LOWER WITHAM CATCHMENT MANAGEMENT PLAN CONSULTATION REPORT

NRA

National Rivers Authority
Anglian Region

JUNE 1995

ENVIRONMENT AGENCY

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LOWER WITHAM CATCHMENT MANAGEMENT PLAN

CONSULTATION REPORT

JUNE 1995

Please respond with your comments to:-

Catchment Planning Officer
National Rivers Authority
Northern Area
Aqua House
Harvey Street
Lincoln
LN1 1TF

Tel: 01522 513100

LOWER WITHAM CATCHMENT MANAGEMENT PLAN

FOREWORD

The National Rivers Authority, NRA, was created in 1989 as an independent environmental watchdog. It has as its prime purpose the protection and improvement of the aquatic environment throughout England and Wales.

In achieving this purpose the NRA seeks to effectively manage water resources, substantially reduce pollution, and provide effective flood defence for people and property. It aims to operate openly and balance the interests of all who benefit from and use rivers, groundwaters, estuaries and coastal waters.

The NRA has chosen to develop the concept of Catchment Management Planning to help it achieve its aims. A Catchment Management Plan (CMP) treats a river, together with the land, tributaries, and underground water connected with it, as a discrete unit or catchment. The approach considers all major uses which impact upon the water environment in a catchment. It seeks to identify and resolve problems within the catchment in an integrated way, developing a partnership approach, where appropriate, towards dealing with those problems.

This document marks the start of that process by inviting the public and all organisations with an interest in the water environment to comment on its contents, to identify their concerns for the Lower Witham Catchment, and to suggest any options for their solutions.

For catchment planning purposes, the River Witham Catchment has been split into the Upper and Lower Witham Catchment Plan areas. A plan for the Upper Witham is scheduled for completion in January 1997. It is recognised that in many aspects the two Plans are inextricably linked and that where that is the case, they will be managed as one.

The Lower Witham Catchment includes some of the most productive and intensively farmed arable land in England. The conversion and use of land for agricultural purposes over the centuries has significantly transformed what would have been a bog and marsh environment, subject to regular inundation and a haven for wildlife, to a flat featureless landscape protected from inundation by manmade flood defences. It is characterised by its artificial drainage systems giving the fenland great economic, but little environmental value. The Catchment is sparsely populated - its two main towns being Boston and Sleaford.

In the west of the Catchment, the limestone ridge which forms part of the Lincoln Edge slopes gently towards the fens. This limestone forms a significant aquifer which is extensively used for water supply.

VISION FOR THE CATCHMENT

The NRA's vision for the Lower Witham Catchment is to work towards the sustainable management and protection of surface and groundwaters, improvement of the water environment and the provision of effective flood defences and land drainage.

To achieve this vision the NRA will seek to remedy the issues identified in this Plan.

Key objectives will be:

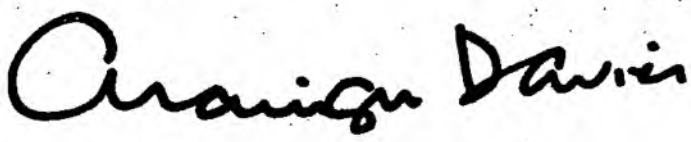
: to protect the catchment from the particular risks of tidal and fluvial flooding, specifically by improving tidal defences to accommodate rising sea levels and by maintaining the integrity of embanked watercourses

: to protect and improve the conservation and amenity value of the River Slea by addressing the problems of poor water quality and low flows

: to continue to protect the quality of groundwater which is used for Public Water Supply

: to improve the conservation value of the water environment by improving habitat diversity along watercourses and by reducing salinity in the lower reaches of the larger watercourses.

Following the consultation period for this plan which will give interested parties an opportunity to express their views and opinions, a more focussed "vision" for the catchment will be developed. This will be incorporated into the Action Plan for the Lower Witham Catchment to be published in December this year.



GRAINGER DAVIES
REGIONAL GENERAL MANAGER

26 June 1995

LOWER WITHAM CATCHMENT MANAGEMENT PLAN

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1. CONCEPT AND PROCESS

The water environment is increasingly becoming a focus for a range of passive and (inter) active uses and activities. The National Rivers Authority is the major environmental protection agency responsible for examining the interaction between such activities and uses, and the water and associated land environment, reconciling any conflicts that may arise, and generally protecting, and where possible improving, the water environment for the benefit of future generations.

The NRA's responsibilities are wide reaching and include:

- effective management of water resources;
- control of pollution and improving the quality of rivers, groundwaters and coastal waters;
- flood defence, including the protection of people and property;
- maintenance, improvement and development of fisheries;
- conservation and enhancement of the natural water environment;
- promotion of water-based recreation including navigation.

The NRA has developed the concept of Catchment Management Planning as an efficient and effective approach to the consideration of the full range of water management issues, which are considered within a geographical area to be relevant and meaningful.

Catchment Management Plans (CMPs) enable individual catchment needs to be taken into account in the management decisions which aim to make real improvements at local level to meet the community's needs. This process of integrated catchment management will enable resources to be targeted where they are most needed.

In managing catchments the NRA aims to:-

- manage water resources to achieve the right balance between the needs of the environment and those of the abstractors;
- control pollution, respond promptly to pollution incidents, and work with dischargers to achieve improvements;
- provide effective defence for people and property against flooding from rivers and the sea, including provision of flood warnings;
- develop fisheries, promote recreation and navigation and conserve and enhance wildlife;

- determine, police, enforce and review the conditions in water abstraction licences, discharge consents, and land drainage consents to achieve operational objectives;

- influence planning authorities to control development to meet NRA objectives for protecting and enhancing the water environment.

The preparation of a CMP will require NRA to:-

- identify the catchment uses and physical attributes;

- set targets for a range of catchment uses;

- compare existing targets with the current status of the water environment to identify shortfalls;

- identify issues and options to address the shortfalls;

- undertake consultation on the uses, targets, issues and options;

- prepare an action plan to address the issues;

- implement the action plan and maintain on-going monitoring and review of the plan.

In producing the CMP the NRA recognises that to achieve its aims it must seek to influence and work with central government, industry, commerce, local authorities, farming, conservation bodies and the general public. It must also take account of other ongoing initiatives such as the production of Development Plans and Water Level Management Plans. An important step in the CMP process is the public consultation on the NRA's draft plan.

Through detailed consultation with all interested organisations the NRA seeks to:

- confirm the range and extent of catchment uses and activities;

- obtain views on the issues facing the water environment identified in the Report;

- begin the process of identifying action plans;

- ensure decisions on the future management of the catchment are based on a wide range of views from interested parties.

The publication of this consultation report marks the start of a three month period of formal consultation. This will enable external organisations and the general public to work with the NRA in planning the future of the water environment in the Lower Witham Catchment.

A CMP will be produced for the Upper Witham Catchment during 1996/7. The NRA recognises there will be links between that and this Lower Witham CMP and will ensure the two are compatible.

FEEDBACK ON THE PLAN

The NRA positively welcomes feedback on this plan.

When commenting on this document the NRA requests that organisations and the general public will consider both points of detail and the following questions:

- have the issues been adequately assessed?
- what are the opinions of consultees on these issues and the options identified?
- are there any issues or options which have not been identified?

The consultation period for the plan ends on Tuesday, 26 September 1995. Those wishing to comment should write to the following address:

Catchment Planning Officer, National Rivers Authority, Northern Area, Aqua House, Harvey Street, Lincoln, LN1 1TF.

Following the consultation period the NRA will produce an Action Plan which will form the basis for both the NRA's and other partners' actions within the catchment over the following 5 year period. The NRA will seek the commitment to planned actions by others where necessary.

A summary of the CMP process and relevant timescales for the Lower Witham CMP are shown in Table 1 (Page 4).

TABLE 1 - THE CATCHMENT PLANNING PROCESS
LOWER WITHAM CATCHMENT TIMETABLE

NRA CMP Team Formed	December 1994
NRA identify catchment uses, catchment current state, catchment targets and catchment shortfalls against targets	
NRA initial thoughts on catchment issues	
Pre-Consultation with: - Angling Interests - Conservation Interests - Planning Authorities - Navigation Interests - Water Companies - Industry - NFU - County Archaeologists	January-March 1995
< Feedback	
Completion and Launch of Draft Consultation Document	June 1995
Full Public Consultation	June - September 1995
< Feedback	
NRA Produce Action Plan with 5 Year Horizon	December 1995
Annual Monitoring	Ongoing 1996 → 1999
Review	2000

During each of the development stages of this Plan, the NRA works in close liaison with its customer consultative committee, the Lincolnshire Catchment Panel.

The NRA would like to acknowledge the help received from those organisations and their representatives who have contributed towards the development of this Consultation Document.

The Other Players

In addition to the NRA there are many other bodies and organisations which have an important role to play in improving the water environment. The NRA also has a wide range of customers with whom it has contact or to whom it provides a service. These include the general public and many representative groups and businesses that form part of the community in the catchment. The following organisations have key responsibilities relevant to the protection of the water environment in the Lower Witham catchment:

- Department of Environment (DoE) are sponsors of the NRA.
- Ministry of Agriculture, Fisheries and Food (MAFF) are also sponsors of the NRA and have an important role in flood defence, fisheries and agricultural pollution. MAFF are responsible for administrating Nitrate Sensitive Areas and Nitrate Vulnerable Zones.
- English Nature (EN) are responsible for the protection and management of SSSIs.
- Countryside Commission are responsible for conservation of landscape.
- Anglian Water Services Ltd (AWSL) are responsible for water supply and sewage disposal.
- Local Authorities (LA's) have a role in environmental health and land drainage and are responsible for dealing with planning (including minerals), and waste disposal.
- Industrial and Trade Associations such as Confederation of British Industry (CBI) and National Farmers Union (NFU) etc. - have an important role, via their members, in the alleviation of pollution risks.
- Angling and Recreation Groups act as vital watchdogs.
- Her Majesty's Inspectorate of Pollution (HMIP) is responsible for authorising industrial processes under Integrated Pollution Control.
- Internal Drainage Boards (IDB) are responsible for supervision of land drainage within defined districts.
- Industry Water Companies and Agriculture are the principal water abstractors and effluent dischargers in the catchment.
- British Waterways are the navigation authority on the River Witham.

- Inland Waterways Association seeks to promote the development and use of waterways for navigation, other recreation and amenity purposes.

- The Port of Boston is responsible for operating port facilities.

- Land and Riparian Owners are responsible for aspects of land and river management/maintenance.

- The Media can readily influence public opinion.

- Pressure Groups can also influence public opinion on environmental matters.

- The Public who use, enjoy and have an interest in the water environment.

