

2204

SEATON, LOOE AND FOWEY CATCHMENT MANAGEMENT PLAN CONSULTATION REPORT



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Published December 1994

Foreword

The Seaton, Looe and Fowey is the first group of catchments for which the NRA's Cornwall Area is preparing a Catchment Management Plan (CMP). The preparation of this plan is part of a national programme to prepare CMP's for all catchments in England and Wales over the next 5 years.

An important part of the Catchment Management Plan process is public consultation which is designed to allow those who live in, or use, the catchment to have an input into the development of NRA plans and work programmes.

The Consultation Report includes relevant information about the catchment and lists the issues identified by the NRA which need to be addressed. Following the public consultation period the NRA will produce a Final Plan which will set out targets for action by the NRA and others over the coming years. We intend to set up Steering Groups comprising representatives of organisations and interests in the catchment to monitor progress.

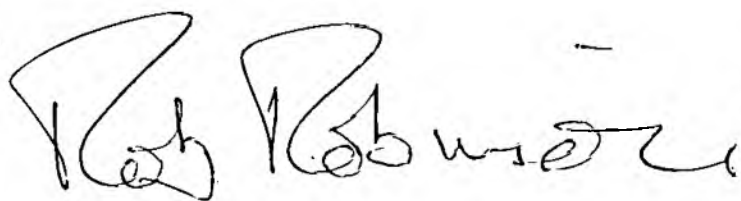
The Seaton, Looe and Fowey catchments are essentially high quality environments and the NRA's vision is one of maintaining and reinforcing current high standards and ensuring that the character of the water related environments is maintained.

We would welcome your views on the future management of these catchments:

- Have we identified all the issues?
- Do you have views on the options for action?
- Do you have any other information or views which you wish to bring to our attention?

This is your opportunity to influence our future plans.

We look forward to hearing from you.



ROB ROBINSON
Area Manager Cornwall

ENVIRONMENT AGENCY



125145

THE NATIONAL RIVERS AUTHORITY

The NRA's mission and aims are as follows:

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

AIMS

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

SEATON, LOOE AND FOWEY CATCHMENT MANAGEMENT PLAN

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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 and historic features

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. The NRA's principal tool to achieve this is catchment management planning. This treats a river together with the land, tributaries and underground water connected with it, as a discrete unit or catchment. The catchment management plan sets out a common vision for a river catchment, reached through consultation. It identifies objectives for catchment water quality, water quantity and physical features and actions for the NRA and others to achieve.

We believe that it is important that the interests of all water users are considered in the development and protection of the water environment and have consequently chosen to promote our vision and management proposals via published Catchment Management Plans (CMPs). 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 model for the production of Catchment Management Plans within the NRA has 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.

1 CATCHMENT MANAGEMENT PLANNING - CONCEPT AND PROCESS

1.2 Scope and Process of Catchment Management Planning (continued)

Targets

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

A tabulated summary of issues arising out of the previous sections is presented with a number of options to address each issue. The organisation responsible and also some advantages and disadvantages of the suggested options are indicated.

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.

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. Therefore we must ensure that this plan is perceived as an agreed strategy for realising the environmental potential of a catchment within the prevailing economic and political constraints. Improvements required to address catchment problems must be prioritised in the context of the funds available to the appropriate agency. This may be a Company or individual who may see little or no financial benefit in carrying out the actions, Local Authorities with government capping or Water Service companies with

investment programmes approved by OFWAT and the DOE.

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 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 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.

While 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.

YOUR VIEWS

The Seaton, Looe and Fowey Catchment Management Plan Consultation Report is the NRA's initial analysis of the issues facing the catchment.

As part of the consultation process we would like to hear your views.

- * Have we identified all the issues?
- * Have we identified all the options for solutions?
- * Have you any comments on the issues and options listed?

Please send any comments in writing to:

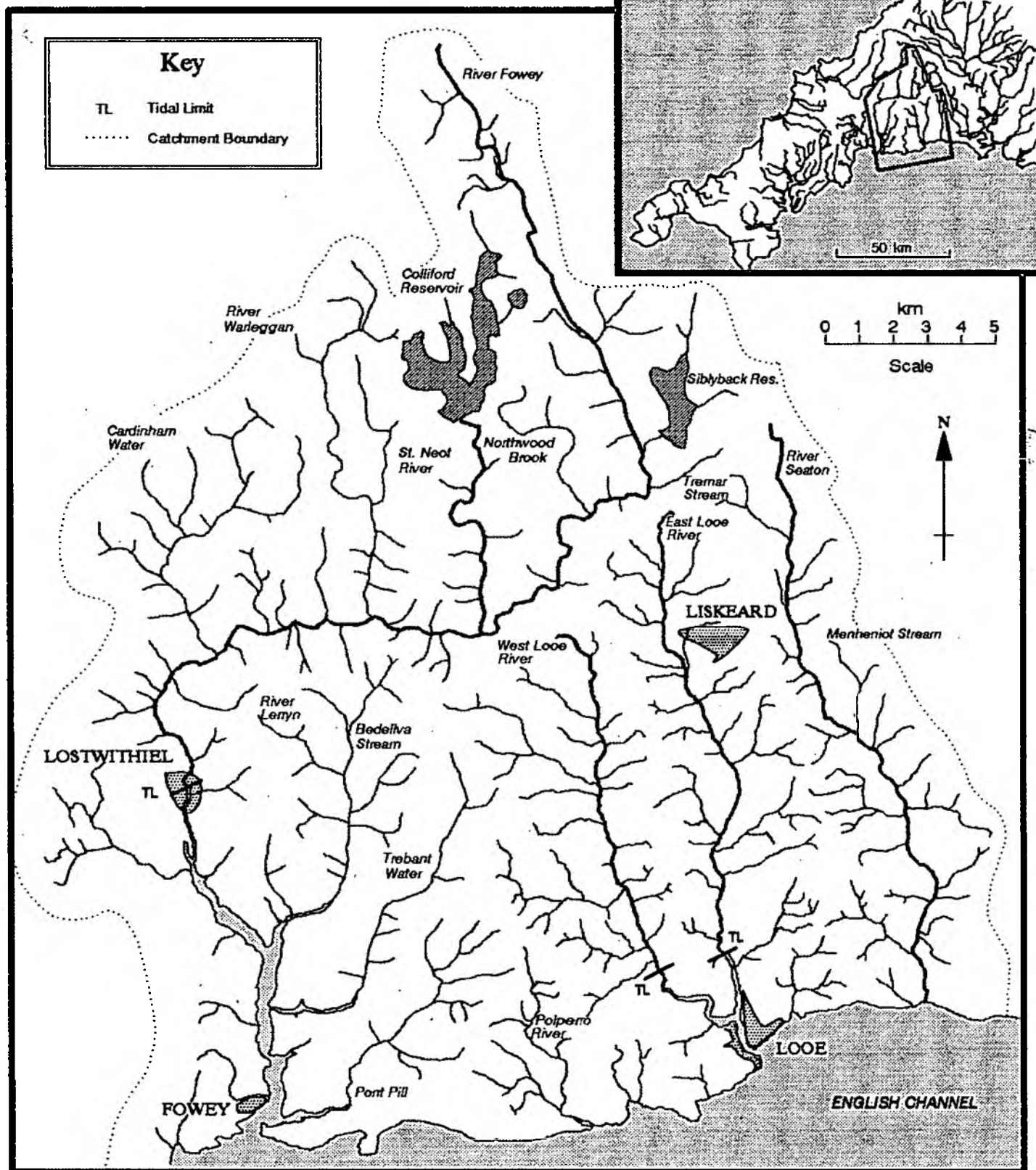
Darragh Turley
Catchment Planner
Cornwall Area
National Rivers Authority
Sir John Moore House
Victoria Square, Bodmin
Cornwall PL31 1EB
Telephone (0208) 78301
Fax. (0208) 78321

All comments must be received by 8th February 1995.

Note: Whilst every effort has been made to ensure the accuracy of this report it may contain some errors or omissions on which we will be pleased to receive comment.

SEATON, LOOE AND FOWEY CATCHMENT

Catchment

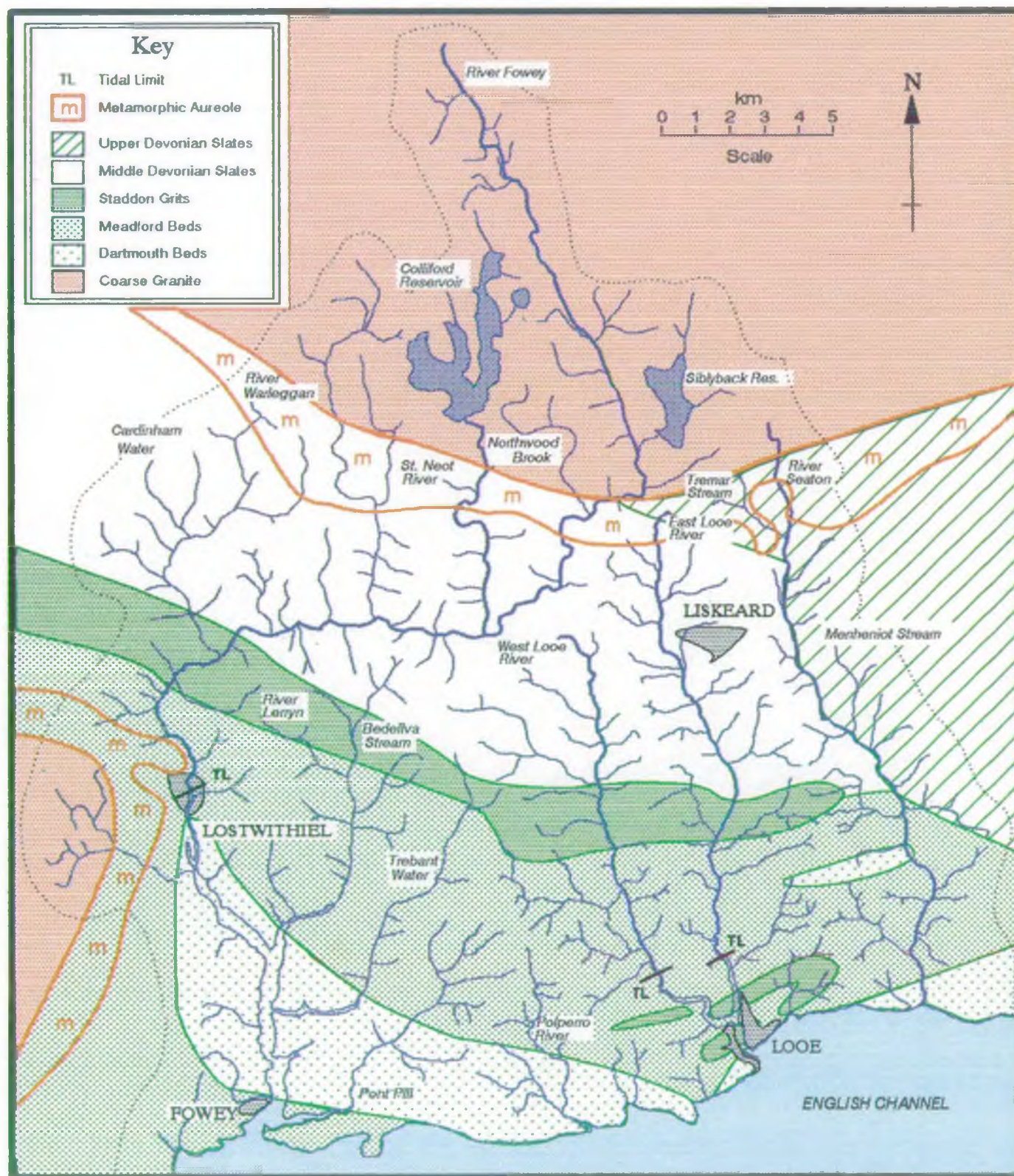


NRA South Western Region

THE SEATON, LOOE AND FOWEY CATCHMENT.



Geology



NRA South Western Region

2.0 INTRODUCTION

The Seaton, Looe and Fowey catchment drains the area of south-east Cornwall from the southern slopes of Bodmin Moor to the south coast between Gribbin Head to the west and Seaton Beach in the east. The total area of the catchment is 465km².

The catchment is essentially rural in character, ranging from open moorland to rolling hills intersected by steep sided river valleys. There is no heavy industry, but historically there was extensive mining activity, especially in the north of the catchment, which has left its own legacy of abandoned mines and workings.

Population

The population of the catchment at the 1991 census was 34,970. Many of these people live in farms, hamlets and villages, although there are four larger towns; Liskeard, Lostwithiel and the ports of Looe and Fowey. Since 1981 there has been an increase in the population, particularly in those parishes with larger settlements and in the east of the catchment, from where many people commute into Plymouth to work.

Dispersed settlement patterns and low population densities give rise to particular infrastructure challenges and problems, which are exacerbated by a summer influx of tourists. Particular effects on the water environment are the demands made on the water supply and sewerage system.

The catchment lies within a Rural Development Area, a status which indicates the need for economic development, with a broader base than the traditionally dominant agriculture.

Geology and Soils

The sources of the Rivers Seaton and Fowey rise on Bodmin Moor at about 300 metres. The underlying granite rock gives rise to thin peaty upland soils (ironpan podzolic soils) and patches of exposed rock. High annual rainfall and these poor soils result in low grade agricultural land and wet moorland which supports rough grazing and conifer plantations.

Moving south, the granite gives way to Devonian sedimentary rocks (slates, shales and thin limestones) the change being marked by a significant increase in gradient. Here the East and West Looe River originate and gradients of all the rivers begin a steady easing towards the sea.

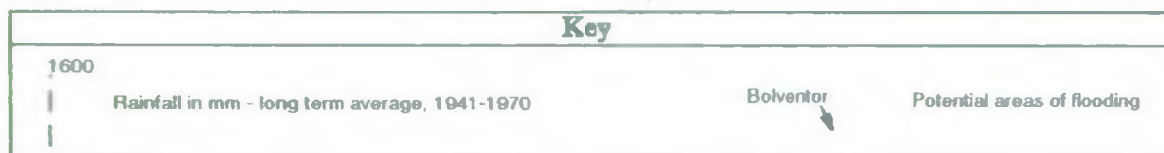
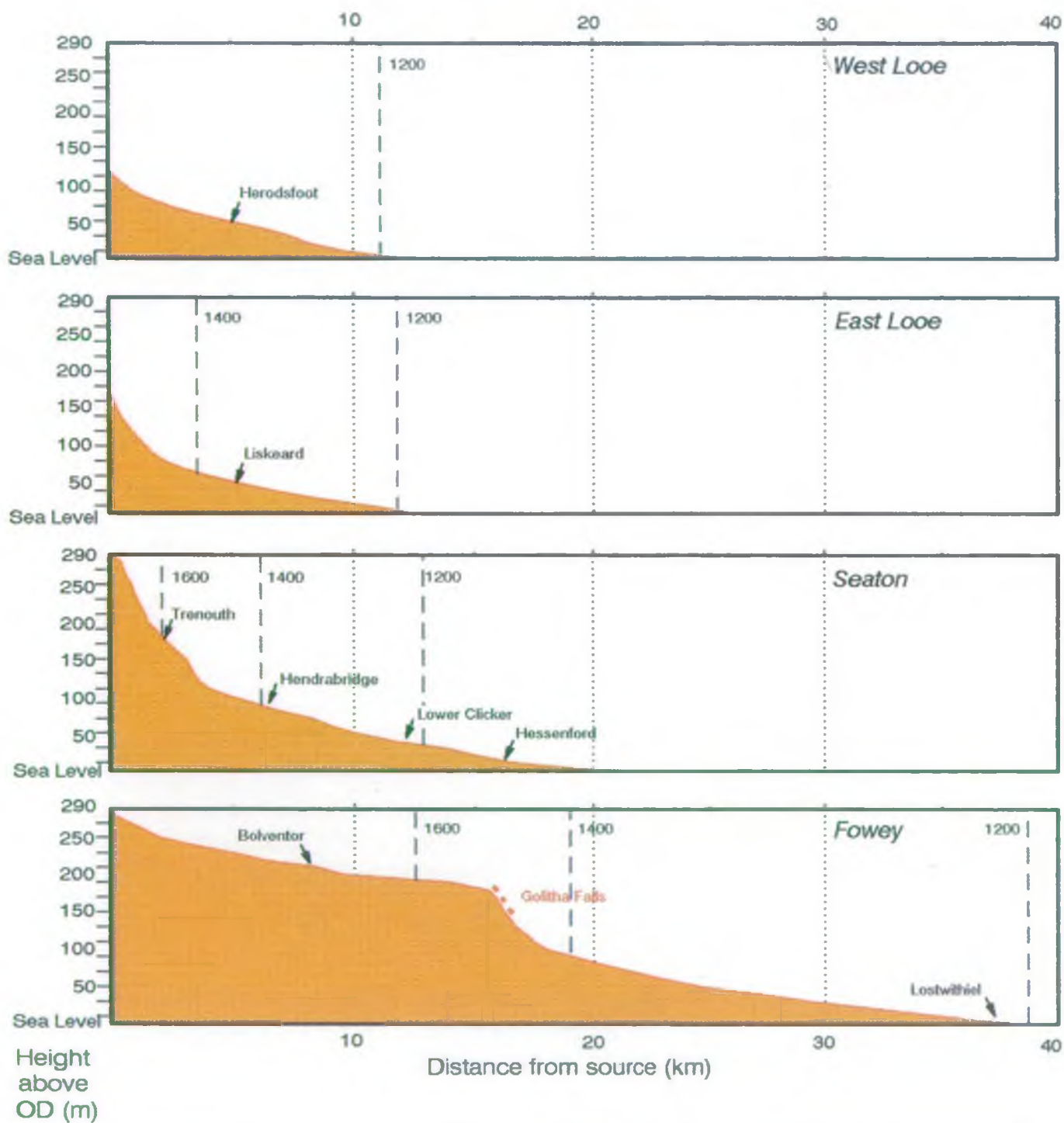
The most widespread soils in the catchment are the brown earths, characteristically free draining, readily cultivated, productive soils which, with the mild climate, support a wide range of agriculture.

More restricted agriculture occurs on the small pockets of seasonally wet cambic stagnogley soils and alluvial gley soils found in the valleys, the former are poor draining and support stock rearing and woodland, the latter deep, free draining and support dairying and cropping.

Mineralisation of the rock through the volcanic activity experienced when Bodmin Moor was forming resulted in pockets of metals such as tin, copper lead and silver. These are located in a series of faults, the trends of which run east-west for tin and copper, and north-south for lead and silver (see Geology Map). These have since been commercially mined.

SEATON, LOOE AND FOWEY CATCHMENT

River Profiles



Hydrogeology

The bedrock underlying the Seaton, Looe and Fowey catchments has been classified as a minor aquifer. It is generally well cemented and has a low intergranular permeability. These rocks have been subject to widespread folding and faulting and it is within associated fractures and fissures that storage and transmission of groundwater occurs. At shallow depths weathering, the accumulation of valley alluvium (as a result of soil creep down valley sides) and other processes enhance groundwater storage and permeability.

Locally, modification of the natural low-level water movements has occurred through historic mining activity. Now-disused adits and shafts have the ability to hold and move considerable quantities of water. Due to the current unstable nature of internal mine structures this can be in an unpredictable way.

The primary groundwater uses are for the provision of river baseflow and to support numerous small scale potable water supplies. 201 groundwater source abstractions are licensed, and a comparable number of unlicensed domestic supplies are estimated to be present within the catchments. Provision of river baseflow in terms of both quantity and quality is most critical during periods of prolonged dry weather.

As a consequence of shallow water tables, low porosity and rapid flow, the groundwater found within the catchments and the water supplies and rivers which it supports is highly vulnerable to contamination from escape of pollutants into the soil.

Hydrology

The catchment receives a high average rainfall, with the greatest amount falling on Bodmin Moor. With short tributary networks, the underlying geology and topography the flows in the rivers are characterised by rapid rises and falls in water levels after periods of rainfall (such a characteristic is known as "flashy"). This character is highlighted on the River Seaton where the Q95 flow (the flow which is exceeded for 95% of the time on average) represents only 20% of average daily flow.

The effect of Colliford and Siblyback Reservoirs on the Fowey system is to reduce the flood peaks especially in the Autumn, extend the period of relatively high flows and increase low flows.

Further detailed information on the hydrology is given in Appendix A.

Tides

Spring tides in the Fowey Estuary typically range from 0.4m to 5.5m, and in the Looe Estuary from 0.3 m to 5.7m .

The Ministry of Agriculture Fisheries and Food flood defence division estimate that any sea defences should allow for a sea level rise of 5mm per year. (MAFF 1991)

3.0 VISION FOR THE CATCHMENT

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

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

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

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

As Guardians of The Water Environment of the Seaton, Looe and Fowey Catchment it is the NRA's role to present the case to protect the water environment from damage; sustaining and extending its environmental value and interest whilst enabling appropriate commercial, industrial and recreational use to be made of it.

In an area of such high amenity and ecological value as the Seaton, Looe and Fowey the emphasis should be on protection of the catchment. The NRA's vision of the future is towards a catchment where;

Minimal compromise of water quality, quantity and physical structure of the water environment is accepted to facilitate economic development.

Improvements continue to be made to existing discharges, meeting the most stringent appropriate standards.

An agricultural and forestry system develops which reduces the risk of diffuse pollution and improves the physical habitats of the river systems and wetlands for wildlife.

The public's enjoyment and appreciation of the river system continues to grow.

The aquatic biodiversity of the catchment is maintained and extended.

There is minimal risk to people and property from flooding.

4.0 CATCHMENT USES

The following section details the uses that are made of the water environment.

The title "catchment uses" is used as a catch-all phrase, although it is recognised that it may not adequately describe activities, inherent values or resources of the catchment.

For each use a description is given of what the use is considered to be and the general impact or requirements it has on or from the water environment. The role and objectives of the NRA in respect of the use and its involvement with the water environment is followed by how the NRA is able to directly control the use through its own **Duties and Powers**, or has a **commitment** to achieving results through liaison with others. The current situation with respect to the use within the catchment is then given.

Particular points of consideration are picked up in the later chapters on water quality, quantity, and physical features, where targets and current state within the catchment are detailed. Where there is a difference between target and state an issue is highlighted.

4.1 CONSERVATION - LANDSCAPE, WILDLIFE AND ARCHAEOLOGY

General

This use relates to the natural and historic built environment and the NRA'S approach to its management.

The Seaton, Looe and Fowey catchment contains a wealth of natural, semi-natural and human built features of value and interest.

The NRA is concerned that degradation of water related features through neglect, mismanagement or insensitive development is minimised and active measures are taken to conserve and enhance them.

The Role and Objectives of The NRA

Under Section 16 of the Water Resources Act 1991¹, and Section 12 of the Land Drainage Act 1991², the NRA is obliged, when formulating or considering any proposals relating to any of its functions, to:

- further the conservation and enhancement of natural beauty and the conservation of flora (plants), fauna (animals) and geological and physiographical (landform) features of special interest;
- have regard to the desirability of protecting and conserving buildings, sites and objects of archaeological, architectural or historic interest;
- take into account the effect which proposals would have on the beauty or amenity of any rural or urban area or on any flora, fauna, features, buildings, sites or objects;

Section 18 of the Water Resources Act refers to a Code of Practice giving practical guidance on conservation.

In addition under Section 2(2) of the Water Resource Act 1991 the NRA has a general duty to promote:

- the conservation and enhancement of the natural beauty and amenity of inland and coastal waters and of land associated with such waters;
- the conservation of flora and fauna which are dependant on the aquatic environment;

The NRA has duties and powers to:

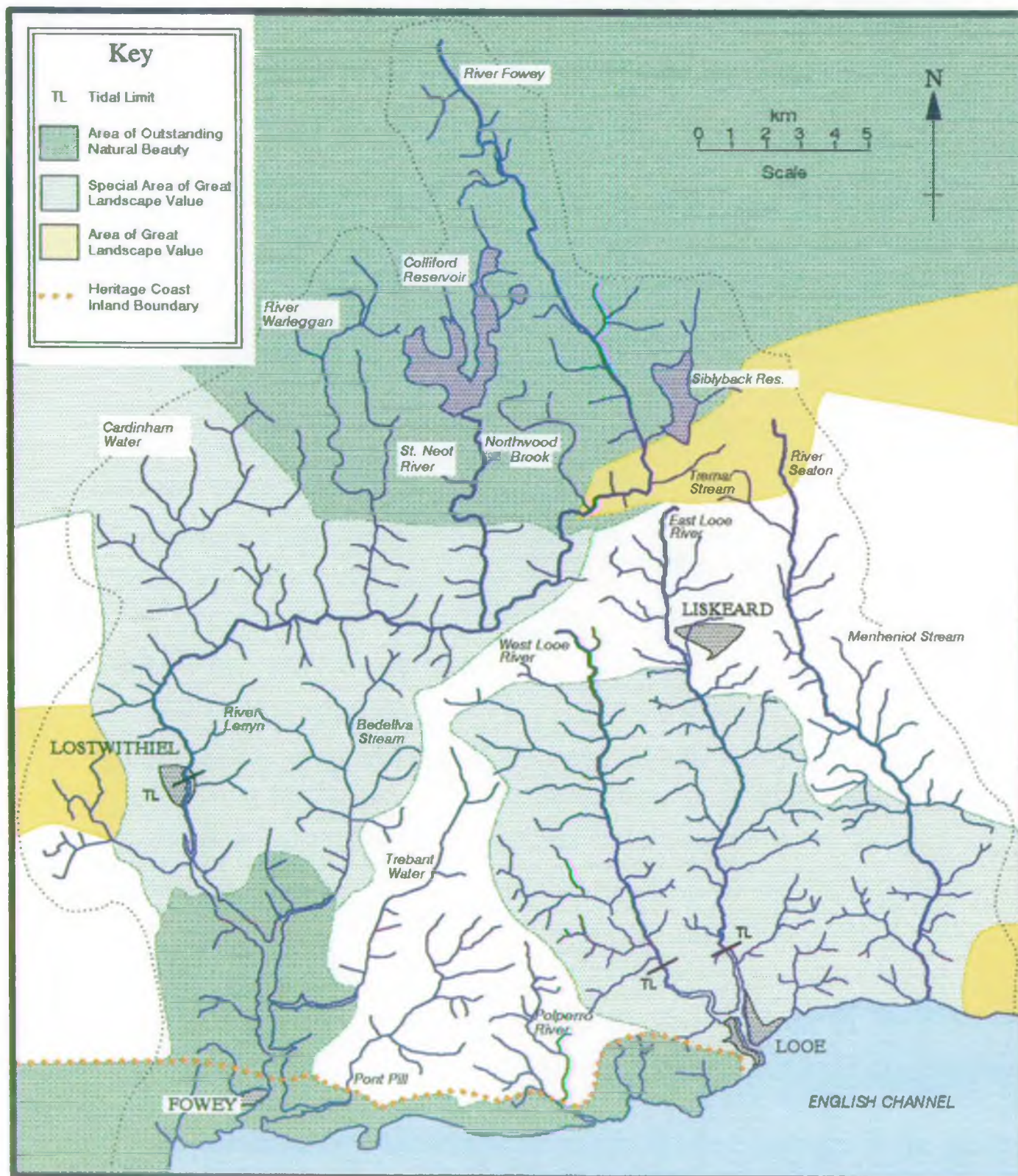
- protect and develop natural and historic features when carrying out works
- protect and develop natural and historic features when licensing others to carry out works
- establish nature reserves on land it owns

The NRA has a commitment to:

- liaise with planning authorities to ensure that conservation interests are taken into account and expressed in Regional, Structure and Local plans.
- work in partnership with conservation organisations to achieve the NRA's objectives.

SEATON, LOOE AND FOWEY CATCHMENT

Landscape Designations



NRA South Western Region

4.1.1 CONSERVATION - LANDSCAPE

Water has been fundamental in shaping the landform and dictating natural vegetation patterns. Human modifications of natural drainage systems and changing land use has been superimposed on these natural patterns. The resulting combination of semi- natural and managed land combines to create a landscape of variety and quality, much of which is covered by landscape designations.

The limited undesignated area of the catchment is still largely rural, and is also of high landscape quality.

Designated Areas

Areas of Outstanding Natural Beauty (AONB):

Bodmin Moor and the coast (and hinterland) from Fowey to West of Looe are AONB's. AONB's are of National importance and are afforded special protection from development by Planning Authorities.

Special Areas of Great Landscape Value (SAGLV) and Areas of Great Landscape Value (AGLV): These are County designations affording the areas protection in the County Structure Plan. SAGLV's are considered equivalent to AONB's. The Mid-Fowey Valley, Boconnoc Area, and the Looe and Seaton Valleys are designated SAGLV's. AGLV's which overlap the catchment are Caradon Hill, Red Moor and Helman Tor and South East Caradon.

Heritage Coast:

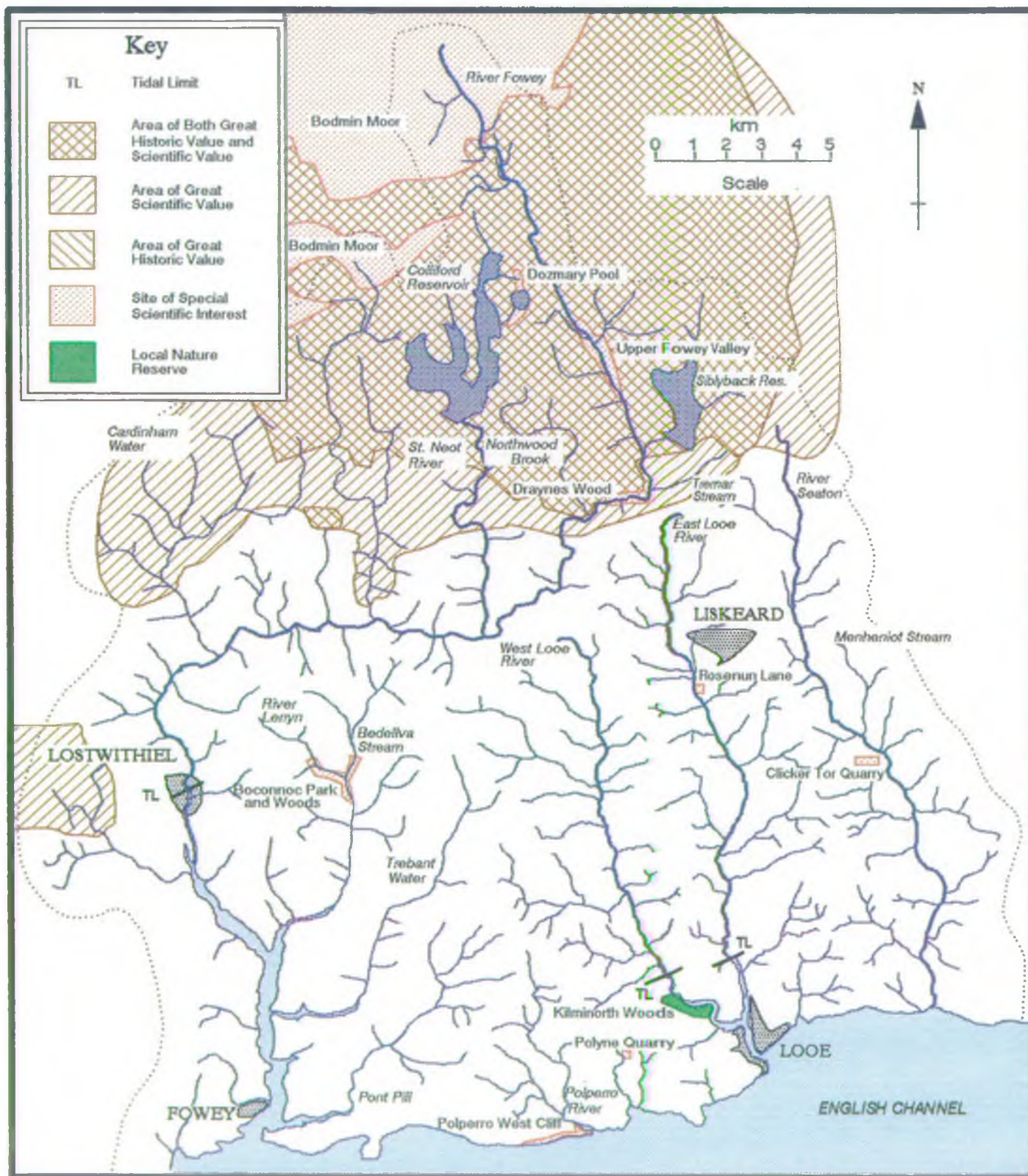
The Gribbin Head to Polperro Heritage coast falls within the catchment. The designation is recognition of its importance in a national context for coastal landscape, conservation and recreation. Heritage coasts seek to develop co-ordinated protection and use through a Heritage Coast Plan (or similar document) which outlines a local management approach and is complemented by planning policies.

The main character of these areas are the exposed open uplands of Bodmin Moor which fall from the north and east to their southern boundary where they are cut by deep river valleys. These valleys of woodland or parkland widen at their base as they flow south through rolling hills to estuaries or discharge direct to an exposed coastline with rugged cliffs and small beaches. The transition from the rugged granite moors to the softer wooded valleys is marked. There has been a change in the character of the landscape through the conversion of semi - natural deciduous woodland to coniferous plantations, particularly in the Fowey valley.

Landscape degradation has particularly occurred in the lower Seaton valley down to Seaton Beach through post war development.

SEATON, LOOE AND FOWEY CATCHMENT

Conservation Designations



4.1.2 CONSERVATION - WILDLIFE

Woodland makes up 14.5% (approximately) of land use, the majority of which (10.8%) is semi-natural habitat. Approximately 11.5% of the remainder of the catchment is made up of semi-natural habitats including bogs, mires and saltmarsh.

The catchment is of high conservation value. Particularly important in this is the aquatic environment and surrounding river corridor, both as a habitat resource and as a wildlife corridor.

Riparian (the natural vegetation immediately alongside a watercourse) and aquatic vegetation varies over the catchment, dependent to a degree on local geology and landform. The vegetation is dominated by trees such as alder, oak, sycamore, hawthorn, hazel and ash, other sections support bogs and mires, ancient woodland or saltmarsh.

Aquatic vegetation is limited in the upper Seaton system and parts of the Fowey system due to the impact of metal toxicity. Localised areas of shading by the riparian vegetation also naturally reduce aquatic vegetation. Bryophytes are often the largest component of aquatic vegetation.

The extensive coastline contains areas of high quality intertidal and subtidal environments, however the NRA possesses little survey data. The Heritage Coast designation offers some protection to the landward aspect of the coast. Below low water mark however there is no protection through the planning system, and as yet there are no formal or voluntary designations relating to marine conservation.

The NRA contributed to a project carried out by the Cornwall Wildlife Trust (CWT) to produce a map based habitat database for the county through interpretation of aerial photographs. The resultant maps are particularly useful in identifying natural or semi-natural habitats throughout the catchment which are not covered by other designations and might therefore be vulnerable to adverse development. Within the catchment the maps show that, excepting Bodmin Moor, permanent wetland areas are largely restricted to the headwaters of watercourses.

The potential of the database is being fully realised in a current project between CWT, Cornwall County Council and the EC where information is being translated onto a Geographical Information System (GIS).

One significant indicator in the water environment is the freshwater invertebrate community and the food chain this supports. The NRA undertakes routine biological monitoring throughout the catchment and compares actual results against a predicted score for the river type, largely to monitor long term water quality. This is supported by data from fisheries and conservation surveys which focus on key indicator species which are indicative for the type of river in a high quality state, and invasive species which are seen as a threat to the sustainable diversity of native flora and fauna.

Biological and fisheries data generally indicate a high quality water environment, supporting varied invertebrates, game and coarse fish. Localised problems, particularly metal contamination have reduced the diversity and abundance of both groups. More detailed information is given in Appendices C and E.

Designated Areas

Much of the catchment is of recognised conservation value, with the following national, county and local level designations:

CATCHMENT USES

Sites of Special Scientific Interest (SSSIs) :

SSSIs are recognised as nationally important sites, and afforded specific protection through legislation. They are overseen by English Nature, who the NRA are obliged to consult if sites are likely to be affected by any developments or operations, directly undertaken or licensed. There are 9 SSSIs in the catchment, six of which have aquatic interest (Appendix B). Of these the NRA carries out river maintenance within Bodmin Moor, North and the Upper Fowey Valley, and seeks to agree operation and maintenance plans with English Nature.

National Nature Reserve (NNR) :

Golitha Falls NNR, part of Draynes Wood SSSI, is owned and managed by English Nature. It is nationally important for the species it supports, particularly the damp ancient woodland with associated bryophytes and lichens.

Areas of Great Scientific Value (AGSV) :

Bodmin Moor and the Mid/Upper Fowey Valley are designated as AGSVs. The AGSV designation is recognition that identified important sites such as SSSIs cannot be sustained effectively as isolated islands and seeks to provide (through the County Structure Plan) buffer zones around sites, wildlife corridors to link sites, and emphasise the most important areas of nature conservation to concentrate resources.

Local Nature Reserve (LNR) :

Kilminorth Woods (at Looe) is a LNR established by Caradon District Council to facilitate management to protect and enhance the conservation value of the historic woodlands. The only significant aquatic component is the estuary, which abuts the woodland edge.

Cornwall Nature Conservation Sites (CNC sites) :

There are a number of CNC sites within the catchment. The reason for designation varies, however two broad categories, moorland and wooded river valleys, are noted, both of which have the water environment as an essential component.

CNC sites have been notified by the Cornwall Wildlife Trust (CWT) as being sites representative of natural and semi-natural habitats found in the County. These include SSSIs and National and Local Nature reserves. A number of others are owned and managed as nature reserves by various voluntary conservation organisations such as CWT and the Woodland Trust. Information on the sites is supplied to the County and District Councils who use the information to assess the impact of development proposals. The CWT also comments on specific development proposals.

The NRA also holds copies of the records for its own use and consults freely with the CWT. Within and outside these areas there are the following rare species.

Rare Species

Throughout the catchment there are many nationally rare species of flora and fauna, many of which are dependent upon the water environment. Records kept by the Cornish Biological Records Unit (CBRU), which in many cases go back well into the last century, reveal that many of these species have been remarkably persistent. Continued high levels of water and habitat quality and further enhancements across the whole catchment, not just in the key, designated areas, are crucial to the long-term health of these populations.

CATCHMENT USES

Within the catchment as a whole certain vulnerable wetland species are very well recorded and worthy of special mention:

- (i) The Otter (*Lutra lutra*) ranges widely across the area, utilising all the watercourses. On the CBRU database, 28 casual records are listed between 1985 and 1993. This mammal is afforded special statutory protection through the Wildlife and Countryside Act and through the EC Habitats Directive and is a species that the NRA can greatly assist through its work.
- (ii) The Dipper (*Cinches cinchis*) has its Cornish stronghold in the Bodmin Moor area. In 1992, breeding was proved at 4 sites in the catchment and was likely in at least another 5 localities. This species can be particularly assisted through sensitive bridge and riverbank repair works.
- (iii) The Kingfisher (*Alcedo atthis*) occurs in small numbers in the catchment. No breeding was confirmed in 1992, but up to 5 pairs were present in suitable sites in the season and may have bred unnoticed. The species has definitely bred at one site here since 1990. There has been an increasing incidence of sightings by NRA staff through the catchment in 1994.
- (iv) The Grey Heron (*Ardea cinerea*) is a very obvious wetland bird. Several heronries occur in this catchment, which between them held 23 occupied nests in 1992, representing 22% of the total Cornish breeding population that year. This proportion has remained relatively stable over recent years. The stands of mature riverside trees are vital for the conservation of this species.

Small numbers of wading birds such as Curlew, Redshank and the uncommon Black-tailed Godwit feed on the intertidal mudflats of the Fowey, while Bodmin Moor is a very important site for wintering waders such as Golden Plover and for small numbers of breeding waders. Rare birds of prey such as Peregrine, Merlin and Hen Harrier hunt across the moor during the winter.

A number of other species, not all truly wetland species, are closely associated with the water environment of the catchment. Often this is due to the riparian habitat constituting the last or most extensive remnants of semi-natural habitat in that area. Filmy Fern, the moss *Fissidens polyphylus*, Spring Squillwort, Small Red Damselfly, Marsh Fritillary and various species of bats, including Noctule and Daubenton's all fall into this category and their conservation can be directly assisted by the works of the NRA.

Of the above species, Otter, Kingfisher, Peregrine, Merlin, Hen Harrier and Golden Plover are all listed in the EU Habitats Directive³ as requiring particular protection and conservation assistance through EC legislation. The NRA will seek to play a major role in safeguarding these populations in particular, as well as the ecosystem in general.

Invasive Species

In a number of places within the catchment, semi-natural vegetation is threatened by the spread of two 'pest' species, Japanese Knotweed and Himalayan Balsam. Both species can spread quickly along the watercourse corridor and form dense stands of vegetation. The main problems associated with the spread of these invasive plants include:

CATCHMENT USES

- the shading out of native plant species and the prevention of natural regeneration of broadleaved trees;
- increased bank erosion as the invasive plant dies back in Autumn;
- dense stands which restrict access for NRA operational staff and the public.

Under the Wildlife and Countryside Act 1981⁴, it is an offence to plant or otherwise cause Japanese Knotweed (and Giant Hogweed, though this is not known as a problem in the catchment) to grow in the wild. Himalayan Balsam has yet to be included in this Act.

Laurel and Rhododendron are also problematic within the catchment, particularly shading out native species and preventing regeneration of broadleaved trees.

The problem has a fairly high public profile in some areas and requires action. The NRA is continuing research into these invasive species and has produced a leaflet "Guidance for the control of invasive plants near watercourses"⁵.

Control needs to be undertaken by landowners and managers throughout the catchment as well as by the NRA.

4.1.3 CONSERVATION - ARCHAEOLOGY

Given the historic developments within the catchment there are likely to be numerous sites of interest which are not designated. The Cornwall Archaeological Unit (CAU) have an ongoing programme (the Sites and Monuments Record) to catalogue such sites. The NRA will take advice from such groups, and in turn inform them of any features which are uncovered and considered of possible interest.

Within the catchment there are a range of designated sites, though few are closely related to the water environment.

Designated Sites

Scheduled Ancient Monuments (SAMs):

There are numerous SAMs within the catchment, largely unrelated to the water environment, although there are a number of bridges. Most SAMs are concentrated on Bodmin Moor. SAMs are of national importance, protected in law and administered by English Heritage, who the NRA are obliged to consult if sites are likely to be affected by any developments or operations, directly undertaken or licensed. They are given full consideration by the NRA in any relevant applications.

Area of Great Historic Value (AGHV):

A large part of Bodmin Moor is designated as an AGHV, recognition of the concentration of archaeological interest.

Historic Settlements :

There are 4 Historic settlements (Fowey, Lostwithiel, Looe and Liskeard), which are designated as being of county importance for archaeological value above and below ground. With the AGHV they are afforded special protection in the Cornwall County Structure Plan.

