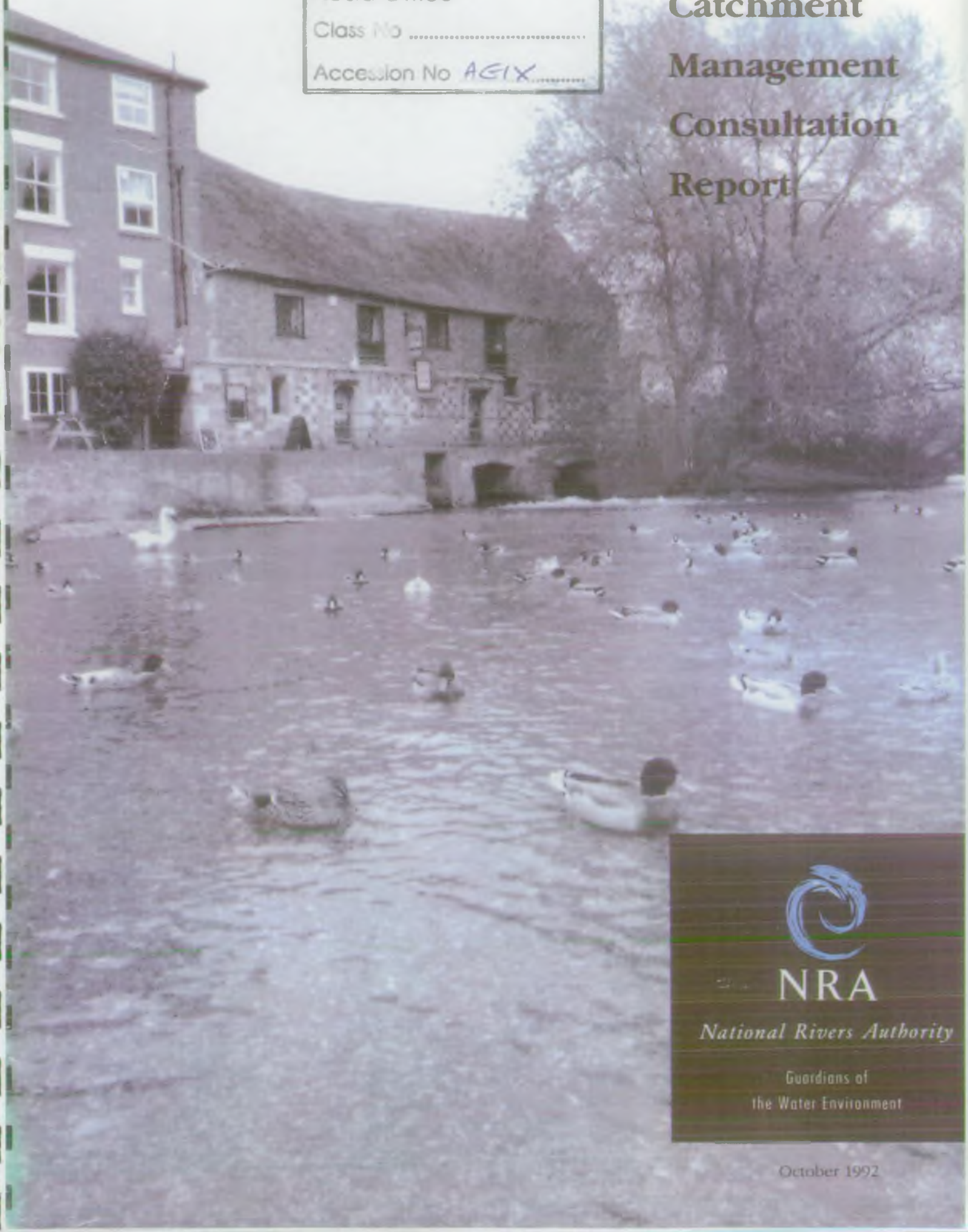
Hampshire Avon Catchment Management Consultation Report



NRA
National Rivers Authority
Guardians of the Water Environment

October 1992

HAMPSHIRE AVON

CATCHMENT MANAGEMENT CONSULTATION REPORT

OCTOBER 1992

Hampshire Avon Catchment Management Plan
Consultation Report

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F O R E W O R D

As 'Guardians of the Water Environment' it is essential that the National Rivers Authority has a sound foundation for its work in managing groundwater, rivers, estuaries and coastal waters.

We see the development of Catchment Management Plans as a way of establishing the important requirements in each river catchment. By public consultation with those who have an interest in the water environment we hope to achieve a broad consensus on the major issues and obtain the commitment of those who will need to play a part with us in their resolution.

This Consultation Report represents a major step in the production of our first Catchment Management Plan in the Wessex Region. We have examined our information on the catchment and identified what we consider to be the main issues.

We now look forward to receiving views from organisations and individuals who have an interest in the Hampshire Avon catchment.

Katharine Bryan
Regional General Manager

THE NATIONAL RIVERS AUTHORITY

The NRA's purpose is as follows:

"The National Rivers Authority will protect and improve the water environment. This will be achieved through effective management of water resources and by substantial reductions in pollution. The Authority aims to provide effective defence for people and property against flooding from rivers and the sea. In discharging its duties it will operate openly and balance the interests of all who benefit from and use the rivers, ground waters, estuaries and coastal waters. The Authority will be businesslike, efficient and caring towards its employees".

AIMS

- To achieve a continuing improvement in the quality of rivers, estuaries and coastal waters, through the control of water pollution.
- To assess, manage, plan and conserve water resources and to maintain and improve the quality of water for all who use it.
- To provide effective defence for people and property against flooding from rivers and the sea.
- To provide adequate arrangements for flood forecasting and warning.
- To maintain, improve and develop fisheries.
- To develop the amenity and recreation potential of waters and lands under NRA control.
- To conserve and enhance wildlife, landscape and archaeological features associated with waters under NRA control.
- To improve and maintain inland waterways and their facilities for use by the public where the NRA is the navigation authority.
- To 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.
- To improve public understanding of the water environment and the NRA's work.
- To improve efficiency in the exercise of the NRA's functions and to provide challenge and opportunity for employees and show concern for their welfare.

HAMPSHIRE AVON CATCHMENT MANAGEMENT PLAN

PHASE ONE

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1 CATCHMENT MANAGEMENT PLANNING - CONCEPT AND PROCESS

1.1 The National Rivers Authority

The National Rivers Authority (NRA) is responsible for protecting and improving the water environment within England and Wales. It has a wide range of responsibilities which include:

- Flood Defence, including the protection of people and property
- Flood Warning
- Effective management of water resources
- Control of pollution and improving the quality of rivers, groundwaters and coastal waters
- Maintenance and improvement of fisheries
- Promotion of water based recreation including navigation
- Conservation of the natural water environment

To achieve its aims, the NRA must work with or seek to influence central government, local government, industry, commerce, farming, environmental organisations, riparian owners and the general public. Successful management of the water environment requires consideration of a wide range of interests and requirements which may sometimes be in conflict.

To assist in its work, the NRA has developed the concept of **Catchment Management Plans (CMP's).** These allow the full range of water management issues to be identified and considered within a geographical area which is relevant and meaningful.

1.2 Scope and Process of Catchment Management Planning

The provisional model for the production of Catchment Management Plans within the NRA envisages two stages:

- Catchment Management Consultation Report and
- Catchment Management Final Plan

The **Consultation Report** includes the following sections:

- Uses

  The uses of the catchment are identified and discussed. Information is normally presented in the form of a map with one or more pages of supporting text. Uses may have impacts on the water environment and/or impose requirements on the water environment. Wherever appropriate, objectives and targets are identified in terms of :

  - water quality requirements
  - water quantity requirements
  - physical features requirements

1.2 Scope and Process of Catchment Management Planning (continued)

- Objectives

  By taking the objectives and targets relevant to the area where each use takes place, overall objectives and targets for the catchment are derived. At any location it is the most stringent use related target which must be achieved.

- State of the catchment

  The State of the catchment is assessed against the objectives and targets which apply. Areas where objectives are not met and issues which need to be addressed in order to meet objectives are identified.

- Issues and Options

  The identified issues are discussed and where possible some options for their resolution are proposed. A tabulated summary of issues and options concludes this section. The organisation responsible and also some advantages and disadvantages of the suggested options are proposed.

The Catchment Management Consultation Plan is intended to form a basis for consultation between the NRA and all those with interests in the catchment. Consultees may wish to:

- raise additional issues not identified in the plan

- comment on the issues and options identified in the plan

- suggest alternative options for resolving identified issues

The NRA recognises that many of the options for action identified by the Consultation Plan will involve organisations or individuals other than the NRA and their views will be crucial to the preparation of the Final Plan.

The **Final Plan** will be produced following consultation and will have regard to the comments received. The Final Plan will form a basis for the NRA's actions within the catchment and also provide a public document which will form a framework for the NRA's interaction with other organisations. The NRA will be seeking commitment to planned actions by others wherever possible.

1.3 Limitations

The finished CMP will inevitably be subject to some limitations, the major examples of which are as follows.

1 CATCHMENT MANAGEMENT PLANNING - CONCEPT AND PROCESS CONTINED

1.3 Limitations (continued)

Where improvement works are required to overcome catchment problems, these works will in many cases be the responsibility of other organisations or individuals. This Authority may have no powers to control the necessary actions directly.

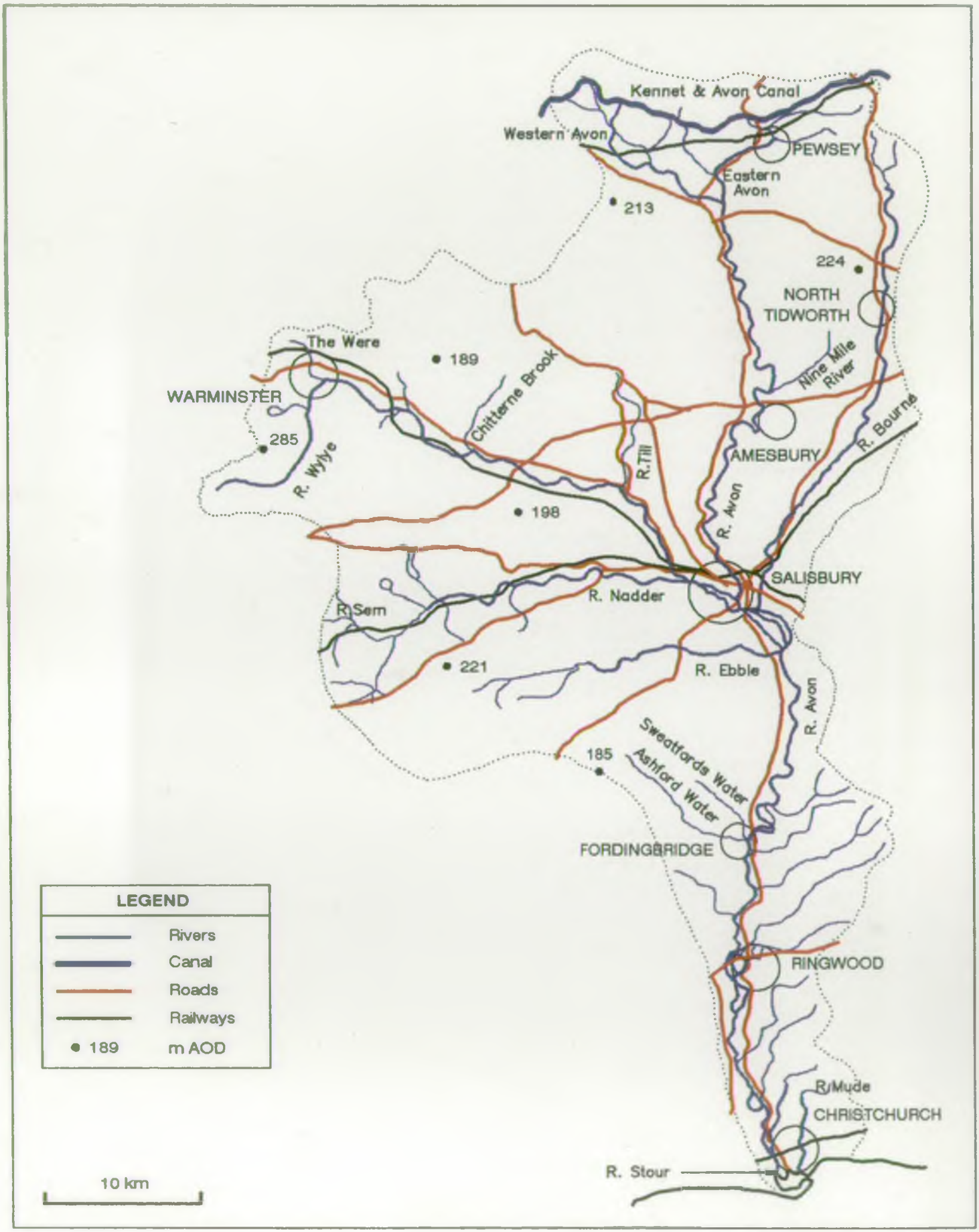
This may be a Company who may see little or no financial benefit in carrying out the actions, or a Local Authority with restricted capital budgets.

It will inevitably be the case that the achievement of some objectives will depend upon the Town and Country Planning Policy of the County or District Council. The NRA is a consultee to such policy, but it is recognised that the Councils are subject to many other constraints in meeting their obligations to the Planning process and will not always be able to put the needs of the river catchment first.

The land-use within a catchment is obviously a major contributor to the state of that catchment, as is apparent from this report. In area terms, the largest land use is agriculture, over which apart from restricted areas (such as SSSI and ESA) there are few relevant controls. In cases where farming practice will need to change to permit the catchment improvements to proceed, it will be necessary to obtain the support of the landowners concerned and for them to make such changes voluntarily.

Whilst these limitations will inevitably hamper the achievement of some of the plan objectives, it is essential that these objectives should still be set and striven after. Alternative means of achieving them might be identified, or the very fact of their identification and publication might bring the necessary pressure to encourage those involved to work towards their achievement.

HAMPSHIRE AVON CATCHMENT



NRA Wessex Region

2.0 HAMPSHIRE AVON CATCHMENT INTRODUCTION

2.1 Catchment Description

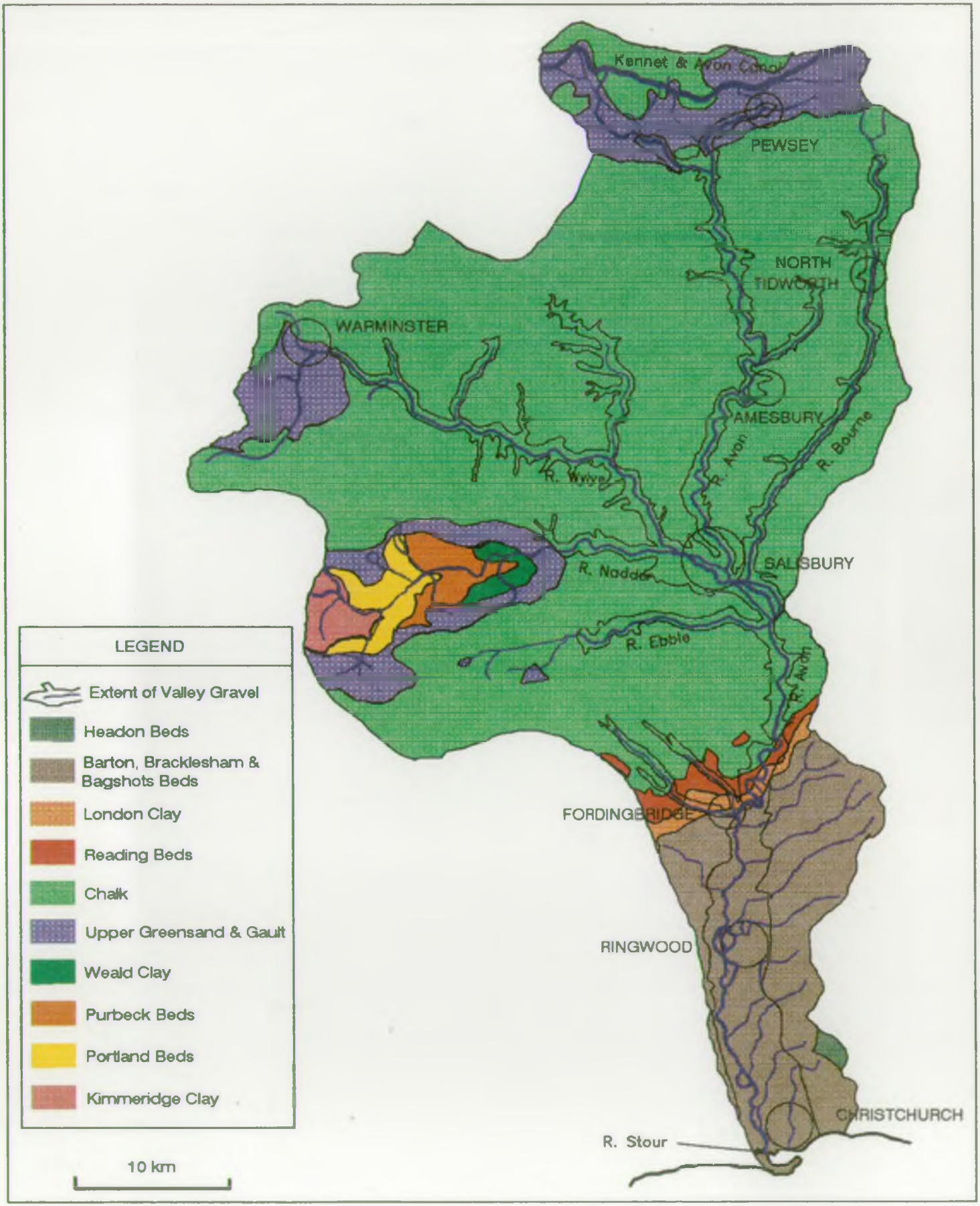
Despite its name, the Hampshire Avon catchment in fact lies within three counties, Hampshire, Dorset and Wiltshire, with the largest part in Wiltshire. The river rises in the Vale of Pewsey, and has a geographical catchment area of some 1,701 sq km.

Together with two of its tributaries, the Bourne and the Wylye, the Avon drains Salisbury Plain. The River Nadder, which is joined by the Wylye at Wilton, drains the escarpment of the South Wiltshire Downs and the Kimmeridge Clay of the Wardour Vale. The River Ebble and Ashford Water both drain the South Wiltshire Downs and join the Avon just downstream of Salisbury and at Fordingbridge respectively. Below Fordingbridge the catchment area is concentrated on the left bank with a number of significant streams draining the Tertiary deposits of the New Forest. The river drains into Christchurch Harbour where it is joined by the Rivers Stour and Mude before discharging to the sea. The total fall of the river from Pewsey to the sea is 110 metres and the average gradient downstream of Salisbury is approximately 1:1000.

The other significant waterway in the catchment area is the Kennet and Avon Canal, lying approximately east-west across the head of the catchment. Whilst this watercourse is chiefly the responsibility of British Waterways Board, it has implications for the Hampshire Avon through the need to keep it supplied with water. Some 25 km of the Kennet and Avon Canal is within the Hampshire Avon Catchment. The summit of the canal is about 5½ km between locks, with 2 km of this lying in the Hampshire Avon Catchment and the remainder in the adjacent River Kennet Catchment.

The catchment is not heavily developed. The major settlements are:
Salisbury (population 39400), Christchurch (41000), Ringwood (13100), Warminster (16500), Pewsey (3100), Fordingbridge (5800), and Amesbury (6300). In addition there are several major military establishments on Salisbury Plain.

HAMPSHIRE AVON CATCHMENT
GEOLOGY

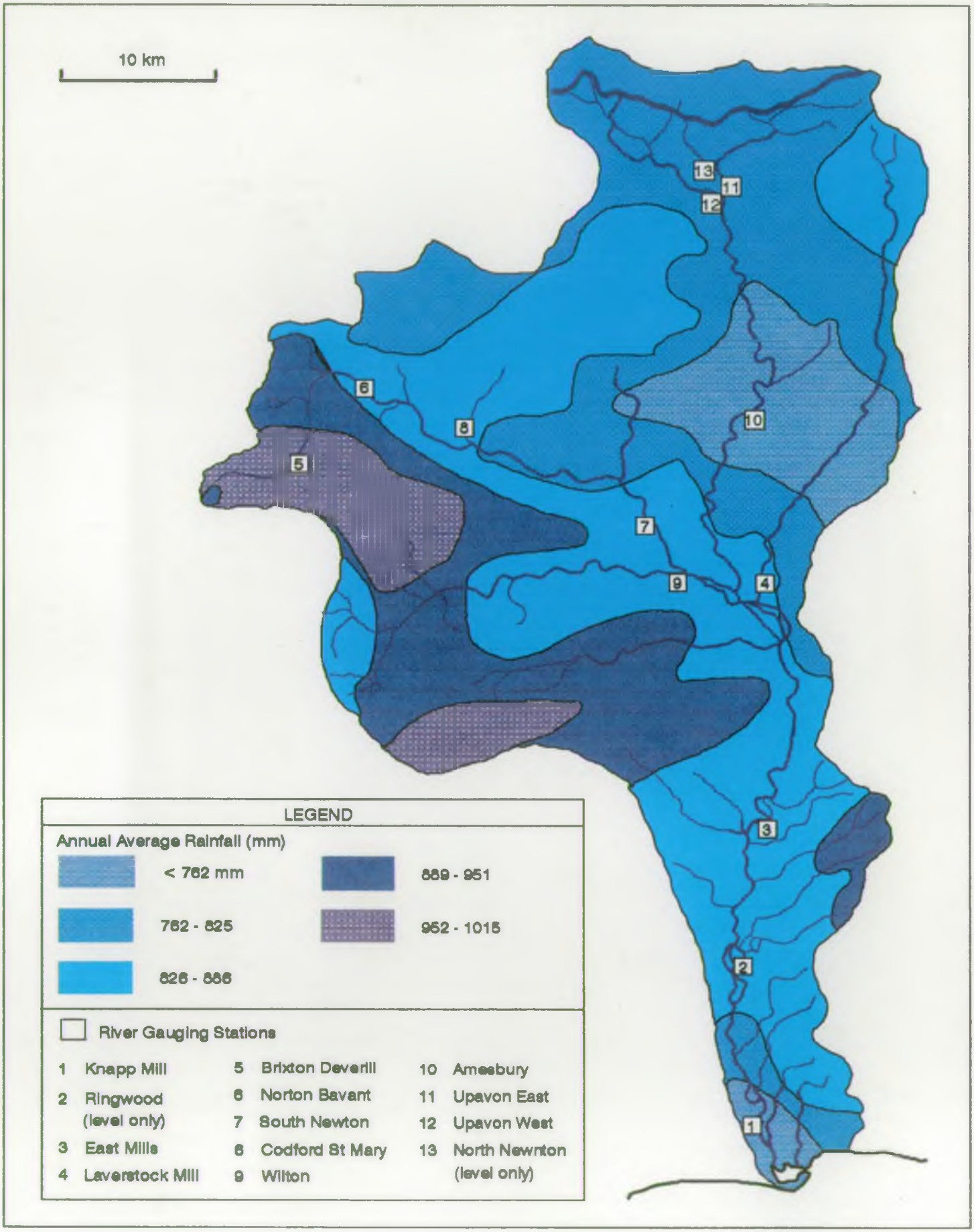


NRA Wessex Region

2.2 Geology

From the map of the geology of the Hampshire Avon Catchment it can be seen that in the Upper Catchment, almost as far south as Fordingbridge, the Chalk is the predominant rock type. The Chalk is a limestone aquifer which supplies alkaline groundwater to feed the Upper Catchment streams. The Chalk is underlain by the Greensand which is exposed in the Vale of Pewsey, the valley of the Upper Wylye south of Warminster and in parts of the valley of the Upper Nadder. The Greensand is also an aquifer but inputs a more acid groundwater into the rivers. A succession of strata are exposed in the Upper Nadder valley including Weald Clay and Jurassic Purbeck and Portland limestones plus Kimmeridge Clay. The geology here has resulted in different farming practices to those of the Chalk, including more dairy farming. Just to the north of Fordingbridge the Avon flows over narrow outcrops of Reading Bed sands and gravels and London Clay before continuing to the sea at Christchurch over Barton, Bracklesham and Bagshot Beds which are acidic clays, sands, silts and gravels. Extensive terrace and valley gravels, together with some alluvium, form a relatively thin cover in the main valley bottoms as shown.

HAMPSHIRE AVON CATCHMENT
CATCHMENT HYDROLOGY



NRA Wessex Region

2.3 Hydrology

The river is largely spring fed from the Chalk which provides a relatively stable discharge throughout the year. Eleven permanent flow gauging stations exist in the catchment. From the records at Knapp Mill (1975-90) the 5%ile low flow (i.e. that flow which is exceeded 95% of the time) is 6 cubic metres per second (cumec); the long term average flow is 19.7 cumec and the 95% high flow is 45 cumec. The minimum flow recorded at that site was 2.5 cumec, during the drought of 1976. The highest recorded flow in the catchment was a current meter gauging of 116 cumec on the 1st of November 1960 at Fordingbridge.

The map opposite indicates a variation in average rainfall within the catchment with highest rainfall on the South Wessex Downs and lowest in the Amesbury and Christchurch areas. It should be noted that this distribution is based on data from 1916-51.

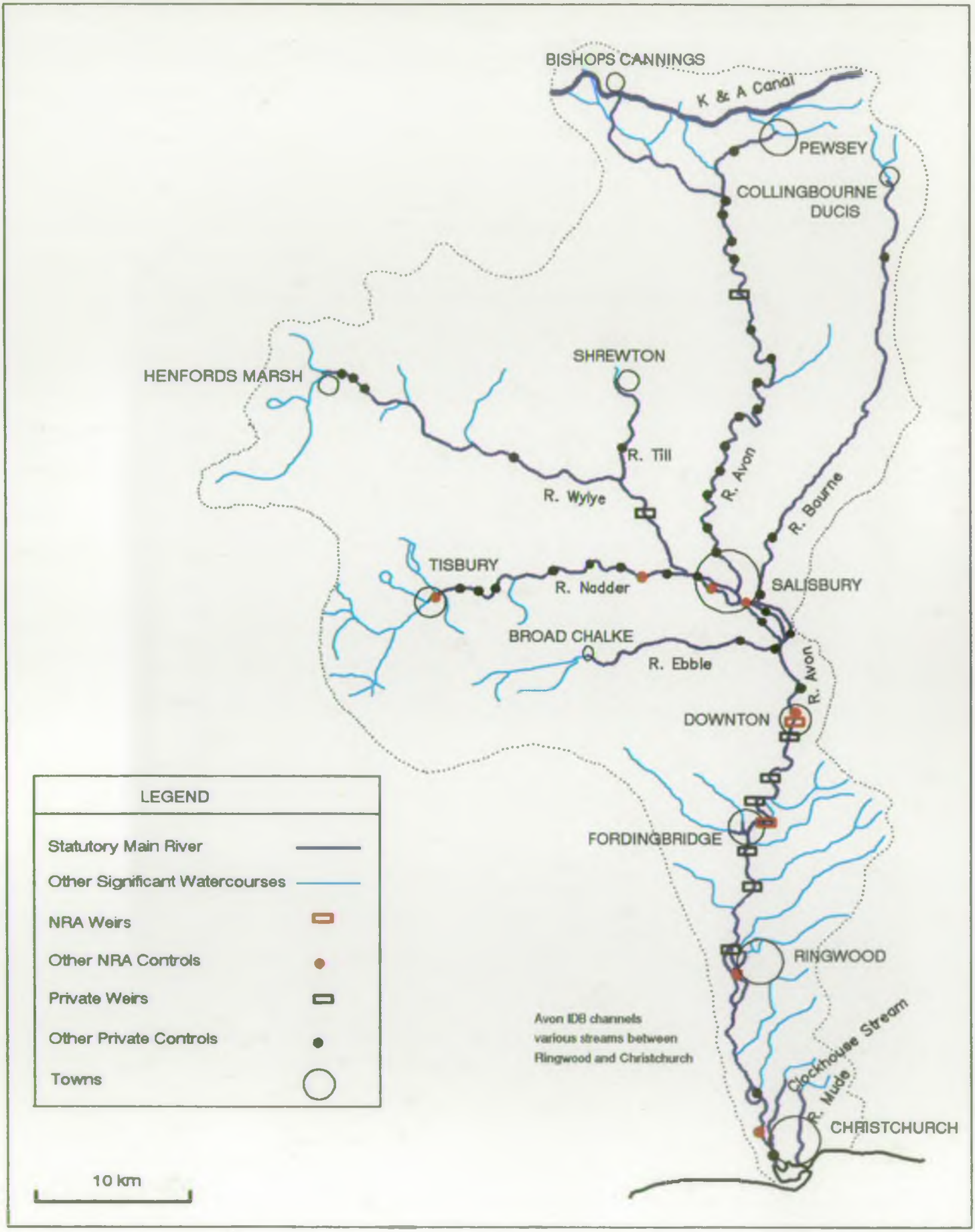
The actual rainfall recorded for Salisbury in recent years is,

Year	1984	85	86	87	88	89	90	91
Rainfall	856	738	924	713	694	713	669	722

The long term average as calculated from this Authority's own records to date at Salisbury is 769 mm.

Flows in the catchment are continuously measured at 13 sites as also indicated on the map opposite.

HAMPSHIRE AVON CATCHMENT
RIVER CONTROL STRUCTURES AND STATUTORY MAIN RIVERS



NRA Wessex Region

3.1 CATCHMENT DRAINAGE - RIVER CONTROL STRUCTURES AND STATUTORY MAIN RIVER

3.1.1 General

This use identifies the basic role of the river as the conveyance of water from land in the catchment to the sea. There is a clear requirement for the provision of effective defence for people and property against flooding from rivers and the sea. Normally flooding is a result of extreme climatic conditions, such as high winds or very heavy rainfall. Flood events are described in terms of the frequency at which, on average, a certain severity of flood is exceeded. This frequency is usually expressed as a return period in years e.g. 1 in 50 years.

The effectiveness of flood defences can be measured in terms of the return period up to which they prevent flooding. It is clear that different types of land use, for example, urban areas and pasture land, require different levels of effectiveness for the defences.

3.1.2 River Control Structures and Statutory Main Rivers

In the river system, certain channels will be designated as statutory Main River, by which means the NRA takes a greater responsibility for the maintenance and control of the channel. At the same time various powers to control the activities of others are taken.

The responsibility for the maintenance of any watercourse normally rests with the riparian landowner, whose ownership as a general rule extends to the centre line of any such river. However, the NRA does have control of the construction of any structure in or close to the statutory Main River. This and other activities likely to affect the bed or bank of the river require the formal consent of the NRA. The NRA has a flood defence operational maintenance department which deals with emergencies (flooding and some pollution control) together with 'permissive' powers to carry out river maintenance. This work is targeted carefully at past flood and drainage schemes to ensure they function as required. In other areas maintenance work is undertaken to a standard consistent with existing land use.

The NRA has limited powers in respect of consents for weirs, dams and culverts and similar obstructions on watercourses, which are not designated statutory Main River. District and County Councils have powers to carry out schemes on such watercourses, but no legal obligation to do so. They would require the NRA's consent under its requirements for overall supervisory duty of drainage matters. With a few minor exceptions, the Water Act 1989 did not change the basis of responsibility and powers in drainage neither does the Water Resources Act 1991 nor the Land Drainage Act 1991.

3.1.3 Local Perspective

In the Hampshire Avon Catchment significant lengths of Main River have been designated as shown on the map opposite. In respect of the operation of the river system the plan indicates 55 control structures on the Main River channels, of which only 8 are operated by this Authority. Whilst in most instances this does not present any difficulties, there are instances where conflict arises over the operation of hatches and sluices by private individuals. River control structures are operated for various reasons such as amenity levels, reductions in flood level,separating out flow into various channels to suit local conditions and to aid abstraction for public water supplies. Regulation of these is controlled through the Authority's Flood Defence Byelaws.

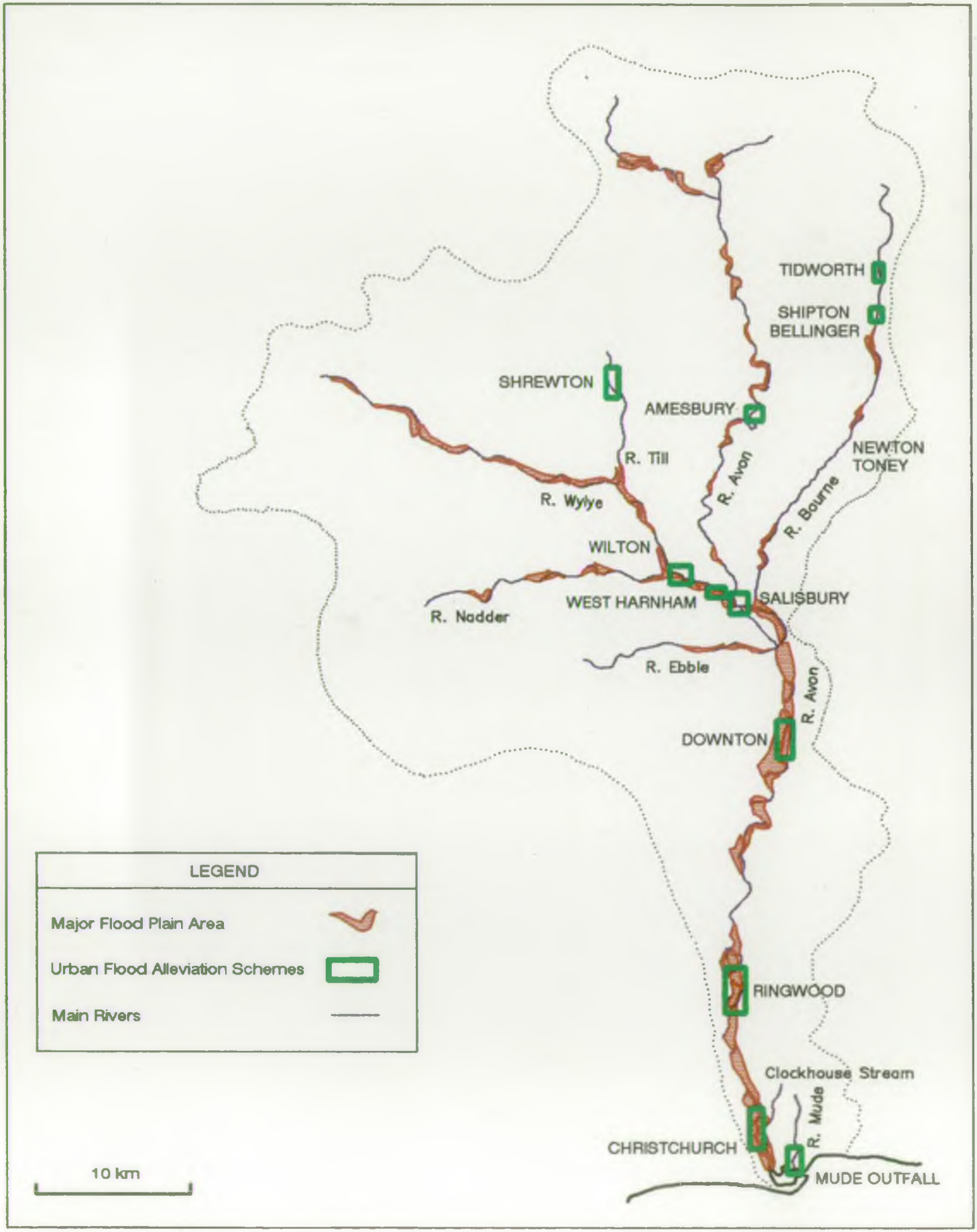
3.1 CATCHMENT DRAINAGE - RIVER CONTROL AND STATUTORY MAIN RIVER - CONTINUED

3.1.4 Objectives

- To control development and works in or adjacent to main river in accordance with the NRA's Flood Defence Byelaws

- To ensure the correct operation of hatches and other water level controls under both flood and normal flows.

