroflora	Substantial adverse changes in macrophyte abundance and diversity		
Effects on microflora	Exceptional increases in plankton, and/or biomass leading to blooms, scum or discolouration		Includes blue-green algae

Notes: [1] It is not necessary that adverse effects should be found in all factors. Evidence should be considered on a site specific basis.

[2] AA: Annual average (Geometric Mean) P: 95%ile (parametric)

TIDAL WATERS

Determinand	Indicative Standard		Notes
	Estuaries	Coastal Waters	
Nitrate (mg N/l)	>0.21	>0.21	Winter concentrations
Phosphorus (μg P/l)	>6.2	>6.2	DAIP[1], Winter concentrations
Chlorophyll a (μg/l)	>10	>10	
Algal Bloom Cell Density (cells/l)	$>5x10^5$	$>5x10^5$	
Dissolved Oxygen	Daytime O_2 depletion	-	Linked to algal decay NOT organic inputs from discharges
Effects on fauna	Invertebrate, shellfish, fish mortalities		NOT associated with organic pollution
Effects on macroalgae	>10 hectares (>25% of available intertidal area) in which algal cover exceeds 25%		Especially *Enteromorpha* and *Ulva*
Effects on microalgae	Presence of significant blooms leading to accumulation of scum/foam on beaches; public complaints/concern		
Estuary Flushing Times (weeks)	>1 to 2	-	

Notes: [1] DAIP Dissolved available inorganic phosphorous

The assessment of whether a stretch of water is actually or potentially eutrophic is not possible simply by reference to numeric chemical criteria, however, they do provide an indication of symptoms, and the importance of each of the criteria should be assessed on a local basis.

EC DIRECTIVE CONCERNING THE QUALITY REQUIRED OF SURFACE WATER INTENDED FOR THE ABSTRACTION OF DRINKING WATER IN THE MEMBER STATES (75/440/EEC)

Definition of the Standard Methods of Treatment for Transforming Surface Water of Categories A1, A2 and A3 into Drinking Water

Category A1

Simple physical treatment and disinfection, eg rapid filtration and disinfection.

Category A2

Normal physical treatment, chemical treatment and disinfection, eg pre-chlorination, coagulation, flocculation, decantation, filtration, disinfection (final chlorination).

Category A3

Intensive physical and chemical treatment, extended treatment and disinfection, eg chlorination to break-point, coagulation, flocculation, decantation, filtration; absorption (activated carbon), disinfection (ozone, final chlorination).

I	=	**mandatory**
G	=	**guide**
O	=	**exceptional climatic or geographical conditions**

CHARACTERISTICS OF SURFACE WATER INTENDED FOR THE ABSTRACTION OF DRINKING WATER			CATEGORIES					
			A1		A2		A3	
PARAMETERS			G	I	G	I	G	I
1	pH		6.5 to 8.5	-	5.5 to 9	-	5.5 to 9	-
2	Coloration (after simple filtration)	mg/l Pt scale	10	20 (0)	50	100 (0)	50	200 (0)
3	Total suspended solids	mg/l SS	25	-	-	-	-	-
4	Temperature	°C	22	25 (0)	22	25 (0)	22	25 (0)
5	Conductivity	$\mu s/cm^{-1}$ at 20°C	1000	-	1000	-	1000	-
6	Odour	(dilution factor at 25°C)	3	-	10	-	20	-
7	Nitrates	mg/l NO_3	25	50 (0)	-	50 (0)	-	50 (0)
8	Fluorides	mg/l F	0.7 to 1	1.5	0.7 to 1.7	-	0.7 to 1.7	-
9	Total extractable organic chlorine	mg/l Cl	-	-	-	-	-	-
10	Dissolved Iron	mg/l Fe	0.1	0.3	1	2	1	-
11	Manganese	mg/l Mn	0.05	-	0.1	-	1	-
12	Copper	mg/l Cu	0.02	0.05 (0)	0.05	-	1	-
13	Zinc	mg/l Zn	0.5	3	1	5	1	5
14	Boron	mg/l B	1	-	1	-	1	-
15	Beryllium	mg/l Be	-	-	-	-	-	-
16	Cobalt	mg/l Co	-	-	-	-	-	-
17	Nickel	mg/l Ni	-	-	-	-	-	-
18	Vanadium	mg/l V	-	-	-	-	-	-

CHARACTERISTICS OF SURFACE WATER INTENDED FOR THE ABSTRACTION OF DRINKING WATER			CATEGORIES					
			A1		A2		A3	
PARAMETERS			G	I	G	I	G	I
19	Arsenic	mg/l As	0.01	0.05	-	0.05	0.05	0.1
20	Cadmium	mg/l Cd	0.001	0.005	0.001	0.005	0.001	0.005
21	Total Chromium	mg/l Cr	-	0.05	-	0.05	-	0.05
22	Lead	mg/l Pb	-	0.05	-	0.05	-	0.05
23	Selenium	mg/l Se	-	0.01	-	0.01	-	0.01
24	Mercury	mg/l Hg	0.0005	0.001	0.0005	0.001	0.0005	0.001
25	Barium	mg/l BA	-	0.1	-	1	-	1
26	Cyanide	mg/l Cn	-	0.05	-	0.05	-	0.05
27	Sulphates	mg/l SO_4	150	250	150	250 (0)	150	250 (0)
28	Chlorides	mg/l Cl	200	-	200	-	200	-
29	Surfactants (reacting with methyl blue)	mg/l (laurylsulphate)	0.2	-	0.2	-	0.5	-
30	Phosphates	mg/l P_2O_5	0.4	-	0.7	-	0.7	-
31	Phenols (phenol index) paranitraniline 4 aminoantipyrine	mg/l C_6H_5OH	-	0.001	0.001	0.005	0.01	0.1
32	Dissolved or emulsified hydrocarbons (after extraction by petroleum ether)	mg/l	-	0.05	-	0.2	0.5	1
33	Polycyclic aromatic hydrocarbons	mg/l	-	0.0002	-	0.0002	-	0.001