CATCHMENT USES

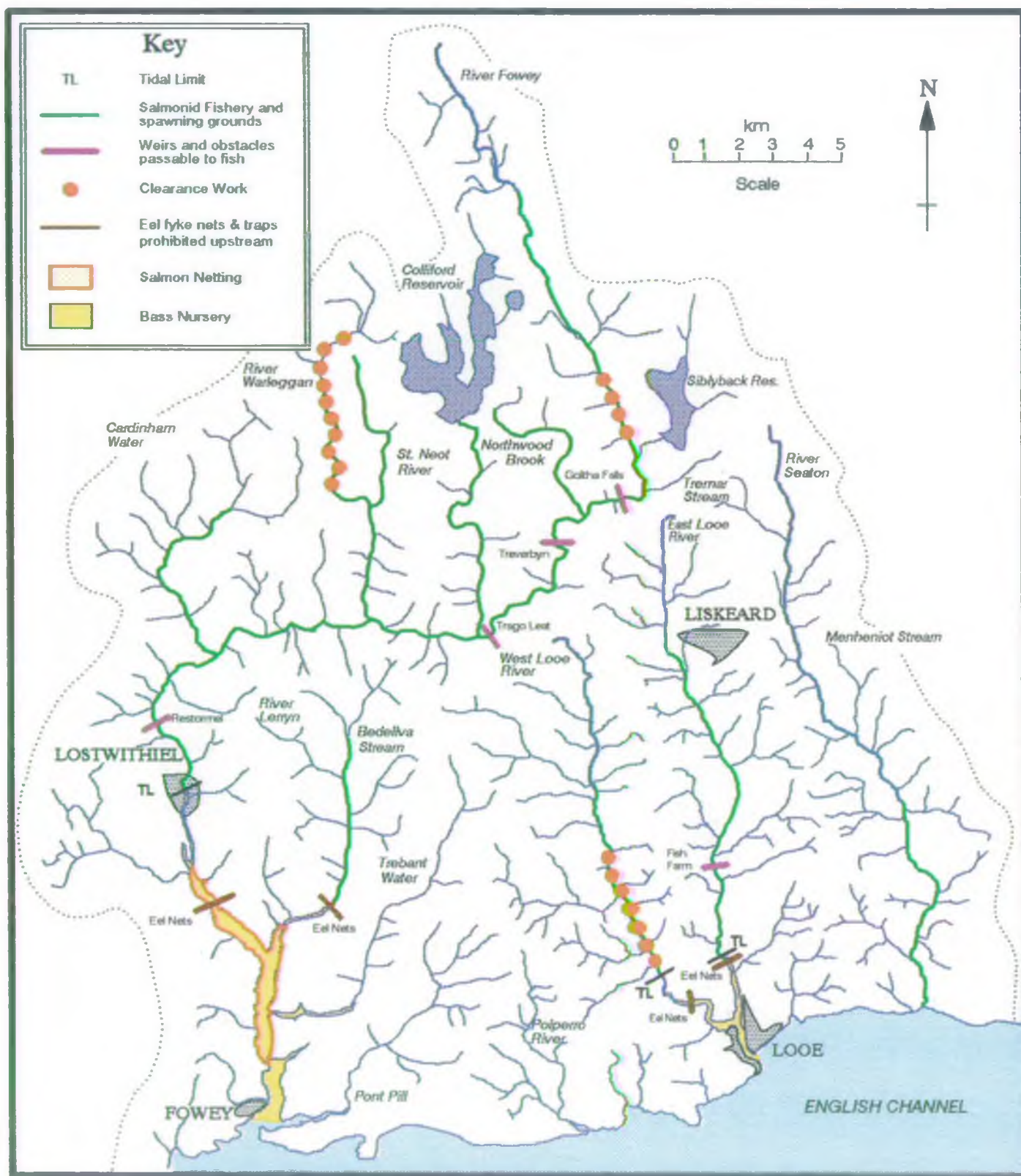
Listed Buildings:

There are hundreds of listed buildings within the catchment which **are** considered of county importance. Records are kept by District and County Councils and **protection** is offered through the planning system.

The NRA checks that any "in-house" developments or operations do **not** impact on listed buildings. Due to the number of listed buildings within the catchment **applicants** seeking NRA licences to undertake abstractions, discharges or works are required **to** carry out their own search.

SEATON, LOOE AND FOWEY CATCHMENT

Fisheries



NRA South Western Region

4.2 FISHERIES

4.2.1 General

This use relates to the conservation of fish species and the maintenance and development of their environment.

Areas of concern to the NRA are the impacts on natural fisheries from pollution and decline in water quality, the illegal taking of fish, the escape of non-native species from fish-farms, the impedance of migratory fish and the reduced quality of habitats required to support fish.

The Role and Objectives of the NRA

The NRA aims to maintain, improve and develop fisheries.

The NRA has duties and powers to:

- regulate fishing through a licensing system.
- police the illegal taking of fish and the sale and export of wild salmon and trout.
- ensure the unobstructed migration of salmon and sea trout between the sea and their spawning grounds.
- control the movement of and introduction of fish or spawn into any waters other than fish farms.
- control fish disease outside fish farms.
- monitor fish stocks.
- raise income through duties on fishing licences.
- ensure adequate levels of water to support fisheries.

The NRA has a commitment to:

- liaise with other organisations with a role to play in the protection and management of inland and coastal fisheries.
- maintain effective links with local authority planning departments to ensure fisheries are not adversely affected by development plans
- prevent or limit fish losses by the implementation of emergency and rescue policies.
- control the movement or introduction of fish or spawn into fish farms through liaison with Ministry of Agriculture, Fisheries and Food (MAFF).

4.2.2 Local Perspective

The Seaton, Looe and Fowey catchment has a high-quality salmonid fishery. There are over 65 km of river, and 2 reservoirs, Colliford and Siblyback, designated as salmonid stretches under the EC Freshwater Fish Directive⁶. The stretches consist of: the River Seaton downstream of Hendra Bridge; the West Looe River downstream of Churchbridge; the full lengths of the St Neot and Warleggan Rivers and the River Fowey downstream of Lamelgate. However, salmonids are found throughout the catchment and to the top of the river systems. The River Seaton crosses Seaton Beach so migrating salmonids move into fresh water at high tide.

Fish Stocks

Fish stocks in the catchment have remained reasonably steady during the past few years.

Juvenile surveys in 1985 and 1993 on the River Seaton show that the headwaters above Stonybridge do not support any fish life. These stretches have elevated metals levels resulting from numerous old mine workings. The rest of the river indicates good populations of juvenile trout, and adult sea trout are found downstream of Trouts Mill. Tremar stream has shown a dramatic fall in trout populations between the two surveys; in 1985 this site had the highest population density of trout fry and parr but 1993 results suggest that the trout fry were absent and few trout parr remained. Although eels were present in both surveys the healthy population of bullheads in Tremar Stream had disappeared by 1993. Eels are present throughout the River Seaton downstream of Stonybridge and bullheads downstream of Blackson. Water sampling and biological monitoring (see Section 5.1) indicate that there is persistent organic enrichment of the stream. There have also been periods of drought between the surveys. Both of these factors could contribute to the decline.

Good trout numbers were found throughout the Looe catchment in the 1985 survey. Salmon fry were present on both Looe rivers although there was a marked preference for the West Looe. Good trout fry populations were found at the highest sites on both the East and West Looe. Eels and bullheads were found at all sites on both rivers. The Looe rivers are due to be re-surveyed in 1994.

The River Fowey was surveyed in 1980 and 1991. The river has shown improvements in its juvenile salmonid population over the past 20 years, especially the Warleggan River which now supports a healthy salmon and trout population. Both surveys show a strong trout population in the Warleggan River, Cardinham Water, Trenant Stream and the River Lerryn. Bullheads and eels are present downstream of Codda on the River Fowey and throughout the upper tributaries and the River Lerryn.

The NRA has recently installed a fish counter at Restormel to gather data on volume and seasonality of migration and to evaluate issues such as the perceived lack of a spring salmon run.

Restocking

The NRA's Colliford hatchery, immediately downstream of the reservoir, is used for rearing salmon and trout for mitigation work throughout Cornwall including stocking Colliford Reservoir with native brown trout.

Maintenance

Trash dam clearance and rehabilitation of spawning gravels was carried out along the West Looe river from Sowdens Bridge to Church Bridge in 1992 and it is intended to update the work every three years. The East Looe river maintains itself, the gravels being regenerated by the scouring action of trash dam pools.

Seven sites on a 3 mile stretch of the River Fowey in the Draynes Valley have been cleared annually to stop sedimentation and weed encroachment and to keep the river at its original width. In 1995 a programme of weed clearance on the Warleggan upstream of Wooda Bridge to the A30 will commence. Re-assessment will be needed at the top site when roadworks at

CATCHMENT USES

Shallow Water Hill are completed. The NRA would seek to maintain these spawning areas (see Section 5.3).

Enforcement

The NRA routinely carries out enforcement and anti-poaching work to ensure that fish are not being taken illegally. This includes patrols throughout the freshwater system, and by boat in the estuaries and out to sea.

Sea Fisheries

The NRA has sea fisheries responsibilities for the Looe and the Fowey estuaries. Both are bass nursery areas with no bass fishing permitted between 1 May and 31 December.

4.2.3 COMMERCIAL FISHING FOR WILD FISH STOCKS

General

This use is principally concerned with the use of nets and other types of gear to catch migrating eels, sandeels, salmon and trout or other freshwater fish

The Role of the NRA

Migratory salmonid fisheries are closely controlled by Net Limitation Orders that are designed to maintain stocks.

The NRA has duties and powers to:

- licence commercial salmonid fisheries within the terms of the Orders and enforces its provisions.
- licence the capture of eels and non-salmonid freshwater fish, other than by rod and line.
- licence commercially caught fish in freshwaters with rod and line under the rod licensing system.

Local Perspective

Commercial fishing for wild stocks in the Looe estuary is restricted to netting for sandeels and freshwater eels. A by-law in force since 1981 prohibits the netting of salmon.

In the Fowey estuary 4 licensed seine nets fish for salmon and sea trout from 1 March to 31 August. There is also some sand eel netting carried out. Rainbow trout are farmed in cages at Fowey. Occasionally escapees are captured by the netsmen.

The NRA regularly monitors licensed operators to ensure that they adhere to the conditions of their licence.

CATCHMENT USES

4.3 AGRICULTURE

4.3.1 General

With more than 80% of the land in England and Wales used for agriculture, there is significant scope for impact on the water environment. Areas of concern to the NRA include:

- Pollution of surface waters and groundwaters from animal wastes, fertilizers, pesticides and other associated agro-chemicals.
- Soil erosion resulting in increased siltation of surface waters and the transport of soil with associated nutrients and pesticides to watercourses.
- The effect of land drainage leading to rapid surface water run-off and easy access of contaminated surface water to watercourses.
- Destruction of river banks by uncontrolled stock resulting in bank erosion.
- The drainage and insensitive management of wetlands limiting their ecological potential and hydraulic and water quality buffering capacity.

The Role and Objectives of the NRA

The NRA aims to limit the negative impact of agriculture on the aquatic environment and promote environmentally sympathetic practices.

The NRA has duties and powers to:

- use existing powers to control point source discharges to the water environment from agricultural activities through its discharge consenting role.
- use existing powers to control abstraction.
- enforce the Control of Pollution (Silage, Slurry and Agricultural Fuel) Regulations 1991⁷ for the design of new storage and handling systems.

Additionally the NRA has a commitment to:

- carry out a systematic programme of visiting livestock farms to persuade and guide farmers to control illegal point source discharges.
- encourage waste minimization in an aim to reduce the amounts of waste being stored.
- encourage the careful application of livestock farm waste to agricultural land in accordance with the Code of Good Agricultural Practice⁸ and by use of Farm Waste Management Plans.
- identify to Government "sensitive areas" for the restriction of certain agricultural practices e.g. nitrate sensitive areas and nitrate vulnerable zones.
- encourage appropriate land management alongside rivers, including the use of "buffer zones" and set-aside to move cultivation and livestock away from watercourses.
- further develop and promote the concept of "best land use practice" techniques to prevent diffuse pollution of surface and groundwaters.

CATCHMENT USES

collaborate with MAFF, National Farmers Union (NFU), Country Landowners Association (CLA) and other agricultural organisations to establish an effective way forward for the prevention of farm pollution.

4.3.2 Local perspective

Agricultural land use reflects the nature of the soils and relief of the land, ranging from poor, wet limiting soils in the north to the fertile, free-draining brown earths in the south capable of supporting a variety of agricultural activities. There are no flood prevention structures to prevent seasonal flooding of agricultural land and land drainage is limited to the Upper Fowey Valley.

Agricultural activity in the catchment is primarily mixed farming on holdings averaging 275-300 acres. There are large numbers of dairy units within the catchment and these cause most of any farm pollution problems.

Maize is increasingly grown in the catchments, bringing its own potential for problems. The crop is often heavily manured before planting and after harvesting. Sustained rainfall on these manured fields can result in run-off to rivers and roads leading to discolouration and pollution of water courses. The NRA nationally is currently involved in research into the use, movement and impacts of the chemical *Atrazine* which is heavily used when maize is grown has been shown to be persistent in water.

Table 2 Agricultural Land Use

River	Use	Approximate Hectares	Percentage of Catchment
Seaton	Improved Grassland	3327	57.0
	Arable	1113	19.1
	Coniferous Woodland	155	2.7
	Broadleaf Woodland	698	12.0
Looe	Improved Grassland	7371	55.5
	Arable	2471	18.6
	Coniferous Woodland	512	3.9
	Broadleaf Woodland	1475	11.1
Fowey	Improved Grassland	13795	50.3
	Arable	3187	11.6
	Unimproved Grassland	2600	9.5
	Coniferous Woodland	1223	4.5
	Broadleaf Woodland	2600	9.5

The remainder of the catchment is made up of natural and semi-natural features such as scrub, bracken, unimproved grassland, saltmarsh, wetland and open water.

CATCHMENT USES

The table below shows the pollution incidents in 1992/93 arising from agricultural activities.

Table 3 Pollution incidents arising from agricultural activities 1992/3

Year	Major	Significant	Minor	Source Not Found
1992	0	0	17	0
1993	0	2	19	2

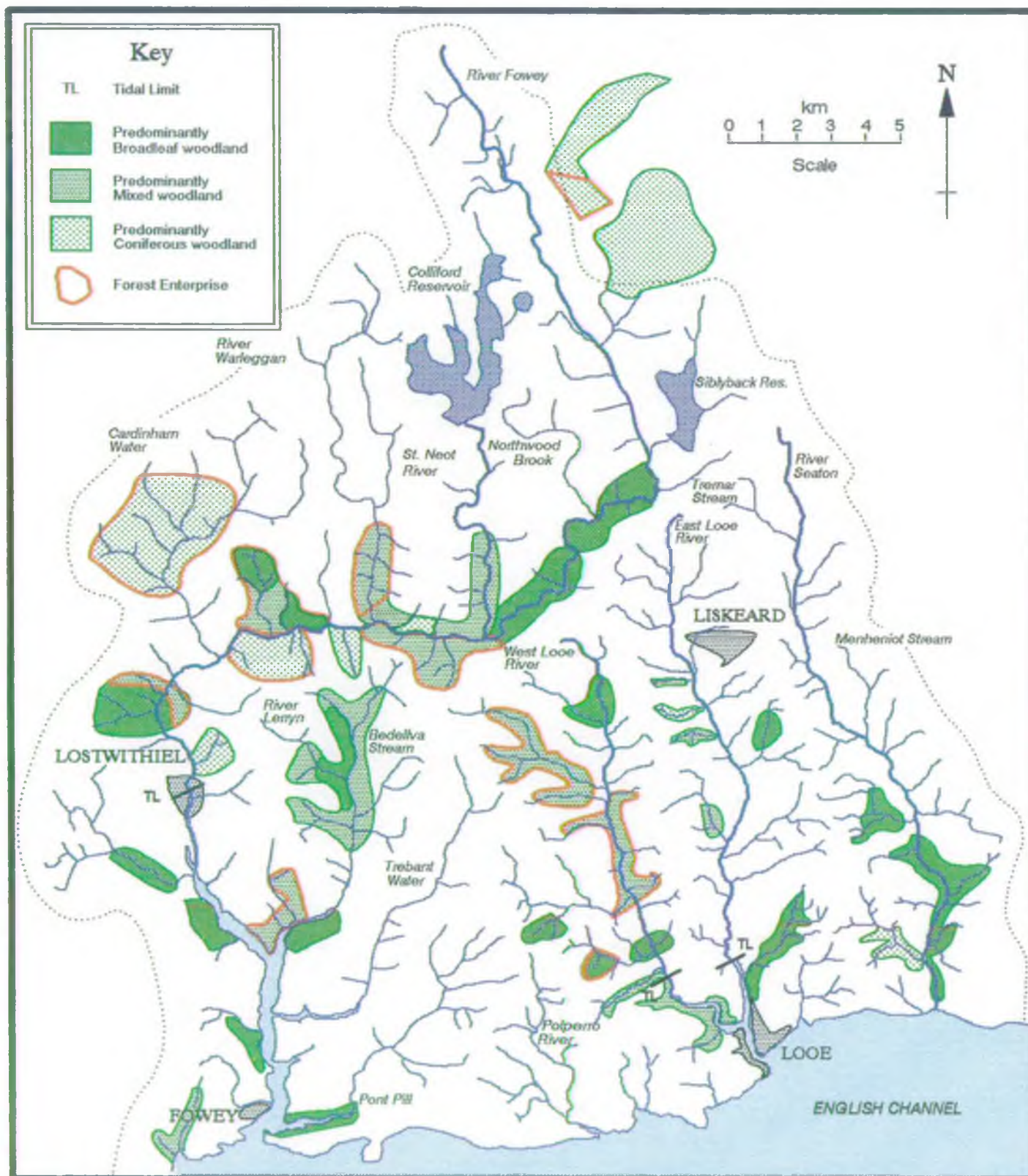
Note: Definition of Severity Codes given in Appendix G

The River Seaton and the Looe Rivers were the subjects of a Farm Campaign in 1988/89. The East Looe was task-forced in 1993/94, and the West Looe and Seaton will be in the winter of 1994/95. There has been no significant amount of agriculturally-caused pollution in the River Fowey catchment in the past few years.

Agricultural use of the Seaton, Looe and Fowey catchment will probably continue to be dominated by dairy and arable farming. With the agreements through the Common Agricultural Policy (CAP) and General Agreement on Trade and Tariffs (GATT) there may be increased set aside of land, reduced management and increased opportunities for conservation and recreation within the countryside.

SEATON, LOOE AND FOWEY CATCHMENT

Forestry



Source: OS 1:50000 maps

NRA South Western Region

4.4 FORESTRY

4.4.1 General

The NRA recognizes that well managed forestry in appropriate areas can have minimal impacts on water and can benefit the overall environment. However, in certain circumstances conversion of land to forest and subsequent activities can have serious impacts on the water environment. Areas of concern to the NRA include:

- Acidification of surface waters caused by the planting, harvesting and replanting of conifers on poorly buffered upland soils. The forest canopy scavenges sulphur and nitrogen pollutants from the atmosphere, and tree growth removes base cations from the soil.
- Soil erosion due to forestry activities resulting in high suspended sediment loads and siltation of surface waters.
- Reduced water yield in catchments because forests cause increased evapotranspiration.
- Pollution of surface waters and groundwaters from the use of fertilizers and pesticides.
- Effects on the habitat and conservation value of riparian and associated land.

The Role and Objectives of the NRA

The NRA aims to limit the negative impact of forestry on the aquatic environment and promote environmentally sympathetic practices.

The NRA has duties and powers to:

- regulate certain aspects of forestry infrastructure development through the enforcement of Land Drainage legislation.

Additionally the NRA has a commitment to:

- agree and improve links with the Forestry Authority and with Local Authorities to ensure uniform and adequate consultation on all forestry schemes, and on Structure/District/Local Plans, particularly in relation to Indicative Forestry Strategies.
- identify to the Forestry Authority and Local Authorities areas potentially sensitive to the planting of forests.
- develop a more proactive approach to "best land use practice" techniques. The Forestry Authority in consultation with the NRA and others has published the Forest and Water Guidelines⁹ which summarizes best practice for forestry in relation to the protection of the water environment.
- develop a consistent approach to environmental impact assessment for proposed forestry schemes.

4.4.2 Local Perspective

Forestry and woodland cover approximately 14.5% of the catchment area of which 73% is deciduous or mixed woodland. Much was originally ancient natural and semi-natural woodland. Over recent years much of this ancient woodland has been replanted.

The largest plantations are indicated on the map; the majority of which are in private ownership. Public access is limited to blocks owned or managed by Forest Enterprise and the National Trust land at Respryn.

Most woodland can be found on steep slopes adjacent to the rivers and tributaries of the catchment. In the catchment area, as in the rest of Cornwall, the greatest potential for problems to the watercourse arises from pollution caused by careless harvesting. The Forest Authority, which licences felling, is aware of the problem and advises applicants with reference to Forest and Water Guidelines⁹. With major river abstractions the catchment is particularly sensitive to potential pollution and problems with turbidity have been experienced in the past.

Coniferous woodland mainly occupies land of limited agricultural potential and where soil drainage is impaired due to low permeability, such as the steep sided valleys of Bokenver and Keveral Woods on the West Looe and Smallacombe Downs on Bodmin Moor. Smallacombe is the largest plantation due to be harvested during the next 10 to 15 years although no area larger than five hectares is planned to be felled at one time.

90% of new plantings are deciduous, with most blocks between 2 and 5ha. Except on larger private units the production of timber is not the prime aim, the trend being towards amenity, conservation, landscaping and shelter belt plantings. This management can be expected to be more sympathetic in terms of impact on the water environment and landscape generally. There is forestry within the catchment owned and managed by Forest Enterprise (the operational arm of the Forestry Commission). This is managed with commitment to improve landscape, conservation value and public access to comply with their statutory duty (unless any such activity is prohibited by conditions of a lease agreement). At Cardinham Woods long term plans have been drawn up to achieve these objectives.

Only the very top 2km² (approximately) of the River Fowey around its source falls within a Critical Load area (where sulphur levels, causing acidification, are considered to be impacting on the ecosystem - see glossary). However outside this area within the headwaters of the River Fowey, St Neot River and Northwood Brook pH levels are breaching water quality standards (see Section 5.1). Though this is considered to be attributable to local geology and mining activities rather than forestry the NRA is concerned about any new forestry plantings may exacerbate the problem. The NRA would therefore wish to be closely consulted in the planning of any new areas of forestry.

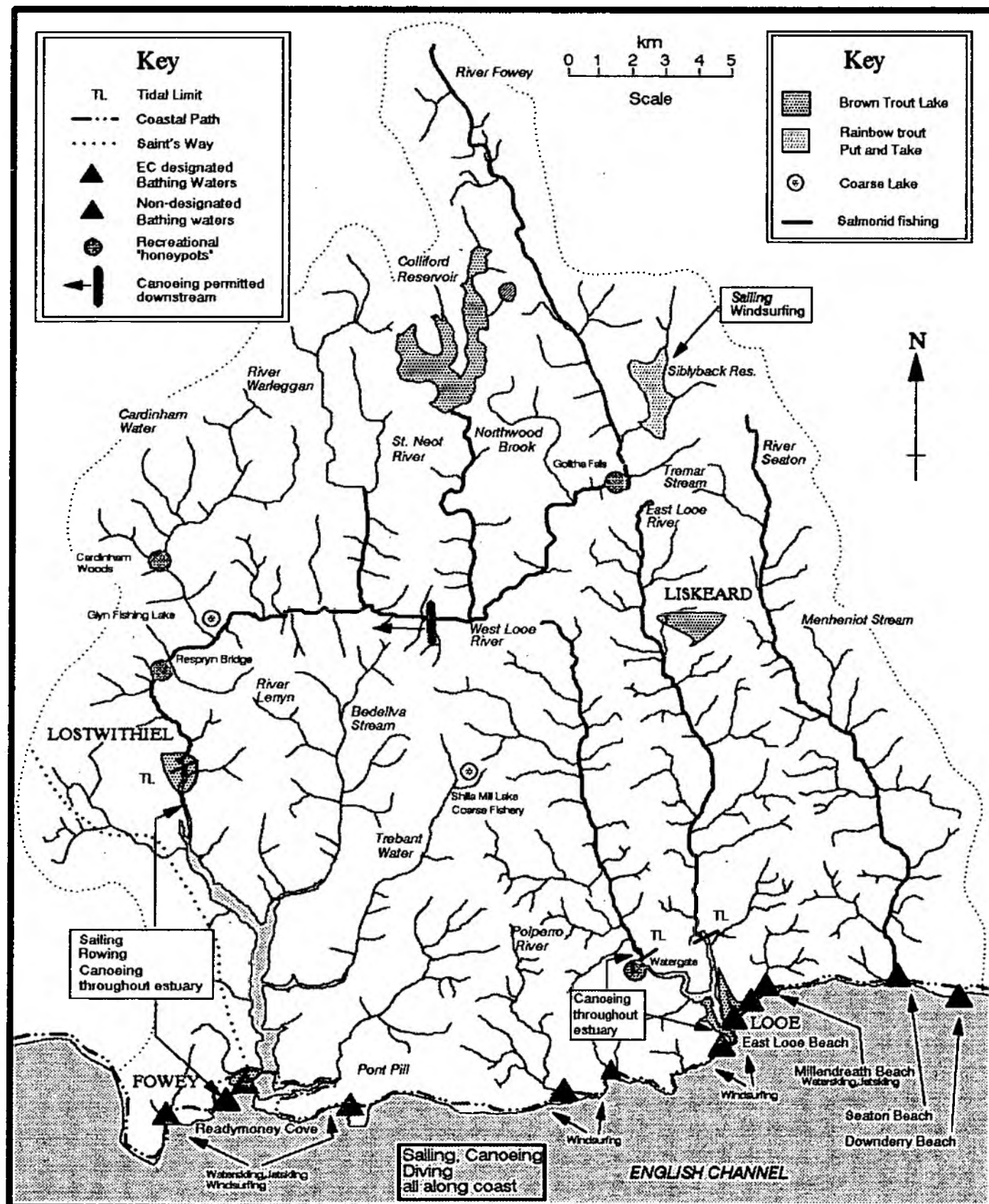
Forestry is not considered to impact on total water resources within the catchment. However, there may be increased surface water run off from canopy compared to other land uses, exaggerating spates and causing associated problems such as erosion and increased sediment transportation.

CATCHMENT USES

Forestry is not considered likely to be developed significantly unless financial incentives change, therefore the leaning towards small, non-commercial, deciduous units will continue. Under normal forestry practice, felled blocks of conifers would be replanted with conifers. As indicated in Section 4.1.1 extensive conifer plantings have brought about a change in the landscape. Planning the shape of blocks to be felled and using a mixture of species when re-planting offers an opportunity to integrate forestry into the landscape. At such time the Forestry Authority will also be promoting deciduous planting alongside watercourses, to act as buffer zones and conservation corridors, in line with the "Forest and Water Guidelines".

SEATON, LOOE AND FOWEY CATCHMENT

Recreation



4.5 RECREATION AND AMENITY

4.5.1 General

This use is concerned with water-contact sports of all kinds, fishing and informal recreation such as walking.

During the past 50 years there has been a significant increase in leisure demand for water-contact sports and outdoor recreation. Forecasts indicate that as people obtain more leisure time and mobility, participation in watersports and outdoor leisure pursuits will increase.

Areas of concern to the NRA include:

- conflict between recreational users and other legitimate water users;
- damage to habitats by overuse in intensively visited sites;
- that water conditions are suitable in areas of identified recreational use.

The Role and Objectives of the NRA

The NRA aims to develop the amenity and recreational potential of inland and coastal waters and associated lands.

The NRA has duties and powers to:

- protect and promote amenity and recreational uses in the performance of all its functions, either directly carrying out works or licensing others
- make bylaws to regulate or prohibit boating and recreational activity on land and waters that it owns or manages and also on inland water where a right of navigation exists but where there is no controlling authority.
- ensure that land and water under the NRA's control is made available for recreational purposes, and that in doing so the needs of persons who are chronically sick or disabled are taken into account.
- to promote the use of inland and coastal waters, and the land associated with them for the purpose of recreation to the extent that it deems desirable.

The NRA has a commitment to:

- liaise with others to safeguard existing resources and manage them effectively to ensure that their optimum recreational value is realised whilst not conflicting with other water users or damaging the environment.
- liaise with others to preserve and maintain access for the public to places of natural beauty and to buildings, sites and other objects of archaeological, architectural or historic interest.
- liaise with other bodies and organisations to develop coordinated strategies for the promotion and management of recreation.

4.5.2 Local Perspective

Estuaries and coast

There are five EC Designated Bathing Beaches in the catchment (see Recreation map) and several other well used bathing beaches along the coast. Rowing, canoeing and sailing are permitted in the Looe and Fowey Estuaries. Management of these activities is the responsibility of the two Harbour Commissioners. In the Looe Estuary the area upstream of the A357 road bridge holds most of the pleasure craft and motorised boats are available for hire. Commercial and recreational fishing boats operate largely downstream of the bridge and there are no known conflicts between users. Because Looe is an important working fishing port it is thought unlikely that recreational opportunities in the estuary will increase significantly.

In the Fowey Estuary larger sailing yachts do not generally venture further than Golant, with the majority mooring just within the estuary and sailing outside its mouth. Lighter recreational use of the upper estuary is compatible with its high conservation value. This value is recognised by the Harbour Commissioners who plan to leave the upper sections unmoored. This and other issues will be further explored in an assessment of the estuary management currently being prepared for the Harbour Commissioners.

There are not considered to be any conflicts between user groups within the estuary.

Boat trips between Fowey and Lostwithiel have been trialled through the summer of 1994 and are considered to be successful and likely to continue. They are however, low-level use, and being tidally restricted, unlikely to expand.

Special trains between the two towns have also been run, but again this is a non-impacting use, and dependent on the goodwill of BR and ECC to continue.

The possibility of a cycle route between Fowey and Lostwithiel has been explored. It seems impractical to create any link adjacent to the railway line and estuary and therefore impact on the water environment is limited.

Canoeing

The British Canoe Union has negotiated an agreement for canoeing on the River Fowey between 14 February and the end of March, from Newbridge to the estuary. This formal access agreement safeguards against 'cowboy runs'.

The 1993/94 season was considered a success, with no known adverse impact on the fishery or fishermen. The BCU would like to extend the season from January to March to enable greater use. They would also like to create an access point at Respryn to enable greater flexibility for groups on the lengths of river they undertake in any stage. There is understood to be opposition from the Parish council due to excessive use of the road and car park.

Siblyback and Colliford Lakes

Sailing and picnicking are popular at Siblyback Lake (owned and managed by South West Water Services Ltd), where there is also a birdwatching hide owned by the Cornwall Birdwatching and Preservation Society.

CATCHMENT USES

Public Access

There is limited public access along most of the rivers within the catchment and therefore low recreational usage except for a few intensively visited sites. The network of paths at Respryn Bridge, owned by the National Trust, and Cardinham Woods, managed by Forest Enterprise, are very heavily used all year round, particularly by local people. Golitha Falls, owned by English Nature, is another popular area for recreation. Footpaths run beside the West Looe River through the woods between Sowdens Bridge and Churchbridge, with a picnic site at Watergate. Two long-distance footpaths cross the catchment, the Coastal Path and the Saints Way from Fowey to Padstow.

The southern part of the catchment lies in a Tourism Restraint Area, a designation which attempts to limit the impact of tourism on the environment. The coastal area is very heavily used and encouragement is given to recreational pursuits away from the coast. It is not yet known whether this will result in the few available footpaths being overused. Respryn and Golitha Falls are already considered by the National Trust and English Nature to be at saturation level.

Project Explore (a joint initiative by Cornwall County Council, the Countryside Commission, the Cornwall Tourism Development Action Programme and the South Cornwall Heritage Coast Service), based at Looe, has been set up to promote green tourism. The aim is to strike a balance between the recreational wants of locals and tourists and the conservation needs of the landscape in the area between Seaton and Fowey and inland to Lostwithiel.

Actions seek to encourage recreational users away from the pressurised coast and spread their impact throughout the year by extending seasons.

Project Explore will be undertaking a survey of users in the Looe Estuary through 1994 to establish baseline data to help manage possible future change.

Bodmin Moor

The north of the catchment on Bodmin Moor, is another area sensitive to pressure, with heavily used areas developing around car parks and limited access points to open moor. The Bodmin Moor Commons Bill is currently proceeding through Parliament. It is not yet known exactly what changes in agricultural and amenity uses of the Upper Fowey catchment, and to a lesser extent the headwaters of the River Seaton, this will bring. There are fears however that access will become more limited.

A 1993 'Access Study' prepared for the Countryside Commission and Bodmin Moor Commons Association¹⁰ explores the existing and future access impacts and problems. Suggestions for coping with access hinge on developing key car parking areas and the development of licensed paths on open land and the existing Public Rights of Way network.

Angling

The catchment is known for its salmonid fishing; late salmon runs on the River Fowey and sea trout on the Looe rivers. The salmon season runs from 1 April to 15 December and that for trout, migratory and brown, from 1 April to 30 September. The upper reaches of the Fowey and its tributaries are important spawning grounds and access is difficult, so most angling effort takes place below Golitha Falls and on the lower reaches of the tributaries.

Rod returns for 1991 (the last year available) were 64 salmon and 570 sea trout on the River Fowey and 1 salmon and 82 sea trout from the Looe rivers.

CATCHMENT USES

There is no recognised coarse fishery on the Seaton, Looe and Fowey Rivers.

Most of the fishing rights are owned by fishing clubs and private owners but there are small stretches of the banks open to the general public on National Trust and Forestry Commission property. The two reservoirs owned by South West Water Services are open for bankside fishing, Colliford being a natural brown trout fishery and Siblyback a rainbow trout put-and-take. There are small lakes and ponds throughout the catchment that provide coarse fishing, the two largest being Shillamill Lakes coarse fishery near Trebant Water and Glyn Fishing Lake near the confluence of the River Fowey and Cardinham Water. No threat is perceived to the local native fish populations from escapees from the stocked lakes.

4.6 AQUACULTURE

4.6.1 General

This use relates to the farming of fish and crayfish and molluscs and the cultivation of watercress.

By its nature aquaculture has direct links with the water environment and consequently potential for an adverse impact on water quality, quantity and physical structure. Areas of concern to the NRA are:

- the impact of abstraction on groundwater or surface water resources.
- the impact of discharges on water quality.
- the introduction of alien species and fish disease into natural fish populations.
- the impact of feeding, chemicals and pharmaceuticals on water quality.
- the maintenance of free passage for migratory fish.
- the protection of licensed rights to use the water resource.

The Role and Objectives of the NRA

The aim of the NRA is to limit the impact of aquacultural activities on the water environment and ecology.

The NRA has duties and powers to:

- issue and enforce abstraction licences and discharge consents.
- licence the movement of fish between farms to minimise the risk of disease transmission.
- ensure that the free passage of wild fish is not impaired.
- comment fully on applications for any new enterprises to Local Planning Authorities.

Additionally the NRA has a commitment to:

- encourage the safe and minimal use of pharmaceuticals and pesticides.
- control the movement or introduction of fish or spawn into fish farms through liaison with MAFF.
- control the impact of disease occurring in fish farms through liaison with MAFF.

4.6.2 Local Perspective

Over the past few years the NRA has been reviewing the authorizations of commercial fish farms in the area. A Fish Farm Control Group was set up to make sure that all fish farms had all relevant permissions for abstractions, discharges and weirs. Changes in licensing following the Water Act 1989¹¹ had given rise to anomalies that the Group has endeavoured to put right.

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There are only a small number of fish farms in the Seaton, Looe and Fowey catchment.

A licensed abstraction from a fish farm on the St Keyne Stream causes the stream to dry up under summer flows in the reach between the abstraction and discharge points, a distance of approximately 150 metres. There are some brown trout but no migratory fish in the stream. The consent conditions are very tight as there is little or no dilution of the discharge.

A spring-fed fish farm in the Lanlivery Stream catchment could cause occasional water quality problems when ponds are flushed out, but for most of the time does not discharge into the watercourse.

A fish farm on the river Seaton at Lower Clicker has been developed in the floodplain. The NRA is liaising with Caradon District Council to ensure the development is in accordance with its planning permission.

Occasional Rainbow Trout escapees from cages at Fowey have been caught by netsmen, but are not considered to have a significant impact on the wild fish stocks in the River Fowey.

The NRA runs Colliford hatchery to produce salmon and sea trout for mitigation work on the St Neot and Fowey rivers and the River Fal restocking project. The hatchery also produces brown trout to stock Colliford reservoir.

Table 4 Fish Farm Abstractions /Discharges

River	Fish Farm	Location	Abstraction	Discharge
St Neot	Colliford Hatchery	SX 179 709	100,000m ³ /d	100,000m ³ /d
Fowey	Lanlivery Carp	SX 083 587	Spring-fed	No consent
Fowey	Fowey Sea Trout Hatchery	SX 118 524	No abstraction licence needed	Currently processing
	Fowey Sea Trout Cages	SX 128 528	No abstraction licence needed	No consent required
E Looe	Seasons	SX 245 593	5,000m ³ /d	5,000m ³ /d
E Looe	Riverview	SX 248 593	4,546m ³ /d	4,546m ³ /d

A proposal for a large new fish farm on a tributary of the River Seaton at Bake Farm has recently been made. Conditions on the operation of any new fish farms will be made to protect the water environment and other legitimate users. The proposal will require NRA permissions and planning permission. The NRA will review the application in line with policy.

4.7 THE BUILT AND DEVELOPING ENVIRONMENT

4.7.1 General

The built and developing environment has significant implications for the water environment. New developments require the extraction and processing of building materials. They alter the natural landscape, causing increased surface water run-off which could lead to flooding and introduce activities which bring a higher risk of pollution. New housing and industry increases the demand on services, including water supply, and result in increased amounts of waste which require treatment and discharge from sewage works or disposal to land.

Globally, it is recognised that human activity and demands are exceeding the Earth's carrying capacity. International concerns and desire for sustainable development culminated in the United Nations Conference on the Environment and Development held in Rio de Janeiro in 1992 where many nations signed up to a declaration of rights and obligations with respect to environment and development, called the "Earth Charter", and an agenda for action, "Agenda 21". The UK Government has responded positively to concerns through its White Paper "This Common Inheritance"¹² and the Government Planning Policy Guidance. In considering sustainable development policies and strategies, the NRA is keen to promote balanced development, ie an appropriate balance between the built and natural environment. This will be achieved through the protection and enhancement of the natural environment and efficient and wise water management.

The County and District Planning Authorities are responsible for controlling development within the catchment. The determination of planning applications is on the basis that developments should be allowed unless the proposal would cause demonstrable harm. In determination, a number of policy matters are taken into consideration with decision making being guided by development plans (structure and local), government advice in planning policy guidance notes (PPGs) and Department of the Environment (DoE) circulars. Local authority policy documents add further guidance.

4.7.2 The Role and Objectives of the NRA

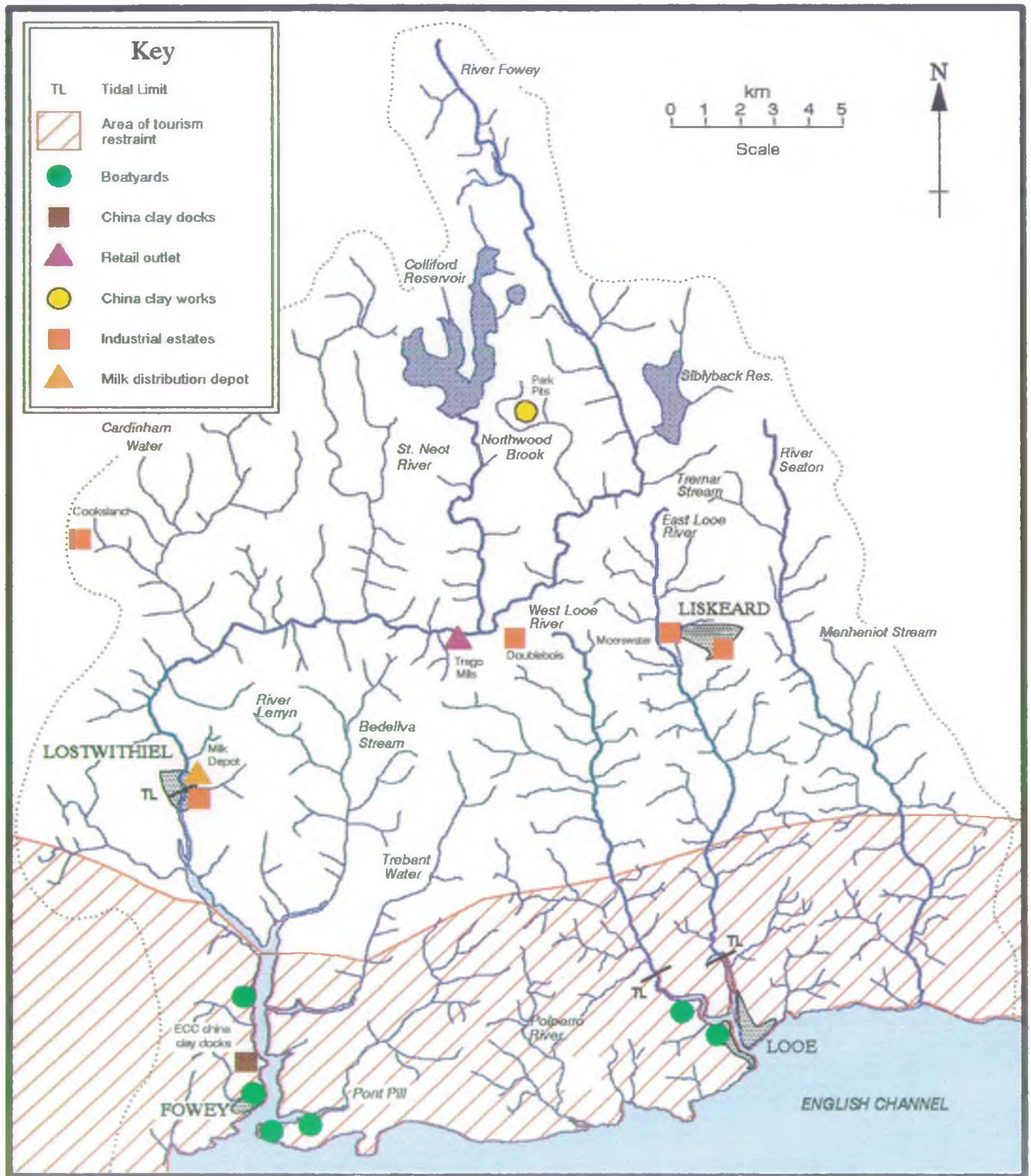
The NRA has some limited control over development through its own powers under the Land Drainage Act 1991² and the Water Resources Act 1991¹. These relate to the consenting of development in, over or under water courses, and the control of discharges into and abstractions from the water environment (see Section 4.8).

The NRA is unable to independently control developments. However, the NRA is a statutory consultee to local planning authorities for development plans and specified types of development proposals. Various DoE planning circulars also identify the NRA as advisors to the Local Planning Authorities (LPA's), in particular 30/92 "Development and Flood Risk"¹³. In order to fulfil the aspirations within the NRA's Mission Statement and to carry out its commitment to sustain all uses of the water environment, the Authority will:

- influence development planning by assisting strategic and local planning authorities in formulating policies, allocating development, identifying constraints and highlighting opportunities for enhancement of the river environment and guidance notes, such as "Guidance Note for Planning Authorities, NRA, January 1994"¹⁴.

SEATON, LOOE AND FOWEY CATCHMENT

Industry



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- guide development control by formal and informal consultation on planning applications, and the production of planning consultation guides.
- influence national policy and public debate through the publication of reports, representations to Government departments, presentation of evidence to Select Parliamentary Committees and funding of appropriate research and development projects.
- publish, in consultation with the DoE, policies for the protection of the water environment such as the "Policy and Practise for the Protection of Groundwater"¹⁵
- request the Secretary of State to make regulations under the provision of the Water Resources Act 1991¹, for example the Control of Pollution (Silage, Slurry and Agricultural Fuel Oil) Regulations 1991⁷.

4.7.3 Local Perspective: Developing Environment

Development Plans

The hierarchy for development plans is:

South West Regional Plan
County Structure Plan
Waste and Mineral Local Plans
District Plans
Development Briefs

The South West Regional Plan provides the framework in which each subsequent plan's policies are developed and handed down.

In its advice to the Secretary of State for the Environment for the **South West Regional Plan**¹⁶, the South West Regional Planning Conference embraced the principles of sustainable development and recommended:

- development decisions in the region must take account of the need for the protection, conservation and efficient management of water resources, and the maintenance and improvement of the quality and volume of supplies.
- the region's coastline must be conserved and managed to secure an appropriate balance of uses on land and water compatible with the reduction and minimisation of pollution, the protection of undeveloped areas and the enhancement of its beauty and nature conservation value.
- the environmental consequences of development proposals, including the implications for energy, water resources, waste disposal and pollution must be a prime consideration in preparing development plans, and in the development control process in the region.

The plan predicts a housing increase of 21,700 new dwellings for Cornwall for the years between 1991 and 2001, and 23,300 between 2001 and 2011. Part of this total has already been committed in the **Cornwall Structure Plan**²⁷ which runs from 1986 to 2001.

The NRA is currently discussing issues with Cornwall County Council for the New Structure

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Plan, Waste Disposal Plan and Minerals Local Plan. We are also involved in the emerging Districts' Local Plans. The NRA will seek to influence the allocation of land to ensure that adequate infrastructure exists prior to development and, furthermore, that development does not damage conservation interests or be at risk from, or result in, flooding.

North Cornwall Local Plan¹⁸ does not allocate any major development within the catchment, though extensions of housing and industrial premises to Cooksland on the edge of Bodmin may drain into the catchment of the Fowey. The allocations within the **Restormel Local Plan**¹⁹ result in extensions to Lostwithiel and infilling in Fowey, but the most significant impacts are the allocation within the **Caradon Local Plan**²⁰ which identify additional development around Liskeard. The NRA has particular concerns over the proposed development exacerbating existing flooding on the River Seaton.

All local plans have incorporated a number of policies for positively protecting the water environment as a result of early discussions with the NRA.