HAMPSHIRE AVON CATCHMENT
URBAN FLOOD ALLEVIATION SCHEMES



NRA Wessex Region

3.2 CATCHMENT DRAINAGE - FLOODING AND FLOOD ALLEVIATION

3.2.1 General

Flood Plain

The flood plain is an important element of the overall river system to convey flood flows. In a major flood event, water is 'stored' temporarily in the flood plain thereby decreasing peak flows downstream. Normally the wider the flood plain the more important it is in attenuating flood levels. The NRA controls within its Byelaws any activity in the flood plain likely to worsen flood conditions. Planning Authorities also seek the NRA's advice and take this into account when deciding on planning consent for proposals within the flood plain.

Urban Flooding

In pre-war years, the pressure for new development was of course very much less than occurs now. Individual communities were more stable, and had accumulated local knowledge; thus building would not take place on land subject to flooding through local advice. Nowadays the pressures are greater, and there is very much greater reliance on the intervention of Planning Controls to avoid unsuitable locations. The greater concentration of housing within each development, together with the much higher value of home contents makes the potential losses through flooding very high indeed.

Rural Flooding

For many years, the improvement of drainage to increase agricultural production has been a major component of the work of predecessor Authorities to the NRA. Both capital schemes and major maintenance programmes have been carried out to ensure reduced water levels and to minimise flood losses. This position has now changed with the result that most NRA activity is now centred on protection of urban communities from river and sea flooding.

Tidal Flooding

This can be caused by surge tides (i.e. tides significantly in excess of those predicted), or wave action, or a combination of both. Property damage as a result of seawater inundation is usually greater than that of river water alone. The threat of increased sea levels due to global warming is an added concern in the provision of sea defences. The provision of sea defences is the responsibility of many different bodies, with the coastline divided into lengths of responsibility.

3.2.2 Local Perspective

The catchment is dominated by the underlying Chalk strata which allow significant amounts of rainfall to go into aquifer storage. Generally therefore the catchment reacts slowly to rainfall and flood events are not frequent; but they do occur, with the most recent notable events in 1960 and 1990. The main exception to this slow response is from the River Nadder which reacts faster to rainfall being a short, reasonably steep river with underlying geology of less permeable strata. Channel regime within the Avon Catchment has naturally adjusted to expecting a standby inflow of water from springs. If heavy rain falls on a frozen catchment then run-off is "flash" with no inflow to the aquifer. The river system, particularly

3.2 CATCHMENT DRAINAGE - FLOODING AND FLOOD ALLEVIATION CONTINUED

3.2.2 Local Perspective (continued)

tributaries with little flood plain storage, become quickly overwhelmed with floodwater and severe damage can occur. Events like this are rare, the last occurring in 1841 on the River Till. A national disaster fund, believed to be the first of its kind, was set up to raise money to reconstruct 47 cottages that were destroyed by flood water.

Flood Alleviation Schemes have been carried out at various locations (see map) in response to flood events. Nevertheless, some urban areas are still at risk from severe fluvial flood events within the catchment. Surface water and non-Main River flooding is more likely to be frequent than that experienced from a Main River, and solutions to these rest with the District and County Authorities. Whilst schemes for the protection of property can be devised there is always the possibility of an event more severe than the design standard. Thus planners of future development close to the river corridor should be mindful of potential risks.

Despite the low tidal range and natural protection afforded from waves by the harbour, properties in Christchurch are subject to flooding as a result of extreme tidal surges, or the combination of high tides and flood flows in the Rivers Stour and Avon. Floodwater caused damage to 60 properties during 1989. The NRA and Christchurch Borough Council are presently planning a way forward to deal with this situation.

3.2.3 Flood Warning

As a part of the NRA's commitment to maintaining a good standard of flood warning, a set of procedures have been produced for the Region on a river by river basis. Thus in the Hampshire Avon Catchment separate procedures exist for the River Wylye, River Nadder and tributaries, Upper Avon, and Lower Avon. Each procedure is documented and outlines the catchment type and response to rainfall, sites considered to be at special risk, data gathering points in the catchment, and specific flood warning data. This latter item, based on calculated and observed river responses, consists of various threshold water levels (ie rates of flow) at upstream gauging stations which will be likely to result in downstream flooding. Periods of time before the flooding can be expected at each location at risk are included and this information will form the basis of any warning issued. Such procedures are re-assessed and modified if necessary in response to each flooding or near flooding event.

3.2.4 Operational Maintenance

This involves a variety of activities needed to ensure the efficient use of the river system for its basic purpose of conveying water. Activities such as weedcutting, tree removal, bank repair, shoal removal and repair and control of hatches are necessary to maintain flows. Repair of flood banks or walls, and related flow controls ensure that flood alleviation schemes can function as designed. In some instances, dredging will be required to maintain the carrying capacity of the channel, although this is a much less common activity than in the past.

3.2 CATCHMENT DRAINAGE - FLOODING AND FLOOD ALLEVIATION CONTINUED

3.2.5 Environmental Considerations

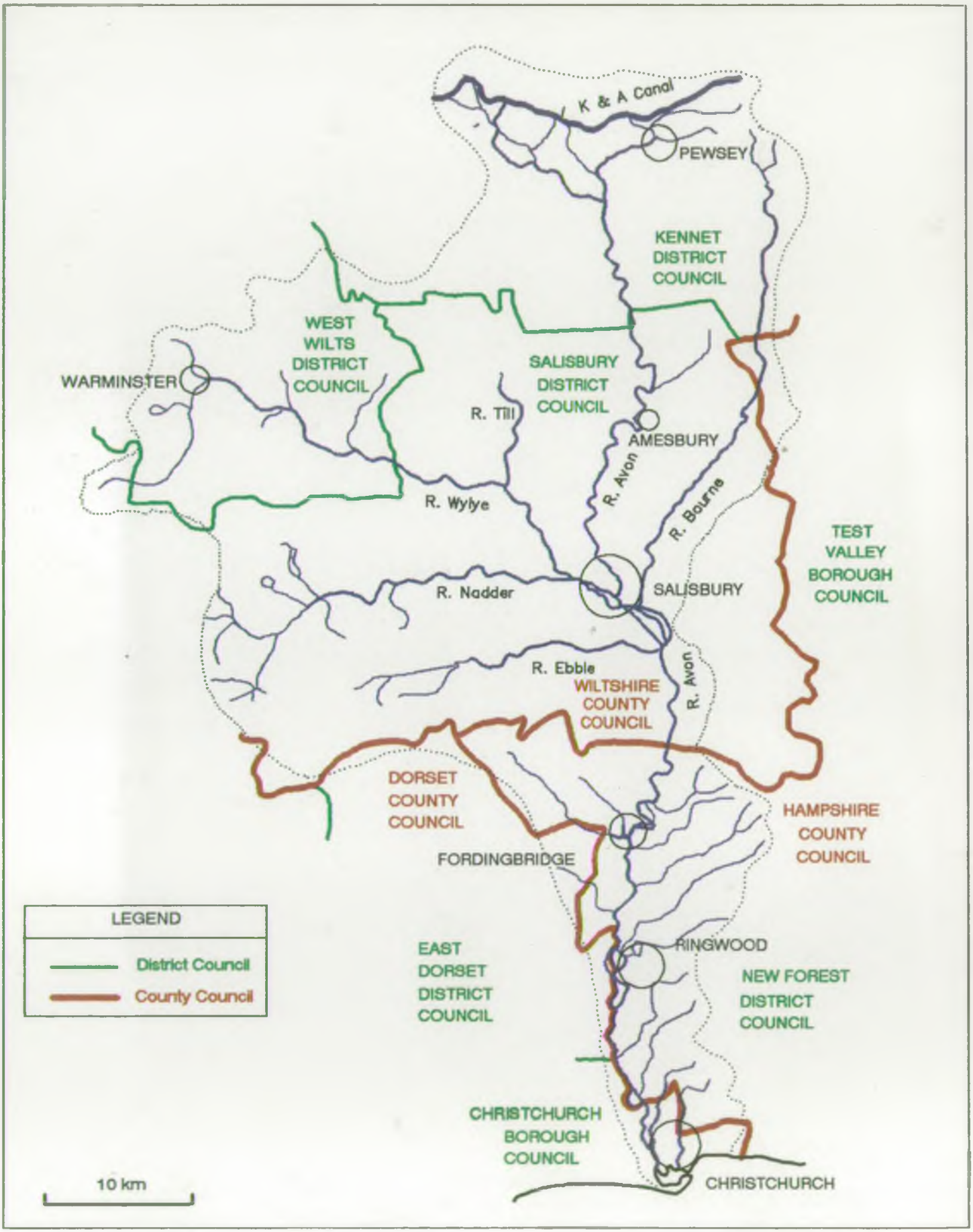
The Authority is in the process of compiling "Operational and Maintenance Plans" for Sites of Special Scientific Interest in all the catchments within the Wessex Region. The Avon Valley has important SSSIs and consultation has commenced with English Nature to agree an acceptable approach to operational maintenance for the Avon between Salisbury and Christchurch.

The recent draft proposals for ESA designation of the valley between Salisbury and Christchurch may in future mean further changes to river management where this is in line with agreed changes in farming practice.

3.2.6 Objectives

- To control development and other works in rivers or the flood plain such that risks of flooding are not increased.
- To provide effective flood defences for the protection of people and property to a standard appropriate to land use (see section 4.5)
- To provide adequate arrangements for flood forecasting and warning.
- To carry out weedcutting where and when necessary to protect relevant land use.
- To take account of environmental requirements when undertaking Flood Defence works.

HAMPSHIRE AVON CATCHMENT
DEVELOPMENT: ADMINISTRATIVE BOUNDARIES



NRA Wessex Region

3.3 DEVELOPMENT

3.3.1 General

The planning of uses within a river catchment must be related to development planning on a wider basis, particularly on a District and County level. The use identified here relates to the predicted future commercial and residential development within the catchment as outlined in the respective published District Local Plans and County Structure Plans. The policies of the Town and Country Planning Authorities towards Recreation, Countryside, Conservation, Waste Disposal and Mineral Extraction are covered in relevant sections within this plan.

The NRA is consulted routinely by local planning authorities for development which may have an impact on NRA functions, although the final decision on planning matters is made by the local authority and they are not bound to take the NRA's comments into account. However, if the development entails an abstraction or impoundment then a Licence from the NRA is required: if it involves a discharge, or work on or near a watercourse, then the NRA's consent is required.

It should be noted that any development within the County and Districts will normally be permitted only where it complies with the objectives and policies of the planning authority. Such policies which relate to environmental protection often include elements to protect NRA interests.

3.3.2 Local Perspective

The administrative boundaries are shown on the plan opposite from which it can be seen that three County and seven District or Borough Councils have at least part of their areas in the catchment.

The current Hampshire Structure Plan (as submitted to the Minister) proposes a period of reduced growth from 1990-2001, with the majority of new development in the period taking place on re-development sites or on greenfield sites that have been previously allocated, but not taken up. The towns of Ringwood and Fordingbridge are the main centres concerned.

Although Dorset is the smallest county represented by area, it includes the town of Christchurch, the largest centre of population in the catchment. The current approved County Structure Plan (1986-2001) proposes an additional 2500 dwellings in the Borough Council's area, Not all of this will be within the Avon Catchment, but allocation of greenfield sites for 900 houses are known to be.

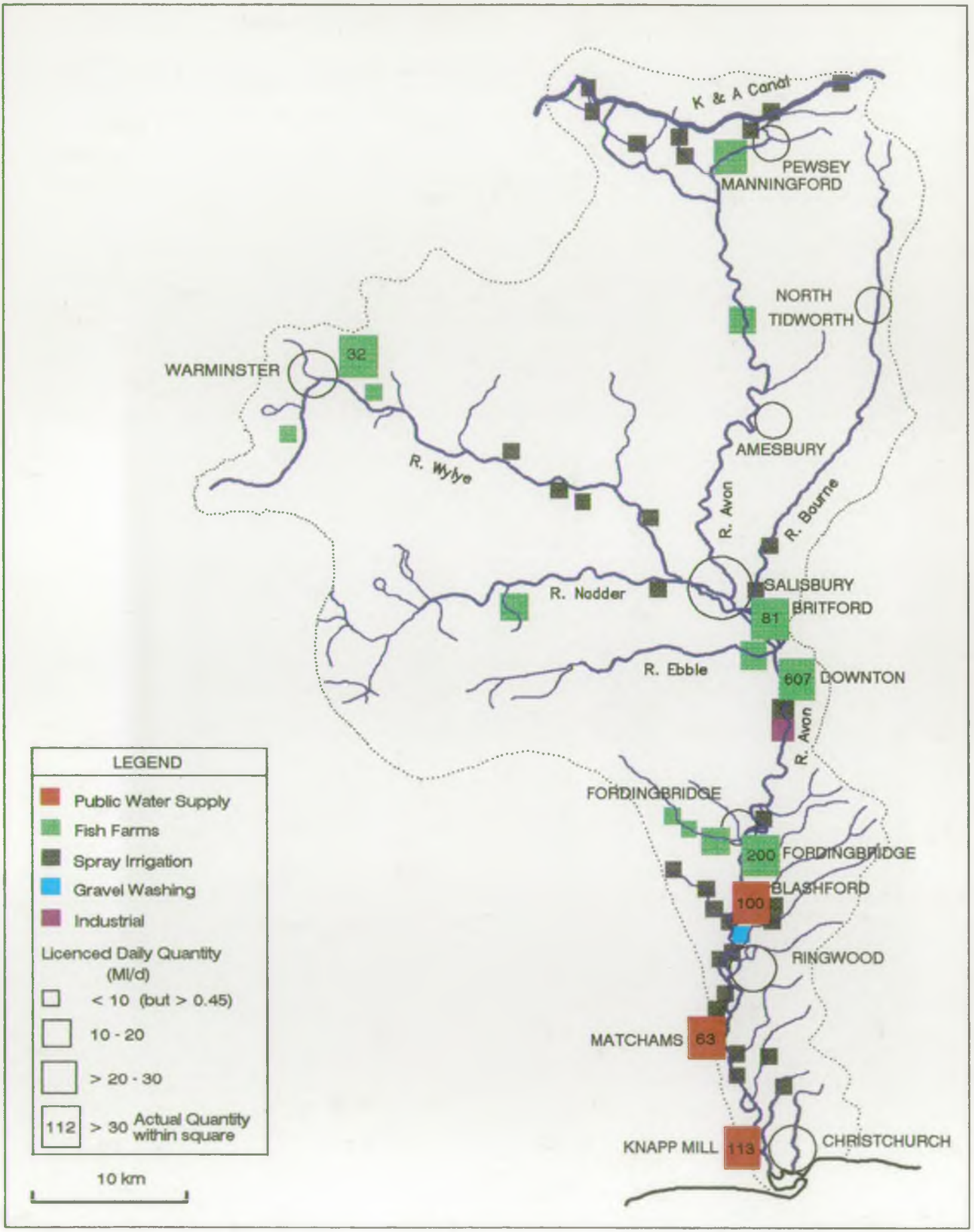
Wiltshire Structure Plan for 1990-2001 is currently under consideration by the Secretary of State. Within the Hampshire Avon Catchment, significant house building is proposed in and around Salisbury (3100 houses) Amesbury (1300) and Warminster (1200).

In general, provision is made for industrial development in line with the housing development proposed.

3.3 Objectives

- The NRA's objectives as outlined for other uses in this Section will be applied through the planning process.

HAMPSHIRE AVON CATCHMENT
SURFACE WATER ABSTRACTIONS



NRA Wessex Region

3.4 SURFACE WATER ABSTRACTIONS

3.4.1 General

This use covers the abstraction of water from surface sources such as streams, rivers and lakes. Generally such an activity requires a surface water abstraction licence, however, there are some exemptions. The main one is for abstractions of less than 20 cubic metres per day for domestic and general agricultural use. Surface abstraction licences specify a maximum hourly, daily and annual quantity which may be abstracted and may be conditional upon a minimum prescribed flow (ie. a flow below which no abstraction is permitted) being maintained in the river below the abstraction point. Minimum prescribed flow conditions are frequently included under current practice but were not always included in older licences.

A number of licences were granted as 'licences of right' upon the implementation of the Water Resources Act 1963. Such licences were based upon evidence of established use and were not necessarily supported by technical appraisal of their impact.

The use categories fall into two main types. Firstly consumptive uses, where the abstraction represents a sustained and significant loss of water from the catchment (eg. spray irrigation) and non-consumptive uses where abstraction represents only a temporary loss of water from the catchment (eg. fish farming).

3.4.2 Local Perspective

The Hampshire Avon Catchment is made-up of 6 subcatchments: the River Ebble, River Nadder, River Wylye, River Bourne, Upper Hampshire Avon (North of Salisbury) and the Lower Hampshire Avon (South of Salisbury). The river flows in the Hampshire Avon are characterized by a high base flow component derived from springs arising in the headwaters of the Upper Avon and major tributaries. Direct surface run-off from precipitation also contributes to flows but makes a less significant contribution than in many other catchments.

The map opposite shows the spatial distribution of the various surface water abstraction uses within the catchment. The purpose of the abstraction is identified by colour coding and the quantity is indicated by the proportional size of the symbols. The majority of the larger surface abstractions are concentrated in the Lower Hampshire Avon (South of Salisbury).

3.4.3 Consumptive Uses

Uses which involve the abstraction of water and an effective loss from the catchment may be described to as consumptive uses.

Public water supply forms the largest consumptive use with the quantities licensed representing approximately 17.9% of all surface water abstractions. There are three main abstraction licences operated by water companies. These are at

- Blashford Lakes (Wessex Water). Water is removed into storage from the River Avon and stored in the Blashford Lakes development. Water is then abstracted from the lakes for public water supply.

3.4 SURFACE WATER ABSTRACTIONS - CONTINUED

3.4.3. Consumptive Uses (continued)

- Matchams (Bournemouth and District Water Company). Public water supply, again abstracted from the Lower Avon.

- Knapp Mill (West Hampshire Water Company). Water is abstracted from the Lower River Avon for Public Water Supply and to supply Fawley Power Station with cooling water.

Although generally viewed as a consumptive loss it is important to remember that much of the water used for public supply is returned via sewage works which discharge within the catchment. Such returns may however be at some distance from the point of abstraction.

Spray irrigation represents approximately 1.8% of the annual surface water licensed quantity. Although distribution is wide the main concentrations of abstractions are in the Lower Avon Valley and in the Upper Avon and Vale of Pewsey. This represents a virtual loss to the catchment as most of the water is evaporated.

3.4.4 Non-Consumptive Uses

Uses where the water is returned immediately (or within a very short distance) may be referred to as non-consumptive uses.

Fish Farms account for approximately 80% of the annual licensed quantity abstracted from the Avon. In many instances this represents a substantial part of the whole flow of the river. Fish Farms are generally very low loss as virtually all of the water abstracted is returned to the watercourse. Some even form on-stream features using a large proportion of the flow of the Upper Avon and the Upper Wylye. However the largest abstractions are found in the Lower Hampshire Avon at Britford, Downton and at Fordingbridge. Although they are generally not of major water resources significance their localised impact may be quite substantial by virtue of their effect on other uses.

Other minor use categories include gravel washing (non-consumptive), industrial (consumptive) and cress beds (non-consumptive). Together these abstractions represent 0.31% of surface water licensed abstractions.

The Lower Avon is where the largest development of surface water abstraction has taken place, mainly due to the close proximity to large urban centres and the abundance of large surface flows. From a public water supply point of view this area is strategically important for future public demand and is currently the subject of a study being undertaken for the NRA by consultants, Sir William Halcrow and Partners.

3.4.5 Surface Water Objectives

- To ensure that surface water resources are managed and developed such that both existing licences and other water uses and environment interests are protected.

3.4 SURFACE WATER ABSTRACTIONS - CONTINUED

3.4.5 Surface Water Objectives (continued)

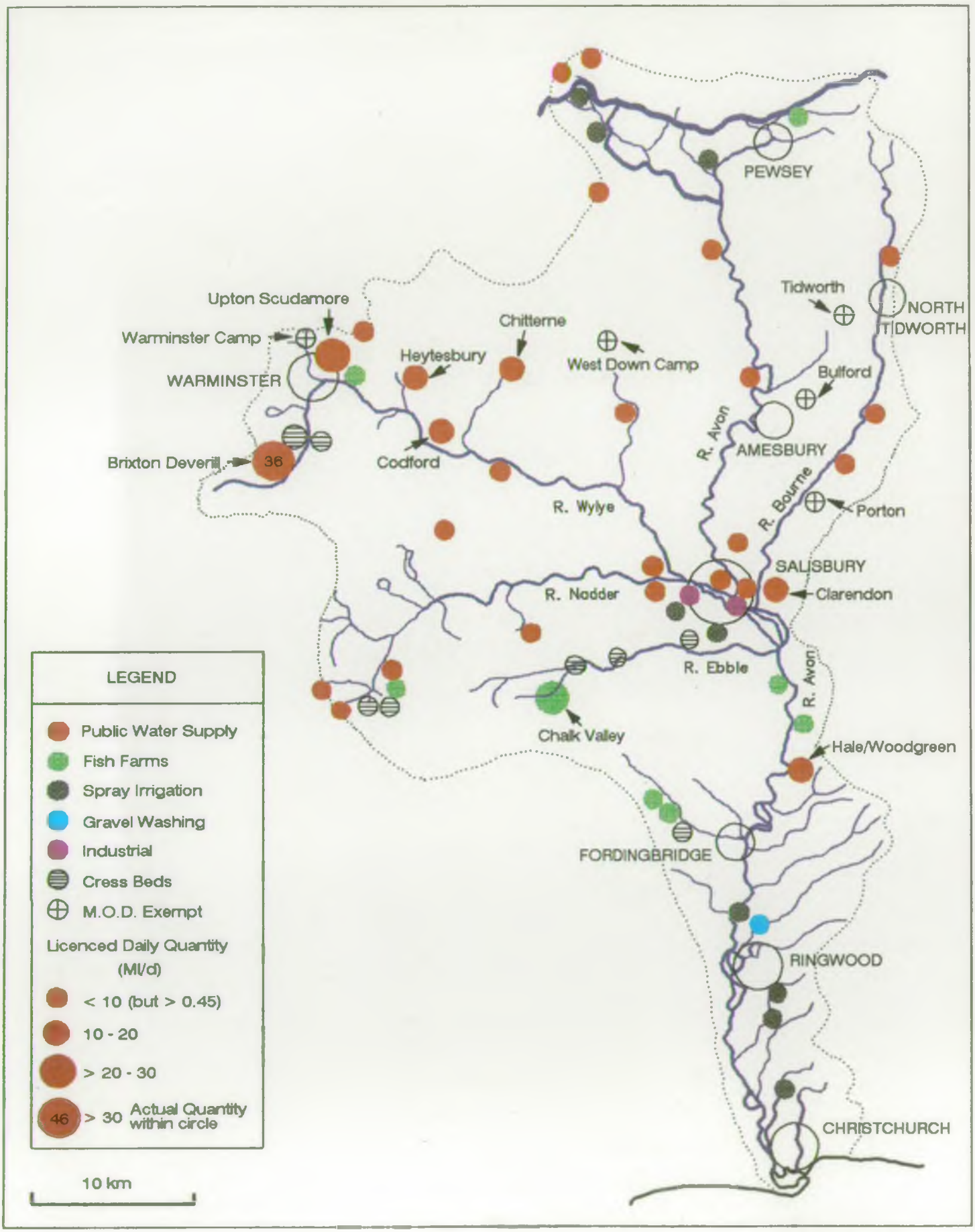
- To secure, where possible, appropriate measures for the benefit of the catchment within any new licences.

3.4.6 Environmental Requirements

Water Quality - compliance with EC Directive on the Quality of Water for Abstraction (75/440/EC) and Water Quality Objectives.

Water Quantity - availability of resources within the terms specified in licences also having regard for residual quantities required for other uses.

HAMPSHIRE AVON CATCHMENT
GROUNDWATER ABSTRACTIONS



NRA Wessex Region

3.5 GROUNDWATER ABSTRACTIONS

3.5.1 General

The groundwater use relates to abstraction of water via boreholes, wells and springs. Abstractions are controlled by a licence which specifies the maximum allowable annual and daily quantities which can be used. The governing legislation is the Water Resources Act 1991.

Groundwater abstraction licences for boreholes are normally issued following 'test pumping' and an appraisal of any impacts on existing adjacent licences and the local hydrogeological regime. As with surface water abstractions, a number of licences were granted as 'licences of right' upon implementation of the Water Resources Act 1963 and these licences may not have been subject to appraisal of their impact.

Groundwater makes an important contribution to the base flow component of river flow. This is especially important in the headwaters of rivers where groundwater can make up a large proportion of river flow. In the management of this resource it is important that new abstractions should not derogate existing riparian rights, licensed sources, or affect surface water systems or environmental interests.

3.5.2 Local Perspective

The main occurrence of groundwater abstractions is in the upper tributaries: the River Nadder, River Ebble, River Wylye, River Bourne and the Upper Hampshire Avon.

The main aquifer in the Region is Cretaceous Upper Chalk which generally has a high permeability (water passes easily through joints, cracks and bedding planes). Porosity (storage capacity for water) is also high at up to 40% but individual pores are microscopically small. The Lower Chalk is more marly and does not provide such a good aquifer as its permeability is lower. This is underlain by Greensand which relies on intergranular porosity. The Lower Chalk and Greensand are more generally exposed in the Upper Wylye, Upper Nadder and the Pewsey area of the Upper Avon.

Groundwater abstracted from the Hampshire Avon Catchment is put to 7 types of use. Quantitatively the main uses are Public Water Supply 45%, Agricultural Spray Irrigation 26%, Cress Beds 12.5%, Fish Farming 11.7% of abstracted quantity. Minor uses such as the Ministry of Defence, Gravel Extraction and Industrial uses make up the remaining 4.8%.

The map opposite shows the distribution of all groundwater abstractions greater than 0.45 megalitres per day based on use type and quantity. The map shows that abstractions for public water supply are concentrated in the upper catchment with areas of particular significance being the Upper Wylye and the Salisbury area. Concern has been expressed that in such areas, over-abstraction from the aquifer is decreasing stream flows. In recent years this has been compounded by several very dry summers and winters. The NRA is currently investigating these concerns with a detailed study of the Upper Hampshire Avon to evaluate the impact on rivers due to groundwater abstraction and to seek measures for environmental improvement where this can be seen to be justified.

3.5 GROUNDWATER ABSTRACTIONS - CONTINUED

3.5.2 Local Perspective (continued)

The map for section 4.3 shows source catchment areas for important licensed groundwater abstractions. In these areas there is a presumption against the granting of any new licence. This is because any new abstraction will most probably cause some degree of derogation of the existing source. Developments in terms of waste disposal, manufacture and storage, sewage sludge disposal, mineral extractions, energy exploration and exploitation, and agricultural intensification may also have water quality implications for existing sources.

3.5.3 Groundwater Objectives

- To safeguard existing licensed sources and needs for other catchment uses including the protection of river surface water flows.

- To provide for protection, and where possible the enhancement, of the water environment.

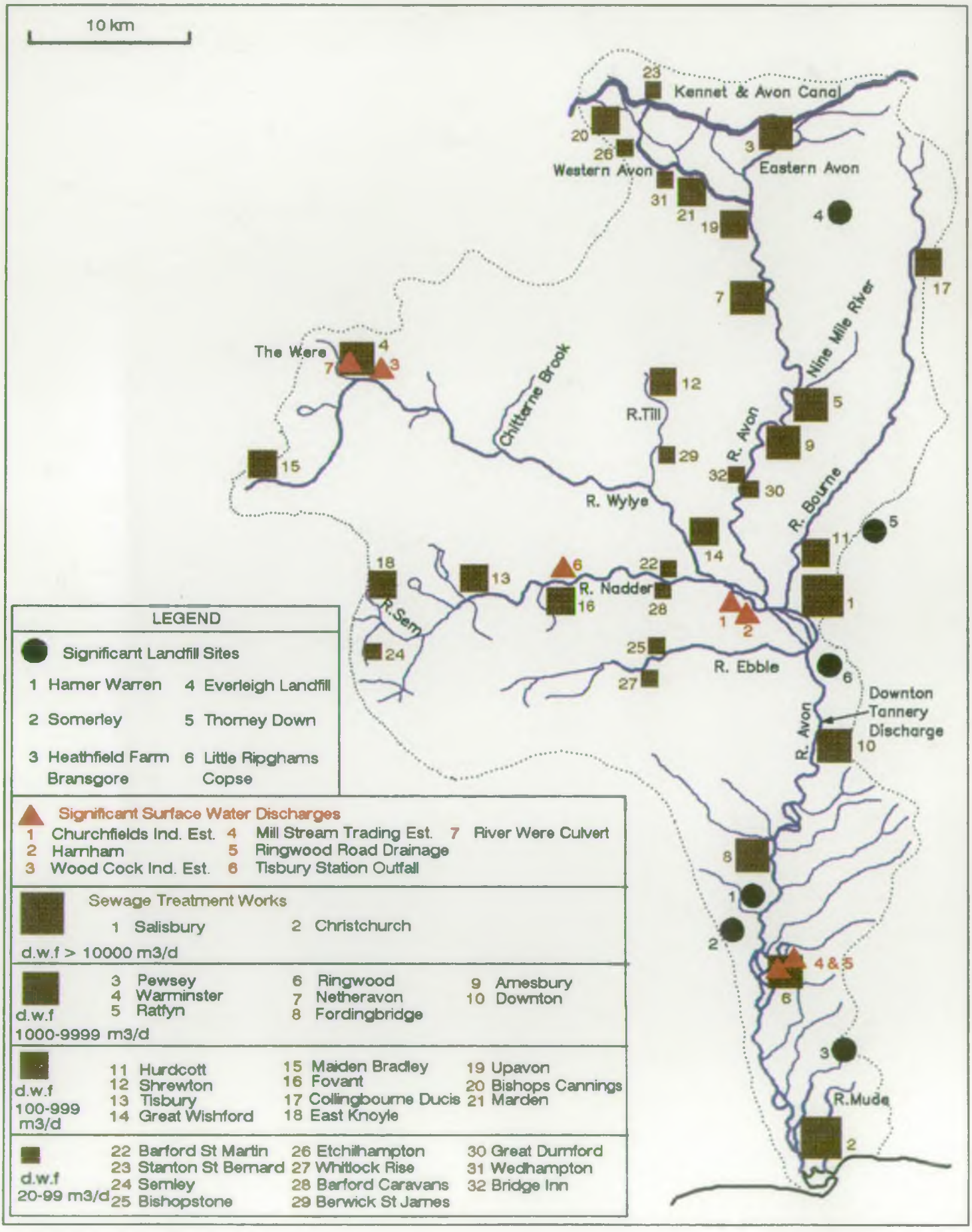
- To investigate the effect of existing groundwater abstractions on river flows and general aquifer groundwater levels and where necessary seek remedies for adverse effects.

3.5.4 Environmental Requirements

Water Quality - compliance with relevant use related criteria including relevant parts of EC Directive on the Quality of Water for Human Consumption (80/778/EC)

Water Quantity - availability of resources within the terms specified in licences, having regard for residual quantities required for other uses.

HAMPSHIRE AVON CATCHMENT
EFFLUENT DISPOSAL



LEGEND

Significant Landfill Sites

1 Harner Warren
2 Somerley
3 Heathfield Farm Bransgore
4 Everleigh Landfill
5 Thorney Down
6 Little Ripghams Copse

Significant Surface Water Discharges

1 Churchfields Ind. Est.
2 Harnham
3 Wood Cock Ind. Est.
4 Mill Stream Trading Est.
5 Ringwood Road Drainage
6 Tisbury Station Outfall
7 River Were Culvert

Sewage Treatment Works

d.w.f > 10000 m3/d
1 Salisbury
2 Christchurch

d.w.f 1000-9999 m3/d
3 Pewsey
4 Warminster
5 Ratfyn
6 Ringwood
7 Netheravon
8 Fordingbridge
9 Amesbury
10 Downton

d.w.f 100-999 m3/d
11 Hurdcott
12 Shrewton
13 Tisbury
14 Great Wishford
15 Maiden Bradley
16 Fovant
17 Collingbourne Ducis
18 East Knoyle
19 Upavon
20 Bishops Cannings
21 Marden

d.w.f 20-99 m3/d
22 Barford St Martin
23 Stanton St Bernard
24 Semley
25 Bishopstone
26 Etchilhampton
27 Whitlock Rise
28 Barford Caravans
29 Berwick St James
30 Great Durnford
31 Wedhampton
32 Bridge Inn

NRA Wessex Region

3.6 EFFLUENT DISPOSAL

3.6.1 General

This use principally relates to the disposal of domestic, industrial and agricultural effluents to the river system. In addition surface water drainage from urban areas can often contain significant pollution loads, spillages from a range of domestic, commercial, agricultural and industrial activities may occur and substances may be leached from the land. Discussion follows under three headings:

- Continuous Effluents
- Intermittent Discharges
- Diffuse Sources

The particular feature of these uses is that it has no intrinsic requirement for any particular environmental condition to be met; more important is the need to protect other uses from the effects of its discharges.

Continuous Effluents

This use relates to the disposal of domestic, industrial and agricultural effluents to the river system. The conditions to be met by a particular discharge are set out in a specific discharge consent. They are calculated based upon the upstream water quality and flow rate in the receiving watercourse, and the degree of downstream water quality degradation that can be tolerated before other uses are adversely affected. It follows that if there is any subsequent deterioration in upstream water quality, or river flow degradation beyond the values assumed in calculating the consent, then downstream uses could be put at risk.

Intermittent Discharges and Diffuse Sources

This use relates to both consented and non-consented intermittent pollution discharges received by the catchment. The sources of these intermittent discharges are varied in terms of both frequency and impact, and include consented stormwater overflows surface water outfalls, accidental industrial, agricultural or road traffic spillages, and the discharges derived from the more diffuse sources such as runoff from land.

This use also highlights the potential risks to the catchment from such sources as chemical stores, given the potentially severe impacts which could occur as a result of accidents. Pollution of groundwater aquifers also occurs and this can be a very significant problem due to the difficulty of removing the contamination once it has occurred.

3.6.2 Local Perspective

Continuous Effluents

Sewage effluents from 32 sewage treatment works (STW's) with dry weather flows (DWF's) greater than 20 m^3/d are discharged to watercourses in the catchment. The two largest STW's are Salisbury and Christchurch which contribute 37% and 30% of the total DWF of sewage effluent respectively. Other STW's which are locally significant because of the limited

3.6 EFFLUENT DISPOSAL - CONTINUED

3.6.2 Local Perspective (continued)

Local Effluents (continued)

dilution available in the upper parts of the catchment are Pewsey, Warminster, Ratfyn, Netheravon and Amesbury.

The total DWF of sewage effluent discharged upstream of Knapp Mill gauging station (ie excluding Christchurch STW) is equivalent to 8.5% of the typical low summer river flow (95% exceeded river flow) at this point.

Sewage effluents discharged within the catchment are predominantly of domestic origin with only a small trade effluent component, therefore consent conditions for STWs are primarily aimed at controlling the loads of biochemical oxygen demand (BOD), suspended solids and ammonia which are discharged.