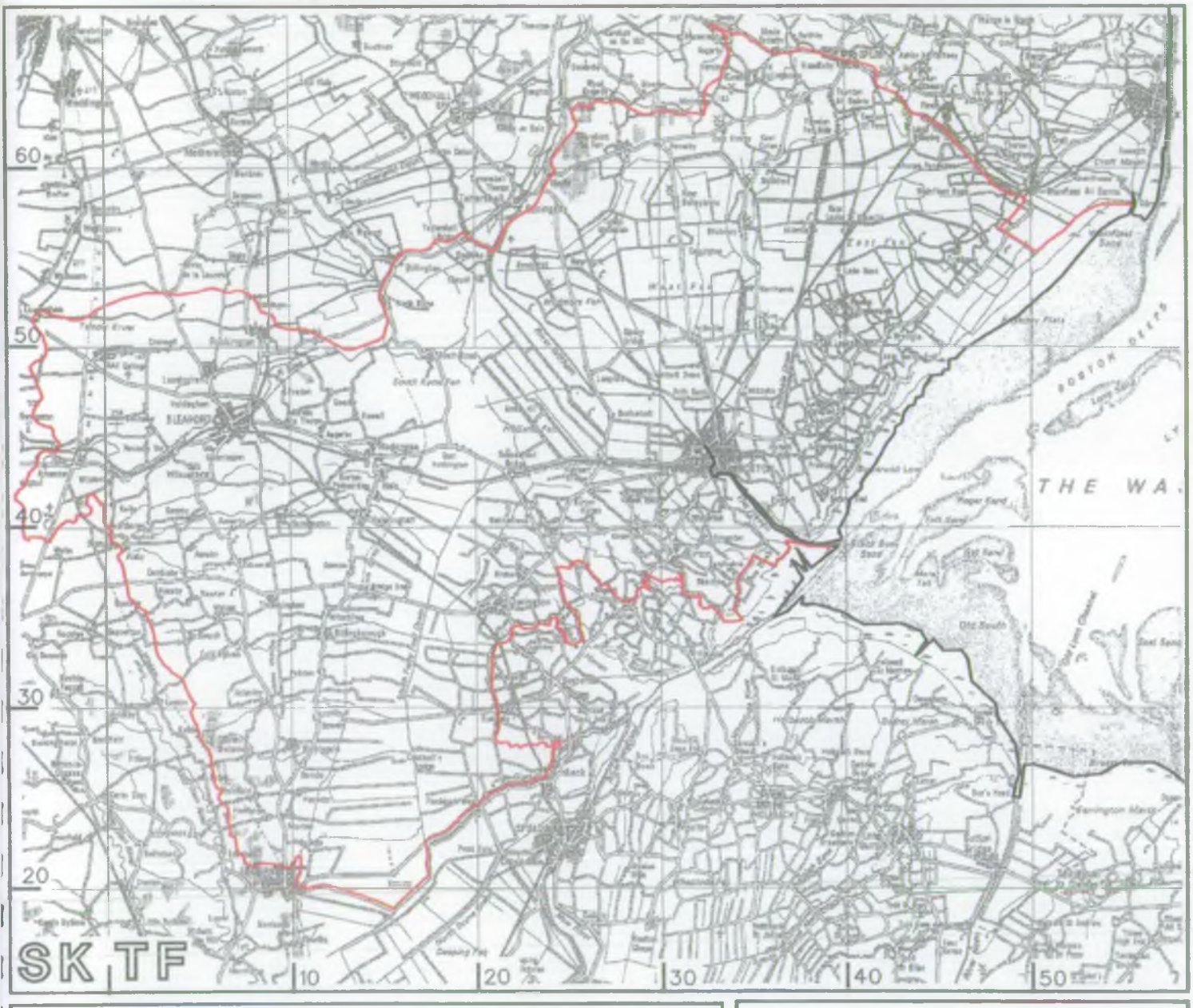
- Voluntary Conservation Bodies provide specialist advice to the other players.

- Farming and Wildlife Advisory Group (FWAG) provide advice and assistance to the farming community on matters associated with wildlife and the environment.

- Country Landowners Association (CLA) represent landowners on issues and consultations which affect their interests.

THE LOWER WITHAM CATCHMENT MANAGEMENT PLAN

MAP NUMBER 1
JUNE 1995



KEY

— CATCHMENT BOUNDARY
— TIDAL DEFENCES

THE LOWER WITHAM CATCHMENT

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2. OVERVIEW

2.1 INTRODUCTION

The Lower Witham Catchment covers a large part of South Lincolnshire. It has a total surface area of 1370 square kilometres. The area is characterised by large areas of flat fenland, much of which is close to or below sea level. Without artificial coastal and river defences much of the area would be marshland inundated by the sea.

The only significant higher land in the catchment is to the west of a line between Sleaford and Bourne. The Lincolnshire Limestone which forms a prominent feature in Lincolnshire outcrops to the west, north and south of the catchment. The land also rises to the north east of the catchment towards the Lincolnshire Wolds.

The catchment only contains two towns of any size - Boston, which is also a port, and Sleaford. The area is largely rural with little industrial development of any significance. It is highly developed agriculturally especially on the fens where double harvesting is commonplace. Its ongoing agricultural development is symptomised by land reclamation schemes along the coastline undertaken in recent years.

The River Witham which is an embanked channel dissecting the catchment is the principal river carrying upland waters from the Upper Witham catchment. The low lying fens on either side of this river are essentially drained by networks of smaller drains maintained by Internal Drainage Boards (IDB's) discharging to both main river and directly to tidal waters. The River Slea is the only river in this catchment to discharge to the River Witham above the tidal sluice at Boston, in its upper reaches it is more typical of a "natural" river system.

The Lincolnshire Limestone provides an important source of groundwater for public water supply in the west of the catchment.

The agricultural industry within this catchment plays a significant role both in terms of its economic welfare and in terms of its impact upon the physical environment. Two hundred years ago vast tracks of land would have been permanently under water, reedswamp or seasonally flooded - today in its place is rich, productive farmland which sustains the local economy and is of strategic importance to the nation.

This transformation has been at a significant cost in terms of wildlife - today less than 10 acres of natural fenland remains within this catchment and its associated flora and fauna, once regarded as common, are under threat.

The key objectives for this catchment are:

1. to maintain sea defences against the backdrop of rising sea levels.

2. to maintain an equitable share of water between its various users and the needs of the water environment.

3. to work in partnership with others to secure and maintain real improvements in the water environment.

Map No. 1 shows the Catchment Area.

2.2 HYDROLOGY

The Lincolnshire Limestone outcrops to the west of Sleaford and to the west of the catchment forming a permeable recharge area for the limestone aquifer. Spring flows from this aquifer support both the River Slea system and, outside this Catchment (to the west) the River Glen.

The higher land to the south of Sleaford drains via a series of embanked highland carriers to the South Forty Foot Drain. The Wolds in the north of the Catchment drain via the East and West Fen Catchwater system - also embanked.

Low lying land to the west and south of the Witham drains via a system which is pumped to the South Forty Foot Drain, to the east of the Witham it predominantly discharges to the Hobhole into the tidal length of the River Witham. Along a narrow coastal strip some waters are pumped directly into the Wash.

2.3 HYDROGEOLOGY

The principal aquifer is the Lincolnshire Limestone, which outcrops to the west of Sleaford and to the west of the catchment. It has a maximum depth of 30 metres and dips to the east where it is progressively overlain by an increasing thickness of clays and alluvium. From its outcrop, rainfall replenishing the limestone percolates to the water table and moves eastward where it is discharged as spring flows or drawn towards abstractions in the Sleaford area and fens west of the South Forty Foot.

Boreholes drilled into the aquifer are an important source of groundwater. In many areas the water in the confined limestone is under artesian pressure.

South of the River Slea catchment there are no significant spring flows and some old boreholes have run out of control discharging at times, significant flows to local watercourses. Many have been identified and now sealed or regulated.

To the east of the South Forty Foot river, water in the limestone aquifer is saline and not usable; in the fens to the east of the River Witham there is a considerable thickness of clay and no significant aquifer exists.

In the north of the Catchment a small area of Spilsby Sandstone outcrops providing spring flows to the Hagnaby Beck and East Fen Catchwater. The Chalk outcrops have no significant impact on the Catchment.

2.4 HYDROMETRIC NETWORK

The NRA operates an extensive network of hydrometric stations and boreholes to measure and record rainfall, river levels and flows, groundwater levels and tide levels.

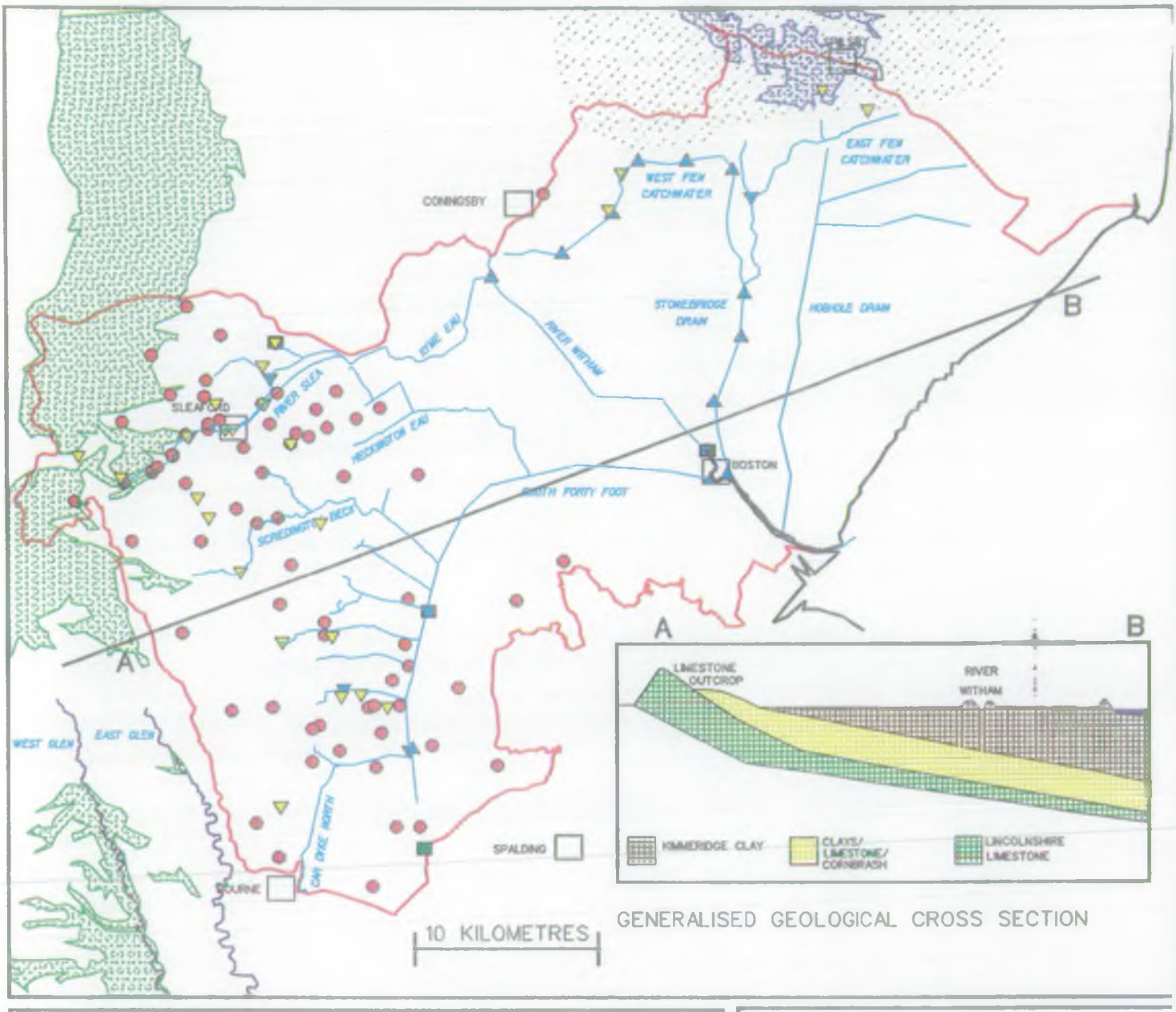
Internal Drainage Boards monitor drain levels in their drainage systems.