In a **Development Brief** Caradon DC have outlined a strategy for the redevelopment of the Seaton Valley ("Seaton Valley Planning Brief"²¹). Development since the war has caused degradation of the aquatic environment, landscape quality and localised flooding. Through the "Brief" Caradon are attempting to rectify these impacts and bring about environmental enhancements. The NRA has commented on the planning brief and is generally supportive of the aims and proposals of the 3rd Draft. However, areas identified for holiday accommodation are subject to river and/or tidal flooding and the NRA opposes such development. The NRA also seeks a greater restoration of the flood plain than has been outlined.

The NRA recommend formal development restraints in areas serviced by inadequate sewerage and sewage treatment systems which result in unacceptable pollution and/or non-compliance with statutory water quality standards. A schedule of such settlements is presented to the relevant council annually. The recommendations is then formally debated and accepted as **Policy**. A list of settlements is included in Appendix F.

Road Schemes

The NRA is a statutory consultee to the Department of Transport (DoT) in the process of developing any new trunk roads and inputs into road schemes proposed by County and District Councils. The NRA are involved throughout the process, from route choice and design to completion of construction and through consultation seeks to protect all potentially impacted aspects of the water environment and secure enhancements.

Particular areas of concern are:

- the proximity of roads to watercourses. Roads running alongside watercourses may reduce the conservation and amenity value and provide a continuous threat of pollution through incidents such as road crashes. Such incidents have occurred on the River Fowey and caused considerable environmental damage.
- possible pollution and loss or damage to habitats during construction.

The NRA has powers to control highway drainage through prohibition notices and discharge consents. We can therefore insist on consultation on highway drainage design to ensure inclusion of pollution alleviation measures and containment traps for accidental spillage where they are not voluntarily installed.

Within the catchment there is a proposal to improve the A38 between Liskeard and Bodmin.

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The DoT have consulted the NRA on a number of route options for these new roads. The consultation considered 6 route options: 4 in the Fowey Valley (brown, yellow, grey and red options) and 2 on high ground following the approximated line of the A390, bypassing East, Middle and West Taphouse before following a West-North-West direction to Bodmin (green/black and blue/black options). The NRA prefers the blue/black route on Water Quality, Conservation and Flood Defence grounds with the green/black route as our next preference. The NRA wishes to discourage the valley route options.

4.7.4 Local Perspective: Built Environment

Existing development can have an adverse impact on the water environment either:

- as a consequence of the 'use' or 'activity' of the development (eg industrial), or
- as a result of physical alterations

Activity

Industrial processes usually produce waste byproducts. Adequately treated liquid byproducts can be discharged to the water environment. The NRA can control these by means of a Consent to Discharge (see Section 4.12). The Environmental Protection Act 1990²² introduced regulations to control industrial processes which used very hazardous substances. This 'integrated pollution control' of 'prescribed processes' requires the authorisation of HMIP who must consult the NRA.

Accident, fire or damage at developed sites could result in pollution of rivers or contamination of drinking water supplies - this could be particularly significant on the River Fowey where surface water abstraction is used for public water supply. A number of industries or firms are now voluntarily adopting codes of operation and conduct to minimise the potential risks. The NRA will advise on and support such initiatives. One example is the BASIS scheme for agrochemical stores. Within the catchment a number of companies have been checked and registered.

Of concern to the NRA for potential pollution are:

- road accident involving tankers on any route;
- escape of oils, etc from scrap metal businesses;
- fractured petrol station storage tanks causing groundwater contamination;
- spillages from refuelling at the ports of Looe, Polruan and Fowey;
- fire at Trago Mills (the contaminated fire fighting water could enter the River Fowey, threatening the public abstractions downstream).
- the proximity to the River Fowey of timber treatment processes in the Glyn Valley and at Lostwithiel;
- the proximity of and risk of pollution from industrial units at Moorswater, Liskeard to the East Looe.

Physical Alterations

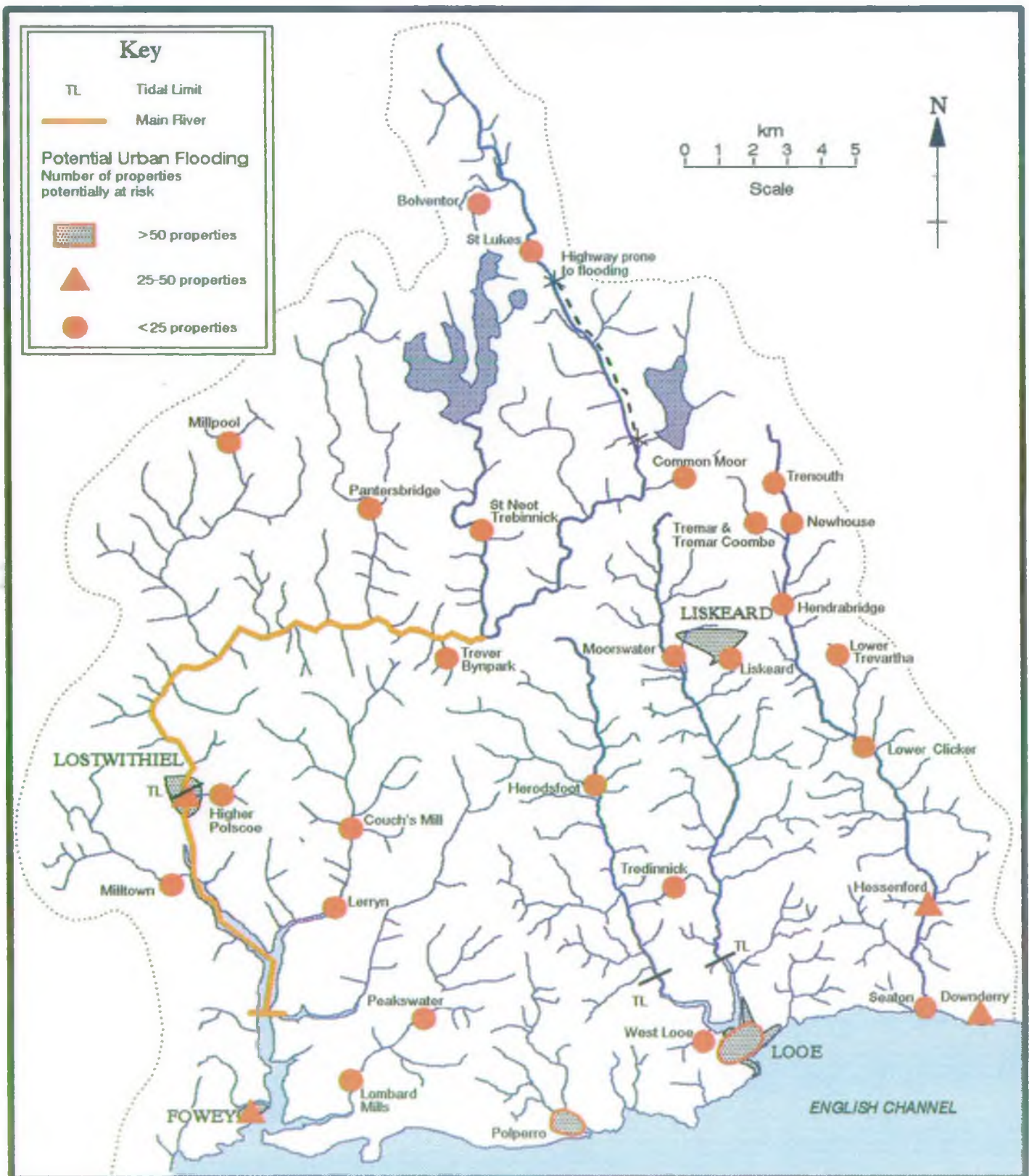
Inappropriate development can destroy wetlands, increase flood risk by constraining channels and building in the floodplain (see Section 4.8) and detract from the amenity of the landscape.

Of particular concern to the NRA are:

- floodbanks on the east bank of River Seaton upstream of Seaton Beach;
- inadequate culverts or bridges with limited capacity (see Section 4.8).

SEATON, LOOE AND FOWEY CATCHMENT

Flood Defence



4.8 FLOOD DEFENCE

4.8.1 General

This use deals with the protection of people and property from flooding.

Areas of concern to the NRA include:

- development generating increased run off which would cause or exacerbate flooding downstream;
- development in the flood plain which would be liable to flood, cause or exacerbate flooding downstream;
- climate change contributing to rising sea levels;
- changes in agricultural activity requiring different standards of drainage;
- litter and debris being thrown into rivers blocking culverts and causing flooding.

The Role and Objectives of the NRA

The NRA aims to provide effective protection for people and property from flooding. This is achieved by the construction and maintenance of flood defences and through the provision of effective and timely flood warnings.

The NRA's power for carrying out these flood defence functions are contained within the Land Drainage Act 1991² and the Water Resources Act 1991¹. For the purposes of this legislation, all watercourses are classified as either "main rivers" or "ordinary watercourses". The NRA generally has more comprehensive powers on main rivers and its Land Drainage byelaws only apply to main rivers and not ordinary watercourses.

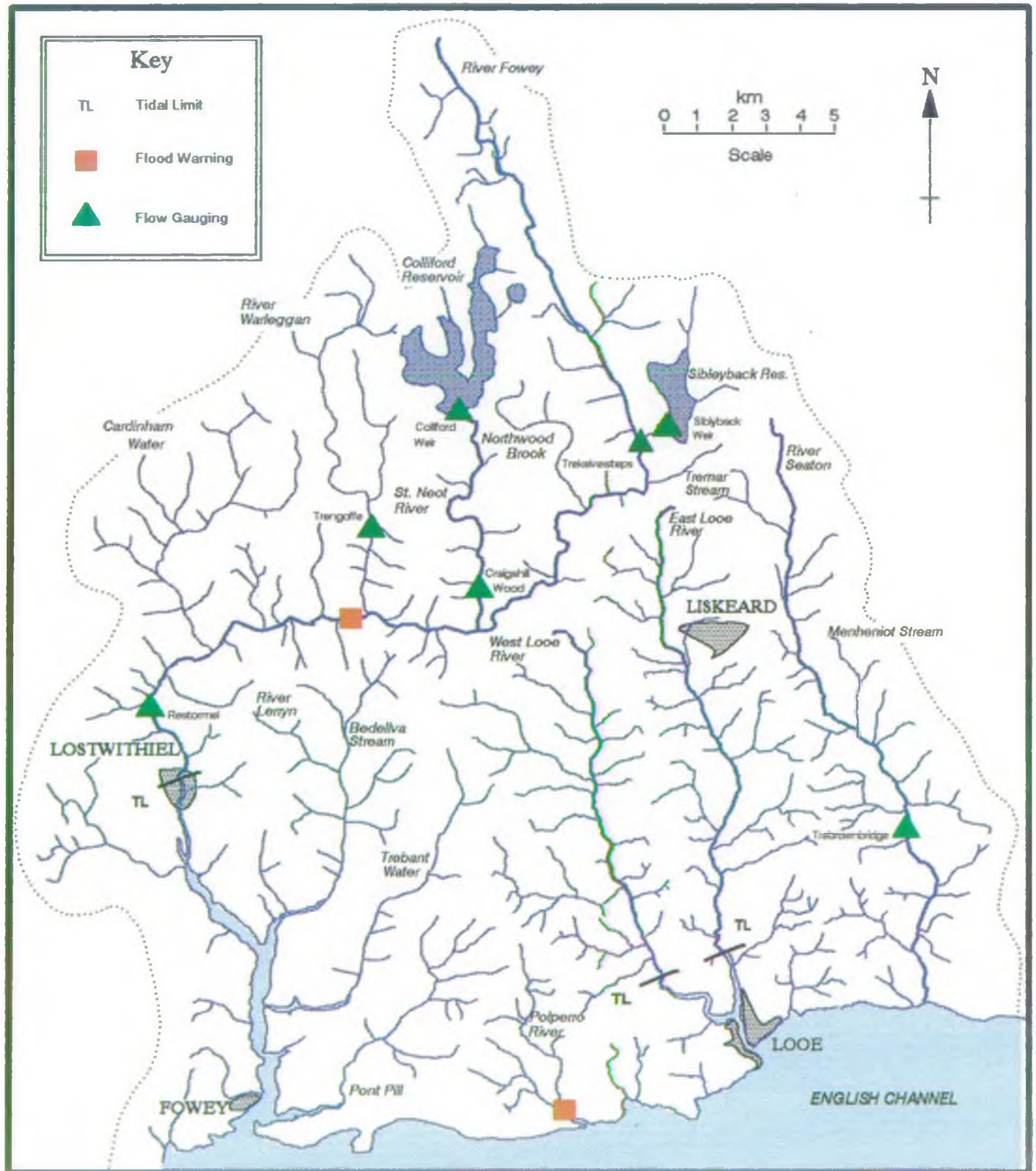
Flood events are described in terms of the frequency at which a certain flood level is exceeded. This frequency is usually expressed as a return period in years. An event described as a once in 100 year flood is a flood which can be expected to be equalled or exceeded once in 100 years on average.

The NRA is also charged with ensuring adequate provision of flood forecasting and warning which it actions through 24 hour monitoring of weather, river and tidal conditions and flood warnings issued to local authorities, other bodies and the general public via the police.

The NRA has duties and powers to:

- promote a flood alleviation scheme on a main river where the frequency and extent of flooding justifies it. On ordinary watercourses the local authority is the drainage authority and has the necessary permissive powers to promote a scheme. Such schemes require the approval of the NRA;
- carry out maintenance on flood defence works that were constructed by the NRA or its predecessors;
- regulate most new works or alterations to existing workings such as dams, weirs, bridges and culverts under the Land Drainage Act, Water Resources Act or its byelaws;
- make recommendations on flood defence matters to the local planning authorities on individual planning applications and local and structure plans;
- install, operate and improve systems to provide warning of impending flooding so that risk to life is diminished and damage to property alleviated;

SEATON, LOOE AND FOWEY CATCHMENT Hydrometric Network



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- carry out flood defence work on the river channel and banks with due consideration to minimise any conflict with other river uses, especially fisheries and conservation interests. Internal consultations are carried out at the planning stage of all new works and whenever possible the riverside habitat is significantly enhanced while at the same time achieving the level of flood protection required.

The NRA has a commitment to:

- encourage suitable land management by landowners and developers;
- improve the Emergency Response Level of Service (ERLOS) so that where possible a warning is issued at least 2 hours in advance of flooding and that NRA resources are mobilised within specified times depending on the location and potential consequences of a flood incident.

Flood Defence Management Framework

During the final plan period the NRA is to implement its Flood Defence Management Framework which has been devised with the objective of improving the NRA's physical management of main rivers.

The framework considers the main river system and any control structures or flood defences as 'assets' to be managed in a consistent, cost effective manner, based on the use (and subsequently value) of the land they protect.

Current land uses are surveyed and appropriate Standards of Service required from the protecting 'asset' are established. Where there is a difference between standards currently provided and those required (now or in the future) action required will be established through consultation with interested parties. The process also involves a survey of 'assets' to assess their condition and any maintenance requirements and a survey of flood risks. These surveys (known as Section 105 surveys) include flood plain mapping and information on flooding problems and will be used both in flood defence management and in advising planning authorities on development and flood risk issues.

4.8.2 Local Perspective

The only length of main river in this study area is a length of the River Fowey from Two Waters Foot at its upstream limit to a point opposite Penpoll Creek at its downstream limit.

On this length the NRA maintains the flood defences at Lostwithiel. These are earth embankments on the west bank around the playing fields and on the east bank around Madderly Moor which are designed to alleviate the effects of river and tidal flooding from the River Fowey in Lostwithiel.

Flood Warnings for the River Fowey are currently issued when thresholds are reached at the river level gauge at Wainsford (NGR SX 152 653). Warnings are colour coded Yellow, Amber or Red to indicate their severity.

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There has been a history of infrequent flooding on the River Seaton at Courtneys Mill Bridge and Hessenford. In the last few years increases in incidents have caused the NRA concern, particularly with the ongoing development on the east of Liskeard which will drain to the River Seaton and may further exacerbate the problem. The NRA has expressed this concern to Caradon District Council who are the relevant drainage authority. They are currently undertaking a study to establish the extent of the problem and possible measures to prevent impact. The NRA has provided information to the consultants and will screen any firm proposals which are made to ensure no impacts on other identified uses.

If the current feasibility study for Caradon District Council results in a proposal for a scheme to alleviate flooding on the River Seaton, the NRA would consider implications for other identified uses before giving approval.

Flood warnings for the River Seaton are issued using information from the river level gauge at Trebrowbridge (NGR SX 299 596).

There are a number of locations around the catchment where flooding is known to occur, most of which only affect a few properties (see flood defence map).

In general the flooding is due to one or a combination of the following :

- inappropriate development within the flood plain;
- or the inability of the river channel and existing culverts to cope with increased flows;
- or extreme tides, exacerbated by rising sea levels.

Increased flows can be the result of higher than normal rainfall, increased run-off from the land or built environment, or combinations of the three.

With the exception of Lostwithiel none of the above locations are designated as main river and therefore the responsibility for any action rests with private individuals or the relevant local authority. The NRA will however seek to prevent any increase in incidence of flooding due to further inappropriate development through its own legislation and the planning system.

Flooding of the railway line along the East Looe River occurs, occasionally preventing the line from being used. This is considered to be the result of blocked culverts, the responsibility of the railway.

The NRA is currently applying to the Ministry of Agriculture, Fisheries and Food for a length of the Polperro River and Landgreek Stream at Polperro to be mained so that the necessary powers will be available to promote a flood alleviation scheme for the town. The scheme is currently in the capital works programme to start in January 1995

Flood Warning for Polperro is provided by a local audible siren triggered by an upstream river sensor. A repeater siren is shortly being installed.

The NRA is presently assessing the feasibility of a capital scheme to alleviate tidal flooding problems at Fowey. If the cost of improvements can be justified it is likely that provision will be made in the Medium Term Capital Programme to carry out work in the future. Full consultation with all interested parties will take place prior to any work starting. The earliest likely start date is presently 1998.

CATCHMENT USES

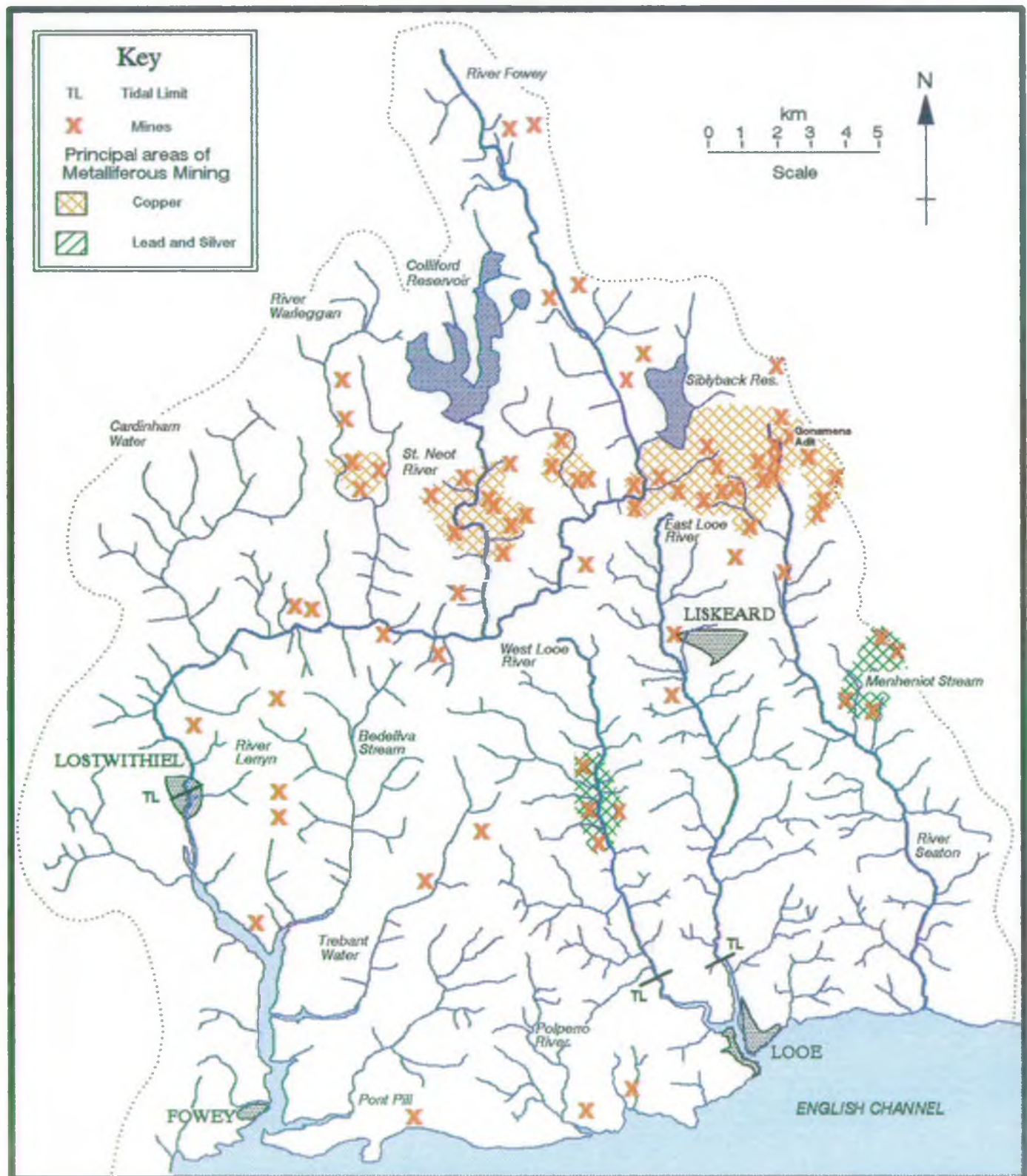
Tidal flooding problems at Looe have previously been investigated. At that time a flood alleviation scheme could not be justified using MAFF/NRA criteria. It is possible that the NRA will again look at this problem.

Colour coded Tidal Flood Warnings are issued for the South Cornwall Coast. Action is taken by the Local Authorities and Emergency Services at known flooding locations.

The NRA will produce a Section 105 survey to phase 1 standard (as listed in the Memorandum of Understanding 1993²³) for the catchment before the end of 1999.

SEATON, LOOE AND FOWEY CATCHMENT

Mining Activity



NRA South Western Region

4.9 MINING/QUARRYING

4.9.1 General

The NRA recognises the economic importance of quarrying, mining, gravel and mineral extraction to the region, however, exploration and extraction can significantly affect surface and groundwaters locally and across catchments.

Areas of concern to the NRA include:

- Extraction can result in the loss of aquifer material and groundwater resources.
- Extraction often involves de-watering, sometimes for substantial periods of time. De-watering can lead to the loss of water supply from wells and boreholes, the removal of natural groundwater discharges to ponds and streams, and can affect wetlands.
- Removal of material from above the water table reduces natural filtration and increases pollution risk to groundwaters.
- There is an increased risk of pollution from plant or operations close to or below the water table.
- Surface water run-off from spoil heaps and worked areas and discharges from mines and quarries can contain toxic and suspended materials that are harmful to aquatic life.

Abandonment of mines and after use of quarries may also pose threats to the water environment.

The Role and Objectives of the NRA

The aim of the NRA is to limit the impact of mining activities on the water environment and promote suitable after use of sites.

The NRA has duties and powers to:

- consent discharges from quarries and operational mines.

Additionally the NRA has a commitment to:

- fulfill its obligations under the Water Resources Act 1991¹ through liaison with planning authorities and control through the planning process. The NRA is a statutory consultee for Mineral Local Plans and mining proposals, and an informal consultee on other relevant developments.

In considering proposals, the NRA will have regard to its "Policy and Practice for the Protection of Groundwater"¹⁵ which states:

"For any proposals which would physically disturb aquifers, lower groundwater levels, or impede or intercept groundwater flow, the NRA will seek to achieve equivalent protection for water resources and the water environment as if the effect were caused by an abstraction controllable under the Water Resources Act 1991."

The NRA will object to a new proposal for mineral extraction where there will be demonstrable harm to water resources and the water environment, unless measures to mitigate any effects can be agreed within planning controls.

The NRA will normally object to proposals where the obstruction of groundwater flow is likely to cause undesirably high groundwater levels or cut-off groundwater flow, unless measures to mitigate any effects can be agreed.

- encourage best practice regarding the backfilling of any abandoned shaft, well, borehole, tunnel or adit in order to prevent pollution or loss of water resources.

4.9.2 Local Perspective

China clay is extracted from Park Pits at the top of Northwood Brook and piped to a drying plant at Moorswater, Liskeard. The pipeline crosses the River Fowey near Golitha Falls. The effluent from Park Pits is treated to raise the low pH before discharge into the watercourse. Potential pollution problems can arise from failures in this treatment or clay slurry discharging from the escape valves on the pipeline, or, as in one instance, a failure in the pipeline. An application for a three-fold increase in volume from the Moorswater discharge has recently been made. The effluent from Moorswater is very clean but such a large increase needs full evaluation.

Two working stone and aggregate quarries lie within the catchment, Lean Quarry near Horningtops and Lantoom Quarry near Dobwalls, both of which have caused water quality problems in the past. Small abandoned stone quarries are to be found throughout the catchment. There have been proposals for use as waste disposal sites and reports of small-scale fly tipping in some of these quarries. Each proposal is assessed individually, depending on many factors including the geology and proximity to ground and surface waters. The scale of the fly tipping has not been investigated.

Westwood Quarry, adjacent to the railway at Taphouse, has been proposed for re-opening.

The north of the catchment is pockmarked with abandoned mines and workings, especially the headwaters of the River Seaton which rises near the 19th Century Caradon copper mines. The river has elevated copper and zinc levels in these reaches (main source: Gonamena Adit) which has been shown to impact on the instream ecology, with low biological scores and invertebrate life restricted to metal tolerant species. Instream plant species (macrophytes) are also low in numbers (see Section 5.1). There is no known impact on macro fauna.

Lead and silver were mined at Menheniot and Herodsfoot at the same time, the latter being a prolific producer. Lostwithiel mines gave a considerable yield of iron during the 19th century.

The NRA South Western Region is currently engaged on the "Mines Database" project, set up to compile a comprehensive database on mines, adits and associated infrastructure. With detailed information on the nature and drainage of specific workings it is an attempt to be more pro-active and forward plan for potential impacts on the water environment. Surveying of the internal workings of old mines is impracticable.

Currently the project has covered Devon and part of Cornwall, including the Seaton, Looe and Fowey catchment. Information has been gathered largely as a desktop exercise and, given the

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extent and historical nature of mining in the catchment, work to date cannot be considered totally comprehensive or accurate, but rather a first step. Further development of the project could result in ground truthing and adding to existing data.

Similar work is being carried out by Caradon District Council and there is liaison to share information.

Many of the mines in the catchment have been abandoned for about a hundred years. As the internal structures reach the end of their life, shaft and adit collapse can alter volumes and direction of groundwater flows and the concentrations of metals they contain.

Responsibility for the physical dangers posed by shafts and adits lies with the landowner, however, where there is public access and a perceived threat to public health the District council may intervene.

There is no current minerals plan covering the catchment, though county are due to start compilation towards the end of 1994. The NRA would welcome the strategic guidance.

4.10 CONTAMINATED LAND

4.10.1 General

The Department of Environment considers it impossible to unambiguously define contaminated land, however it gives a loose definition as:

"...land which represents an actual or potential hazard to health or the environment as a result of previous or present use." (DoE, 1989)²⁴

The NRA is concerned about pollution, or the risks of pollution, associated with contaminated land, whether in a derelict state as a result of disturbance caused during redevelopment or from active industrial sites.

Consideration has been given by the NRA to the risks posed to controlled waters from contaminated land, in a national report "Contaminated land and the water environment"²⁵. This report emphasises that the scale of the problem has yet to be fully evaluated and identifies the following issues:

- assessment and prioritisation of risks to the water environment;
- measures to achieve remedial action;
- the need for the NRA to be proactive in dealing with contaminated land issues as prevention is naturally always better than cure.

The Role and Objectives of the NRA

The NRA's interests are directed towards the extent to which contaminated land already does or has the potential to cause pollution of controlled waters and ensuring, by promotion of pollution prevention measures that land does not become polluted in the future.

The NRA must then consider how best to apply its duties and powers either directly through the Water Resources Act 1991 or indirectly through other legislation such as the Environmental Protection Act 1990 and Acts relating to the planning system.

As well as a national commitment to achieving and maintaining Water Quality Objectives (WQO's) the UK (and NRA) are bound to comply with EC Directives and other International Agreements.

Responsibility for contaminated land rests with the landowner. Where the owner intends to undertake remedial action it is essential the NRA be consulted to ensure further pollution does not occur during the work.

The NRA has Duties and Powers to:

- prosecute where the owner causes or knowingly permits pollution. In cases where the owner is unable to carry out remedial works identified via the NRA's assessment, application should be made to existing sources of government grant.
- The NRA may use its own resources (recoverable or not) in order to carry out short term remedial work involving capital; they should not take on the responsibility for the long term running of sites which would involve crossing the barrier from 'regulator' to 'operator'.

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In assessing the risks within a particular surface water catchment the NRA will as a priority seek to identify areas which are causing:

- a breach of an existing Water Quality Standard, or would prevent the achievement of a Water Quality Objective;
- a significant contribution to the annual input into coastal waters, via any route, of substances targeted for reduction;
- a source of more than trace quantities of PCB's.

The identification of impacts on groundwater is recognised as a particular difficulty. This will be assisted in the future by the proposed implementation of a national groundwater monitoring network and a NRA national survey of known point source groundwater pollution.

The NRA has a commitment to:

- ensure through the planning process that redevelopment of sites of contaminated land do not lead to degradation of the water environment, or non compliance with environmental quality standards.

The NRA is not yet a statutory consultee in the redevelopment of contaminated land, however it involves itself as far as possible as an informal consultee from site specific proposals at local authority level to preventative policy at a national level;

The NRA promotes specific policies in it's document "Policy and Practice for the Protection of Groundwater"¹³.

4.10.2 Local Perspective

Historic development within the catchment has undoubtedly left areas of contaminated land, most obviously areas of mineral extraction and ancillary industries. Impact on the water environment is currently being experienced in high metal levels in the upper part of the catchments which are affecting in stream ecology. Due to the extensive nature of mineral workings diffuse sources (not all logged) are contributing to the problem. As levels are not at a point to threaten public health and there is no identified solution for a short term project to bring long term cure no NRA expenditure or work is planned within the catchment in the short term.

The Regional Mines Database project is attempting to catalogue areas involved in mineral extraction so that:

- when site specific redevelopment applications are made the problem is not exacerbated, or indeed may be improved;
- when further resources are available particularly problematic sites, or types of site can be targeted;
- if continuing research generates applicable solutions, sites, or types of site, can be targeted.

Caradon District Council is currently engaged in compiling a database of areas of possible contaminated land, based on categories given in the Department of Environment consultation document of May 1991. Sites identified in the database are not precluded from redevelopment, but are identified as requiring proper prior investigation. The NRA is liaising with Caradon over the database and will consult on individual planning applications to seek to protect and enhance

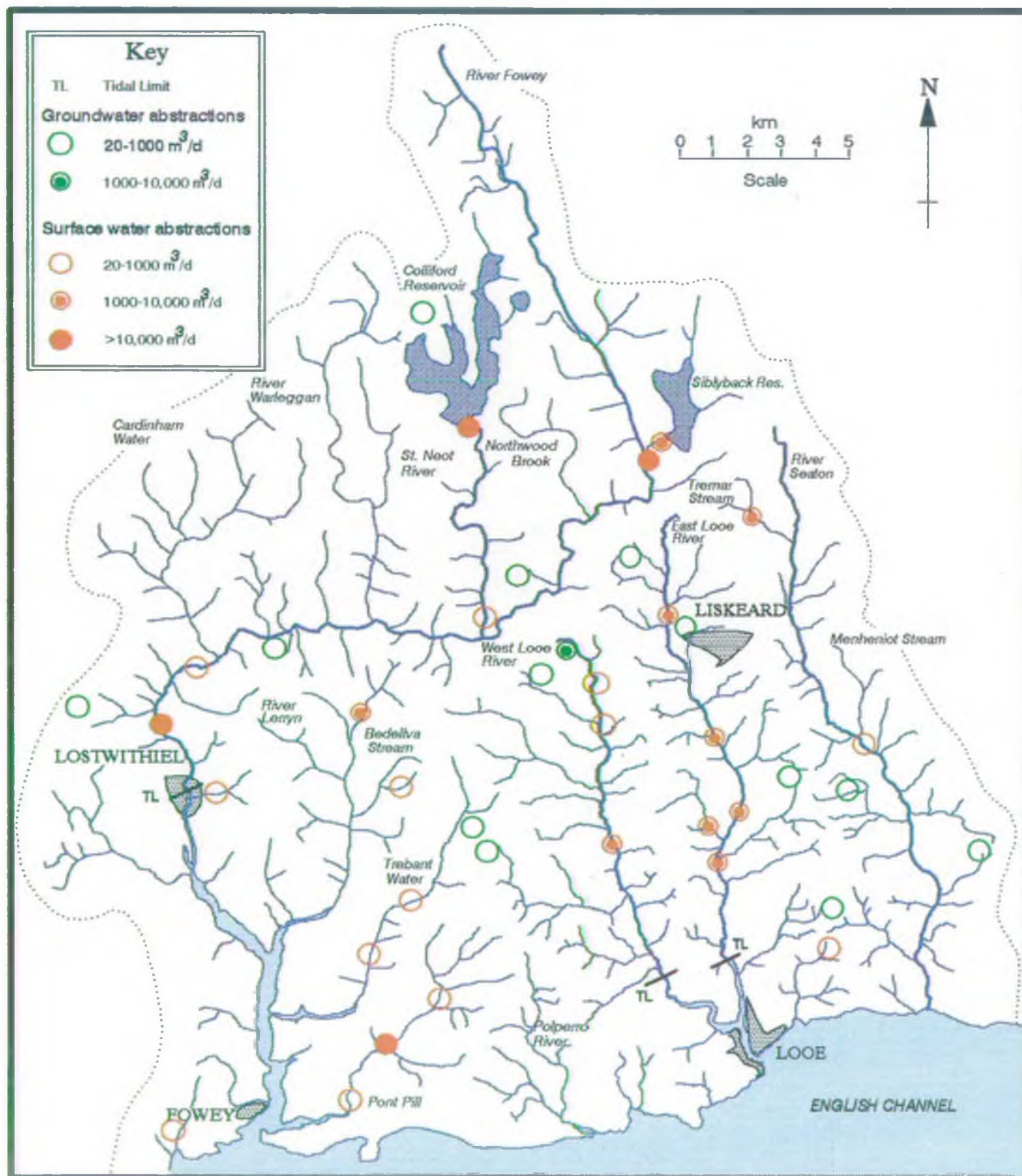
CATCHMENT USES

the water environment.

Experience gained with investigation of contaminated land sites shows that locally groundwater pollution can often be expected in the vicinity of gas works sites, landfills, manufacturing plant, old underground fuel storage tanks, industrial estates and mines. While not generally documented such pollution is undoubtedly present locally at many sites within the Seaton, Looe and Fowey catchments. The overall proportion of groundwaters affected is however likely to be small.

SEATON, LOOE AND FOWEY CATCHMENT

Abstractions



4.11 WATER ABSTRACTION

4.11.1 General

This use relates to the abstraction of surface and groundwaters for a variety of purposes, including potable water supply, industrial and agricultural, pisciculture, amenity and spray irrigation.

Abstraction can have a significant impact on surface or groundwaters by altering total volumes and rates of flow or infiltration. Abstractions fall into two basic categories: consumptive and non-consumptive uses. Consumptive uses generally involve a loss of a proportion of the water abstracted. Non-consumptive uses are those which essentially return all the abstracted water back to the catchment.

The NRA is concerned that abstractions do not have a detrimental impact on the water environment or other existing water users.

The Role and Objectives of the NRA

The NRA's aim is to manage water resources to achieve the right balance between the needs of the environment and those of water abstractors.

The NRA has duties and powers to:

- licence abstractions.
 - Licences will only be granted where resources are available, the need is justified and are subject to conditions to ensure they will not cause derogation of existing protected rights, or adversely impact in-river uses or the river environment. Conditions include:
 - * how much water can be abstracted in specified periods, and how this is assessed;
 - * where it can be used and for what purpose;
 - * flow conditions to protect the environment and other legal users.
- enforce conditions imposed on any abstraction licence.
- take action against illegal abstractions.
- apply to the Secretary of State for 'emergency' or 'ordinary' drought orders to minimise the impact on the environment.

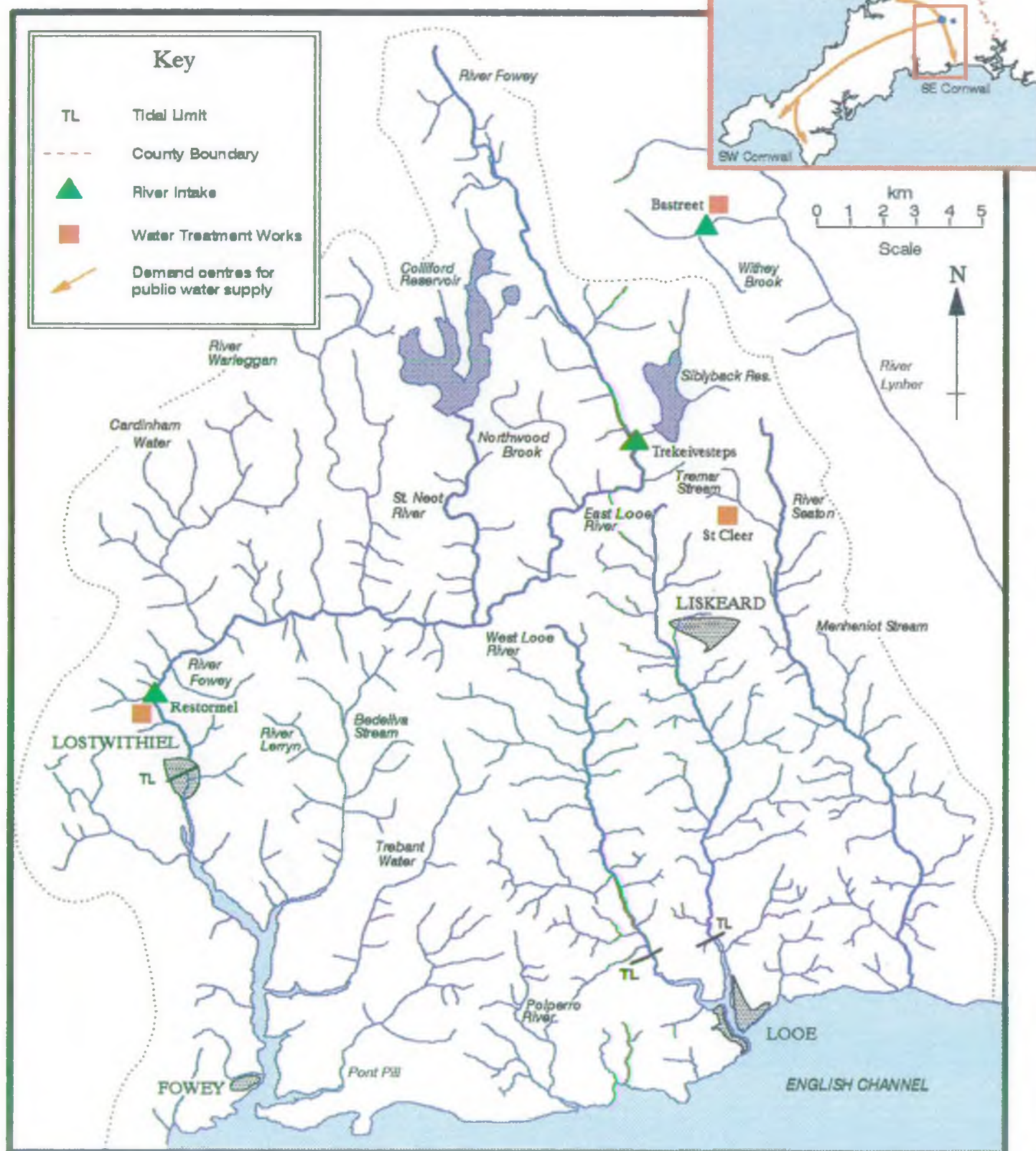
Regional licensing policy currently has a basis of protection centred on protection of a Q95 based condition and limited disruption to hydrograph pattern. This policy will be refined as more detailed knowledge on habitats and environmental needs emerges from national R & D Projects.

There are however exceptions to licensing control, particularly certain abstractions of under 20 m³/day.

Additionally the NRA has a commitment to:

- liaise with other bodies and organisations which have a role to promote the water environment. This is critical to the NRA's proactive role of protecting and enhancing the water environment and planning the availability of water resources for the future.
- apply its "Policy and Practice for the Protection of Groundwater"¹⁵ in the catchment to protect the availability of these groundwater resources, either through its own authorizations (duties and powers) or by statutory or non-statutory consultation with other agencies.

Colliford Lake and Siblyback Reservoir Scheme



CATCHMENT USES

'Licences of Right' (LORs) and 'Licences of Entitlement' (LOEs) were granted under the Water Resources Acts of 1963 and 1989. The NRA were required by law to issue these types of licence on the basis of established use and could not impose conditions to protect the environment. Where such licences cause significant detrimental impacts on the water environment or downstream uses, the NRA will negotiate agreement with holders of LOEs or LORs for a modification of the abstraction to moderate or prevent any impacts.

4.11.2 Local Perspective

There are 29 surface water and 201 licensed groundwater abstractions within the catchment. The annual total abstraction volumes in the catchment are 55,556,835m³ and 435,550m³ from surface water and groundwater sources respectively. Only 14 groundwater abstractions are over 20 cubic metres per day. Abstractions below this figure are considered of minor importance, though would still be assessed in relation to their location. These figures reflect the nature of the geology and groundwater aquifer, where permeability is low and can therefore only support small abstractions.

All "significant" abstractions are shown on the Abstractions map. Uses of the water range from private water supply to agricultural/industrial and recreational use but by far the most important is abstraction by South West Water Services Limited for potable water supply.

The catchment contains the strategic Colliford Reservoir, which, with Siblyback Reservoir and River Fowey abstractions is used for public water supply within this and adjacent catchments to the south east (Lynher) and north west (Camel), and to the south west (via a trunk mains).

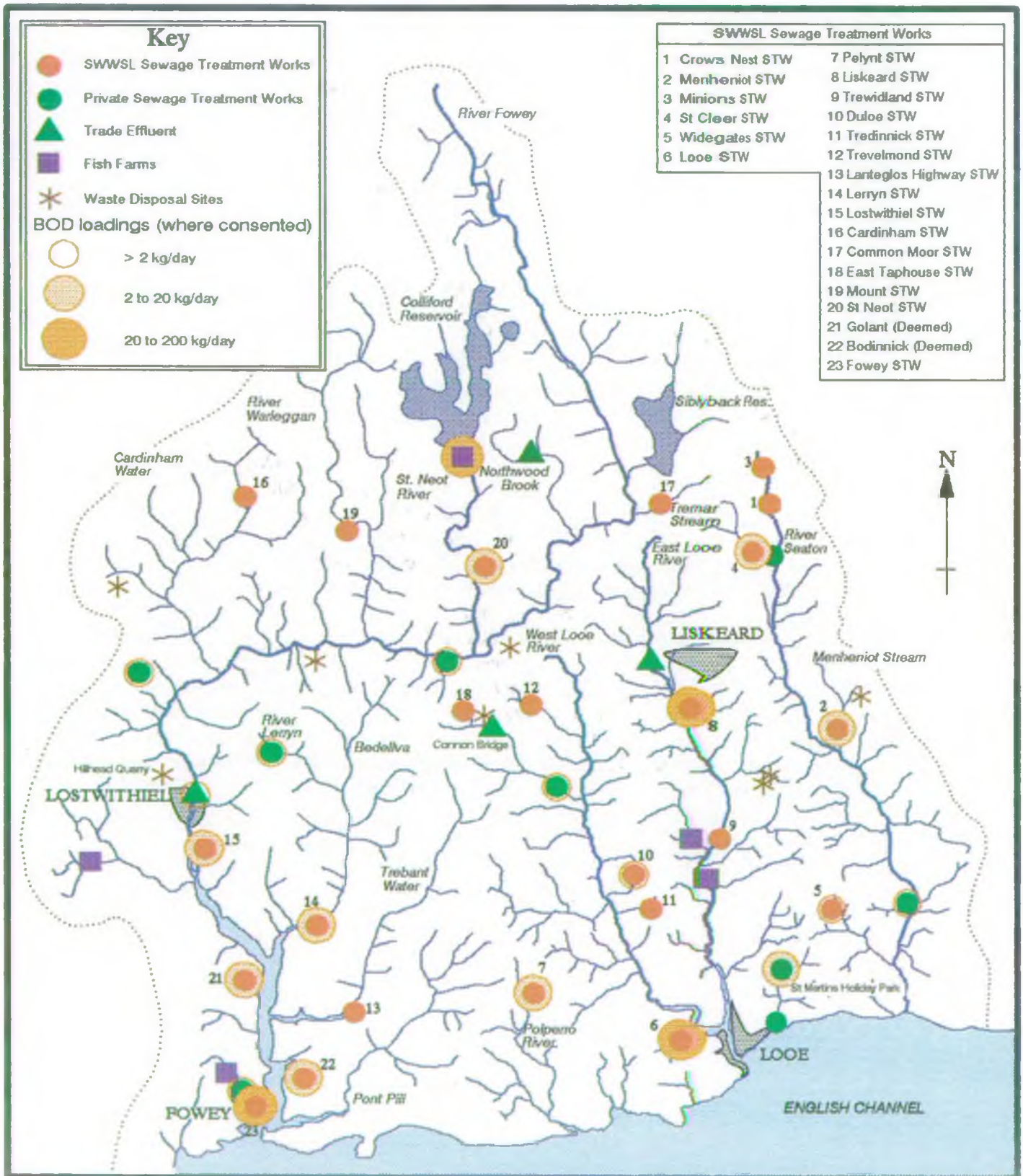
The Colliford and Siblyback sources are used conjunctively with other sources in the adjacent catchments. The system is complex but essentially works as follows for public water supplies:

- Augmentation releases are made from Colliford to the St Neot River for abstraction at Restormel (on the River Fowey) when the River Fowey reaches a defined prescribed flow. The abstraction at Restormel is then known as a "supported" abstraction. At times when the flow in the Fowey is above the prescribed flow "unsupported" abstraction can take place, within the abstraction licence conditions.
- In addition Colliford can be used to supply water directly to water treatment works in adjacent catchments to the north west and south east.
- A compensation flow of 5.68 Ml/d is released continually into the St Neot River from Colliford.
- Augmentation releases are also made from Siblyback into the Siblyback Stream (to support abstraction at Trekeivesteps and Restormel) and by pumping into the adjacent Withy Brook for abstraction at Bastreet in the neighbouring Lynher catchment.
- A prescribed flow at Trekeivesteps defines when abstractions at this point need to be "supported". Similarly, the river abstraction at Bastreet on the Withy Brook is constrained by a prescribed flow which triggers the need for the water transfer from Siblyback.
- A compensation flow of 3.09 Ml/d is released continually into the Siblyback Stream from Siblyback reservoir.