Sewage effluents contain high concentrations of plant nutrients and can contribute up to 50% of the nitrate and the major proportion of the phosphate in the river under dry weather low flow conditions.

The discharge from Downton Tannery is the only significant industrial process effluent discharged directly to the river.

Fish and watercress farms comprise another category of effluent discharges. Fish farms are all subject to consent conditions. Consents for watercress farms are shortly to be introduced under new national guidelines.(See Section 3.7)

The loads of BOD which are authorised for discharge from fish farms and STWs within the catchment are of a similar order.

Intermittent Discharges

Sewer and pumping station overflows are located on most sewerage systems in the catchment, and are subject to consents which aim to limit the frequency of the discharge to occasions when intense rainfall occurs. On many sewerage systems, particularly older systems, sewers may be overloaded and overflows may occur at greater than acceptable frequency. Wessex Water Services are working with the NRA to systematically survey sewerage systems and identify and improve or eliminate unsatisfactory overflows.

Surface water drainage from some types of development is liable to contamination. Notable examples are surface water outfalls draining industrial premises or estates. Seven significant discharges of this type are made to watercourses in the catchment. Such discharges are normally required to pass through oil interceptors as a minimum.

Other examples of intermittent pollution are pollution incidents which can arise from any activity where pollutants escape into the river system. The major areas for such incidents in the Hampshire Avon Catchment are from urban areas (particularly industrial premises) and from farms, the western Avon and the upper reaches of the Nadder being the areas most frequently affected by this latter source.

3.6 EFFLUENT DISPOSAL - CONTINUED

3.6.2 Local Perspective (continued)

Diffuse Sources

Levels of nitrate in the river waters of the catchment have not exceeded the EC Drinking Water limit of 50 mg/l (as Nitrate) at potable water supply abstraction points. No groundwater sources in the catchment have exceeded this limit. However a rising trend in nitrate concentrations was seen through the 1970's and 80's (it is not clear if this is now levelling off). At times of the highest concentrations (during winter high flows) it is evident that the major source is leaching from the land.

All plant nutrients may contribute to increased growth of aquatic plants (algae and aquatic macrophytes), a process known as eutrophication. The nutrient status of the catchment has become an issue and is discussed in section 6.10

Levels of total pesticides which exceed EC Drinking Water standards have been found in the Lower Avon and Nadder Catchments. It has not been established if the source of these pesticides is agricultural or other uses.

3.6.3 Environmental Objectives

- To control the discharge of domestic, industrial and trade effluent to watercourses in such a way that water quality objectives are met and other uses are not compromised.

- To prevent and/or control intermittent and diffuse pollution in such a way that no other uses are compromised.

3.6.4 Environmental Requirements

Water Quality

- No deterioration in upstream water quality, beyond that assumed in setting the consent.

Water Quantity

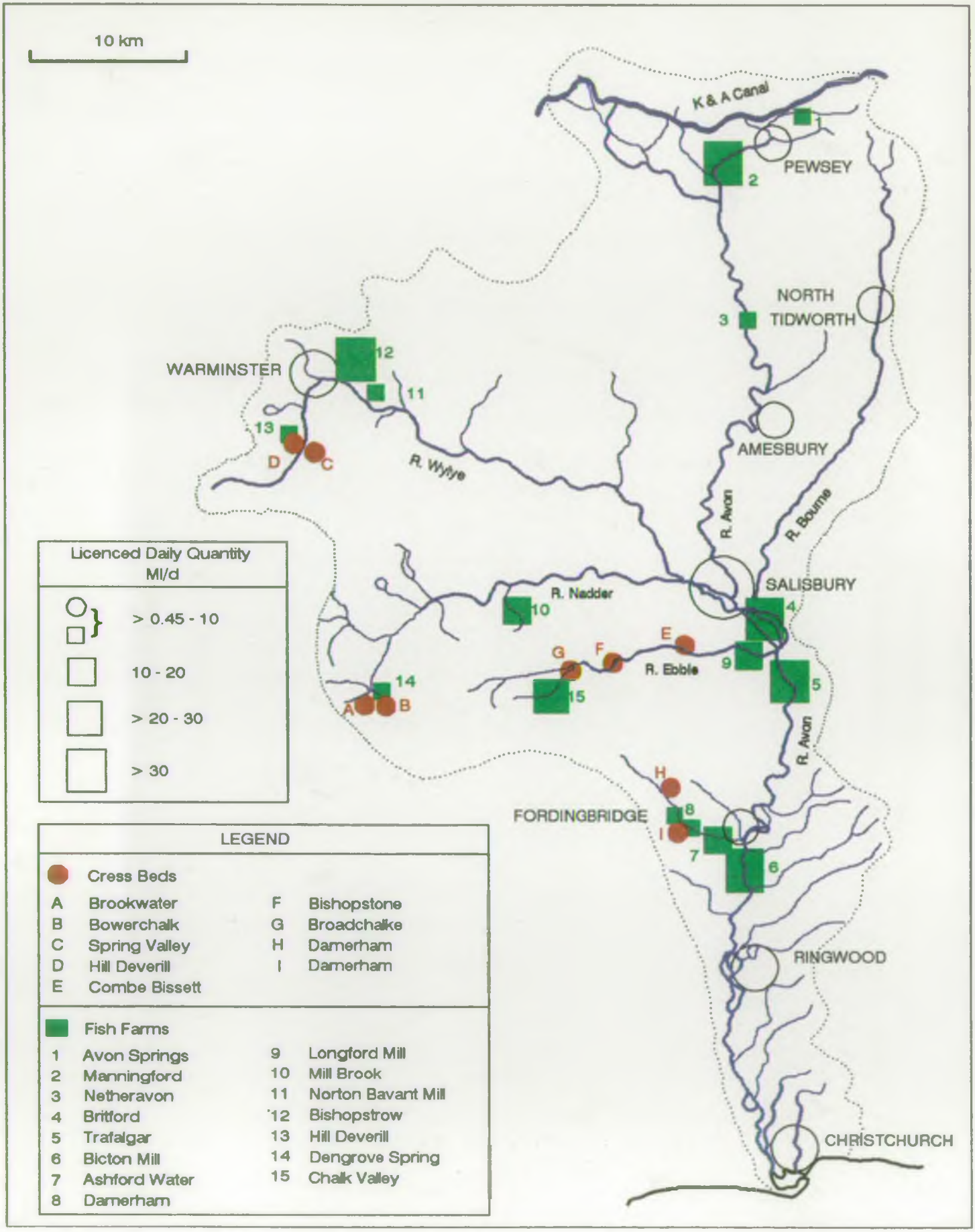
- No diminution of the flow regime below that assumed in setting consents. Consents are normally set by reference to 95% exceeded river flows.

Physical Features

- Outfalls must be sited so as to achieve a specified degree of effluent mixing with the river contents within a specified distance.

Note that where discharges are made to one channel in a multiple channel regime all of the above requirements may be effected by the portioning of flow between channels.

HAMPSHIRE AVON CATCHMENT
AQUACULTURE



NRA Wessex Region

3.7 AQUACULTURE

3.7.1 General

This use involves the operation of the river or riverside beds or ponds on a commercial basis for the production of watercress or the rearing of fish. An important feature of both uses is that they are non-consumptive, i.e. all the water used is returned to the catchment close to its point of abstraction.

The main operations are typically located on the headwaters of spring fed chalk streams, where the plants are raised from seedlings on gravel beds. Some farms increase the water flow through the cress beds by pumping water from boreholes. If the cress is grown in compliance with the industry's own Code of Practice, it must be solely supplied with groundwater to ensure that it is pest free. Activities such as cleaning, disinfecting and pest control can give rise to pollution problems. The NRA is currently introducing a national policy for the control of cress farm discharges.

Fish farms typically divert a licensed proportion of river flow through the ponds in which fish are reared, returning it to the river downstream, although some use springs or borehole sources. The effluent can be contaminated with organic matter from the large concentration of fish, or with chemicals and veterinary products if these are in use. In addition, escapes of fish can disrupt fisheries, whilst the presence of the reared fish may compete with and adversely affect wild populations in the vicinity.

Effluents from fish farms are subject to control by consents to discharge and abstraction of water is also now controlled following amendments of the legislation introduced in the Water Act 1989.

3.7.2. Local Perspective

The Hampshire Avon is a significant area for watercress production. The main watercress farms in the Hampshire Avon Catchment are at Longbridge Deverill on the River Wylye and at two sites on the River Ebble. Smaller sites operate at Ludwell on the headwaters of the River Nadder and at Damerham on the Ashford Water.

The Hampshire Avon is one of the most heavily developed rivers in England and Wales in terms of fish farming. There are two main types of site, those using spring derived water (sometimes augmented by borehole supplies) which are located on the headwaters and smaller tributaries and those which operate by diverting river water through pond systems. The latter category include several very large farms (including probably the largest in England and Wales) which are located on the Avon downstream of Salisbury.

3.7.3 Environmental Requirements

Water Quality - compliance with relevant use related criteria (see Appendix 1) and Water Quality Objectives

Water Quantity - availability of resources within the terms of specified licences also having regard for residual quantities required for other uses and environmental interests.

3.8 LIVESTOCK WATERING AND SPRAY IRRIGATION

3.8.1 General

These agricultural uses relate to the widespread access of stock to watercourses for drinking and to the abstraction of water for the irrigation of crops. Provision of water storage for winter flows and subsequent use in summer is increasingly part of spray irrigation schemes.

3.8.2 Local Perspective

Whilst there is an increasing trend to fence stock away from watercourses (with potential benefits to the watercourse through reduced bank degradation and silt movement), most watercourses are widely used as a water source for livestock. It has been assumed in this Plan that this is an essentially ubiquitous use in the Hampshire Avon Catchment.

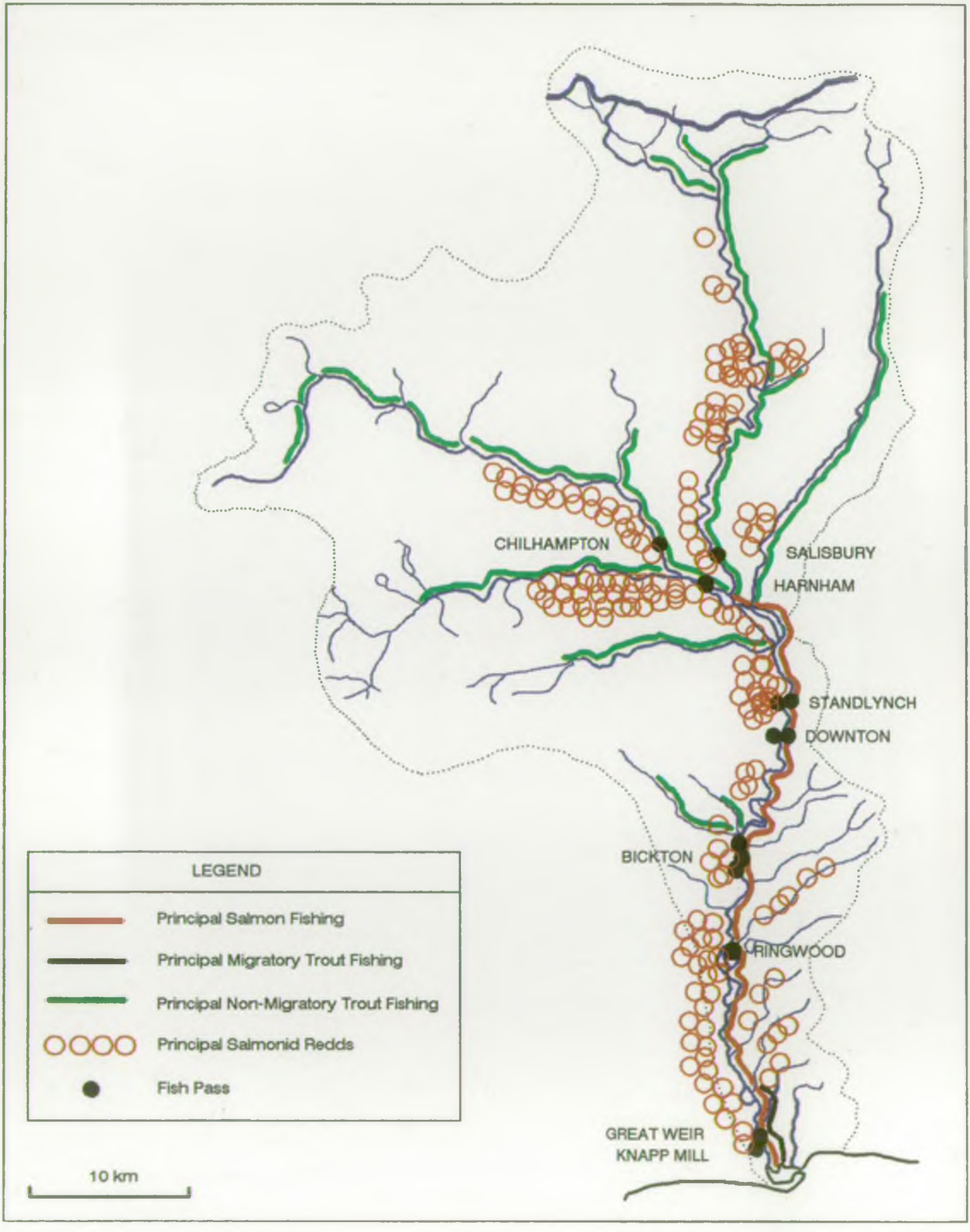
Reference to Section 3.4 demonstrates that a number of spray irrigation abstractions are licensed in the catchment. The greatest density of such licences are on the Lower Avon and its tributaries and in the Pewsey Vale. However spray irrigation abstractions are made in most parts of the catchment.

3.8.3 Environmental Requirements

Water Quality - compliance with relevant use related standards (see Appendix 1)

Water Quantity - availability of resources within the terms of specified licences whilst ensuring adequate residual flows for other uses and environmental interests. (Note - many spray irrigation licences are subject to minimum prescribed flow (MPF) conditions, which require cessation of abstraction in drought conditions.

HAMPSHIRE AVON CATCHMENT
GAME FISHERY



NRA Wessex Region

3.9 GAME FISHERY

3.9.1 General

This use refers to the conservation of wild populations of salmonid fish and their habitats and to the recreational fishing for salmon and trout.

3.9.2 Local Perspective

The Avon Catchment is well known for its salmon, migratory trout and brown trout fisheries. The best of the salmon rod fishing takes place between Christchurch and Fordingbridge, whilst the main migratory trout fishery is located at Christchurch. The Upper Avon and its major tributaries above Salisbury are preserved as brown trout fisheries and with the exception of the River Nadder are all chalk streams. There are also several well known stillwater put and take trout fisheries located within the catchment.

As with other salmon rivers in the UK, there has been a decline in the run of large spring salmon. The salmon rod catch is now predominantly composed of smaller summer fish and grilse. Rod-caught migratory trout average around 1.3kg and their annual catch has declined in recent years from a peak in the late 1970's.

Over the last twenty years the Authority has constructed fish passes at hatches and other obstructions to facilitate the upstream movement of migratory salmonids to their spawning grounds. The installation of fish passes has enabled salmon in particular, to penetrate further up the catchment than was previously the case. This change is reflected in the current distribution of salmon redds shown on the map opposite.

Illegal netting for salmon and migratory trout during the summer months, particularly in Christchurch Harbour and the lower reaches, can pose a serious threat to stocks. The illegal taking of migratory salmonids from the upper reaches at spawning time can also be a problem during low flow conditions.

Annual electric fishing surveys of salmon and trout parr have been undertaken at selected sites in the catchment since 1987. It is hoped to extend this work to the main Avon. Studies have been carried out by the Authority to determine the relationship between the movement of adult salmon and river discharge. This information is needed to ensure that water abstractions are managed in a way that will not interfere with salmon migration. Related studies are also underway into the habitat requirements of both the spawning and juvenile stages of trout and salmon, particularly with regard to flow.

The annual cutting of river weed, mainly the chalk stream water crowfoot, *Ranunculus spp.*, is an important fisheries management activity undertaken by the angling interests in the Upper Avon Catchment. This work is carried out to provide good holding places for adult trout and to facilitate fly fishing. The cut weed is collected and removed from the River Avon by the Authority at boom sites below Salisbury. Between Salisbury and Christchurch the weedcutting is carried out by the Authority for Land Drainage purposes. The salmon angler gains some benefit from the activity by the provision of more open water, however over-cutting can cause damage to coarse fish stocks and a careful balance between all these interests has to be maintained. The development of several large on-river trout farms

3.9 GAME FISHERY - CONTINUED

3.9.2 Local Perspective (continued)

over the last two decades has posed new problems for salmon stocks on the Avon. Local flow depletion caused by large diversions of river flow can, particularly under winter low flow conditions, cause difficulties for upstream migrating salmonids. These flow diversions can also cause the entrapment and mortality of smolts. Provision of fish passes and smolt by-pass channels can alleviate these problems to some extent. These issues are discussed further elsewhere in Section 6.22.

3.9.3 Fisheries Objectives

To maintain, improve and develop the wild salmonid resource of the Avon Catchment in accordance with Regional and National Policy.

Without prejudice to its other statutory duties the Authority will seek to promote the use of the Avon for salmonid angling in accordance with its own recreational strategies and codes of practice.

3.9.4 Fisheries Requirements

Monitor and control the levels of exploitation of illegal and legal fishing to ensure spawner escapement is sufficient to provide for future runs of migratory salmonids.

Improve the existing system of stock monitoring by further developing the annual surveys of juvenile salmonid populations and give consideration to the installation of counting stations for adult fish.

Establish habitat criteria for spawning and nursery areas. Undertake investigation into the levels of siltation in redds and consider the application of practices to improve the quality of spawning gravels.

3.9.5 Environmental Requirements

General

To maintain water quality, water quantity and habitat, to sustain wild populations of salmonids at a level appropriate for the river.

Water Quality

Water Quality not to deteriorate below the mandatory limits for pollutants as specified in the EEC Fisheries Objectives (78/659/EEC) for salmonid fisheries. Ideally water quality should meet the guideline limits for pollutants as specified in the EEC Fisheries Directive (78/659/EEC).

3.9 GAME FISHERY - CONTINUED

3.9.5 cont Water Quality (continued)

Should comply with the standards set for a salmonid fishery in accordance with any statutory water quality objectives.

Water Quantity

Develop operational guidelines for the management of large public water supply abstractions so as to safeguard the upstream movements of salmon. Consideration to be given to flow sparing and/or diurnal modulation of abstraction (see section 6.19).

Establish flow criteria for both juvenile and adult salmonids (non-migratory stages) both to protect existing habitat against future abstractions and, when opportunities occur, to help mitigate existing low flow problems.

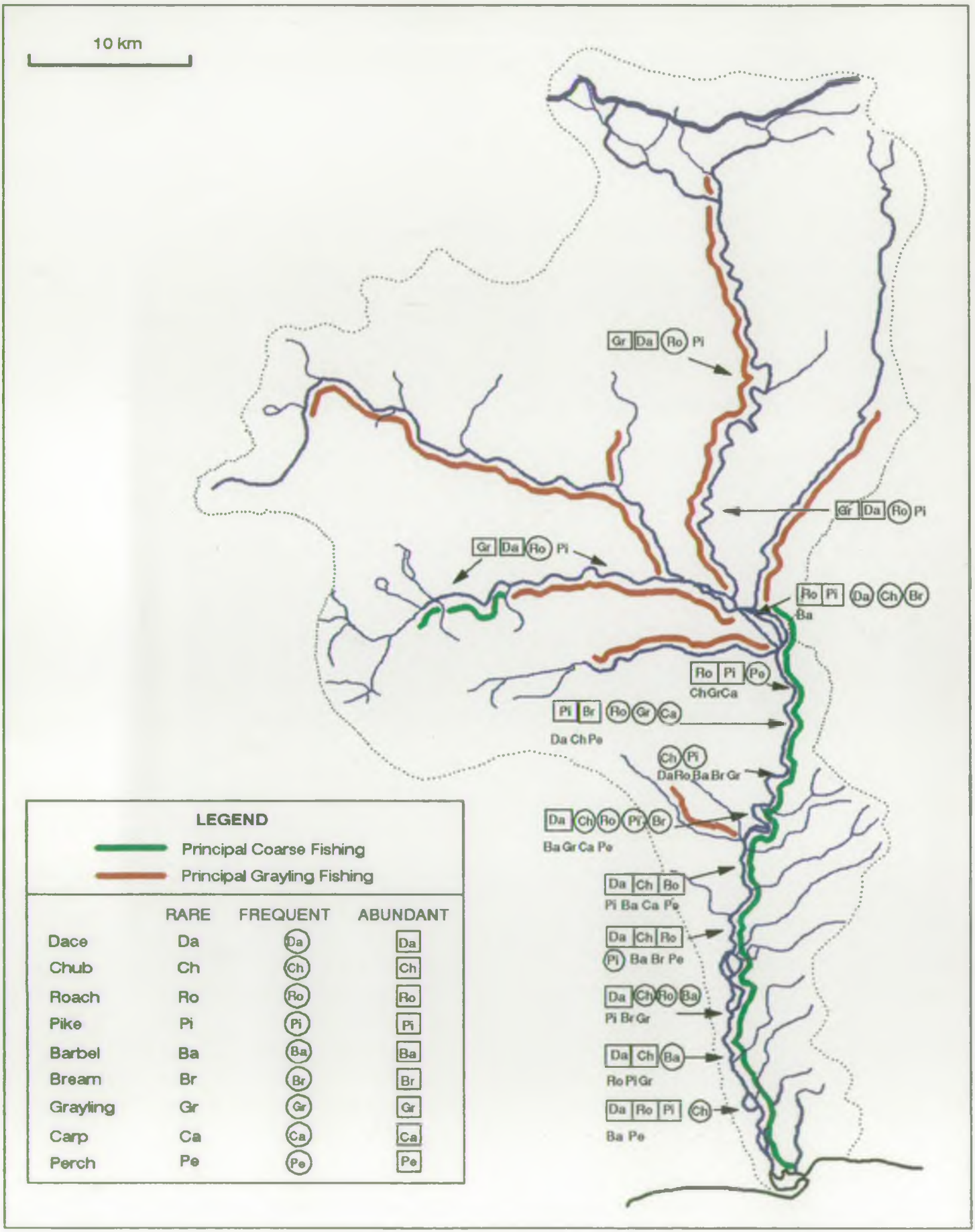
Physical Features

Construct fish passes at sites where physical barriers seriously impede the upstream movement of migratory salmonids. A new fish pass is scheduled for Harnham Hatches and consideration is being given to installing another in the Britford area.

Protect against habitat degradation, particularly resulting from siltation and/or a loss of river bed complexity, due to engineering works. In sensitive areas for migratory salmonids, works of this nature should be undertaken outside of the period November - April (inclusive).

Promote the installation of appropriate exclusion devices at intakes to prevent the ingress and subsequent mortality of salmonid migrants.

HAMPSHIRE AVON CATCHMENT
COARSE FISHERY



LEGEND

Principal Coarse Fishing

Principal Grayling Fishing

	RARE	FREQUENT	ABUNDANT
Dace	Da	Da	Da
Chub	Ch	Ch	Ch
Roach	Ro	Ro	Ro
Pike	Pi	Pi	Pi
Barbel	Ba	Ba	Ba
Bream	Br	Br	Br
Grayling	Gr	Gr	Gr
Carp	Ca	Ca	Ca
Perch	Pe	Pe	Pe

NRA Wessex Region

3.10 COARSE FISHERY

3.10.1 General

This use refers to the conservation of wild populations of non-salmonid fish and their habitats, and to recreational fishing for species other than salmon and trout.

3.10.2 Local Perspective

The River Avon has a very diverse fish fauna and at least 27 species of non-salmonid fish are known to be present. The Avon is nationally renowned by anglers for its specimen coarse fish, particularly barbel, roach, chub and dace. The best coarse fishing is found between Christchurch and Salisbury, whilst quality grayling fishing is to be had on the Upper Avon (above Salisbury) and the Rivers Wylye, Nadder and Bourne. Stillwater coarse fishing takes place at several disused gravel pits located throughout the catchment. Large numbers of mullet enter Christchurch Harbour each year and provide good sport for the angler.

Rod fishing for all species (other than sea fish) is regulated by the Authority by means of a national licensing system. Fishing licences can be purchased from distributors located throughout England and Wales. All the fisheries on the Avon are privately owned and permits are required from the owners prior to fishing.

During the 1970's and 1980's persistent complaints were received from anglers that coarse fishing on the River Avon was deteriorating, particularly between Downton and Fordingbridge. These complaints resulted in a series of public meetings being held. The development of large on-river trout farms, the Water Authority's weedcutting practices, the removal of coarse fish from the upper reaches by trout fishermen and the decline of the water meadow system were held by many to be important factors affecting the coarse fishery.

These concerns initiated a series of investigations by the Water Authority. The diversion of substantial quantities of river flow through a large trout farm was found to be the cause of significant entrapment and mortality amongst coarse fish. Subsequently, modifications were undertaken at this site which helped to alleviate this problem. A more 'sympathetic' approach to weedcutting was introduced by the Authority, with special consideration being given to leaving marginal weed to provide areas for fry.

The lack of quantitative scientific data on coarse fish stocks was identified at an early stage as a major weakness in the Authority's ability to assess temporal change. This stemmed from the practical difficulty of effectively sampling a large, weedy river such as the Avon, with their current electric fishing equipment. This led to Wessex Water Authority and the Department of the Environment jointly funding the Freshwater Biological Association to carry out a large-scale electric fishing survey of coarse fish populations during the summer of 1987.

The need to further develop sampling equipment capable of operating on large rivers was given a significant impetus following the inception of the NRA. After extensive development, a special electric fishing boat was constructed and this was used to undertake an extensive survey of coarse fish stocks on the River Avon during the summer of 1991.

3.10 COARSE FISHERY - CONTINUED

3.10.3 Fisheries Objectives

To maintain, improve and develop the wild non-salmonid resource, in accordance with Regional and National NRA Policy. Without prejudice to its other statutory duties the Authority will seek to promote the use of the River Avon for non-salmonid angling in accordance with its own strategies and codes of practice.

3.10.4 Fisheries Requirements

Monitor coarse fish populations and their habitats by means of periodic strategic surveys. Investigate the cause of any significant changes in coarse fish populations or habitat and take appropriate action.

Wherever possible, ensure that potentially harmful activities such as weedcutting and dredging are undertaken in a manner likely to cause least harm to the non-salmonid resource and to its recreational value for angling.

The Authority will consider undertaking works to improve coarse fish habitats e.g. renovation of weirs and hatches, providing sufficient potential fisheries benefits exist to justify the expenditure.

3.10.5 Environmental Requirements

To maintain water quality, water quantity and habitat so as to sustain wild populations of non-salmonid fish at a level appropriate for the river.

Water Quality

The non-salmonid fisheries occupy the same geographic confines as salmonid fishery. The water quality requirements of the former must therefore not deteriorate below the more demanding mandatory limits set for salmonid fisheries, as specified by the EEC Directive (78/659/EEC) or by future statutory water quality objectives.

Water Quantity

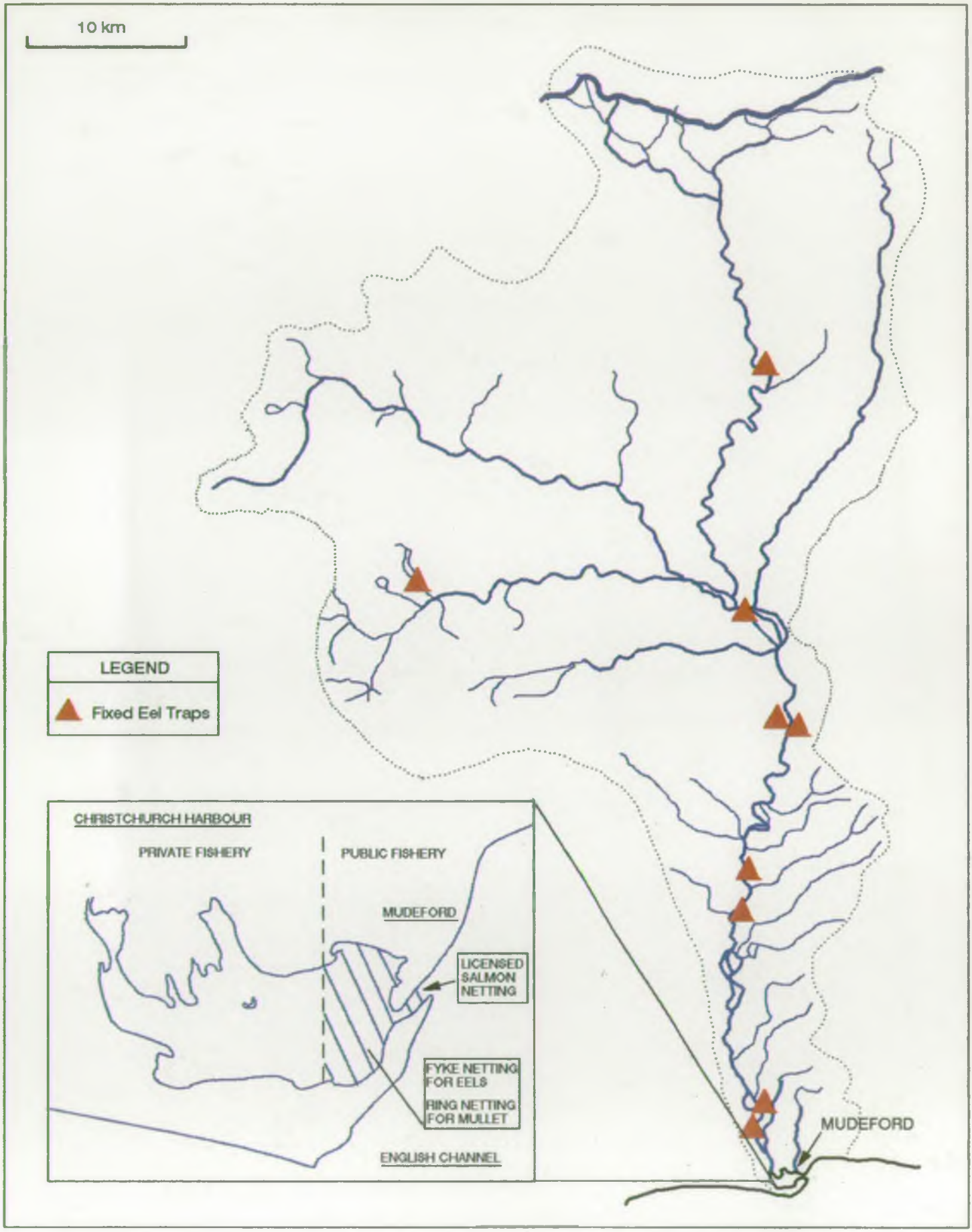
As for Game Fishery.

Physical Features

Ensure there are no barriers to coarse fish movements in the catchment.

Ensure adequate diversity of habitat to provide spawning, nursery and holding areas.

HAMPSHIRE AVON CATCHMENT
COMMERCIAL FISHERIES



NRA Wessex Region

3.11 COMMERCIAL FISHERIES

3.11.1 General

This use refers specifically to the legal taking of wild fish in their natural environment by instruments other than rod and line.

3.11.2 Local Perspective

Licensed netting for salmon and migratory trout takes place at the seaward end of Christchurch Harbour on the joint estuary of the Rivers Avon and Stour. Fishing is solely by means of draft or seine nets. The fishery is regulated by the Authority by means of a licensing system and the number of nets is limited to six in accordance with the Wessex Water Authority (Limitation of Draft and Seine Net Licences) Order 1981.

Netting for salmon and migratory trout is permitted between 1st February and 31st July (inclusive). Within this period, fishing is further restricted by means of weekly close times.

Net catches have shown a downward trend since the early 1960's. Little netting now takes place before mid-March because of a shortage of early-running spring fish. Few migratory trout are caught before May the majority being taken in June and July. Unlike the net caught salmon, net caught migratory trout tend to be consistently heavier than those taken by rods.

Between 1986 and 1990 (inclusive), the Authority purchased live salmon from the netsmen. These fish were radio-tagged, then released alive into the Harbour. The subsequent movements of these fish into freshwater and through the river system were monitored and related to prevailing river discharge. This study was aimed at providing guidelines for the management of large public water supply abstractions to ensure that future movements of salmon could be protected.

A small amount of fyke netting for mainly brown eels (non-migratory stage) takes place both in Christchurch Harbour and the Lower Avon. Fishing for silver eels (migratory stage) takes place at several large fixed traps located between Christchurch and Salisbury. Some of these eels are exported to Holland, others are sold locally, or in London. The fyke netting and trapping of eels in freshwater and tidal waters is regulated by the Authority by means of a licensing system.

Some ring netting for mullet, takes place in the public fishery in Christchurch Harbour. Within the confines of Christchurch Harbour, the NRA has the powers of a local fisheries committee.

3.11.3 Fisheries Objectives

To maintain, improve and develop wild populations of migratory salmonids, eels and other exploited species of fish, in accordance with Regional and National NRA Policy.

To maintain an acceptable overall yield from the migratory salmonid fisheries and an acceptable allocation of the yield between licensed rod and net fisheries.

3.11 COMMERCIAL FISHERIES - CONTINUED

3.11.4 Fisheries Requirements

To monitor and control the exploitation of salmon and migratory trout within waters under the NRA's control to ensure that there is sufficient escapement of spawning stock.

3.11.5 Environmental Requirements

General

To maintain water quality, water quantity and habitat so as to sustain wild populations of exploitable fish at a level appropriate to the river.

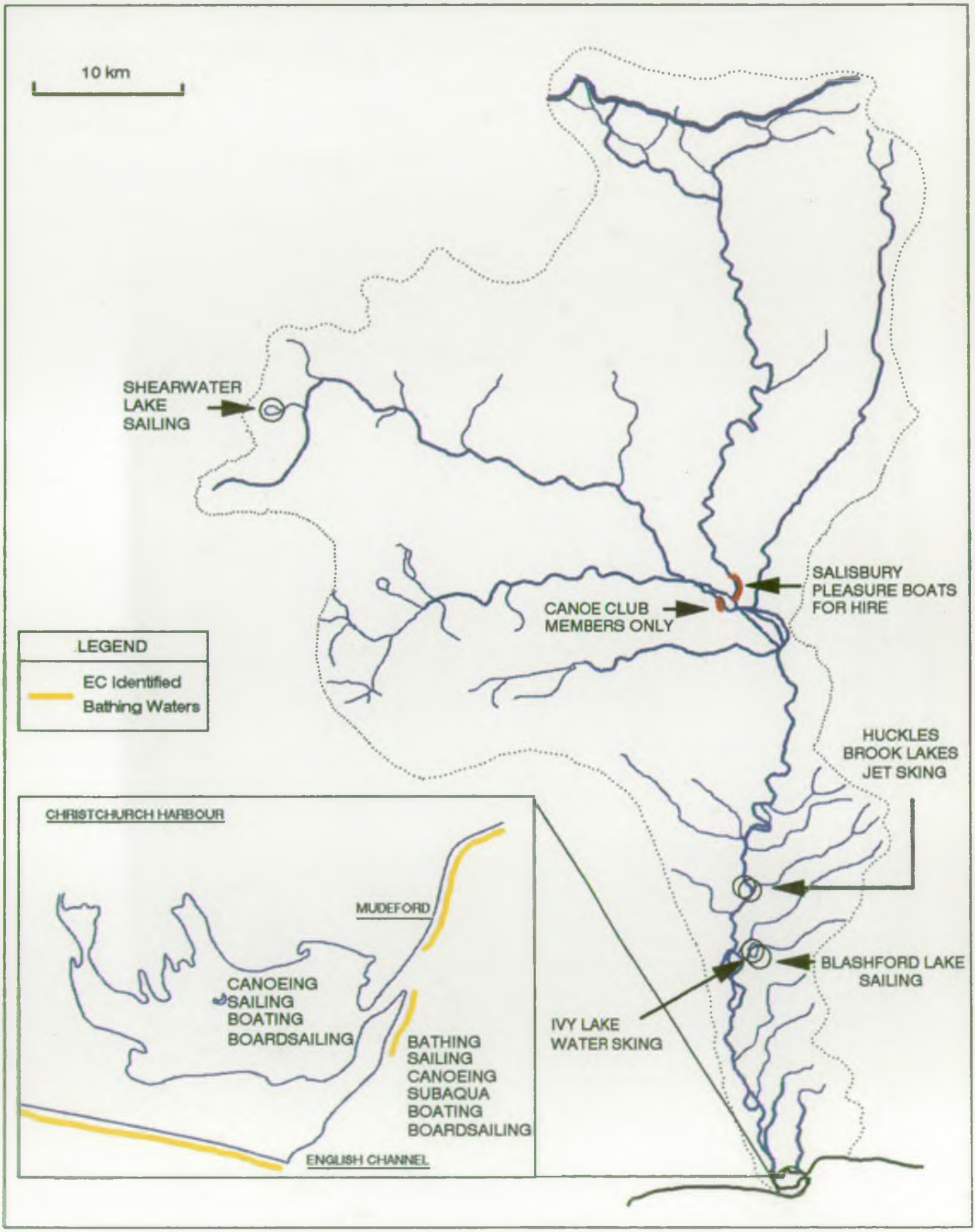
Water Quality

See Game Fishery.