For flood warning and forecasting purposes a number of rainfall, river flow and tide level sites are connected to the Authority telemetry system.

Map No. 2 shows geological and hydrometric details of the catchment.

THE LOWER WITHAM CATCHMENT MANAGEMENT PLAN

MAP NUMBER 2
JUNE 1995



GENERALISED GEOLOGICAL CROSS SECTION

KEY

- CATCHMENT BOUNDARY
- TIDAL DEFENCES
- WATERCOURSE
- RAINGAUGES
- RIVER FLOW GAUGING STATIONS
- RIVER LEVEL GAUGING STATIONS
- OBSERVATION BOREHOLES
- SPRINGFLOW MONITORING POINT
- LINCOLNSHIRE LIMESTONE
- SPILSBY SANDSTONE
- THE WOLDS

GEOLOGICAL AND HYDROMETRIC DETAILS

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2.5 WATER RESOURCES

The availability of water in the Catchment is determined by the hydrogeology and potential storage of surface water. Much of the Catchment is clay and surface water run-off is an important factor.

The only aquifer of any importance is the Lincolnshire Limestone, which is an important source of groundwater in the Catchment. Its contribution to surface water is limited during summer months.

The aquifer is highly developed for public water supply purposes and in smaller volumes for private supplies in the Fens (west of the South Forty Foot Drain) for domestic and agricultural purposes. The resources of the aquifer are fully committed to existing licences and there is little scope for further development.

The River Witham is the most important surface water resource. The natural summer flows in the Witham are limited and are subject to significant demands upstream of this Catchment. In order to meet demands the Authority can augment flows in the river by the transfer of water from the River Trent at Torksey. This allows existing demands within this Catchment to be met.

Extensive lengths of drains east of the Witham are used each summer to store water for irrigation purposes. The lowland system is filled in the spring of each year from the River Witham at Antons Gowt, near Boston, and subsequently augmented with licensed transfers at Dogdyke, near Conningsby, as required. Winter storage of water for irrigation is encouraged by the NRA in preference to summer water abstraction.

Most water abstractions are controlled by abstraction licences issued by the NRA under the Water Resources Act 1991 (previously the Water Resources Act 1963). Surface and groundwater sources developed before 1963 were granted licences of right under the Water Resources Act 1963. Abstraction licences granted since 1963 are only issued if there is sufficient water available, the need for the water is justified, all rights of existing uses are protected and the water environment, eg. rivers, springs and wetland sites, will not be unacceptably affected.

Seasonal low flows in many of the Catchment's watercourses impact on water quality and upon flora and fauna, this is reflected in a number of issues in this Plan.

2.6 WATER QUALITY

Surface Water

River Quality Surveys carried out for the years 1992 - 1994 inclusive indicate water quality within the Catchment was mostly of fair quality. Exceptions to this are the Old River Slea below Sleaford, which is affected by low flows and the discharge from the Sleaford Sewage Treatment Works; the Frampton Town Drain, which is also affected by the discharge from Frampton Sewage Treatment Works and by eutrophication; and the Hobhole Drain affected by both eutrophication and saline intrusion.

The slow moving and shallow nature of the lowland watercourses, and the nutrient-rich run-off from agricultural land cause many of the watercourses to become eutrophic. Other influences upon water quality in the catchment include localised pollution from inadequate village sewage disposal systems, intermittent pollution to surface water from landfill sites, and isolated pollution incidents. Salinity in the lower reaches of some watercourses poses a problem for fish populations and spray irrigators during periods of low flow. Water quality within the tidal length of the River Witham is good.

Groundwater

The catchment includes part of the Lincolnshire Limestone Aquifer, which is extensively developed for public water supply by Anglian Water Services and, to a limited degree, for industrial use in the Sleaford area.

Groundwaters in parts of the aquifer are affected by high nitrate concentrations and some areas are designated Nitrate Vulnerable Zones and Nitrate Sensitive Areas.

2.7 FLOOD DEFENCE

Tidal Defences

The catchment has 22 kilometres of tidal and 20 kilometres of sea defences which protect approximately 813 square kilometres of predominantly agricultural land and the town of Boston which lie below the highest astronomical tide levels of 4.9 metres AOD.

Maintaining the integrity of these defences is of vital importance for the protection of both land and people, particularly against the background of rising sea levels.

The gradual reclamation of land over the centuries - some as late as the 1970s - has involved the successive construction of sea defences along the coastline seaward of their previous lines.

The condition of some of these sea defences now gives cause for concern and a strategy to address their maintenance or replacement is now required.

Fluvial Defences

The main arterial watercourses for this catchment - the Witham, South Forty Foot Drain and the Maud Foster system (including the Stonebridge Drain and the East and West Fen Catchwaters) are embanked to prevent flooding of low lying land. These watercourses carry highland waters from the whole of the Witham Catchment across the fens to discharge to tidal waters through structures designed to prevent the influx of tidal waters. The condition of some lengths of embanked river defences, notably along the Witham and Maud Foster, are inadequate for the land use protected.

The system of flood protection/land drainage maintained by the NRA is complemented by an extensive network of drainage channels maintained by the Witham Fourth, Black Sluice and Witham First Drainage Boards. The importance of the agricultural industry to this area makes the effectiveness of both fluvial defences and land drainage a key feature of this plan.

Outside Internal Drainage Board areas, localised flooding occurs due to the inadequate maintenance of watercourses by riparian owners and the insufficient capacity of some watercourses to accommodate the increased run-off which follows uncontrolled development.

2.8 FISHERIES, RECREATION, CONSERVATION, AND NAVIGATION

Fisheries

The catchment is characterised by slow moving watercourses and seasonal fluctuations of river levels dictated by flood defence and agricultural requirements. Regular and extensive surveys are carried out on the catchment's watercourses which indicate healthy fish populations which is reflected in the popularity of the catchment with anglers.

The fish species to be found are typical of lowland rivers, ie roach, bream and pike. Brown Trout are found in the River Slea which is an 'upland' springfed tributary of the Witham.

During low flow periods the lower reaches of the major watercourses can suffer from saline intrusion causing fish mortalities. The River Slea, in particular, suffers from low flows - during drought periods lengths of the Slea dry up, environmental circumstances change and fish populations suffer accordingly.

Recreation

Recreational use of the water environment is extensive. The Witham, in particular, is popular with anglers, as a navigable waterway, and as a general amenity area with public footpaths. Other activities enjoyed include birdwatching, sailing, canoeing, and along designated lengths of river bank, horse riding.

The coastline and marshland adjacent is an internationally important Nature Reserve and asset to the catchment.

There also exist numerous enclosed still waters which are used for both coarse and trout fishing.

Conservation

The Wash Estuary and parts of the immediately adjacent coastal plain contain a number of conservation areas of National and International importance. For the purposes of the Lower Witham Catchment Management Plan any issues related to this area have been dealt with in the Wash Estuary Management Plan which was published in December 1994. (A copy of this Plan may be obtained by contacting the NRA at the address given at the front of this Plan.)

Elsewhere within the low lying areas of the catchment, modifications to the river and drainage systems for land drainage purposes have resulted in degraded "in-channel" habitat and aquatic plant diversity and the loss of natural fenland habitat. These waters are also naturally eutrophic exerting further constraints on bio-diversity. This situation is accentuated by the maintenance of low winter water levels in many of the watercourses.

In upland zones in the west and north of the catchment, areas of mixed farming include some sizeable woodlands, some of which are Sites of Special Scientific Interest.

As part of a new MAFF initiative and in order to give important water dependant SSSIs due consideration for their future well-being, interested parties, including English Nature and those drainage authorities operating in areas where SSSIs exist, have been tasked to produce Water Level Management Plans (WLMPs) for identified sites.

Within this catchment the Wilsford and Rauceby Warren SSSI near Sleaford may require such a Plan. If this is the case, a plan will be produced during the summer of 1995 led by the Witham First IDB.

Navigation

The port of Boston is home to a small fishing fleet and provides dock facilities for vessels up to 3000 tonnes. The River Witham is a navigable waterway and provides a route from Boston and the Wash to Lincoln and beyond - its use is predominantly recreational. The navigation authority for the Witham, between Boston and Lincoln, is British Waterways.

The River Slea/Kyme Eau, which joins the Slea at Chapel Hill, is currently navigable as far as Cobblers Lock, Anwick, subject to river levels. Proposals are being considered by the Slea Navigation Society to extend the Slea Navigation upstream to Sleaford. These proposals which could be of both recreational and commercial benefit to the area could have other impacts upon the water environment.

Limited recreational use is also made of drains maintained by the Witham Fourth Internal Drainage Boards and the Maud Foster system, although they are collectively recognised as the "Witham Navigable Drains". The body responsible for the navigation along the Maud Foster is unclear.

2.9 LAND USE/DEVELOPMENT

The vast majority of land within the Catchment (around 96%) is used for agricultural purposes. Much of this is highly productive and versatile. Crops grown include cereals, potatoes, beet, and vegetables; bulbs and flowers grown in the open are also an important feature; 8% of the total agricultural land was set aside in 1993.

The catchment is situated within the administrative boundaries of Lincolnshire County Council, Boston Borough Council, and the District Councils of East Lindsey, North Kesteven, South Holland, and South Kesteven.

The two main population centres are at Boston and Sleaford - the historical drift of population away from rural to urban areas continues. Industry and employment within the catchment is closely allied to the farming sector. The port of Boston is home to a small fishing fleet and provides a link with Europe and beyond.

The catchment is served by roads whose historical constraint of river crossings is still evident today, they form an essential link for the transport of goods beyond the catchment - much of the farm produce being sent to the markets in London. Proposals to improve the road infrastructure by extending the M11 motorway into Lincolnshire are for the moment on hold. The proximity of Sleaford to the A1, and the railway link to London and Lincoln, makes it attractive to commuters in the East Midlands and London.

3. CATCHMENT USES

Introduction

This section identifies those activities and uses within the Catchment which have an impact upon the water environment. They are important to the NRA who, as the major player in this field, have to consider all their needs when making decisions affecting the water environment.