The major use of the reservoirs is for augmentation. This ensures that at times of low natural flow the river downstream of the reservoir benefits from enhanced flows to the abstraction point at Restormel.

Over 900 Ml of storage at Colliford is allocated as a Fisheries Water Bank, available for use by the NRA to make special releases at critical times to benefit the fishery.

SEATON, LOOE AND FOWEY CATCHMENT Effluent Discharges



4.12 EFFLUENT DISPOSAL

4.12.1 General

Water is used in a variety of domestic, industrial and agricultural processes and has to be returned to the environment, mostly as effluent discharges. In addition, our towns and roads are drained to convey rainfall away from development, resulting in intermittent discharges of storm sewage and surface water.

Man has historically used water as a waste carriage system. Dilution and biological processes lead to a cleansing effect of rivers and seawater on discharges so that the impact of the effluent is diminished in time. Effluent discharge at appropriate levels is therefore recognised as a legitimate use of the water environment.

Liquid waste can also be generated from waste disposal sites (see Section 4.13) and agricultural processes (see Section 4.3), and irrigated over land. The former is licensed and regulated by the Waste Regulation Authority, the latter guided by MAFF.

The Role and Objectives of the NRA.

The role of the NRA is to protect and improve the water environment. One of the fundamental ways in achieving this is the control of discharges. A discharge can require the consent of the NRA under Schedule 10 of the Water Resources Act 1991¹. When an application for a consent to discharge is received, the NRA has to decide whether to grant the consent and, if so, what conditions (if any) should be applied to the consent to protect receiving waters.

Water Quality Objectives relating to the environmental need and end uses of a receiving water are a fundamental cornerstone of discharge control policy (Water Quality Objectives are set out in Section 5.1). Once the desired receiving water quality is identified, the necessary effluent quality to ensure achievement of the water quality objective can be determined. Discharge consents only apply to point source discharges, that is to say, specific, identifiable discharges of effluent from a known location. Diffuse sources of pollution, such as agricultural run-off, and pollution incidents, such as accidental spillages, cannot be controlled by discharge consents. Some discharges are made into soakaways in the ground. Here, the NRA's "Policy and Practice for the Protection of Groundwater"¹⁵ is applied to protect groundwaters and water supplies.

The NRA has duties and powers to:

- control discharges with consents.
- prosecute dischargers who significantly contravene their consent conditions.
- prevent illegal discharges.
- monitor discharges.
- review consents.

Additionally the NRA is committed to:

- maintain links with other regulatory bodies.
- develop procedures for controlling intermittent discharges particularly storm sewage overflows.
- maintain links with local planning authorities to control development where further amounts of effluent disposal will cause a decline in water quality (see Section 4.7).
- direct the investment by private water companies to improve sewage treatment works.

CATCHMENT USES

Improvements to SWWSL STWs over the next 10 to 15 years are subject to available funding to be approved by OFWAT (the Office of Water Services, the governments economic regulator for the water industry). Strategic Business Plans for these investments (AMP2) have been developed based on guidelines agreed between the Water services companies, NRA, DOE and OFWAT. In priority sequence, AMP2 includes:

- (i) Schemes required to meet and maintain current EC and domestic statutory obligations
- (ii) Schemes required to meet and maintain new EC and domestic statutory obligations
- (iii) Schemes which have been separately justified, required to maintain river quality relative to the 1990 survey or to achieve river or marine improvements.

Strategic Business Plans were submitted in early 1994, and OFWAT declared the associated customer charging base in July 1994. However no commitment to the delivery of the environmental programme can be given by SWWSL until their request for an assessment by the Monopolies and Mergers Commission (MMC) is completed. It should be emphasised therefore that the improvements identified for the Seaton, Looe and Fowey Catchment under AMP2 are provisional until a financial commitment is established.

The timing of any improvement works will depend on a priority rating system agreed between SWWSL and the NRA. Details of individual works will not be known until after the completion of the MMC assessment.

4.12.2 Local Perspective

Within the catchment there are 20 SWWSL sewage treatment works (STW's), plus Fowey which is currently being built. Of these, 10 are small works (serving populations of less than 250 persons) which receive no trade effluent and have descriptive consents, where no numerical quality standards are imposed. The others have conditions for sanitary parameters, and in additional conditions for metals are imposed on the discharge from Looe STW.

A new sewage treatment works and sewerage system is under construction at Fowey and Polruan. An interceptor sewer is being laid along the Fowey foreshore with lateral sewers to individual discharges. Secondary treated effluent will be discharged from a new deep water point off Caffa Mill. The scheme is designed to ensure compliance with the EC Bathing Water Directive²⁶ at the nearest designated Bathing Water beach, Readymoney Cove.

There are recognised problems with the performance of a number of works, identified in the water quality 'state of catchment' (Section 5.1). These will be tackled through ensuring compliance with consent, consent reviews or new works/infrastructure.

There are 29 Storm Sewer Overflows, of which 2 have been causing problems. The pumping station at Trevecca, Liskeard has recently been uprated and the other, in Looe, will be uprated shortly.

The NRA has reviewed the consent conditions for Lodge Hill STW, Liskeard but SWWSL have

CATCHMENT USES

appealed to the DoE against a number of the standards.

There are 10 STWs operated by private concerns or individuals. The operation of a number of these causes the NRA concern.

Environmental impact on receiving waters has been caused by two Caradon District Council STW's, at No Mans Land and Fairy Cross. The NRA is currently reviewing the operation of both these and a further Caradon DC works. The effect of the discharges from Millendreath Holiday Village and St. Martins Holiday Park on Millendreath Beach, which may be affecting bathing water quality, are also being assessed (see Section 5.1).

Recent concerns over environmental health have been reported at Lostwithiel where sewage is entering into the River Fowey. Investigation work by SWWSL indicates the source of the problem as foul water from a housing estate entering the surface water sewer. The NRA is currently pursuing this matter with Restormel Borough Council who are considered to be the responsible body.

There are 10 private trade consents, 6 for fish farms, 2 for china clay works, Cannon Bridge refuse tip and the milk transportation depot at Lostwithiel.

There are a significant number of historic 'deemed' consents on the Fowey and Looe Estuaries. The NRA is involved in negotiating improvements to the operation of these often basic systems and has achieved improvements in many cases.

In the Fowey Estuary 16 private discharges are to connect to the new Fowey Sewerage Scheme along with 50 South West Water discharges, (all except Bodinnick). Other private discharges have been investigated with a view to making improvements. English China Clays have 37 deemed consents into the Fowey Estuary and the future operation of these is under discussion with the NRA at present.

A number of dischargers in the Looe Estuary are to install treatment plants and the NRA has issued consents to come into force in 1995.

The following table shows the pollution incidents in 1992/93 arising from industrial and sewage effluents.

Table 5 Pollution incidents arising from industrial and sewage effluents 1992/3

Year	Major	Significant	Minor	Source Not Found
SEWAGE 1992	0	1	27	10
1993	0	1	37	1
INDUSTRIAL 1992	0	2	13	1
1993	0	2	16	2

Note: Definitions of Severity Codes are given in Appendix G.

CATCHMENT USES

The past, current and projected proportion of population on mains sewerage systems is given below

Table 6 Population on mains sewerage

	1989	1992	2011 (low)	2011 (high)
Seaton	69.0	70.7	74.8	76.3
Looe	89.6	90.7	92.2	92.2
Fowey	69.8	72.9	76.5	78.1
The past, current and projected proportion of population on mains sewerage systems (Source: SWWSL, Forward Planning Dept.)				

As can be seen there are, and will continue to be significant proportion of private discharges. The regional policy is to discourage the proliferation of small private treatment plants and discharges in favour of mains connections.

(Note: OFWAT prescribed a £200.00 connection fee from 1995/96)

There are currently 9 NRA recommended areas of development restraint (Appendix F) throughout the catchment based on STWs which are not complying with their consents, or are having an environmental impact on receiving waters or are causing failures of EC directives. Development Restraints are representations by the NRA to Planning Authorities to prevent development which would require connections to mains sewerage system which would exacerbate an existing problem.

South West Water Services have a 10 year programme to improve sewerage and sewage treatment systems impacting on the water environment throughout the South West. A number of schemes are planned for the Seaton, Looe and Fowey catchment :

- * Improvement of Fowey sewerage system is underway together with the construction of a new STW.
- * Looe sewerage system and treatment works is planned to be upgraded by 1998 to ensure compliance of the EC Bathing Waters Directive²⁶ at East Looe Beach.
- * A new STW is due for construction at Seaton, which will also treat sewage from Donderry.
- * Upgrading of the Golant Bodinnick and Polperro systems are due for completion by 2005.

The timing of these projects is subject to change following negotiations between SWWSL and OFWAT in the summer of 1994 over the AMP programme (see explanation in Section 4.12.1).

4.13 WASTE DISPOSAL

4.13.1 General

This use relates to the disposal of solid wastes to land. Solid wastes invariably generate a liquor (known as leachate) through the breakdown of the waste or the ingress of water. Depending on the nature of the wastes involved this can vary from non toxic to highly toxic. The NRA is particularly concerned with the containment and handling of leachate and the threat it poses to both surface and groundwaters

Landfill sites are currently licensed by the County Waste Regulation Authority who are responsible under Waste Management Licensing Regulations 1994²⁷ (which superseded the 1974 Control of Pollution Act²⁸), for ensuring that the sites do not endanger public health, cause water pollution or cause serious detriment to the local amenity. The NRA is a statutory consultee on all applications for Waste Disposal licences and would look to control and influence solid waste disposal to safeguard the water environment..

The Role and Objectives of the NRA

The aim of the NRA is to prevent the pollution of ground and surface water resources through solid waste disposal practices.

The NRA has duties and powers to :

- monitor the quality of waters around waste disposal sites
- prosecute where there is shown to be pollution of ground or surface waters

Additionally the NRA has a commitment to :

- liaise with planning authorities and others to encourage the location of new landfill sites in areas where groundwater (and surface waters) is least vulnerable to pollution (see "Policy and Practice for the Protection of Groundwater"¹⁵).
- ensure that , as part of the Planning Permission or Waste Management Licence, adequate provision is made for monitoring and preventing pollution of controlled waters . Adequate provision must also be made for long term maintenance and monitoring of leachate control and disposal systems and for the integrity of any cap, basal or side seals.

4.13.2 Local Perspective

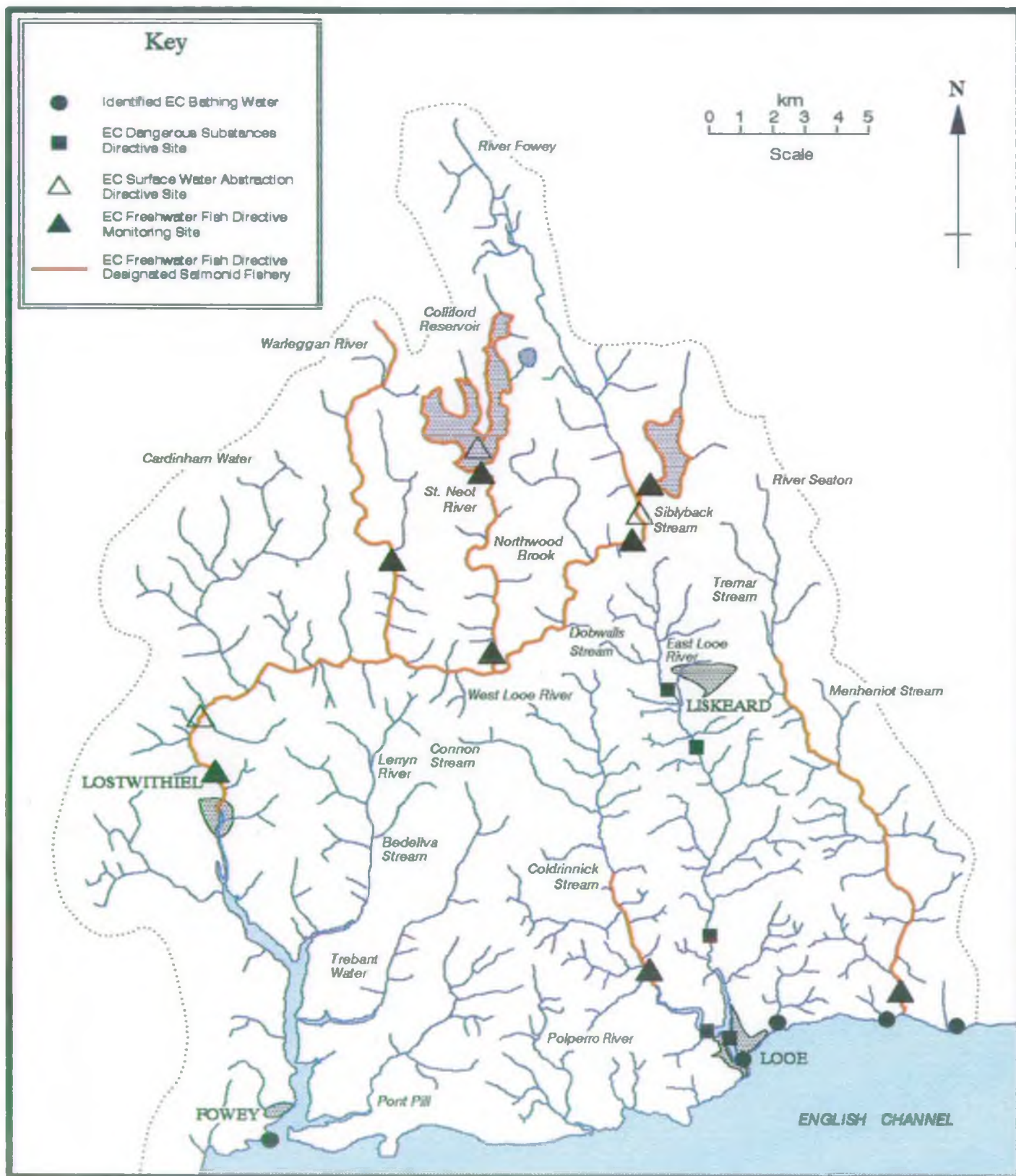
There are currently 7 waste disposal and 2 scrap metal sites in the catchment. Of the waste disposal sites, 6 are used solely for inert construction and demolition waste. There are 3 closed landfill sites, two of which were used for inert waste and one, Hillhead Quarry, was used for water treatment sludge. This site causes no known problems. There are a number of small unlicensed sites throughout the catchment, usually for domestic waste, most of which have been in existence for 10 to 15 years and have had time to stabilise. There are no known impacts on ground or surface waters.

CATCHMENT USES

Connon Bridge Tip, the largest of the sites is licensed for inert and putrescible waste (organic waste which will rot). The site generates leachate (the liquid from the rotting waste) which contains high levels of BOD and Ammonia. The leachate is irrigated over surrounding land which acts as a cleansing filter. Chemical and biological monitoring points are spread around the site and though there have been past problems with the leachate irrigation area there is currently no evidence of impact. Leachate has however been leaking through a damaged culvert which runs through the site and has entered the Connon Stream causing chronic pollution. Short term measures have been implemented and the operators are in negotiation with the NRA over suitable long term action.

TARGETS AND CURRENT STATE

SEATON, LOOE AND FOWEY CATCHMENT EC Directives



NRA South Western Region

WATER QUALITY TARGETS & CURRENT STATE

5.1 WATER QUALITY TARGETS AND CURRENT STATE

The NRA aims to maintain and improve where appropriate the quality of water for all those who use it. This is achieved by setting targets/standards for water quality based on:

- Ensuring compliance with the standards laid down in EC directives.
- Water Quality Objectives to protect recognised uses.

Comparison of the "current status" of water quality in the catchment with the targets will enable issues to be identified.

EC DIRECTIVES

The current status of water quality within the catchment will be compared with targets set by EC Directives appropriate to the catchment. Issues will be identified where standards set out in EC Directives are not being met.

Derogations

Certain parts of the catchment are subject to low pH due to acidic run-off from Bodmin Moor and uncontrollable inputs of trace metals particularly from historic mining and natural geology. Where EC Directive standards (under the EC Freshwater Fish and Surface Water Abstraction Directives) for pH and metals are not met due to inputs from natural sources the NRA will recommend a derogation that is that these standards will not be applied.

EC Freshwater Fish Directive⁶

The Freshwater Fisheries Directive on the quality of waters needing protection or improvement in order to support fish life, 78/659/EEC is concerned with ensuring that water quality in the designated stretches of water is suitable for supporting fisheries.

The Directive contains two sets of quality standards, one at levels to support a cyprinid fish population (i.e. coarse fish) and another set at stricter levels to support a salmonid fish population (e.g. salmon and trout). There are also two sets of standards for each fishery type, imperative standards which must be achieved and guideline standards which Member States should aim to achieve (Appendix D, Table 1).

Stretches of the River Seaton, River Looe and River Fowey catchment have been designated as salmonid fishery as shown in the accompanying map. Since 1992, the River Warleggan from source to the confluence with the River Fowey has been derogated for total zinc which is considered to come from natural origins. There are no stretches of river in the catchment designated as cyprinid fishery.

Current State

The designated sites in the River Seaton and River Looe catchments met all imperative standards in 1991, 1992 and 1993.

The designated sites in the River Fowey catchment met all imperative standards in 1992 and 1993. However, the imperative standard for total zinc was exceeded in 1991 in the River Fowey at Draynes Bridge, in the River Warleggan at Panter's Bridge, in the St. Neot River at Two Waters Foot and in the Siblyback Reservoir. It is thought that these past high zinc concentrations were due to natural inputs.

Issue 1: Exceedences of the imperative standard for total zinc causing EC Freshwater Fish Directive Failure.

WATER QUALITY TARGETS & CURRENT STATE

EC Dangerous Substances Directive^{29,30,31}

The Dangerous Substances Directive "on pollution caused by certain substances discharged in the aquatic environment of the community", 76/464/EEC, is concerned with controlling certain substances considered harmful which are discharged to the aquatic environment.

The Directive established two lists of compounds. List I contains substances regarded as particularly dangerous because of their toxicity, persistence and bioaccumulation. Discharges of List I substances must be controlled by Environmental Quality Standards (EQSs) issued through Daughter Directives. List II contains substances which are considered to be less dangerous but which still can have a deleterious effect on the aquatic environment. Discharges of List II substances are controlled by EQSs set by the individual Member States (Appendix D, Table 2).

Monitoring of List I and List II Dangerous Substances is carried out downstream of Looe STW on a tributary of the West Looe estuary and in the West Looe estuary. List I Dangerous Substances are monitored in the East Looe River downstream of Liskeard STW (see Section 4.12). List II Dangerous Substances are monitored in the East Looe River downstream of Moors China Clay Driers.

Current State

The EQSs for List I Dangerous Substances have been met at all sites monitored in the catchment since 1992. However, recently there have been occasional high concentrations of hexachlorocyclohexane (HCH) in the tributary to the West Looe Estuary which have been attributed to Looe STW.

The EQSs for List II Dangerous Substances have been met at all sites monitored in the catchment since 1992.

Issue 2: Occasional high concentrations of HCH attributable to Looe STW.

In addition to designated sites, monitoring of Dangerous Substances is carried out at other sites within the catchment. This monitoring has identified elevated concentrations of lead which exceed the EQS in the Menheniot Stream and the River Seaton. It is thought that these high concentrations are a result of historical mining activity in the catchment.

Issue 3: Elevated lead levels in the Menheniot Stream and the River Seaton.

EC Surface Water Abstraction Directive³²

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

The Directive sets out imperative standards which must be achieved, and guideline standards which Member States should aim to achieve, for water for public supply which is to be given different levels of treatment (Appendix D, Table 3).

Monitoring for the EC Surface Water Abstraction Directive is carried out at three sites in the catchment at Colliford Reservoir, and in the River Fowey at Trekeivesteps and at Restormel.

Current state

In 1991 all three sites met the imperative standards. In 1992 all the sites exceeded the imperative standard for phenols even though few positive results were found. The apparent exceedence was due to the statistical method used to interpret data recorded below the limit of detection.

WATER QUALITY TARGETS & CURRENT STATE

In 1993 all three sites exceeded the imperative standards for dissolved and emulsified hydrocarbons even though few positive results were found. The apparent exceedence was due to the statistical method used to interpret data recorded below the limit of detection.

In 1993 all three sites exceeded the imperative standard for coloration and Colliford Reservoir also exceeded the imperative standard for dissolved iron. These exceedences have been attributed to peaty soils (colour) and local geology in the upper catchment (iron).

Issue 4: Exceedence of EC Surface Water Abstraction standards for phenols, dissolved and emulsified hydrocarbons, coloration and iron.

EC Bathing Waters Directive^{26,23}

The Bathing Waters Directive 'concerning the quality of bathing water' (76/160/EEC) aims to protect the environment and public health of bathing water, by reducing pollution entering identified bathing areas. As the competent authority for implementing this directive, the NRA has a two-fold obligation. The first is to monitor the quality of popular bathing waters and to provide the results to the DoE which assesses compliance. The second is to maintain and improve where necessary bathing water quality so that it complies with the standards laid down in the Directive. To achieve this the NRA has to identify the sources of pollution, quantify the effects and ensure that improvements take place.

The Directive lays down nineteen physical, chemical and microbiological parameters for assessing the quality of bathing waters which include total and faecal coliform's, salmonellae, enteroviruses, pH, transparency, colour, mineral oils, surface-active substances and phenols (Appendix D, Table 4). Compliance with the requirements of the Directive is assessed by the DoE on a parameter by parameter basis, principally against the mandatory standards for total and faecal coliforms.

There are five EC Bathing Waters in the Seaton, Looe, Fowey catchment at Seaton Beach, Downderry, Millendreath, East Looe and Readymoney Cove.

Current state

All of the identified EC Bathing Waters have beaches within the catchment (see Section 4.5) have failed the Directive at some time since 1986, as follows:

<u>Identified Bathing Water</u>	<u>Bathing Season When Failure Was Recorded</u>
Seaton Beach	1986 1987 1988 1992
Downderry	1987
Millendreath	1989
East Looe	1986 1989 1993
Readymoney Cove	1986 1987 1991 1993

The main causes of failures of the EC Bathing Water Directive standards at Seaton Beach and Downderry Beach are crude sewage outfalls (see Section 4.12). In addition, riverine inputs from the River Seaton, together with contamination from private discharges (which may include the Caradon District Council STW at No Man's Land) contribute to failures at Seaton Beach. Bacterial contamination from unknown sources of the stream at Downderry contributes to failures at Downderry. A scheme to improve sewage disposal at Seaton and Downderry is proposed under SWWSL's Marine Capital Programme. Some improvements to private discharges at Hessenford have already been carried out.

WATER QUALITY TARGETS & CURRENT STATE

The main causes of failures of the EC Bathing Water Directive standards at Millendreath are high bacterial concentrations in Millendreath Stream deriving from sewage discharges from Millendreath Holiday Village and possibly St Martin's Holiday Park.

The main causes of failures of the EC Bathing Waters Directive standards at East Looe are the sewerage system at Looe, Looe STW (see Section 4.12) and intermittent high concentrations of bacteria in both East and West Looe Rivers (most significantly the East Looe) during periods of high rainfall. SWWSL have been upgrading the sewerage system in Looe and improvements at Looe STW have been proposed under AMP2 (see note about AMP2 in Section 4.12).

The main cause of failures of the EC Bathing Water Directive standards at Readymoney Cove are the crude sewage discharges to the Fowey Estuary from Fowey. A scheme to improve sewage disposal to the Fowey Estuary is currently under construction as part of SWWSL's Marine Capital Programme.

Issue 5: Failure of EC Bathing Water quality standards.

In addition to the identified EC Bathing Waters listed above, seven other "non-identified" bathing waters have been monitored during one bathing season since 1991 by the NRA at Looe Plaidy Beach, Looe Hannafore, Talland Bay, Polperro Beach, Whitehouse Beach, Polridmouth and Lantic Bay.

Of these, Looe Plaidy, Looe Hannafore, Talland Bay, Polperro Beach and Whitehouse Beach, exceeded the EC Bathing Water standards in the year they were monitored. Planned improvements to sewerage at Polperro and sewage disposal at Fowey may improve water quality at Polperro and Whitehouse Beaches respectively. The NRA is unable to require investment by SWWSL at non-identified Bathing Waters which exceed the Directive standards.

EC Urban Wastewater Treatment Directive (UWWTD)⁴⁴

The EC Directive "concerning urban wastewater treatment", (91/271/EEC) lays down minimum standards for the provision of sewage collection systems and sewage treatment. The Directive specifies secondary treatment for all discharges serving population equivalents greater than 2,000 to inland waters and estuaries and greater than 10,000 to coastal waters, but provides for higher standards of treatment for discharges to "sensitive" areas and lower standards of treatment to "less sensitive" areas. Sensitive areas are those surface waters which receive discharges serving population equivalents of greater than 10,000, and are or may become eutrophic in the near future. "Less Sensitive" areas or "High Natural Dispersion Areas (HNDAs)" are those waters with high, natural dispersion where a lower level of treatment is required, subject to "Comprehensive Studies" being carried out by the discharger to establish that a lower level of treatment will be sufficient to protect the environment from adverse effects. Discharges below the specified population equivalents for inland and estuaries and coastal waters must also receive "appropriate" treatment as defined in the AMP2 guidance note.⁴⁰ (see Section 4.12).

Current State

Improvements to the crude sewage discharges at Polperro, Bodinnick and Golant have been proposed under AMP2 (see Section 4.12) as requiring Appropriate Treatment under the UWWTD because of the recreational use of the receiving waters.

WATER QUALITY TARGETS & CURRENT STATE

EC Nitrates Directive³⁵

The EC Directive "concerning the protection of waters against pollution caused by nitrates from agricultural sources" (91/676/EEC), requires Member States to identify waters affected by pollution from nitrates or which could be affected by pollution from nitrates, "Polluted Waters (Eutrophic)", if protective measures are not taken. The land draining to these areas are designated as "nitrate vulnerable zones" (NVZ) and action plans must be established to reduce existing nitrate pollution and preventing further pollution. The identification of vulnerable zones has been limited to catchments around strategic public water supply sources where existing data shows that standards for nitrates in the Drinking Water Directive have been or will be exceeded by 2010.

Current state

High concentrations of total oxidised nitrogen have been found in both the Looe and Fowey Estuaries. In the Looe Estuary sporadic high "chlorophyll A" concentrations suggesting the presence of algal blooms have been found, but in the Fowey Estuary high chlorophyll a concentrations are more persistent. The algal blooms do not yet appear to be having a significant effect on dissolved oxygen in these estuaries. Further detailed studies will be starting shortly to establish the eutrophic status of the Fowey Estuary. **Issue 6: Fowey Estuary has been identified by the NRA for further studies in 1995 and 1996 to establish the extent of eutrophication.**

EC Groundwater Directive³⁶

Whilst the EC Groundwaters Directive controls the release of certain substances to groundwaters, there are no statutory standards for groundwater quality. In assessing the significance of polluting activities the NRA has regard for the 'uses' made of the groundwaters of which the most important are, provision of river base flow, and abstraction for drinking water.

Groundwater quality within the catchments is generally reflected by river water quality observed during dry weather periods when river flow is almost entirely derived from groundwater seepage. Within the catchment this indicates that groundwater quality is likely to be generally suitable for providing river base flow and supporting identified river water uses, except in areas disturbed by mining activity.

Evidence of suitability of groundwater for potable use is provided by a baseline survey of private water supplies located throughout rural areas of Devon and Cornwall which was undertaken by the NRA during 1992-3. While only twenty four samples were obtained from within the Seaton, Looe and Fowey catchment these showed a similar pattern to the overall results within Devon and Cornwall. The data shows groundwaters generally comply with drinking water standards. Notable exceptions were for bacteriological contamination, Nitrates, Iron and Manganese.

There is evidence that poor bacteriological quality is generally associated with poor well maintenance. For nitrates, where the data shows approximately 10% of sources failing the EC Nitrate Directive³⁵, the most important inputs are likely to arise from agricultural activities, although locally inputs from septic tank drainage may be significant.

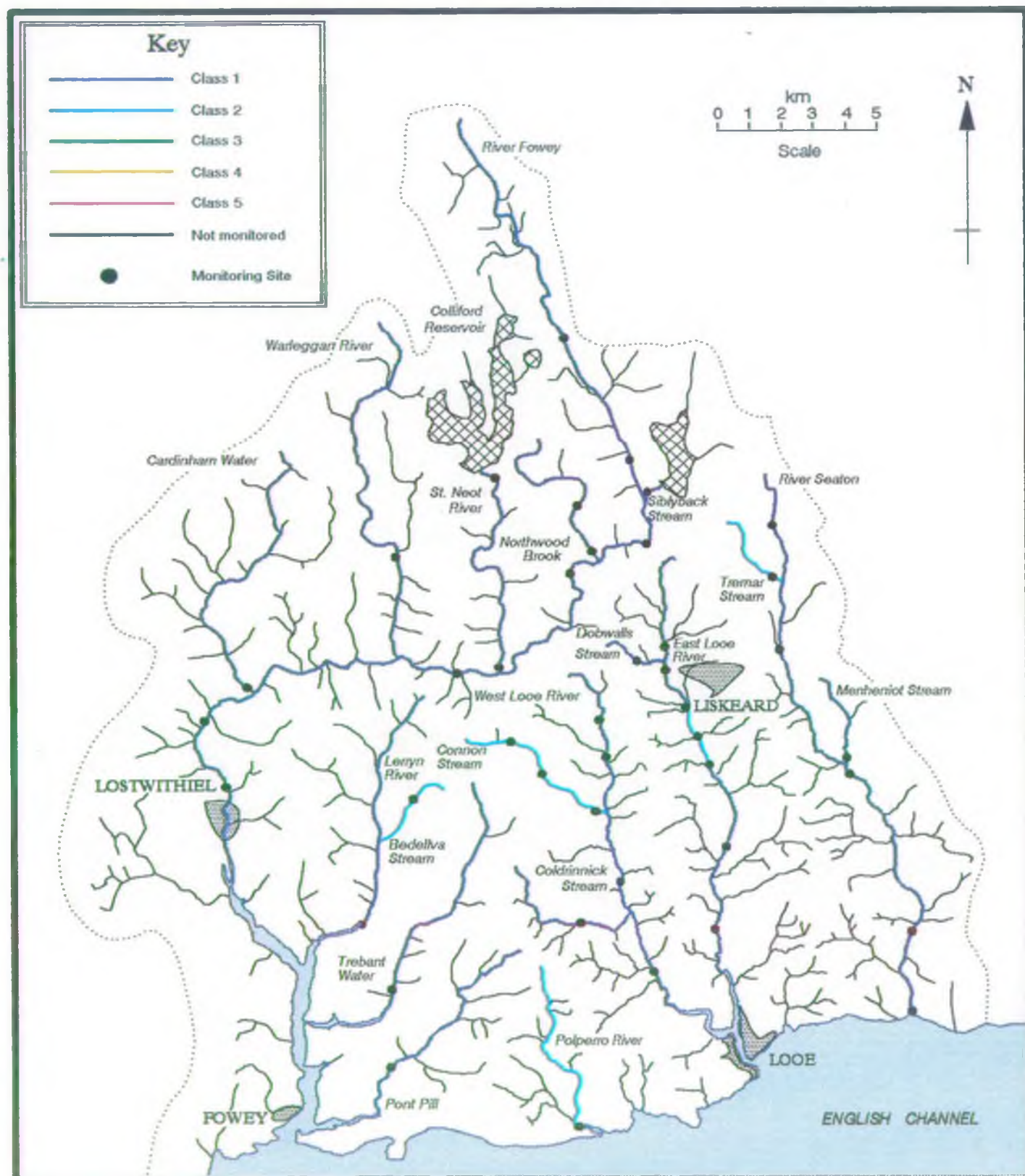
High Iron and Manganese concentrations are most likely to arise from "natural" weathering of soil and bedrock, although this can be made worse by general organic pollution.

6.1.2 ANNEX 1A Reduction Programme³⁷

At the second and third North Sea Conferences, the UK Government made a commitment to reduce the loadings (concentration x flow) of certain substances (Appendix D, Table 5) entering tidal waters from rivers and direct discharges by 50% (70% for mercury, cadmium and lead) by the end of 1995 compared to a 1985 baseline. In England and Wales the NRA is responsible for identifying inputs where reductions must be made in order to meet this commitment.

SEATON, LOOE AND FOWEY CATCHMENT

Water Quality Targets - River Ecosystem Use Classes



WATER QUALITY TARGETS & CURRENT STATE

The River Fowey at Restormel is monitored for Annex 1 A substances.

Current State

Significant loads of mercury, cadmium, copper, zinc and lead were recorded at the Restormel site on the Fowey in 1992. Results are currently being compiled nationally by the NRA with a view to identifying sites where reductions in loadings should be made.

Issue 7: Following national compilation of data, if the Fowey appears on the national priority list, investigations may be required to determine the source of these substances and whether reductions could be made.

WATER QUALITY OBJECTIVES FOR FRESHWATER

The Water Resources Act 1991¹ contains legislation which allows the Secretaries of State to prescribe classification schemes for water quality and to use them for the setting of Water Quality Objectives (WQOs). Previous references to water quality have been based on the National Water Council (NWC) classification system. Because of its limited range of chemical parameters and subjective interpretation it has been replaced with a dual system of use-related classifications, statutory WQOs and a general quality assessment (GQA) system. These reporting facilities will operate in parallel and will represent a neutral translation in standards from the NWC scheme. Whilst the WQO system will examine compliance with EC Directives and specific use-related standards, the purpose of the GQA is to provide a means of accurately assessing and reporting on the general state of controlled waters in a nationally consistent manner.

WATER QUALITY OBJECTIVES³⁸

A Use-Related Scheme: The Classification Scheme proposed for establishing statutory WQOs is based upon the recognised uses to which a river stretch may be put. These uses include River Ecosystem, Abstraction for Drinking Water Supply, Agricultural Abstraction, Industrial Abstraction, Special Ecosystem, and Watersports. The first phase of WQO implementation will be restricted to the River Ecosystem Use Class only; the standards for further uses are still under development. For each stretch, a target River Ecosystem Use Class will be proposed, including a date by which this level of water quality should be achieved.

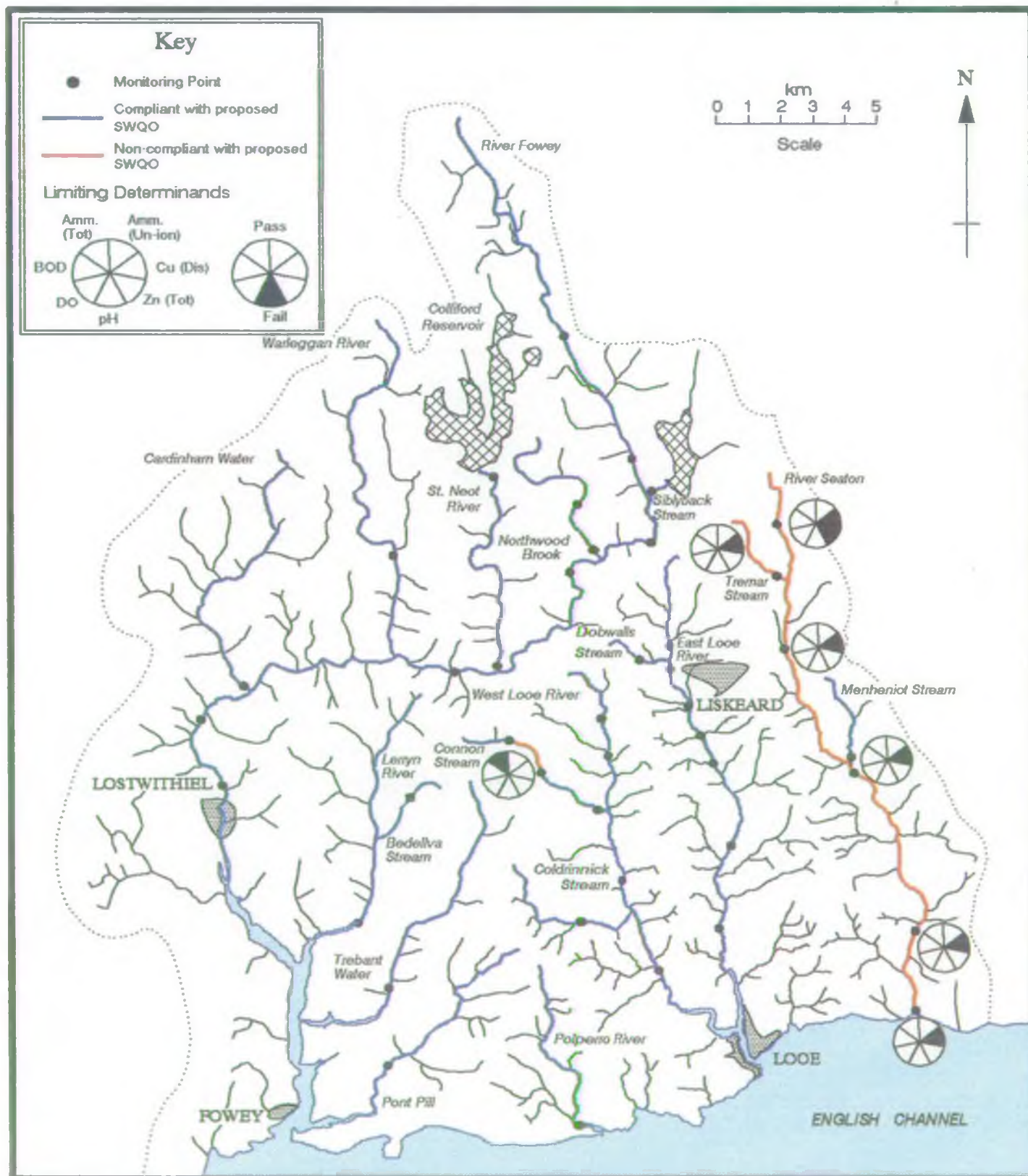
River Ecosystem Use Class:³⁹ There are five Classes within the River Ecosystem scheme, one of which will be applicable to every stretch of classified river. The term 'Ecosystem' is used in recognition of the need to protect the ecosystem that is sustained in a healthy river. The proposed standards for the five River Ecosystem Classes are based on the chemical water quality requirements of different types of ecosystem, and consequently the types of fisheries they are capable of supporting, (*Appendix D, Table 6*).

"Set Aside" of Data

The document "Water Quality Objectives: Procedures used by the National Rivers Authority for the purpose of the Surface Waters (River Ecosystem) (Classification) Regulations 1994³⁸", provides for setting aside of data for pH and metals where local geology is responsible for non-compliance. Current and historical data shows that in order to protect the good water quality indicated by organic determinands in the Seaton, Looe, Fowey catchment, data for pH and metals should be "set aside" at certain sites when assessing compliance.

SEATON, LOOE AND FOWEY CATCHMENT

Compliance With River Ecosystem Use Class Targets



WATER QUALITY TARGETS & CURRENT STATE

Water Quality Objectives based on the RE Classification

The proposed WQOs for the catchment are shown on the map "water quality targets". It is proposed that these WQOs will apply from 1995, *INITIALLY ON A NON-STATUTORY BASIS*. Current and historical data shows that elevated levels of copper and zinc, and low pH occur at certain sites within the catchment, therefore it is proposed to set aside data in those years when sites fail to achieve their target class because of elevated metal concentrations or low pH.

Current State

Stretches where the current water quality does not achieve the Water Quality Objectives are shown on the map, "state of catchment".

Water Quality Issues have been identified where target water quality has not been achieved or where an improvement in target class can be expected as a result of investigations into sources of poor water quality.

Seaton System

In 1993 the stretch of the River Seaton from the source to Crow's Nest did not achieve target class RE1 due to elevated concentrations of total zinc and total copper (in 1992 low pH also contributed to the failure to achieve RE1). The stretch from Crow's Nest to Courtneys Mill Bridge did not achieve RE1 because of high copper concentrations. Drainage from a number of old mines on Bodmin Moor and acidic run-off from Bodmin Moor appear to be responsible for the poor water quality.

The lower stretches of the River Seaton from Courtneys Mill Bridge to the mouth also have elevated concentrations of total copper and so did not achieve WQO RE1. The RE1 standard is based on dissolved metal concentrations, however due to limited dissolved copper data, total copper data had to be used in the assessment of water quality. The limited amount of dissolved copper data showed that if dissolved copper data was used for assessment of water quality in the future then the lower reaches of the River Seaton would achieve the WQO of RE1.

Elevated concentrations of copper attributed to local geology and historic mining have also been identified in the Tremar Stream.

Issue 8: Elevated copper, zinc and low pH levels in the upper stretches of the River Seaton and elevated copper levels on the Tremar Stream causing WQO failure.

Looe System

The whole of the East Looe River achieves its target class of RE1 or RE2.

On the West Looe the Connon Stream failed to achieve the RE2 target class for the monitoring point at Trevillis Wood due to elevated levels of total ammonia which was due to leachate from Connon Bridge Landfill Site. Temporary measures have been undertaken to prevent impact and longer term measures are being developed by the site operators. The water quality objective for the whole of the Connon Stream is RE2. Improvements at the Connon Bridge Landfill site will contribute to achieving that class however there are also unidentified inputs upstream of the site that are resulting in elevated levels of ammonia.

Issue 9: Elevated ammonia levels on the Connon Stream causing WQO failure.

WATER QUALITY TARGETS & CURRENT STATE

Fowey System

In 1993 the whole of the River Fowey achieved RE Class 1, however in 1992 RE Class 5 was achieved from the source to Drayne's Bridge due to low pH which resulted from acidic run-off from Bodmin Moor. The St Neot River achieved RE Class 1 in 1993, however in 1992 the stretch from Colliford Lake to Colliford Bridge achieved RE Class 5 because of low pH which was due to acidic run-off from Bodmin Moor and humic acids in Colliford Lake. In 1993 the Northwood Brook achieved RE Class 1 but in 1992 the stretch from source to Wortha achieved RE Class 5 due to low pH caused by acidic run-off from Bodmin Moor.

Issue 10: Low pH values in the upper reaches of the River Fowey, St Neot River and Northwood Brook causing WQO failure.

Bedellva Stream achieves its WQO of RE2, however the long term objective is class RE1. At present this is not achieved due to an unknown source of organic enrichment, thought to be due to poor farm practices.

Issue 11: Organic enrichment in the Bedellva Stream.

FRESHWATER BIOLOGICAL MONITORING

The ecological quality of a freshwater catchment is monitored using benthic macro-invertebrates. These are small animals which inhabit the river sediments. They are unable to move far and so respond to long-term conditions within the watercourse throughout the year. They provide an overall indication of the ecological condition of the river which complements the GQA chemical classification.