CHARACTERISTICS OF SURFACE WATER INTENDED FOR THE ABSTRACTION OF DRINKING WATER			CATEGORIES					
			A1		A2		A3	
PARAMETERS			G	I	G	I	G	I
34	Total pesticides (parathion, BHC, dieldrin)	mg/l	-	0.001	-	0.0025	-	0.005
35	Chemical oxygen demand (COD)	mg/l O_2	-	-	-	-	30	-
36	Dissolved oxygen oxygen saturation rate	% O_2	>70	-	>50	-	>30	-
37	Biochemical oxygen demand (BOD_5) (at 20 °C with nitrification)	mg/l O_2	<3	-	<5	-	<7	-
38	Nitrogen by Kjeldahl method (except NO_3)	mg/l N	1	-	2	-	3	-
39	Ammonia	mg/l NH_4	0.05	-	1	1.5	2	4(0)
40	Substances extractable with chloroform	mg/l SEC	0.1	-	0.2	-	0.5	-
41	Total organic carbon	mg/l C	-	-	-	-	-	-
42	Residual organic carbon after flocculation and membrane filtrations (5 μ) TOC	mg/l C	-	-	-	-	-	-
43	Total coliforms 37 °C	/100 ml	50	-	5000	-	50000	-
44	Faecal coliforms	/100 ml	20	-	2000	-	20000	-
45	Faecal streptococci	/100 ml	20	-	1000	-	10000	-
46	Salmonella		Not present in 5000 ml	-	Not present in 1000 ml	-	-	-

3RD NORTH SEA CONFERENCE - PRIORITY HAZARDOUS SUBSTANCES (ANNEX 1A LIST OF SUBSTANCES)

Mercury
Cadmium
Copper
Zinc
Lead
Arsenic
Chromium
Nickel
Aldrin
Dieldrin
Endrin
Isodrin
HCH
DDT
Pentachlorophenol
Hexachlorobenzene
Hexachlorobutadiene
Carbon tetrachloride
Chloroform
Endosulphan
Trifluralin
Simazine
Atrazine
Triorganotin compounds
Azinphos-ethyl
Azinphos-methyl
Fenitrothion
Fenthion
Malathion
Parathion
Parathion-methyl
Dichlorvos
Trichloroethylene
Tetrachloroethylene
1,1,1-trichloroethane
Trichlorobenzene
1,2-dichloroethane
Polychlorinated biphenyls
Dioxins (*)

At the 3rd North Sea Conference, the UK Government undertook to reduce loadings (flow x concentration) of the 'Annex 1A' list of substances except dioxins (*) entering UK tidal waters from rivers and direct discharges by 50% (70% for Hg, Cd, Pb) by 1995, against a 1985 baseline.

APPENDIX 7

EC DIRECTIVE 'ON THE PROTECTION OF GROUNDWATER AGAINST POLLUTION CAUSED BY CERTAIN DANGEROUS SUBSTANCES' (80/68/EEC)

EXTRACTS

Article 1

1 The purpose of this Directive is to prevent the pollution of groundwater by substances belonging to the families and groups of substances in List I or II in the Annex, hereinafter referred to as 'substances in Lists I or II', and as far as possible to check or eliminate the consequences of pollution which has already occurred.

2 For the purposes of this Directive:

(a) 'groundwater' means all water which is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil;

(b) 'direct discharge' means the introduction into groundwater of substances in Lists I or II without percolation through the ground or subsoil;

(c) 'indirect discharge' means the introduction into groundwater of substances in Lists I or II after percolation through the ground or subsoil;

(d) 'pollution' means the discharge by man, directly or indirectly, of substances or energy into groundwater, the results of which are such as to endanger human health or water supplies, harm living resources and the aquatic ecosystem or interfere with other legitimate uses of water.

Article 3

Member States shall take the necessary steps to:

(a) prevent the introduction into groundwater of substances in List I; and

(b) limit the introduction into groundwater of substances in List II so as to avoid pollution of this water by these substances.

ANNEX

LIST I OF FAMILIES AND GROUPS OF SUBSTANCES

List I contains the individual substances which belong to the families and groups of substances enumerated below, with the exception of those which are considered inappropriate to List I on the basis of a low risk of toxicity, persistance and bioaccumulation.

Such substances which with regard to toxicity, persistance and bioaccumulation are appropriate to List II are to be classed in List II.

1 Organohalogen compounds and substances which may form such compounds in the aquatic environment.

2 Organophosphorus compounds.

3 Organotin compounds.

4 Substances which possess carcinogenic mutagenic or teratogenic properties in or via the aquatic environment([1]).

5 Mercury and its compounds.

6 Cadmium and its compounds.

7 Mineral oils and hydrocarbons.

8 Cyanides.

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[1] Where certain substances in List II are carcinogenic, mutagenic or teratogenic, they are included in category 4 of this list.

ANNEX Continued

LIST II OF FAMILIES AND GROUPS OF SUBSTANCES

List II contains the individual substances and the categories of substances belonging to the families and groups of substances listed below which could have a harmful effect on groundwater.

1 The following metalloids and metals and their compounds:

1	Zinc	11	Tin
2	Copper	12	Barium
3	Nickel	13	Beryllium
4	Chrome	14	Boron
5	Lead	15	Uranium
6	Selenium	16	Vanadium
7	Arsenic	17	Cobalt
8	Antimony	18	Thallium
9	Molybdenum	19	Tellurium
10	Titanium	20	Silver

2 Biocides and their derivatives not appearing in List I.

3 Substances which have a deleterious effect on the taste and/or odour of groundwater, and compounds liable to cause the formation of such substances in such water and to render it unfit for human consumption.

4 Toxic or persistent organic compounds of silicon, and substances which may cause the formation of such compounds in water, excluding those which are biologically harmless or are rapidly converted in water into harmless substances.

5 Inorganic compounds of phosphorus and elemental phosphorus.

6 Fluorides.

7 Ammonia and nitrites.

EC DIRECTIVE 'CONCERNING THE PROTECTION OF WATERS AGAINST POLLUTION CAUSED BY NITRATES FROM AGRICULTURAL SOURCES' (91/676/EEC)

(Directive notified in December 1991)

EXTRACTS (SEE ALSO APPENDIX 4)

Article 1

This Directive has the objective of:-

- reducing water pollution caused or induced by nitrates from agricultural sources and

- preventing further such pollution.

Article 3

1 Waters affected by pollution and waters which could be affected by pollution if action under Article 5 is not taken shall be identified by the Member States in accordance with the criteria set out in Annex 1.

2 Member States shall, within a two-year period following the notification of this Directive, designate as vulnerable zones all known areas of land in their territories which drain into the waters identified according to paragraph 1 and which contribute to pollution. They shall notify the Commission of this initial designation within six months.

3 When any waters identified by a Member State in accordance with paragraph 1 are affected by pollution from waters from another Member State draining directly or indirectly into them, the Member State whose waters are affected may notify the other Member State and the Commission of the relevant facts.

The Member States concerned shall organize, where appropriate with the Commission, the concertation necessary to identify the sources in question and the measures to be taken to protect the waters that are affected in order to ensure conformity with this Directive.

4 Member States shall review and if necessary revise or add to the designations of vulnerable zones as appropriate, and at least every four years, to take into account changes and factors unforeseen at the time of the previous designation. They shall notify the Commission of any revision or addition to the designations within six months.