Water Quantity

See Game Fishery.

HAMPSHIRE AVON CATCHMENT
WATER BASED RECREATION AND AMENITY



NRA Wessex Region

3.12 WATER BASED RECREATION AND AMENITY

3.12.1 General

This use relates to water based recreation other than angling that takes place in the river corridor and to the more general enjoyment of the riverine environment.

3.12.2 Local Perspective

Christchurch Harbour

A large part of Christchurch Harbour is owned by the West Hants Water Co. (WHWC). This extends from the tidal limit to a line drawn approximately due north of the seaward end of Hengistbury Head. Between this line and the sea, the Harbour is owned by the Crown. There is a public right of navigation on all tidal waters.

Christchurch and Bournemouth Borough Councils exercise some control over navigation in the parts of the harbour within their jurisdiction by means of Byelaws. There are two sets of Byelaws, one set applies from the tidal limit to the top of the Run at Mudeford (4 knot speed limit). Christchurch Bay Byelaws apply from the top of (and including) the Run and adjacent shore (8 knot speed limit). The doubling of the speed limit allows craft to navigate a safe passage through the fast waters of the Run. These Byelaws are enforced jointly by the WHWC, Christchurch Borough Council and the Police.

Although no formal Navigation Authority exists, the responsibility for the laying of buoys to ensure a navigable channel through the Harbour is undertaken by the Christchurch Harbour Association.

The mooring rights are owned by the WHWC within the boundaries of their ownership. Christchurch Borough Council have control of the mooring rights on the Crown Property. In some parts of the Harbour moorings have been let to individuals and private organisations. Visitors moorings are only available from Christchurch Sailing Club. Occasional anchorage is available from WHWC.

Recreational activities in Christchurch Harbour include:

Sailing
Boardsailing
Rowing
Boating (low powered pleasure crafts)

Water skiing is excluded by the 4 knot speed limit. There are 2 sailing clubs, 1 yacht club and 1 rowing club active in the harbour.

Pleasure boats can be hired for the hour or the day from 4 companies. There are 5 boatyards offering repair and service facilities.

3.12 WATER BASED RECREATION AND AMENITY - CONTINUED

3.12.2 Local Perspective (continued)

New Forest Water Park (Hucklesbrook Lakes)

These two lakes are situated 2 miles south of Fordingbridge. The site includes a club house and bar. Water-skiing, jet-skiing and aqua-rides are available to non-members on an hourly basis.

Wessex Water, Blashford Lakes

These two lakes are owned by Wessex Water plc. The largest, Spinnaker, has facilities for sailing and wind surfing with clubs for each activity.

The other, Ivy, has a water-skiing club, and is restricted to members only.

Wessex Water Plc have developed a 'Blashford Lakes Management Strategy and Plan' which seek to provide an integrated framework for the use of the area.
Shearwater Lake, Warminster

Sailing takes place under the control of Shearwater Sailing Club. The season is from March 16th to November 30th. There is no public access.

Lake Pleasure Gardens, Warminster

A small lake set in a town park, this has rowing boats for hire on an hourly basis through the summer.

River Avon, Salisbury

The Boathouse Inn has rowing boats for hire on an hourly basis from Easter to September 30th. The boats may use a 1.5km section of river, there is no public right of navigation. Salisbury Canoe Club also use this section of the Avon as well as a 0.5km section of the River Nadder. This is restricted to members only.

As can be seen, relatively few opportunities exist for non-fishing recreation due to the importance attached by riparian owners to game fishing.

3.12.3 Navigation

At present, other than Christchurch Harbour, there is no use of the catchment for navigation due to the opposition of riparian owners and fishing interests to any wider use. However, in 1664 the River Avon Navigation Act was passed "which allowed the making navigable of the Salisbury Avon from Christchurch to New Sarum and the River Wylye from Salisbury to Wilton. This act has never been repealed." (Cross: "The Salisbury Avon Navigation"). The last public attempt to sail a small boat up the Avon under the Act was made in 1907, which was challenged by the fishing and riparian owner at Winkton. The case has never been pursued.

3.12 WATER BASED RECREATION AND AMENITY - CONTINUED

3.12.4 Amenity

The amenity value of the Hampshire Avon and its tributaries may be viewed in relation to urban areas and rural areas respectively.

Within urban areas there is no doubt that the rivers within the catchment form features within many towns. However there remain opportunities for enhancement of urban areas by the more sympathetic planning and landscape management of river corridors.

In more rural areas the rivers in the Hampshire Avon and valleys in which they flow are highly regarded in terms of their amenity value. Perhaps the most notable point in relation to enjoyment of these areas is that access is limited in large parts of the catchment. Increased facilities for passive recreation (eg bird watching) may be compatible with other uses.

3.12.5 Catchment Requirements

Water Quality - achievement of relevant use related standards (ie water contact sports, general amenity).

Water Quantity - basic flow regime, absence of gross impacts.

Physical Features - adequate access points for recreation, adequate footpaths.

HAMPSHIRE AVON CATCHMENT
SITES OF SPECIAL SCIENTIFIC INTEREST

NRA Wessex Region

3.13 DESIGNATED CONSERVATION AREAS

3.13.1 General

This use relates to the conservation and enhancement of natural beauty, wildlife, landscape and physical features, including archaeology. Conservation covers both designated sites and the wider countryside associated with rivers and coasts. Its primary aim is to protect the characteristic features of our aquatic ecosystems.

3.13.2 Local Perspective

The Hampshire Avon Catchment is of international importance for nature conservation and is an integral part of the landscape of southern England.

It provides an important link between three areas, the chalk downlands of Wiltshire, the Dorset heathlands and the New Forest. The Avon Catchment reflects these links in a wide range of semi-natural habitats including fine examples of lowland heath, unimproved grasslands and ancient, broadleaved woodlands. The river and associated ditch system is one of the most important in Britain for the diversity of plants and animals which it supports.

The outstanding nature conservation value of the catchment is recognised in numerous statutory designations. At an international level the Lower Avon Valley is a candidate Special Protection Area (SPA) for birds and a RAMSAR wetland site. (See Appendix 3) The catchment includes over 60 Sites of Special Scientific Interest (SSSI's) and one National Nature Reserve (NNR).

At a county level one Local Nature Reserve (LNR) has been designated near Salisbury and several other LNR's are proposed. The value of many other semi-natural habitats within the catchment is recognised through the non-statutory network of Sites of Nature Conservation Interest (SNCI's) under the auspices of Local Authorities and the County Wildlife Trusts. Some of these non-statutory sites are covered by planning policies and guidelines. It is likely that the forthcoming SPA designation will incorporate these fragmented sites into a unified area of international importance for wintering and breeding birds.

The upper part of the catchment falls within an Area of Outstanding Natural Beauty (AONB) while, more recently, the Environmentally Sensitive Areas (ESA) scheme has been extended into the Avon Catchment. This provides financial incentives to farmers who maintain traditional land use practices. The Avon Valley ESA and part of the South Wessex Downs ESA fall within the catchment.

Much of the catchment is of great archaeological and historic interest, and includes numerous Scheduled Ancient Monuments (SAMs) which date from prehistory. Today much of the interest of the river focuses on Salisbury Cathedral and the complex system of mills and water meadows which dominated the Avon valley throughout the 18th and 19th centuries. Many of the existing SSSIs are remnants of this intensively managed, man-made system. Their continued survival depends on a delicate balance of traditional management practices linked to the river and its floodwaters. The accompanying map shows designated SSSI's. The blue and red areas indicate wetland sites which are dependent upon the hydrological

3.13 DESIGNATED CONSERVATION AREAS - CONTINUED

3.13.2 Local Perspective (continued)

regime of the Avon and its tributaries. The NRA has a special role to play in safeguarding the scientific interest of these wetland sites and of the River Avon itself.
On a wider perspective the conservation duty also extends into those parts of the catchment which are influenced by the hydrological regime and any changes which may impact upon surface water wetland sites. This remit includes the impact of flood defence works, proposed abstractions and discharges.

3.13.3 The Nature Conservation Interest

The river and flood plain

The River Avon and its upper tributaries are alkaline and support a community of aquatic plants including water crowfoot *(Ranunculus spp.)* pondweeds *(Potomegeton spp.)*, milfoils *(Myriophyllum spp.)* and water starworts *(Callitriche spp.)* Along with the larger emergent species such as arrowhead *(Sagittaria sagittifolia)* these form a characteristic chalk stream association. This contrasts sharply with the eastern tributaries which arise in the Tertiary gravels of the New Forest and are more acidic. These streams support a more specialised plant community including several rare and uncommon species. The pattern of plant communities reflect changes in the physical characteristics of the river, particularly substrate, flows and depth. These diverse micro-habitats support an exceptionally large number of animal species. This biodiversity is well illustrated by the fish; 27 different species occur in the Avon system, the highest number recorded from any British river.

Beyond the confines of the river channel animals such as kingfisher, heron and otter depend on the productive coarse fish stocks for food. The main interest of the flood plain centres on the herb-rich meadows and grassy heaths which are of high botanical interest and also support nationally and internationally important bird populations. These comprise large numbers of waders and wildfowl in winter, the occurrence of Bewick's swan is of particular note. During spring and summer lapwing, redshank and snipe breed in the valley. A recent NRA/RSPB survey has shown that the Lower Avon Valley is one of the most important areas for breeding waders in southern England.

These bird populations are dependent upon:

i) periodic temporary flooding
ii) the retention of high groundwater levels in the flood plain meadows throughout spring and early summer
iii) the maintenance of extensive grazing systems

3.13 DESIGNATED CONSERVATION AREAS - CONTINUED

3.13.3 The Nature Conservation Interest (continued)

Christchurch Harbour

The estuarine mudflats, grazed saltmarsh and marginal habitats are important for breeding birds, including two of national importance. It also supports large numbers of migrants in spring and autumn. The estuary itself is a valuable breeding and nursery site for fish including bass, mullet and pollack.

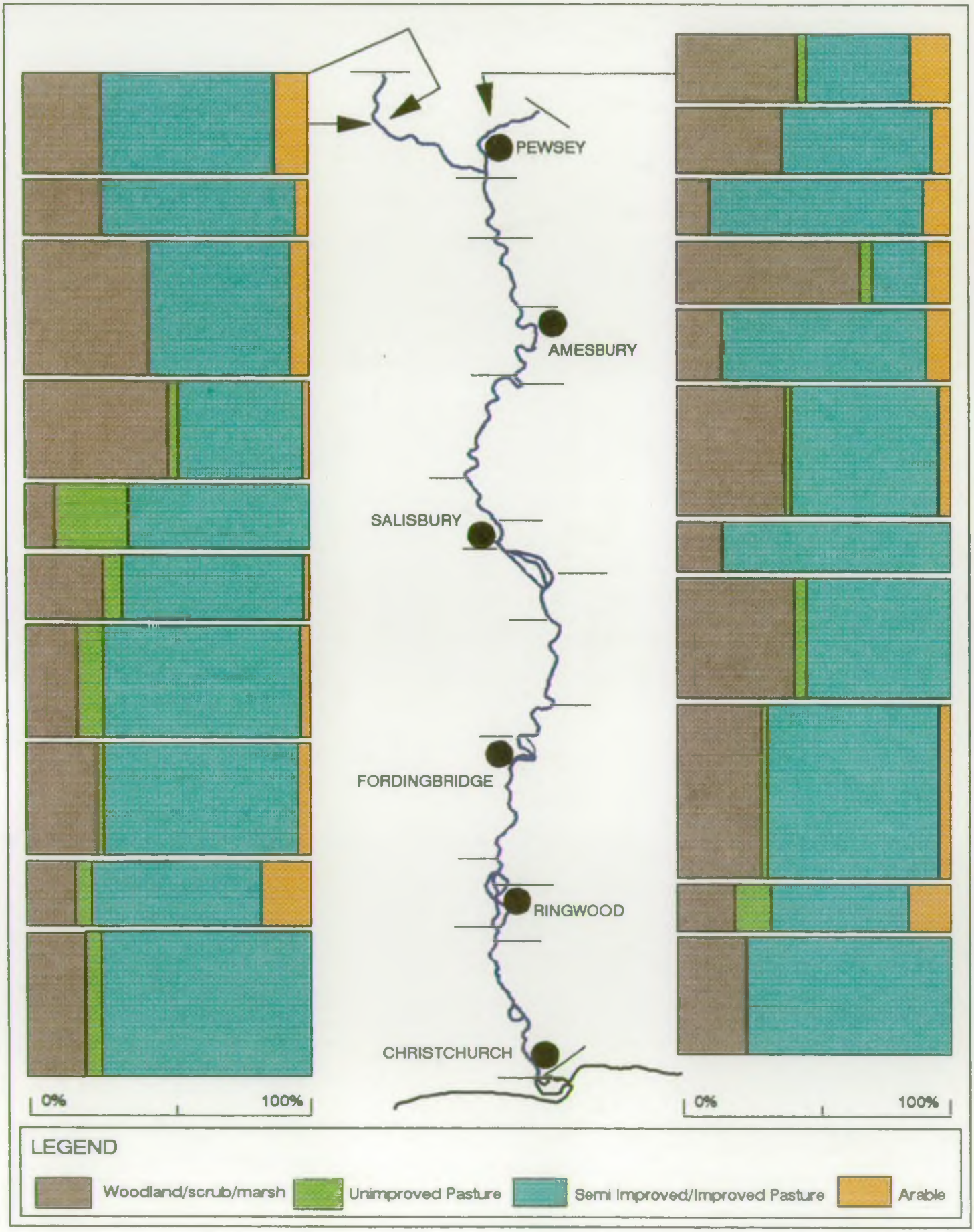
3.13.4 Conservation Objectives

- to conserve the biodiversity of the R. Avon, its tributaries and associated watercourses.
- to safeguard all semi-natural habitats associated with wetlands and watercourses.
- to restore and enhance wildlife habitats particularly wetlands and bankside vegetation.
- to safeguard riverside landscapes, historic features and archaeological remains.
- to support internal and external initiatives which meet these objectives.

3.13.5 Environmental Requirements

- ensure conservation objectives are met in consideration of the core functions of the Authority.
- maintain periodic, winter temporary flooding in the Lower Avon valley.
- maintain and restore high groundwater tables in the Avon flood plain.
- restore ecologically acceptable flows to all rivers in the catchment.
- increase the proportion of bankside cover particularly reeds, scrub and trees.
- promote the environmentally sensitive management of watercourses and bankside vegetation.

HAMPSHIRE AVON CATCHMENT
RIVER CORRIDOR - LAND USE



NRA Wessex Region

3.14 RIVER CORRIDOR AND CATCHMENT LAND USE

3.14.1 General

This use relates to the conservation interest of river corridors outside the designated conservation areas. Land use within the wider catchment also impacts on the river.

3.14.2 Local Perspective

The Hampshire Avon Catchment is predominantly rural in character. Although intensive agriculture is the main land use the catchment retains a relatively high proportion of semi natural habitats compared to other river catchments in southern England. The balance between intensive and extensive (traditional) farming systems is of key importance in the future management of the river and its flood plain.

The accompanying map shows the occurrence of different land use categories along the river corridor of the River Avon. This information was derived from a recent river corridor survey and refers to land adjoining the river, usually within 25 metres of the riverbank. Agriculturally improved pasture is the dominant land use followed by semi-natural vegetation in the form of woodland, scrub and marsh. The proportions of arable land and of unimproved pasture are relatively low close to the river; however this does not reflect their true importance in terms of the catchment as a whole. On a wider perspective the Upper Catchment is farmed more intensively than the Lower Avon, large parts of which are still managed on an extensive grazing system.

3.14.3 Management and Land-use Change

As in most parts of England and Wales increasing agricultural production from 1940 onwards resulted in dramatic changes within the Avon Catchment. Today most of the Upper Catchment is used for intensive arable, sheep and dairy production. This has impacts on the river in terms of water quality, abstraction and land drainage as discussed in separate sections of this plan. From a conservation viewpoint the primary impact has been in terms of habitat loss and reduced species diversity both within the river channel and on adjoining land. Many of these historic changes are irreversible but there are opportunities to enhance the Upper Avon and its tributaries through improved management of the river corridor. This requires three key elements:

i) the restoration of bankside trees and shrubs through planting and natural regeneration.

ii) the maintenance of a varied river channel including features such as riffles, pools, meanders and shoals.

iii) the establishment of buffer zones (headlands) alongside watercourses.

Compared with the Upper Catchment the extent of habitat loss on the Lower Avon has been much less marked where large parts of the valley are protected and managed along traditional lines. Few of the original water meadow systems remain, however there are notable examples at Britford and Lower Woodford near Salisbury.

3.14 RIVER CORRIDOR AND CATCHMENT LAND USE - CONTINUED

3.14.3 Management and Land-use Change (continued)

Various incentive schemes operate throughout the valley, their primary aim being to maintain unimproved pastures through extensive grazing with cattle, ponies and sheep. Current schemes include SSSI management agreements, Local Authority management agreements (for example Hampshire County Council's Countryside Heritage Scheme), Countryside Stewardship and, most recently, the ESA scheme.

Future management requirements within the Lower Avon Valley will involve retention of periodic winter flooding and the retention of high water levels across the flood plain. This in itself constrains changes in land use and will favour traditional management patterns.

3.14.4 Land use within the Wider Catchment

In addition to the conservation aspects of the river corridor, agricultural land use within the wider catchment is important in relation to the river. Examples include the leaching of nitrate from farmland and the increase in mobilisation of sediment associated with arable land.

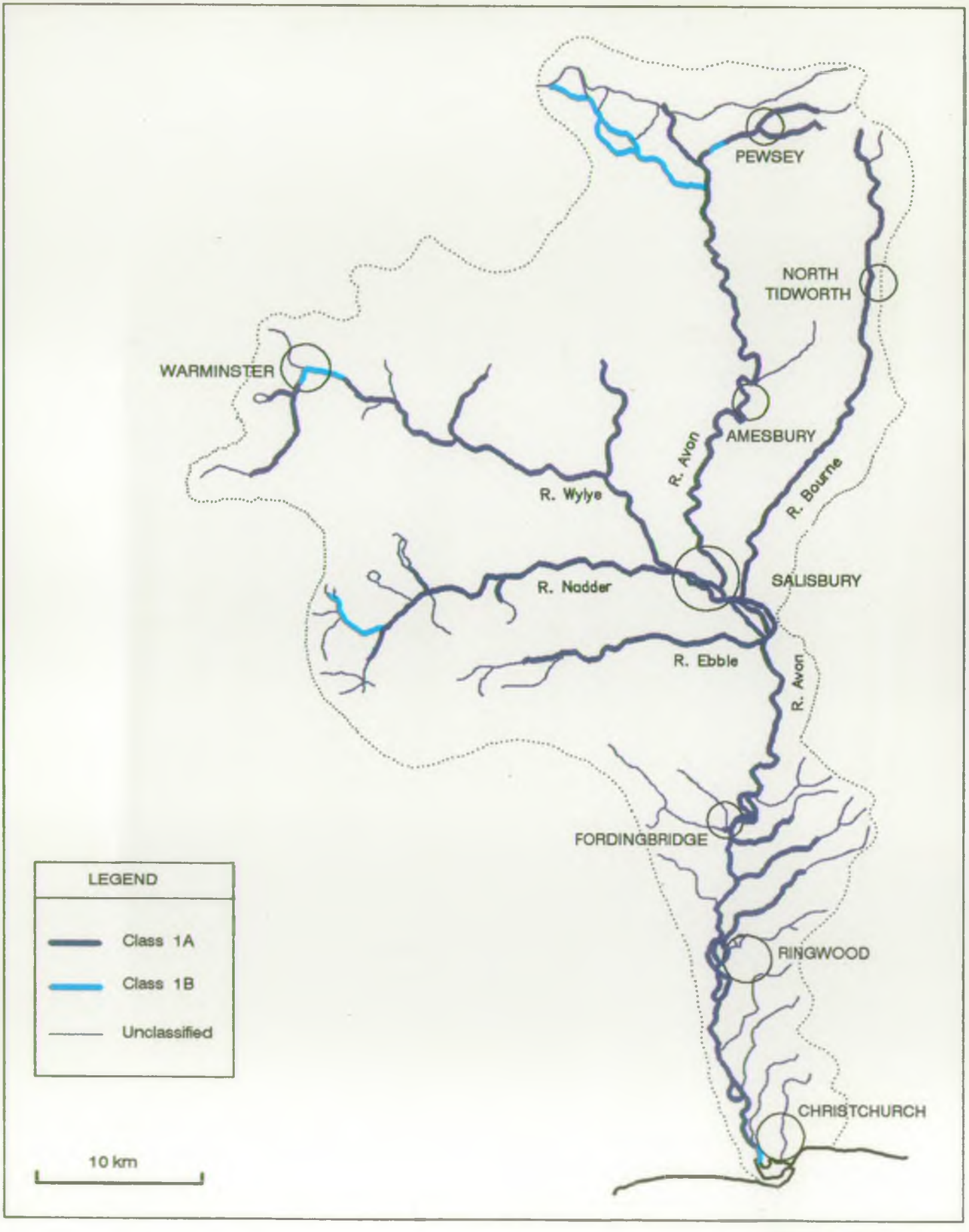
3.14.5 Environmental Requirements

Water Quality - achieve quality consistent with general ecosystem suite of use related standards. (See Appendix 1)

Water Quantity - basic flow regime, absence of gross impacts.

Physical Features - achieve and maintain appropriately diverse, woodland, scrub or extensively stocked grassland in 'buffer zones'. - fence to exclude stock from banks.

HAMPSHIRE AVON CATCHMENT
NWC WATER QUALITY OBJECTIVES



NRA Wessex Region

4.1 WATER QUALITY OBJECTIVES

4.1.1 General

For the purposes of this plan, objectives for water quality will be considered in two parts.

Firstly, objectives for the quality of all rivers were set in 1979 in terms of the NWC River Quality Classification following extensive consultation. The status of the catchment as measured against these objectives has therefore been considered.

Secondly, a series of suites of water quality criteria which are required for specific uses have been developed. The status of the catchment has also been assessed against this rather more comprehensive set of determinands.

4.1.2 Existing River Quality Objectives

(a) Background

In 1979, River Quality Objectives (RQOs) were set for rivers throughout England and Wales, in terms of the NWC River Quality Classification, which includes criteria for Dissolved Oxygen, BOD (ATU) and Ammonia. The Classification includes a broad indication of the fisheries and water supply uses which might be made of rivers in each class. For example Classes 1A and 1B would be considered suitable for salmonid (game) fisheries and water supply with conventional treatment whereas Class 2 would be suitable for cyprinid (coarse) fisheries and would only be suitable for water supply after advanced treatment. (See Appendix 1 for full classification).

The RQOs set in 1979 were "long term" RQOs, and the target was for their achievement by 2001. The Water Resources Act 1991 (which incorporates relevant Sections from the Water Act 1989) includes provision for statutory water quality objectives (SWQOs). The NRA is currently developing a framework for the specification of SWQOs for rivers and other controlled waters. The approach is likely to be more specifically related to water uses. The setting of SWQOs will involve local consultation.

Although the existing RQOs will eventually be superseded, they are the currently established management objectives and are therefore considered in the Catchment Management Plan.

The use of classification schemes for the setting of Water Quality Objectives was not extended to tidal and coastal waters.

(b) Local Perspective

Long Term River Quality Objectives for the Hampshire Avon specified quality generally in Class 1A with relatively short stretches in Class 1B. These latter stretches reflected the reality that achievement of class 1B immediately downstream of Warminster and Pewsey STWs would not be possible due to the limited dilution available and that the geological and land use characteristics of the Western Avon and River Sem would preclude attainment of Class 1A quality. In addition, the stretch of the Waterloo branch of the Avon downstream of Christchurch STW was also given a Class 1B objective to reflect limitations on dilution.

4.1 WATER QUALITY OBJECTIVES - CONTINUED

4.1.2 Environmental Objective

(c) To achieve the designated Water Quality Class for each reach.

(d) **Environmental Requirements**

	NWC CLASS	
	IA	IB
Dissolved Oxygen (% Sat) 5%ile	>80	>60
BOD (atu) (O_2 mg/l) 95%ile	<3.0	<5.0
Ammonia (total) (N mg/l) 95%ile	<0.3	<0.7

4.1.3 Use specific water quality criteria

(a) **Background**

Suites of relevant water quality criteria have been developed for each of the major river uses namely:

- Aesthetic requirements
- Salmonid (game) fishery
- Non-salmonid (coarse) fishery
- Potable abstraction
- Bathing
- Immersion sports
- Agricultural irrigation
- Livestock watering

Suites of water quality criteria which are required for the above uses are set out in Appendix 1. These suites include the requirements for compliance with relevant EC Directives. It has been assumed that the salmonid fishery criteria are also adequate for aquaculture requirements. It has also been assumed that requirements for the general protection of aquatic life are covered by the non-salmonid fishery requirements.

Special nature conservation requirements are important in the Hampshire Avon and ideally specific water quality requirements related to water dependent features of SSSIs would also be specified. However in the absence of such criteria, the suite for salmonid fish has been taken to broadly cover these requirements (with the exception of plant nutrients, which has been identified as a specific issue in the Plan).
The water quality requirement which applies to any particular stretch is determined by the strictest use-related requirement.

4.1 WATER QUALITY OBJECTIVES - CONTINUED

4.1.3 Local Perspective

(b) The catchment is characterised by an almost universal application of three suites namely:

- Aesthetic criteria
- Salmonid fishery
- Non-Salmonid fishery (including general protection of aquatic life)

Also, on the lower stretches the potable abstraction suite applies. In Christchurch Harbour the immersion sports suite applies. In the adjacent coastal areas both the immersion sports and bathing suites apply.

4.2 WATER QUANTITY OBJECTIVES

4.2.1 General

Whatever the specific requirements identified with the catchment area the policies and actions to be pursued will be in conformity with the statutory duties of the NRA. In this respect the emphasis in all endeavours will be on the need to conserve and to ensure the proper use of water resources and to do so within the catchment.

4.2.2 River Low Flows

Where it is reported that river flows have declined to an unacceptable level as a consequence of historic abstraction rights the circumstances will be investigated. The NRA will co-operate with local communities on reaching conclusions as to the proper balance of water resources usage and to acceptable management strategies and where appropriate make proposals for alleviating problems caused as a consequence of abstractions. It is the aim of the NRA to determine a range of seasonal river flows appropriate to the maintenance of the characteristic habitat and river ecosystems.

4.2.3 Further demands for Water Use

The NRA is analysing data on water use and will be reviewing forecasts of future demand for the purpose of anticipating needs for water resource developments. With respect to use for public water supplies it will be expected that the fullest opportunities will be taken for effective demand management, particularly in the context of leakage control and in the introduction of general domestic metering in zones of high consumption. In all of its dealings with potential new abstractors the NRA will seek to achieve environmental benefits from any new arrangements whether these can materialise from minor local improvements or from the strategic considerations associated with conjunctive use of major sources.

4.2.4 Water Storage Reservoirs

The desire to promote a change in emphasis from direct groundwater abstraction towards surface water abstraction nearer to the mouth of the Avon requires the provision of some bankside storage if downstream flows are to be fully protected. Reclamation of disused mineral workings appears to offer the only opportunity for reservoirs on a significant scale. This does not mean that the NRA will support the excavation of new areas of mineral working simply as a means of providing storage. The removal of sands and gravels represent the removal of shallow aquifers which themselves may be important to local streams. However, where local problems can be overcome by engineering means and positive after-use proposals conform with a strategy for reducing groundwater abstractions in areas of river environment stress, then this would assist the rationalisation of water resources management.

4.2.5 New Abstractions

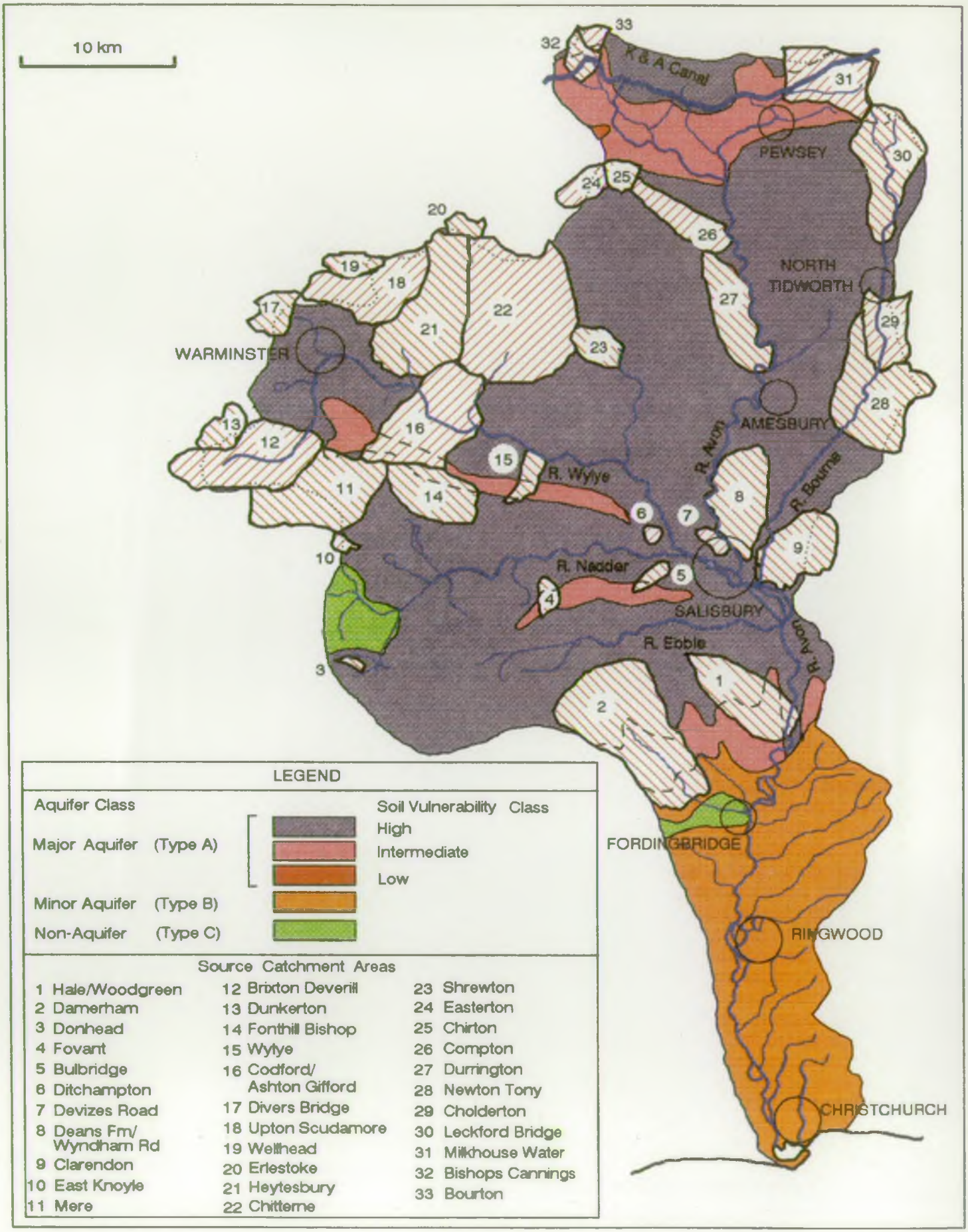
The NRA will consider all new abstraction licence applications within the framework of the Water Resources Act 1991. The impacts of new abstractions will be carefully considered on their own merits and viewed in the light of the sensitive issues and

4.2 WATER QUANTITY OBJECTIVES - CONTINUED

4.2.5 New Abstractions (continued)

problems specific to the Hampshire Avon Catchment. Small low loss abstractions will generally be acceptable. However there will be a presumption against any proposed new large, high loss, abstractions from the catchment where these are not accompanied by a commitment to provide independent storage for conserving excess winter rainfall or run-off. Any proposed abstraction other than those in the small low loss category will need to be supported by an environmental statement which adequately demonstrates that material adverse environmental impacts will not arise. The NRA will seek to improve controls on existing licences whenever the opportunity arises.

HAMPSHIRE AVON CATCHMENT
GROUNDWATER PROTECTION POLICY



LEGEND

Aquifer Class

Major Aquifer (Type A)

Minor Aquifer (Type B)

Non-Aquifer (Type C)

Soil Vulnerability Class

High

Intermediate

Low

Source Catchment Areas

1 Hale/Woodgreen
2 Damerham
3 Donhead
4 Fovant
5 Bulbridge
6 Ditchampton
7 Devizes Road
8 Deans Fm/ Wyndham Rd
9 Clarendon
10 East Knoyle
11 Mere
12 Brixton Deverill
13 Dunkerton
14 Fonthill Bishop
15 Wylye
16 Codford/ Ashton Gifford
17 Divers Bridge
18 Upton Scudamore
19 Wellhead
20 Erlestoke
21 Heytesbury
22 Chitterne
23 Shrewton
24 Easterton
25 Chirton
26 Compton
27 Durrington
28 Newton Tony
29 Cholderton
30 Leckford Bridge
31 Milkhouse Water
32 Bishops Cannings
33 Bourton

NRA Wessex Region

4.3 GROUNDWATER PROTECTION OBJECTIVES

4.3.1 General

At the time of preparation of this Catchment Management Plan (CMP), a document entitled "Policy and Practice for the Protection of Groundwater (PPPG)" is under final revision before issue by the NRA. Its key objective is to provide a framework on which to build individual policies covering all types of threat to groundwater, large and small, from point and diffuse sources, and by both conservative and degrading pollutants. In the preparation of any CMP, the groundwater must form a major part of the considerations; thus the Authority's policy towards groundwater must form an integral part of that plan, which will in turn become one vehicle by which individual policies are implemented.

The PPPG contains policy statements on the following aspects of groundwater protection:

- 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
- Unacceptable activities in the inner protection zone
- Diffuse pollution

The various policies are related to the risk posed by the activity, thus maps have been prepared for the whole country identifying major, minor, and non-aquifers. At a Regional level, Source Protection Areas are identified for major abstractions. In due course, these will be sub-divided into 3 zones of increasing risk.