Samples are collected from a network of sites in the catchment during Spring, Summer, and Autumn, and are analysed to give a complete list of macroinvertebrate families (taxa) present. The diversity of taxa found is related to water quality using the Biological Monitoring Working Party (BMWP) scoring system. The actual score is compared to a predicted score for a physically similar river of good ecological quality and the difference between what was found and what was predicted is used to classify the river given below:

<u>Biological Class</u>	<u>Description</u>
A	Good
B	Moderate
C	Poor
D	Very poor

Biological monitoring takes place throughout the catchment.

The invertebrate community of the River Seaton has a low biological score which is consistent with the high metal concentrations in the water. The biological community of the East Looe River reflects a continued improvement in water quality throughout the river. Biological scores for the Polperro River are good, however the species present reflect organic enrichment. For more detail see Appendix E

WATER QUALITY IN ESTUARINE AND COASTAL WATERS.

There are no statutory water quality objectives for estuaries however there are a number of recognised standards against which estuarine water quality can be assessed.

WATER QUALITY TARGETS & CURRENT STATE

NWC Estuary Classification Scheme

Until it is replaced by a GQA scheme, the NRA currently uses the subjective NWC Estuary Classification System, which was adopted in 1980, for the assessment of the water quality in estuaries. The classification system is based on the recommendations of the Classification of Estuaries Working Party which reported to the Department of Environment (DoE) and NWC Standing Technical Advisory Committee on Water Quality (Appendix D, Table 7). The classification aims to provide a simple assessment of the status of estuaries.

The estuary is subjectively assessed for its biological, aesthetic and chemical quality with points being awarded if certain descriptive criteria are met. In defining the descriptions, the uses to which the estuary might be put was considered, for example passage of migratory fish, fishing, shellfisheries, wildlife, amenity value and industry. The score is then combined to give a Class.

The four classes of the NWC estuary classification system are as follows:

<u>Class</u>	<u>Description</u>
A	Good
B	Fair
C	Poor
D	Bad

Research is currently being carried out by the NRA to establish a new GQA classification scheme in time for the 1995 national river quality survey, which will replace the NWC classification.

Current State

The Looe and the Fowey estuaries both achieved Class A in 1985, 1990 and 1991. The maximum number of points for class A was not achieved due to localised effects of discharges from the Looe and Fowey sewerage systems which caused aesthetic pollution.

Passage of migratory fish

Where passage of migratory salmonid fish is a recognised use in an estuary the NRA may set non-statutory standards for ammonia and dissolved oxygen during critical periods of the year when salmonid migration is taking place, as defined in the AMP2 Guidance Note³⁴⁰. (Appendix D, Table 8).

Current state

The passage of migratory fish is a recognised use in the Looe and Fowey Estuaries and non-statutory standards for ammonia and dissolved oxygen have been met in both estuaries in the years 1990 to 1993 inclusive.

Monitoring of estuarine and coastal water quality also occurs under a number of permissive monitoring programmes.

Biological Estuarine Surveys

Biological data provides a good indication of the overall health of an estuary. Surveys provide a baseline of biological information against which changes of community structure can be assessed.

WATER QUALITY TARGETS & CURRENT STATE

Surveys of the macro-invertebrate fauna of the Fowey estuary have been undertaken. The community structure and species composition was typical of this type of environment.

Bioaccumulation studies

Mussels and seaweed have the ability to take up metals and organic compounds from seawater and concentrate these substances within their tissues, this process is known as bioaccumulation. Analysis of mussel tissue gives an indication of contaminants present in seawater, even contaminants which may be present at only very low concentrations.

Current state

Samples of mussels from the Looe Estuary contained low or only slightly elevated levels of metals and organic compounds. However, mussels and seaweed sampled from the Fowey estuary at Cliff contained a level of arsenic which was higher than the typical ranges for mussels and seaweed in England and Wales.

Issue 12: Higher than expected levels of arsenic in mussels and seaweed at one site in the Fowey Estuary.

Water Contact Sports

The coastal section of the catchment is used extensively for water contact sports. The survey of bathing water quality for the EC bathing Water Directive and the non-designated beaches shows water quality problems close to beaches however this permissive programme provides data on water quality further off-shore.

Current State

All monitored locations complied with imperative standards for the EC Bathing Water Directive.

CONSENT NON COMPLIANCE AND POOR PERFORMANCE OF SEWERAGE SYSTEMS

Lostwithiel STW (which discharges to the estuary) and Fairy Cross STW (discharging to a tributary of the River Leryn) are currently failing to meet their discharge consent conditions (see section 4.12). Works are in progress to address both problems and the NRA is monitoring both closely.

Issue 13: Failure of STW's to meet discharge consent Conditions.

There have been recent environmental health concerns in Lostwithiel through sewage entering into the surface water drainage system, and thus the River Fowey (see Section 4.12). Responsibility appears to rest with Restormel Borough Council.

Issue 14: Untreated sewage entering the River Fowey at Lostwithiel.

Elevated concentrations of BOD and total ammonia at the top of the Polperro River are resulting from Pelynt STW. Improvements to the works are planned by SWWSL. Poor water quality at the lower end of the river has been the result of effluent entering the river from fractured sewer pipes (largely caused by the 1993 storms). SWWSL are currently involved in improving the system.

WATER QUANTITY TARGETS & CURRENT STATE

5.2 WATER QUANTITY TARGETS AND CURRENT STATE

General Targets

The NRA aims to manage water resources to achieve the right balance between the needs of riverine and wetland ecosystems, the needs of aquifer dependant systems, the needs of abstractors and dischargers, lawful water users, in-river needs, and to provide protective defence for people and property from flooding.

Specific Targets

The NRA will seek to achieve the above targets through the following measures:

- determining new abstraction and impoundment applications in accordance with regional and national policy;
- including appropriately worded conditions on any new licence that is issued to;
 - * prevent over exploitation of groundwater resources;
 - * prevent deleterious effects on migratory salmonid movements and spawning, nursery and wetland habitats;
 - * ensure sufficient dilution for consented discharges;
 - * ensure adequate water is available for existing licensed abstractions, other protected rights, legal water uses and in-river use;
 - * ensure proper records are maintained of actual abstraction to permit a proper understanding of water resource use within the catchment;
- enforcement of abstraction licence conditions by the NRA;
- reviewing existing Regional licensing policy in the light of any results from National R&D projects;
- implementing the "Policy and Practice for the Protection of Groundwater"¹⁵ in order to protect groundwater yields and flows.

Where the above general target has not been met the NRA will undertake the following actions:

- Investigate low flow sites within the context of national policy and available manpower and financial resources;
- Seek opportunities to transfer licenced resources downstream;
- Seek an element of environmental gain from any future water resources scheme.

Flood defence: currently the two criteria listed below are used to determine acceptability of any given flooding regime.

- In protected built-up areas the river bank should not be breached or overtopped by a flood flow with a specified return period - generally 100 years for built-up areas.

WATER QUANTITY TARGETS & CURRENT STATE

- In rural floodplains, the return period is generally determined by land use.

However, the NRA is to introduce Flood Defence Management Framework during the plan period. The Flood Defence Management Framework (FDMF) has been devised with the objective of improving the NRA's physical management of the main rivers (see Section 4.8).

Ensure Adequate Provision of Flood Warning in the Catchment.

The setting of targets for the issuing of Flood Warnings is currently under consideration. A project to establish Emergency response levels of service for main rivers in the Region is being undertaken. Geographical and hydrological factors may not permit consistent targets to be established over all rivers.

Results of the Emergency Response Levels of Service project will enable target times for flood warnings for flood prone locations to be established.

Current State

Impacts on in stream ecology, migratory salmonid movements and spawning, nursery and wetland habitats.

There is significant "total-loss" water abstraction in the catchment, largely on the Fowey system. This can currently be supported through Colliford and Siblyback Reservoirs which are also used to augment natural river flows when they otherwise might fall below environmentally acceptable levels. This said, there are still perceived impacts, though no empirical evidence exists:

- Autumn and Winter flows on the Rivers Fowey, St Neot and Siblyback Stream may be reduced due to reservoir replenishment. Siltation and weed growth in the channel of the St Neot river have been occurring indicating increased sediment loads and/or inadequate flushing.
- in 1991-94 blue/green algal blooms have caused problems for recreational use and fish rearing on Colliford.
- A reduction in the quality of the fishing through the operation of Colliford through reduced flows sometimes providing a false lead for migratory fish at the St Neot/Fowey junction and coloration from releases. An initial study By Dr D Solomon for SWWSL, "Effects of releases of water from Colliford Reservoir" (March 1988⁴¹) concludes that there is no evidence of impact on the fishery. Fishing may be affected by coloration but only requires a change in fishing method.

Operational procedures relating to the abstractions should be regularly reviewed.

Issue 15: Perceived impacts on the fishery and fishing and recreation through reservoir operation.

There has been no evidence gathered that the reduced "spate" nature of the rivers has adversely impacted the wildlife of the river or riparian zone. Biological monitoring indicates populations representative of expected type throughout the catchment (given water quality). Similarly, there is no known effect on the frequency of flooding of the floodplain and no known negative impact on

WATER QUANTITY TARGETS & CURRENT STATE

wetland or wet meadows. Indeed reservoir operation may reduce the severity of flooding. Collection of evidence on these subjects may be gathered as part of **Issue 15**.

Knowledge of the catchment wildlife is not sufficient at present to identify and set targets for flow requirements. Similarly the general flow requirements of different ecosystems and particular species (excepting fish) is not known. The NRA is currently engaged in national R & D Project work to establish flow requirements.

Issue 16: Lack of knowledge of wildlife flow requirements.

Groundwater resources.

As has been highlighted in sections 2.0 and 4.11 the hydrological nature of the catchment will only support small, localised groundwater abstractions. This also means that the effect of any ground or surface water abstractions on groundwater resources will be similarly limited.

There are not known to be any significant impacts on the volume of groundwater resource.

Dilution for consented discharges.

There are a number of existing discharges where the discharged effluent is causing environmental impact (see section 5.1). Theoretically improvements could be made with increased dilution through larger flows, however there are no identified locations where there are additional water resources are available to improve problematic consented discharges.

New abstractions that impact water quality will not be allowed. Similarly development which would cause or exacerbate existing locations of poor water quality will be resisted.

River flows which have declined to, or are at an unacceptable level as a consequence of licensed groundwater and surface water abstractions;

In 1990 the NRA South West Region commissioned Sir William Halcrow and Partners to produce a report identifying the problems caused by artificially low river flows within the region. This report, "NRA South West Region - Low Flows Study"⁴², identified 109 low flow sites where low flows could adversely affect the river in terms of amenity, fisheries or ecology. Problem sites were ranked as "serious, major, medium, small and minor" according to their perceived severity of low flow effects.

Within the catchment there were five identified sites where there are perceived low flow problems:

- Two of these are connected with public water supply and reservoir operation where prescribed flows exist which should protect the watercourse. Failure to do so should be identified in options for **Issue 15**.
- An abstraction at Doblebois Weir has the potential to have a major impact the River Fowey. The abstraction is made by the Duchy of Cornwall, which is exempt from licencing restrictions.
- The remaining two are connected with fish farms; A fish farm on a tributary of the River Fowey has two groundwater abstractions, which may reduce baseline flow in the nearby watercourse, however no actual impact has been recorded.
A fish farm on the St Keyne Stream (see 4.6.2) has an historic "Licence of Entitlement" and the abstraction can and does dry up a short stretch during periods of low flows. The NRA can only negotiate or buy out the licence to effect a change. The former has been suggested to the

WATER QUANTITY TARGETS & CURRENT STATE

owner unsuccessfully. In a regional context it was categorised as 'minor', and within the context of national policy and available manpower and financial resources the matter has been unable to be progressed to date.

Issue 17: Environmental impact of a fish farm abstraction on the St Keyne Stream.

Flooding of people and property.

Flooding is a problem at a number of locations within the catchment (see Section 4.8). In some cases this has been due to development higher in the catchment altering surface water run off characteristics and an inability of the channel to cope with higher flows, in others due to inappropriate development within the floodplain or (natural) movement of the channel. The NRA are progressing flood defence schemes for Polperro and Fowey.

Responsibility for other areas currently flooding rests with the LPAs who are the drainage authority, and it is they who should be advancing further actions.

Issue 18: Existing flooding in a number of locations.

NRA maintained flood defence structures at Lostwithiel have not been assessed within the Flood Defence Management Framework. There is a commitment to do so by the end of 1999.

Development Control

Proposed developments, particularly the major new extension to the East of Liskeard flowing to the River Seaton are a cause of concern. They will alter flow characteristics, exacerbate existing flooding (as at Hessenford - see section 4.8) and possibly create new flooding problems. The NRA is working closely with Caradon District Council prior to the second phase of building to ensure acceptable flow levels are achieved, and/or downstream structures are altered to cope with changed flows.

Issue 19: Threat of increased downstream flooding.

Flood Warning in the catchment.

Details of current flood warning systems are given in section 4.8. The setting of targets for the issuing of Flood Warnings is currently under consideration. A project to establish Emergency Response Levels of Service for main rivers in the Region is being undertaken.

Results of the Emergency Response Levels of Service project will enable target times for flood warnings for flood prone locations to be established.

Considerations for future demand.

The significance of the catchment to provide water, particularly for potable supply has already been indicated. Due to the strategic nature of water provision, and the importance of the catchment within this, it is essential to look at the water supply targets for the region.

In 1992 demand predictions for domestic water use looked as if they would rise by about 1% per year over the next 30 years ("Water for the South West - 1992 NRA consultation document"⁴³). However, over the last two years there has been a strong indication of a change of attitude from one of "supply must meet demand" to demand management and the possible beneficial demand constraining effect of metering individual properties. This change in attitude is fully supported and will continue to be promoted by the NRA.

WATER QUANTITY TARGETS & CURRENT STATE

The demand predictions for public water supply produced by the NRA for the water resources strategy for England and Wales used a range of predictions from low to high. The "high" prediction assumes a 1% increase each year of the use of water at home but the "low" and "medium" predictions expect increases of little over half that rate.

The NRA will shortly be reworking the demand predictions for this part of Cornwall and present the results in the Water Resources Development Strategy to be published early in 1995.

Existing resources for public water supply in the Colliford Zone (as defined in the Water Resources Consultative Document) have been recently revised (downwards) to 171 MI/d, but average demands would still not exceed the reliable available resources until 2008 or later. As in all other zones there is an anticipated shortfall in the period 2011 and 2021, so there is an identified need to identify new sources to meet demand.

Improvements which could be made are:

- the more efficient use of water resources, both in cutting distribution losses and reducing consumer demand. These will be promoted by the NRA at Regional and National levels;
- Increasing links with the Roadford Zone to make best use of resources;
- If new water resources are required, a pump storage scheme (pumping from a river during higher winter flows) into Colliford is favoured but considerable investigation of this option is needed before any firm programme would be supported.

Presently the building of a further strategic reservoir would be unlikely within the catchment. Monitoring of changing demands and more detailed research into options to meet supply shortfalls is required.

Issue 20: Projected shortfall in Public Water Supply from 2008.

Spray irrigation is the only Private Water supply use that is identified as potentially expanding in the Region. Within the catchment there are not large numbers of agricultural/horticultural units which would immediately be likely to want to irrigate, however any applications would be dealt with regard to NRA policy.

Canoeing takes place on the River Fowey. The season is time limited not by volumes of water but by agreement with fishing interests however there is a self-imposed restriction on canoeing at Respryn when water levels are below 2'6". Under such levels canoes can scrape against gravels and possibly impact the fishery, which the canoe users wish to avoid. The NRA will offer advice based on research when it becomes available to reduce conflict and further multiple use of the same water.

Issue 21: To help promote the responsible use of the River Fowey by canoeists.

PHYSICAL FEATURES TARGETS & CURRENT STATE

5.3 PHYSICAL FEATURES TARGETS AND CURRENT STATE

General

This section considers the requirements for physical features of rivers, estuaries and the coast in relation to conservation (landscape, wildlife and archaeology), fisheries, recreation and flood defence within the catchment.

The targets will reflect the combined requirements of all legitimate uses at a location where this is practicable. There will be situations where there may be conflict and an element of compromise is required.

Local perspective

The Seaton, Looe and Fowey is a catchment of great natural beauty and ecological value, with high quality riverine and coastal environments supporting a variety of uses as highlighted in the previous section. The NRA will seek to preserve, and enhance where possible, these qualities through its own statutory powers and in collaboration and liaison with other bodies concerned with the management of the area.

Specific Targets

River channel

Targets

- Maintain or re-establish natural channel morphology within watercourses.
- Maintain appropriate levels of in stream vegetation to provide adequate cover for fish and habitats for other wildlife associated with the river.
- Maintain and improve salmonid spawning areas.
- Artificial barriers must not obstruct the passage of migratory fish. Provision must be made for the free passage of migratory fish in any new structure and existing passes must be maintained. Any new structures in or adjacent to the water course should be sympathetic to the surrounding landscape.
- Natural or artificial barriers should not lead to excessive exploitation of fish.

Current State

Rivers and watercourses within the catchment are generally in natural channels, for although some historical re-direction has occurred, (ie. through tin streaming), they have not been subject to hard engineering.

There was a loss of natural channel on the St Neot River (including salmonid spawning areas) when Colliford Lake was constructed. Mitigation work in the form of a breeding and release programme is ongoing.

Croys (artificial structures used to narrow river channels and create an upstream pool) have been placed in the mid Fowey to improve fishing. Whilst this increases the likelihood of catching fish on a given stretch, there may be no loss to the fishery. There is concern however about the appropriateness of man-made structures in the landscape and improper design leading to upstream and downstream bank erosion requiring further engineering. With any new applications the NRA will be seeking design criteria which answer both potential problems.

Issue 22: Construction of inappropriate structures within the river channel.

PHYSICAL FEATURES TARGETS & CURRENT STATE

In addition to built structures within the channel there are naturally occurring trash dams and blockages caused by debris and trees falling in from the banks. The NRA seeks to remove significant blockages which may pose a flooding threat (to persons or property) or impede passage of migratory fish, and may seek to undertake trimming of the bankside trees on an irregular basis. Overhanging trees and smaller blockages are a natural part of the river system providing substrate, food and shelter for in-stream ecology and scouring out pools and possibly rejuvenating gravels. The importance of these effects is recognised by NRA, who follow an internal code of "best practice" on where and how to intervene for trash dams.

Issue 23: Removal of trash dams and trimming of overhanging trees.

Siltation of the natural gravels is occurring in the Upper Fowey, possibly due to increased agricultural run-off from land drainage and disturbed ground from the construction of the A30 trunk road. Initial siltation allows the establishment of Hemlock Water Dropwort which in turn slows the river flows and increases siltation in an ever-increasing spiral.

Fisheries gravel rehabilitation work by the NRA and fishing clubs to remove both silt and Hemlock Water Dropwort has re-established the gravels for spawning, increased the quality of the invertebrate community and reduced lateral erosion of banks, retaining the natural channel shape and relieving flooding problems. The NRA's biological survey in 1994 indicated the highest biological index scores ever and an increasing number of adult kingfishers and dippers have been seen in these reaches.

If the road construction was the main cause of the siltation it is expected that the problem will decline. If it does not land drainage is considered the principal cause and would require addressing to prevent the need for ongoing maintenance work.

Issue 24: Optimising the size of the natural Salmonid fishery to fulfil its environmental capacity.

It is noted that Hemlock Water Dropwort is establishing in the lower Fowey below Restormel water intake and below Colliford dam. This could be due to a number of factors, mild winters, sediment and nutrient input or lower flows. Whilst there are not significant spawning gravels within the stretch other ecological interests could be impacted, though at present our understanding does not allow for a comprehensive appraisal.

Issue 25: Establishment of Hemlock Water Dropwort.

There is considered to be concretion of the bed of the Connon Stream upstream of the confluence at Herodsfoot. Invertebrate surveys however indicate an improvement, though this could be principally due to improving water quality. No migratory salmonids are currently using the stretch although there is a resident brown trout population. NRA investigations into the water quality of the Connon Stream are identified in **Issue 9**.

Sand removal during dredging of the Fowey Estuary by the Harbour Commissioners during 1994 is considered by the sand-eel netmen to have had an impact on their yield, however there is continual recruitment of sand from the freshwater system replenishing the sand bar.

In stream vegetation is as would be expected throughout the catchment with the exception of the increase in Hemlock Water Dropwort, and the paucity of Bryophytes (due to metals) in the upper Seaton.

Except for Colliford Dam, there are no obstacles impassable to migratory fish in the catchment. A mitigation programme to compensate for the physical loss of the upper St Neot River spawning grounds when Colliford reservoir was constructed is carried out by the NRA at Colliford Hatchery.

PHYSICAL FEATURES TARGETS & CURRENT STATE

Riparian Zone

Targets

- Maintain appropriate riparian vegetation to provide adequate cover and habitats for wildlife associated with the river and its corridor.
- To maintain the integrity of the river and riparian zone as an important wildlife corridor the NRA will seek to resist new 'hard' (building and earthworks) development within 7 metres of a watercourse or wetland or inter-tidal area.
- Assess and control the impact of invasive species.
- River maintenance and other works should be carried out in an environmentally acceptable way, and where possible should lead to enhancements.

Current State

There is a need for knowledge of the vegetation and morphology along the riparian zone (as well as river channel and flood plain). Surveys of broad categories of habitat within the catchment have been undertaken through the interpretation of aerial photographs. This can be compared against previous data to monitor rates of habitat change, and the importance of sites in a Regional context.

For the purposes of site specific river work more detailed information is required. The NRA has a limited amount of River Corridor Survey (RCS) information, based on sites where we are involved in maintenance or projects, or which we own. Resources do not allow for extensive RCS throughout the catchment, or to adequately manipulate the data once gathered.

The NRA is developing a new River Habitat Survey (RHS) methodology which assesses a number of physical and biological features on a given river section, which can then be compared to an expected "normal" for that type of river stretch. This could be the intermediate methodology required to link the habitat data and RCS.

Issue 26: Lack of information on the status of riparian habitats throughout the catchment.

The riparian zone throughout much of the catchment is largely undeveloped, however, through changes in land use areas of natural and semi-natural habitat have been reduced or degraded. Principally this has been the loss of ancient semi-natural woodland which has been replanted with conifer plantations, which are generally recognised as having reduced conservation value. Forest Enterprise are effecting phased change on their holdings to plantings alongside watercourses with particular consideration for conservation, recreation and landscape interests. This is in line with the Forest and Water Guidelines⁹, (see Section 4.3).

Issue 27: The restoration of native deciduous woodland and associated vegetation along the riparian zone in areas planted under coniferous forestry.

No new major developments within 7m of the watercourse, wetland or inter-tidal area are known about within the catchment. Proposed re-development of existing industrial premises in Lostwithiel, adjacent to the River Fowey may offer an opportunity for enhancement.

Japanese Knotweed and Himalayan Balsam, Rhododendron and Laurel are present throughout the catchment, though their full extent is not known. Impacts on native species can be locally significant and work needs to be done to monitor both spread and impact. Any attempts to address the issue will require involvement of landowners.

Issue 28: Assess the extent and impact of invasive species.

Bank erosion by livestock has not been identified as a specific problem, although it may be contributing to the siltation of spawning gravels and the spread of Hemlock Water Dropwort (see **Issues 24 and 25**). Suspended solids have not been identified as a problem by SWWSL for surface water abstractions, however the Fowey Harbourmaster would like to see reduced loads so he could

PHYSICAL FEATURES TARGETS & CURRENT STATE

reduce the frequency of channel dredging. There is no known figure for a normal annual sediment budget.

The NRA may seek to undertake a tree trimming programme on the Fowey main River section between 1997 and 1998 as ongoing management for flood defence purposes. Conflict with conservation and fisheries interests may arise. To overcome conflict the NRA will visit sections to ensure no undue disturbance occurs (particularly to protected species such as Otter) and best practice guidelines will be followed. (see also **Issue 23**)

The maintenance of flood defences is due to be assessed as part of the NRA's market testing scheme. As part of this, conservation requirements and opportunities for enhancements are also assessed and written into the contract specification, known as Service Level Agreements.

Flood plain

Targets

- Flood plains should be retained to fulfill their natural function of flood storage and must not have their capacity reduced.
- Land drainage for agriculture and forestry should not adversely affect the conservation value of rivers and associated habitats, or increase the risk of flooding.
- The NRA will seek to prevent bank erosion by cattle and other livestock and encourage farmers to provide specific livestock watering points.
- Maintain and enhance the wetland component of the floodplain.

Current State

With the exception of Bodmin Moor, the Upper Fowey Valley and Warleggan, wetlands are not particularly significant in the catchment largely because of the free-draining nature of the valley soils in the catchment. Opportunities to increase the area of wetland within the catchment is limited although further work could be done to explore the possibilities. Wetland areas generally occur at the top of watercourses, where there are springs and bogs and these are usually small in area. There is a need therefore to protect existing wetlands.

Issue 29: Protection of existing wetlands.

Wetlands, including bogs and mires, in the Upper Fowey Valley and on Bodmin Moor have been extensively drained and/or agriculturally improved. Additionally on Bodmin Moor agricultural management techniques and recreational pressure have resulted in degraded semi-natural habitats. Impacts on Bodmin Moor have been reviewed in the Countryside Commission's Landscape of Bodmin Moor Study⁴⁴ and English Nature's Natural Area Project⁴⁵. The latter makes specific recommendations to maintain and enhance wetlands, streams, rivers and open water and increase otter populations as joint actions by EN and NRA. On the whole the proposed actions are standard NRA practices, however, where site-specific needs are indicated the NRA would look to become involved.

Issue 30: The maintenance and restoration of aquatic semi-natural habitats and associated species.

Much of the East Looe is constrained on one side by the railway line which is undoubtedly preventing the river from moving across the floodplain. Being higher than the natural top of the channel, it is also restricting flooding on one side and reducing the area of flooded pasture. No threat to property results, however, erosion of the railway line is occurring. It may also be exacerbating the flooding off the railway line identified in section 4.8. As part of the communication network and as a tourism feature the railway line is seen as a permanent feature.

PHYSICAL FEATURES TARGETS & CURRENT STATE

There has been built development within the flood plain in a number of locations where the development has been inappropriate and where flooding is now experienced. Responsibility for protection rests with individuals and District Councils, however, the NRA will be required to assess any proposed schemes. Erosion of the road in the Draynes Valley has occurred. Some emergency repairs have been made but major repairs will be required.

In some locations features such as bridges are unable to cope with new higher flows generated through surface run off from new development, such as at Hessenford (see Issue 19).

Degradation of the flood plain has occurred in the lower Seaton Valley. Proposals for re-development including environmental gain and the restoration of the floodplain to its natural function have been made by Caradon District Council. The NRA has participated in the process, supports the general aims and would seek to become further involved with more detailed proposals.

Issue 31: The re-development of the lower Seaton Valley and restoration of the flood plain and habitats.

Wider catchment

Target

- Influence the management of the wider landscape to maintain and enhance the water environment.

Current State

Replacement of semi-natural deciduous forest with large blocks of single stand conifers is seen to have reduced the conservation and landscape value within the catchment. Areas of conifers are due to be felled, and re-planting provides an opportunity to introduce a mixture of species and vary the ages of the stands. National R&D shows that mixed age structure reduces the environmental impacts of forestry. The latter option will however incur a cost if blocks are cut before or after their financially optimum time. The NRA looks to input into forestry plans when the Forestry Authority and planning Authorities are granting planting licences.

Issue 32: The re-establishment of "mixed stand" forestry.

As discussed in Section 4.4 only a small part of the catchment falls within an identified Critical Load area. The headwaters of the catchment outside this area are acidic and the NRA would have concerns about any new large plantings in these areas exacerbating the problem.

Issue 33: The threat of increased acidification through new forestry plantings.

Generally, the mixed agricultural practices within the catchment are not identified as having a particular impact on the water environment. Agriculture is however a continuous threat to the water environment where there is inadequate infrastructure or management. Section 5.1 indicates there may be a small number of agricultural units which are impacting the water environment.

With a high number of animal units in the catchment the threat of slurry related incidents is high and continued vigilance is required.

Development has occurred outside of the floodplain which impacts on the water environment through increased flows (see Section 5.2). The potential threat of further development at Liskeard has been highlighted and the NRA is liaising with Caradon District Council. Road developments such as the new A30 and the proposed Bodmin to Liskeard road can pose threats.

Issue 34: Potential environmental impact from the new Bodmin to Liskeard road.

PHYSICAL FEATURES TARGETS & CURRENT STATE

Wildlife

Targets

- Monitor populations of key species within the catchment to assess their status.
- Maintain existing habitats and species by protection and appropriate management.
- Promote appropriate management of the river corridor to optimise biodiversity and achieve maximum carrying capacity for certain key species.

Current State

There is limited public access along much of the watercourses so wildlife in the river corridor is not usually disturbed.

Whilst it is not presently possible to fix definite targets, monitoring is carried out by the NRA that gives an indication of the abundance of fish species and other aquatic life present in a watercourse. This can be compared against expected populations and estimations of environmental carrying capacity. Indicator species such as otter and kingfisher can be monitored to give an indication of the health of a catchment.

The presence of locally and nationally important species within the catchment are an indication of its quality and diversity. Records indicate that populations of some species are holding ground and, indeed, in some cases, such as the otter, are increasing.

Other indicator species such as dipper and kingfisher seem to exhibit healthy populations, however information is not comprehensive and cannot be related to specific numeric targets for populations. The NRA carry out various forms of survey, though only fisheries and invertebrate data is of a detailed nature. There is an identified need for more detailed wildlife information to tie in with other studies (see **Issues 26 and 30**) and R+D work.

Whilst the natural fishery is considered as being of high quality it is felt that the catchment can support larger numbers of fish. Limiting factors are identified as; insufficient spawning gravels, water quality problems (principally metals) and poaching. The NRA will seek to prevent poaching and other unnatural interference with fish stocks, and rehabilitate poor spawning beds (See **Issue 24**).

It is possible to create new spawning areas using gravel arrestors (large boulders) used to trap gravels moving downstream, or introduce gravel. There can be conflict between this work and the loss of natural channel features. Such development will be judged on a case-by-case basis considering existing channel form, ecology and landscape quality (see **Issue 22**).

It is not presently possible to establish an exact target for the maximum carrying capacity for salmonids, and thus a cut off point for NRA efforts. However ongoing monitoring, principally through a new fish counter will assist in the process. See **Issue 24**.

Cormorants roosting at Siblyback Lake and in both the Fowey and the Looe estuaries are perceived as impacting on juvenile salmonid populations, especially the smolt run through the Draynes Valley. In both estuaries cormorants are considered to be impacting on juvenile bass. However, there is no analytical data to accurately measure the scale of the impact and until such evidence is provided, and serious impact proved, the NRA will not support steps to cull the birds. The NRA fish counter at Restormel will help to accurately assess fish stocks over time.

Issue 35: The perceived impact of cormorants on the fishery.

PHYSICAL FEATURES TARGETS & CURRENT STATE

In 1994 commercial salmon netmen in the Fowey Estuary have experienced predation on salmonid stocks by seals. As this is considered natural predation on a natural source it falls outside the NRA's brief. Applications for licences to cull are made to MAFF, and must be supported by evidence of financial loss.

Issue 36: Seal predation on salmonids in fishing nets in the Fowey Estuary.

Recreation and Access

Targets

- Provide suitable access for maintenance of river/channel and flood defences.
- Survey and monitor all NRA holdings and land under NRA control according to approved methodologies. Develop and review site management plans to encourage appropriate recreational use and maximize the nature conservation benefit on all existing owned and maintained flood defence schemes.
- Implement a monitoring and recording system for the recreational use of the catchment.
- Liaise with relevant bodies, such as County and District Councils, Project Explore and British Canoe Union, to ensure an integrated approach to all recreational promotions.
- The NRA will, where possible, be active in promoting the amenity and recreational potential and use of land and waters outside of its ownership and management, including collaborative projects such as walking and circular routes, educational and interpretive material, ecology trails, picnic sites, panoramic viewpoints and visitor facilities.

Current State

Access to the river channel and flood defences for regular maintenance by the NRA is considered adequate. Any access required for "one off" actions (such as tree trimming) will be internally assessed for impact on conservation, recreation and landscape interests.

As well as being part of the general ecology of the catchment, the fishery is also identified as a major commercial/recreational use. Access for fishing is generally good through the catchment and low level management is carried out by fishing clubs and riparian owners.

NRA control over access by others is limited unless the land is NRA owned or a Land Drainage consent is required.

Colliford Hatchery is the only NRA land holding within the catchment. A management plan has not as yet been undertaken for the site.

The NRA has undertaken limited work on a recreational database, largely of the freshwater section, to identify sites where various water related activities take place. Further work is planned to attempt to quantify levels of use. The results will be used by the NRA in liaison with other recreational providers to help assess opportunity and need (see next issue).

General access for passive recreational activities (such as for walking) is limited throughout the catchment, and at Respryn and Golitha Falls high levels of usage are having a detrimental impact on the environment. Management at these sites is ongoing, but the development of alternative sites would alleviate the problem and options should be explored. Development must take into account wildlife interests. Any development of public access would obviously require willingness from landowners. The process may be assisted by enhanced payments to grants such as the Woodland or Countryside Stewardship schemes.

Issue 37: To develop alternative sites/routes for passive recreational access.

PHYSICAL FEATURES TARGETS & CURRENT STATE

Canoeing takes place over a stretch of the Fowey under an access agreement with BCU. The first season has been completed and is considered successful with no impacts on fishing interests. The BCU would like to extend the agreed period to enable greater numbers to enjoy the facility and to stop 'cowboy runs' outside the agreed times.

To increase awareness of the scheme the BCU would like to place signs outlining the details of the agreement at main entry points. They would also like to develop proper access steps at the "halfway" entry point to prevent erosion and establish a new access point at Respryn. The Parish Council are worried about the increased use of the site. See Issue 21

Access to Bodmin Moor is described in the Countryside Commission Access Study^{10,44}, describing current use, impacts and conflicts. General recommendations are made on the rationalising of car parking and improvement of rights of way. There are no site-specific measures involving the NRA. Both Countryside Commission reports were driven by the Bodmin Moor Commoners Bill, the full implications of which will not be felt until it is introduced. The NRA will seek to continue promotion of site-specific improvements to the water environment through schemes such as the Countryside Commission's Countryside Stewardship and Forestry Commission planting grants.

Access to the estuaries is either private access or controlled by the Harbourmaster. There are no known problems in either estuary.

Archaeology

Target

- The NRA will seek to preserve features of archaeological interest in the catchment.

Current state

The NRA holds a database of Archaeological features within the catchment which provides a basis for monitoring proposals. As levels of expertise within the NRA are limited specialist advice is sought from Cornwall Archaeological Unit and English Heritage. This consultation will continue.

Coastal Area

Targets

- Seek to prevent development which interferes with natural coastal processes.
- Seek to conserve and enhance the coastal strip, intertidal and sub-tidal areas.
- Prevent development which impacts on coastal ecology.

Current State

Apart from development within and at the mouths of the Fowey and Looe Estuaries, sea defences on the coast are limited and the current form is due to natural physical processes.

There is a proposal to establish a Voluntary Marine Conservation Area off the coast at Looe, starting from the tidal limits in the estuary out to The Limmicks in the east to Hore Stone in the west following the 10m (underwater) contour. The aim is to promote and protect what is considered a high quality, multi-use environment. The work is being led by a Project Officer based with Project Explore at Looe who is currently engaged in canvassing interested parties. The result will be a discussion document, due to be published in October 1994, exploring the desire for, and feasibility of, establishing a VMCA.

PHYSICAL FEATURES CURRENT STATE

Water quality within the estuary is an issue common to both this management plan and the VMCA. The NRA have contributed data and will continue to participate in the process.

Issue 38: The promotion of a Voluntary Marine Conservation Area off Looe.

There is currently a business proposal being explored to construct a 7 mile long artificial reef from Rame Head west to Downderry, constructed out of worn-out tyres and china clay waste. It is suggested that the reef will provide new habitat for marine life, increase the fishery and provide a recreational facility. The project has raised general concerns that the opposite effects, pollution and habitat degradation, will occur. Details of the scheme are not sufficiently developed to enable proper informed comment and a significant environmental assessment and trials of the construction material are required. As this is not yet a firm proposal it is not dealt with as an issue.

6.0 ISSUES

6.0 ISSUES

N O.	Issue	Options	Advantages	Disadvantages	Responsibility
1.	Exceedences of the Imperative Standard for Total Zinc Causing EC Freshwater Fish Directive Failure.	1 Continue Monitoring to Confirm If Derogation If Caused by Natural Geology. 2 If Confirmed the NRA Will Seek A Derogation for Zinc	No Unnecessary Expenditure Compliance with Directive	None Known	NRA
2.	Occasional High Concentrations of HCH Attributable to Looe STW.	1 Review Consents At Looe STW. 2 Improvements to Looe STW - Identified Under AMP2 3 Continue Monitoring	Compliance with Directive Improved Water Environment Ensure Continued Compliance	None Cost	NRA SWWSL NRA
3.	Elevated Lead Levels in the Menheniot Stream and the River Seaton	1 Investigation to Identify Sources 2 If confirmed to Be Natural in Origin the NRA Will Seek A Derogation for Lead	No Unnecessary Expenditure	Resorces	NRA
4.	Exceedence of EC Surface Water Abstraction Standards for Phenols, Dissolved and Emulsified Hydrocarbons, Coloration and Iron.	1 Validate Results on Further Samples to Establish Problem 2 If Analytical Improve the Methods Used to Determine Concentrations of Phenols and Dissolved and Emulsified Hydrocarbons 3 If Not Investigate Source	Quantify Problem No Unnecessary Expenditure No Directive Failures Meet Directive Standards	None Known None Known Resources	NRA NRA NRA

N o.	Issue	Options	Advantages	Disadvantages	Responsibility
5.	Exceedence of EC Bathing Water Quality Standards.				
	Downderry Beach	1 New STW Planned At Seaton	All Options;	None - in Progress.	SWWSL
	Seaton Beach	2 Investigate Bacterial Loadings in Downderry Stream	Compliance with EC Directive	Resources	NRA
	Millandreath Beach	1 New STW Planned At Seaton	Environmental Improvements	Cost Resources	SWWSL
		2 Investigate Bacterial Loadings in River Seaton Below Hessenford		Resources	NRA
	East Looe Beach	1 Investigate Bacterial Loadings in Millandreath Stream			NRA
		2 Review Consent of Millandreath Holiday Village			NRA
	Readymoney Cove	1 Improvements to Sewerage System		Cost	SWWSL
		2 Improvements to STW At Looe		Cost	SWWSL
		3 Investigate bacterial loadings in East Looe		Resources	NRA
		1 New STW being built at Fowey		Ongoing	SWWSL

N o.	Issue	Options	Advantages	Disadvantages	Responsibility
6.	Fowey Estuary Has Been Identified by the NRA for Further Studies in 1995 and 1996 to Establish the Extent of Eutrophication.	<p>1 Investigation to Establish Extent of Eutrophication</p> <p>2 If Identified As Suitable Designate As Sensitive Area Or Polluted Area Under UWWTD or EC Nitrates Directive</p>	<p>Establish Whether Problem Or Not Prior to Further Resource Allocations</p> <p>Ability to Require Expenditure for Further Environmental Improvements</p>	<p>Resources</p> <p>Potential Cost</p>	<p>NRA</p> <p>NRA/ Dischargers</p>
7.	Following National Compilation of Data, If the Fowey Appears on the National Priority List, Investigations May Be Required to Determine the Source of These Substances and Whether Reductions Could Be Made.	<p>1 Identification of Importance in A National Context</p> <p>2 Identify Major Sources of Inputs</p> <p>3 Propose Actions to Reduce Inputs</p>	<p>UK Compliance with Commitment.</p> <p>Environmental Benefits</p>	Resources//Cost	<p>NRA</p> <p>NRA</p> <p>NRA</p>
8.	Elevated Copper, Zinc and ph Levels in the Upper Stretches Of the River Seaton And Elevated Copper Levels on the Tremar Stream Causing WQO Failure.	1 "Set Aside" Data As Sources Due To Natural Background Levels	The NRA Can Require Higher Standards for Other Parameters	None Known	NRA

N o.	Issue	Options	Advantages	Disadvantages	Responsibility
9.	Elevated Ammonia Levels on the Connon Stream Causing WQO Failure.	1 Improvements to Connon Bridge Landfill Site 2 Investigate Other Sources Upstream Of Landfill Site	Both Options: Meet Target Class Environmental Improvements	Cost Resources	Cornwall Environmental Services NRA
10	Low Ph Values in the Upper Reaches of the River Fowey , St Neot River and Northwood Brook Causing WQO Failure.	1 "Set Aside" Data As Sources Due to Natural Background Levels	The NRA Can Require Higher Standards for Other Parameters	None Known	NRA
11	Organic Enrichment in the Bedellva Stream.	1 Investigation to Identify Sources Of Input	Propose Action to Achieve Environmental Improvements and Move Toward Longer Term WQO Objective.	Resources	NRA
12	Higher Than Expected Levels of Arsenic in Mussels and Seaweed At One Site in the Fowey Estuary.	1 Initial Investigation to Establish Type and Source of Arsenic	Quantify Importance and Opportunities to Address The Issue	Resources	NRA
13	Failure of STW's to Meet Discharge Consent Conditions.	1 Enforce Consents 2 Improve Works Performance	Prevent Environmental Impact Meet Consent Conditions	Cost	NRA SWWSL

N o.	Issue	Options	Advantages	Disadvantages	Responsibility
14	Untreated Sewage Entering the River Fowey At Lostwithiel.	1 Locate and Rectify Cause	Prevent Threat to Public Health	Cost	Restormel Borough Council
15	Percieved Impacts on the Fishery and Fishing and Recreation Through Reservoir Operation.	1 Detailed Study Required of Operational Procedures of Reservoir & Flow Regime in River 2 Monitoring of Downstream Ecology & Fishery	Establish Actual Impact for Further Work	Cost	NRA/SWWSL NRA
16	Lack of knowledge of Wildlife Flow Requirements	1 Implement R&D When Results Become Available 2 Survey and Monitor Wildlife 3 Liaise with External Bodies Such As English Nature Who Produce Relevant Information	All Options; Sound Basis for Decisions That Will Improve the Health of the Catchment Efficient Use of Resources	Cost and Timescale Cost of Surveys/ Monitoring	NRA/EN/CWT
17	Environmental Impact of a Fishfarm Abstraction on the St Keyne Stream	1 Negotiate Agreement with Owner 2 Buy Out Part of the Licence	Environmental Improvement Environmental Improvement	Potential Cost to Owner Cost	NRA/Owner NRA
18	Existing flooding in a number of locations	1 NRA Schemes At Polperro, Looe And Fowey 2 Private Flood Defence Schemes 3 Drainage Authority Schemes	Effective Flood Defence Effective Flood Defence Effective Flood Defence	All Options; Cost Potential Environmental Impact	NRA LPA/Developers/ Landowners LPA

N o.	Issue	Options	Advantages	Disadvantages	Responsibility
19	Threat of Increased Downstream Flooding.	1 Alteration to Structures Downstream to Cope with New Higher Flows 2 Planning & Management of Development to Prevent Flooding	Prevent Flooding No Additional Flooding Problems Reduce Potential Environmental Impact	Cost Potential Environmental Impact	District Councils/ Developer NRA District Councils/NRA
20	Projected Shortfall in Public Water Supply From 2008.	1 More Efficient Water Use; A, Reduce Demand B, Reduce Losses C, Link Source Zones 2 Monitor Demand 3 Plan for New Resources - Pump Scheme	Delay the Need for Major New Schemes Effective Management of Resource Prevent Need for Major New Reservoir	Cost Cost Cost	A, NRA/ SWWSL B, SWWSL C, SWWSL NRA SWWSL/NRA

N o.	Issue	Options	Advantages	Disadvantages	Responsibility
21	<p>Promote and Enhance Responsible Canoeing on the River Fowey Flow Levels Occasionally Impacting Canoeing.</p> <p>Promote Canoe Access Agreements.</p> <p>Reduce Physical Impact</p>	<p>1 Establish Extent of Problem - Record Impacted Days</p> <p>1 Develop Canoe Access Agreements</p> <p>2 Provision of Information Boards On Riverside to Publicise Agreement</p> <p>1 Improved Access/Exit Points</p>	<p>Quantify Impact Prior to Allocation Resources</p> <p>All Options; Control Access Through Responsible Organisations</p>	<p>Resources</p> <p>None Known</p> <p>Cost</p> <p>Cost</p>	<p>BCU/NRA</p> <p>BCU/Riparian Owners/NRA</p> <p>BCU/NRA</p>
22	<p>Construction of Inappropriate Structures Within the River Channel.</p>	<p>1 All New Land Drainage Applications Will Have to Pass NRA Design Criteria</p>	<p>Minimise the Environmental Impact of Structures</p>	<p>Monitoring of Construction</p>	<p>NRA</p>
23	<p>Removal of Trash Dams and Trimming of Overhanging Trees.</p>	<p>1 Clearance Work Carried Out to NRA Best Practice</p>	<p>Removal of Flooding Threat</p> <p>Retain Full Conservation Value of Riparian Strip</p>	<p>Cost</p>	<p>NRA</p>