5 Member States shall be exempt from the obligation to identify specific vulnerable zones, if they establish and apply action programmes referred to in Article 5 in accordance with this Directive throughout their national territory.

Article 6

1 For the purpose of designating and revising the designation of vulnerable zones, Member States shall:

(a) within two years of notification of the Directive (December 1993), monitor the nitrate concentration in freshwaters over a period of one year:

(i) at surface water sampling stations, laid down in Article 5(4) of Directive 75/440/EEC and/or at other sampling stations which are representative of surface waters of Member States, at least monthly and more frequently during flood periods;

(ii) at sampling stations which are representative of the groundwater aquifers of Member States, at regular intervals and taking into account the provisions of Directive 80/778/EEC;

(b) repeat the monitoring programme outlined in (a) at least every four years, except for those sampling stations where the nitrate concentration in all previous samples has been below 25 mg/l and no new factor likely to increase the nitrate content has appeared, in which case the monitoring programme need be repeated only every eight years;

(c) review the eutrophic state of their fresh surface waters, esturial and coastal waters every four years.

ANNEX 1 - CRITERIA FOR IDENTIFYING WATERS REFERRED TO IN ARTICLE 3(1)

A Waters referred to in Article 3(1) shall be identified making use, inter alia, of the following criteria:

(1) whether surface freshwaters, in particular those used or intended for the abstraction of drinking water, contain or could contain, if action under Article 5 is not taken, more than the concentration of nitrates laid down in accordance with Directive 75/440/EEC;
(2) whether groundwaters contain more than 50 mg/l nitrates or could contain more than 50 mg/l nitrates if action under Article 5 is not taken;
(3) whether natural freshwater lakes, other freshwater bodies, estuaries, coastal waters and marine waters are found to be eutrophic or in the near future may become eutrophic if action under Article 5 is not taken.

B In applying these criteria, Member States shall also take account of:

(1) the physical and environmental characteristics of the waters and land;
(2) the current understanding of the behaviour of nitrogen compounds in the environment (water and soil);
(3) the current understanding of the impact of the action taken under Article 5.

PUBLICATIONS

1 Somerset Levels and Moors Water Level Management and Nature Conservation Strategy (NRA).

2 Wildlife and Countryside Act 1981, HMSO, ISBN 0-10546 981-5.

3 Land Drainage Act, HMSO, ISBN 0-10-545 991-7.

4 Water Resources Act 1991, HMSO, ISBN 0-10-5457 91-4.

5 Salmon Act 1986, HMSO, ISBN 0-1-546286 1.

6 Salmon and Freshwater Fisheries Act 1975, HMSO, ISBN 0-10-545175-4.

7 Diseases of Fish Act 1937, HMSO.

8 European Council Directive on the Quality of Freshwaters Needing Protection or Improvement in order to support Fish Life (78/659/EEC). Official Journal of the European Communities No. L222.

9 Taunton Deane District Local Plan, Taunton Deane Borough Council.

10 DoE Circular 30/92, Development and Flood Risk.

11 Guidance Notes for Local Planning Authorities on the Methods of Protecting the Water Environment Through Development Plans, NRA, January 1994.

12 South West Regional Planning Guidance, HMSO, July 1994.

13 Somerset Structure Plan Review, Somerset County Council.

14 West Somerset - Dulverton Area Local Plan (West Somerset Parishes) 1984.

15 Bridgwater Area Local Plan 1990.

16 Devon County Structure Plan 1984, Devon County Council.

17 Mid Devon Local Plan (Deposit Draft 1995).

18 Taunton Deane Local Plan Issues and Options Report February 1995, Taunton Deane Borough Council.

19 West Somerset District Council District Wide Local Plan Consultation Report 1995, West Somerset District Council.

20 Position Statement on Landfill and the Water Environment, NRA, HO-1/95-5k-B-AMRS.

21 Draft for consultation of the Waste Local Plan Somerset County Council, January 1996, Somerset County Council.

22 Taunton Deane Nature Conservation Strategy Document, to be published soon.

23 Waste Regulation Authority Waste Management Plan Draft, September/October 1995, Somerset County Council.

24 Forestry Commission: Forest and Water Guidelines, 2nd Edition, 1991, ISBN 0-11-71029-2.

25 NRA National Water Resources Strategy 1993, ISBN 87316048. Water, Nature's Precious Resource, March 1994, ISBN 011 88 65234.

26 Strategic Business Plan (Asset Management Plan 2), Wessex Water plc.

27 European Council Dangerous Substances Directive 'On Pollution Caused By Certain Substances Discharged In The Aquatic Environment Of The Community' (76/464/EEC).

28 European Council Surface Water Abstraction Directive (75/440/EEC).

29 Policy and Practice for the Protection of Groundwater, NRA, 1992, ISBN 0-11-885822-X.

30 Tomorrow's Water, Water Resources Development Strategy, NRA South Western Region, April 1995. SW-4/95-K-B-ANOQ.

31 European Council Directive on Species and Habitats (92/43/EEC). Official Journal of the European Communities No. L206.

32 Code of Good Agricultural Practice for the Protection of Water, MAFF, 1991.

33 European Council Directives Concerning Urban Wastewater Treatment (91/271/EEC) and Concerning The Protection Of Waters Against Pollution Caused By Nitrates From Agricultural Sources (91/676/EEC).

34 European Council Directive Concerning The Quality Required Of Surface Water Intended For The Abstraction Of Drinking Water In The Member States (75/440/EEC).

35 3rd North Sea Conference - Priority Hazardous Substances (Annex 1A List Of Substances).

36 European Council Directive 'Concerning The Protection Of Waters Against Pollution Caused By Nitrates From Agricultural Sources' (91/676/EEC).

37 River Plants, Haslam 1978, ISBN 0 521-21493.

38 Guidance for the Control of Invasive Plants near Watercourses, Japanese Knotweed, Giant Hogweed and Himalayan Balsam. HO-9/94-20k-C-AKVI.

39 Contaminated Land and the Water Environment Report - NRA National Water Quality Series No. 15, 1994, ISBNO-11-8865218.

POLLUTION INCIDENT CATEGORIES

Category 1

A major incident involving one or more of the following:

a) potential or actual persistent effect on water quality or aquatic life;

b) closure of potable water, industrial or agricultural abstraction necessary;

c) extensive fish kill;

d) excessive breaches of consent conditions;

e) extensive remedial measures necessary;

f) major effect on amenity value.