3.1 ABSTRACTION

General

Water is abstracted for use for public water supply, general agriculture, domestic, spray irrigation and industrial purposes. All major abstractions of water whether from groundwaters, surface waters or tidal waters are required to be licensed by the NRA to ensure a balanced and sustainable use of resources.

The largest number of licences are for agriculture and spray irrigation use from both groundwater and surface water sources. The demand for water for industrial use within this Catchment is relatively small. The largest demand for water is for Public Water Supply.

The total licensed quantity for abstraction is 20309 thousand cubic metres per annum (tcma). In 1993, actual abstraction amounted to 13165 tcm that is 64% of total licensed quantity.

Map No. 3 shows key abstraction details.

3.1.1 Public Water Supply

Water may be abstracted for use from either surface waters, ie rivers and springs, or from groundwater sources, ie boreholes. The public water supply is used for industrial, commercial and domestic purposes (ie drinking, washing, etc). The public water supply system in this catchment is operated by Anglian Water Services Ltd (AWS).

Groundwater is the major source of water for public water supplies in the catchment taken from boreholes operated by AWS. Water taken from these borehole sources is used almost entirely to meet domestic demand. The quality of water abstracted from the Lincolnshire Limestone suffers from high nitrate levels. In some sources water is blended with low nitrate to comply with EC limits.

There are no surface water abstractions for public water supply within this catchment. However, some water is supplied to the catchment for potable use by AWS derived from surface waters from Rutland Water via Saltesford near Grantham. Potable water is also imported to the fenland area, east of the River Witham originating from groundwater sources in the Louth Catchment.

The total licensed abstraction for public water supply use is 13790 tcma, which accounts for 68% of the total licensed quantity. In 1993, actual abstraction was 85% of licensed quantity and accounted for 58% of total licensed quantity.

3.1.2 General Agriculture

Water is abstracted by farmers for general agricultural use, as water for stock, and for general spraying purposes (excluding spray irrigation).

In total there are 99 licences for general agricultural use, all water being taken from groundwater sources. Most of these are in the South Forty Foot Fens to the west of the River Witham where historically there have been copious artesian supplies across a wide area of the fens. Many of these abstractions are also used for domestic purposes as many farms have no mains water supply. Agricultural abstraction from surface water sources, less than 20 cubic metres per day, do not need to be licensed.

The total licensed abstraction is 265 tcma which accounts for 1% of total licensed abstraction.

3.1.3 Spray Irrigation

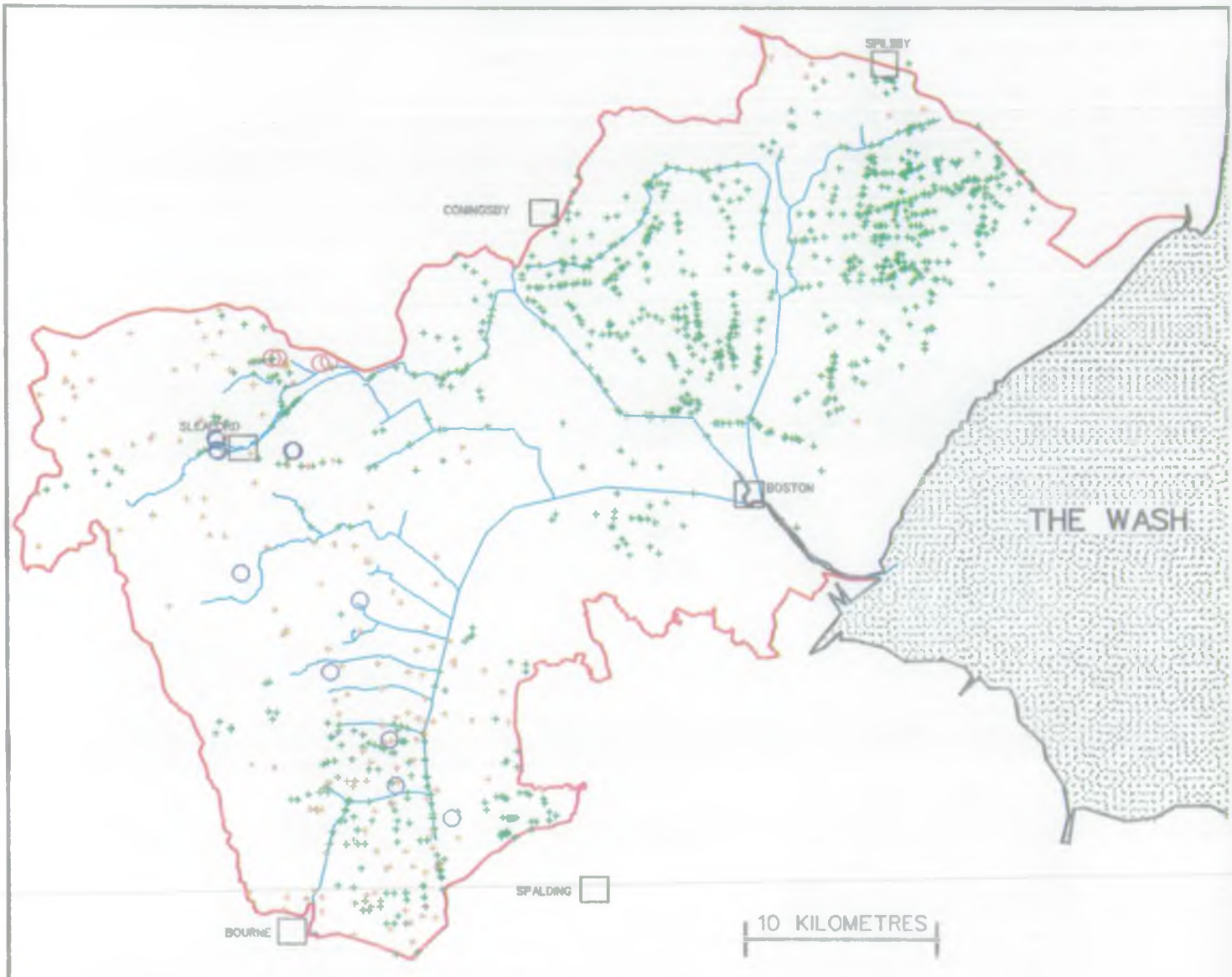
Much of the land in this catchment benefits from spray irrigation on its silty soils. The availability of water for certain crops, such as potatoes and beet, is a critical factor in determining their yield and profitability.

Water for spray irrigation in the fenland area to the north of Boston and east of the River Witham is abstracted from the network of Internal Drainage Board drains. These are augmented by water transferred from the River Witham, which, in turn, is augmented with water transferred from the River Trent (via the Fossdyke). In the fenland area to the west of the South Forty Foot Drain water is available from both the local drains and the underlying Lincolnshire Limestone aquifer. The use of water for spray irrigation elsewhere in the catchment is limited.

The total quantity licensed for spray irrigation purposes is 5400 tcma which accounts for 27% of total licensed quantity. In 1993, actual abstraction was 15% of licensed quantity and accounted for 6% of total actual abstraction. During periods of low flow, surface water abstraction for spray irrigation can have an impact on surface water levels and flows, placing additional stress on the environment.

THE LOWER WITHAM CATCHMENT MANAGEMENT PLAN

MAP NUMBER 3
JUNE 1995



NB Groups of abstraction points may be covered by only one licence in the table below

KEY

- CATCHMENT BOUNDARY
- TIDAL DEFENCES
- MAIN RIVER
- PUBLIC WATER SUPPLY
- INDUSTRIAL
- SPRAY IRRIGATION
- GENERAL AGRICULTURAL

ABSTRACTION DETAILS

USE (1993)	No. OF LICENCES	ABSTRACTION (TCMA) *	
		LICENSED	ACTUAL
PUBLIC WATER SUPPLY	7	13790	11722
INDUSTRIAL	4	854	594
SPRAY IRRIGATION	216	5400	835
GENERAL AGRICULTURAL	99	265	14‡
TOTAL	326	20309	13165

* (TCMA) - Thousand cubic metres per annum

‡ Returns not required for Licences of less than 20 m3/day

National Rivers Authority
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Lincoln
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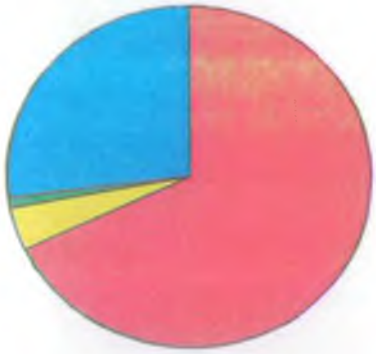
TABLE 2

WATER RESOURCES ABSTRACTION LICENCES

Number of licences

USE	No. OF LICENCES	% OF TOTAL
PWS	7	2
INDUSTRIAL	4	1
AGRICULTURAL	99	31
SPRAY IRRIGAT'	216	66
TOTAL	326	100

Licensed abstraction



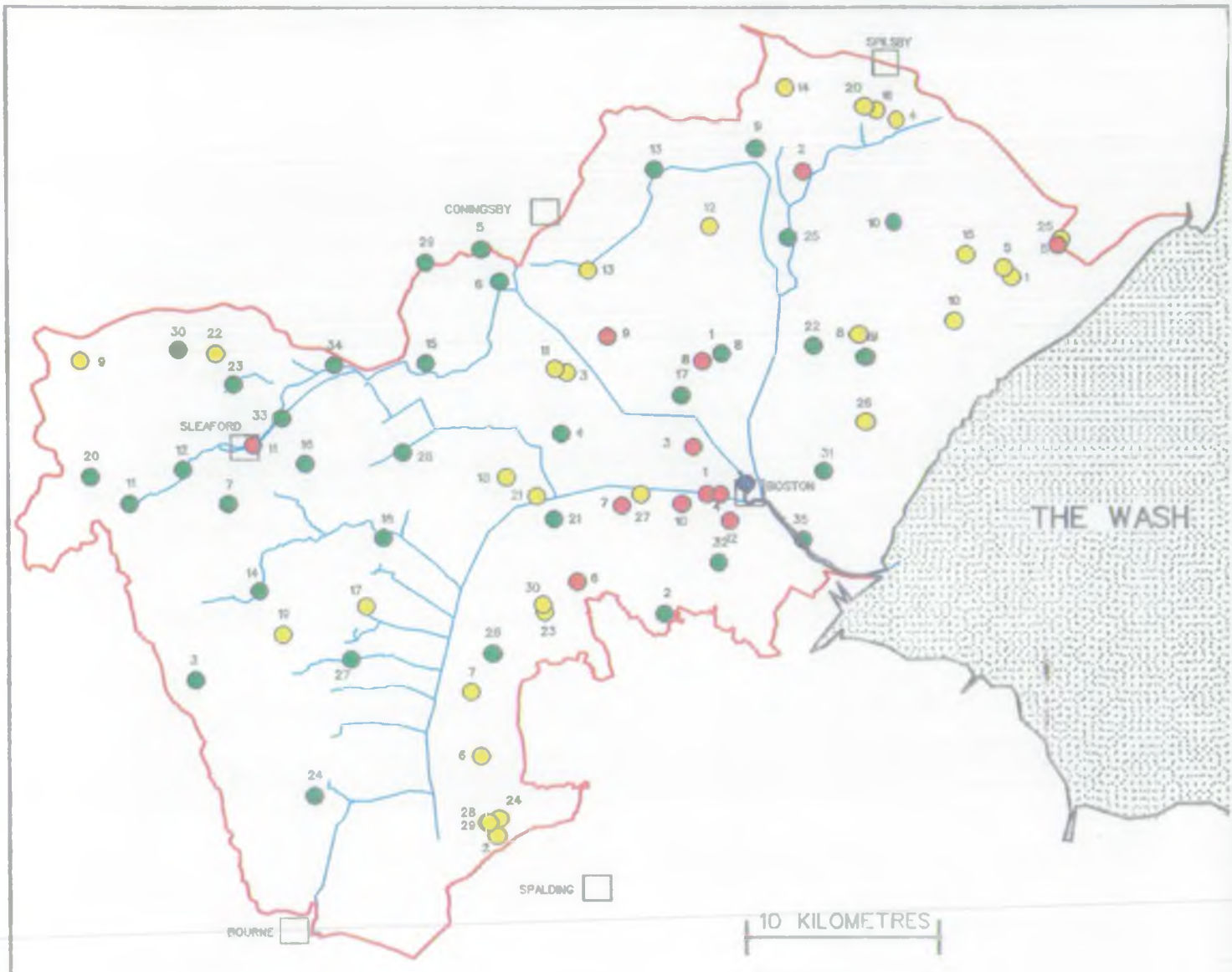
USE	TCMA	% OF TOTAL
PWS	13,790	68
INDUSTRIAL	854	4
AGRICULTURAL	265	1
SPRAY IRRIGAT'	5,400	27
TOTAL	20,309	100