4.3.2 Local Perspective

The aquifers and source protection areas within this catchment are shown on the adjacent map.

The aspects above are now considered in more detail in the context of this plan.

- Physical disturbance of aquifers will include activities such as mineral extraction (the mineral must be worked where it is) and construction projects involving excavation work. Other construction proposals can only be considered as and when they are put forward. The NRA can influence the proposals through its role as a Planning consultee and, where appropriate, through its own licences and consents. It should be noted that some gravel workings may offer opportunities for water storage and play a role in water resources development.

- Waste disposal on land takes place at a number of locations in the catchment. The major impact on NRA interests is in respect of groundwater, but there is also the possibility of pollution to surface water, and the interruption of surface water drainage. The NRA is a statutory consultee to both the Planning and Waste Regulation Authorities for such proposals, and will exercise the PPPG through these controls.

4.3 GROUNDWATER PROTECTION OBJECTIVES - CONTINUED

4.3.2 Local Perspective

- Contaminated land has not been identified as a problem in the catchment. If any sites are identified, the relevant policies will be implemented.

- Disposal of sludges and slurries to land includes wastes from agriculture, industry and sewage treatment. Provided the activities conform to certain criteria, there are no statutory controls governing them, other than EC legislation covering sewage sludge disposal. Nevertheless, the NRA is committed to limiting this activity in Source Protection Areas, which is being achieved by enlisting the co-operation of disposal contractors in their use of land.

- Discharges to underground strata include both surface water and effluents from agriculture and industry. In many instances this is positively encouraged, as for example where roof drainage from new developments is directed to soakaways to assist aquifer recharge and reduce the 'flashy' discharge to watercourses. Nevertheless, there will also be areas where the aquifer is vulnerable to long term contamination. "No-go areas" for septic tank use are already in force.

- The inner Source Protection Zone (when identified) will be that land within a 50-day travel time of the source. Certain specific activities within this zone will be opposed through the planning process as a result of this policy.

- Diffuse pollution is by its definition not attributable to any one location, and is therefore principally governed by land use and land management. Other than by the creation of "Water Protection Zones" and "Nitrate Sensitive Areas", opportunities for the NRA to influence this, other than by persuasion are limited. Nevertheless policies are outlined in the PPPG. (See also Section 3.6)

4.4 PHYSICAL FEATURES OBJECTIVES

4.4.1 General

This section will consider the general requirements for the physical features of the river channel and its corridor (i.e. adjacent land).

It is important to note that the management of the physical features of the river and its corridor may be equally important for some uses (e.g. conservation) as specific structural modifications.

4.4.2 Local perspective

For the uses identified in section 3, physical features objectives are identified as follows:

Development Control

- to ensure that all new development proceeds without detriment to the catchment through increased flooding or significant changes to the flow regimes of channels.

Flood Defence

- to ensure that the river topography remains suitable for the efficient passage of high flows and that control structures are adequately operated and maintained. To ensure that river weed is controlled within the constraints of the needs of the natural environment and the interests of fishermen.

Fisheries and Fishing

- to ensure that no obstructions exist to hinder the passage of migrating fish; to ensure that flows and bed conditions remain suitable for spawning.

Recreation

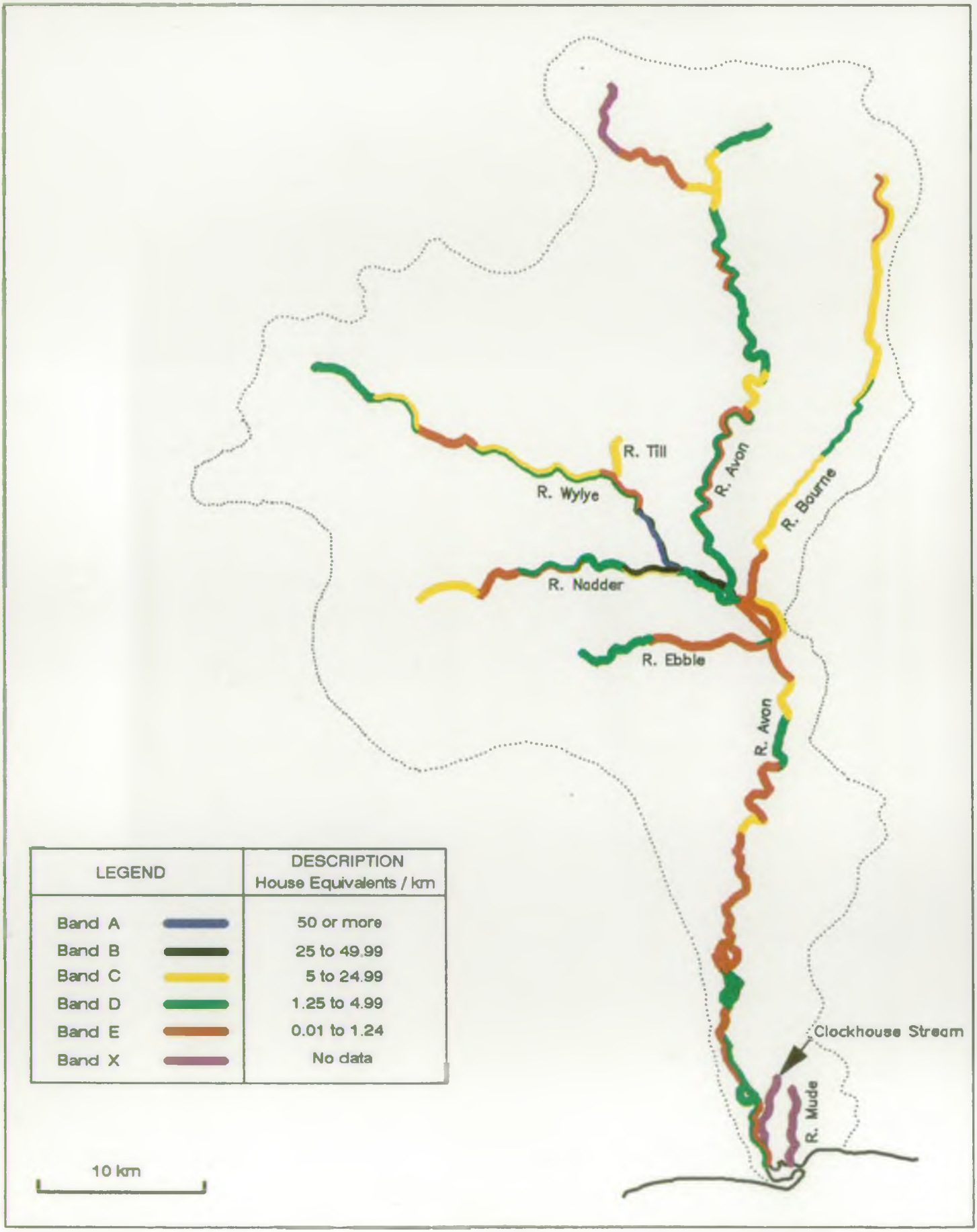
- To ensure that sufficient access is available to the river to support the recreation that can be pursued.

Conservation

- To provide the necessary variety of channel conditions, including depth, flow and substrate type to support the diverse plant and animal communities for which the catchment is noted.

To maintain the landscape features and character of the River Avon corridor.

HAMPSHIRE AVON CATCHMENT
FLOOD DEFENCE - OBJECTIVES



LEGEND	DESCRIPTION House Equivalents / km
Band A	50 or more
Band B	25 to 49.99
Band C	5 to 24.99
Band D	1.25 to 4.99
Band E	0.01 to 1.24
Band X	No data

NRA Wessex Region

4.5 FLOOD DEFENCE OBJECTIVES

4.5.1 General

A system is under development by the NRA to determine the present standard of service, being achieved for Flood Defence maintenance.

The system determines whether present levels of river maintenance have produced a level of protection within a target standard, above standard or below. The river system is divided into reaches between 4-7 km in length. An assessment is made of the "Land Use" by considering for each reach the agricultural or urban content within the flood plain and for each element (e.g. road, house, intensive grazing) a score is given. The score is measured by a single unit called a "House Equivalent" and by the score achieved, the reach is placed into one of several Land Use Bands (see map opposite). Typical land use relating to each band is as shown below.

Land Use Band	Description of Typical Land Use
A	A reach containing the urban elements of residential and non-residential property distributed over a significant proportion of its length, or densely populated areas over some of its length. Any agricultural influence is likely to be over-ridden by urban interests. Amenity uses such as parks and sports fields may be prominent in view of the floodplain's proximity to areas of population density. Band A = 50 or more house equivalents /km
B	Reaches containing residential and/or non-residential property either distributed over the full length of the reach or concentrated in parts but characterised by lower densities than Band A. Band B = 25 to 49.99 house equivalents /km
C	Limited numbers of isolated rural communities or urban fringe at risk from flooding, including both residential and commercial interests. Intensive agricultural use could also be included. Band C = 5 to 24.99 house equivalents /km
D	Isolated, but limited number of residential and commercial properties at risk from flooding. Agricultural use will probably be the main customer interest with arable farming being a feature. In undeveloped pockets of largely urban use, amenity interests may be prominent. Band D = 1.25 to 4.99 house equivalents /km
E	There are likely to be very few properties and major roads at risk from flooding in these reaches. Agricultural use will be the main customer interest with either extensive grassland or, where the flood plain extent is small, arable cropping being the most common land uses. Amenity interests are likely to be limited to public footpaths along or across the river. Band E = 0.01 to 1.24 house equivalents /km

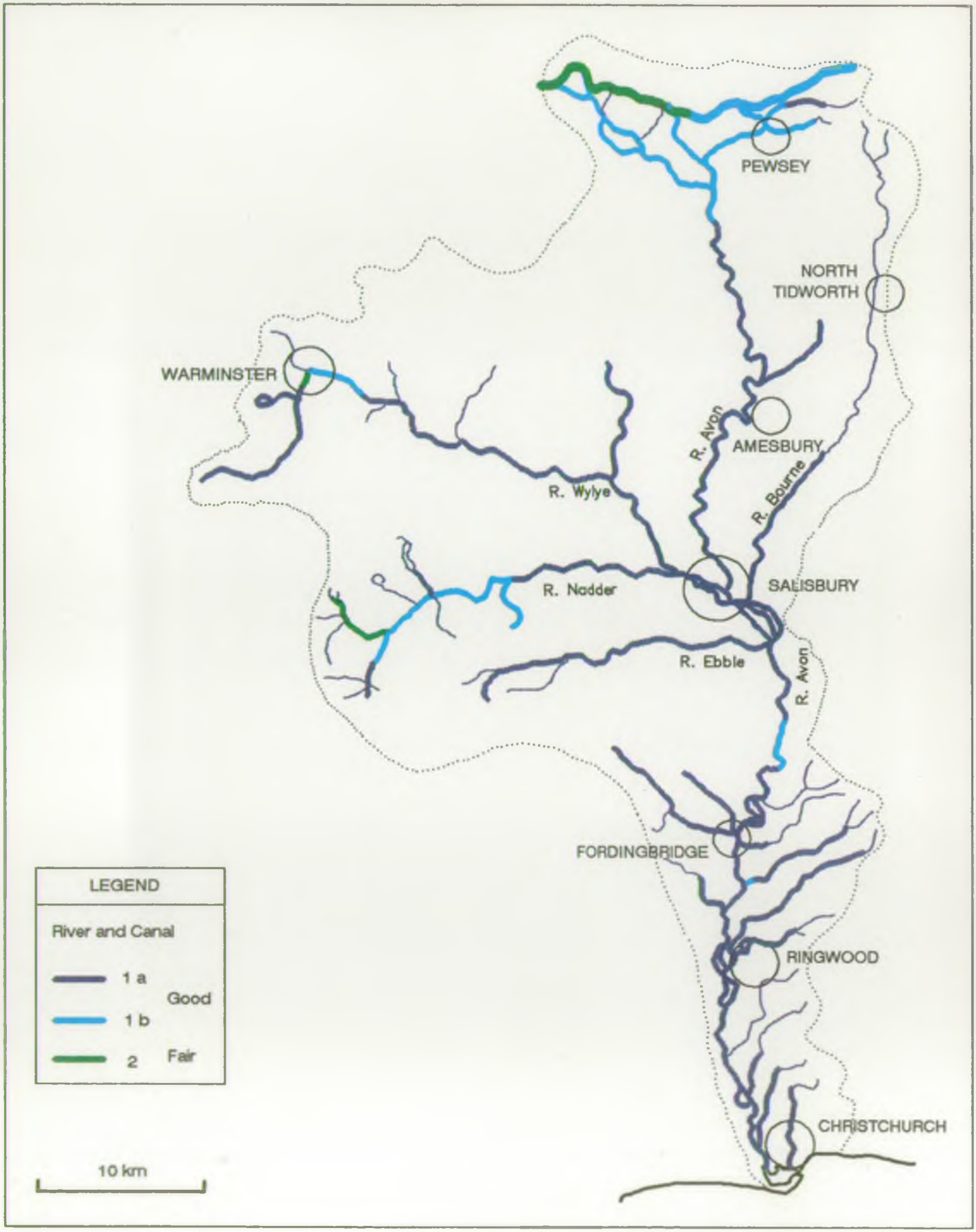
4.5 FLOOD DEFENCE OBJECTIVES - CONTINUED

4.5.2 Capital Works

The target standard for urban flood defence schemes is a return period of 100 years of higher, although a lower standard can be accepted if this is all that can be justified by a cost/benefit analysis.

HAMPSHIRE AVON CATCHMENT

NWC RIVER QUALITY 1990



NRA Wessex Region

5.1 STATE OF THE CATCHMENT: WATER QUALITY

5.1.1 General

Having set water quality objectives and targets it is possible to assess the state of the catchment against these targets. The assessment has been made using data from the routine water quality sampling programme. A three year period (1989-1991 calendar years) has been taken.

The map opposite indicates stretches where water quality does not meet Long Term River Quality Objectives (LTO) Classification and use related standards.

5.1.2 Failures to Meet Standards

(a) Western Avon - failure to meet LTO (Class 1B) for BOD, ammonia and dissolved oxygen on some stretches. These failures are most likely related to farm discharges but several small sewage works may also contribute. Use related standards (salmonid fishery) are also infringed on some stretches. Considerable efforts to control farm discharges in this sub-catchment have been made over many years and the effects detected are thought to reflect the impact of what is essentially 'good agricultural practice'. The LTO of Class 1B may be an unrealistic target for the whole of the tributary with the current mix of agricultural land use in the catchment.

(b) Eastern Avon - failure to meet LTO (Class 1A) for BOD. The reasons for this failure is not clear. If either sewage or farm discharges were responsible then elevated ammonia concentrations (and non-compliance) would be expected.

(c) Upper Avon (upstream of Netheravon) - marginal failure to meet LTO (1A) in terms of BOD and ammonia. Most likely the residual impact of Eastern and Western Avon qualities.

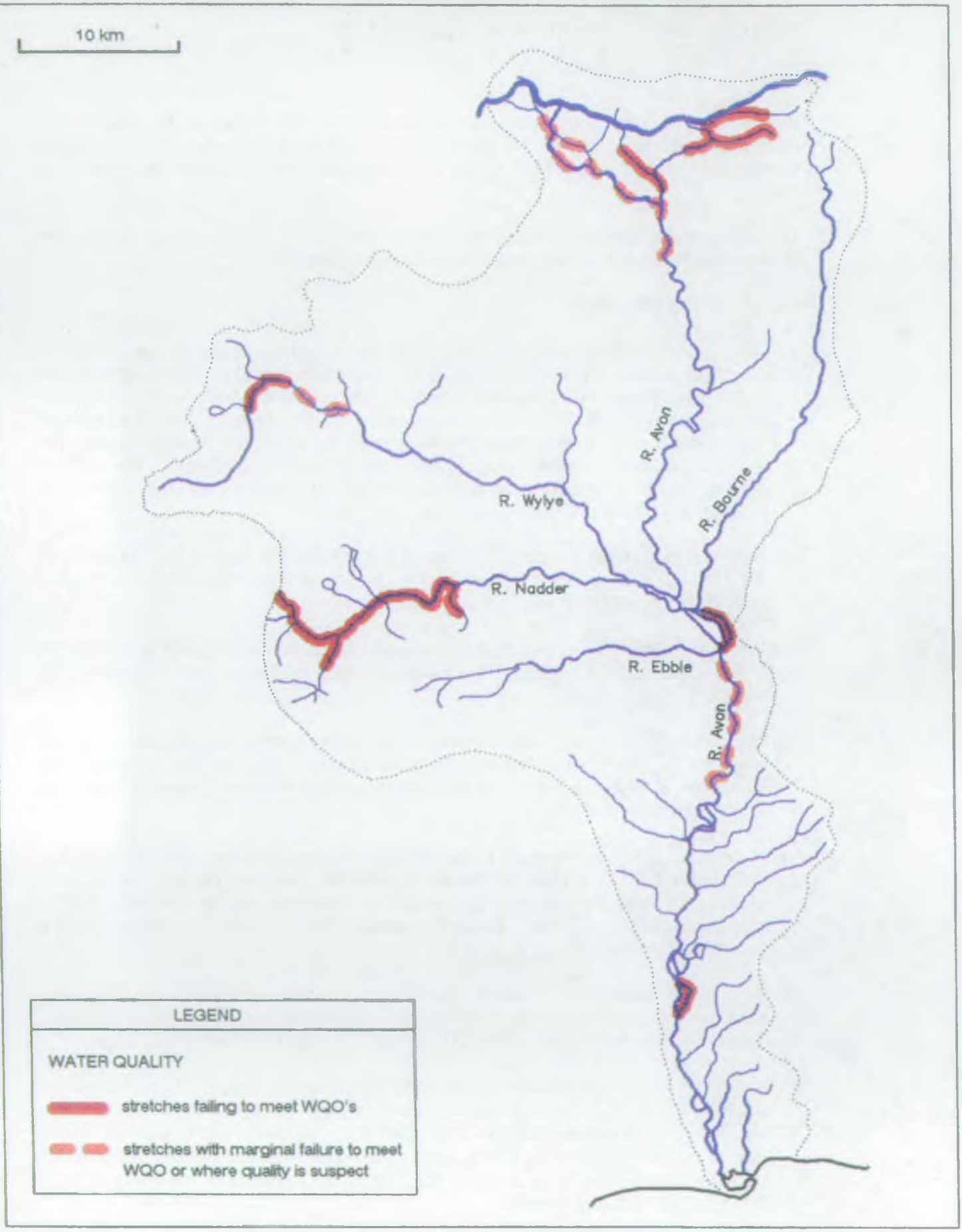
(d) River Wylye (Warminster) - failure to meet LTO (Class 1A and Class 1B) and use related standards for BOD, ammonia and dissolved oxygen. The problem is caused by Warminster STW discharge but other problems (possibly storm overflows or surface water discharges may contribute).

(e) River Sem - failure to meet LTO (Class 1B) for BOD and ammonia. Problems are due to the impacts of dairy farms in this small catchment with clay geology. Substantial water quality improvements have been made in recent years and the scope for further improvements may be limited. The achievement of the LTO may be unrealistic whilst current land use obtains.

(f) River Nadder (upstream of Tisbury) - failure to meet LTO (Class 1A) for BOD and ammonia. Water quality in this stretch reflects agricultural land use in both the Upper Nadder and Sem catchments. The LTO of Class 1A may be an unrealistic target.

(g) Hampshire Avon (downstream of Salisbury STW) - failure to meet LTO and use related standards for BOD, ammonia and dissolved oxygen in the Old River (Petersfinger Channel) downstream of Salisbury STW discharge. Salisbury STW receives initial dilution in the Old River in which flow is dependent on the overall operation of hatches within the Britford area (see 6.23). Under most conditions the dilution for Salisbury STW effluent is limited.

HAMPSHIRE AVON CATCHMENT
STATE OF THE CATCHMENT - WATER QUALITY



NRA Wessex Region

5.1 STATE OF CATCHMENT: WATER QUALITY - CONTINUED

5.1.2 Failures to Meet Standards

(h) Hampshire Avon (downstream of Britford to Standlynch) - marginal failure to meet LTO for dissolved oxygen. Much of the Lower Avon is characterised by a very large diurnal variation in dissolved oxygen concentrations which is typical of rivers with dense growths of aquatic plants. The oxygen demand resulting from Salisbury STW, when superimposed on the natural variations, appears to be leading to minimum oxygen concentrations which are of concern.

(i) Hampshire Avon (Downton-Hale) marginal failure to meet LTO for dissolved oxygen and ammonia. This is likely to reflect the impact of a large fish farm upstream of Downton superimposed on the impacts described under (h) above.

(j) Hampshire Avon, Bickerley Mill Stream (downstream of Ringwood STW) - Failure to meet LTO and use related standards for BOD and ammonia. Flows in the Mill Stream are controlled by upstream hatches which are operated such that only limited dilution is available for Ringwood STW effluent. There is public access to the Mill Stream which adds a further dimension to this issue.

(k) Lower Avon, Matchams and Knapp Mill - marginal periodic failure to meet EC Standards for pesticides in drinking water. The pesticides concerned are atrazine and simazine and the occurrence of these pesticides has been identified in the Avon downstream of Salisbury and in the River Nadder. The source has not been identified. The concentration of pesticides detected below are those believed to affect river life.

5.1.3 Other Water Quality Issues

In addition to issues arising from failures to meet specified standards the following water quality issues have also been identified.

(a) Fovant - groundwater contamination with pesticides. Water abstracted from the Wessex Water Services public water supply source has been found to contain pesticides in excess of the EC limit for drinking water. A special treatment plant has been installed to remove those pesticides.

(b) Newton Toney - groundwater contamination with chlorinated solvents. Water abstracted from the Wessex Water Services public supply source has been found to contain organic solvents in excess of the EC limit for drinking waters. A special treatment plant has been installed. The source of these contaminants is almost certainly MOD sites in the vicinity. Abstractions operated by the MOD are also affected. The cause is probably historic disposal practices. Disposal arrangements have been improved in recent years.

(c) Storm sewage overflows and surface water drainage - local impacts from both these sources have been identified in the catchment.

(d) Watercress farms - the use of chemicals and the discharge of solids from some farms has given cause for concern with local impacts being detected.

5.1 STATE OF CATCHMENT: WATER QUALITY - CONTINUED

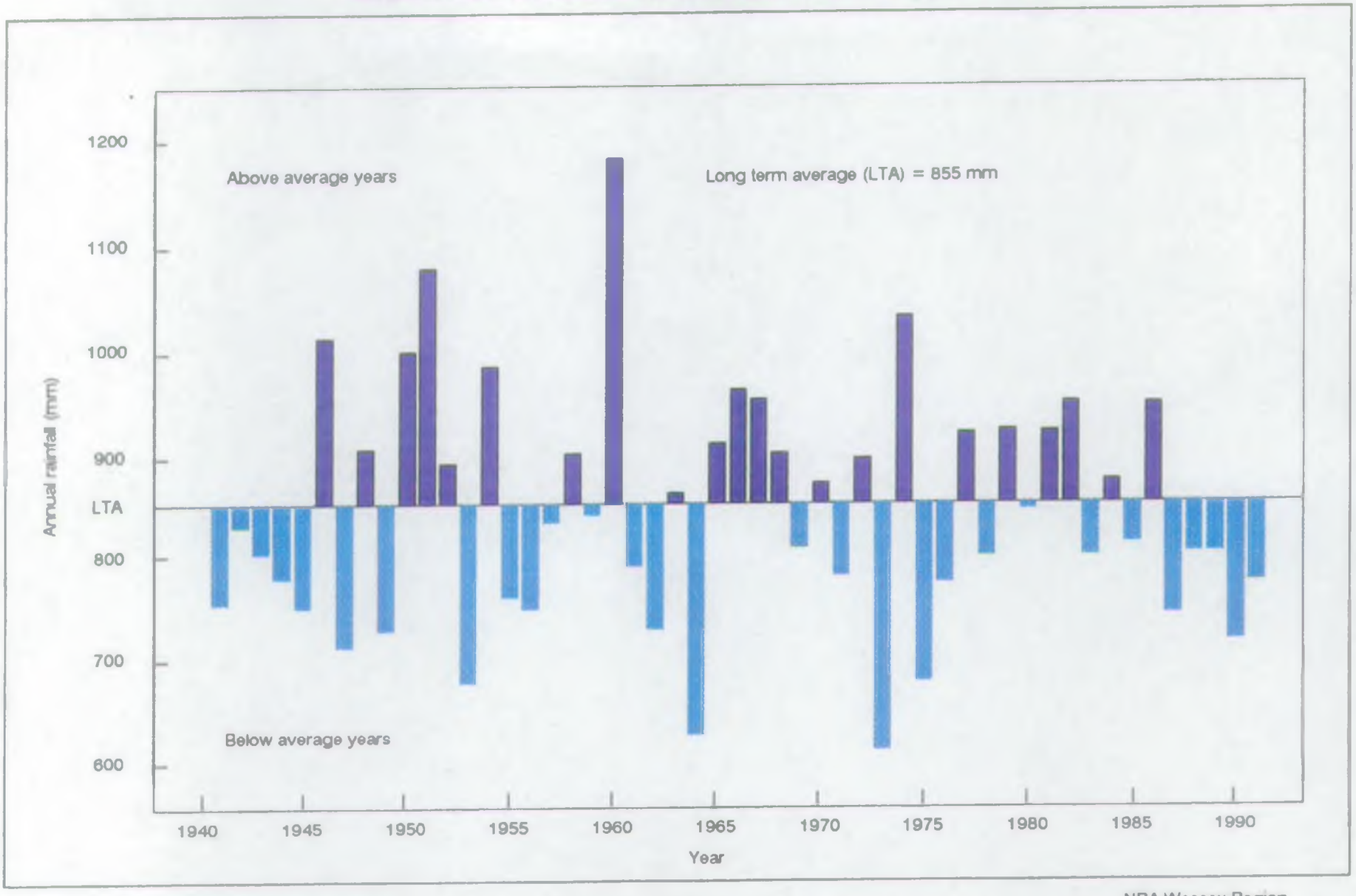
5.1.3 Other Water Quality Issues (continued)

(e) Fish Farms - although improvements in the quality of effluents from many fish farms have been achieved in recent years, the potential impact of the larger farms remains of concern.

(f) Christchurch Harbour - microbiological quality. The microbiological quality of the harbour is frequently raised in relation to water contact recreational uses (e.g. boardsailing and sailing). No health related microbiological standards are yet available for such uses although the development of such standards has been considered by the NRA in the context of Statutory Water Quality Objectives.

(g) Nutrient Status - No generally applicable criteria are available for the classification of the nutrient status of rivers. However, there appear to be ecological changes within the Hampshire Avon system which may be related to the concentrations and availability of plant nutrients. The EC Nitrate Directive and EC Urban Waste Water Directive provide for 'vulnerable zones' and 'sensitive areas' respectively. Such designations are intended to reflect waters in need of protection from nutrient enrichment. The status of the Hampshire Avon in relation to the criteria for identification of 'vulnerable zones' or 'sensitive areas' is under examination.

WESSEX REGION
GRAPH OF ANNUAL RAINFALL FROM 1941 TO 1991



NRA Wessex Region

5.2 STATE OF THE CATCHMENT: WATER QUANTITY

5.2.1 Water Resources

At any given time the availability of water resources will be a function of the antecedent rainfall, the capacity for storage of that rainfall and the manner in which it is being exploited.

The variability of rainfall is demonstrated on the graph of Annual Rainfall (shown opposite) where it can be seen that not only is the catchment subject to occasional annual extremes but also to regular longer events of below average rainfall. It is misleading to accept rainfall alone as an indicator of available resources since it is subject to evapotranspiration. It is the residual, or 'hydrologically effective rainfall', that determines the quantities replenishing groundwater and river flows. Thus while the drought period April 1975 to March 1976 experienced a total rainfall of 64% of average for the region, the effective rainfall was only 20% of long term average.

The storage of rainfall excess depends almost entirely on natural features in this catchment. Only very recently have attempts been made to deliberately create surface storage reservoirs to detain water for later use. The catchment is blessed with extensive exposures of the Chalk aquifer with a vast natural underground storage capacity. In the Upper Nadder, Greensand also forms an important aquifer. Elsewhere in areas where the Chalk is confined below more recent deposits the superficial deposits of Sands and Gravels provide a degree of storage important to the small tributary streams in the south.

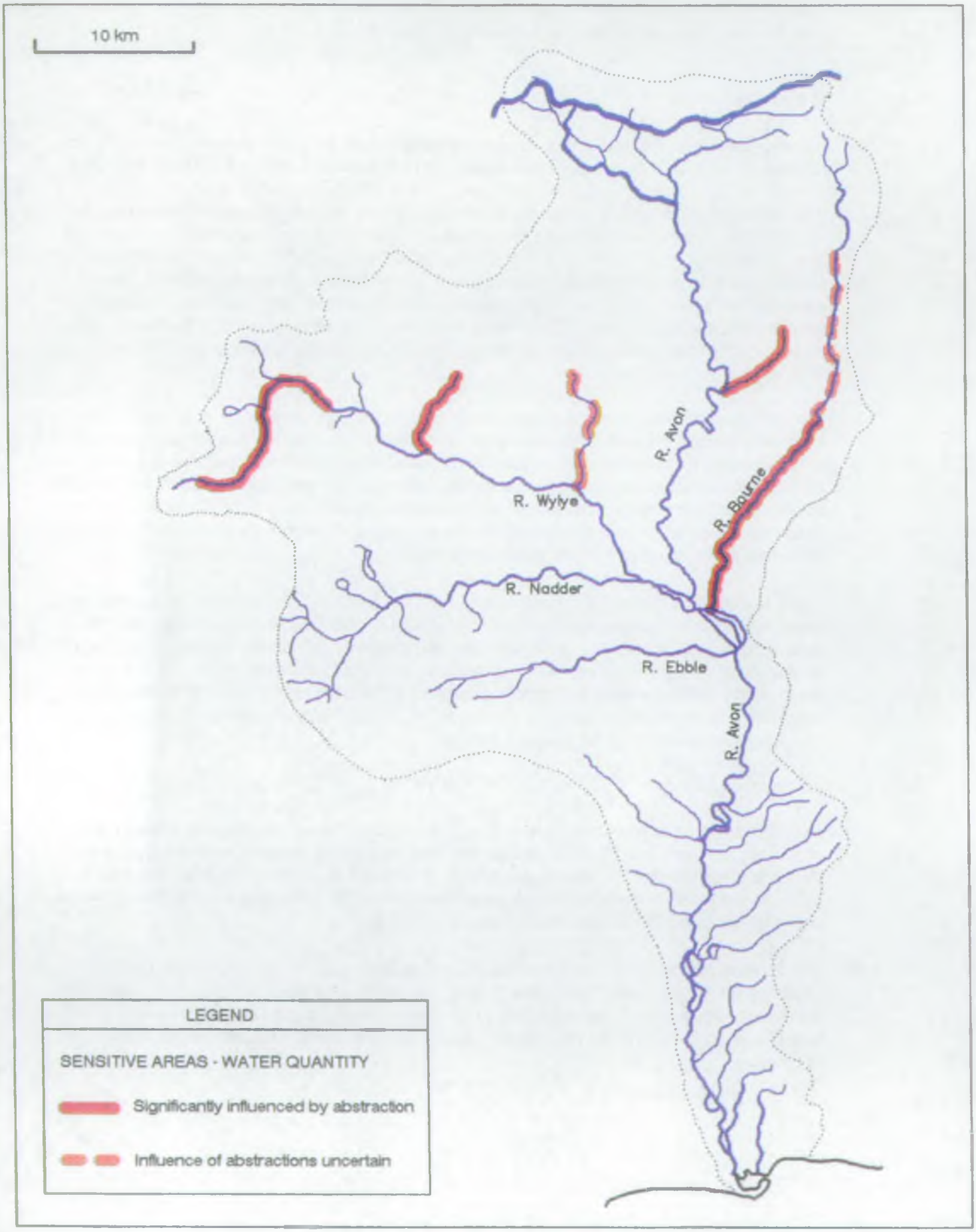
There is a contrast between the northern and southern parts of the catchment in the way the water resources are exploited. In the areas of Chalk and Greensand exposure the usual practice has been to develop wells and boreholes; taking advantage of the reliability of groundwater storage as well as the high quality of naturally filtered water. In the Lower Avon, while shallow wells in the gravels offered an alternative, major supplies of water were made available direct from the river, relying on its steady replenishment from the upstream Chalk aquifer even during the severest draught.

5.2.2 Abstraction Licences

Exploitation of water resources by abstractions for various uses is dominated by three classes of abstractor: water supply undertakings; fish and watercress farmers; and the Ministry of Defence. Only the first two classes are subject to the need to obtain abstraction licences and although the MOD is essentially in the same business as the first class, its supplies of water are in the main locally acquired and locally disposed of.

Fish farmers require very large quantities of high quality water to sustain their activities and this is particularly so along the Lower Avon. The local difficulties that can arise from this are described elsewhere in this report but in catchment terms the use of water resources in this way is non-consumptive; the volumes of water are returned to the mainstream little changed in quantity.

HAMPSHIRE AVON CATCHMENT
STATE OF THE CATCHMENT - WATER QUANTITY



NRA Wessex Region

5.2 STATE OF THE CATCHMENT: WATER QUANTITY - CONTINUED

5.2.2 Abstraction Licences (continued)

Water Supply undertakings, however, exert a more significant influence on the distribution of water resources; moving water large distances from its origins and indeed removing large quantities from the catchment altogether. The catchment is a major source of water for both public water supplies and industrial use and water is exported to other catchments where conditions for suitable resource developments are less favourable.

Abstraction of water in itself does not necessarily radically modify the water environment; losses during consumption, changes in quality and its return to locations remote from source all contribute to changes to the water resource system.

5.2.3 Groundwater Resources

Major abstractions of water from boreholes in the Chalk of the northern area of the catchment have followed the convention that the annual excess rainfall which recharges our aquifers can be retrieved by pumping without detriment to streamflows. The high quality and security of groundwater together with comparatively low cost of development and maintenance have ensured its development in preference to surface waters. Traditionally borehole sources were developed within easy reach of the communities they were to serve and a minimum of distribution, treatment and pumping costs were incurred.