Category 2

A significant pollution which involves one or more of the following:

a) notification to abstractors necessary;

b) significant fish kill;

c) measurable effect on invertebrate life;

d) water unfit for stock;

e) bed of watercourse contaminated;

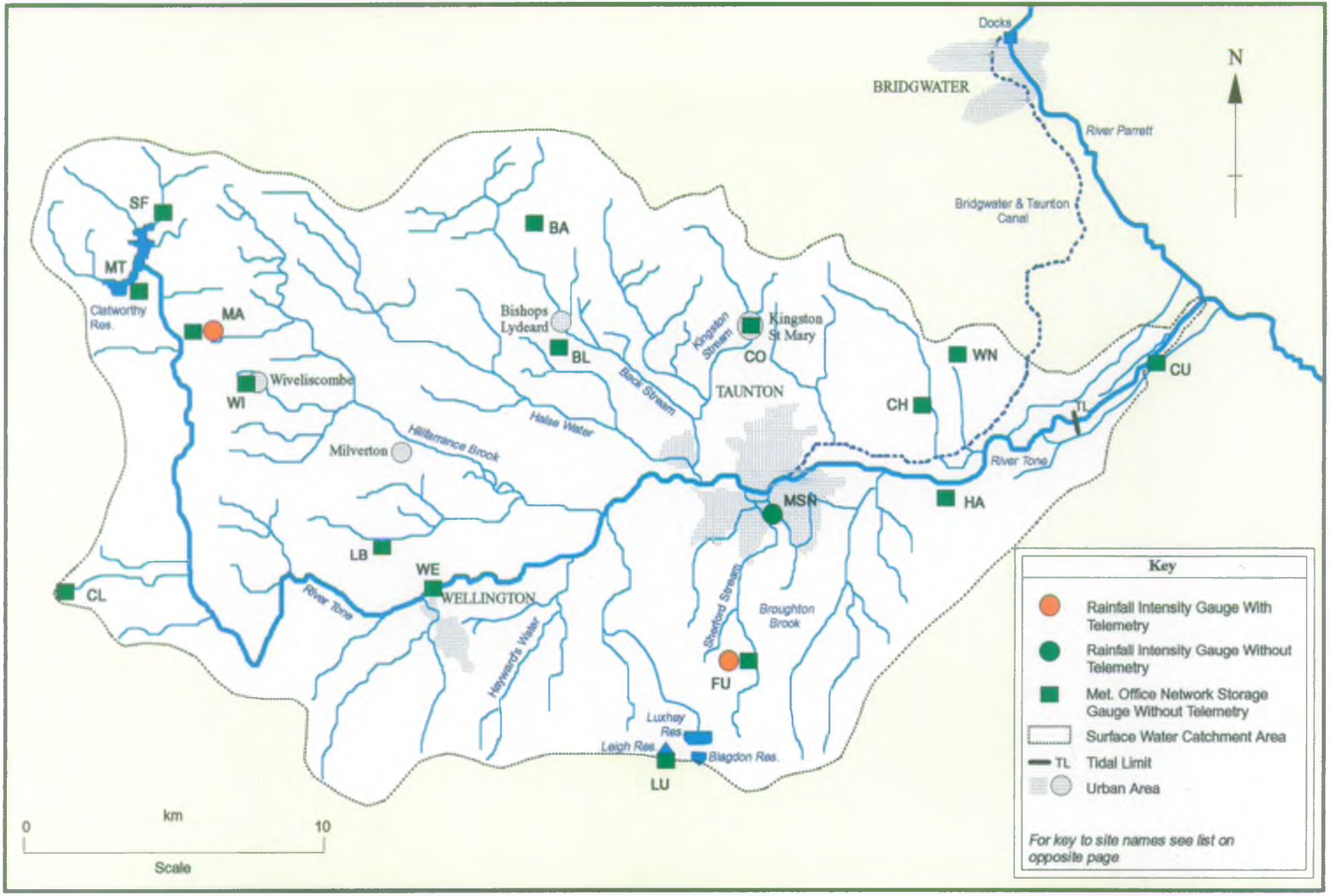
f) amenity value to the public, owners or users reduced by odour or appearance.

Category 3

Minor

Suspected or probable pollution which on investigation proves unlikely to be capable of substantiation or to have no notable effect.

Appendix 11 - Location of Rainfall Measurement Gauges



Information correct as of May 1995

RAINFALL MEASUREMENT

Non Telemetered Met. Office Network Storage Gauge

BA	=	ST 165 326	Bagborough
BL	=	ST 171 289	Bishops Lydeard
CH	=	ST 278 268	Creech Heathfield
CL	=	ST 026 222	Clayhanger
CO	=	ST 222 297	Camplins Orchard
CU	=	ST 344 288	Curry Moor
FU	=	ST 212 198	Fulwood
HA	=	ST 286 246	Ham STW
LB	=	ST 114 235	Langford Budville (Inc Temperature)
LU	=	ST 201 175	Luxhay
MA	=	ST 065 291	Maundown
MT	=	ST 048 310	Mill Town
SF	=	ST 054 327	Clatworthy Sedge Farm
WE	=	ST 130 218	Wellington STW
WI	=	ST 081 280	Wiveliscombe
WN	=	ST 286 291	West Newton