Actual abstraction 1993

USE	TCMA	% OF TOTAL
PWS	11,722	89
INDUSTRIAL	594	4
AGRICULTURAL	14	1
SPRAY IRRIGAT'	835	6
TOTAL	13,165	100

THE LOWER WITHAM CATCHMENT MANAGEMENT PLAN

MAP NUMBER 4
JUNE 1995



KEY

- CATCHMENT BOUNDARY
- TIDAL DEFENCES
- MAIN RIVER

- INDUSTRIAL DISCHARGES

SEWAGE TREATMENT WORKS

- ANGLIAN WATER
- PRIVATE
  (NB Private STW shown are those discharging > 5 cubic metres per day)
- COMBINED SEWER OUTFALL

FOR LOCATION OF STW SEE OVER THE PAGE

INDUSTRIAL DISCHARGE SOURCES AND SEWAGE TREATMENT WORKS

National Rivers Authority
Anglian Region
Northern Area
Harvey Street
Lincoln
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Tel: (01522) 513100
Fax: (01522) 512927

ANGLIAN WATER SEWAGE TREATMENT WORKS

1. FRITHVILLE
2. ROPERS LANE (SUTTERTON)
3. PICKWORTH
4. AMBER HILL
5. TATTERSHALL
6. CHAPEL HILL BOLINGBROKE
7. SILK WILLOUGHBY
8. FRITHVILLE
9. EAST KIRKBY
10. NEW LEAKE HECKINGTON
11. WILSFORD
12. SOUTH RAUCEBY
13. MAREHAM LE FEN BRIDGE
14. OSBOURNBY
15. SOUTH KYME
16. KIRKBY LA THORPE
17. GIPSEY BRIDGE
18. HELPRINGHAM BENINGTON
19. OLD LEAKE BRIDGE
20 ANCASTER
21. SWINESHEAD
22. SIBSEY
23. LEASINGHAM
24. DUNSBY
25. STICKNEY
26. DONINGTON
27. HORBLING
28. HECKINGTON
29. BILLINGHAY
30. CRANWELL
31. FISHTOFT
32. FRAMPTON
33. SLEAFORD
34. ANWICK
35. BOSTON

PRIVATE SEWAGE TREATMENT WORKS

1. CHURCH END, FRISKNEY
2. PINCHBECK SCHOOL
3. P MACDOWELL, HOLLAND FEN
4. TOYNTON ST PETER, SPILSBY
5. WILDMORE CRESCENT, FRISKNEY
6. GOSBERTON CLOUGH
7. QUADRING FEN
8. NR CHURCH MIDVILLE
9. HURLINGHAM BUSPARK, FULBECK HEATH
10. GOLD FEN BANK, WRANGLE
11. PARSONS DROVE, KIRTON
12. KINGS CLOSE, NEW BOLINGBROKE
13. WILDMORE CLOSE, NEW YORK
14. HAGNABY ROAD, OLD
15. FRISKNEY SMALL END
16. TOYNTON ALL SAINTS SCHOOL
17. 1-8 WEST STREET, SWATON
18. COUNCIL HOUSES, EAST
19. 15-37 ACRE LANE, THREEKINGHAM
20. TOYNTON ALL SAINTS HALL
21. HALLAM DROVE, SWINESHEAD
22. ROXHOLME NURSING HOME
23. DRURY LANE, BICKER
24. TASSACH LTD, NORTHGATE
25. HOUSING SITE, FRISKNEY
26. T H CLEMENTS & SON,
27. ORCHARD HOUSE, HUBBERTS
28. PINCHBECK WEST (RURAL AVENUE)
29. ELIZABETH CRESCENT, WEST PINCHBECK
30. DRURY LANE, BICKER

INDUSTRIAL DISCHARGES

1. HIGHWAYS DEPOT, WYBERTON
2. PCP MOTORS, STICKFORD
3. TRANSIT VEHICLE WASHDOWN
4. COOKS LOCK DEPOT, BOSTON
5. IVY HOUSE FARM, WAINFLEET
6. LAWLORDLAND BICKER BAR
7. P & D COSBY, KIRTON HOLME
8. GORDON GRANT & SONS, FRITHVILLE
9. POULTRY FARM
10. C & G CONCRETE, FRAMPTON
11. SLEAFORD SWIMMING POOL
12. CALDERS & GUANDIDGE, BOSTON

Demand for spray irrigation is concentrated in a short season and depends on weather conditions.

3.1.4 Industrial Abstraction

There is little industrial development within this Catchment, local industrial needs for water are normally supplied from the mains.

Four groundwater sources are licensed for industrial use and none from surface waters. This water is used for food processing purposes in the Sleaford area.

The total licensed quantity is for 835 tcma which accounts for 4% of total licensed abstraction. In 1993 actual abstraction was 70% of licensed quantity and accounted for 3% of total licensed quantity.

3.2 EFFLUENT DISPOSAL

Watercourses are used to receive a range of both treated and untreated effluent. At certain times of the year effluent returns can make up a significant proportion of river flow.

Map No. 4 shows Industrial Discharge Sources and Sewage Treatment Works.

3.2.1 Treated Effluent

Treated effluent sources include those sewage treatment works operated by the Water Undertaker, in this Catchment AWS; those operated by private individuals, companies and district councils; and those operated by commercial/industrial premises.

The conditions which must be complied with by those discharging effluent to watercourses are specified in consents issued by the NRA. Consents are calculated taking into account upstream water quality and dilution available in the receiving watercourse. Consents are designed to ensure that downstream water quality remains acceptable for its many uses and compliant with prescribed water quality standards. NB - Historically consents may not have these standards.

There are 35 Anglian Water sewage treatment works in the Lower Witham Catchment. In addition, there are 78 sewage treatment works operated by private individuals, companies or local Councils, of which 30 have discharges of greater than 5 m^3 per day.

Trade effluents from industrial areas and principal towns in the Catchment are usually treated at sewage treatment works operated by Anglian Water Services Ltd. However, a number of trade effluent discharges are made, after treatment, to controlled waters.

3.2.2 Untreated Effluent

Untreated effluent sources include those discharges from emergency and storm water overflows from sewerage systems.

Emergency overflows occur due to electrical or mechanical breakdown of pumps which transfer sewage to the sewage treatment works.

Storm water overflows are constructed on foul drainage systems receiving surface water in addition to sewage. A tremendous volume of water enters the common sewer in times of very wet weather, and it would be impractical to construct sewers large enough to convey all this water to the sewage works. Overflows are therefore constructed to allow dilute sewage effluent in storm conditions to discharge direct to the watercourse when flows within foul drainage systems reach a certain level. These overflows are screened to prevent gross solids entering the watercourse.

In the past it was common practice to set storm sewage overflows at 6 times dry weather flow as it was considered that at this dilution the discharge would not impact on the receiving watercourses. In most cases this is sufficient, however there are more sophisticated techniques available, including computer modelling which can be used when the overflow is in a more sensitive area.

There are 29 combined sewer overflows in the catchment. Only one of these, from London Road Pumping Station, Boston, has at present been identified as unsatisfactory (shown on Map No. 4).