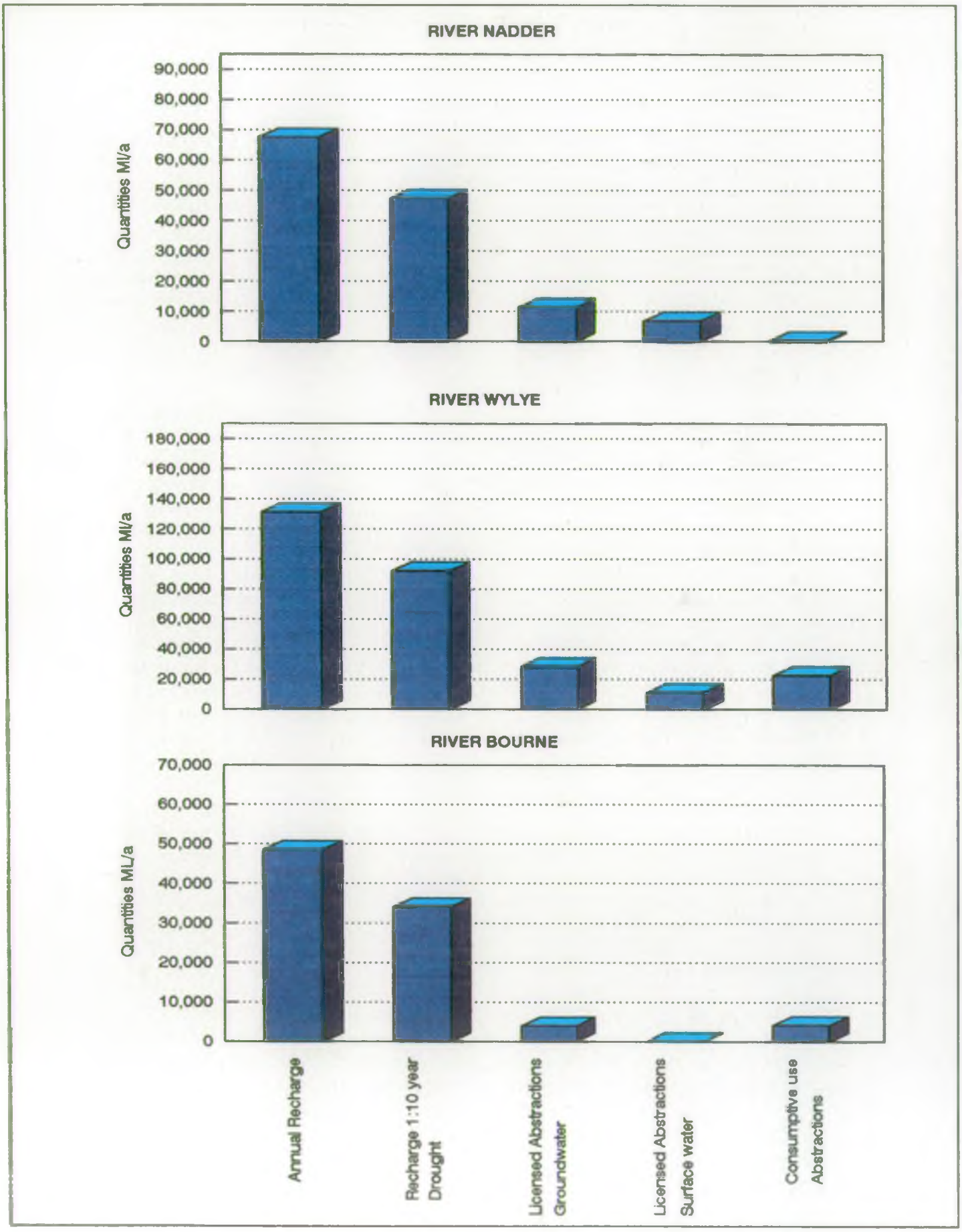
Although such sources of water are abundant in the Upper Avon Catchment little attention has in the past been given to assessing the combined impact of groups of sources on the water environment. The exception is in the River Wylye Catchment where the largest development occurs. Here a detailed investigation of the hydrology was made before the granting of new licences as a group from Brixton Deverill to Codford and conditions were imposed which were intended to protect the aquifer and streams against the effects of abstraction. These are now under review within the context of NRA - Wessex Region's Low Flow Alleviation studies.

It follows that in utilising storage by pumping from boreholes the natural regime of hydraulically connected streams will be modified. It remains to be seen from current studies of these effects to what extent streamflows have been disturbed. Even if the general impact of groundwater abstractions may have a significance difficult to equate with measurable loss of river habitat or amenity it is quite probable that localised effects of individual boreholes or pairs of boreholes have been substantial.

5.2.4 Surface Water Resources

Comments are made above and elsewhere on the scale and effect of fish farming. The other major user of surface water resources is the public water supply undertaker. In the Avon Catchment there are three such undertakers, each of which utilises surface water intakes concentrated in the lower reaches between Ibsley and Christchurch.

HAMPSHIRE AVON MANAGEMENT PLAN
WATER BALANCE (Fig 1 of 2)



NRA Wessex Region

5.2 STATE OF THE CATCHMENT: WATER QUANTITY - CONTINUED

5.2.4 Surface Water Resources (continued)

The longer-established licences at Matchams and Knapp Mill are not constrained by protected river flows. Abstractions may continue up to the licensed limit regardless of the dry weather flow in the river. The more recent licence for the Blashford Lakes complex limits abstractions to those periods when river flows exceed a prescribed flow; at other times the storage in the lakes must be mobilised to satisfy consumption.

These abstractions at the lower end of the Avon represent the largest component of loss of surface water resources. Consumption of the water is mostly significantly downstream or out of catchment and not returned. The consequences are not obvious but at times of low river flow it is reasonable to believe there will be an influence on the behaviour of migratory salmonids.

5.2.5 General

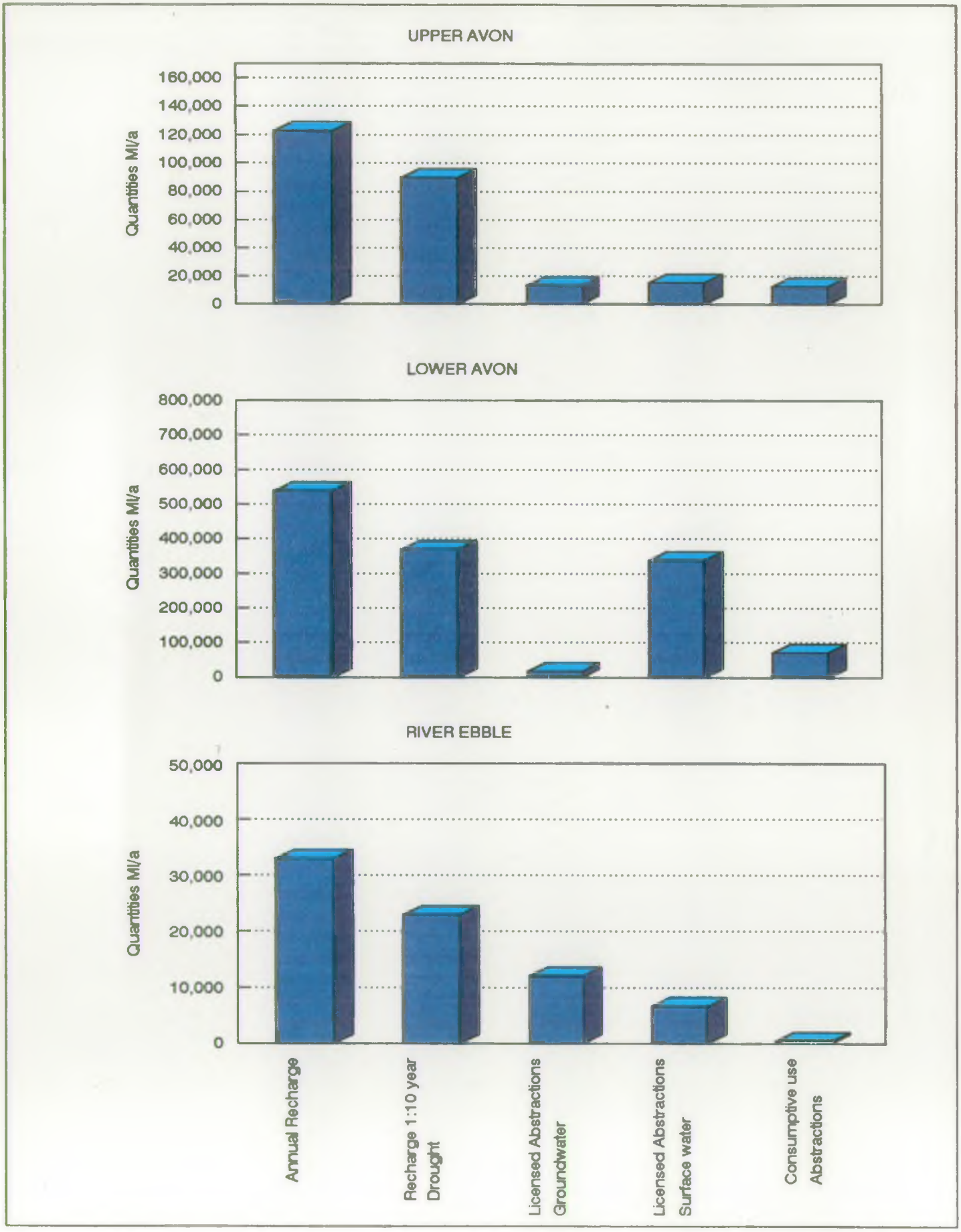
Where there are valid requirements for water abstraction and competition arises with other river uses there is a need to strike a balance between the various interests to secure an optimum development of resources. This must be undertaken within a framework to satisfy proper protection of the natural environment. A simple picture of the existing balance within each sub-catchment can be seen from figures 1 and 2. These are preliminary illustrations which will be progressively refined and do not attempt at this stage to demonstrate the nett effect of abstractions.

There is clearly an existing high demand for water use for drinking water purposes, industry and agriculture and this demand is increasing. Equally it is clear that the available water resources within the Hampshire Avon Catchment are capable of further sustainable development. Such development must however be achieved without detriment to stream flows. Future water resources management will need to include a judgement as to the degree to which future demands can be met and to optimise development and use of the resources.

Historic piecemeal developments of water sources has left a pattern of largely uncoordinated resource development systems. The effects of these in so far as they may have caused a decline in ecosystems or in the amenity value of streams are still under review. The scope for change will be linked with opportunities to consider how individual sources can be brought into the control of a conjunctively managed number of sources; where a greater benefit might be obtained in terms both of yield and of streamflows. Thus the groundwater sources in the north currently isolated from the southern river intakes, might make a future bigger contribution to public water supplies by their occasional use to regulate river flows for abstraction further downstream.

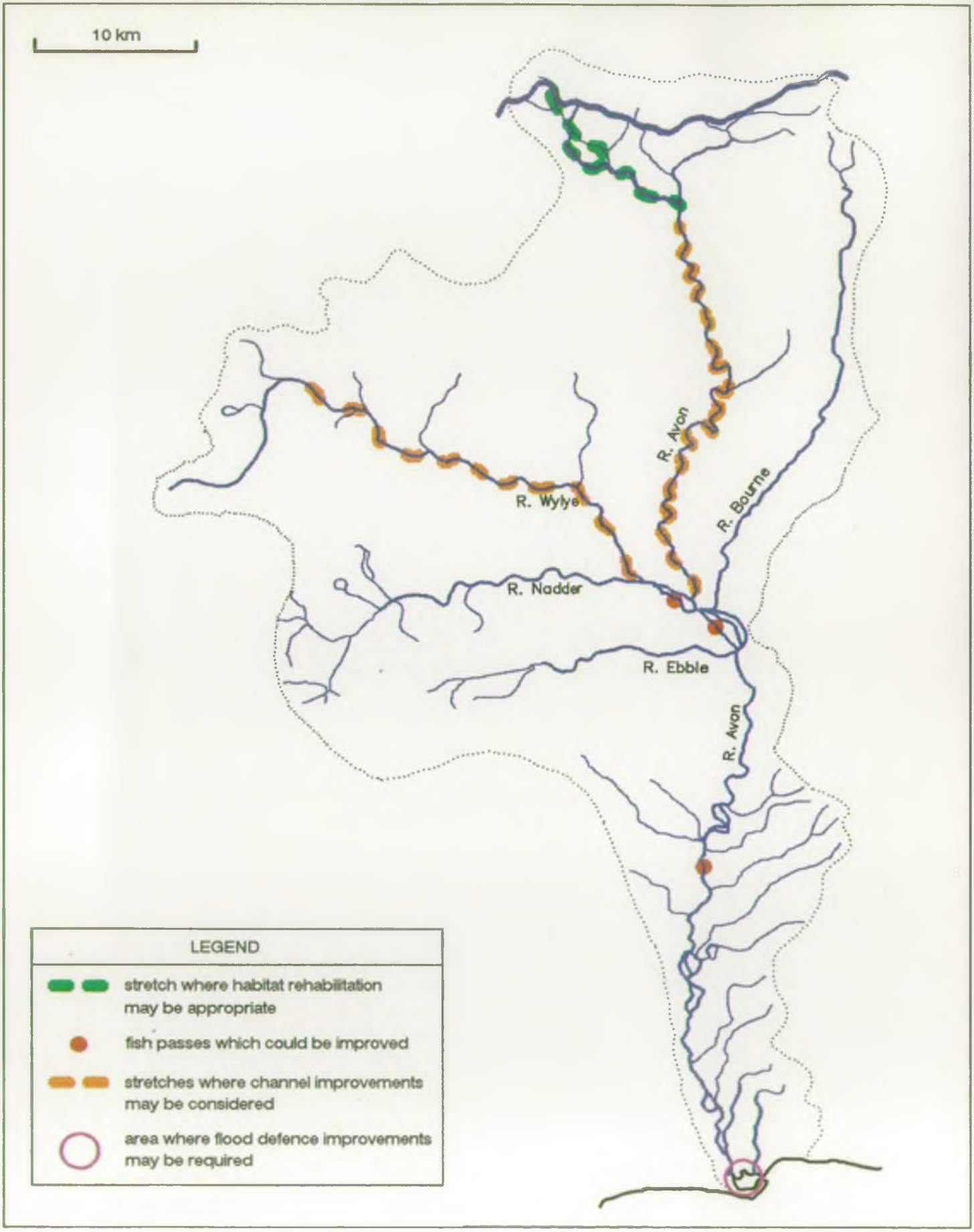
In considering changes necessary to resolve present environmental difficulties or to meet increased demands, the key to successful catchment management remains a faithful observance of the now well published NRA policy of meeting large demands for water abstractions from sites near the mouth of the river. This will need associated storage reservoirs near to the river valley.

HAMPSHIRE AVON MANAGEMENT PLAN
WATER BALANCE (Fig 2 of 2)



NRA Wessex Region

HAMPSHIRE AVON CATCHMENT
STATE OF THE CATCHMENT - PHYSICAL FEATURES



NRA Wessex Region

5.3 STATE OF THE CATCHMENT: PHYSICAL FEATURES

5.3.1 General

It has proved difficult to assess the current state of physical features against the somewhat diverse and subjective criteria which are described in 4.4.

In many cases, investigation work is required to determine whether physical features improvements or enhancements are necessary and/or practical.

However a number of issues have been identified and are summarised below.

5.3.2 Issues

(a) Some stretches of river channel which have been subject to flood defences schemes (mostly in the 50's and 60's) could benefit from some habitat rehabilitation.

(b) Some other stretches of river channel may be capable of physical improvement with benefits to fisheries, nature conservation and landscape.

(c) Silt is of considerable concern in the catchment and both its control and management within the river system should be addressed.

(d) There are few obstructions to fish movement but fish passes at Harnham, Bickton and Britford could be improved.

(e) Management of weirs and hatches could be improved generally, with significant issues arising in some locations eg. Britford.

(f) Weedcutting has significant impacts on water depth and the physical river environment and impacts on several uses. In the longer term, especially taking the ESA proposals into consideration, there may be scope for reduction or elimination of weedcutting by the NRA.

(g) Although not strictly under the 'physical features' heading, the issue of public access in terms of footpaths, picnic areas and interpretation facilities has emerged.

(h) It is clear that there is increasing demand for water-based recreation and the management of boats in Christchurch Harbour and the potential for recreational use of the Avon are issues.

5.4 STATE OF THE CATCHMENT: FLOOD DEFENCE

5.4.1 Maintenance

As described in 4.5.1 above, the formal system for assessing compliance with maintenance Standards of Service is not yet in operation as the levels of protection have not been fixed. When this has been achieved, the Authority's maintenance programme will be re-assessed and any necessary changes proposed will be discussed through the normal consultation process.

5.4.2 Capital Schemes

The various urban flood alleviation schemes that have been carried out are shown on the map facing page 9. These achieve varying standards, as discussed in 4.5.2. For example, the Wilton (South Street) Scheme is designed to a 30 year return period, whilst Wilton (North Street) and West Harnham are to the preferred 100 year return period. The schemes at Salisbury, Fordingbridge, Downton and Ringwood were all designed in the 1960's to cope with the largest flood experienced (1960), without a specific return period being assigned.

5.4.3 Continuing Flood Risk

The presence of a flood alleviation scheme does not remove entirely the risk of flooding. Thus schemes which protect urban conurbations to a return period of less than 100 years should be considered still to have a medium risk of flooding, whilst a 100 year scheme will present a low risk. In addition, no matter what type of scheme has been implemented, a continuing programme of maintenance will be required to maintain the level of protection. It is considered however, that all existing schemes have performed satisfactorily in flood events following their construction.

The locations that are currently considered to be lacking the best protection that could be given are:

- Christchurch Harbour and Stour/Avon confluence area where properties are still at risk especially from the combination of tidal surge and river flood water from the Hampshire Avon and River Stour catchments.

- Tisbury, where flooding due to inadequate surface water drainage has been experienced in recent years. Since this is not associated directly with the Main River, the necessary powers to carry out works lie with the Local Authorities in the first instance.

6.1 IMPACT OF SEWAGE TREATMENT WORKS - WARMINSTER AND SALISBURY

6.1.1 Nature of Problem

Warminster STW

The Wylye downstream of Warminster STW exhibits elevated BOD and ammonia concentrations and fails to meet its Class 1B LTO for a distance of some 4 km.

There is an additional concern over the quality of the River Were which drains from the centre of the town and may be affected by storm overflows.

Salisbury STW

There are two aspects of concern downstream of Salisbury STW.

Firstly the river is divided into 3 channels in this area and the Old River, to which the sewage effluent is discharged receives limited flow (see Section 6.23 - Britford Area - flow apportioning). The Old River fails to meet its LTO and use related objectives upstream of its reunion with the Britford Carrier.

Secondly, there is some evidence that the oxygen sag below this discharge, when superimposed on the naturally large diurnal oxygen variation in the river caused by aquatic plants, results in unacceptably low oxygen levels at certain times.

Ringwood STW

There is a local problem downstream of the Ringwood STW in the Bickerly Mill stream. The problem is again lack of dilution in a divided river stretch.

6.1.2 Solutions

Warminster STW

This works is already scheduled for improvement by Wessex Water Services.

Salisbury STW

Neither problem downstream of Salisbury is simple to deal with and options for solutions include improving the flow in the Old River, relocating the outfall as well as tightening effluent standards. Further investigations are required.

Ringwood STW

Reapportioning of flow or resiting of the outfall are options for dealing with this.

6.2 IMPACT OF FARM DISCHARGES - WESTERN AVON, EASTER AVON, SEM AND NADDER

In general the Hampshire Avon Catchment is subject to less impact from livestock farming than many others in the Region. Significant impacts of such activities are restricted to sub-catchments which favour livestock farming because of soil type.

Considerable efforts have been made over the last 30 years to control farm wastes within these sub-catchments. This work has produced substantial improvements over the years with the River Sem Catchment receiving most attention in the recent past.

It is becoming clear that even when farming practices comply with 'good agricultural practice' it is difficult to achieve the very high water quality specified in LTO's for these catchments (Class 1A and Class 1B - see section 4.1). Their achievement could only be guaranteed by major changes in agricultural practice and reversion to extensive grassland systems.

It is unlikely that land use changes on the required scale could be achieved without some form of compensation scheme (eg similar to the ESA or NSA schemes).

Given these circumstances the LTO's specified in 1989 may have been unrealistic and they require re-examination.

However the NRA will continue to press for high standards of farm waste management in these catchments.

6.3 PESTICIDES IN THE LOWER AVON AND NADDER

Water Supply Undertakers (Water Companies) are required to monitor water supplies for compliance with the Water Supply (Water Quality) Regulations 1989. These basically reproduce the standards specified in the EC Directive on Water for Human Consumption.

The Regulations include standards for the total and any individual pesticide of 500 ng/l and 100 ng/l respectively. In the event that concentrations exceed these levels in any particular drinking water supply, the water undertaker is required to notify the Department of the Environment's Drinking Water Inspectorate and provide a statement of the date by which the infringement will cease and the action being taken.

The action taken typically involves treatment of the water to remove the pesticides and/or notification of the NRA who are required to consider possible control measures within the relevant catchment area.

In practice it has proven difficult for the NRA to identify specific sources of pesticides in such cases.

In the Hampshire Avon Catchment, levels of triazine pesticides which infringe the Water Quality Regulations have been detected at the Fovant groundwater source (operated by Wessex Water Services) and at Matchams and Knapp Mill abstractions from the Avon itself operated by the Bournemouth and District and West Hants Water Companies respectively. In the case of the River Avon the infringements are periodic and relatively short lived presumably relating to hydrological events in the catchment. However they remain of concern to the companies.

Triazine pesticides have in the past been used both in agriculture and for general weed control (e.g. by public utilities, local authorities and British Rail).

Within the river system, the major input of these pesticides appears to be the Nadder Catchment although specific sources have not been identified.

The Nadder Catchment includes a railway line and MOD establishments which could be potential sites of heavy (historic) use. In addition this pesticide is used on maize which is grown in substantial acreage in the catchment.

Some public authorities (including BR and Hampshire County Council) have now stopped using triazines because of the potential problem for water supplies, and the use of triazine for all non-agricultural purposes will be banned from August 1993. Its approval for use on maize will continue.

6.4 GROUNDWATER CONTAMINATION

6.4.1 Nature of Problem

There are two cases of groundwater contamination which are known within the catchment.

Fovant Borehole Source

Water abstracted for public supply from the Fovant borehole source (operated by Wessex Water Services) has exhibited triazine pesticide concentrations in excess of the Water Supply (Water Quality) Regulations 1989 standards (see 6.3).

Newton Toney Borehole Source

Water abstracted from the Newton Toney borehole source (operated by Wessex Water Services) has exhibited chlorinated solvent concentrations which exceed the Water Supply Regulation Standards.

6.4.2 Solutions

Fovant Borehole Source

Wessex Water Services have installed additional treatment plant to remove pesticides and the NRA has attempted to identify possible sources. The most probable source of the pesticide in this case is agricultural use (maize).

Newton Toney Borehole Source

Wessex Water Services have installed treatment plant for the removal of chlorinated solvents.

The most probable sources of the contaminants in this case were MOD sites. Substantial improvements to waste disposal systems and practices have been introduced at relevant sites in recent years.

6.5 MINISTRY OF DEFENCE BASES

6.5.1 Nature of Problem

The catchment of the Hampshire Avon above Salisbury has a considerable number of large military bases with thousands of service personnel and their dependants. One or two, such as Bulford, discharge to sewage works operated by Wessex Water Services Plc, but the majority have their own sewage treatment facilities. The largest include the Warminster School of Infantry, Larkhill, Tidworth, Boscombe Down and Porton Down.

As Crown establishments these dischargers are exempt from legal control under the Water Resources Act 1991 unless the dischargers voluntarily waive their exemption.

No Ministry of Defence (MOD) establishments in the catchment have chosen to waive their exemption although in the mid 80's the Property Services Agency (PSA) (who at that time were responsible for infrastructure works on all MOD sites) set up a register in each of their regional offices for the sites which they operated. This register included target standards for effluents together with effluent monitoring data. The former Wessex Water Authority was consulted on the target effluent standards.

It should be noted that PSA's overall role in the infrastructure management of Crown properties no longer obtains and individual bases or groups now make their own arrangements for the provision of these services. It is understood that the registers of information on effluent discharges from MOD sites is no longer held by the PSA regional office but by the works consultants employed by each base.

The NRA occasionally samples some of these discharges, but they are not part of the routine monitoring programme. Many of the discharges go to soakaways on MOD land, discharging to groundwater.

The information provided to Wessex Water Authority during consultation on target effluent standards was mainly concerned with basic engineering data and the domestic element of the sewage. Little information was available on the components of the sewage from other sources on the sites. It is known that most of these camps have workshop facilities of some sort. There is therefore the possibility that the discharges could contain heavy metals or de-greasing solvents. The NRA has little information relating to the potential pollution risks at these sites. There is at least one case where MOD sites appear the most probable source of groundwater pollution by chlorinated solvents (see 5.1)

6.5.2 Solutions

Because the NRA and its predecessors had little direct control over discharges had little direct control over discharges and pollution risks on MOD sites they have historically been given relatively little attention.

There appear to be a number of initiatives which indicate a greater awareness of pollution issues within the MOD. For example the NRA has recently been consulted on surface water and foul sewage disposal as part of proposals for redevelopment at Tidworth.

6.5. MINISTRY OF DEFENCE BASES - CONTINUED

6.5.2 Solutions (continued)

There is a clear need for improved liaison arrangements between the NRA and those responsible for the operation of the various MOD sites in the catchment if the benefits of improvements are to be maximised. Clarification of responsibilities at each site is particularly necessary following the changes which have removed the overall coordinating role of PSA.

6.6 STORM SEWAGE OVERFLOWS AND SURFACE WATER RUNOFF

6.6.1 Nature of Problem

In the past the discharge of dilute sewage and surface water runoff during storms has been generally ignored. However as a result of improved monitoring, higher environmental awareness and expectations, and improvements in continuous discharges, the effects of rainfall-induced discharges have become more significant.

Surface water runoff can be as strong and polluting as crude sewage in the first flush. In separately sewered areas wrong connections of foul drainage are not uncommon and these add to the polluting load. When surface water runoff discharges to watercourses with low dilution, it can have a major ecological impact. In studies in other areas these discharges have been implicated in destroying salmonid spawning areas by direct toxic effects and by siltation of spawning gravels. Some discharges of surface water from industrial areas in this catchment are, from time to time, polluted with industrial materials and oil.

6.6.2 Solutions

As a result the NRA has begun to apply more attention to the most significant polluting sources of this type. These are sewer and pumping station storm overflows, surface water runoff from industrial areas and highway drainage. Surface water runoff from urban areas is significant in some areas. Attention has therefore focused on specific urban discharges, which are being identified for priority attention.

Wessex Water Services have agreed a sewer survey programme with the NRA. They are surveying all sewerage systems and modelling the flows in the sewers and the operation of overflows. In the light of these surveys and model output, the NRA is specifying a programme of improvements for each sewerage system, in order to protect water quality. Consultation is in progress on Salisbury sewers and reports are expected shortly on Wilton, Amesbury and Fordingbridge. Reports on Downton, Pewsey and Warminster are due during the next three years.

In order to reduce the impacts from surface water runoff it will be necessary to insist on effective oil interception and solids settlement on some surface water drainage systems. This will involve making an input at planning stage on new and extended drainage systems. It will also involve approaching owners of existing drainage systems to add additional treatment stages by reviewing consents.

6.7 BLASHFORD LAKES INTAKE

6.7.1 Nature of Problem

The intake to the Blashford Lakes Water Storage Scheme is located in the millstream at Ibsley. This stream, which is used for trout fishing by Christchurch Angling Club, is owned by Somerley Estate (Lord Normanton). It leaves the main river above the big weir and rejoins about 1/4 mile downstream.

At the design stage, the NRA Wessex Region Fisheries Department requested that an intake be constructed in the bed of the river such that fish would not be sucked in. The intake beds consist of beds of stones on a grille and the water is sucked from the river through the beds. The operation of the intake is computer controlled such that almost any pattern of bed use and backwashing can be arranged in response to the accumulation of debris on the beds.

After construction, the intake was not used for many months. In 1991 Wessex Water Services decided that they wanted to make it operational and backwashed a part of the intake. This backwashing was witnessed by fishery interests and caused great concern because of the large amount of accumulated silt, debris and algae which was "blown off" and flowed down the river causing much discolouration and (claimed by the angling club) driving trout out of the millstream. As a result of this concern a meeting was held at the intake to discuss the problem.

6.7.2 Solutions

It was decided that there would be a careful programme of backwashing which would be monitored to clear the filter with regular routine backwashing to keep it clean. If the backwashing caused too much pollution then Wessex Water Services would have to revise their plans and possibly use mud suction devices to remove the silt.

The backwashing was carried out in January 1992 and the intake is now clear and being routinely backwashed at night every few days. This is stopping any further accumulation of silt. Wessex Water Services are now paying for the removal of the silt which settled in the rest of the millstream and hopefully this will resolve the problem.

It is considered that the process of backwashing the intake is subject to the issue of a Consent to Discharge by this Authority. It has not been consented hitherto, due largely to the difficulties in deciding what conditions should be applied to this unusual activity, and also because it is not appropriate to issue the consent until it was known that the discharge could be made satisfactorily. These investigations are proceeding.

6.8 IMPACT OF WATERCRESS FARMS

6.8.1 Nature of Problem

During the cleaning of watercress beds, large concentrations of silt can be released which if allowed to discharge can give rise to complaints by downstream riparian owners and users.

In order to control Crookroot, a disease of watercress, farmers have applied zinc at low concentrations in solution to the water supplied to watercress beds. Some concern exists that this could lead to a build up of zinc in sediments with consequent effects on aquatic life.

Watercress farmers apply pesticides to watercress to control beetles and other macroinvertebrates. There is concern that the applied pesticide could leach out into the receiving watercourse.

In some cases, watercress growers may use hypochlorite solution to ensure that cut cress meets Public Health requirements. Disposal of the spent hypochlorite solution could give rise to pollution.

Most watercress farms have not been subject to effluent control by consent.

In some cases, boreholes at watercress farms increase stream flow such that if watercress farming were to be discontinued, the stream flow would be considerably diminished which would give concern to downstream riparian owners and users who have become used to the enhanced stream flow.

6.8.2 Solution

Following the recent completion of detailed discussions with the watercress industry, effluents from all watercress farms will now be consented by the NRA.

Watercress farmers are now designing and installing settlement facilities to be able to comply with suspended solids limits in effluent discharge consents.

Growers only use pesticides for which MAFF has given provisional approval for off-label use.

6.9 WATER QUALITY OF CHRISTCHURCH HARBOUR IN RELATION TO RECREATIONAL USES

6.9.1 Nature of Problem

Christchurch Harbour is effectively the joint estuary of the Hampshire Avon and Dorset Stour. Water entering the harbour reflects the quality of these two rivers. In terms of bacteriological quality these rivers reflect both general catchment activity (e.g. from agricultural livestock) and point source discharges (e.g. STWs discharging to the rivers).

The Harbour is extensively used for water contact recreation, notably boardsailing.

There is widespread concern about the bacteriological quality of the Harbour and possible health risks to those involved in water contact sports. A number of cases of illness as a result of such contact have been claimed.

A related issue is the more general one of bacteriological quality of the river at inland sites where bathing or other water contact may take place.

6.9.2 Solution

The NRA recognises that the bacteriological quality of waters used for water contract sports is a legitimate concern of those who take part. However no health related bacteriological standards are available against which objectives or targets can be set. The NRA has sponsored some research relevant to of this problem and has recognised this issue in developing a framework for Statutory Water Quality Objectives.

However with the current state of knowledge the NRA is not certain that the development of meaningful health related standards is technically possible.

If such standards were to be introduced it is likely that one implication would be the need for disinfection of sewage effluents in relevant areas. Even with the implementation of such measures, the control of bacteriological inputs from more diffuse sources in the catchment would be impossible and compliance with any standard might not be possible.

6.10 EUTROPHICATION

6.10.1 Nature of Problem

Eutrophication is considered here to be nutrient enrichment of waters which results in the stimulation of an array of symptomatic changes, among which increased production of algae and macrophytes (aquatic plants), deterioration of water quality and other changes, are found to be undesirable and interfere with water uses.

On the Hampshire Avon the 'change' or perceived deterioration in water quality over the last couple of decades has manifested itself usually in relation to complaints of the smothering of the bottom substrate and weeds with 'brown algae' at certain times of the year, and an associated loss of general water clarity when this material becomes detached and mixed by water flow: fisheries and the general ecology are 'assumed' to have declined as direct result of this phenomenon.

A few complaints have been received regarding excessive growths of macrophytes as a result of eutrophication, possibly as a result of the Authority's active policy of weed control, the timing of which itself may lead to regrowth stimulation and a largely dominant monoculture of *Ranunculus spp.*

Routine algal and chlorophyll 'a' monitoring of the Hampshire Avon was carried out by Wessex Water Authority and the West Hampshire Water Company from 1977 to the mid 1980's. During this relatively short period of time chlorophyll 'a' increased in concentration but was largely confined to the spring diatom bloom covering the March, April and May period. The dominant species associated with this bloom are *Navicula viridula, Diatoma vulgare* and subdominant species such as *Cocconeis spp*, and *Nitzchia palea.* Most of these species were recorded from the Avon during the 1930's by Butcher, however it is the dominant *Navicula viridula* which marked the significant change in the algal flora of the Avon. It was therefore subsequently considered that the algal flora was moving towards that seen in the Stour, which could be interpreted as a measure of increasing eutrophication in the Avon.

Since the mid 1980's very little work has been carried out on the Avon microflora apart from a predictable annual response to complaints of discoloured brown water as a result of the continuing algal blooms which still occur in the spring period on the Avon. This has usually involved microscopic examination of material, water transparency measurement and quantification of the amount of epiphytic material on *Ranunculus* (43kg of mainly diatoms per tonne of weed).

6.10.2 Solutions

A possible research project to investigate 'Algal growth in the Hampshire Avon : implications for river ecology and management' is being considered. Such a research programme is essential in order to establish and/or provide a reference against which progress can be assessed. It would also identify significant information gaps and lead to the development of a cost effective monitoring programme for the long term.

6.10 EUTROPHICATION - CONTINUED

6.10.2 Solutions (continued)

The development of management strategies for the protection of environmental quality must involve a step by step framework for the development of such strategies so that eutrophication-related water quality can be potentially managed for given water uses.

A basic practical framework consists of the following steps:

- Identify eutrophication problem and establish management goals.
- Assess extent of available information and progress with investigative research project to answer questions related to, for example, algal growth, species composition, changes and causes etc.
- Identify available, feasible eutrophication control methods.
- Analyze all costs and expected benefits of alternative management strategies.
- Analyze adequacy of existing regulatory framework for implementing alternative management strategies.
- Select desired control strategy and disseminate plan to interested parties.
- Use regulatory mechanisms to minimise future eutrophication problem.

At this stage within the NRA Wessex Region we are very much at the beginning of this process and therefore there is a requirement to firmly establish the basics in terms of identifying and quantifying the basic eutrophication problems.

6.11 SUSPECTED IMPACTS OF ABSTRACTION ON FLOWS IN SOME OF THE UPPER TRIBUTARIES

6.11.1 Nature of Problem

There is growing concern from the public and conservation bodies about low flows in the rivers which make up the Upper Hampshire Avon. These include the Upper Avon and its tributaries: the Wylye, Nadder, Bourne and Ebble. These rivers are largely fed by groundwater, most notably from the extensive chalk aquifer which underlies the catchment. It is claimed that groundwater abstraction from this aquifer for both public and private water supply has had a significant effect on river flows.

Areas of particular interest are on the rivers Wylye and Bourne where there are large public water supplies from the aquifer. The main concern is of depleted flows caused by permanently reduced groundwater levels and larger proportions of stream flow going into the ground. Sources of particular concern are those at Brixton Deverill, Upton Scudamore, Codford, Chitterne and Heytesbury.

The difficulties of assessing the effect of these abstractions on river flows has been compounded in the last 4 years by low rainfall. The question posed was "Is the reduction in river flows a natural, climatic related problem, or is it induced by aquifer depletion by abstraction or a combination of both?"

6.11.2 Action Taken

A study of the rivers Ebble, Nadder, Wylye, Bourne and Upper Avon was commenced in October 1991, by Sir William Halcrow and Partners. The study is in 2 phases:

- A general overview of all the rivers, to define the groundwater catchments and characteristics of each, and how these vary seasonally;

- A more detailed study of the River Wylye and its tributaries, as this is the main focus of complaints about low flows.

The first phase is due to be reported at the end of August 1992, and the final report is due at the end of January 1993. Both phases include the construction of computer models which will be used to examine the effect of abstractions, both individually and conjunctively, on flows in the rivers.