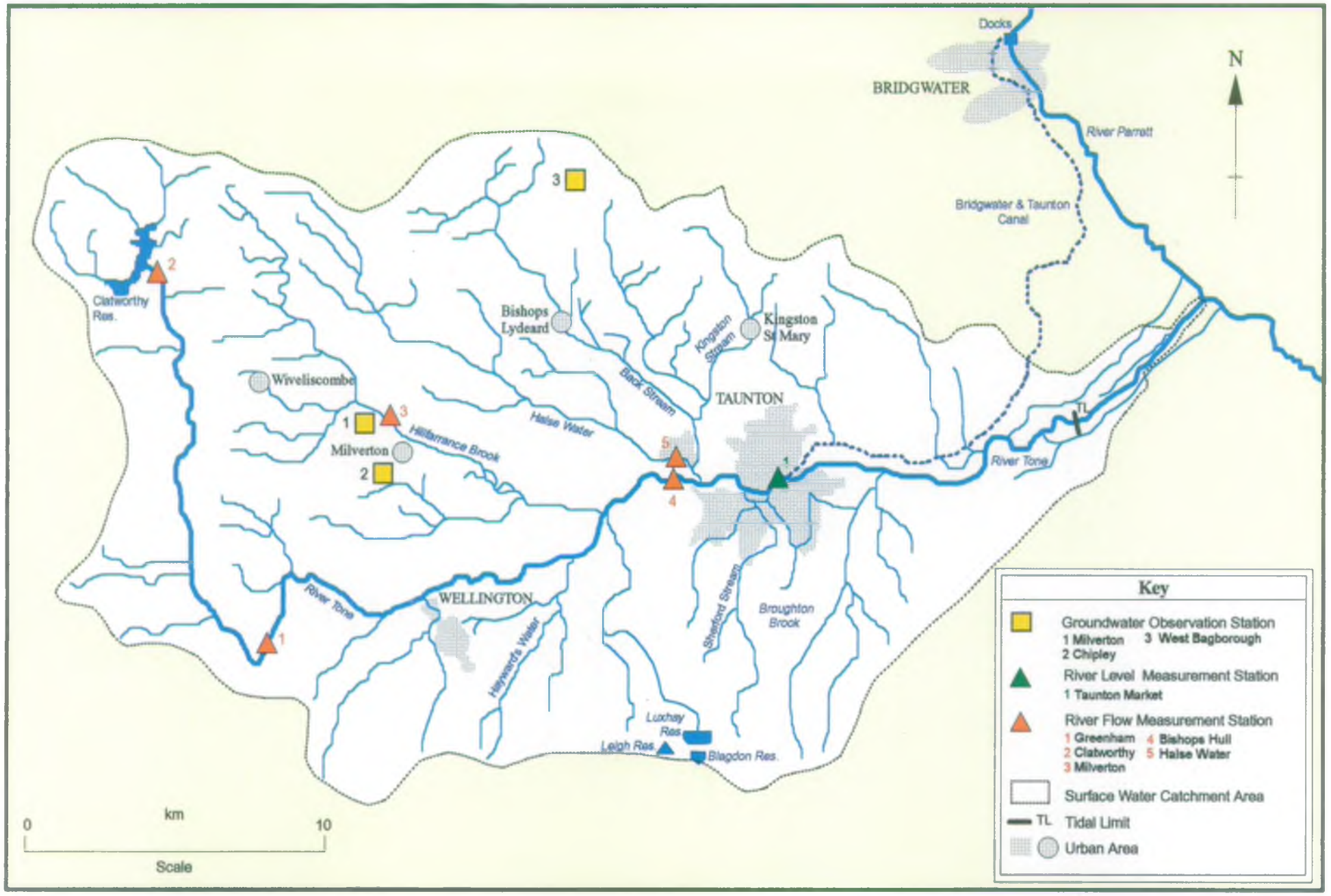
Rainfall Intensity Gauge with Telemetry

FU	=	ST 212 198	Fulwood
MA	=	ST 065 291	Maundown

Rainfall Intensity Gauge without Telemetry

MSN	=	ST 232 240	Mount St Nurseries

Appendix 12 - River Level, Flow Measurement and Groundwater Observation Stations



Information correct as of May 1995

FLOW AND LEVEL MEASUREMENT

River Flow Stations with Telemetry

BH	=	ST 206 250	Bishops Hull
GR	=	ST 078 202	Greenham
HW	=	ST 206 253	Halse Water
MI	=	ST 113 270	Milverton

River Flow Stations without Telemetry

None.

Please note. Flow data can be computed for two points along the Tone using flow information from upstream gauging stations:

ST 208 250	Downstream of Tone/Halse Water confluence
ST 302 261	Knapp Bridge

River Level Stations with Telemetry

TM	=	ST 230 253	Taunton Market

River Level Stations without Telemetry

None

Groundwater Observation Boreholes

CHI	=	ST 116 253	Chipley
MV	=	ST 110 270	Milverton
WB	=	ST 182 338	West Bagborough

APPENDIX 13

NRA POLICY AND PRACTICE FOR THE PROTECTION OF GROUNDWATER

Summary Guide

In order to provide a framework for decision making, the NRA published its "Policy and Practice for the Protection of Groundwater" (PPPG) in December 1992. This document is available separately from HMSO. This appendix serves as a guide to how the policy is implemented, the NRA's principal concerns regarding threats to groundwater and to emphasise that we have a part of play in protecting a valuable resource.

The policies are related to the risk posed by the activity taking into account the vulnerability of groundwater to pollution and paying particular attention to protecting the groundwater used for public water supply.

The NRA is engaged in a national programme of designating Source Protection Zones within these public supply catchments according to agreed criteria and following a timetable which should see completion by 1998. In accordance with the PPPG three zones of decreasing risk will be defined.

Zone 1 - The Inner Source Protection Zone will be that area defined by a fifty day travel time from any point below the water-table to the source (and as a minimum of fifty metres radium from the source).

Zone 2 - The Outer Source Protection Zone is that area defined by a 400 day travel time from any point below the water-table to the source.

Zone 3 - The Source Catchment is that area within which all groundwater will eventually discharge to the source.

The PPPG provides guidance on the acceptability of activities within such zones and in the absence of completion of the zonation maps the NRA will advise on the suitability of proposed development locations on the basis of existing information. In order to ensure sources will be properly protected, prior to these zones being established, we are also defining "Source Consultation Zones" within which we will seek referral of particular development activities to assess source protection requirements.

Another key element in the strategy to protect groundwater resources on a regional scale is the production of Groundwater Vulnerability Maps covering England and Wales at a scale of 1:100,000 identifying areas in which groundwater resources are vulnerable according to properties of the soil and underlying strata and require protection from potentially polluting activities. The maps are designed to be used by planners, developers, consultants and regulatory bodies to ensure that developments conform to PPPG. The programme of map production is on-going with map completion expected during 97/98. In the absence of such map information the NRA will advise on the suitability of proposed development locations.

Outlined overleaf are the key policy areas and NRA concerns regarding the protection of groundwater. In some cases the NRA can utilise its own powers but more often the NRA will need to influence other bodies, particularly local planning authorities and developers in order to achieve pollution prevention objectives. Please refer to the full PPPG document for detailed and informed policy interpretation.

NATIONAL RIVERS AUTHORITY - SOUTH WESTERN REGION
POLICY AND PRACTICE FOR THE PROTECTION OF GROUNDWATER
SUMMARY GUIDE

	POLICY STATEMENT	PRINCIPAL CONCERNS AND CONTROLS
A	Control of Groundwater Abstractions	No derogation of existing water rights. No unacceptable detriment to watercourse or water feature dependent on groundwater. No deterioration to WQ by incursion of saline or polluted waters. **Controls through Abstraction Licences under Water Resources Act (WRA) 1991.**
B	Physical Disturbance of Aquifers and Groundwater Flow	Effects on water resources from proposals that physically disturb aquifers, lower groundwater levels, impede or intercept groundwater flow eg quarrying and gravel extraction, mining, construction of highways, railways, cuttings and tunnels, landfill using impermeable materials, borehole construction and abandonment activities that interconnect naturally separate aquifers. Interception of recharge waters. **NRA seeks controls through planning process.**
C	Waste Disposal to Land	Pollution risks to groundwater from landfill and other waste related activities including: incinerators, transfer stations, civic amenity sites, waste chemical treatment plants, storage of special wastes and scrapyards. **Controls as statutory consultee to Planning & Waste Regulation Authority.**
D	Contaminated Land	Pollution risks from derelict land in a contaminated state or due to disturbance during re-development or from active industrial sites. Contaminated land may include land currently or previously used in connection with coal gas production, landfill sites and other waste disposal activities, waste lagoons, chemical manufacture, heavy industry, mining, sewage treatment works, metal and oil refining and hydrocarbon storage. **NRA seeks controls through Planning process and negotiation with developers.**