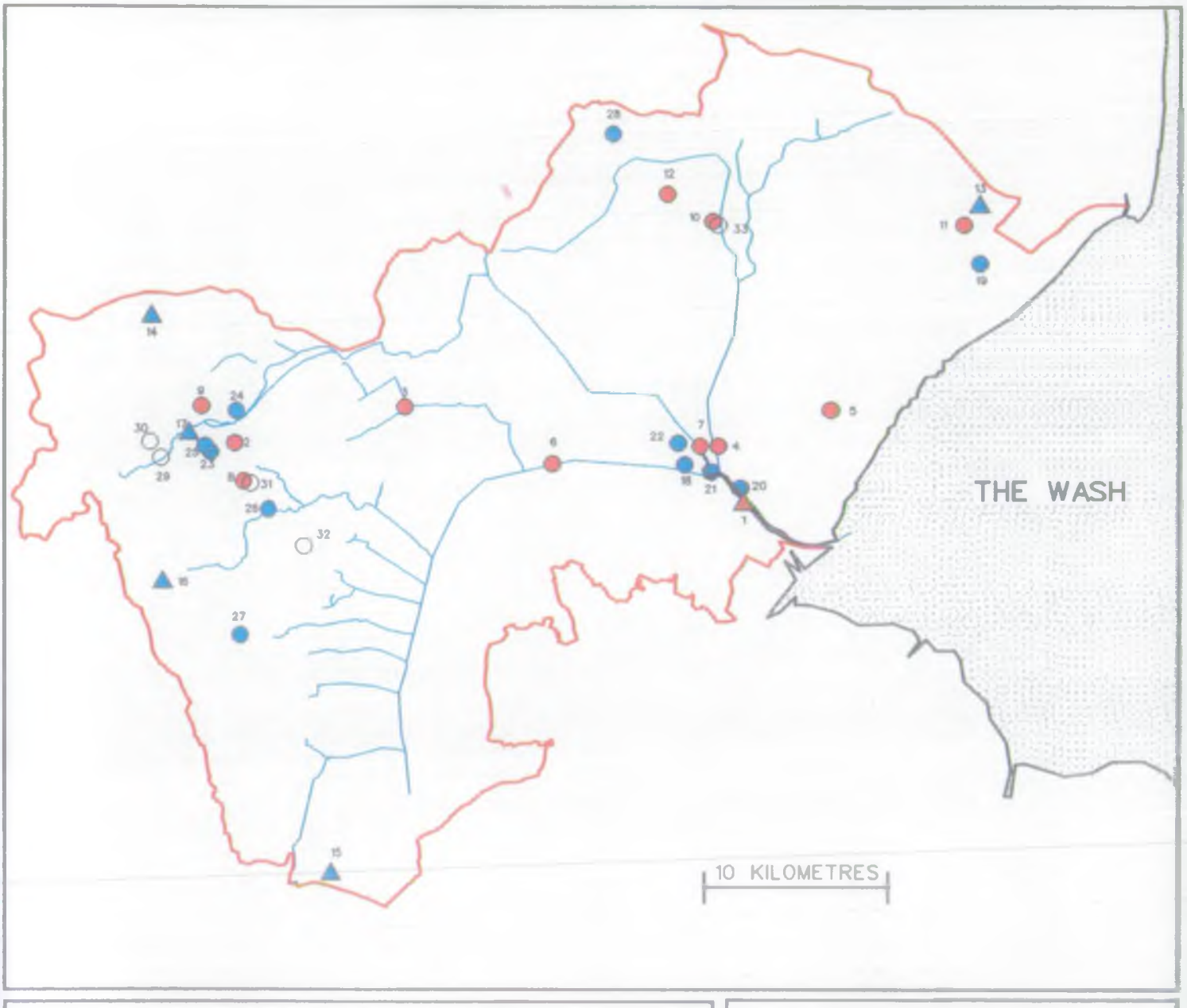
3.2.3 Septic Tanks

In rural areas, premises are often served by septic tanks, these however, provide insufficient treatment to allow the effluent to be discharged to watercourse. For new development the NRA, as a consultee in the Planning process, where appropriate, asks for conditions to be added to planning decisions stipulating septic tank effluent be discharged to an adequate soakaway to prevent pollution of the water environment.

Many houses in the catchment have septic tanks which, on the whole, work adequately. However, localised pollution does occur where septic tanks are wrongly connected to watercourses or where soakaway systems are insufficient.

THE LOWER WITHAM CATCHMENT MANAGEMENT PLAN

MAP NUMBER 5
JUNE 1995



KEY

- CATCHMENT BOUNDARY
- TIDAL DEFENCES
- MAIN RIVER

WASTE TYPE			LANDFILL SITES
Non inert	Inert	Unknown	
▲	▲	△	SITE IN USE AND RECEIVING WASTE
●	●	○	SITE NO LONGER RECEIVING WASTE

NON INERT WASTES ARE THOSE WHICH ARE LIKELY TO GENERATE LEACHATES
SUCH SITES HAVE STRICT OPERATING CONDITIONS IMPOSED ON THEM BY THE WRA

LANDFILL SITES

National Rivers Authority
Anglian Region
Northern Area
Harvey Street
Lincoln
LN1 1TF
Tel: (01522) 513100
Fax: (01522) 512927

LANDFILL SITES

NON INERT		STATUS
1.	SLIPPERY GOWT NEW TIP, BOSTON	IN USE
2.	MAREHAM LANE, SLEAFORD	NOT IN USE
3.	STAR FEN, HECKINGTON, FORMER REFUSE SITE	NOT IN USE
4.	BURGESS PIT, FRIESTON ROAD/+	NOT IN USE
5.	HALL LANE, BENNINGTON/+	NOT IN USE
6.	SYKEMOUTH DRIVE, SWINESHEAD/+	NOT IN USE
7.	CARLTON ROAD, BOSTON	NOT IN USE
8.	SILK WILLOUGHBY/(75)+	NOT IN USE
9.	HOLDINGHAM, SLEAFORD/+	NOT IN USE
10.	BRICK YARD, STICKNEY/+	NOT IN USE
11.	CROSS ROAD, FRISKNEY/+	NOT IN USE
12.	NEW BOLINGBROKE/+	NOT IN USE

INERT		STATUS
13.	SCALDGATE, WAINFLEET ST MARY	IN USE
14.	BRAUNCEWELL QUARRY, BRAUNCEWELL, SLEAFORD	IN USE
15.	BOURNE, PART NG 7600, SPALDING ROAD	IN USE
16.	COTTAGE KENNELS, DEMBLEBY PIT	IN USE
17.	BOILING WELLS FARM, S RAUCEBY, SLEAFORD	IN USE
18.	HESSLE AVENUE (REAR OF), BOSTON	NOT IN USE
19.	FRISKNEY LAND TO EAST OF MAIN ROAD	NOT IN USE
20.	BOSTON, FORMER SALVAGE DEPOT, FISHTOFT ROAD	NOT IN USE
21.	BATH GARDEN AREA, PORT OF BOSTON	NOT IN USE
22.	LANGRICK ROAD, BOSTON (91)	NOT IN USE
23.	QUARRINGTON (77)+	NOT IN USE
24.	WOODBRIDGE ROAD, SLEAFORD (69)+	NOT IN USE
25.	STUMP HILL, QUARRINGTON (84)	NOT IN USE
26.	SCREDDINGTON (79)	NOT IN USE
27.	FOLKINGHAM (84)	NOT IN USE
28.	MAREHAM LE FEN	NOT IN USE

UNKNOWN		STATUS
29.	SOUTH RAUCEBY +	NOT IN USE
30.	SOUTH RAUCEBY +	NOT IN USE
31.	WILLOUGHBY GORSE +	NOT IN USE
32.	BIRTHORPE ROAD, BILINGBOROUGH	NOT IN USE
33.	BRICK PITS, WEST FEN	NOT IN USE

3.3 LANDFILL ACTIVITY

General

The use of land for a wide range of waste disposal and recycling operations, eg waste transfer stations, incinerators, scrap yards, landfill sites etc poses a threat to the quality of both groundwater and surface water. Waste management is enforced by Lincolnshire County Council the Waste Regulation Authority (WRA), in this Catchment, who issue licences. These ensure the sites are controlled during both operational and post-closure phases. Surrender of the licence is only permissable when the site no longer poses a risk of pollution.

There is a potential for pollution from all waste disposal operations, but of greatest concern to the NRA is landfill. Where waste is disposed of in this manner, there is a risk of polluting leachates escaping and contaminating ground and surface water.

In addition to disposal of wastes at specific sites, sewage sludge and other industrial wastes, such as dairy, food processing, abattoir, septic tank and cess pit wastes can be spread onto agricultural land. Operators are required to notify the Waste Regulation Authorities of their intention to spread waste on particular sites and may do so without a licence if spreading is of agricultural benefit without causing an environmental hazard.

As a statutory consultee to the Waste Regulation Authority (WRA) the NRA carries out its duty to protect the water environment from the adverse impacts of waste disposal activities ensuring the NRA's "Groundwater Protection Policy" and MAFF's "Code of Good Agricultural Practice" are considered in the licensing of Waste Disposal Activity.

Catchment Perspective

There are 71 Waste Disposal sites in the Lower Witham Catchment, of which 15 are landfill sites. Leachate generating wastes have been deposited in 5 landfill sites, it is these sites which pose the greatest risk of pollution.

New landfill sites, taking leachate generating wastes, are constructed as full containment sites, using either natural or artificial liners. To minimise leachate production the landfill sites are filled in successive cells (thereby exposing the minimum amount of waste to rainfall), and liquid waste inputs are strictly controlled. The leachate depth within the site is also regulated. When landfilling has been completed, the site is capped with an engineered low permeability material to further minimise infiltration of rainwater.

Monitoring of landfill sites is undertaken by both the site operator, as part of their licence conditions, and the Waste Regulation Authority.

In the past, landfilling has been undertaken at unlined sites. Such sites, where leachate migration may pose a threat to groundwaters or surface waters, are identified and appropriate action is taken.

Map No. 5 shows details of landfill sites registered and regulated under the Control of Pollution Act 1974. There are no known problems relating to any sites.

3.4 FLOOD DEFENCE

General

Flood defences are constructed to provide effective defence for people and property against flooding from rivers and the sea. Flooding from the sea and tidal waters is usually threatened as a consequence of extreme climatic conditions, such as the coincidence of low atmospheric conditions - which raise tide levels, and high winds. Fluvial flooding is likely to result from intense rainfall or when the discharge to tidal waters is restricted by the tidal cycle.

The standard of flood defence provided depends on the type of land being protected and whether it is being protected from tidal or fluvial flooding. Urban flood defences are usually built to a higher standard than those for agricultural land.

Responsibility for the maintenance of flow in watercourses normally rests, in the first instance, with the riparian landowner, however, under the Water Resources Act 1991, the NRA exercises a general supervision over all matters relating to flood defence in England and Wales. It has powers to control obstructive works on any watercourse. Internal Drainage Boards have similar powers for watercourses within their areas.

Main arterial watercourses are formally designated as the "Statutory Main River". On Main Rivers, the NRA has permissive powers to carry out works and control the actions of others. Any proposal that could interfere with the bed or banks or obstruct the flow in the river requires formal consent from the NRA.