The consultants submitted an Inception Report in December 1991 which reviewed the data available and commented on the limitations of the study in the light of the available data. They made recommendations for an extension to the inputs by an ecological consultant, to allow a wider consideration of the effect of low flows on the river's flora and fauna: these have now been approved.

Approval is also being sought for a site investigation, which was a further recommendation of the Inception Report. The intention is to construct 4 boreholes, and to test pump these to determine the local characteristics of the aquifer.

6.11 SUSPECTED IMPACTS OF ABSTRACTION ON FLOWS IN SOME OF THE UPPER TRIBUTARIES - CONTINUED

6.11.2 Action Taken

To expand the available groundwater data, well surveys have been undertaken in each catchment, and additional monitoring points have been identified, which are currently being dipped monthly.

6.11.3 Solutions

Specific details of the action which must be taken to remedy unacceptable river flows in the Upper Hampshire Avon will largely depend on the findings and recommendations of the Halcrow report. However the type of action which may be implemented includes bed lining schemes in some sections of rivers where leakage is causing substantial water loss through the river bed. Groundwater compensation schemes in the upper tributaries is another option. Water would be pumped from new or existing supply boreholes and used to artificially augment flows in tributaries identified with specific low flow problems. Abstraction could also be encouraged away from critical areas with perhaps the larger abstractions being replaced by storage schemes lower down the catchment. More drastic action may include the amending of licence conditions or altering the abstraction regime. In critical cases the action may even involve revocation of existing licences. Sensible water resources management will be encouraged for all new applications received. Whatever the solutions are they will probably involve a combination of the above possible remedies.

6.12 PRESSURE ON WATER RESOURCES IN THE LOWER AVON CATCHMENT

6.12.1 Nature of Problem

The Hampshire Avon Catchment provides a vital resource for three major Public Water Supply Companies. These are Wessex Water Services, The Bournemouth and District Water Company and the West Hampshire Water Company. All three have forecast rapidly increasing demand for water in South East Dorset and they all are likely to seek to meet the demand by increased abstraction from the Lower Hampshire Avon.

Currently all three abstract large quantities of water from the Lower Hampshire Avon to meet their supply requirements. Wessex Water Services abstract up to a maximum licensed quantity of 50 Ml per day at the Blashford Lakes site north of Ringwood. The West Hampshire Water Company can abstract 113.65 Ml per day at Knapp Mill just north of Christchurch. Also the Bournemouth and District Water Company can abstract 63.64 Ml per day at Matchams, which is half way between Christchurch and Ringwood. At present there are operational difficulties due to the conditions which are contained in these licences and under which they operate. Increase in demand will only serve to compound these problems and the granting of new licences will be difficult under the present circumstances. As well as obvious supply difficulties there are also potential sensitivities in the allocation of resources between competing public water supply companies.

6.12.2 Action Taken

The NRA have awarded a short study to Sir William Halcrow and Partners to identify the available resources in this area, to forecast demand for each water company and to assess potential for the construction of additional storage reservoirs for raw water.

The study will recommend the optimal use of the available resources to meet the requirements of all companies, and will take into account the findings of Dr D J Solomon's fish tracking study, in which he made recommendations for levels of residual flow.

The study commenced in January 1992 and by February 1992 had produced a set of working papers, covering demand forecasts, planning and environmental constraints and fisheries issues. A final report will be provided in Autumn 1992.

6.12.3 Solutions

The two main aspects which must be considered are firstly the ability to meet future needs, and secondly managing demand. To meet future needs of growth in supply requirements possible remedies include the establishment of new reservoir storage sites in the Lower Hampshire Avon. These would be similar to the schemes currently operating in the Blashford area. Reservoir filling would take place at times of high flow hence storing excess resources. This would have the effect of buffering the impact of abstraction at times of low flows. River regulation and water transfer schemes might form another remedy. Groundwater, abstracted from the upper Hampshire Avon could be used to augment river flows in the Upper tributaries. Flows would be maintained and the water abstracted for surface storage lower down the catchment. This would have the effect of augmenting flows in the upper tributaries whilst helping to meet the increased demand in the Lower Avon.

6.12 PRESSURE ON WATER RESOURCES IN LOWER AVON CATCHMENT - CONTINUED

6.12.3 Solutions (continued)

The river would act as a natural water transference system. Methods which could be introduced to manage demand include the introduction of metering and leakage control. Metering in some tests has been shown to reduce demand by 10% on average and by up to 25% during peak period demand. Leakage control covers loss of water through the pipes under control of suppliers. Greater efficiency in water distribution would lead to a decrease in water wastage. Metering would also increase public awareness of exactly how much water is going to waste and would represent sensible water resources management.

6.13 POSSIBLE IMPACT OF HISTORIC FLOOD DEFENCE SCHEMES AND DREDGING

6.13.1 Nature of the Problem

There is a body of opinion that some stretches of the river channel (mainly in the headwaters and tributaries) have been substantially changed by flood defence schemes which were undertaken many years ago. Although little maintenance of these schemes has been undertaken and some reversion of the channel has taken place, nevertheless there may be scope for further remedial engineering or habitat restoration to enhance habitat diversity. A possible example of river affected in this way is the Western Avon.

Since there is some debate about the validity of the claims of channel degradation a study to identify and assess relevant river stretches is required as a first step.

6.14 SILTATION AND COMPACTION OF SALMONID SPAWNING GRAVELS

6.14.1 Nature of the Problem

It is commonly believed that changes in land use, particularly in the Upper Avon Catchment, may have resulted in increased silt inputs to the river. High silt levels increase the proportion of fines in gravel, reducing void space and the rate of intra-gravel flow. The consequential reduction in oxygen supply to salmonid eggs and alevins can result in increased mortality.

Over the last few decades, changes in farming practice in the Avon Catchment tended to promote cereal production at the expense of grazing. These changes in agriculture could have increased the degree of risk of soil erosion, resulting in greater run-off of sediment into the Avon via drainage systems.

Concern has also been expressed that some spawning gravels may be suffering from compaction thereby making it more difficult for salmonids to "cut" redds.

Concern over the compaction of chalk stream gravels is not a new issue. In the past it was reported that River Keepers would rake gravels in the autumn in an attempt to make them clean and friable prior to spawning time. There are also reports that harrows were sometimes towed through gravels, using a horse or tractor, to help "break up" compacted sections of the river bed.

An additional factor cited by some observers is that lower flows in recent years have failed to flush accumulated silt downstream.

6.14.2 Solutions

Many of the factors likely to cause increased siltation of gravels are outside the control of the National Rivers Authority. However, river gravels are used by salmonids for egg deposition. The quality and quantity of these gravels can be critical, both for breeding success and the survival of the young stages of salmonids. In view of the changes which have taken place in the catchment, the Authority are proposing to undertake an investigation of spawning gravels (see Decline of Spring Salmon). The exact nature and scope of this study has still to be determined.

In addition, work which forms part of an NRA national Research and Development project is being undertaken to monitor the characteristics of silt movement in the catchment.

6.15 DECLINE IN CATCHES OF LARGE SPRING SALMON

6.15.1 Nature of Problem

Falling catches of spring salmon on the River Avon have concerned the Authority and local fishing interests for a number of years. This decline is also apparent on other rivers in the country. For the purpose of this report spring salmon are defined as 'those fresh fish caught between the start of the season (1 February) and 30 April.

Historically spring salmon on the River Avon consisted predominantly of large 3 SW fish (ie fish which had remained at sea for three winters before returning to freshwater to spawn). The spring run also contained a few very large 4 SW fish. Numerically spring fish peaked on the River Avon in the 1930's and catches remained high until the 1950's but have declined steadily since. 2 SW fish now often outnumber 3 SW fish in spring catches and 4 SW fish have virtually disappeared.

In 1990, the Authority put forward a proposal to delay the start of rod and net fishing for salmon from 1 February to 15 April. This measure was aimed at reducing the level of exploitation on large, early-running fish thereby enabling more to escape and spawn. Consultation on the above measures drew a mixed response from anglers and riparian owners, which led the Authority to defer its proposal and seek more information. As a result, the Authority appointed a consultant (Dr D Solomon) to undertake an analysis of the situation, to consider contributory factors and suggest remedial action. His findings lead to the following situation.

6.15.2 Solutions

It is believed that conservation measures to protect and enhance the relict 3 SW salmon stock are appropriate but that on their own they are unlikely to lead to a substantial increase in the numbers of spring fish without a shift in marine conditions. Given these circumstances, the Authority are considering implementing the following measures to reduce the level of exploitation on spring fish and to investigate enhancement possibilities:

- Limiting net fishing for salmon to the period 15 April - 31 July. Currently the season is 1 February - 31 July.

- Restricting rod fishing for salmon before 15 May to fly only using fly rod and line.

- To assist in promoting a national investigation into the problems of declining spring salmon stocks.

- To seek advice of a population geneticist on the genetic implications of a restocking exercise to enhance stocks of 3 SW fish.

- To undertake a feasibility study of such a restocking programme in both a local and national context.

- To undertake an investigation into the suitability of gravels for salmon spawning in the Avon Catchment. (See 6.14)

6.16 THE COARSE FISHERY BETWEEN DOWNTON AND FORDINGBRIDGE

6.16.1 Nature of Problem

In the early 1970's anglers began to complain to Wessex Water Authority (WWA) about declining coarse fish catches in the Downton - Fordingbridge area. It was said that catches of roach and dace in particular had declined - catches of smaller fish being particularly badly affected. The decline was first noticed in the Downton area and spread out from there along the river. The complaints culminated in a public meeting in 1975 and the Authority undertook an investigation resulting in reports in 1976 and 1978.

In the early 1980's complaints again built up with a public meeting being called in September 1984. This resulted in a further investigation by WWA with a report being produced in December 1987.

The two Wessex Water Authority investigations considered a range of possible factors including pollutions, weed-cutting, abstraction, fish farming, loss of water meadows, land drainage schemes, diseases and parasites.

The 1976 report suggested that weed-cutting, loss of water meadows and land drainage changes could have caused changes in fish populations and hence catches. Subsequently the 1987 report pointed to possible effects of changes in land use, weed-cutting practice, decline in water meadow systems and the obstructing and trapping effect of large fish farms on coarse fish in the course of their movements between feeding/growing areas and spawning areas.

Anglers in particular had always pointed to possible effects of fish farms, the major ones on the Avon being constructed in the late 1960's/early 1970's, although repeated Wessex Water Authority investigations concluded that the quality of discharges from these units should not pose any significant threats to coarse fish populations.

A major handicap in the resolution of this problem until recently was the lack of suitable techniques for assessing fish stocks in large swift rivers like the Avon. In 1987, the Freshwater Biological Association (FBA), undertook a survey of the Avon at 12 sites using a boom electric fishing boat.

The results of this survey indicated that in terms of mean coarse fish biomass, the Avon compared well to other rivers in the UK. However, although dace and chub were evenly distributed along the river, roach and barbel were not. The uneven distribution of juvenile fish suggested that spawning areas may be limited.

In 1991 the NRA, having developed an improved large-scale electric fishing boat, carried out a survey of 22 sites. Findings concurred with the long held views of anglers - namely that there was a relative shortage of the younger age groups of roach, dace and chub in the Downton - Fordingbridge area. Overall biomass and population density estimates were similar to those obtained by the FBA in 1987.

6.16 THE COARSE FISHERY BETWEEN DOWNTON AND FORDINGBRIDGE - CONTINUED

6.16.2 Solutions

The causes of this problem are not fully understood. However, the recent survey of coarse fish populations highlighted a relative shortage of young roach, dace and chub between Downton and Fordingbridge, with respect to other parts of the Avon. The underlying cause(s) of this difference in population structure need to be investigated. Water quality aspects and the availability of suitable habitat need to be considered, as well as the role that fish farms and other obstructions may play in hampering the movements of coarse fish.

6.17 ILLEGAL FISHING IN CHRISTCHURCH HARBOUR

6.17.1 Nature of the Problem

Illegal fishermen frequently attempt to take catches of salmon and sea trout from the Harbour mainly by the use of fixed nets set from small boats. This activity has to be controlled if stocks are not to be damaged by over exploitation.

Large numbers of valuable salmon and sea trout pass through, or accumulate in, the Harbour in summer months. Under low flow conditions, which may be extended by abstraction from the Avon, salmon will accumulate in some areas.

Because of the densities of fish arising, valuable catches can be taken with short lengths of fixed net set from boats. Illegal fishermen have a large number of entry and exit points and moored boats and other features provide cover for the rubber dinghies and other small craft often used. These vessels need only to be on the open water for short periods whilst setting or hauling nets and are therefore difficult to detect even when night vision equipment is deployed.

6.17.2 Solutions

A significant amount of manpower has to be used to counter these activities each year, modern communications and detection equipment being utilised. There is a need to improve the techniques and equipment used, as rapidly as technical developments allow, to minimise the use of expensive manpower. Intelligence gathering both at a local level and through co-operation with adjacent NRA Regions, should be maintained and developed.

Much of the Harbour fishery is in private ownership and the owners also undertake patrols to combat poaching.

6.18 IMPACT OF SWANS AND PREDATORS

6.18.1 Nature of Problem

A recurring complaint from fishing interests is that the number of swans at various locations in the catchment, but particularly on the Wylye, are excessive and their feeding activities can at certain times result in almost total removal of weed. This is seen as damaging to the quality of fishing and fisheries.

6.18.2 Solutions

The problem of over-grazing by swans has been examined by the NRA and its predecessors in the past. Evidence to support the extent and significance of damage caused to fisheries and the general river ecosystem is difficult to substantiate.

Action to cull or remove swans to other sites requires authorisation under the Wildlife and Countryside Act 1981.

The activities of predators such as cormorants and mink are also cited as problems in the catchment. In the case of cormorants, work in the past has failed to confirm that they are significant predators of salmonids or coarse fish.

Action to cull or manage swans or other species is difficult to reconcile with the NRA's overall role.

6.19 CONFLICT BETWEEN ABSTRACTIONS FROM THE LOWER AVON AND THE FLOW REQUIREMENTS FOR THE MIGRATION OF SALMON

6.19.1 Nature of the Problem

The upstream movements of adult salmon into and through freshwater are known to be influenced by river flow. Any significant changes to flows could seriously impact on salmon migration with consequential effects on stock levels and catches. An understanding of the relationship between river flow and the upstream movement of salmon is therefore essential if stocks are to be safeguarded against potentially harmful changes in the river regime.

There is a possibility in the next few years that there will be a requirement to further develop the water resource potential of the Lower Avon for public supply purposes. It was against this background, that in 1986, Wessex Water Authority commissioned a study by an independent consultant (Dr D Solomon) to establish the relationship between salmon migration and catches, and river flow and other environmental variables. The information obtained could then be used to assess the impact of future water resource development on salmon movements and help formulate optimal operating rules to protect this fishery. Responsibility for this investigation was passed to the National Rivers Authority.

The five year study involved the tracking of radio-tagged salmon in the river, and comparison of their movements with recorded river flow rates. The main conclusions reached were:

- Salmon movements both into and up the river were closely related to river flow.

- Most fish entered the river in early summer when the flow to the estuary was greater than 8-9 cumecs, but below that flow most salmon remained in the estuary.

- Once in the river salmon would migrate intermittently upstream for up to 3 weeks if flows exceeded 8-9 cumecs at Knapp Mill and at the end of this period no further movements took place until the Autumn spawning run.

Results from the fish tracking study showed that salmon tended to arrive at the tidal limit predominantly during the hours of darkness. Results from the scanner site upstream of the first obstruction on the river (Knapp Mill and Great Weir) showed that most fish passing this point did so during the first hours of daylight. The state of tide did not influence the time of arrival of fish at the tidal limit. However the times of salmon arriving at scanners at various points upstream were more evenly spread through the 24 hour period, showing that once salmon had entered the river their movement was not influenced by the time of day.

6.19.2 Solutions

The results of the fish tracking study provide some useful guidelines for future water resource management of the Lower Avon. These and other aspects are currently under consideration by the Authority. The following account outlines some of the main findings of the study.

Linking direct supply abstractions to a single prescribed flow would only prove beneficial to salmon, providing it exceeded 8 to 9 cumecs. However, flows below 8 to 9 cumecs are not infrequent and such an approach would require very large storage reservoirs to ensure a yield for public water supply, at times when abstraction from the river was not possible.

6.19 CONFLICT BETWEEN ABSTRACTIONS FROM THE LOWER AVON AND THE FLOW REQUIREMENTS FOR THE MIGRATION OF SALMON - CONTINUED

6.19.2 Solutions (continued)

The use of prescribed flows is relevant to abstractions for storage reservoirs (eg Blashford Lakes). Results from the fish tracking study showed that salmon movements into and through the river were virtually unaffected by residual flows to the estuary in excess of 13 cumecs. There should, therefore, be scope for reducing the prescribed flow from the present 23 cumecs, which would enable the Blashford abstraction (30 ml/d) to take place on more occasions than is now the case. However this increased frequency of abstraction should ideally be offset against reductions in 'take' from other abstractions further upstream, at times critical for salmon migration, eg on falling flows around 8 - 9 cumecs at Knapp Mill during the peak months for salmon movement.

The provision of partial protection to salmon movements by targeting particular flow ranges or events is a concept known as flow sparing. This would involve stopping abstraction at critical flow "windows" such as falling flows around 8 to 9 cumecs at Knapp Mill and summer spates. The timing of flow sparing in relation to salmon runs is important. Ceasing abstraction for a few days on the falling limb of a spate hydrograph in June/July would be more beneficial than the same operation in mid-August. Adopting this approach would require the provision of bankside storage which could be drawn into supply when direct river abstraction ceased. Flow sparing would have less of an impact on the overall movement of salmon during low flow years, when flows fall below the critical level and remain there for several weeks.

Modulating abstraction by stopping the 'take' of water at critical times (eg certain times of day) could also be a strategy worth considering. However, such an approach would involve taking more water when abstraction was allowed and having a bankside storage facility for supply when abstraction ceased.

The results present a strong case for diurnally modulating abstraction at the tidal limit (eg ceasing abstraction from 2000 - 0800 hours BST) but at the cost of doubled abstraction for the other 12 hours. However, it would appear that little would be gained by modulating abstraction on a tidal basis.

6.20 WEED-CUTTING

6.20.1 Nature of Problem

Flows in the River Avon are sustained at a relatively high level throughout the spring and early summer by virtue of the Upper Catchment being predominantly chalk. Whereas flows in many rivers fall off as weedgrowth starts to become significant, this is not the case in the River Avon. The combination of flow and weedgrowth lead to elevated water levels and, if no action is taken, out-of-bank flows and flooding occurs. This effect would occur from mid-June onwards having a serious impact on farming, particularly haymaking, at a critical time.

The pattern of weed-cutting on the River Avon has altered significantly in the last twenty years. Previous practice had been to clear weed from the full width of the channel, but in recent years, with the exception of some short lengths, a margin of vegetation has been left against both banks. The previous practice was to make two cuts each year. In recent years one cut only has been carried out which can commence at any time between June - August dependent on weed growth and weather conditions. To prevent waterlogging and reduce the extent of flooding, weed-cutting has traditionally been programmed to start in late May/early June.

A problem arises in the lower sections of the river where streams from the New Forest discharge into it. Here the steep, rapid run-off catchments are particularly prone to thunderstorm type rainfall. These catchments support more intensive agriculture than the Avon valley and potential losses would be high. Failure to cut weed in the River Avon would lead to unnecessary flooding in these tributaries.

Additionally weed-cutting in the spring can significantly reduce water levels in the river effecting to some limited extent reductions in ground moisture and therefore affect the full conservation potential of breeding wader bird populations. However without some form of weed-cutting, conditions become more difficult for game fishermen and to a lesser extent coarse fishermen.

Mechanical weed-cutting launches require a minimum draft to operate. The action of weed-cutting initially creates a rise in levels downstream necessary for floating weed launches, but can in itself create flooding of small areas of agricultural land. Weed boom sites necessary to collect and dispose of weed have problems of effluent control as the weed rots. The purpose of weed-cutting is to improve freeboard conditions to allow agricultural land to drain better. It will not prevent flooding, but lessen the risk. With the possibility of an ESA designation some weed may not be cut in future in order to raise river levels.

6.21 Solutions

The NRA will continue to follow its recently published "Code of Practice on Weed-cutting" and to review its performance yearly every Autumn.

It is considered that there may be scope for reducing the extent of weed-cutting for Flood Defence purposes in the future (eg in the context of the Lower Avon ESA). Impacts on other river uses and the funding of cutting for purposes other than Flood Defences will need to be considered.

6.20 WEED-CUTTING CONTINUED

6.20.2 Solutions (continued)

A better means of controlling the disposal of cut weed and its resultant effluent will be carried out by the NRA. The co-operation of all those that benefit from weed-cutting is requested to assist in the disposal of cut weed.

6.21 LACK OF WEED AT NETHERAVON

6.21.1 Nature of Problem

There have been recent complaints (spring and early summer 1992) of lack of weed in certain stretches of the Avon and its tributaries. It is assumed that these complaints concern water crowfoot (*Ranunculus spp*).

6.21.2 Solutions

Investigations have been made and no water quality problems have been identified which could account for these observations. It has been found that weed was growing in adjacent stretches of the river and it has been concluded that the most likely cause has been the climatic conditions (low rainfall and hence low river flows) which have resulted in sub-optimal conditions for weed growth in the affected stretches.

No action by the NRA is proposed other than to monitor weed growth in areas subject to complaint and in the catchment generally.

6.22 IMPACT OF LARGE TROUT FARMS ON THE HAMPSHIRE AVON

6.22.1 Nature of Problem

Large trout farms were developed on the Hampshire Avon during the 1970's. The farms have caused much concern to anglers, conservationists and other interested parties. The concerns have, in the main centred around the abstraction or diversion of water from the river and the discharge of effluent back into the river. Although all fish farms on the Hampshire Avon are now subject to abstraction licences and discharge consents, consideration should be given to the following impacts:

- Fish farm effluents present a number of difficulties. Large farms may give rise to considerable loads of suspended solids, ammonia and materials exerting biochemical oxygen demand. The respiration of fish could lead to depletion of the oxygen dissolved in river water. Concern has been expressed about the discharge of chemicals used to treat fish diseases, at the potential for the discharge of disease organisms themselves and their impact on natural river fish populations. The suggestion that the discharge of pheromones or other substances may alter the behaviour of natural river fish populations so that they avoid areas downstream from trout farms, has also been cited as a potential problem, but does not appear to be supported by experience on some farms on the Hampshire Avon.

- The accidental or deliberate release of farmed fish into the river can cause adverse effects by the interaction of these fish with the natural fish populations.

- Abstraction or diversion of water from the river channel has caused concern particularly because the diversion may affect the ability of fish to migrate upstream or downstream past the fish farm. In addition small fish moving downstream could be entrapped and killed by being carried into fish farm intakes, and fish migrating upstream may be diverted from the main river into effluent channels.

- Fish farms attract predatory fish-eating birds such as herons and in order to protect both the fish farm stock and the bird populations most farms have found it necessary to provide some barrier, usually netting, to eliminate the problem.

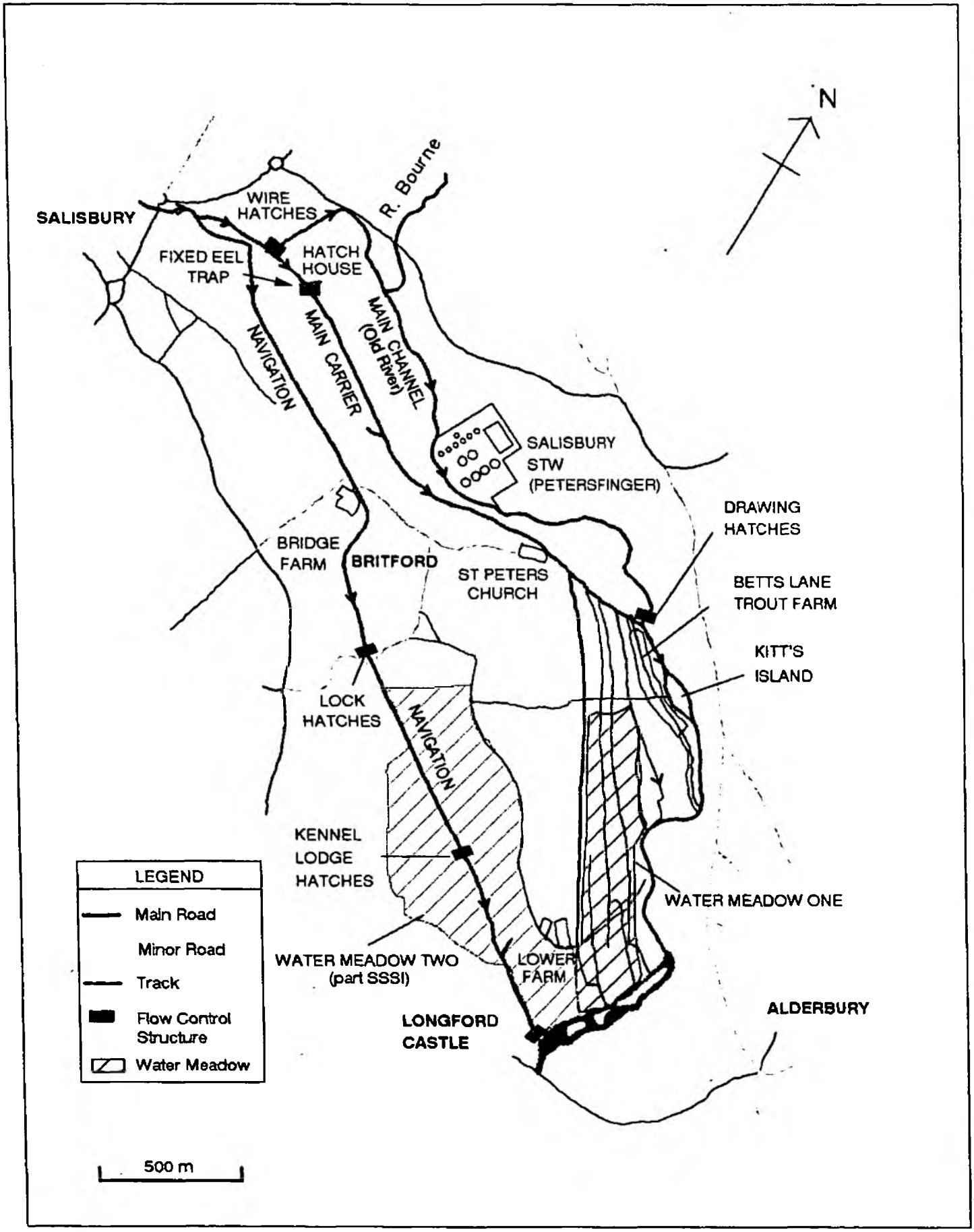
6.22.2 Solutions

Many aspects of the identified impacts of large trout farms on the Hampshire Avon have been addressed by the operators. It must be said however that these farms continue to cause great concern to other river users.

The NRA will continue to monitor the effluent from fish farms and to check for any impact on the river system.

The extent to which large fish farms affect the movements of both game and coarse fish will also continued to be monitored by the NRA. (See also 6.16)

HAMPSHIRE AVON CATCHMENT
BRITFORD AREA - FLOW APPORTIONING



NRA Wessex Region

6.23 BRITFORD AREA - FLOW APPORTIONING

6.23.1 Nature of Problem

Just downstream of New Bridge, Salisbury, the River Avon has been split into three separate channels. These channels - the Navigation, Carrier and Main - each have requirements for river water i.e. amenity, wild fish stocks, fish farm, fixed eel trap, two working water meadow systems, dilution of discharge effluent from Salisbury (Petersfinger) Sewage Treatment Works and general agricultural needs. Low river flows result in competing demands for valuable river water and considerable co-operation is required from all water users. Insufficient water for the water meadow systems means that the intricate arrangement for diverting flows to irrigate agricultural land, cannot be achieved. One such system has a high conservation value (designated as an SSSI) and reductions in water quantity put at risk the existence of delicate flora. Insufficient water for the fish farm, or indeed wild fish stocks in the river itself could result in a fish kill. Water quality can be affected if river flows are depleted from the Main Channel affecting dilution of effluent as it discharges from the Sewage Treatment Works. The upstream migration of salmon at Britford can also be affected by flow depletion, particularly if the natural river flow is low at or around spawning time. The River Bourne adds little flow and provides little assistance with overcoming this problem.

Each channel is served with controls (see plan opposite). At the junction of the Main Carrier and Main Channel lifting hatches regulate flows ("Wire Hatches"). In the Main Carrier a major structure known as "Hatch House" exists. These two structures determine the flows down the Main Carrier and Main Channel and to a lesser extent the Navigation which is more dependent on bed levels and subsidiary cross link channels. At the downstream end of the system, a control exists at the point the Carrier meets the Main Channel and this serves to raise levels for a Water Meadow System and the Fish Farm. Along the Navigation Channel "Lock Hatches" is an important hatch for maintaining levels upstream for amenity purposes. Under the terms of a "Deed for Irrigation", Whittle Estate have most of the duties and powers to properly manage the system, with some policing from the NRA under its Byelaws. Under the current arrangements it is clear that optimum management of water levels and flow in this area is not being achieved.

6.23.2 Solutions

Tighter restrictions on limiting the number of river control operators in order to maintain agreed minimum river levels.

Control structures to be maintained for easy and efficient operation.

Survey existing river bed profile to determine how much this has deteriorated from the original design and whether dredging works would assist in making existing river control more effective.

The NRA will help to co-ordinate the efforts of the Whittle Estate and others to come to a better arrangement of operation and to increase surveillance of river levels by installation of telemetry in key locations. Operational rules have been recently agreed and are already assisting in solving these problems.

Consideration is being given to the construction of fish pass(es) at this location to improve the upstream access for salmon.

6.24 THE OPERATION OF WATER LEVEL STRUCTURES

6.24.1 Nature of Problem

River controls in the form of hatches and tilting weirs regulate the river level sometimes in conjunction with fixed controls such as weirs. Needs in terms of river level are sometimes diametrically opposed; e.g. the need to lower water levels to prevent waterlogging of farm land and provide adequate freeboard for land drains to function, as opposed to providing a high river level in order to promote diverse flora and fauna species in the river and on the flood plain. This conflict has become even more important as a result of the ESA designation for the Avon Valley between Salisbury and Christchurch.

The influence of moveable controls such as hatches, on river level is dependent on a number of factors, which can include channel size, gradient and flow. The extent of the "backwater" produced is not easily predicted. Contrary to some public opinion the controls do not "dam the river", but they influence the level locally. Their influence to level fades out the further upstream you extend from the controls. In a situation where a general raising of river levels is required such as that now under consideration for the proposed ESA the present number of controls available to change river level is critical (see map 3.2). It is unlikely that sufficient river controls exist at present to enable a general river rise to be produced over a long length of river.

6.24.2 Solutions

River level raising could concentrate in areas where controls exist, but will be the subject of careful consultation by all parties and will require the formal consent of the NRA.

Some additional river controls could be constructed, but the burden of cost would fall upon the beneficiaries of such a scheme and again would require NRA consent.

6.25 GLOBAL WARMING AND SEA LEVEL RISE

6.25.1 Sea level rise

Global sea level rise as a consequence of temperature increases from the "greenhouse effect" should be considered in any overall future sea defence and coast protection strategy. Sea level rise is expected to occur from a combination of thermal expansion of ocean waters and an increase in volume due to snow / ice melt transferring water from land to sea. Predictions of level rise vary depending on the location and the assumptions used. The model currently accepted by the NRA anticipates the rise to be uniform up to the year 2050, after which significantly greater rises in sea level are presently predicted. The forecast for the Christchurch area is for a rise of 5mm per year. Thus over the normal flood defence scheme design life (50 years) a total increase of 250mm is predicted.

Sea defence protection levels are determined by a combination of factors; the design event (ie tide and wave heights), and, as necessary, a freeboard (extra height) to allow for settlement and weathering of soft defences, and also an allowance for sea level rises due to the gradual sinking of the south west of Great Britain. Now that the phenomenon of sea level rise has been accepted an additional freeboard of say 250/300mm is presently added to allow for this. In addition defences are being designed so that their heights can be easily raised if the predictions are incorrect.

Investigative work has now commenced to determine the feasibility of constructing defences to protect properties adjacent to Christchurch Harbour and property near to the confluence of the Hampshire Avon and Dorset Stour.

It is recognised however, that it is not possible to continue to protect all land from flooding, regardless of cost, and that some degree of coastline regression is inevitable. The NRA will therefore oppose any new development that is likely to result in an increasing risk of tidal inundation and hence be subject to an increasing capital cost for protection.

6.25.2 Inland water effects

The effect on inland water of climatic change resulting from global warming is more uncertain. Current projections suggest a rise in mean temperature in southern England of 2.5^{0}c by 2050. Predictions of changes in precipitation on a local scale are very uncertain. The best current indications are no overall change in average summer rainfall and a slight increase in winter rainfall. The occurrence of extremely dry summers, such as that of 1976, is expected to increase significantly. Another suggestion is that rainfall events will be less frequent than at present, but heavier when they occur.

The impact of any changes on the interests of the NRA will depend not only on the climate changes, but also the resultant changes in human activity, such as agricultural crops and general land use. The NRA is in the process of producing a preliminary report on the impact of global warming on the NRA's activities. This report is expected shortly and lines of action will be determined.

6.26 DEVELOPMENT CONTROL

6.26.1 Nature of the Problem

The NRA - Wessex Region's views upon the future aims of Town and Country planning and how it can affect the water environment have been well received by the Planning Authorities within the Hampshire Avon Catchment.

The three County Structure Plans all contain policy statements related to NRA interests. The Wiltshire Landscape Plan contains Policies for river valleys and wetlands and pays particular attention to the River Avon.

The seven District and Borough Councils which are wholly or partly in the Hampshire Avon Catchment have over the past three years, produced Local Plans for parts of their areas. These include detailed policy statements related to NRA interests.

These existing plans contain policy statements which are in themselves mainly negative. They seek to control activities which would be detrimental to the water environment.

The District Planning Authorities are now obliged to produce District -Wide Local Plans by 1996. Advice and guidance has been issued by the Department of Environment which confirms the NRA's role and greater liaison between NRA offices and Local Planning Authorities has recently taken place. As a result it is now more likely that future plans will include Policies which address the concerns and aspirations of the NRA.

The NRA have limited powers to implement some of their planned objectives. Quite correctly they must rely on other agencies and in particular the Local Planning Authorities, to reflect NRA requirements in producing and administering sensitive Policies.

6.26.2 Solutions

To achieve many of the Catchment Management Plan objectives and findings it is seen as essential that Forward Plans of the Local Authorities reflect them. In this way then will be added advantage of them being acknowledged alongside other local issues.

The NRA hope that in the next round of Plans, Policies will be developed that approach the water environment in a positive way. Thus it is visualized that Policies will aim to protect, promote and enhance the many aspects of the water environment in the River Avon Catchment.

The NRA wishes to see a more uniform approach to planning throughout the whole length of river corridors and will seek to advise and support moves by the Planning Authorities to achieve this aim. An example of such an approach can be seen in the neighbouring Test Valley where the River Test corridor has been designated as the "Valley of the River Test Heritage Area" by the Planning Authority. The purpose of the designation is to provide special protection and management of the river valley, including the urban areas, because of its outstanding scenic, ecological and historic qualities and rural character. It will provide a focus for future initiatives to enhance and protect the river valley as an integral unit.

6.26 DEVELOPMENT CONTROL - CONTINUED

6.26.2 Solutions (continued)

The NRA believes that a similar approach would be both appropriate and desirable in the River Avon Valley and would seek to work with the Planning Authorities to promote such an initiative.