NATIONAL RIVERS AUTHORITY - SOUTH WESTERN REGION
POLICY AND PRACTICE FOR THE PROTECTION OF GROUNDWATER
SUMMARY GUIDE

	POLICY STATEMENT	PRINCIPAL CONCERNS AND CONTROLS
E	The Application of Liquid Effluent, Sludges and Slurry to Land.	Risk to groundwater quality dependent upon the chemical and microbiological content of the waste, the rate, method and timing of application and groundwater vulnerability.
	- Agricultural Wastes	Produced from various farming activities including animal wastes and silage liquors. The NRA will liaise with farmers and seek to encourage them in the preparation of waste management plans for their farms. These should include the drawing up of a map identifying land suitable for the spreading of farm effluent without detriment to groundwater. **NRA seeks control through MAFF Code of Good Agricultural Practice for the Protection of Water.**
	- Sewage Sludge	Produced exclusively at sewage works and disposed of by sewage undertakers or their contractors. **Control through liaison with Statutory Undertakers, HMIP Competent Authority for Sludge (Use in Agri) Regs.**
	- Controlled Waste	Industrial effluent sludges, both organic and inorganic in nature and including septic tank contents. **Control through consultation with Waste Regulation Authorities on Registration of Exemptions under Environmental Protection Act 1990.**
F	Discharges to Underground Strata	Protection of groundwater quality by **NRA control of discharges under the Water Resources Act 1991** through consenting or prohibiting discharges to groundwater either direct or via a soakaway. No consented discharge of List 1 substances to underground strata. Sealed effluent storage tanks for domestic sewage effluent in Zone 1 in the absence of main sewer. Discharges of sewage effluent to groundwater from new septic tanks or STWs >5m3/d will be controlled. Discharges <5m3/d will be controlled when groundwater judged at risk.

NATIONAL RIVERS AUTHORITY - SOUTH WESTERN REGION POLICY AND PRACTICE FOR THE PROTECTION OF GROUNDWATER SUMMARY GUIDE

	POLICY STATEMENT	PRINCIPAL CONCERNS AND CONTROLS
G	Diffuse Pollution of Groundwater	Groundwater contamination arising through areal spread of pollutants eg Nitrates/Pesticides, and cumulative effects of many individual events eg farm wastes or industrial solvent spillages. **Controls possible under Section 94 of WRA 1991 ie Nitrate Sensitive Areas. Also Discharge Consent Controls and Regulations (Section 92) of WRA 1991 eg Silage, Slurry and Agricultural Fuel Oil Regulations.**
H 1	Additional Threats Production, Storage & Use of Chemicals (Raw & Waste)	Point source risk to groundwater quality. **Controls through Planning (Hazardous Substances) Act 1990 - Applies to new storage of significant quantities of specific hazardous substances - NRA statutory consultee. Otherwise NRA seeks controls through planning process.** Normally NRA will object to proposals within Zones 1 and 2. Storage of waste may require a Waste Management Licence (NRA Statutory Consultee).
H 2	Storage of Farm Wastes and Intensive Livestock Housing	In vulnerable locations leachate from stored wastes or effluent from intensive livestock housing can be highly polluting. **Control through the Silage, Slurry and Agricultural Fuel Oil Regulations 1991 for all new, substantially enlarged or reconstructed installations.** The Code of Good Agricultural Practice of the Protection of Water (MAFF 1991) offers guidance generally. The NRA wishes to discourage the establishment of farm waste storage areas and substantial livestock housing within the Inner Source Protection Zone (Zone 1) unless adequate measures can be agreed to minimise risk of pollution. **NRA seeks controls through planning process.**
H 3	Graveyard and Animal Burial Sites	Large graveyards are a potential threat to groundwater quality. New sites or extensions opposed within Zone 1. **NRA seeks controls through planning process.** Animal burial sites rejected in Zone 1. **Code of Good Agricultural Practice provides guidance.**

NATIONAL RIVERS AUTHORITY - SOUTH WESTERN REGION
POLICY AND PRACTICE FOR THE PROTECTION OF GROUNDWATER
SUMMARY GUIDE

	POLICY STATEMENT	PRINCIPAL CONCERNS AND CONTROLS
H 4	Sewage Works, Foul Sewers and Storm Overflows	Risk of contamination to groundwater resources. New STWs opposed in Zones 1 and 2. New sewers opposed in Zone 2. **NRA seeks controls through planning process. Sewage works and storm overflows controlled by Discharge Consents through WRA 1991.**
H 5	Additional Threats (Cont'd) Oil and Petroleum Storage and Transport via Pipelines	Groundwater pollution from leakage from underground tanks and accidental rupturing of tanks and pipework. Storage Regulations expected under Section 92 WRA 1991, similar to H2 above. New hydrocarbon storage opposed to in Zone 1. Underground storage of hydrocarbons discouraged in Zones 2 and 3. **NRA seeks controls through the planning process.** Oil pipeline routes opposed in Zone 1 and discouraged in Zones 2 and 3. **NRA seeks controls through the planning process.**
H 6	Major Developments and Infrastructure	Drainage from major roads or railways can pose risks to groundwater due to spillages after accidents. Also changes to discharge and runoff patterns. Major communications routes opposed in Zone 1. Developments such as airfields, industrial parks and large areas of vehicle parking may involve storage/loading/unloading of hydrocarbons, solvents and other potentially contaminating substances. Such developments opposed in Zone 1. **NRA seeks control through planning process.** **Discharges from highway drains and contaminated site drainage can be controlled by prohibition notices and discharge consents.**

NATURE CONSERVATION AND ARCHAEOLOGICAL DESIGNATIONS

Area of Outstanding Natural Beauty (AONB)
Designated by the Countryside Commission under the National Parks and Access to the Countryside Act 1949, to conserve and enhance the natural beauty of the landscape, mainly through Planning controls.

Local Nature Reserve (LNR)
Nature reserves established, and usually managed, by district/borough councils. Local authorities are empowered to designate such sites under the National Parks and Access to the Countryside Act 1949.

National Nature Reserve (NNR)
Sites owned or leased and managed by English Nature and established as reserves under the National Parks and Access to the Countryside Act 1949.

RAMSAR sites
Sites identified by UK Government under the Convention on Wetlands of International Importance which was ratified by the UK Government in 1976.

Scheduled Ancient Monument (SAM)
Sites of national importance designated under the Ancient Monuments and Archaeological Areas Act 1979.