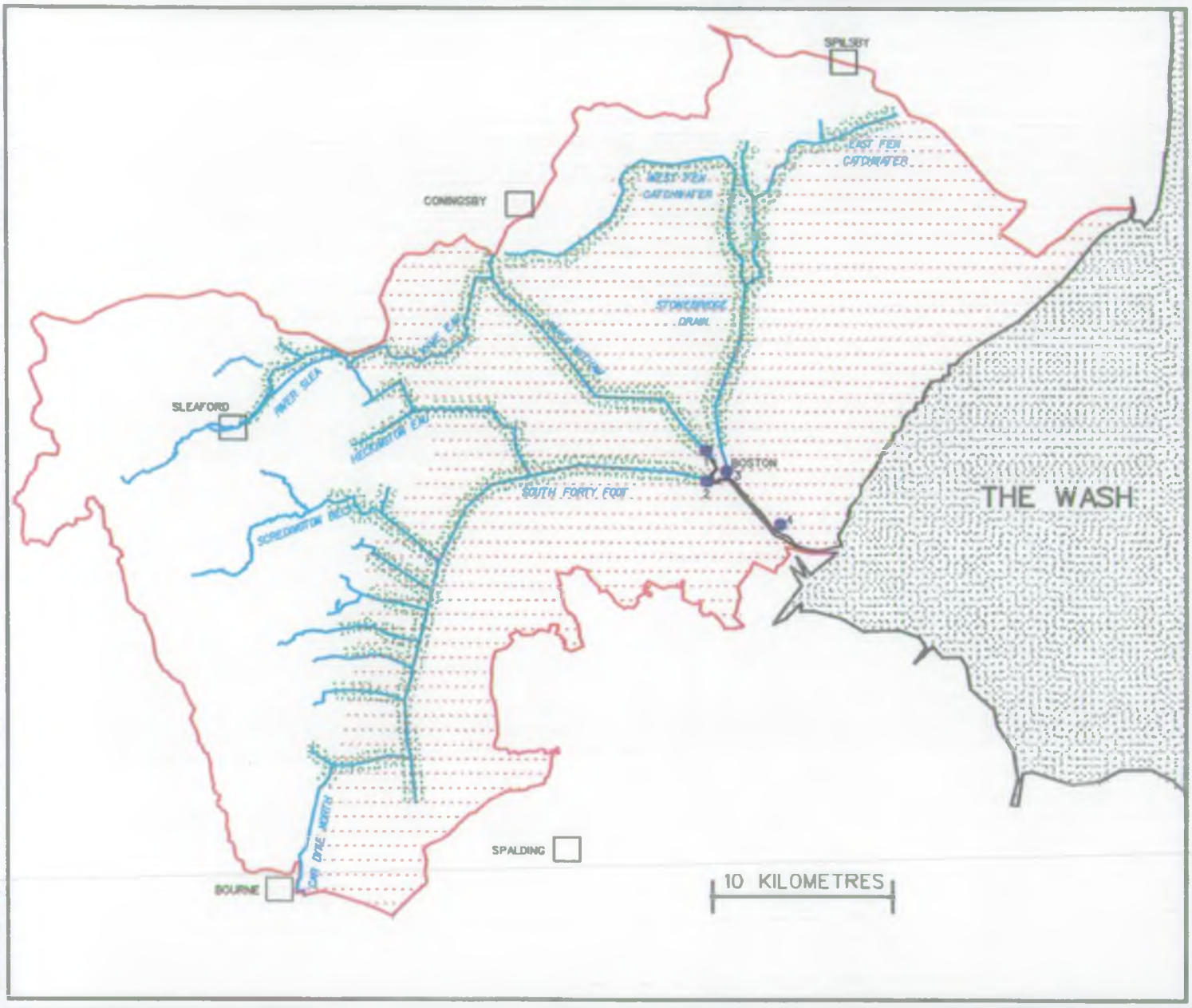
The nature of works carried out for flood defence sometimes conflicts with other Catchment uses, for example proposed improvement works to tidal defences may encroach upon valuable wildlife habitat. The NRA seeks to reduce conflicts by undertaking consultation with other users to ensure that such works are executed with minimum effect to the environment and that where possible environmental enhancements are made.

Map No. 6 shows fluvial and tidal defences in the catchment.

Map No. 7 shows land drainage details in the catchment.

THE LOWER WITHAM CATCHMENT MANAGEMENT PLAN

MAP NUMBER 6
JUNE 1995



KEY

- CATCHMENT BOUNDARY
- TIDAL DEFENCES
- MAIN RIVER
- EMBANKED LENGTH
- AREA OF LAND BELOW HIGH SPRING TIDE LEVEL

- 1 WITHAM OUTFALL (GRAND SLUICE)
- 2 SOUTH FORTY FOOT OUTFALL
- 3 MAUD FOSTER OUTFALL
- 4 HOBHOLE OUTFALL

FLUVIAL AND TIDAL DEFENCE STRUCTURES

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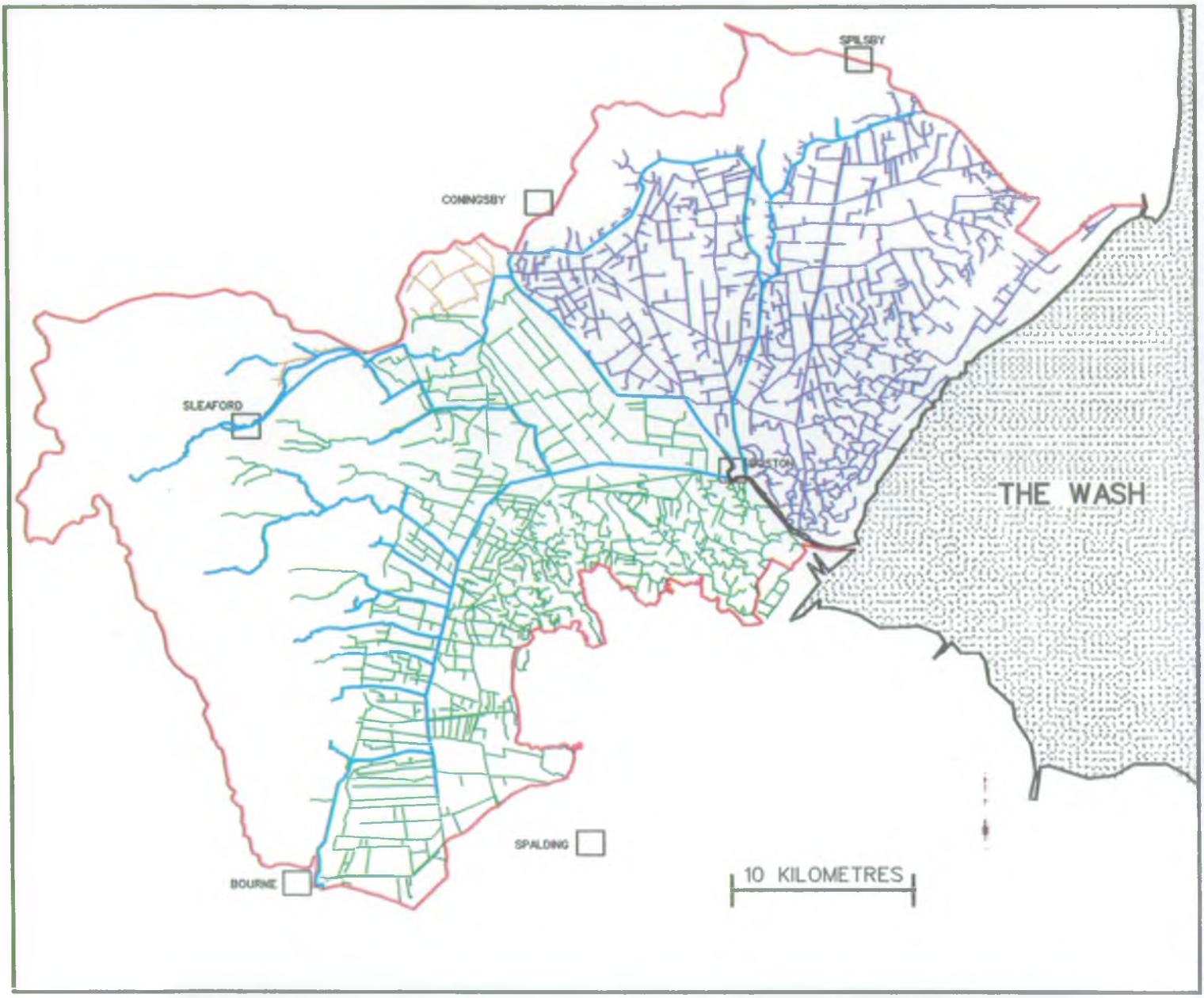
THE LOWER WITHAM CATCHMENT MANAGEMENT PLAN

MAP NUMBER 7
JUNE 1995



KEY

- CATCHMENT BOUNDARY
- TIDAL DEFENCES
- MAIN RIVER

IDB WATERCOURSES

- WITHAM FORTH
- BLACK SLUICE
- WITHAM FIRST

MAIN RIVER AND INTERNAL DRAINAGE BOARD WATERCOURSES

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Fax: (01522) 512927

3.4.1 Tidal Defences

Substantial tidal defences have been constructed and maintained along the Wash coastline and Witham Haven in order to protect this area from tidal inundation.

The town of Boston sits on the Witham Haven 10 km from its outfall to the Wash. The Haven is tidal through the town, the tidal limit being at Grand Sluice. The maintenance of adequate tidal defences on the Haven is of vital importance to the town.

High grade agricultural land borders the Wash on the eastern side of the Catchment. Successive land reclamation schemes have taken place since Roman times, taking in the accreting marshes behind raised embankments in the form of enclosures. In some areas up to three separate lines of embankment now exist denoting the areas of previously reclaimed land.

3.4.2 Land Drainage

The Catchment area is predominantly agricultural. Drainage within the fen area is of vital importance to the productivity of this highest grade arable land. Internal Drainage Boards provide and maintain a drainage system for the low lying areas. Much of this water is pumped either to NRA main river or direct to the Witham Haven.

Waters flowing through the Catchment from the surrounding highland areas are conveyed across the low lying fen within raised flood embankments. The Witham enters the Catchment at Dogdyke, near Coningsby, and is the major watercourse providing drainage for a large part of Lincolnshire. The Maud Foster/Stonebridge system collects highland waters flowing from the northern boundary of the catchment and conveys it across the fen area to the north of Boston. The South Forty Foot Drain and its tributaries carry highland waters and land drainage waters from the Black Sluice Internal Drainage Board from the western and southern boundaries across the fens to Boston.

The highland water carriers of the River Witham and Maud Foster Drain are dependent on gravity outfalls to the tidal Haven. Capacity for storing water within the channel area is built into the rivers to allow for the temporary cessation of discharge during periods of high tide. Rapid fluctuations in water levels can be expected at these times. Waters carried by the Hobhole Drain and South Forty Foot Drain may discharge through gravity outfalls or by pumping.

3.4.3 Flood Warning

The NRA provides information and advice to the County Police Forces for the purpose of giving them warnings of areas likely to be affected by flooding for both tidal and fluvial events.

The NRA operate a network of gauging stations on main rivers throughout the Catchment which continually monitor water flows and levels. These stations are linked to a central computer warning system by way of telemetry. This allows tidal and fluvial conditions to be monitored and advance warnings provided to the police based on a colour phase system which indicates the likelihood and severity of a particular event.

3.5 LAND USE/DEVELOPMENT

3.5.1 Agriculture

The Ministry of Agriculture, Fisheries, and Food's Agricultural Land Classification (ALC) System classifies land by grade according to the extent to which its physical or chemical characteristics impose long term limitations on agricultural use. These limitations may affect flexibility of cropping, level of yield, the consistency of yield or the cost of obtaining it. Under the MAFF ALC System, land is classified into one of five grades; Grade 1 being of excellent quality, Grade 5 being of very poor quality. Grade 3 comprises good to moderate quality land.

Approximately 70% of land in the Lower Witham Catchment Area is mapped as Grade 1 and 2. Approximately 26.4% is mapped as Grade 3 with only 0.5% mapped as Grade 4 and with 4% in non-agricultural or urban use. This illustrates the high concentration of the better quality agricultural land in the catchment.