N o.	Issue	Options	Advantages	Disadvantages	Responsibility
24	Optimising the Size of the Salmonid Fishery to Fulfil its Environmental Capacity	1 Monitoring Fish Populations by Use Of Fishcounter/ Surveys and Catch Returns	Establish Success of Work and Benefit of Expenditure	Resources	NRA
	Siltation of Natural Gravel Beds.	1 Short Term Rehabilitation of Gravels;removal of Silt and Weed	Improved Water Environment/Fishery	Cost	NRA/Fishing Clubs
		2 Long Term Assess Causes and Extent of Problem	All: Improved Water Environment/Fishery No Maintenance Costs	Cost	NRA/CC/MAFF/EN
		2a Reduce Sediment Loads in Watercourses		Maybe Less Economical Land Use Limits Water Bank for Other Users	Landowners SWWSL/NRA
		2b Water Releases to Cleanse River			
	Concretion of the Bed of the Connon Stream.	1 Assess Causes and Extent of Problem	Quantify Problem and Benefits	Resources	NRA
	Illegal Exploitation of Fish (Salmonids and Bass)	1 Enforcement	Protects Stocks	Resources	NRA

N o.	Issue	Options	Advantages	Disadvantages	Responsibility
25	Establishment of Hemlock Water Dropwort.	1 Assess Causes and Extent of Establishment and Impact 2 Removal of Weed and Silt 3 Change Land Uses and Flow Regimes To Minimise Conditions That Exacerbate Spread of Weed (Reduce Loadings and Increase Flow)	Ensure Wise Use of Resources Improved Water Environment Improved Water Environment Minimise Amount of Annual Clearance/Maintenance and Disturbance to River	Cost Cost Cost Less Efficient Use of Water Resources and May Be An Uneconomic Use of Land	NRA NRA/Fishing Clubs NRA/ Landowners/ SWWSL
28	Lack of Information on the Status of Riparian Habitats Throughout the Catchment.	1 Implement R&D to Set Targets 2 Implement River Habitat Survey Methodology Once Agreed 3 Liaison with Relevant External Bodies, EN, CWT etc.	All Options; The Ability to Improve on Best Practises Better Allocation of Resources	Cost	NRA/EN NRA NRA/EN/CC/ CWT + Others
27	The Restoration of Native Deciduous Woodland and Associated Vegetation Along the Riparian Zone in Areas Planted Under Coniferous Forestry.	1 Planting Grants to Encourage Deciduous Planting 2 Guidance When Felling and Planting Licences Are Applied for	Financial Help to Restore Habitats Improve Habitats for Wildlife	Cost to and Willingness of Landowners None Known	Forestry Authority/ Landowners/ NRA/ CC/ Forestry Enterprise

N o.	Issue	Options	Advantages	Disadvantages	Responsibility
28	Assess the Extent and Impact of Invasive Species.	<p>1 Assess Extent and Impact on NRA Owned Land and Draw Up Appropriate Programmes for Treatment Based on NRA Policy and R&D</p> <p>2 Assess Extent and Impact Throughout the Catchment and Encourage Riparian Owners to Take Appropriate Action</p>	All Options; Prevent Impact on Native Species	<p>Cost</p> <p>Cost Willingness of Landowners</p>	<p>NRA</p> <p>NRA Conservation Bodies and Landowners</p>
29	Protection of Existing Wetlands.	<p>1 Use of Schemes Such As Countryside Stewardship Schemes to Encourage Landowners to Preserve Habitats</p> <p>2 Protection Through the Planning Process</p> <p>3 Advice From NRA and Other Bodies To Be Given to Landowners</p>	<p>Financial Help to Create Habitats</p> <p>Strong Level of Control Where Permission Required</p> <p>Uptake Likely to Be Better If Preservation Undertaken Voluntarily</p>	<p>Need to Inform Landowners of Grants</p> <p>Requires Monitoring</p> <p>Resources</p>	<p>NRA/CC/EN Landowners</p> <p>NRA/Planning Authorities</p> <p>NRA/EN/CC/ CWT</p>

N o.	Issue	Options	Advantages	Disadvantages	Responsibility
30	The Maintenance and Restoration of Aquatic Semi-Natural Habitats and Associated Species.	1 Planting Grants to Encourage Landowners to Create Habitats 2 Advice From NRA and Other Bodies On Maintenance and Restoration Work to Be Carried Out	Financial Help to Create Habitats Uptake Likely to Be Better If Preservation Undertaken Voluntarily	Need to Inform Landowners of Grants Resources	NRA/CC/Forestry Authority/EN MAFF NRA/CC/Forestry Authority/EN
31	The Re-Development of the Lower Seaton Valley and Restoration of the Flood Plain and Habitats.	1 Follow Caradon District Council Planning Brief	Control on Type and Size of Development to Minimise Impact on Water Environment Restoration of Flood Plain	Potential Loss of Revenue	Caradon DC/ Developer
32	The Re-Establishment of "Mixed Stand" Forestry.	1 Promotion of Mixed Species Plantings 2 Promotion of Mixed Age Blocks	Both Options; Improved Conservation and Landscape Value	Both Options; Potential Economic Loss	Forestry Authority/ LPA's/ CC/NRA
33	The Threat of Increased Acidification Through New Forestry Plantings.	1 Assess All Proposals For Plantings in Headwater Areas	Prevent Increased Acidification	Resources	Forestry Authority/ /NRA
34	Potential Environmental Impact From the New Bodmin to Liskeard Road.	1 Undertake An Environmental Impact Assessment of Route Options 2 Monitor Construction	Minimise Impact Minimise Impact	Cost Resources	DOT/NRA NRA

N o.	Issue	Options	Advantages	Disadvantages	Responsibility
35	The Perceived Impact of Cormorants on the Fishery.	1 Data to Be Collected to Analyse Scale of Impact	Fulfill NRA Policy	Cost Disagreement Between Users	NRA/Riparian Owners/Fishing Clubs
36	Seal Predation on Salmonids in Fishing Nets in the Fowey Estuary.	1 Need to Establish Scale of Financial Loss	Quantifiable Base for Action		Netsmen
37	To Develop Alternative Sites/Routes for Passive Recreational Access.	1 Liaison with Other Providers 2 Use of Access Payments in Grants Such As Countryside Stewardship and Farm Woodland Grant 3 Promote Permissive Paths 4 Complete NRA Recreational Survey	Optimise Resources and Avoid Duplication of Effort Financial Inducement to Help Landowners to Open and Manage Their Resource Highlight Areas Needing Management Or Opportunities to Increase Use	Potential Conflict with Established Users and Conservation Interests Resources	Project Explore NRA/LPAs/Public Bodies/CC Landowners NRA
38	The Promotion of A Voluntary Marine Conservation Area Off Looe.	1 Assessment of Resource 2 Assess Need and Willingness for VMCA Status	All Options; Preservation of the Resource and Reductions in Conflict	Cost Possible Conflict Between Existing Users	Project Explore /Public Bodies/General Public/NRA

APPENDICES

HYDROLOGY

The River Seaton descends very steeply in its first 2km at a rate of 70m/km and then less steeply for the next 4 km at 19m/km. Below this point the river falls gently at a rate of 8m/km for 10km and then just 3m/km for the final 4 km to the sea. The overall gradient from source to tidal limit is 14.8m/km.

The East and West Looe rivers fall fairly steeply from source to tidal limit, at average rates of 13 and 10 m/km respectively.

The River Fowey descends steeply in its first 2km at a rate of 20m/km, and then very gradually in the next 12 km at a rate of 6m/km. The following 3km is very steep at 33m/km with a gentle descent of 4m/km over the last 26km to the tidal limit. The river has an overall gradient of 8m/km. Gradients are shown on the profile diagram (see Section 2.0).

An analysis of the 22 year record for Trebrowbridge gauging station on the River Seaton (SX 299 595) indicates a mean daily flow of 1.014 m³/sec and a measured Q95 flow (the flow which is exceeded for 95% of the time on average) of 0.203m³/sec. The Q95 flow represents 20% of the mean daily flow.

There are no gauging stations on the Looe Rivers and so no recent continuous flow data is available.

Although there are six gauging stations on the River Fowey system, all, apart from Trengoffe on the Warleggan River, measure flows that have been influenced by Colliford and Sibblyback reservoirs or associated abstractions for public water supply. As a consequence they do not represent the 'natural' flow of the river system but modified flows. An analysis of the 31 year flow record at Restormel gauging station (SX 098 625) indicated a mean daily flow of 4.741m³/sec and a measured Q95 flow of 0.757m³/sec, 16% of the mean daily flow.

Maximum mean daily flow values at Trebrowbridge and Restormel are 9.543m³/sec and 97.5 m³/sec respectively. These and the maximum instantaneous flows of 14.126 m³/sec and 126.6 m³/sec were recorded on 27 December 1979.

The minimum mean daily flow, 0.128 m³/sec, was recorded at Trebrowbridge on 26 August 1976. This represents 13% of the mean daily flow. Although flows should fall below the Q95 level for approximately 18 days per year on average, on the River Seaton in the drought years of 1976, 1984, 1989 and 1990 flows were below this level for 63, 86, 86 and 40 days respectively.

Details of flow surveys carried out on the three systems in 1994 are shown in the following tables. These give an indication of the flow distribution during moderate to low flows.

FOWEY DRY WEATHER FLOW SURVEY

SITE NAME	NATIONAL GRID REFERENCE	DATE	FLOW M ³ S ⁻¹	DATE	FLOW M ³ S ⁻¹	DATE	FLOW M ³ S ⁻¹
PALMERS BRIDGE	SX 191 776	25.06.76	0.068	04/08/90	0.123	07/06/94	0.237
HARROWBRIDGE	SX 206 744	25.06.76	0.118	04/08/90	0.194	07/06/94	0.345
HIGHER LANGDON	SX 214 733			04/08/90	0.026	07/06/94	0.403
SIBLYBACK	SX 230 703			04/08/90	0.079	07/06/94	0.167
TREKEIVESTEPS	SX 226 697			04/08/90	0.246	07/06/94	0.668
DRAYNES BRIDGE TRIB	SX 228 690	25.06.76	0.034	04/08/90	0.020	07/06/94	0.049
TRENANT TRIB	SX 209 682	25.06.76	0.058	04/08/90	0.069	07/06/94	0.170
TREVERBYN MILL BRIDGE	SX 206 675	25.06.76	0.234	04/08/90	0.346	07/06/94	0.999
ASHFORD BRIDGE	SX 203 662			04/08/90	0.377	07/06/94	0.995
DOUBLEBOIS BRIDGE	SX 189 651			04/08/90	0.341	07/06/94	0.991
CLAPPER BRIDGE	SX 181 706			04/08/90	0.681	07/06/94	0.634
ST NEOT BRIDGE	SX 184 678			04/08/90	0.770	07/06/94	0.665
CRAIGSHILLWOOD	SX 184 660			04/08/90	0.810	07/06/94	0.707
TWOWATERSFOOT	SX 185 650			04/08/90	0.772	07/06/94	0.742
PANTERSBRIDGE L/B STREAM	SX 158 682					07/06/94	0.143
PANTERSBRIDGE R/B STREAM	SX 158 682					07/06/94	0.285
TRENGOFFE	SX 159 674			04/08/90	0.244	07/06/94	0.448
HOLTROADDOWNS BRIDGE	SX 151 653			04/08/90	1.548	07/06/94	2.262
LEBALL WOOD BRIDGE	SX 128 652			04/08/90	1.490	07/06/94	2.385
GLYN MILL - CARDINHAM WATER	SX 110 644	225.06.76	0.078	04/08/90	0.109	07/06/94	0.280
GLYN MILL - FOWEY	SX 111 644	25.06.76	0.707	04/08/90	1.518	07/06/94	2.664
CARDINHAM L/B STREAM	SX 117 682					07/06/94	0.051
CARDINHAM R/B STREAM	SX 117 682					07/06/94	0.075
FLETCHERS BRIDGE	SX 103 659	25.06.76	0.071			07/06/94	0.244
RESPRYN BRIDGE	SX 099 635					07/06/94	2.842
RESPRYN BRIDGE TRIB	SX 102 634					07/06/94	0.022
RESTORMEL	SX 098 624	25.06.76	0.628	04/08/90	0.917	07/06/94	2.101

APPENDIX A

SEATON DRY WEATHER FLOW SURVEY

SITE NAME	NATIONAL GRID REFERENCE	DATE	FLOW $\text{m}^3 \text{s}^{-1}$	DATE	FLOW $\text{m}^3 \text{s}^{-1}$	DATE	FLOW $\text{m}^3 \text{s}^{-1}$
TRENOUTH	SX 2643 6898	02/07/76	0.021	26.04.94	0.097	20.06.94	0.053
TREMAR	SX 2613 6787	02/07/76	0.036	26.04.94	0.152	20.06.94	0.058
ST CLEER	SX 2486 6854			26.04.94	0.014	20.06.94	0.0035
HENDRA BRIDGE	SX 2650 6561	02/07/76	0.113	26.04.94	0.517	20.06.94	0.233
HENDRA BRIDGE LB TRIBUTARY	SX 2659 6593			26.04.94	0.015	20.06.94	0.005
B3254 ROAD BRIDGE	SX 2663 6709			26.04.94	0.359	20.06.94	0.163
LANSEATON LB TRIBUTARY	SX 2655 6634			26.04.94	0.055	20.06.94	0.021
ROSELAND BRIDGE	SX 2754 6316			26.04.94	0.705	20.06.94	0.282
TREVIDDO RB TRIBUTARY	SX 2812 6207			26.04.94	0.022	20.06.94	0.010
TROUTS MILL LB BRIDGE	SX 2842 6204			26.04.94	0.073	20.06.94	0.032
FACTORY	SX 2845 6198	02/07/76	0.165	26.04.94	0.764	20.06.94	0.318
COURTNEY'S MILL BRIDGE LB TRIBUTARY	SX 2894 6167			26.04.94	0.015	20.06.94	0.006
COLDRENICK VIADUCT	SX 2916 6115			26.04.94	0.843	20.06.94	0.331
TREBROWN BRIDGE GS	SX 2995 5946	02/07/76	0.199	26.04.94	0.931	20.06.94	0.389
COLVASE RB TRIBUTARY	SX 2992 5874			26.04.94	0.035	20.06.94	0.016
BAKEWOOD LB TRIBUTARY	SX 3061 5785			26.04.94	0.021	20.06.94	0.007
HESSENFORD UPSTREAM	SX 3064 5767	02/07/76	0.166	26.04.94	1.022	20.06.94	0.433
HESSENFORD RB TRIBUTARY	SX 3052 5741	02/07/76	0.029	26.04.94	0.011	20.06.94	0.003
HESSENFORD DOWNSTREAM	SX 3072 5735			26.04.94	1.199	20.06.94	0.462
CARCOE WOOD LB TRIBUTARY	SX 3020 5622			26.04.94	0.041	20.06.94	0.019
KEVERAL WOOD RB TRIBUTARY	SX 3001 5570			26.04.94	0.103	20.06.94	0.039
SEATON TIDAL LIMIT	SX 3032 5450			26.04.94	1.345	20.06.94	0.578

APPENDIX A

EAST LOOE DRY WEATHER FLOW SURVEY

SITE NAME	NATIONAL GRID REFERENCE	DATE	FLOW m ³ s ⁻¹	DATE	FLOW m ³ s ⁻¹	DATE	FLOW m ³ s ⁻¹
HIGHWOOD LB STREAM	SX 2334 6577			06/05/94	0.082	20/07/94	0.034
HIGHWOOD RB STREAM	SX 2324 6578			06/05/94	0.079	20/07/94	0.028
LOOE MILLS TRIBUTARY	SX 2320 6504			06/05/94	0.022	20/07/94	0.008
LOOE MILLS	SX 2320 6503	30/06/76	0.058	06/05/94	0.208	20/07/94	0.072
LAMELLION MILL	SX 2387 6359	30/06/76	0.127	06/05/94	0.277	20/07/94	0.102
LODGE HILL LB TRIBUTARY	SX 2439 6279			06/05/94	0.036	20/07/94	0.010
LODGE HILL RB TRIBUTARY	SX 2417 6275			06/05/94	0.010	20/07/94	0.003
TRUSSEL BRIDGE	SX 2455 6204	30/06/76	0.134	06/05/94	0.378	20/07/94	0.179
LAMETTON MILL	SX 2509 6110			06/05/94	0.049	20/07/94	0.014
CAUSELAND BRIDGE TRIBUTARY	SX 2478 5906			06/05/94	0.034	20/07/94	0.011
SKANTS TRIBUTARY	SX 2477 5851			06/05/94	0.036	20/07/94	0.017
PLASHFORD TRIBUTARY	SX 2504 5791			06/05/94	0.034	20/07/94	0.015
TREGARLAND BRIDGE	SX 2481 5756	19/09/90 25/10/90	0.268 0.454	06/05/94	0.635	20/07/94	0.274
SANDPLACE	SX 2487 5713	30/06/76	0.160	06/05/94	0.608	20/07/94	0.243

WEST LOOE DRY WEATHER FLOW SURVEY

SITE NAME	NATIONAL GRID REFERENCE	DATE	FLOW m ³ s ⁻¹	DATE	FLOW m ³ s ⁻¹	DATE	FLOW m ³ s ⁻¹
LOWER HILL	SX 2126 6348			10/05/94	0.055	20.07.94	0.023
GRATTON WOOD	SX 2122 6260			10/05/94	0.031	20.07.94	0.015
SCRAWNS BRIDGE	SX 2158 6213	30/06/76	0.029	10/05/94	0.110	20.07.94	0.040
CONNON BRIDGE	SX 1900 6250	30/06/76	0.002	10/05/94	0.014	20.07.94	0.005
HERODSFOOT	SX 2145 6045	30/06/76	0.027	10/05/94	0.131	22.07.94	0.056
HERODSFOOT UPSTREAM OF LB TRIBUTARY	SX 2145 6053			10/05/94	0.126	22.07.94	0.002
HERODSFOOT RB TRIBUTARY	SX 2143 6040	30/06/76	0.019	10/05/94	0.061	20.07.94	0.031
HARTSWELL WOOD TRIBUTARY	SX 2138 6013			10/05/94	0.018	22.07.94	0.015
BURNTWOOD TRIBUTARY	SX 2134 5961			10/05/94	0.006	22.07.94	0.002
CHURCH BRIDGE	SX 2191 5859	30/06/76	0.056	10/05/94	0.228	20.07.94	0.106
COLDRENNICK WOOD TRIBUTARY	SX 2202 5780			10/05/94	0.051	22.07.94	0.025
TREGARRICK MILL	SX 2044 5712	30/06/76	0.011	10/05/94	0.039	20.07.94	0.018
HALL WOOD TRIBUTARY	SX 2279 5581			10/05/94	0.032	20.07.94	0.017
SOWDENS BRIDGE	SX 2306 5555	30/06/76	0.104	10/05/94	0.360	20.07.94	0.172
UPSTREAM OF FORD	SX 2320 5510	19/09/90 25/10/90	0.138 0.449	10/05/94	0.405	22.07.94	0.190

APPENDIX A

APPENDIX B

SSSI DESIGNATIONS

Dozmary Pool - an ancient natural moorland lake occurring at a height unparalleled in the SW. It is oligotrophic, supporting a limited but interesting flora (including nationally rare species) and associated fauna. The Pool has considerable value for wildfowl on passage and winter visitors. To the north and south of the Pool are important areas of mire and wet and dry acid grassland and heath.

Upper Fowey Valley

- waterlogged raw acid peat soils overlying alluvial gravels give rise to a mosaic of wet heath, valley mire, acid grassland and willow carr. These support a high diversity of flora and fauna, including breeding birds and dragonflies and damselflies.

Bodmin Moor - a mosaic of wet heath, dry grassland, bogs and wetland supporting a variety of floral and faunal communities including rare and local plants. The moors are one of the best dragonfly and damselfly sites in Cornwall and are of major importance to nesting and wintering birds.

Boconnoc Park and Woods

- enclosed parkland and woodland of international importance for its rich and diverse lichen flora. Of additional interest are the 9 recorded dragonfly species.

Polperro West Cliffs

- a rich assemblage of higher and lower plants including Red Data Book species and some notable local invertebrates. The cliffs support breeding populations of Shag and Fulmar.

Polyne Quarry, Clicker Tor Quarry and Rosenun Lane are all designated for their geological interest.

DISTRIBUTION OF FISH SPECIES IN THE RIVER FOWEY CATCHMENT 1991

SPECIES									
SITE		TROUT	SALMON	SEA TROUT	BULLHEAD	BROOK LAMPREY	MINNOW	FLOUNDER	EEL
POWEY	LESKERNICK	-	-	-	-	-	-	-	-
	CODDA	+	-	-	C	-	A	-	C
	PALMERSBRIDGE	+	-	-	C	-	C	-	P
	TREZIBBETT	+	+	+	C	-	A	-	C
	LOWER LANGDON	+	+	+	C	-	A	-	C
	DRAYNES BRIDGE	+	+	+	A	-	-	-	P
	TRENGALE WOOD	+	+	+	P	-	-	-	P
	TREVERBYN	+	+	+	C	-	P	-	C
	DOUBLEBOIS	+	+	+	C	C	-	-	C
	HALFWAY	+	+	+	C	P	-	-	C
	NEWBRIDGE	+	+	+	C	-	-	-	C
	GLYNN	-	-	-	-	-	-	-	-
	RESPRYN BRIDGE	+	+	+	C	-	-	-	A
	LAMELGATE	+	+	+	C	-	A	-	P
RESTORMEL	+	+	+	A	-	C	P	A	
TRENANT	HULKER	-	-	-	-	-	-	-	-
	DOWNS FORD	+	-	-	-	-	-	-	-
	NORTH WOOD	-	-	-	-	-	-	-	-
	CARPUAN	+	+	-	-	-	-	-	C
	CHAPEL	+	+	-	-	-	-	-	C
ST NEOT	COLLIFORD FALL	+	+	+	-	-	-	-	C
	ST NEOT	+	+	-	C	-	-	-	C
	MILLHOUSE	+	+	-	C	-	-	-	C
	LAMPEN	+	+	-	C	-	-	-	C
	CARNGLAZE	+	+	-	A	P	-	-	C
	PENGELLY	+	+	+	C	C	-	-	C
	PENGELLY BRIDGE	+	+	-	A	C	-	-	C
WARLEGGAN	TEMPLE	+	+	-	-	-	-	-	C
	U/S MAIDENWELL	+	+	+	-	-	-	-	C
	WOODA BRIDGE	+	+	+	-	-	-	-	C
	CARNE WOOD	+	+	+	-	-	-	-	C
	PARTNERS BRIDGE	+	+	+	-	-	-	-	C
	WARLEGGAN G.S.	+	+	+	-	-	-	-	C
	WEST WOOD	+	+	+	A	-	-	-	P
	WARLEGGAN TRIB.	+	+	-	-	-	-	-	-

SPECIES									
SITE		TROUT	SALMON	SEA TROUT	BULLHEAD	BROOK LAMPREY	MINNOW	FLOUNDER	EEL
CARDINHAM	MILLPOOL BRIDGE	+	+	-	A	-	-	-	P
	PEACH BRIDGE	+	+	-	C	C	-	-	C
	WOODFORD	+	+	-	C	-	-	-	P
	MARGATE FORD	+	+	+	C	-	-	-	C
	FLETCHERS BRIDGE	+	+	+	C	-	-	-	P
	CARDINHAM	+	+	-	C	C	-	-	C
	CHURCH BRIDGE	+	+	-	C	P	-	-	C
	CALLABARRETT	+	+	-	C	-	-	-	P
	LERRY	LERRY	+	+	+	C	P	-	-
COUCHS MILL		+	+	-	C	A	-	-	C
BOCONNOC		+	-	-	A	-	-	-	C

+ PRESENT
 - ABSENT
 P PRESENT
 C COMMON
 A ABUNDANT

DISTRIBUTION OF FISH SPECIES IN THE RIVER SEATON, 1985

SPECIES			
SITES	TROUT	EEL	BULLHEAD
<u>RIVER SEATON</u>			
CROWS NEST	-	-	-
ROSECRADDOC	-	-	-
STONY BRIDGE	+	A	-
ROSELAND	+	A	-
TROUTS MILL	+	A	-
COURTENY MILL	+	A	-
BLACKETON	+	A	A
LYDCOTT	+	A	A
TREMAR	+	A	A

+ PRESENT
- ABSENT

ABUNDANCE INDEX
(NO. OF FISH PER SECTION)

A = 0.50
B = 50-100
C = ≥100

DISTRIBUTION OF FISH SPECIES IN THE EAST AND WEST LOOE RIVERS, 1985

SPECIES					
SITES	TROUT	SALMON	EEL	BULLHEAD	BROOK LAMPREY
<u>WEST LOOE RIVER</u>					
HIGHWOOD	+	-	A	B	A
LOOE MILLS	+	+	A	A	-
MOORSWATER	+	-	A	A	-
COOMBE JUNCTION HALT	+	-	A	A	-
TRUSSEL BRIDGE	+	+	A	B	A
LANDREAST	+	-	A	A	A
LANDLOOE	+	-	B	A	-

SPECIES					
SITES	TROUT	SALMON	EEL	BULLHEAD	BROOK LAMPREY
<u>WEST LOOE RIVER</u>					
MIDDLE QUARRY PARK	+	-	A	C	A
SCAWN MILL	+	+	A	B	A
MILLCOMBE FARM	+	+	A	B	-
CHURCHBRIDGE	+	+	A	B	-
GILLHILL WOOD	+	+	A	B	A
SOWDEN'S BRIDGE	+	+	A	A	A
TRESARREN	+	+	A	A	A
TREGARRICK MILL STREAM	+	+	A	A	A

APPENDIX D

TABLE 1: EC DIRECTIVE ON THE QUALITY OF FRESHWATERS NEEDING PROTECTING OR IMPROVEMENT IN ORDER TO SUPPORT FISH LIFE (78/659/EEC)

DETERMINAND	SALMONID WATERS		CYPRINID WATERS	
	'G'	'I'	'G'	'I'
Dissolved Oxygen as mg/l O ₂ ^{*a}	100% > 7	50% > 9	100% > 5	50% > 7
pH as pH units	-	6.0-9.0	-	6.0-9.0
Suspended Solids at mg/l ^{*b}	25	-	25	-
BOD (Total) as mg/l O ₂	5	-	8	-
Nitrite as mg/l N	0.150	-	0.460	-
Non-ionised Ammonia as mg/l N	0.004	0.021	0.004	0.021
Ammonia (Total) as mg/l N	0.030	0.780	0.160	0.780
Total Residual Chlorine as mg/l HOCl	-	0.005	-	0.005
Zinc (Total) as mg/l Zn	-	-	-	-
Water Hardness 0-50	-	0.03	-	0.30
(mg/l CaCO ₃) 50-100	-	0.20	-	0.70
100-250	-	0.30	-	1.00
>250	-	0.50	-	2.00
Copper (Dissolved) as mg/l Cu	-	-	-	-
Water Hardness 0-50	0.005	-	0.005	-
(mg/l CaCO ₃) 50-100	0.022	-	0.022	-
100-250	0.040	-	0.040	-
>250	0.112	-	0.112	-
^{*a} For dissolved oxygen, 50% median and 100% minimum standard. ^{*b} For suspended solids, the 'G' value is an annual average concentration.				
For application of these standards, reference <u>must</u> be made to Article 6 and the Annexes of the Directive, and the appropriate DoE Implementation Guidelines.				

APPENDIX D

TABLE 2: EC DANGEROUS SUBSTANCES DIRECTIVE ON POLLUTION CAUSED BY CERTAIN SUBSTANCES DISCHARGED IN THE AQUATIC ENVIRONMENT OF THE COMMUNITY, (76/464/EC)

EQSs FOR LIST I SUBSTANCES (INLAND WATERS)

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

APPENDIX D

EQS_s FOR LIST I SUBSTANCES (TIDAL WATERS) Table 2 continued

Parameter	Units	Value	Status (1)
Mercury (2)	µg Hg/l	0.3	AA,D
Cadmium (2)	µg Cd/l	2.5 0.5	AA,D AA,D,B
Hexachlorocyclohexane (HCH) (2)	µg/l	0.02	AA,T
Tetrachloromethane (CTC)	µg/l	12	AA
DDT (para-para DDT isomer) (2)	µg/l	0.01	AA
Total DDT (2)	µg/l	0.025	AA
Pentachlorophenol (PCP) (2)	µg/l	2	AA
'The Drins' (from 1 Jan 1989)	µg/l	0.03 (3)	AA,T
Aldrin (from 1 Jan 1994)	µg/l	0.01	AA
Dieldrin (from 1 Jan 1994)	µg/l	0.01	AA
Endrin (from 1 Jan 1994)	µg/l	0.005	AA
Isodrin (from 1 Jan 1994)	µg/l	0.005	AA
Hexachlorobenzene (HCB) (2)	µg/l	0.03	AA
Hexachlorobutadiene (HCBd) (2)	µg/l	0.1	AA
Chloroform	µg/l	12	AA
1,2-dichloroethane	µg/l	5	AA
Trichloroethylene	µg/l	10	AA
Perchloroethylene	µg/l	10	AA
Trichlorobenzene(TCB)	µg/l	0.4	AA

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

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

- Notes: (1) AA=Annual Average, T=Total, B=Background Monitoring
 (2) A 'standstill' provision exists for concentrations in sediments and/or shellfish and/or fish
 (3) Maximum of 0.005 for Endrin

APPENDIX D

EQSs FOR LIST II SUBSTANCES (INLAND WATERS) (1)Table 2 continued

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

APPENDIX D

EQSs FOR LIST II SUBSTANCES (TIDAL WATERS) Table 2 continued

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

Notes:

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

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

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

B Std denotes standards for the protection of other aquatic life

APPENDIX D

TABLE 3: EC DIRECTIVE CONCERNING THE QUALITY REQUIRED OF SURFACE WATER INTENDED FOR THE ABSTRACTION OF DRINKING WATER IN THE MEMBER STATES (75/440/EEC)

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

Category A1

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

Category A2

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

Category A3

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

I = mandatory

G = guide

O = exceptional climatic or geographical conditions

APPENDIX D
Table 3 Continued

CHARACTERISTICS OF SURFACE WATER INTENDED FOR THE ABSTRACTION OF DRINKING WATER			CATEGORIES					
			A1		A2		A3	
			G	I	G	I	G	I
PARAMETERS								
1	pH		6.5 to 8.5	-	5.5 to 9	-	5.5 to 9	-
2	Coloration (after simple filtration)	mg/l Pt scale	10	20 (0)	50	100 (0)	50	200 (0)
3	Total suspended solids	mg/l SS	25	-	-	-	-	-
4	Temperature	°C	22	25 (0)	22	25 (0)	22	25 (0)
5	Conductivity	µs/cm ¹ at 20°C	1000	-	1000	-	1000	-
6	Odour	(dilution factor at 25°C)	3	-	10	-	20	-
7	Nitrates	mg/l NO ₃	25	50 (0)	-	50 (0)	-	50 (0)
8	Fluorides	mg/l F	0.7 to 1	1.5	0.7 to 1.7	-	0.7 to 1.7	-
9	Total extractable organic chlorine	mg/l Cl	-	-	-	-	-	-
10	Dissolved Iron	mg/l Fe	0.1	0.3	1	2	1	-
11	Manganese	mg/l Mn	0.05	-	0.1	-	1	-
12	Copper	mg/l Cu	0.02	0.05 (0)	0.05	-	1	-
13	Zinc	mg/l Zn	0.5	3	1	5	1	5
14	Boron	mg/l B	1	-	1	-	1	-
15	Beryllium	mg/l Be	-	-	-	-	-	-
16	Cobalt	mg/l Co	-	-	-	-	-	-
17	Nickel	mg/l Ni	-	-	-	-	-	-
18	Vanadium	mg/l V	-	-	-	-	-	-
19	Arsenic	mg/l As	0.01	0.05	-	0.05	0.05	0.1
20	Cadmium	mg/l Cd	0.001	0.005	0.001	0.005	0.001	0.005
21	Total Chromium	mg/l Cr	-	0.05	-	0.05	-	0.05
22	Lead	mg/l Pb	-	0.05	-	0.05	-	0.05
23	Selenium	mg/l Se	-	0.01	-	0.01	-	0.01
24	Mercury	mg/l Hg	0.0005	0.001	0.0005	0.001	0.0005	0.001

APPENDIX D
Table 3 Continued

CHARACTERISTICS OF SURFACE WATER INTENDED FOR THE ABSTRACTION OF DRINKING WATER			CATEGORIES					
			A1		A2		A3	
			G	I	G	I	G	I
PARAMETERS								
25	Barium	mg/l Ba	-	0.1	-	1	-	1
26	Cyanide	mg/l Cn	-	0.05	-	0.05	-	0.05
27	Sulphates	mg/l SO ₄	150	250	150	250 (0)	150	250 (0)
28	Chlorides	mg/l Cl	200	-	200	-	200	-
29	Surfactants (reacting with methyl blue)	mg/l (laurylsulphate)	0.2	-	0.2	-	0.5	-
30	Phosphates	mg/l P ₂ O ₅	0.4	-	0.7	-	0.7	-
31	Phenols (phenol index) paranitraniline 4 aminoantipyrine	mg/l C ₆ H ₅ OH	-	0.001	0.001	0.005	0.01	0.1
32	Dissolved or emulsified hydrocarbons (after extraction by petroleum ether)	mg/l	-	0.05	-	0.2	0.5	1
33	Polycyclic aromatic hydrocarbons	mg/l	-	0.0002	-	0.0002	-	0.001
34	Total pesticides (parathion, BHC, dieldrin)	mg/l	-	0.001	-	0.0025	-	0.005
35	Chemical oxygen demand (COD)	mg/l O ₂	-	-	-	-	30	-
36	Dissolved oxygen saturation rate	% O ₂	> 70	-	> 50	-	> 30	-
37	Biochemical oxygen demand (BOD ₅) (at 20°C with nitrification)	mg/l O ₂	< 3	-	< 5	-	< 7	-
38	Nitrogen by Kjeldahl method (except NO ₃)	mg/l N	1	-	2	-	3	-
39	Ammonia	mg/l NH ₄	0.05	-	1	1.5	2	4 (0)
40	Substances extractable with chloroform	mg/l SEC	0.1	-	0.2	-	0.5	-
41	Total organic carbon	mg/l C	-	-	-	-	-	-
42	Residual organic carbon after flocculation and membrane filtrations (5 µ) TOC	mg/l C	-	-	-	-	-	-
43	Total coliforms 37°C	/100 ml	50	-	5000	-	50000	-

APPENDIX D
Table 3 Continued

CHARACTERISTICS OF SURFACE WATER INTENDED FOR THE ABSTRACTION OF DRINKING WATER			CATEGORIES					
			A1		A2		A3	
PARAMETERS			G	I	G	I	G	I
44	Faecal coliforms	/100 ml	20	-	2000	-	20000	-
45	Faecal streptococci	/100 ml	20	-	1000	-	10000	-
46	Salmonella		Not present in 5000 ml	-	Not present in 1000 ml	-	-	-

APPENDIX D

TABLE 4: EC DIRECTIVE CONCERNING THE QUALITY OF BATHING WATERS (76/160/EEC)

MICROBIOLOGICAL STANDARDS

Parameter	Units	Value (1)		Status	
		I	G	I	G
Total coliforms	no/100ml	10,000	500	95% of samples	80% of samples
Faecal coliforms	no/100ml	2,000	100	95% of samples	80% of samples
Faecal streptococci	no/100ml	-	100	-	80% of samples
Salmonella	no/l	0	-	95% of samples	-
Enterovirus	PFU/10l	0	-	95% of samples	-

PFU = Plaque Forming Units

Notes : I = Imperative or Mandatory standard.
G = Guideline standard.

AESTHETIC CRITERIA

Parameter	Analysis Method	Description/Standard
Colour	Visual inspection	No abnormal change
Mineral oils	Visual inspection	No visible surface film
	Olfactory inspection	No odour
	mg/l after extraction and weighing dried residue	≤0.3
Surface-active substances (methylene-blue active)	Visual inspection	No lasting foam
	mg/l as lauryl sulphate	≤0.3
Phenols	Olfactory inspection	No specific odour
	mg/l	≤0.05
Transparency	m	1
Tarry residues, solid floating material, effluent slicks	Visual inspection	Absent

APPENDIX D

TABLE 5: 3RD NORTH SEA CONFERENCE - PRIORITY HAZARDOUS SUBSTANCES (ANNEX 1A LIST OF SUBSTANCES)

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

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

TABLE 6 : STANDARDS FOR THE FIVE RIVER ECOSYSTEM USE CLASSES

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

TABLE 7: NWC ESTUARY CLASSIFICATION SCHEME

ALLOCATION OF POINTS

Aesthetic Quality

(One description only is chosen)

- (a) Estuaries or zones of estuaries that either do not receive a significant polluting input or which receive inputs that do not cause significant aesthetic pollution. 10 Points
- (b) Estuaries or zones of estuaries which receive inputs which cause a certain amount of aesthetic pollution but do not seriously interfere with estuary usage. 6 Points
- (c) Estuaries or zones of estuaries which receive inputs which result in aesthetic pollution sufficiently serious to affect estuary usage. 3 Points
- (d) Estuaries or zones of estuaries which receive inputs which cause widespread public nuisance. 0 Points

Biological Quality

(Scores under a,b,c and d are summed)

- (a) Allows the passage to and from freshwater of all relevant species of migratory fish, when this is not prevented by physical barriers. (Relevant species include salmonids, eels, flounders and cucumber smelts etc.) 2 Points
- (b) Supports a residential fish population which is broadly consistent with the physical and hydrographical conditions. 2 Points
- (c) Supports a benthic community which is broadly consistent with the physical and hydrographical conditions. 2 Points
- (d) Absence of substantially elevated levels in the biota of persistent toxic or tainting substances from whatever source. 4 Points
- Maximum score 10 Points

Chemical Quality

(One value only is chosen)

	<u>Value</u>	<u>Score</u>
Dissolved oxygen exceeds a saturation value of:	60%	10
	40%	6
	30%	5
	20%	4
	10%	3
	Below 10%	0

DESCRIPTION OF QUALITY PARAMETERS

Aesthetic Quality

In assessing aesthetic quality the following factors are considered: smell, colour, debris, oil, recognisable sewage solids, and effects from discharge of domestic or industrial effluent.

The assessment also takes into account the natural turbidity of the waters in the area, algal growth, and the frequency with which floating oil and debris enter the area.

Biological Quality

Biological quality is classified by the following features:

(a) Passage of migratory fish

Except where other uses are deemed of greater importance, an estuary should allow the passage of all those species of migratory fish which can be supported by the freshwater reaches. The estuary would fail this criterion if the passage of one or more of the relevant species were seriously impeded by adverse water quality. Thus certain east coast estuaries, for instance, would not be failed because migratory salmonids do not pass through them, but would be failed if they did not allow the passage of elvers and eels. Similarly, an estuary would not be failed on this parameter if the only impediment to migration was a physical barrier. The main deterrent to migration is usually low dissolved oxygen, and this is reflected in the classification score under chemical quality.

However, the scheme takes into account the possibility that fish might be able to migrate through an estuary with the lowest water quality classification if at the appropriate time there is sufficient dissolved oxygen present to allow migration to occur. For example, the lowest dissolved oxygen may occur during the third quarter of the year, whereas elvers and eels migrate during the second and fourth quarters respectively.

(b) Fish population

To comply with this parameter, the classification scheme requires that each area of the estuary contains a population of fish appropriate to the physical and hydrographic conditions for most of the time. It follows that where water quality criteria for recreational, commercial, or biological grounds are not met, fish populations will also be reduced, either sporadically or permanently, in numbers or species and this will therefore also cause the area of estuary to fail in this respect.

(c) Benthic community

To comply with this parameter the benthic community of each area would have a diversity and biomass which is consistent with the physical and hydrographic conditions. This parameter is included because the sedentary characteristics of benthic organisms reflect the conditions at a given location, in contrast to the fish population which is mobile. It is often not easy to determine whether the benthos is healthy or otherwise, although the extreme are readily recognisable. Thus the benthic community may need to show a substantial deterioration before its failure to comply can be stated with any certainty.

APPENDIX D

Table 7 continued

(d) Persistent toxic or tainting substances

The accumulation of toxic or tainting substances by estuarine organisms may affect their subsequent acceptability for human consumption, or the viability of populations of sensitive species. The presence of higher-than-background concentrations of persistent chemicals in the biota would not constitute grounds for failing an area of estuary on this parameter, unless the substances approach concentrations which could cause harm to the organisms or render knowledge of the nature of inputs to an estuary, there is no reason to expect the accumulation of such substances in the biota, parts of the estuaries would be given the highest rating.

Chemical Quality

The chemical quality is classified in terms of dissolved oxygen levels which refer to those obtained under the worst conditions, where necessary averaged with depth and over a tidal cycle. It is expected that water having a mean dissolved oxygen value of 60 per cent will exceed this value for a substantial portion of the time.

TABLE 8: WATER QUALITY TARGETS TO PROTECT MIGRATORY SALMON FISHERY USE IN ESTUARIES¹

Parameter	Units	Value	Status ²	Comments
Dissolved Oxygen	mg/l	5.0 3.0	P MIN	
Unionised Ammonia	mg N/l	0.021 0.25	AA, TA MAC	1. Tidally averaged during periods of salmon migration 2. Max pH = 8.2 for calculation of UIA

Notes: 1: From "AMP2 Guidelines, Version 2", Approved by the Quadripartite Meeting 14/12/93

- 2: P = 95%ile
 MIN = absolute minimum
 AA = Annual average
 TA = Tidally averaged during periods of salmon migration
 MAC = Maximum Allowable Concentration

APPENDIX E

BIOLOGICAL SURVEY SUMMARY - SUMMER 1994

NAME: SIMON TOMS, BIOLOGIST

CATCHMENT: 13A

DATE: 6 JULY 1994

RIVER SEATON

The following biological monitoring points in 13A, the River Seaton catchment, were surveyed during the 1994 Summer sampling season. They were NRA 06 1307, 1301, 1308, 1305, 1303 and 1306. Grid references for each of the above sampling points are given on the biological report form (see overleaf).

SITE 1307 TREMAR TRIBUTARY - ROSECRADDOC

The BMWP and ASPT score obtained on 09/06/94 indicated that poor/reasonable water quality was present at the site. This result is consistent with previous years sampling although representing a slight improvement on both the 1991 and 1993 Summer scores.

This site would appear to display a consistent paucity of group (1) taxa including stoneflies which have been observed to be tolerant of acidic mine waste drainage at other sites within the 13A catchment. However, the mining influence at the top of the Tremar tributary would appear to be limited and the most likely cause for the observed decline in group (1) taxa is organic enrichment from the STW situated below the village of Tremar. Unlike most other sampling sites within the 13A catchment (with the exception of 1305) the Tremar tributary has a flourishing macrophyte community dominated by Hemlock water dropwort, Oenanthe crocata and Bryophytes including Amblystegium riparium. The presence of this lowland acid sensitive bryophyte in a headwater of this type is indicative that the nutrient status of the stream has been increased as a result of organic enrichment.

SITE 1301 - RIVER SEATON - HENDRA BRIDGE

The BMWP score obtained in the Summer 1994 survey was consistent with that of previous years results and again indicated continuing poor biological quality. The invertebrate community was typical of acidic mine waste drainage, comparable to that of a nutrient poor moorland headwater, dominant in Stoneflies, Baetid mayfly and Rhyacophilid Caseless caddis. The absence of bryophytes often associated with naturally acidic streams, tends to suggest antagonistic metalliferous contamination.

SITE 1308 - MENHENIOT TRIBUTARY - AT FACTORY

The Summer 1994 result indicated reasonable/good water quality. This score is consistent with the results of previous years, although in Summer 1993 a relatively low BMWP score was obtained. The decline would appear to have been across a whole range of invertebrate groups with varying tolerances to pollution. This tends to infer that a pollution event was not the cause.

The results obtained from this tributary are the best observed from any watercourse sampled in the 13A catchment and indicates the possible potential for water quality within the Seaton catchment. Group (1) taxa, the group most sensitive to organic enrichment, have been found to be present in good numbers at this site.