Sites of Nature Conservation Interest (SNCI)
Sites selected (usually by County Wildlife Trusts) as sites of 'County' ecological importance.

Sites of Special Scientific Interest (SSSI)
Sites of national importance designated under the Wildlife and Countryside Act 1981. Usually in private ownership, habitats, sites for individual species, geology and land forms may be designated.

Special Landscape Areas (SLAs)
Areas of special landscape quality, designated by the County (ie not nationally endorsed), justifying the adoption, by the County, of particular development control policies and other safeguarding measures.

Special Protection Areas (SPAs)
Sites identified by UK Government under the EC Directive on the Conservation of Wild Birds (79/409/EC).

World Heritage Site
Designated by UNESCO for their international importance.

Sites and Monuments Record
Sites and features of County importance selected by the County Council.

Listed Building
Listed by the Department of National Heritage on advice from English Heritage.

Conservation Areas
Designated by local authorities, normally to protect a group of, or setting for listed buildings.

GLOSSARY

Aardvark	Water Quality data statistical analysis package
AOD	Above Ordnance Datum
AONB	Area of Outstanding Natural Beauty. Designated by the Countryside Commission under the National Parks and Access to the Countryside Act 1942, to conserve and enhance the natural beauty of the landscape, mainly through Planning controls
Aquifer	Rock which holds substantial amounts of water in structure or fissures e.g. chalk, sandstones, limestones
Attenuation feature	A pond designed to store surface water discharges from new development and attenuate (delay) its release. Such ponds can provide environmental enhancements if they are designed sympathetically
Bed Loss	Loss of water through a permeable stream bed
BOD	Biochemical Oxygen Demand
BOD(ATU)	Biochemical Oxygen Demand with nitrification suppressed by allylthiourea
Brown Field Site	Piece of land in rural context that has been subjected to some sort of development, e.g. airfield, tip etc
Buffer Zone (Bio-buffer)	Strip of land, 10-100 m wide, alongside rivers which is removed from intensive agricultural use and managed to provide appropriate habitat types. Benefits include reduction of inputs into the river such as silt, nutrients, livestock waste, as well as improving habitat diversity and landscape
Calcareous	Of, or containing, carbonate of lime or sandstone
Carcinogenic	Cancer causing
CDP	Catchment Drainage Plan
CMP	Catchment Management Plan
Coarse fish	This is a lay-man's term for cyprinid fish and other commonly associated species such as pike, perch and eels of angling significance. Does not normally refer to minor species such as bullhead, stone loach, minnow and stickleback
Consent (Discharge Consent)	A legal document raised by the National Rivers Authority which specifies the conditions under which a discharge may be made

Containment Bund	An earth bank intended to retain liquids
CSO	Combined sewer overflow. A combined sewer is one which takes both surface and foul drainage - usually in older developments
Cyprinid	Fish of the family Cyprinidae (e.g. roach, bream, carp, chub). In the strict sense pike, perch, eel and some other fish species are not cyprinids
Deemed Consent	Under legislation prior to the Water Resources Act 1991, if a consent application was not determined within the statutory timescale then it was 'deemed' granted, so becoming a deemed consent.
Derogate	Loss or impairment of water resource, action causing such loss or impairment
DO	Dissolved Oxygen
DoE	Department of the Environment
DWLP	District Wide Local Plan
Dry Weather Flow (DWF)	When sewage flow is mainly domestic in character, the average daily flow to the treatment works during seven consecutive days without rain (excluding a period which includes public or local holidays) following seven days during which the rainfall did not exceed 0.25mm on any one day. With an industrial sewage the dry-weather flow should be based on the flows during five working days if production is limited to that period. Preferably, the flows during two periods in the year, one in the summer and one in the winter, should be averaged to obtain the average dry-weather flow
Eel	Refers to the common eel *Anguilla anguilla*
EIFAC	European Inland Fisheries Advisory Commission
Elver	The young stage in the life history of the eel
ESA	Environmentally Sensitive Area (MAFF scheme). A scheme of tiered payments for adopting specific environmentally beneficial farming practices
Eutrophication	Nutrient enrichment of water, e.g. increased nitrogen input leaching into rivers from soil treated with chemicals, this chemical enrichment resulting in increased productivity
"Flashy"	Watercourse which has a rapid response to rainfall. Typically has long periods of low flows and high flows may be several hundred times low flow

Foundered strata	Geological term - normal succession of rock types is disturbed by large scale collapses
Geomorphological	The natural processes which produce river features such as channel form
Groundwater	Underground water that has come mainly from the seepage of surface water and is held in the soil and in pervious rocks
HMIP	Her Majesty's Inspectorate of Pollution
IFE	Institute of Freshwater Ecology
Improved Pasture	Regularly reseeded grassland on which fertilizers and herbicides are typically applied
LNR	Local Nature Reserve. Nature reserves established, and usually managed, by district/borough councils. Local authorities are empowered to designate such sites under the National Parks and Access to the Countryside Act 1949
Macrophyte	Plants clearly visible without the aid of a microscope but excluding lichens, fungi, mosses and algae
MAFF	Ministry of Agriculture, Fisheries and Food
Marly	Rock type made up of marl - a calcareous mudstone
Mutagenic	Causing genetic change which when transmitted to offspring causes heritable abnormal variation
MOD	Ministry of Defence
NNR	National Nature Reserve. Sites owned or leased and managed by English Nature and established as reserves under the National Parks and Access to the Countryside Act 1949
Non-Salmonid	See Salmonid - fish not belonging to the salmonid family i.e. coarse fish and minor species
NRA	National Rivers Authority
NSA	Nitrate Sensitive Area
Nutrient	Chemical essential for plant growth, e.g. nitrate, phosphate
NVZ	Nitrate Vulnerable Zone
Odonata	Group of insects comprising dragonflies and damselflies

Percentile	One of 99 values of a variable dividing its distribution into 100 groups with equal frequencies
Population Equivalent (pe)	The volume and strength of an industrial waste water expressed in terms of an equivalent population, based upon a figure of 0.060 kilogramme BOD per capita per day; the population equivalent of an industrial waste water is therefore calculated using the relationship: $\text{population equivalent} = \frac{\text{5-day BOD (mg/l) x flow}(m^3/d)}{0.060 \times 10^3}$
Prescribed Minimum Flow (pmf)	Prescribed minimum flow is the low flow which is used to control abstractions to prevent adverse impact on other users, the environment or water quality
Primary Porosity	A measure of the capacity of a rock to store water in natural intergranular voids
PSA	Property Services Agency
Q95	The flow that is equalled or exceeded for 95% of the time. It is a low flow but lower flows will be experienced from time to time in very dry periods
RAMSAR sites	Sites identified by UK Government under the Convention on Wetlands of International Importance which was ratified by the UK Government in 1976
Reliable Yield	The output capacity of a reservoir, reservoir system, conjunctive use scheme etc. It is the average output (volume/day) that can be sustained through a design drought period. 1976 has been regarded as the critical historical drought sequence, with a risk of occurrence regionally of approximately 1:50 years but current research into extended flow sequences back to the last century and modelling particular water supply schemes suggests that 1975-76 may be much more severe than a 1:50 year sequence.
Riffle	Stony or gravelly part of stream or river bed shallow in dry flow (opposite of pool). Fast streams on most non-chalk areas have alternating riffles and pools
Riparian Owner	Owner of land next to river; normally owns river bed and rights to mid-line of channel
Salmonid	Fish belonging to the family Salmonidae (salmon, trout, grayling)
SAM	Scheduled Ancient Monument. Sites of national importance designated under the Ancient Monuments and Archaeological Areas Act 1979