6.27 NEW ROADS AND BYPASSES

6.27.1 Nature of Problem

A number of new roads and improvements to existing main roads are proposed in the Avon valley. These include the A31 at Ringwood; the Salisbury bypass and the A36 Wylye Valley road. The NRA are concerned about road schemes from the quantity and quality points of view. A new road across a greenfield site reduces groundwater recharge and therefore reduces resources. If the surface water runoff is discharged to a watercourse it can significantly increase flood flows in the watercourse and endanger downstream properties.

From a water quality viewpoint the NRA has two concerns about highway drainage. Firstly the normal runoff of deposits of hydrocarbons, rubber and metal-rich solids can cause significant pollution of controlled waters. Gully pots are relatively ineffectual for preventing this pollution as they provide little settlement or oil separation. The second water quality concern is the pollution from a road traffic accident and in particular the release of hazardous chemicals from road tankers.

6.27.2 Solutions

From a resources and flood risk point of view the NRA prefers that highway drainage discharges to soakaway. In many schemes this has been conveniently provided by soakaway lagoons. If discharge to a watercourse is proposed attenuation is often required.

The water quality of highway run off is normally controlled by settlement and flotation by such means as bypass oil interceptors. On occasions lagoons or attenuation ponds may be required to provide oil and solids separation, and if this is the case, this purpose must be taken account of in their design.

To try to eliminate pollution from road traffic accidents the NRA is requiring a minimum of 20 cu.m of storage capacity on surface water drains of major highways. This is preferably provided on-line and in non-urban situations in open channels. It must be capable of being blocked off. The purpose is to allow the Fire Brigade or water quality staff to block the drainage system and in a 'worst-case' scenario to collect the contents of a tanker after being hosed down by the Fire Brigade. This arrangement is intended to provide the opportunity under most circumstances to prevent river pollution. Pollution traps are even more important before discharge to soakaway as dealing with polluted groundwater is much more difficult than with polluted surface water.

On new road schemes the NRA will specify their requirements to the promoters at an early stage to enable them to be incorporated in the design of the road. This system is operating effectively on the new road schemes within the Avon Catchment.

6.28 MANAGEMENT OF WATER LEVELS TO IMPROVE HABITAT FOR NATURE CONSERVATION

6.28.1 Nature of Problem

The years from the 1940's to the mid 1980's saw a determined national effort towards the continuing improvement of agricultural output. As well as the use of artificial fertilizers, there was a continuing programme of capital and maintenance works on rivers to reduce flooding frequencies and improve drainage of agricultural land. This was generally achieved by the lowering of water levels in the rivers, through channel realignment, dredging or alteration of water level control structures, as well as by intensive weedcutting. Whilst this was very successful in increasing the output of farms and also in allowing conversion of flood plain land to arable production, it has since been recognised that the resulting drier valley bottoms can bring about significant changes to the natural environment. Reductions in the numbers of wading birds have been recorded, and changes in vegetation types noted.

Water meadows are an ancient system of agriculture involving the permanent irrigation of low lying fields by a system of water carriers and drains requiring constant attention to control flows. Once common in the Hampshire Avon and adjacent catchments, most have now fallen into disuse through changes in cropping systems and the labour-intensive nature of their operation. Working Water Meadows exist now only on three farms in the Hampshire Avon Catchment; at Britford (2) and Lower Woodford. As discussed above, the irrigation results in wet grassland conditions favoured by wading birds. In addition it is thought that the carriers and drains which serve the water meadows provide good a good habitat for aquatic fauna and may provide fish breeding areas.

6.28.2 Solutions

The direct reversal of a long-standing policy of water level reduction is not easily achieved. However, the recent designation of the Lower Avon Valley as an Environmentally Sensitive Area (ESA) offers payment to farmers for operating within certain criteria; in the higher band of payments is a requirement to maintain groundwater levels within 300 mm of field levels.

Whilst the ESA does not specifically refer to the re-instatement of water meadow systems, there is reference to the introduction of a Conservation Plan for the designated area, which will, inter alia, provide for the restoration and maintenance of features of archaeological and historical importance. A further initiative not confined to the ESA is the Countryside Stewardship Scheme, operated by the Countryside Commission, which offers grant for certain works that will enhance the environment, which would include reinstatement of water meadows.

Whilst the uptake of such schemes is outside the control of the NRA, nevertheless there will be an involvement for the Authority towards the achievement of water levels needed for their implementation. Discussions are already well advanced in respect of the principles of the ESA scheme, although the first applications will not be received before publication of this report.

6.29 INCREASE PUBLIC ACCESS

6.29.1 Nature of Problem

In surveying the catchment it has been noted that public access to the river (for example by public rights of way) is limited in much of the catchment.

The plan has however emphasised the quality of the Hampshire Avon Catchment in terms of landscape and nature conservation value as well as in terms of its renowned fisheries.

The promotion of the Avon Valley ESA emphasises the importance attributed to the Hampshire Avon and provides a source of public funds for its protection.

It is considered, therefore, that there is a case for the promotion of improved public access to the river. Clearly such improved access would need to be selective and subject to 'zoning'.

6.29.2 Solutions

There is an existing 'Avon Valley Walk' promoted by Hampshire County Council but only relatively short stretches are adjacent to the river or close to the river. Development of some sections closer to the river might enhance this walk.

Picnic sites and interpretation facilities are other aspects of public access which have been identified as having potential for development.

In addition to land based access there is also some interest in increased access for water based recreation. This would be a very sensitive issue but arises from consideration of the historic navigation which existed on the river.

6.30 BUFFER ZONES

The concept of buffer zones alongside rivers has received considerable attention in recent years both within the NRA and amongst nature conservation organisations.

The concept basically involves the isolation of a suitably wide strip (10-100m) alongside rivers which is removed from intensive agricultural use and managed to provide appropriate habitat types.

A number of potential benefits of buffer zones have been cited and these include:

- enhances habitat diversity for nature conservation
- improved landscape appearance
- reduction of impact of soil erosion
- potential for management of weed growth by shading
- reduction of impact of farm livestock wastes
- reduction in nutrients entering rivers

The NRA is currently undertaking R & D work to determine the value and efficacy of buffer zones.

In the Hampshire Avon Catchment the first four benefits of buffer zones would be the most likely to be realised.

The land use immediately adjacent to a substantial part of the Hampshire Avon is of a type which already provides a buffer zone but it is considered that some additional stretches, especially on tributaries, offer scope for development of buffer zones.

Clearly the development of buffer zones requires the co-operation of riparian landowners and would need to be encouraged by grants or other financial support. Potential sources of funding would be the Countryside Stewardship Scheme (operated by the Countryside Commission) and CAP Set Aside arrangements (if the creation of buffer zones was accepted under this scheme).

ISSUE 6.1 IMPACT OF SEWAGE TREATMENT WORKS - WARMINSTER AND SALISBURY

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Warminster			
1 Review discharge consent conditions for Warminster STW and storm overflows	NRA	Improved water quality	
2 WWS to undertake survey of sewerage system	WWS	Provide data for correct decision making	Costs
3 WWS to update Warminster STW	WWS	Improved water quality	Costs
4 WWS to update sewerage system (dependant on outcome of item 3)	WWS	Improved water quality	Costs
Salisbury			
1 Undertake detailed survey of impact of Salisbury STW (particularly DO impacts)	NRA	Provide data for correct decision making	
2 Review consent conditions for STW and storm overflows	NRA	Improvement in water quality	
3 WWS to undertake survey of sewage system	WWS	Provide data for correct decision making	
4 WWS to uprate Salisbury STW	WWS	Improved water quality	Costs
5 WWS to uprate sewerage system (especially SSO's) (dependant on outcome of item 3)	WWS	Improved water quality	Costs

ISSUE 6.2 IMPACT OF FARM DISCHARGES - WESTERN AVON, EASTERN AVON, R. SEM AND NADDER

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
1 Review current situation with farm discharges	NRA/Farmers	Improved basis for decision making	
2 Determine realistic water quality objectives	NRA	Avoid unattainable targets/ inappropriate cost penalties	Less than pristine quality would have to be accepted
3 Undertake further pollution control initiatives	NRA/Farmers	Improved water quality	Costs to farmers
4 Explore scope for "extensification" or changed farming activities in problem catchments	NRA/MAFF/ Farmers	Improved water quality	Would require incentive compensation schemes

ISSUE 6.3 PESTICIDES IN THE LOWER AVON AND NADDER

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
1 Investigate occurrence and endeavour to identify sources	NRA	Improved data for decision making	Costs and uncertainty of identification of controllable sources
2 Discuss survey results with Water Companies	NRA/WWS/ Biwater		
3 Ensure improved Water Supply treatment to remove pesticide	WWS/Biwater	Compliance with EC Standards	Costs
4 Attempt to control sources in catchment	NRA	Improved quality/ compliance with EC Standards	Uncertainty of positive outcome - possible costs to agriculture and other pesticide users
5 Lobby central Government for improved national controls on problem pesticides	NRA/ Water Co's	Long term elimination of problem	Uncertainty, may take long time for effects

ISSUE 6.4 GROUNDWATER CONTAMINATION

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
1 Maintain liaison and data exchange between NRA and Water Companies	NRA/Water Companies	Exchange of information for decision making	
2 Investigate sources of pesticide contamination	NRA	Improved data for decision making	Uncertainty of positive outcome
3 Review other potential sources of contamination (including MOD sites)	NRA	Improved data for decision making	
4 Influence pesticide users re quantities, methods and types of pesticides used	NRA	Reduce risks, improve compliance with EC standards	Costs to users and slow results
5 Provide appropriate additonal treatment where necessary	Water Companies	Compliance with EC Standards	Costs

ISSUE 6.5 MINISTRY OF DEFENCE BASES

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
1 Improve liaison with MOD establishments and survey current pollution risks	NRA/MOD	Increase awareness of issues in MOD and improve data for decision making	
2 Improve (1) pollution control practices and (2) pollution control infrastructure at MOD sites	MOD	Reduction of pollution risks and improved water quality	Costs

ISSUE 6.6 STORM SEWAGE OVERFLOWS AND SURFACE WATER DISCHARGES

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
1 Improve monitoring to identify problem storm overflows and surface water discharges	NRA	Improved basis for decision making	Costs

ISSUE 6.6 STORM SEWAGE OVERFLOWS AND SURFACE WATER DISCHARGES

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
2 Continue and extend sewer survey programme	WWS	Improved basis for decision making	
3 Uprate sewerage systems and eliminate unsatisfactory overflows	WWS	Improved Water Quality	Costs
4 Improve safeguards/ treatment on problem surface water discharges	WWS	Improved water quality reduced no. pollution incidents	Costs, and maintenance problems
5 Ensure that new surface water drainage systems for domestic and industrial developments have adequate safeguards and treatment	NRA/WWS/ Planning Authorities	Protection of water quality	Costs, and maintenance problems

ISSUE 6.7 BLASHFORD LAKES INTAKE

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
1 Monitor operation of intake	NRA/WWS	Identification of future problems	
2 NRA to issue consent for backwash operations	NRA	Appropriate controls established	Difficulties of drafting consent
3 WWS continue to operate frequent backwash regime	NRA/WWS	Minimise silt accumulation and disturbance	

ISSUE 6.8 IMPACT OF WATERCRESS FARMS

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
1 NRA to issue consents to discharge	NRA	Control of discharge quality, protection of water quality	

ISSUE 6.8 IMPACT OF WATERCRESS FARMS

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
2 Settlement facilities to be installed	Watercress Growers	Control of suspended solids	
3 Growers to use only pesticides with MAFF approval for off-label use	Watercress Growers	Protection of water quality	Costs

ISSUE 6.9 WATER QUALITY IN CHRISTCHURCH HARBOUR IN RELATION TO RECREATION

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
1 Consider inclusion of Public Health related microbiological standards in Statutory Water Quality Ojectives	NRA (Nationally)	Development of sound basis for setting quality targets	Technically difficult. May not be possible to develop robust standards
2 Set appropriate use related standards (following consultation)	NRA	Clear public agreed targets	Bacteriological quality may not be controlled adequately by point discharges
3 Install appropriate disinfection plant at relevant STW's (if found to be appropriate)	WSS	Improved bacteriological quality	Costs, and may not ensure adequate quality at all times - diffuse sources

ISSUE 6.10 EUTROPHICATION OF THE RIVER (DIATOM ALGAL BLOOMS)

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
1 Review nutrient data	NRA	Provide basis for decision making	
2 Undertake investigation of algal growth	NRA	Provide basis of decision making	Costs
3 Consider designation as vulnerable zone or sensitive area under EC Nitrate or Urban Waste Water Directive	NRA	Provide framework for control of inputs	Cost (WWS and agriculture)

ISSUE 6.10 EUTROPHICATION OF THE RIVER (DIATOM ALGAL BLOOMS) CONTINUED

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
4 Develop programme for nutrient reduction (if feasible). Might include nutrient reduction at STW and agricultural controls	NRA/WWS /MAFF	Reduction in nutrient inputs	Cost Uncertainty of outcome

ISSUE 6.11 SUSPECTED IMPACTS OF ABSTRACTION ON FLOWS IN SOME UPPER TRIBUTARIES

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
1 Investigate impact of abstraction in Upper Avon and tributaries	NRA	Provide basis for decision making	
2 Bed lining to reduce leakage through river bed	NRA	Improve flow regime in affected stretches	Cost and benefits may be very limited.
3 Provide (additional) compensation flows	NRA/Water Companies	Improve flow regime in affected stretches	Cost and may only be genuinely useful in conjunction with 4.
4 Development of alternative resources	NRA/Water Companies	Improve flow regime in affected stretches	Cost and limited opportunities
5 Revocation or modification of existing licences	NRA	Provide statutory remedy	Cost - compensation and would require alternative sources

ISSUE 6.12 PRESSURE ON WATER RESOURCES IN LOWER AVON CATCHMENT

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
1 Enhanced leakage control by Water undertakers	Water Companies	Reduced demand	Costs and diminishing benefits
2 Introduction of water metering	Government/ Water Companies	Reduced demand	Costs and benefits uncertain

ISSUE 6.12 PRESSURE ON WATER RESOURCES IN LOWER AVON CATCHMENT

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
3 Identification of potential storage basins in Lower Catchment	NRA/Water Companies	Potential for winter storage	Costs and other environmental constraints
4 Comprehensive water resources scheme for catchment	NRA/Water Companies	Sensitive management of catchment resources	Costs and long-term nature of solution

ISSUE 6.13 POSSIBLE IMPACT OF EARLIER FLOOD DEFENCE SCHEMES AND DREDGING, RESULTING IN DEGRADATION OF THE RIVERINE ENVIRONMENT IN SOME LOCATIONS

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
1 Identify areas with potential for restoration and determine costs	NRA	Provide basis for decision making	
2 Undertake restoration schemes (if identified and cost effective)	NRA	Improve habitats and landscape	Costs

ISSUE 6.14 SILTATION AND COMPACTION OF SALMONID SPAWNING GRAVELS

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
1 Undertake investigation of condition of spawning gravels	NRA	Provide basis for decision making	
2 Undertake investigation of sources of silt reaching river	NRA	Provide basis for decision making	
3 Investigate benefits of rehabilitation of gravels and methods available	NRA	Provide basis for remedial activities	Possible impacts on other river interests

ISSUE 6.14 SILTATION AND COMPACTION OF SALMONID SPAWNING GRAVELS (CONT.)			
OPTIONS	**RESPONSIBILITY**	**ADVANTAGES**	**DISADVANTAGES**
4 Prepare guidelines for silt management	NRA	Improve river conditions	Reduce negative impacts of remedial work
5 Consider possible long term policies to reduce silt inputs (land use changes, buffer zones)	NRA/MAFF	Improve river conditions	Costs, economic implications of land use changes

ISSUE 6.15 DECLINE IN CATCHES OF LARGE SPRING SALMON			
OPTIONS	**RESPONSIBILITY**	**ADVANTAGES**	**DISADVANTAGES**
1 Restrict net fishing for salmon in Christchurch Harbour to the period 15 April - 31 July	NRA/MAFF	Promote spawning of '3 sea winter' fish	Economic implications for netsmen
2 Restrict rod fishing to fly only before 15 May	NRA/MAFF	Promote spawning of '3 sea winter' fish	Economic implications to fishery owners/ managers
3 Assist in national investigation of declining 'three sea winter' fish	NRA/MAFF	Provide basis of decision making	
4 Investigate genetic implications of restocking and feasibility of restocking programme	NRA	Provide basis for decision making	
5 Investigate condition of gravels for spawning in Avon catchment	NRA	Provide basis for decision making	

ISSUE 6.16 THE COARSE FISHERY BETWEEN DOWNTON AND FORDINGBRIDGE

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
1 Further detailed investigation to identify the causes of observed uneven distribution of juvenile fish	NRA	Provide basis for decision making	

ISSUE 6.17 ILLEGAL FISHING IN CHRISTCHURCH HARBOUR

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
1 Fishery Owners maintain and increase patrols to combat poaching	Fishery owners	Control poaching, reduce impact on spawning population	Costs
2 NRA to maintain surveillance and patrols and improve techniques using new technology	NRA	Control poaching, reduce impact on spawning population	Costs

ISSUE 6.18 NUMBER OF SWANS ON THE RIVER WYLYE

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
1 Monitor numbers, distribution and impact of swans on river uses	NRA/Riparian Owners	Provide basis for decision making	
2 Cull or translocate swans from problem areas	Riparian Owners/ MAFF	Reduce numbers of swans in areas of nuisance	Action must comply with relevant legislation e.g. Wildlife and Countryside Act

ISSUE 6.19 CONFLICT BETWEEN ABSTRACTION FROM THE LOWER AVON AND THE FLOW REQUIREMENTS FOR THE MIGRATION OF SALMON

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
1 Develop prescribed flow thresholds and operating rules applicable to further development of abstraction from Lower Avon	NRA	Permit increased abstraction whilst allowing salmon movement	
2 Identify and develop additional bank-side storage on the Lower Avon	NRA/Water Companies	Permit operation of prescribed flow operating rules	

ISSUE 6.20 WEEDCUTTING

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
1 Review 'code of practice on weedcutting	NRA	Monitor impact and performance of weedcutting practice	
2 Consider reduction of weedcutting programme	NRA	Raise water levels re ESA, improve habitats for birds, improve habitats for coarse fish	Interference with Salmon fishing
3 Improve disposal arrangements for cut weed	NRA/Riparian Owners	Prevent pollution and nuisance	Costs

ISSUE 6.21 LACK OF WEED AT NETHERAVON

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
1 Monitor weed distribution and growth and other relevant environmental parameters	NRA	Provide basis for making decision	May be difficult to establish cause and effect relationships

ISSUE 6.22 IMPACT OF LARGE TROUT FARMS ON THE HAMPSHIRE AVON

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
1 Continue monitoring and rigorous enforcement of statutory controls	NRA	Protection of river flow and quality	
2 Encourage improved treatment and flow monitoring at fish farms	NRA/Operators	Improved compliance with controls, protection of water quality	Costs
3 Continue to improve screening of intakes and fish passes	NRA/Operators	Less interference with fish movements	Costs
4 Resist development of further large fish farms	NRA	Precautionary approach to environmental protection	Objectives subject to appeal

ISSUE 6.23 BRITFORD AREA - FLOW APPORTIONING

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
1 Limit number of control operators	NRA/Riparian Owners	Clear operational responsibility	Will require agreement of all parties
2 Improve maintenance of control structures	Riparian Owners	Improve ease and precision of control	Costs
3 Survey bed profile re dredging	NRA	Provide basis of decision making	Costs
4 NRA to maintain co-ordination role	NRA	Potential for agreement of improved operating rules	Requires cooperation of all riparian owners
5 Construction of fish pass(es)	NRA	Improved fish migration	Costs

ISSUE 6.24 THE OPERATION OF WATER LEVEL STRUCTURES

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
1 Identify opportunities for beneficial raising of water levels	NRA/Riparian Owners	Potential habitat improvements for nature conservation and fish, landscape enhancement	Care required to avoid negative impacts on fish migration and habitat

ISSUE 6.25 GLOBAL WARMING AND SEA LEVEL RISE

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
1 Build in adequate freeboard and provision for future raising of new sea defences	NRA	Provide for predicted sea level rises	Costs
2 Prevent new development in vulnerable areas	NRA/Planning Authorities	Avoid new development in risk areas	

ISSUE 6.26 DEVELOPMENT CONTROL

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
1 Include relevant policies in Structure and Local Plans	NRA/Planning Authorities	Protection of water environment and NRA interests	
2 Encourage enhancement of river corridor features in Structure and Local Plans	NRA/Planning Authorities	Enhancement of the water environment and landscape	Costs
3 Encourage cross boundary consistency between Planning Authorities within catchment	NRA/Planning Authorities	Consistent policies for catchment	
4 Improve liaison between NRA and Planning Authorities	NRA/Planning Authorities	Improved understanding of NRA's interest	

ISSUE 6.27 NEW ROADS AND BYPASSES (IMPACT OF SALISBURY BYPASS)

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
1 Incorporate flood protection measures into all new schemes	NRA/Highway Authorities/ DoT	Avoid increased flood risk	
2 Incorporate pollution control measures into all new road schemes	NRA/Highway Authorities/ DoT	Avoid pollution risks	
3 Ensure nature conservation and landscape aspects of river corridors are protected in all new road schemes	NRA/Highway Authorities/ DoT	Protect nature conservation and landscape	Costs

ISSUE 6.28 MANAGEMENT OF WATER LEVELS TO IMPROVE HABITAT FOR NATURE CONSERVATION AND REINSTATEMENT OF WATER MEADOW SYSTEMS

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
1 Promote ESA Scheme for Avon Valley	MAFF	Provide financial support for more environmentally sensitive farming	Economic impacts on farmers/ landowners
2 Propose areas for participation in ESA	Landowners	Support ESA initiative, improve habitats	Costs
3 Respond to requests for advice/assistance in development of ESA schemes for specific farms or parcels of land	NRA	Support ESA initiative	Costs Resource Implications may be technically difficult
4 Identify areas with potential for raising water levels as part of ESA	MAFF/NRA	Support ESA Tier 2 initiative	Costs Resource Implications
5 Identify watermeadow areas suitable for restoration	Landowners/NRA	Restore landscape of valley and improve habitats	Costs Resource Implications

ISSUE 6.29 INCREASE PUBLIC ACCESS

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
1 Investigate potential for increased land based public access to rivers and river corridors	NRA/Highway Authorities	Provide basis for decision making	
2 Investigate potential for increased water based public access to rivers	NRA/Riparian owners/Local Authorities/ Sport bodies	Provide basis for decision making	
3 Promote selected access initiatives	NRA/relevant interests	Improve public access to river in selected areas	Potential conflict with other river uses

ISSUE 6.30 BUFFER ZONES

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
1 Investigate potential for use of buffer zones to improve river corridor habitats and determine potential benefits for water quality/silt control	NRA	Provide basis for decision making	
2 Promote buffer zone schemes	NRA/MAFF/ Landowners	Improved river corridor habitats, possible water quality benefits	Economic impacts will probably require financial support mechanism

APPENDIX 1

WATER QUALITY CRITERIA

(1.1) NWC River Quality Classification

(1.2) Aesthetic Requirements

(1.3) Game Fishery - Use related criteria

(1.4) Coarse Fishery - Use related criteria

(1.5) Potable Abstraction - Use related criteria

(1.6) Bathing - Use related criteria

(1.7) Immersion Sports - Use related criteria

(1.8) Agricultural Irrigation - Use related criteria

(1.9) Livestock Watering - Use related criteria

River Quality Classification

RIVER CLASS	QUALITY CRITERIA	REMARKS	CURRENT AND POTENTIAL USES
1a Good Quality	1) 5 percentile Dissolved Oxygen Saturation greater than 80% 2) 95 percentile Biochemical Oxygen Demand not greater than 3 mg/l 3) 95 percentile Ammonia not greater than 0.4 mg/l 4) Where water is abstracted for drinking water, it complies with requirements for A2* 5) Non-toxic to fish in EIFAC terms (or best estimates if EIFAC figures are unavailable)	1) Mean Biochemical Oxygen Demand probably not greater than 1.5 mg/l 2) No visible evidence of pollution	1) Water of high quality suitable for potable supply abstractions 2) Game or other high class fisheries 3) High amenity value
1b Good Quality	1) 5 percentile Dissolved Oxygen Saturation greater than 60% 2) 95 percentile Biochemical Oxygen Demand not greater than 5 mg/l 3) 95 percentile Ammonia not greater than 0.9 mg/l 4) Where water is abstracted for drinking water it complies with the requirements for A2* 5) Non-toxic to fish in EIFAC terms (or best estimates if EIFAC figures are unavailable)	1) Mean Biochemical Oxygen Demand probably not greater than 2 mg/l 2) Mean Ammonia probably not greater than 0.5 mg/l 3) No visible evidence of pollution 4) Water of high quality which cannot be placed in Class 1a because of the effect of physical factors such as canalisation, low gradient or eutrophication	Water of less high quality than Class 1a but usable for substantially the same purposes.

* See note (e)

RIVER CLASS	QUALITY CRITERIA	REMARKS	CURRENT AND POTENTIAL USES
2 Fair Quality	1) 5 percentile Dissolved Oxygen Saturation greater than 40%	1) Mean Biochemical Oxygen Demand probably not greater than 5 mg/l	1) Waters suitable for potable supply after advanced treatment
	2) 95 percentile Biochemical Oxygen Demand not greater than 9 mg/l	2) Water showing no physical signs of pollution other than humic colouration and a little foaming below weirs	2) Supporting reasonably good coarse fisheries
	3) Where water is abstracted for drinking water, it complies with requirements for A3*		3) Moderate amenity value
	5) Non-toxic to fish in EIFAC terms (or best estimates if EIFAC figures are unavailable)		
3 Poor Quality	1) 5 percentile Dissolved Oxygen Saturation greater than 10%		Waters which are polluted to an extent that fish are absent or only sporadically present. May be used for a low grade abstraction for industry. Considerable potential for further use if cleaned up.
	2) Not likely to be anaerobic		
	3) 95 percentile Biochemical Oxygen Demand not greater than 17mg/l. This may not apply if there is a high degree of re-aeration.		
4 Bad Quality	Waters which are inferior to Class 3 in terms of dissolved oxygen and likely to be anaerobic at times		Waters which are grossly polluted and are likely to cause nuisance.
X	Dissolved Oxygen greater than 10% saturation		Insignificant watercourses and ditches which are not usable, where the objective is simply to prevent nuisance.

* See note (e)

APPENDIX 1.1

Notes on the River Quality Classification

NOTES: a) Under extreme weather conditions (eg flood, drought, freeze-up), or when rivers are dominated by plant growth, or by the decay of aquatic plants, rivers usually in Class 1, 2 and 3 may have levels of Biochemical Oxygen Demand and Dissolved Oxygen, or Ammonia outside the stated levels for those classes. When this occurs the cause should be stated along with analytical results.

b) The Biochemical Oxygen Demand refers to the 5-day carbonaceous determination performed in the presence of allythiourea (ATU). Ammonia is expressed as the ammonium ion, NH_4^+.

c) In most instances the chemical classification given above will be suitable. However, the basis of the classification is restricted to a finite number of chemical determinands and there may be a few cases where the presence of a chemical substance other than those used in the classification markedly reduces the quality of the water. In such cases, the quality classification of the water should be downgraded on the basis of biota actually present, and the reasons stated.

d) The standards set up to protect freshwater fisheries by the European Inland Fisheries Advisory Commission (EIFAC). The standards should be expressed as 95-percentiles.

e) The definition and the requirements of A2 and A3 are those specified in the Directive on the Quality of Water Intended for Abstraction for Drinking Water.

The NWC River Quality Classification has been used as a basis for Long Term Water Quality Objectives set by Wessex Water Authority in 1979.

This Classification system has also been used for the 5 yearly national Water Quality Reports in 1980, 1985 and 1990.

This system will be superseded by a new classification system associated with the framework being developed by the NRA for Statutory Water Quality Objectives.

APPENDIX 1.2

AESTHETIC REQUIREMENTS

USE RELATED QUALITY CRITERIA

Determinand	Standard
Colour	No perceptible abnormal discolouration
Mineral Oils	No visible oil
Foaming	Only visible on detailed inspection (<2% cover)
Transparency	No unnatural turbidity *
Litter	Only visible on detailed inspection
Odour	No perceptible odour

* Depending on meterological and geographical conditions

GAME FISHERIES
USE RELATED QUALITY CRITERIA

Determinand	Value	Units	Statistic
Dissolved Oxygen	>70	% saturation	10%ile
BOD	<4	mg/l	90%ile
Total Ammonia	<0.6	mg/l	90%ile
Unionised Ammonia	<0.021	mg/l	95%ile
pH	6-9	pH units	95%ile
Nitrite	<0.5	mg/l	95%ile
Total Residual Chlorine	<0.005	mg/l	95%ile
Total Zinc	<0.3	mg/l	95%ile
Dissolved Copper	<0.04	mg/l	95%ile

These standards are consistent with the salmonid requirements of the EC Directive on the Quality of Water Required for Freshwater Fish (78/659/EC)

These criteria have been taken as appropriate for Aquaculture (Fish Farming) requirements.

APPENDIX 1.4

COARSE FISHERIES
USE RELATED QUALITY CRITERIA

Determinand	Value	Units	Statistic
Dissolved Oxygen	>50	% saturation	10%ile
BOD	<8	mg/l	90%ile
Total Ammonia	<1	mg/l	90%ile
Unionised Ammonia	<0.025	mg/l	95%ile
Total Residual Chlorine	<0.005	mg/l	95%ile
Total Zinc	<1	mg/l	95%ile
Dissolved Copper	<0.04	mg/l	95%ile

These standards are consistent with the cyprinid requirements of the EC Directive on the Quality of Water Required for Freshwater Fish. (78/659/EC)

These criteria are also taken as appropriate for the general protection of aquatic life.

APPENDIX 1.5

POTABLE ABSTRACTION
USE RELATED QUALITY CRITERIA

Determinand	Value	Units	Statistic
Ammonia	<1.5	mg/l	95%ile
Colour	<100 *	Pt. Scale	95%ile
Temperature	<25 *	°C	95%ile
Nitrate	<50	mg/l	95%ile
Dissolved Iron	<2	mg/l	95%ile
Zinc	<5	mg/l	95%ile
Arsenic	<0.05	mg/l	95%ile
Cadmium	<0.005	mg/l	95%ile
Total Chromium	<0.05	mg/l	95%ile
Lead	<0.05	mg/l	95%ile
Selenium	<0.01	mg/l	95%ile
Mercury	<0.001	mg/l	95%ile
Barium	<1	mg/l	95%ile
Cyanide	<0.05	mg/l	95%ile
Sulphates	<250	mg/l	95%ile
Phenols	<0.005	mg/l	95%ile
Hydrocarbons	<0.2	mg/l	95%ile
Polyaromatic Hydrocarbons	<0.0002	mg/l	95%ile
Pesticides	<0.0025	mg/l	95%ile

These standards are consistent with the mandatory requirements for the A2 category of the EC Directive on the Quality of Water Intended for Abstraction for Drinking Water (75/440/EC)

BATHING
USE RELATED QUALITY CRITERIA

Health related standards for bathing are not available.

For water identified as coming within the scope of the EC Directive on the Quality of Bathing Waters (76/160/EC) the relevant criteria (listed below) have been used.

Determinand	Value	Unit	Statistic
E. Coli	2000	No. per 100 ml	95%ile
Total Coliforms	10,000	No. per 100 ml	95%ile

In addition the following aesthetic criteria have been used:

(1) No visual evidence of pollution by gross sewage solids and debris except under occasional unfavourable weather conditions

(2) No formation of sewage slicks, or sewage derived discolouration, or foaming visible from foreshore areas frequented by the public.

IMMERSION SPORTS
USE RELATED QUALITY CRITERIA

Health related standards for immersion sports are not available.

In the absence of other criteria, the following aesthetic criteria have been used.

(1) No visual evidence of pollution by gross sewage solids and debris except under occasional unfavourable weather conditions.

(2) No formation of sewage slicks or sewage derived discolouration or foaming visible.

APPENDIX 1.8

AGRICULTURAL IRRIGATION

USE RELATED QUALITY CRITERIA

Determinand	Value	Unit	Statistic
pH	5.5-8.5	pH units	Annual Average
Chloride	<100-600*	mg CL/1	Annual Average
Boron	<2-8*	mg B/1	Annual Average
Chromium	<2	mg Cr/1	Annual Average
Copper	<0.5	mg Cu/1	Annual Average
Iron	<1-2	mg Fe/1	Annual Average
Lead	<2	mg Pb/1	Annual Average
Nickel	<0.15	mg Ni/1	Annual Average
Zinc	<1	mg Zn/1	Annual Average
Molybdenum	<0.03	mg Mo/1	Annual Average
Selenium	<0.02	mg Se/1	Annual Average
Vanadium	<0.08	mg V/1	Annual Average

* Depends on crop type.

APPENDIX 1.9

LIVESTOCK WATERING

USE RELATED QUALITY CRITERIA

Determinand	Value	Units	Statistic
pH	6-9	pH units	Annual Average
Chloride	<1000	mg Cl/1	Annual Average
Sulphate	<250	mg SO_4/1	Annual Average
Fluoride	<2	mg F/1	Annual Average
Dissolved Oxygen	>30	% saturation	Annual Average
Arsenic	<0.2	mg As/1	Annual Average
Chromuim	<1	mg Cr/1	Annual Average
Copper	<0.2	mg Cu/1	Annual Average
Lead	<0.05	mg Pb/1	Annual Average
Nickel	<1	mg Ni/1	Annual Average
Zinc	<5	mg Zn/1	Annual Average

APPENDIX 2

ABBREVIATIONS

%ile	-	Percentile
%sat	-	% saturation (of oxygen)
3SW	-	Three 'sea winter' (salmon)
AONB	-	Area of Outstanding Natural Beauty
BOD	-	Biochemical Oxygen Demand
BOD (ATU)	-	Biochemical Oxygen Demand with nitrification suppressed by allylthiourea
DO	-	Dissolved Oxygen
DoE	-	Department of the Environment
DWF	-	Dry weather flow
ESA	-	Environmentally Sensitive Area
FBA	-	Freshwater Biological Association (now IFE)
IFE	-	Institute of Freshwater Ecology
LTO	-	Long Term Objective
mg/l	-	milligrams per litre
MOD	-	Ministry of Defence
NNR	-	National Nature Reserve
NRA	-	National Rivers Authority
PSA	-	Property Services Agency
SAM	-	Scheduled Ancient Monument
SNCI	-	Site of Nature Conservation Interest
SPA	-	Special Protection Area
SSO	-	Sewage Storm Overflows
SSSI	-	Site of Special Scientific Interest
STW	-	Sewage Treatment Works
SWQO	-	Statutory Water Quality Objective
WQO	-	Water Quality Objective
WWS	-	Wessex Water Services

APPENDIX 3

NATURE CONSERVATION AND ARCHAEOLOGICAL DESIGNATIONS CITED IN THIS REPORT

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.

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.

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.

RAMSAR sites

Sites identified by UK Government under the Convention on Wetlands of International Importance which was ratified by the UK Government in 1976.

Special Protection Areas (SPAs)

Sites identified by UK Government under the EC Directive on the Conservation of Wild Birds (79/409/EC).

Sites of Nature Conservation Interest (SNCI)

Sites selected (usually by County Trusts) as sites of 'County' ecological importance.

Scheduled Ancient Monument (SAM)

Sites of national importance designated under the Ancient Monuments and Archaeological Areas Act 1979.