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SITE 1305 - RIVER SEATON - COURTENEY'S MILL BRIDGE

The Summer 1994 BMWP result at this site (137) represents the highest BMWP score achieved since sampling began in 1990 and is indicative of reasonable water quality. This result also represents one of the highest scores achieved on the main River Seaton and this may have resulted from two possible reasons:

1) The site is situated approximately ½ mile downstream of the 'clean' Menheniot tributary and 2) it is situated downstream of Menheniot STW. Sanitary waste has often been observed in the river at this site. Mild organic enrichment and the supply of nutrients to a nutrient poor metalliferous watercourse has often been found to have an ameliorating effect resulting in an increase in macroinvertebrate diversity. This would appear to be the case at this site. In addition to this the macrophyte diversity/abundance at this site is far greater than at other sites on the main River Seaton. The presence of the lowland acid-sensitive bryophyte Amblystegium riparium observed in the Spring 1994 again indicates that the nutrient status of the river has been improved at Courteney's Mill Bridge.

SITE 1303 - RIVER SEATON - HESSENFORD

The Summer 1994 BMWP score was consistent with previous years results although lower than the Summer 1993 result. The score was indicative of poor biological water quality and typical of the main River Seaton with the notable exception of Site 1305, approximately 3 miles upstream.

There has been a general paucity of group (1) taxa at the site throughout the last 3 years and this includes the normally acid-tolerant stonefly families. These have been present in small numbers on only a few occasions in previous years. Septic tank contamination was recorded in 1993. In Spring 1994 it was observed that extensive digging upstream of the site had taken place to install a new septic tank for the nearby public house. In this instance, the close proximity to a foul discharge may actually have resulted in a decline in the abundance of organic-sensitive stonefly larvae.

SITE 1306 - RIVER SEATON - SEATON ROAD

The Summer 1994 BMWP score was one of the best observed at this site, but continues to reflect poor biological water quality. The slow flow, large amount of silt and organic debris, tidal back up and the inherent poor water chemistry of the River Seaton would appear to have combined to produce the very poor biological quality results at this site.

The BMWP scores obtained at this site are generally the worst observed on the River Seaton catchment.

SUMMARY

In general the biological water quality of the River Seaton would appear to be impoverished, largely due to metalliferous/acidic mine waste contamination. The main River Seaton has been the worst affected watercourse and to a lesser extent, the Tremar tributary. Both of these streams run off a heavily mined area of Bodmin Moor. The Menheniot tributary exhibited good water quality and would appear to be free from mine waste drainage. This tributary is an outstanding component of the 13A catchment.

At several sites on the River Seaton, Brown Trout were observed. This tends to indicate that the mine waste drainage is chronic rather than acute. The River Seaton supports a small migratory salmonid fishery.

APPENDIX E

BIOLOGICAL SURVEY SUMMARY - SPRING 1994

NAME: TRACY BAGBY, BIOLOGIST

CATCHMENT: 14A

DATE: 7 JULY 1994

This catchment contains one site, at Polperro on the Polperro River. The biological scores from Summer 1994 indicate good water quality and show a slight improvement on previous Summer samples in 1993 and 1990. The site did, however, appear to be organically enriched due to the presence of sanitary waste in the river. A high oxygen content seems to have been maintained despite this because of the physical nature of the river, thus the invertebrate community remained diverse.

NAME: TRACY BAGBY, BIOLOGIST

CATCHMENT: 14B

DATE: 7 JULY 1994

This catchment contains five sites on the East Looe River. Generally, the biological data shows an improvement in water quality throughout this catchment in Summer 1994. Two sites showed significant increases in scores compared to the Summers of 1991 and 1993; Looe Mills (NRA 06 1412) and Railway Halt, Sandplace (NRA 06 1414), where scores were the highest yet recorded.

The invertebrate data for the past four years suggest a decline in water quality in this river below Liskeard Sewage Treatment Works. The two sites sampled above here in Summer 1994; Looe Mills and Venton Veor Bridge (NRA 06 1411), have produced BMWP scores over 200 since sampling started in 1990, while scores are lower at several sites downstream. Trussel Bridge (NRA 06 1413) though not sampled in Summer 1994, was visited in the Spring when sanitary waste was found. Lamellion Mill (NRA 06 1402), further downstream, generally produces scores between 100 and 150 which reflects a poorer water quality. The invertebrate fauna here is less diverse than above the Sewage Treatment Works and incorporates fewer Group 1 taxa, ie those most sensitive to organic pollution. Scores improve slightly at the next site downstream, Landlooe Bridge (NRA 06 1403), although here the landowner has complained of discolouration of the river at weekly intervals.

Railway Halt, Sandplace is the lowest site sampled on the East Looe. Biological results have varied in the three years it has been sampled but this may be due in part to the deep sandy/silty nature of the site as the river approaches the sea. The BMWP score of 195 recorded in Summer 1994 reflects a significant improvement in water quality and a recovery from the organic problems apparent in Summer 1993.

APPENDIX E

BIOLOGICAL SURVEY SUMMARY - SUMMER 1994

NAME: TRACY BAGBY, BIOLOGIST

CATCHMENT: 14C

DATE: 7 JULY 1994

This catchment contains the West Looe River and its tributaries. Seven sites were sampled in this area in Summer 1994.

Three sites were sampled on the Connon Stream. Upstream Connon Bridge Landfill Site (NRA 06 1418) continued to score well with both Spring and Summer samples improving compared to 1993. The diverse invertebrate community reflected good water quality.

The two sites downstream of the landfill site (Downstream Tip Site, NRA 06 1408 and Trevillis Wood NRA 06 1409) have produced variable results which are generally slightly poorer than upstream. The presence of ochre and sewage fungus at these two sites at various times of sampling has suggested some metallic and organic impact from the landfill site. Biological scores for Spring and Summer 1994 reflect good water quality at both sites although there was a small decline at Trevillis Wood in Summer. This appeared to be due to the denaturing of the site by fallen trees and branches.

Tregarrick Mill Bridge (NRA 06 1407) is the only site being sampled on the Coldrinnick Stream in 1994. 1990 results indicated very good water quality whereas Spring and Summer 1993 BMWP scores fell slightly. The ASPT values did, however, remain above 6.7 which suggests that there was no organic pollution. Spring and Summer results for 1994 illustrate a diverse, high-scoring invertebrate fauna.

Three sites on the main West Looe River were visited in Summer 1994. The biological data for each indicate good water quality. Two of the sites, Herodsfoot Bridge (NRA 06 1417) and Sowden's Bridge (NRA 06 1416) have generally shown little variation in score since 1990. The scores for Bosent Bridge (NRA 06 1404), however, have varied in this period perhaps due to organic enrichment as a result of animal access to the site.

APPENDIX E

BIOLOGICAL SURVEY SUMMARY - SUMMER 1994

NAME: KATHERINE DUNN, BIOLOGIST

CATCHMENT: 15A

DATE: 7 JULY 1994

The 15A catchment includes the following Summer routine biological monitoring sites: NRA 06 1511, 1502.

SITE 1511 - BODELLVA STREAM - BOCONNOC - SX 1550 6036

The Summer 1994 BMWP score was the highest Summer score recorded at this site since 1991. Although the BMWP scores deteriorated in the Summer and Autumn of 1991 and 1993 this site reflects good water quality. The invertebrate community present is indicative of a headwater naturally deficient in nutrients.

SITE 1502 - TREBANT WATER - EAST TRENCREEK UPSTREAM PENPOLL SX 1510 551

A significant improvement in BMWP score was noted at this site in Summer 1994 when comparisons were drawn with the Summer of 1993. A reduction in Group 1 taxa sensitive to organic pollution explains the lower BMWP scores recorded throughout 1993. The Summer 1994 score was consistent with the high Summer and Autumn scores recorded in 1990 and thus indicated very good water quality.

SUMMARY

The Summer 1994 biological water quality results for the two sites in the 15A catchment indicate good water quality. The data suggests that these sites are on occasion susceptible to some degree of organic enrichment that has resulted in declining BMWP scores.

NAME: KATHERINE DUNN, BIOLOGIST

CATCHMENT: 15B

DATE: 7 JULY 1994

The 15B catchment includes the following Summer routine biological monitoring sites: NRA 06 1506, 1518, 1517, 1519, 1507, 1515, 1513, 1514 and 1516.

SITE 1518 - NORTHWOOD BROOK-WORTH A SX 2063 6988

The BMWP score obtained in the Summer of 1994 was lower than previous scores and indicated poor water quality. The stream is subject to china clay waste contamination and the invertebrate community present reflected a typical acidic metalliferous influence. A large amount of foam was also present at the time of Summer sampling.

SITE 1506 - CARDINHAM WATER - GLYNMILL SX 1110 6444

The Summer 1994 BMWP score was the highest score recorded since 1990 indicating very good quality at this site. The score was consistent with the Spring 1994 score although a 100% improvement in BMWP was noted when comparisons were drawn with the Summer of 1992. An increase in Group 1 taxa sensitive to organic pollution explains the significant improvement in BMWP and ASPT scores in 1994.

SITE 1507 - WARLEGGAN RIVER - PANTERS BRIDGE SX 1583 6810

The Summer 1994 BMWP score indicated good water quality at this site. The invertebrate community was typical of a slightly nutrient poor moorland river. A lower score obtained in the Summer of 1992 resulted from a reduction in taxa sensitive to organic pollution.

APPENDIX E

SITE 1519 - SIBLYBACK STREAM - TREKEIVESTEPS SX 2279 6991

A significant improvement in BMWP score was noted in Summer 1994 when compared to previous Summer results. Lower scores were recorded throughout 1992 reflecting reasonable to poor water quality. Fewer Group 1 taxa were found in the Summer of 1992 suggesting an organics problem in that year.

SITE 1517 - ST NEOT - COLLIFORD BRIDGE SX 1810 7071

The Summer 1994 BMWP score was the highest score recorded since Spring 1991. The invertebrate community at this site continues to reflect reasonable water quality.

SITE 1515 - FOWEY - BODITHIEL BRIDGE SX 1766 6488

The highest BMWP score ever recorded was achieved in the Summer of 1994. The Fowey at this site continues to be of good water quality.

SITE 1513 - FOWEY - DRAYNES BRIDGE SX 2281 6898

The Summer 1994 BMWP score was consistent with previous Summer scores. The Fowey at this site continues to be of very good water quality.

SITE 1516 - FOWEY - RESTORMEL SX 1076 6132

Although a deterioration in water quality was identified in the Spring of 1994 a significant improvement in water quality was noted in the Summer of 1994. The Summer result was consistent with the score obtained in Summer 1991 and considerably higher than the score obtained in Summer 1992. Variations in score at this site may indicate episodic water quality problems.

SITE 1514 - FOWEY - TREVERBYN BRIDGE SX 2065 6754

The Summer 1994 BMWP score was consistent with the scores obtained throughout 1991 and the Spring of 1992 reflecting good water quality. A significant deterioration in BMWP score in the Summer and Autumn of 1992 resulted from a reduction in Group 1 taxa intolerant to organic pollution.

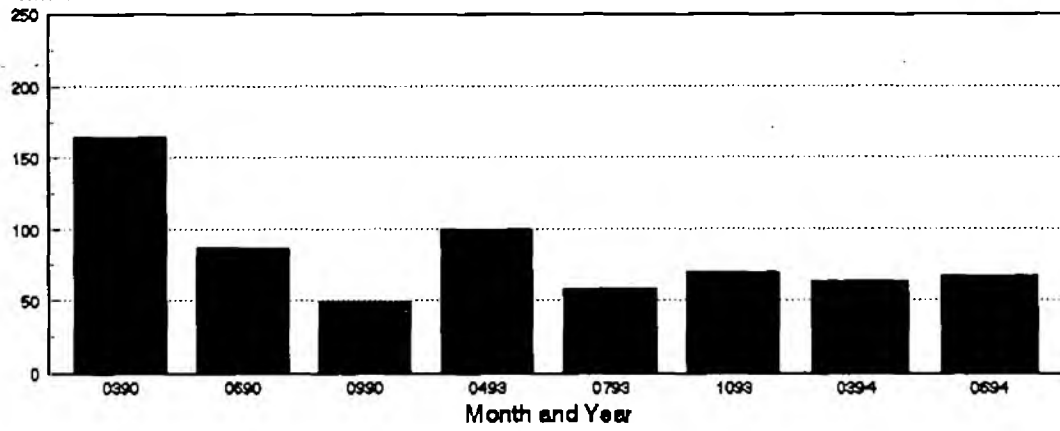
SUMMARY

Seven out of the nine sites sampled in the Summer of 1994 showed very good water quality, reflected by considerable increases in BMWP score. The Summer 1994 BMWP score for the Northwood Brook at Wortha was lower than previous scores and indicated poor water quality. This tributary is affected by china clay contamination and an acidic influence. However an excellent diversity of macrophytes can be observed at this site. The Summer 1994 score for Treverbyn Bridge was consistent with scores obtained throughout 1991 reflecting good water quality. A significant deterioration in the Summer and Autumn of 1992 resulted from a reduction in Group 1 taxa intolerant to organic pollution.

In general the Fowey catchment continues to be of good water quality and continues to support a flourishing salmon and migratory trout fishery.

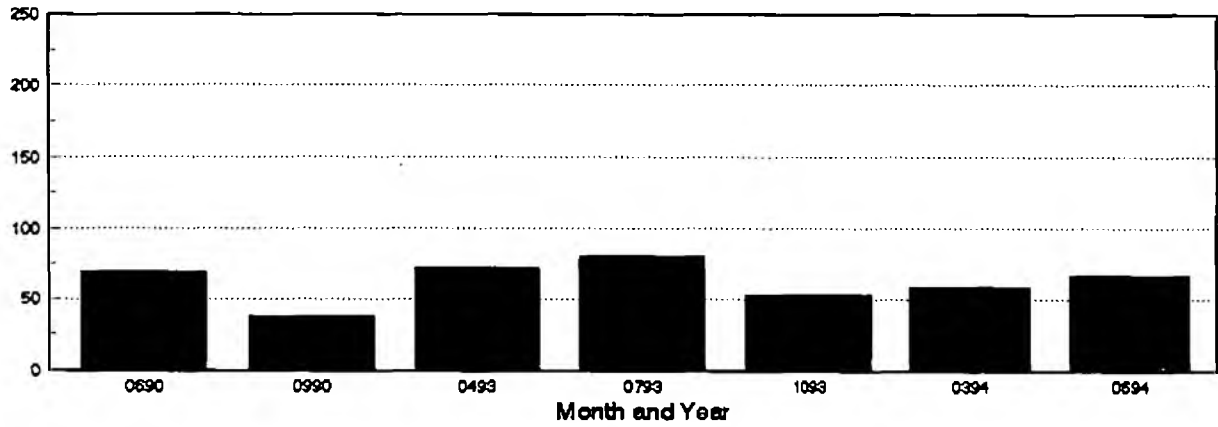
SEATON - Hendra Bridge.
NRAD01301 8020500505

BMWP Score



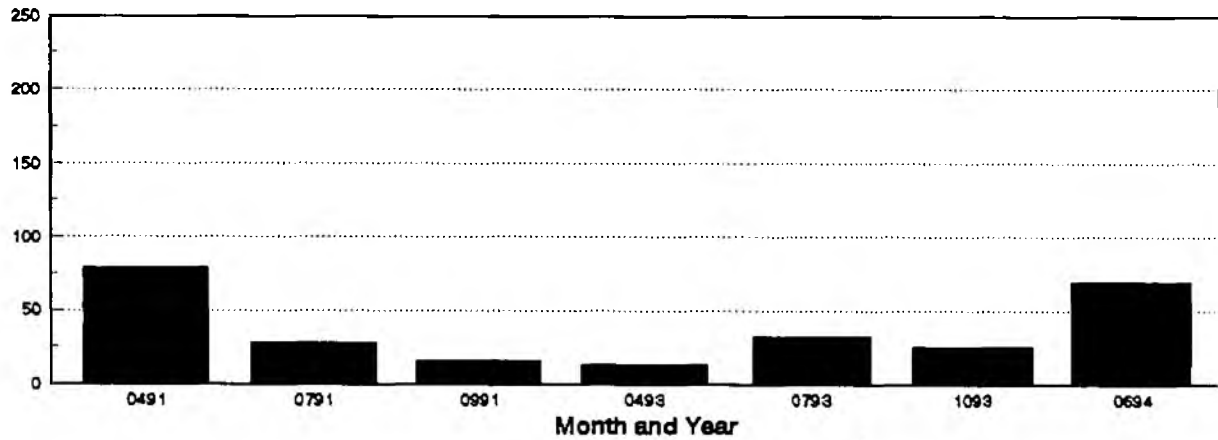
SEATON - Hessenford.
 NRA001303 0000715740

BMWP Score



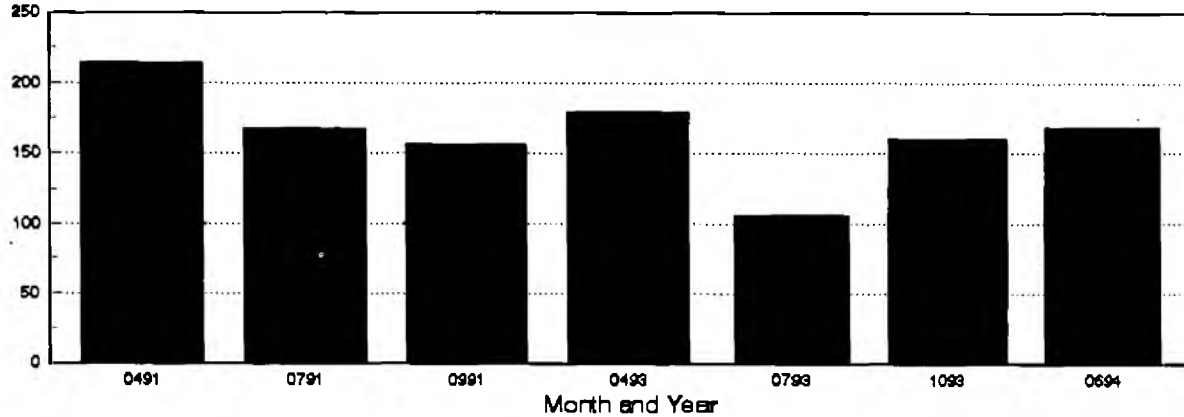
SEATON - Seaton Beach.
 NRA001306 0000335400

BMWP Score



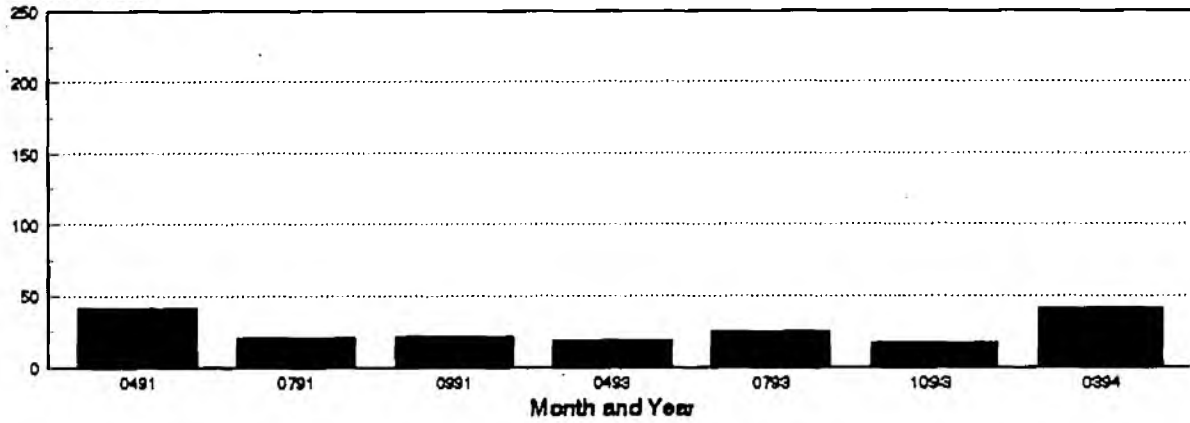
MENHENIOT TRIBUTARY - Factory.
 NRA001308 00028440207

BMWP Score



SEATON - Crows Nest.
NRA001304 0026406938

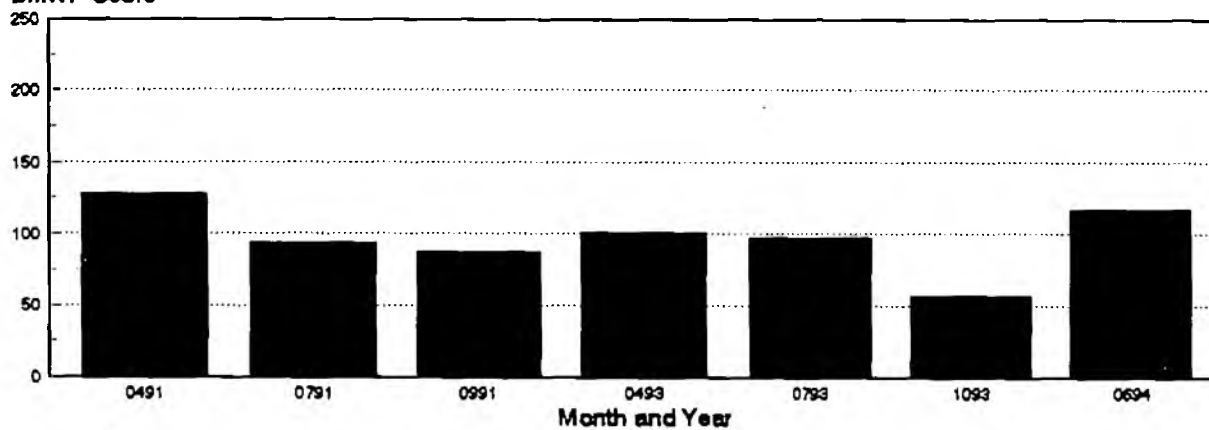
BMWP Score



TREMAR TRIBUTARY - Rosaraddoo.

NRAD01307 0020408750

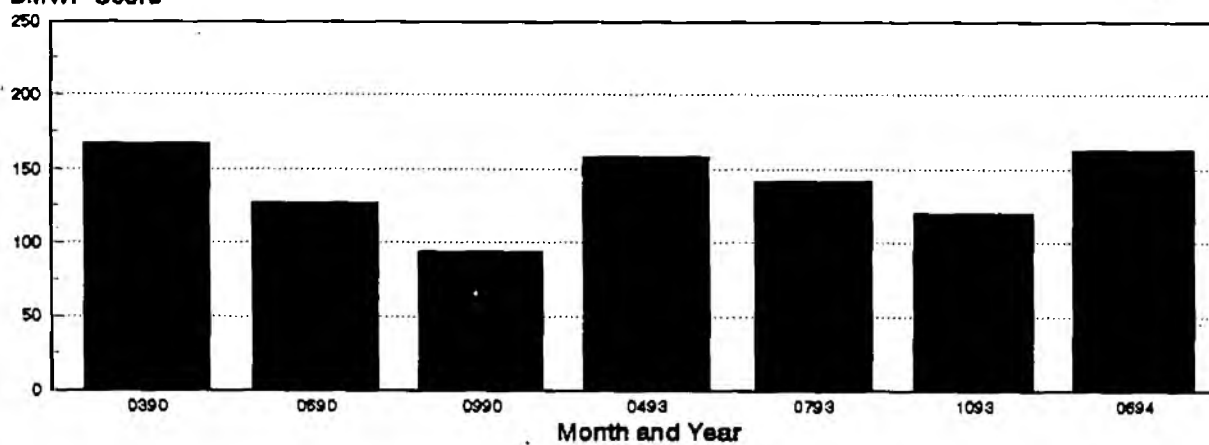
BMWP Score



POLPERRO - Polperro

NRAD01401 0020735090

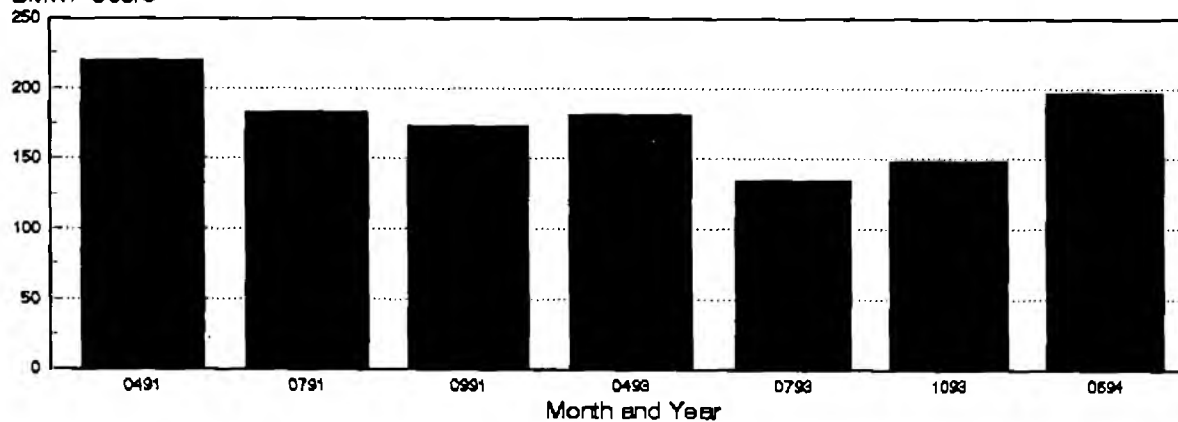
BMWP Score



EAST LOOE - Vention Veor Bridge.

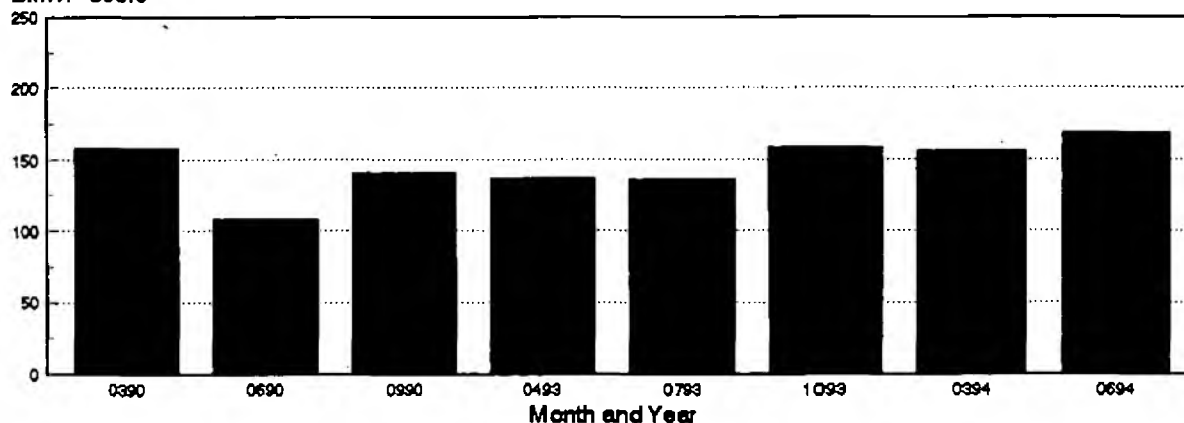
NRAD01411 0020256574

BMWP Score



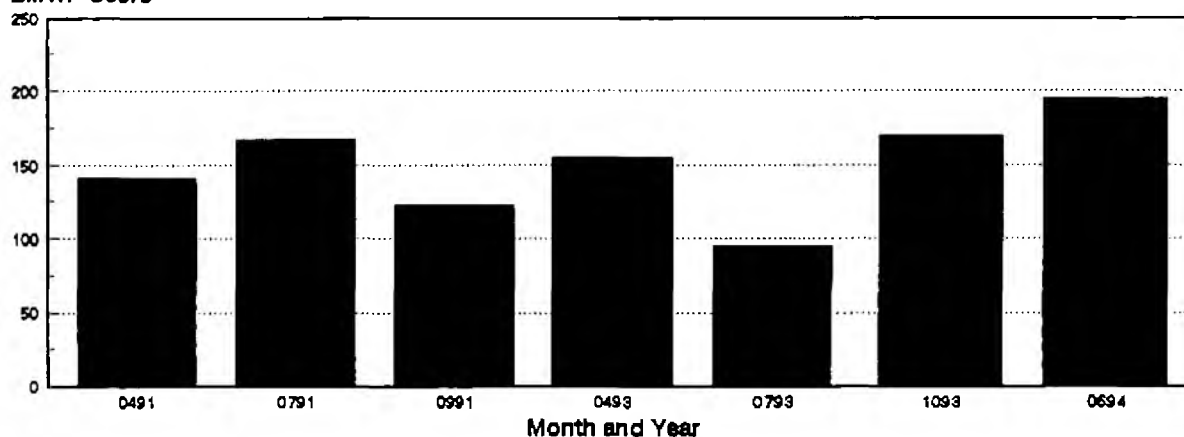
EAST LOOE - Landlooe Bridge.
 NRA061403 0024005056

BMWP Score



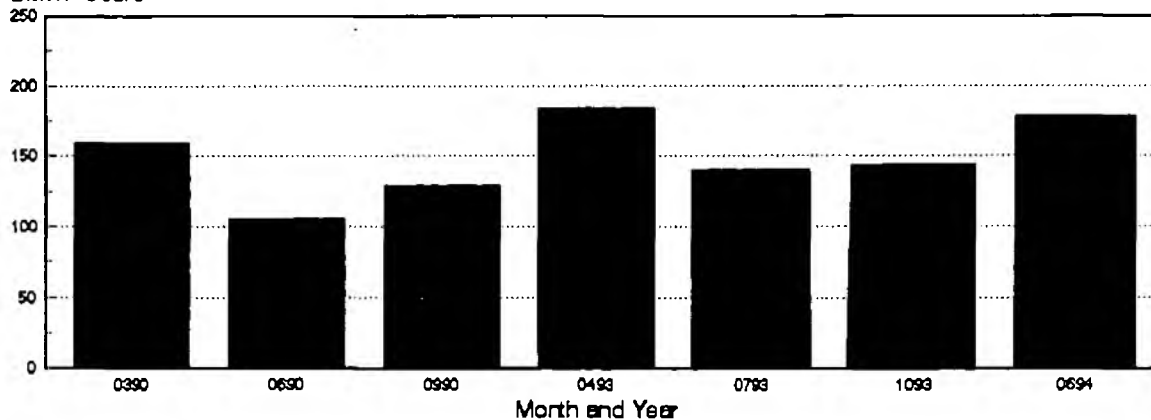
EAST LOOE - Sandplace.
 NRA061414 0024005719

BMWP Score



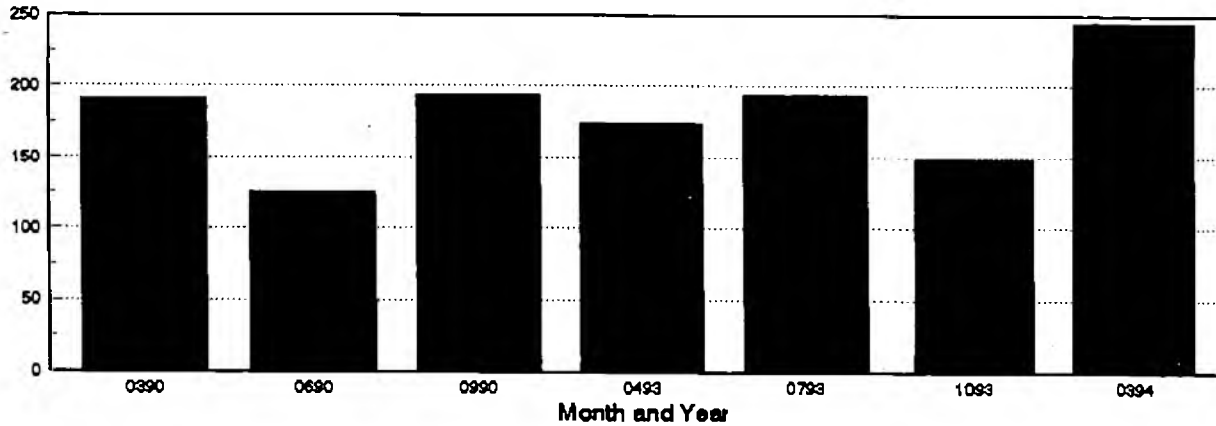
WEST LOOE - Bosant Bridge.
 NRA061404 0021276333

BMWP Score



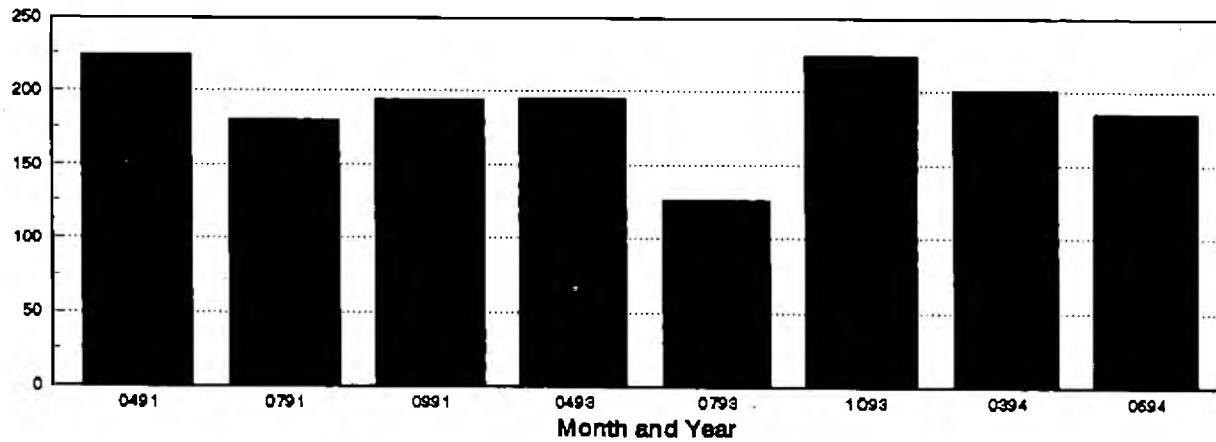
WEST LOOE - Sawn Mill Bridge.
 NRA061405 6021806216

BMWP Score



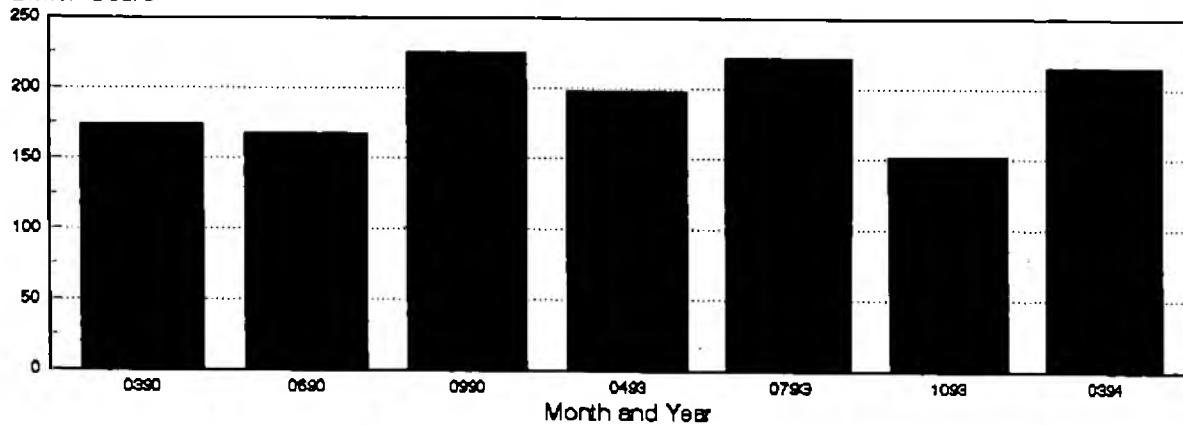
WEST LOOE - Herodfoot Bridge.
 NRA061417 6021468048

BMWP Score



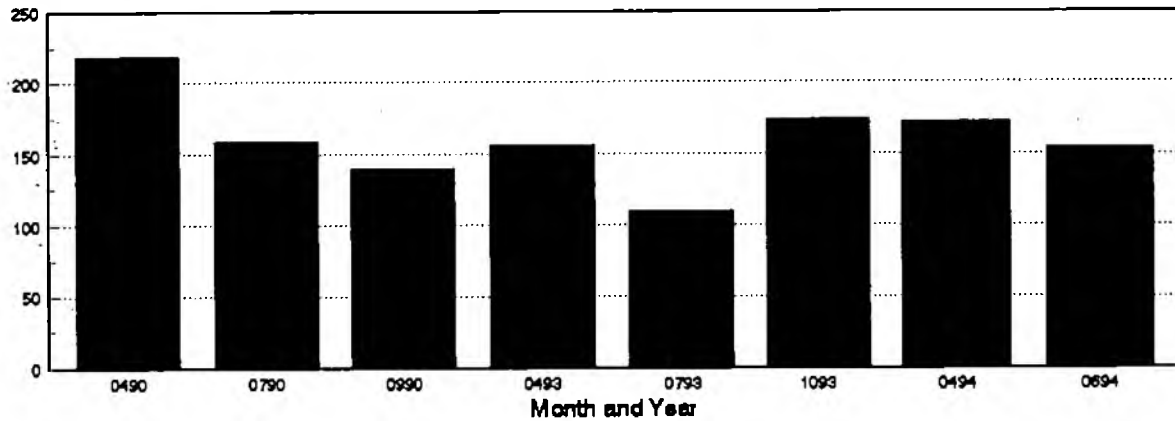
WEST LOOE - Churchbridge.
 NRA061406 6021805885

BMWP Score



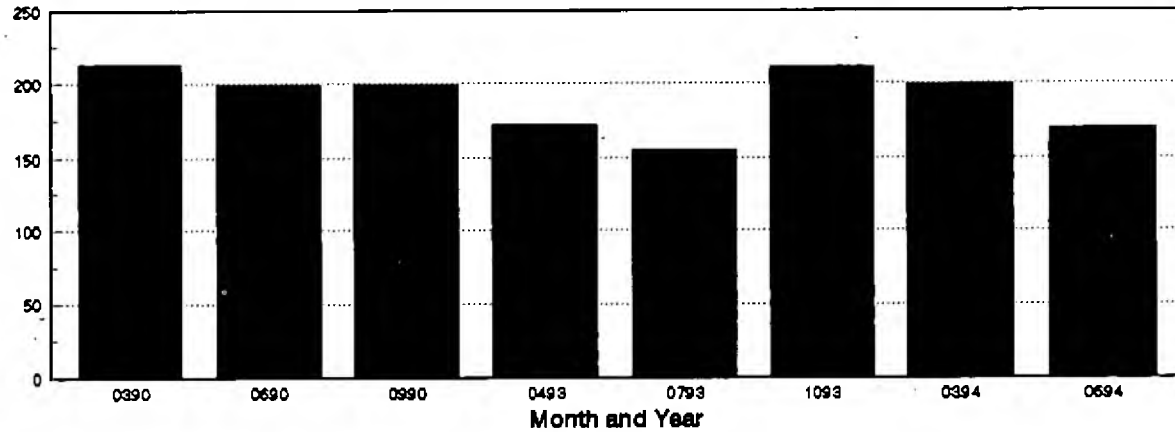
CONNON STREAM - Treville Wood.
 NRA001409 0010500105

BMWP Score



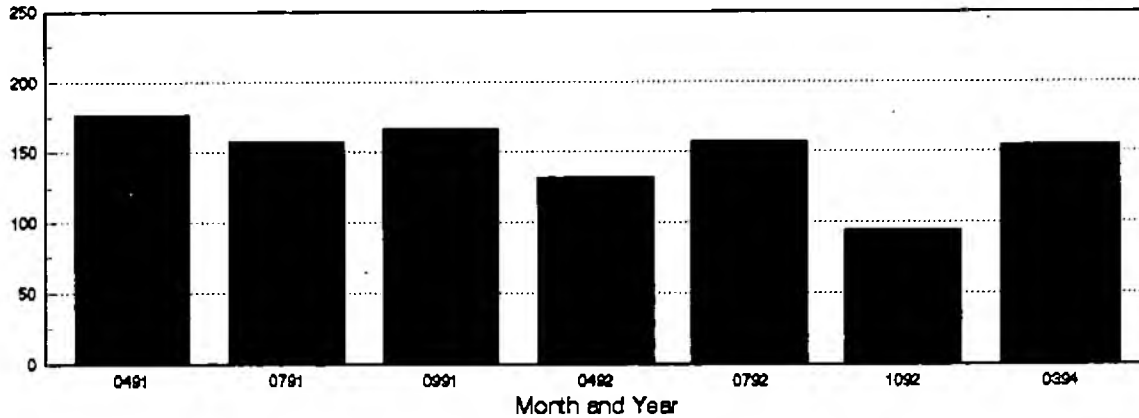
COLDRINNICK STREAM - Tregarrick Mill Bridge.
 NRA001407 0020000711

BMWP Score



FOWEY - Harrowbridge.
 NRA001512 00200007440

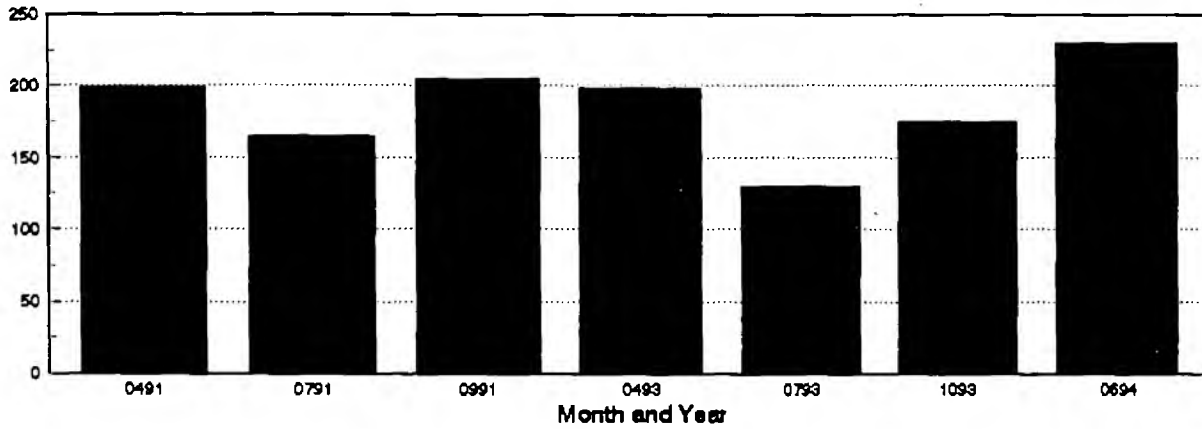
BMWP Score



EAST LOOE - Loe Mills.

NRA001412 0023200465

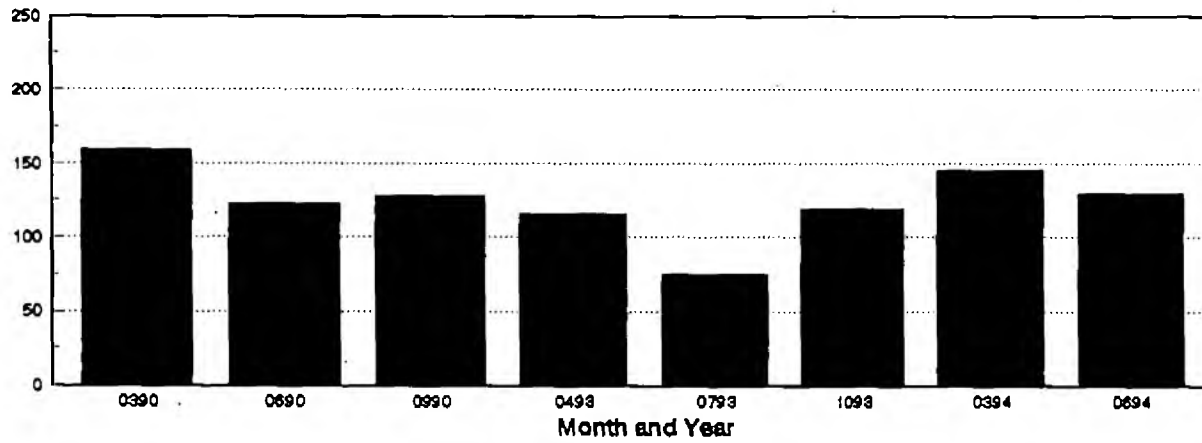
BMWP Score



EAST LOOE - Lamellon Mill.