Semi-Improved Pasture	Reseeded or undisturbed grassland which contains some species typical of unimproved pasture. Receives relatively little artificial fertilizers or herbicides
SLA	Special Landscape Area. Areas of special landscape quality, designated by the County (ie not nationally endorsed), justifying the adoption, by the County, of particular development control policies and other safeguarding measures
SNCI	Sites of Nature Conservation Interest. Sites selected (usually by County Trusts) as sites of 'County' ecological importance
Source	Point of abstraction of water, eg well, borehole, spring
SPA	Special Protection Area. Sites identified by UK Government under the EC Directive on the Conservation of Wild Birds (79/409/EC)
Special Landscape Area	A non-statutory designation used by County Planning Authorities
SSSI	Site of Special Scientific Interest. Sites of national importance designated under the Wildlife and Countryside Act 1981. Usually in private ownership, habitats, sites of individual species, geology and land forms may be designated
STW	Sewage Treatment Works
Substrate	Material making up bed and underwater part of banks of stream. Gravels, silts etc
Surface Water	General term used to describe all the water features such as rivers, streams, springs, ponds and lakes
SWQO	Statutory Water Quality Objectives
Teratogenic	Causing abnormal monster growth in organisms
Unimproved Pasture	Permanent grassland which has not been disturbed for many decades and typically receives no artificial fertilizers or herbicides. Rich in grasses, sedges and flowers
Unsaturated Zone	That part of an aquifer, above the water table, in which cracks, fissures and other large voids are normally air-filled
Weil's Disease	Also known as Leptospirosis - disease associated with rats' urine. Infection can enter through broken skin or eyes, nose, mouth, etc. River users may be at risk
WOAD	Welsh Office Agriculture Department

WQO	Water Quality Objective
WWS	Wessex Water Services

Units

%ile	Percentile
%sat	% saturation (of oxygen)
mg/l	Milligrams per litre
m^3/d	Cubic metres per day
Ml/a	Megalitres per year (one million litres per year)
Ml/d	Megalitres/day (one million litres per day)

APPENDIX 16

THE SOMERSET LEVELS AND MOORS

WATER LEVEL MANAGEMENT AND NATURE CONSERVATION

SUMMARY

The National Rivers Authority has a statutory duty to further the conservation of the wildlife, landscape and archaeology of watercourses and wetlands under Sections 8 and 9 of the Water Act 1989 (as amended). The nature conservation interest of the Somerset Levels and Moors is deteriorating; concern has been expressed over the gradual drying out of the Moors with particular reference to the Sites of Special Scientific Interest. The Somerset Local Flood Defence Committee has examined the situation and has put forward the following strategy:

1 The National Rivers Authority recognizes the outstanding nature conservation interest of the Somerset Levels and Moors and that this is in decline.

2 The Authority seeks to restore and maintain the wildlife and landscape of this internationally important wetland, consistent with its given duties, and to conserve the archaeological interest.

3 The Authority has statutory obligations as regards water management, including the control of water abstraction, discharges, water quality, drainage and water levels.

4 The Authority will give special consideration to the environmental impact of abstraction and discharges throughout the Levels and Moors.

5 The Authority will review its flood defence practices and take into account the requirements for nature conservation, to ensure sympathetic management within the Environmentally Sensitive Area (ESA). Formal management plans will be agreed with English Nature (EN) over activities which affect Sites of Special Scientific Interest (SSSIs). English Heritage will be consulted over matters that affect Scheduled Ancient Monuments (SAMs).

6 The Authority will adopt a presumption in favour of positive water level management for nature conservation on SSSIs, and in other appropriate areas where there is general agreement. Priority will be given to the core areas of SSSIs.

7 Where raised water levels affect agricultural productivity the Authority will support the introduction of a water level premium on ESA payments and/or Section 15 management agreements with English Nature to offset these costs.

8 The Authority will liaise with relevant organisations to draw up a list of priority sites where enhanced water levels are required to maintain and restore the nature conservation interest.

9 The Authority will take action after consultation with the Ministry of Agriculture, Fisheries and Food, English Nature, Internal Drainage Boards and landowners in order to achieve the conservation objectives.

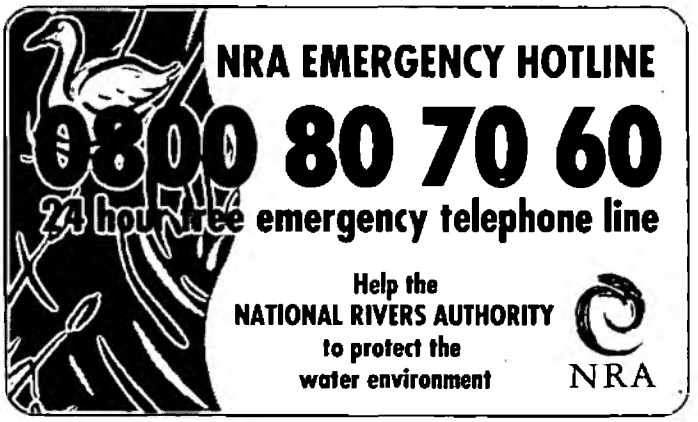
10 The importance of the 'withy' growing industry is fully recognised and in implementing its strategy the NRA will seek to accommodate its special requirements.

11 In implementing the strategy the Authority will take special account of the statutory, practical and financial position of Internal Drainage Boards.

12 Any changes in strategy must ensure that there is no increase in flood risk to human life, habitation or communications.

The success of the proposed strategy will depend on co-ordinated action by many different individuals and organisations. The National Rivers Authority believes that this strategy represents an important opportunity to safeguard the special character of the Somerset Moors.

Telephone the emergency hotline to report all environmental incidents, such as pollution, poaching and flooding, or any signs of damage or danger to our rivers, lakes and coastal waters. Your prompt action will help the NRA to protect water, wildlife, people and property.



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