NRA001402 0026070109

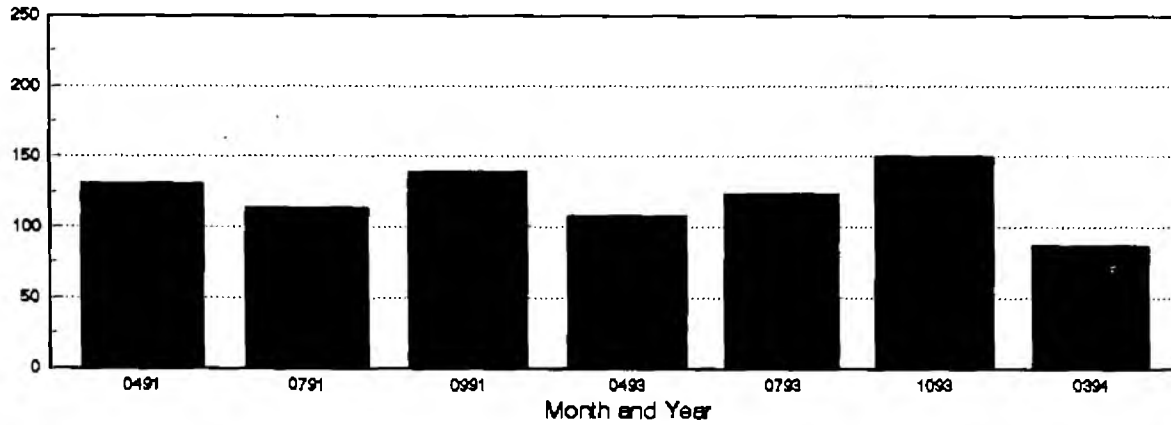
BMWP Score



EAST LOOE - Trussel Bridge.

NRA001413 0024550205

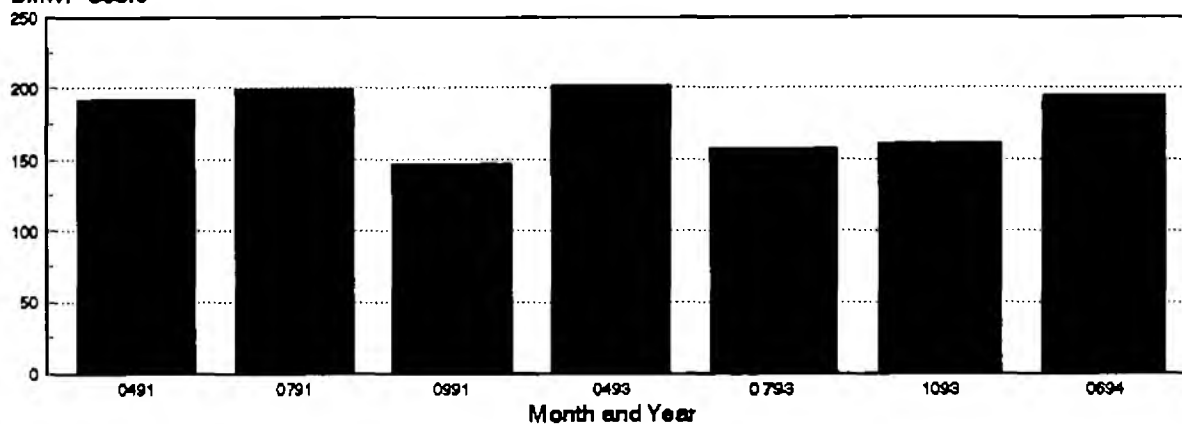
BMWP Score



WEST LOOE - West Looe Bridge.

NRA061418 0022005502

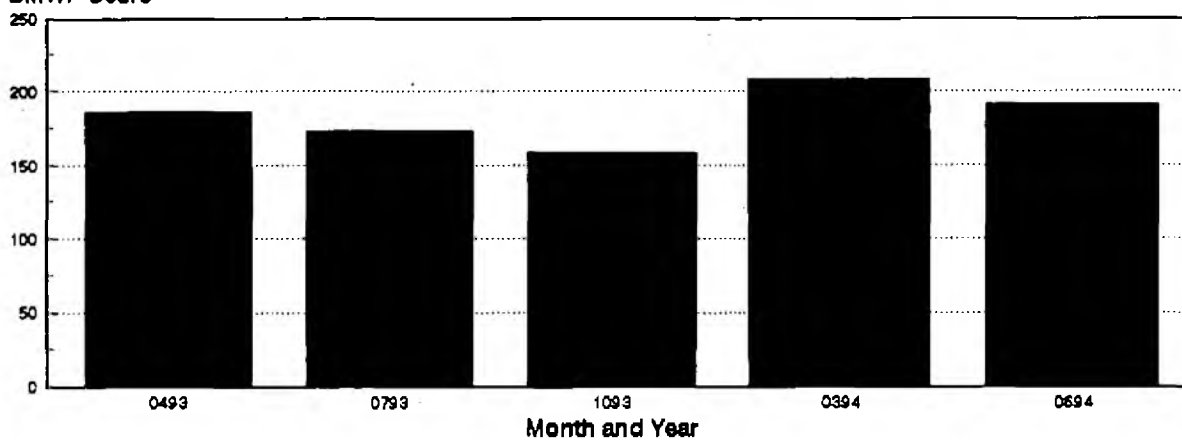
BMWP Score



CONNON STREAM - u/s Tip Site

NRA061418 0018020202

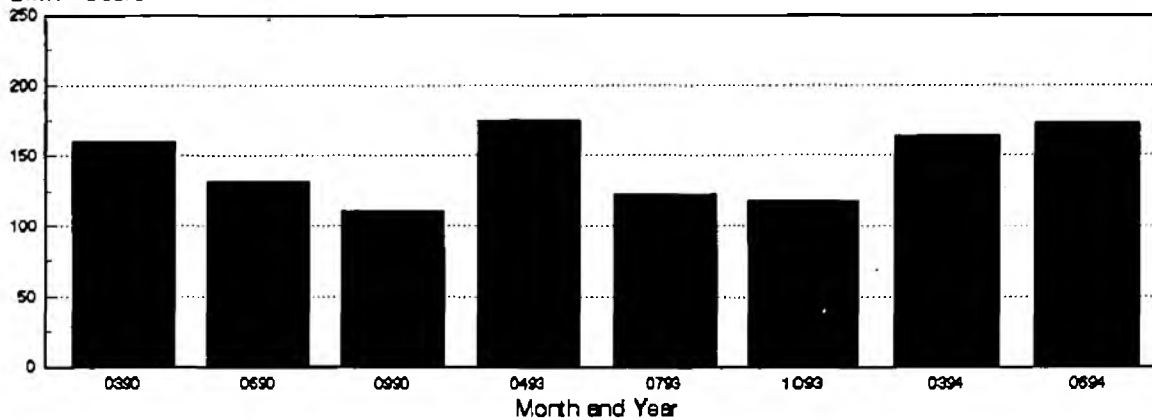
BMWP Score



CONNON STREAM - d/s Tip Site

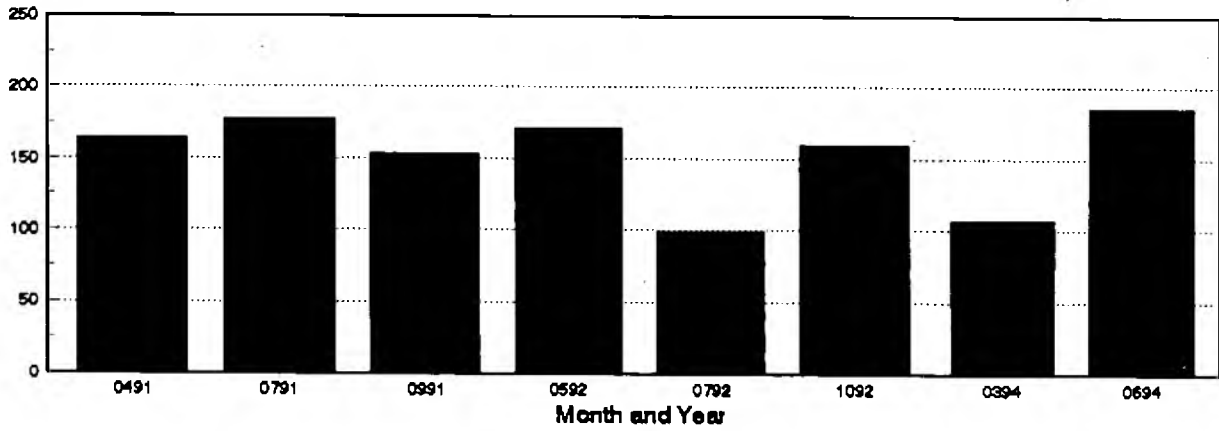
NRA061408 0018000245

BMWP Score



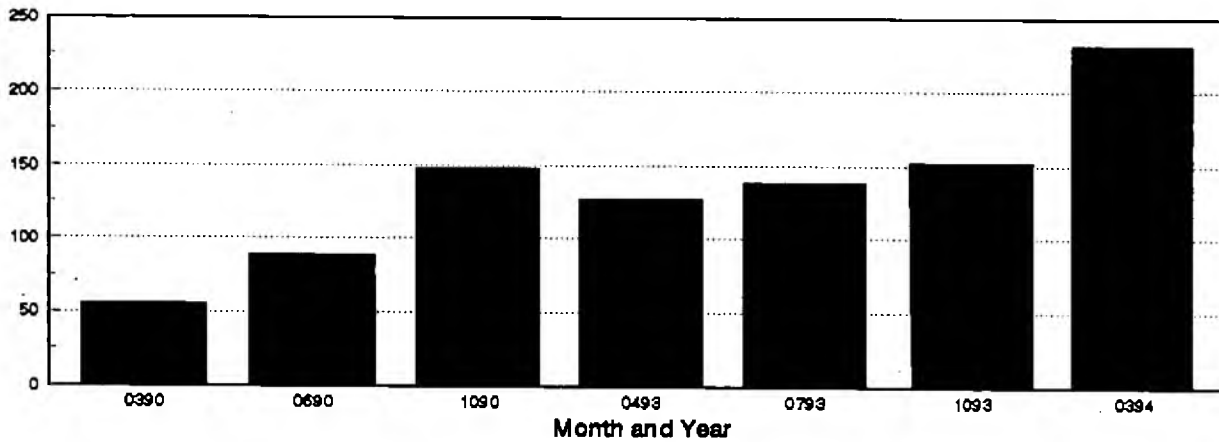
FOWEY - Reestormel.
 NRA081518 6X18768132

BMWP Score



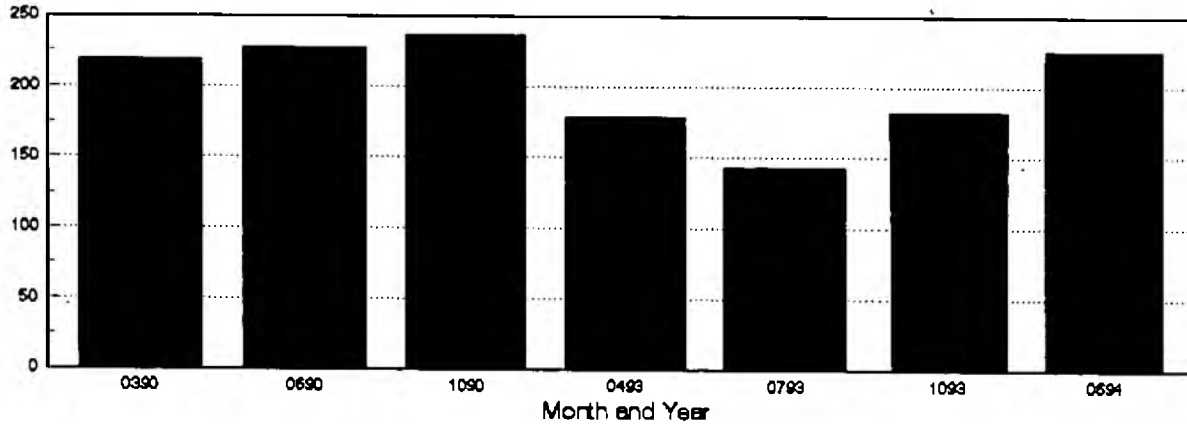
PONT - Trethake Mill.
 NRA081601 6X16816316

BMWP Score



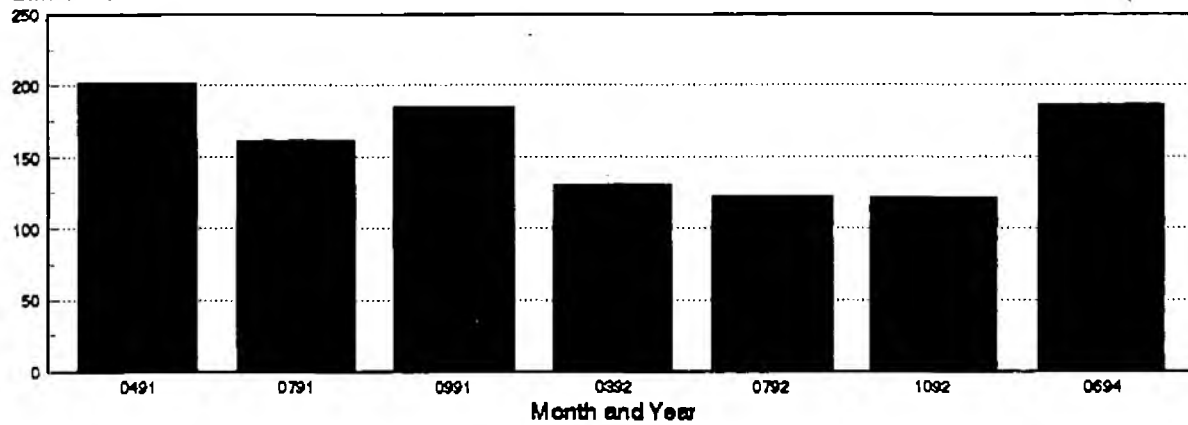
TREBANT WATER - East Trenoreek.
 NRA081502 6X15105566

BMWP Score



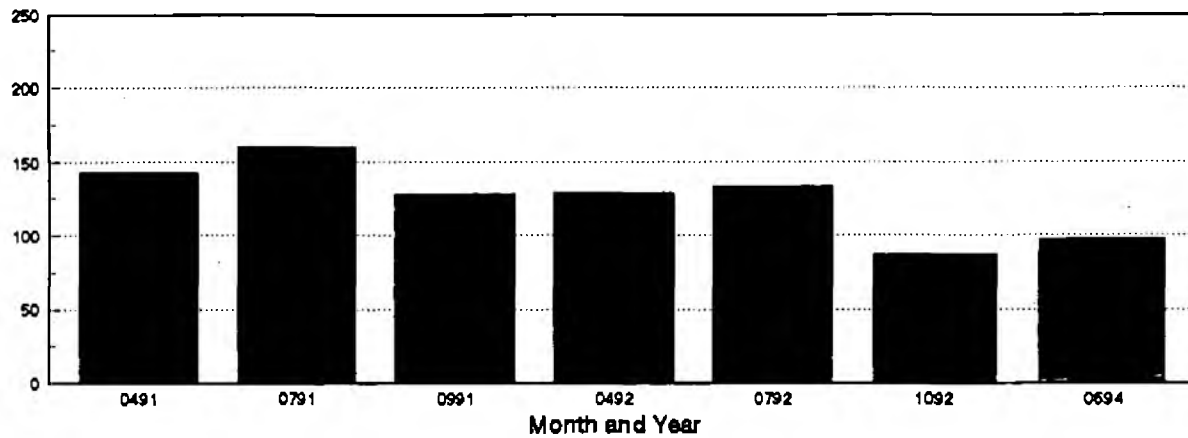
SIBLYBACK STREAM - Trekelvestepa.
 NRA001519 0022700091

BMWP Score



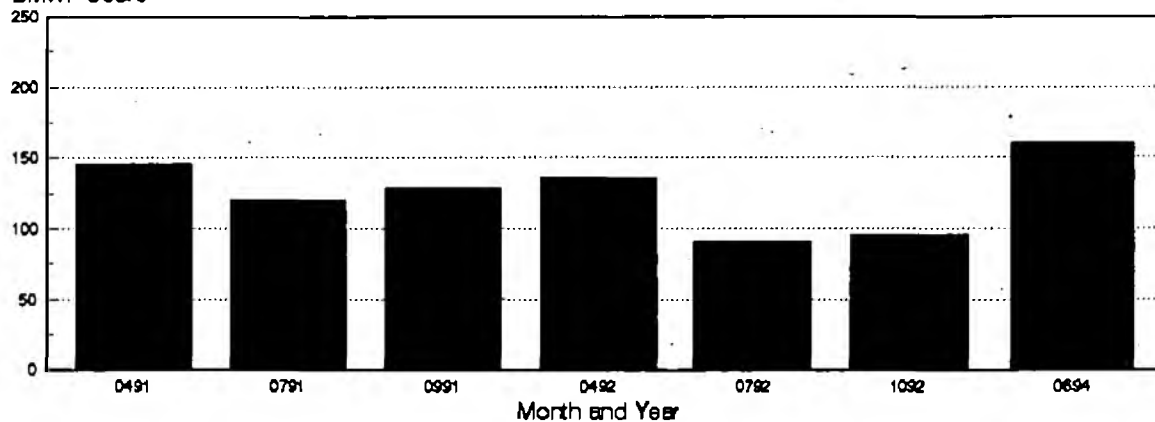
NORTHWOOD BROOK - Wortha.
 NRA001518 0020630000

BMWP Score



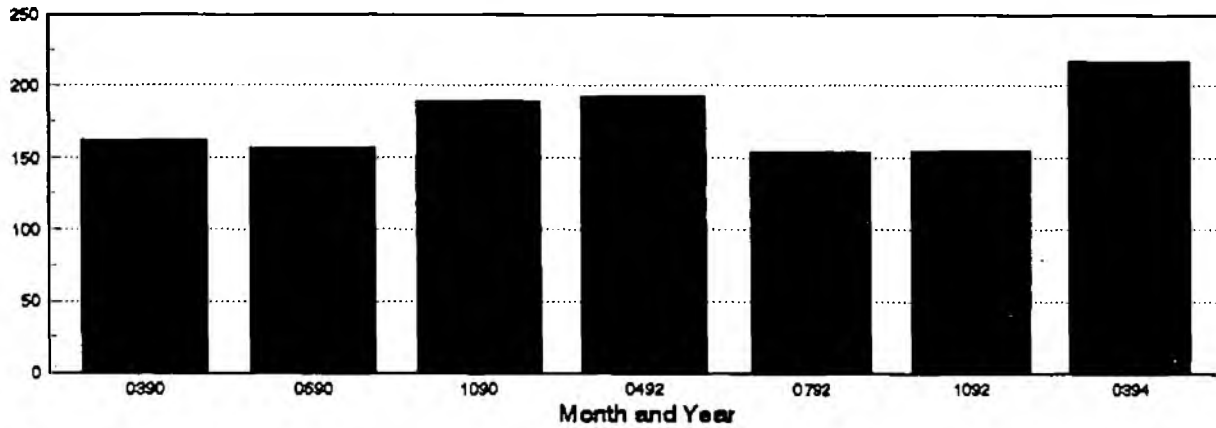
ST. NEOT STREAM - Collford Bridge.
 NRA001517 0018107071

BMWP Score



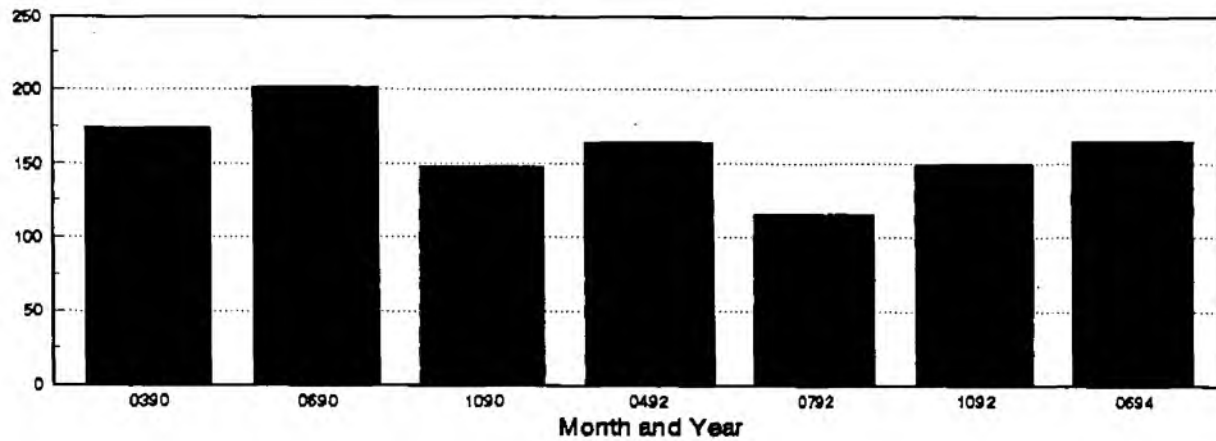
ST. NEOT STREAM - Two Waters Foot.
NRA001508 8X18429799

BMWP Score



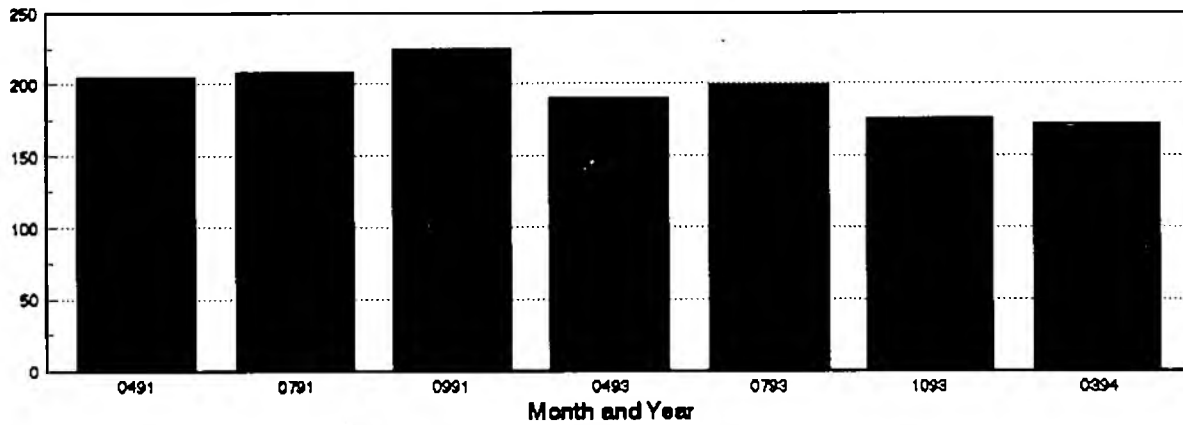
WARLEGGAN - Panthers Bridge.
NRA001607 8X18836810

BMWP Score



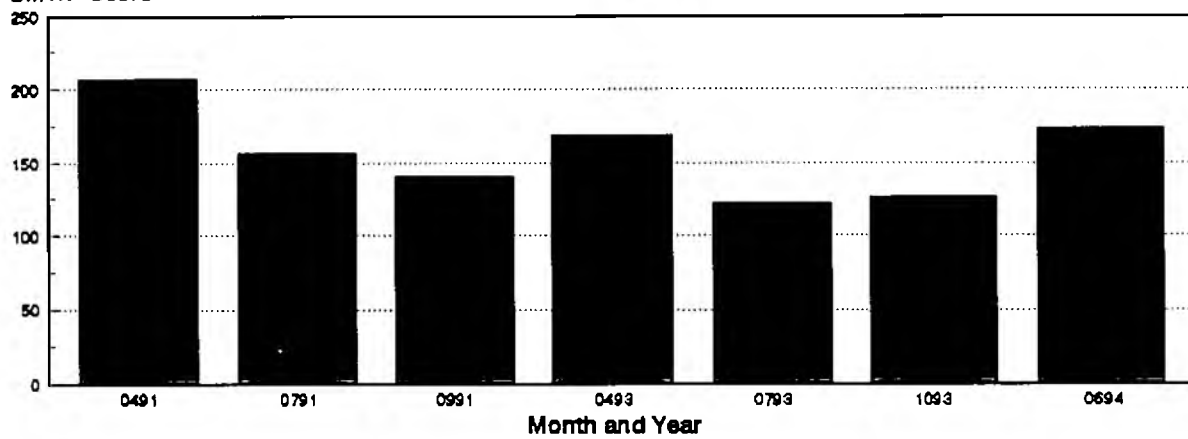
LERRYIN - Lerryn.
 NRA081510 SX14325734

BMWP Score



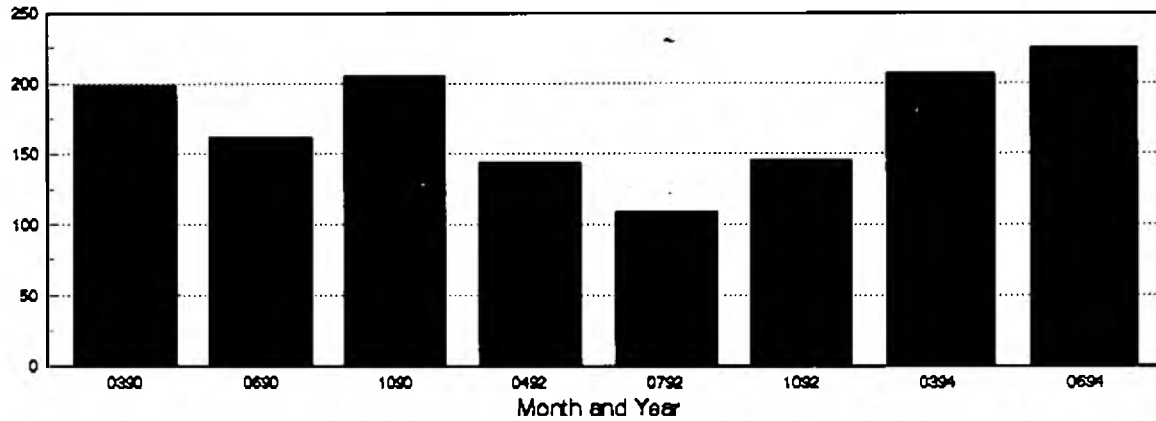
BODELLVA STREAM - Bodeonnoc.
 NRA091511 SX16505038

BMWP Score



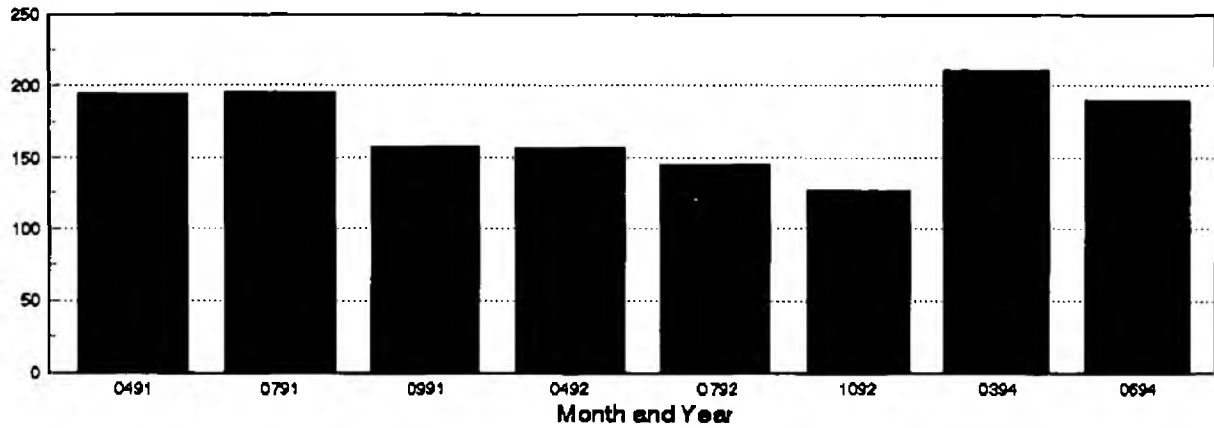
CARDINHAM WATER - Glynmlll.
 NRA051505 SX11105444

BMWP Score



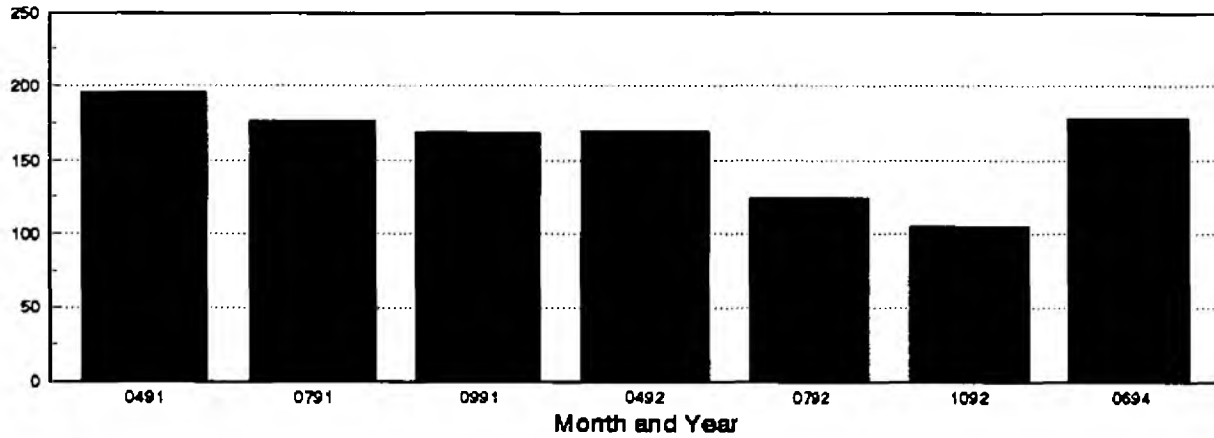
FOWEY - Draynes Bridge.
 NRA061513 6022815599

BMWP Score



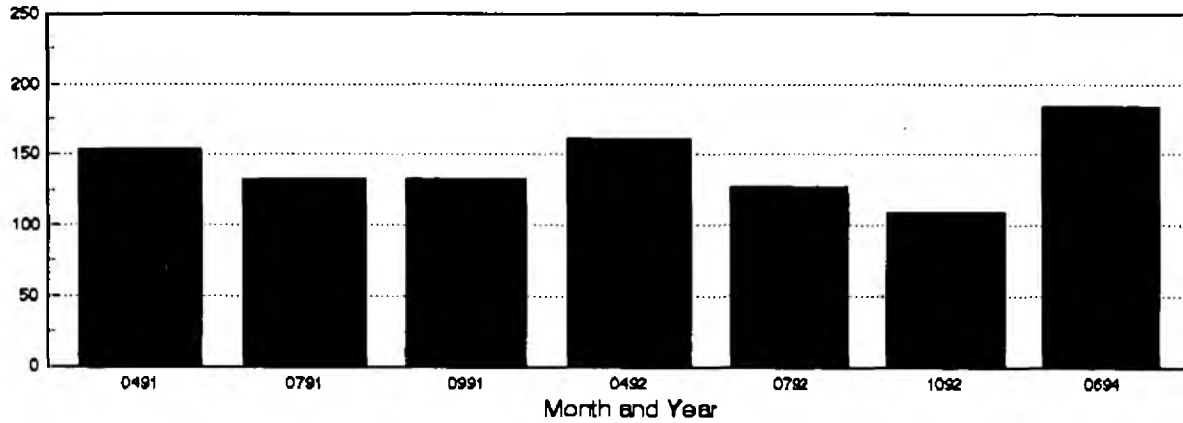
FOWEY - Treverbyn Bridge.
 NRA061514 602068764

BMWP Score



FOWEY - Bodlithle Bridge.
 NRA061515 6017836487

BMWP Score



APPENDIX F**DEVELOPMENT RESTRAINTS DUE TO PROBLEMS IN SEWERAGE INFRASTRUCTURE**

Works	River	Reason for Restraint
Fowey } Polruan }	Fowey Estuary	EC Bathing Water Directive failure
Golant } Bodinnick }	Fowey Estuary	Crude discharge to estuary
Lanreath/ Pelynt	River Pol	Non compliance with discharge consent
Darite } St Cleer } Tremar }	River Seaton	Environmental impact from effluent
Seaton		EC Bathing Water Directive failure
Downderry		EC Bathing Water Directive failure
Duloe	E Looe	Non compliance with discharge consent
E Taphouse	W Looe	Environmental impact from effluent
Looe	Looe Estuary	Non compliance & Bathing Water failure

CATEGORIES OF POLLUTION INCIDENTS

Pollution incidents are divided into four categories:

Category 1 **MAJOR**

A major pollution incident which includes one or more of the following criteria:

- a) **Persistent effect on Water Quality**
Potential or actual persistent effect on water quality or aquatic life due to a discharge or spillage to controlled waters of any substance which is likely to have a persistent impact on the use or quality of that water.
[NOTE:- Persistent for the purposes of this paper means an environmental impact in excess of 21 days.
The inclusion of potential effect allows for those incidents where extensive remedial actions have been instigated by either the NRA or others which have prevented any actual release of pollutant into controlled waters].
- b) **Closure of an abstraction**
Closure of a potable water, industrial or agricultural abstraction necessary.
- c) **An Extensive fish - mortality**
A fish mortality in excess of 100 fish of any species of particular importance to the affected waters.
- d) **Excessive breaches of Consent Conditions**
A major or repeated failure of an effluent treatment plant which results in an excessive contravention of consent conditions together with a readily observable impact on the receiving water.
- e) **Instigation of remedial measures**
The instigation of extensive remedial measures by the NRA or other organisations either to forestall pollution or to alleviate the effect of a pollution incident eg. deployment of heavy plant, fish rescue equipment or major oil containment and recovery equipment etc.
- f) **Effect on amenity value**
Potential or actual adverse effect on an EC designated bathing water or other popular bathing beach or the cancellation of an important recreational event or activity.
- g) **Effect on conservation**
Potential or actual adverse effect on a designated Site of Special Scientific Interest or other site of particular conservation importance.

APPENDIX G

Category 2 SIGNIFICANT

A significant pollution incident involving one or more of the following criteria:

- a) **Notification of abstractors**
Potential or actual impact on water quality that necessitates notifying either surface water abstractors downstream of the incident location or groundwater abstractors in the vicinity of the discharge point.
- b) **A Significant fish mortality**
A fish mortality of between 10 and 100 fish of any notable species of importance to the affected waters.

The lower limit of 10 fish can be reduced if the fish affected are of a species of particular importance to the waters affected eg. adult migratory salmonids.
- c) **Effect on Invertebrate Life**
A readily observable effect on invertebrate life.
- d) **Water unfit for stock watering**
The water quality has been reduced unfit for stock watering and the Authority has advised farmers affected.
- e) **Bed of watercourse contaminated**
The bed of the watercourse is heavily contaminated by fungal/bacterial growths, sewage debris or particulate matter.
- f) **Reduction in amenity value**
Aesthetic quality significantly affected in terms of appearance or odour so as to affect amenity value of downstream users, for example anglers or canoeists.

Category 3 MINOR

A minor pollution incident which has resulted in a localised environmental impact only. Some of the following criteria may apply:

- a) Notification of abstractors not necessary.
- b) A fish mortality of less than 10 fish of any species not of particular importance to the waters affected.
- c) No readily observable effect on invertebrate life.
- d) Water has not been rendered unfit for stock watering.
- e) Bed of watercourse locally contaminated around point of discharge.
- f) Minimal environmental impact and amenity value only marginally affected.

Category 4 UNSUBSTANTIATED

A reported pollution incident which upon investigation proves to be unsubstantiated.

GLOSSARY

ABSTRACTION

Removal of water from surface or groundwater, usually by pumping.

ADIT

Horizontal entrance into a mine or a horizontal passage.

ALLUVIAL DEPOSITS

Sedimentary deposits resulting from the action of rivers. Typically, fine grained material carried by the river and deposited in areas such as flood plains.

AQUIFER

Layer of porous rock or soil able to hold or transmit water.

BASEFLOW

The flow in a river derived from groundwater sources.

BIOACCUMULATION

Concentration of pollutant substances, such as metals, within the tissues of organisms.

BIOCHEMICAL OXYGEN DEMAND (BOD)

A measure of the amount of oxygen consumed in water, usually as a result of organic pollution.

BRYOPHYTES

Mosses and liverworts.

BUFFER ZONE

Strip of land 10-100m wide, alongside rivers which is removed from intensive agricultural use and managed to provide appropriate habitat types. Benefits include reduction of inputs into the river such as silt, nutrient, livestock waste, as well as improving habitat diversity and landscape.

CAMBIC STAGNOGLEY SOILS

Soils with a distinct topsoil and no clay-enriched sub-soil.

CONSENT

A statutory document issued by NRA under Schedule 10 of Water Resources Act 1991 to indicate any limits and conditions on the discharge of an effluent to a controlled water.

CRITICAL LOAD

The maximum load of a pollutant which a given ecosystem can tolerate without suffering adverse change. The Department of Environment has calculated critical loads for freshwaters in the UK, compared them with the non-marine inputs of sulphur, and derived maps which indicate where critical loads for acidity for freshwaters are currently exceeded. Forest planting proposals within these areas are likely to require a catchment-based assessment to determine the susceptibility of surface waters.

CULVERT

Channel or conduit carrying water across or under a road, canal etc.

GLOSSARY

CYPRINID

Fish akin to, or like carp i.e. coarse fish

DE-WATERING

Removal of groundwater to reduce flow rate or diminish pressure.

DROUGHT ORDER

Drought Orders are made by the Secretary of State upon application by the National Rivers Authority or a water undertaker, under powers conferred by Act of Parliament, to meet deficiencies in the supply of water due to exceptional shortages of rain. The terms and conditions under which Drought Orders may be obtained are given in Sections 73-81 of the Water Resources Act 1991. Drought Orders are sub-divided into "Ordinary" and "Emergency" Drought Orders. An "Ordinary" Drought Order could contain provisions such as; to authorise abstraction from an unlicensed source, override the conditions pertaining to an abstraction licence, limit the amount of water which may be taken from a source or vary discharge conditions. An "Emergency" Drought Order might allow the prohibition of use of water for particular purposes, to allow a ban on non-essential use of water (for example in car washes) or to introduce the use of stand-pipes.

ECOSYSTEM

A functioning, interacting system composed of one or more living organisms and their effective environment, in a biological, chemical and physical sense.

ENVIRONMENTAL QUALITY STANDARD (EQS)

The quantity of a substance found in a body of water which should not be exceeded in order to protect a given use of the water body. An EQS is set by the European Community through EC Directives and the government.

ENVIRONMENTALLY SENSITIVE AREA (ESA)

Area where the landscape, wildlife and historic interest are of national importance. Payments are made by Agriculture and Fisheries Departments for appropriate sensitive land management.

EVAPOTRANSPIRATION

Loss of water by land plants due to evaporation.

FAULT

Plane surface of fracture in a rock body, along which observable relative displacement has occurred between adjacent blocks.

FISSURE

A crack or open break in rocks.

FLUVIAL

Pertaining to river flow and its erosive activity.

GLEYSOILS

One of the seven major groups in the soil classification of England and Wales. They are characteristically affected by periodic or permanent saturation by water in the absence of effective artificial drainage.

GROUND TRUTHING

Investigations to check that the situation on the ground matches desk-top studies.

GLOSSARY

HYDROGEOLOGY

Branch of geology concerned with water within the Earth's crust.

LEACHATE

Solution formed when water percolates through a permeable medium. Can be mineral-rich, toxic or even carry bacteria.

MACROINVERTEBRATE

A large invertebrate eg. jellyfish, snail, fly.

MAIN RIVER

Some, but not all, watercourses are designed as 'Main River'. 'Main River' status of a watercourse must be first be approved by MAFF. Statutory (legally binding) maps showing the exact length of 'Main River' are held by MAFF in London and the NRA in Regional Offices. The NRA has the power to carry out works to improve drainage or protect land and property against flooding on watercourses designated as 'Main River'. The NRA do not have the legal power to spend public funds on drainage or flood protection works on watercourses not designated as 'Main River'.

METAMORPHIC AUREOLE

The area around an intruded magmatic body where the country rock has been altered and affected by the heat.

MITIGATION

Rearing of stock salmonids to compensate for loss of juvenile production as a result of major impoundments (dam construction).

PERMEABILITY

The ease at which liquids (or gases) can pass through rocks or a layer of soil.

PODZOLIC SOILS

Well drained black or dark brown soils, with a compact subsurface horizon enriched in humus and normally overlain by a bleached layer.

POROSITY

The volume of water which can be held within a rock or soil, expressed as the ratio of the volume of the voids to the total volume of the material.

POTABLE

Water of a suitable quality for drinking.

Q95

The flow that on average is equalled or exceeded for 95% of the time.

REDD

Hollow created in river bed gravels by spawning salmonid fish into which the female deposits ova.

RED LIST SUBSTANCE

Substance which has been selected for monitoring on the basis of its persistency, toxicity and ability to bioaccumulate.

GLOSSARY

RIFFLE

Stony or gravelly part of river bed shallow in dry flow. Fast streams on most non-chalk areas have alternating riffles and pools.

RIPARIAN OWNER

Owner of riverbank and/or land adjacent to a river. Normally owns riverbed and rights to midline of channel.

RIPARIAN ZONE

Zone alongside watercourse stretching from top of channel to next change in land form (most often banks) or vegetation type.

RIVER CORRIDOR

Land which has visual, physical or ecological links to a watercourse and which is dependent on the quality or level of the water within the channel.

RIVER QUALITY OBJECTIVE (RQO)

The level of water quality that a river should achieve in order to be suitable for its agreed uses.

SALMONID

Game fish of the salmon family eg. salmon, trout and sea trout.

SMOLTS

Young salmon migrating to sea for the first time.

TASK FORCE

An intensive investigation of possible sources of pollution following non-compliance in the catchment.

UNITS

mm	Millimetres
m	Metres
km	Kilometres
km ²	Kilometres squared
persons/km ²	Number of people per kilometres square
ha	Hectares
m ³ /s	Cumecs; cubic metres per second
m ³ /day	Cubic metres per day
Ml/day } Ml/d }	Megalitres per day
Ml/y	Megalitres per year
Kg/day	Kilogrammes per day
tonnes	Metric tonnes
%	Percentage
>	Greater than
≥	Greater than or equal to
<	Less than
≤	Less than or equal to

ABBREVIATIONS

ABBREVIATIONS:

AGLV	Areas of Great Landscape Value
ALF	Alleviation of Low Flow
AMP2	Asset Management Plan 2
AOD	Above Ordnance Datum
AONB	Area of Outstanding Natural Beauty
BASIS	British Agro-chemical Standards Inspection Scheme
BCU	British Canoe Union
BOD	Biochemical Oxygen Demand
BR	British Rail
CAP	Common Agricultural Policy
CBPS	Cornwall Birdwatching and Preservation Society
CBRU	Cornwall Biological Records Unit
CC	Countryside Commission
CCC	Cornwall County Council
CLA	Country Landowners Association
CMP	Catchment Management Plan
CNC	Cornwall Nature Conservation
CPRE	Council for the Protection of Rural England
CWT	Cornwall Wildlife Trust
DoE	Department of the Environment
DLG	Derelict Land Grant
EC	European Commission
ECC	English China Clays
EN	English Nature
EQS	Environmental Quality Standards
ERLOS	Emergency Response Levels Of Service
ESA	Environmentally Sensitive Areas
FA	Forestry Authority
FC	Forestry Commission
FDMF	Flood Defence Management Framework
FE	Forestry Enterprise
GATT	General Agreement on Trade and Tariffs
GQA	General Quality Assessment
GIS	Geographical Information System
HC	Harbour Commissioners
HMIP	Her Majesty's Inspectorate of Pollution
LNR	Local Nature Reserve
LOE	Licence of Entitlement
LOR	Licence of Right
LPA	Local Planning Authority

ABBREVIATIONS

MAFF	Ministry of Agriculture, Fisheries and Food
MMC	Mergers and Monopolies Commission
NFU	National Farmers Union
NGR	National Grid Reference
NLO	Net Limitation Order
NNR	National Nature Reserve
NRA	National Rivers Authority
NSA	Nitrate Sensitive Area
NT	National Trust
NVZ	Nitrate Vulnerable Zone
NWC	National Water Council
OFWAT	Office of Water Services
PCB	Poly Chlorinated Biphenyls
R&D	Research and Development
RCS	River Corridor Survey
RE	River Ecosystem, RE1, RE2 etc.
RHS	River Habitat Survey
RQO	River Quality Objectives
RSPB	Royal Society for the Protection of Birds
SAGLV	Special Area of Outstanding Natural Beauty
SAM	Scheduled Ancient Monuments
SSO	Storm Sewer Overflows
SSSI	Sites of Special Scientific Interest
STW	Sewage Treatment Works
SWQO	Statutory Water Quality Objective
SWWSL	South West Water Services Limited
S105 Surveys	Section 105 of the Water Resources Act allows for Standards of Service, Assets and Flood Risk Surveys
UWWTD	Urban Waste Water Treatment Directive
WQO	Water Quality Objectives
WRA	Waste Regulation Authority
WT	Woodland Trust
WTW	Water Treatment Works

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