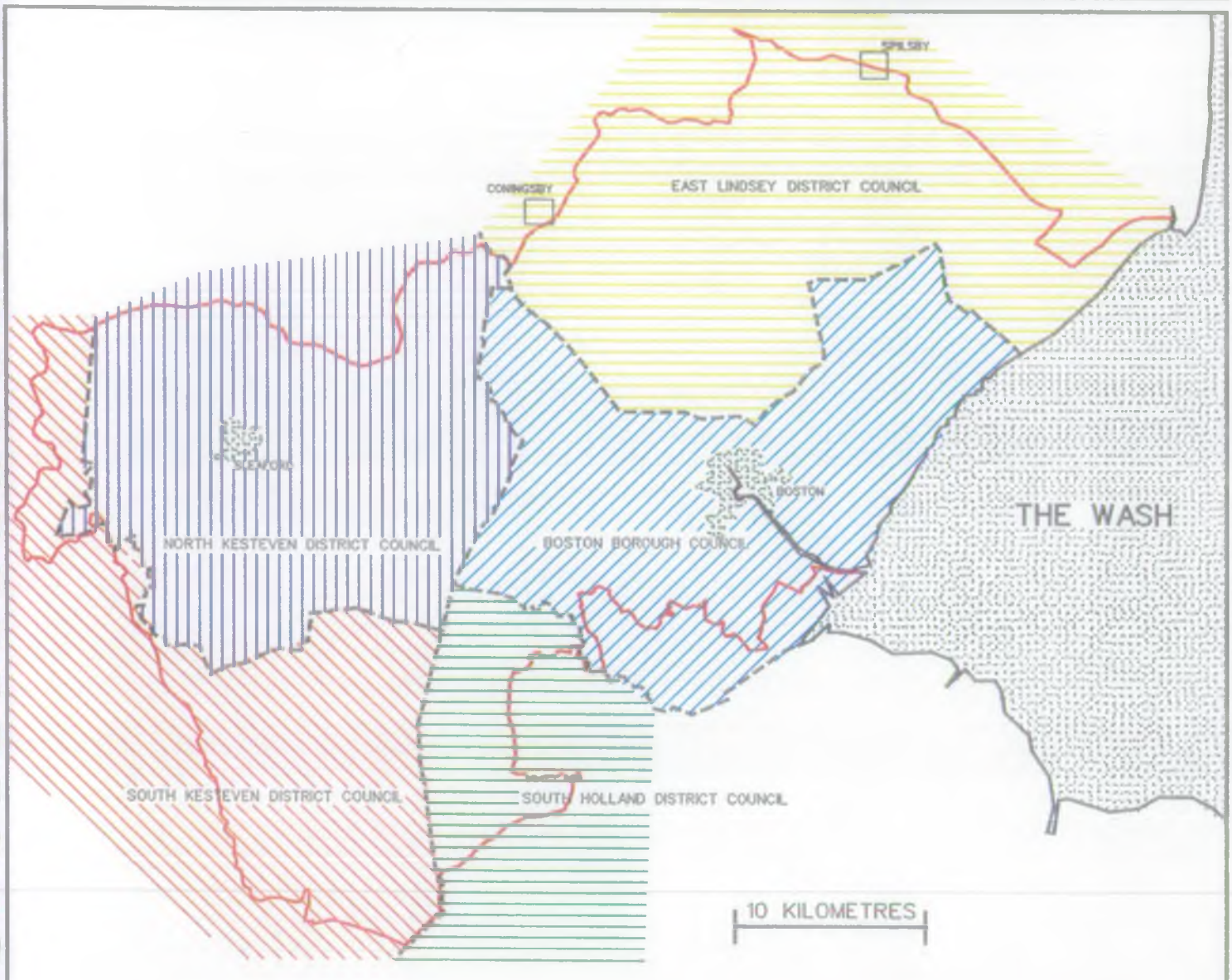
Agriculture is, of course, the dominant land use in the catchment area. Over much of the area the highly productive nature of the land benefits immensely from the comprehensive flood defence measures, and land drainage and field underdrainage systems. The productive nature and versatility of the land is illustrated by the cropping; intensive arable and horticultural cropping is predominant in the catchment area. Crops grown include combinable crops (mainly cereals), potatoes and sugar beet, and field scale vegetables. Bulbs and flowers grown in the open are an important feature. Some hardy nursery stock and fruit are grown. On the most fertile and productive soils in the catchment area "double cropping", which in practice involves 3 crops in 2 years, is a common feature.

As is to be expected, livestock numbers are relatively low. However, there has been a dramatic increase in the poultry breeding flock and table chicken numbers since 1983.

The agricultural industry obviously plays a significant role, both in terms of this catchment's economical welfare and in terms of its impact upon the physical environment. At a national level, this land is of strategic importance, this is reflected by land reclamation schemes undertaken in recent years.

THE LOWER WITHAM CATCHMENT MANAGEMENT PLAN

MAP NUMBER 8
JUNE 1995



KEY

- CATCHMENT BOUNDARY
- TIDAL DEFENCES
- DISTRICT COUNCIL BOUNDARIES
- MAJOR CONURBATION

ADMINISTRATIVE BOUNDARIES

National Rivers Authority
Anglian Region
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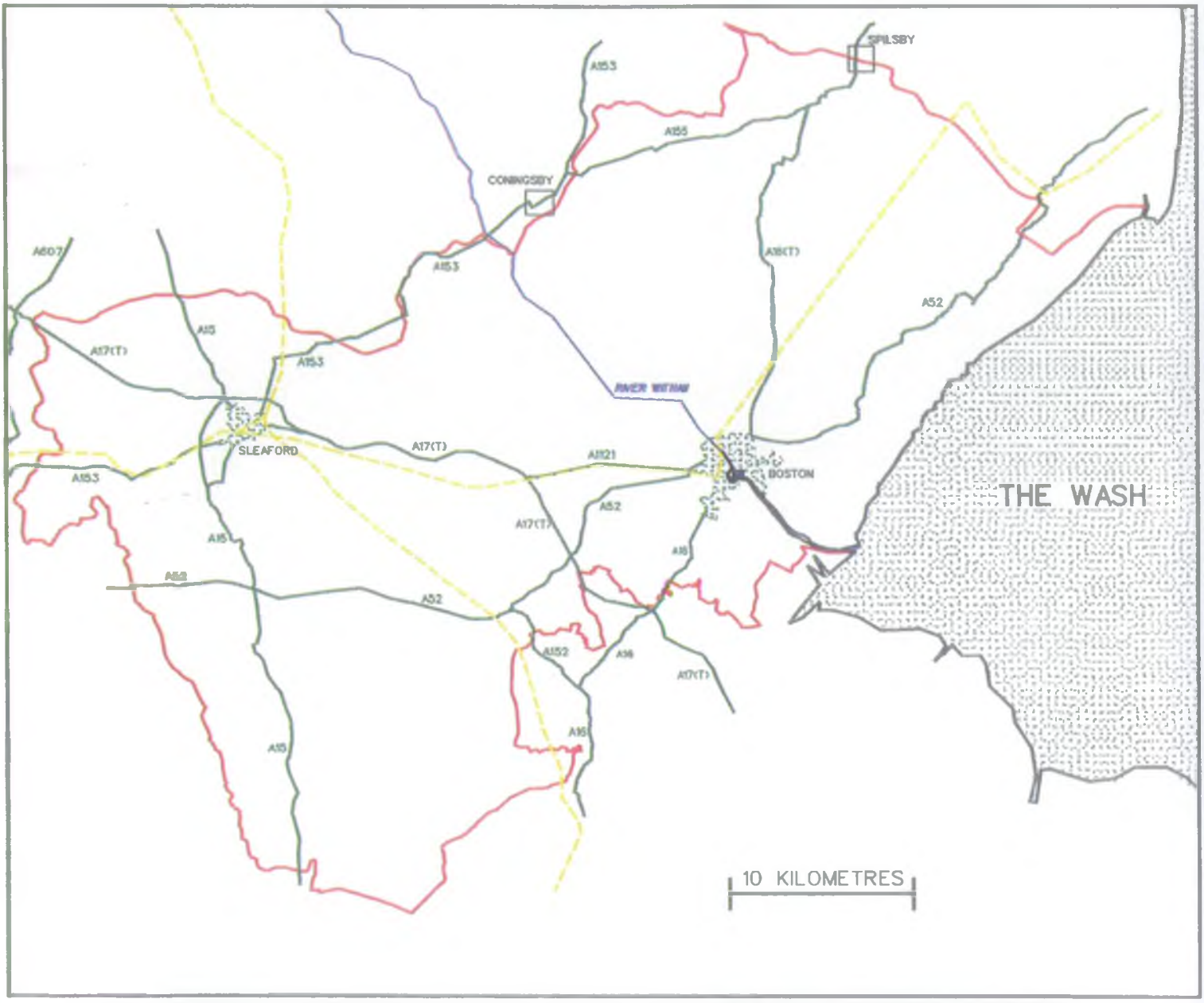
THE LOWER WITHAM CATCHMENT MANAGEMENT PLAN

MAP NUMBER 9
JUNE 1995



KEY

- CATCHMENT BOUNDARY
- TIDAL DEFENCES
- PRINCIPLE "A" ROAD
- RAILWAY
- WITHAM NAVIGATION
- MAJOR CONURBATION
- BOSTON DOCK

INFRASTRUCTURE

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Fax: (01522) 512927

Agricultural land use can raise conflicts within the water environment:

- The maintenance practices undertaken on watercourses and water levels maintained to ensure effective land drainage have a marked effect upon flora and fauna.

- The use of fertilisers and herbicides influences surface water quality, enriching it with nutrients encouraging its eutrophic state. It also impacts on land drainage by increasing weed growth and on groundwater quality by increasing nitrate levels.

- The abstraction of water for irrigation affects water levels.

MAFF are promoting several policies towards improving the water environment, such as Countryside Stewardship, the Code of Good Agricultural Practice for the Protection of Water, and defining Nitrate Sensitive Areas (to help protect groundwater sources used to supply drinking water). There are also other EU initiatives relating to Nitrate Vulnerable Zones.

3.5.2 Development

General

Changes in land use and development have a potentially adverse impact upon the water environment.

They can result in:

i) An increased risk/occurrence of flooding as a consequence of changes to surface water drainage;

ii) An increased risk to water quality, eg:

   a) from effluent discharges to surface water and groundwaters;

   b) from agriculture;

   c) from increased pressure upon the sewerage infrastructure;

iii) An increased demand for water for industrial/agricultural use, and for public water supply;

iv) A risk to flora and habitats, as a consequence, directly or indirectly, of remedial flood defence works and/or water quality problems.

Through its involvements in the Town and Country Planning process, the NRA seeks to influence the development and land use change process in order to protect the water environment from these possible impacts. The final decision on planning matters rest with the Local Planning Authorities (LPAs).

The NRA's participation in this process is essentially at two levels:

i) In the short term, the NRA acts as a Consultee in certain types of application under the Town and Country Planning General Development Order. It liaises and advises on proposals which may impact on matters relevant to the NRA.

ii) In the long term, policy and strategy for change in land use is contained in the Development Plans prepared by LPAs.

Any development upon which the NRA is consulted, whether through the formal planning process, or otherwise, provides an opportunity for the NRA to enhance the interests of the water environment.

Map No. 8 shows administrative boundaries in the catchment.

Map No. 9 shows the catchments infrastructure.

3.6 FISHERIES, RECREATION, CONSERVATION & NAVIGATION

3.6.1 Fisheries

General

The National Rivers Authority has a duty to maintain, improve and develop fisheries and to further the conservation of fish species. Fish populations are affected by the quality and quantity of water as well as by the availability of suitable physical habitat features. Fish are therefore important indicators of the overall health of the river.

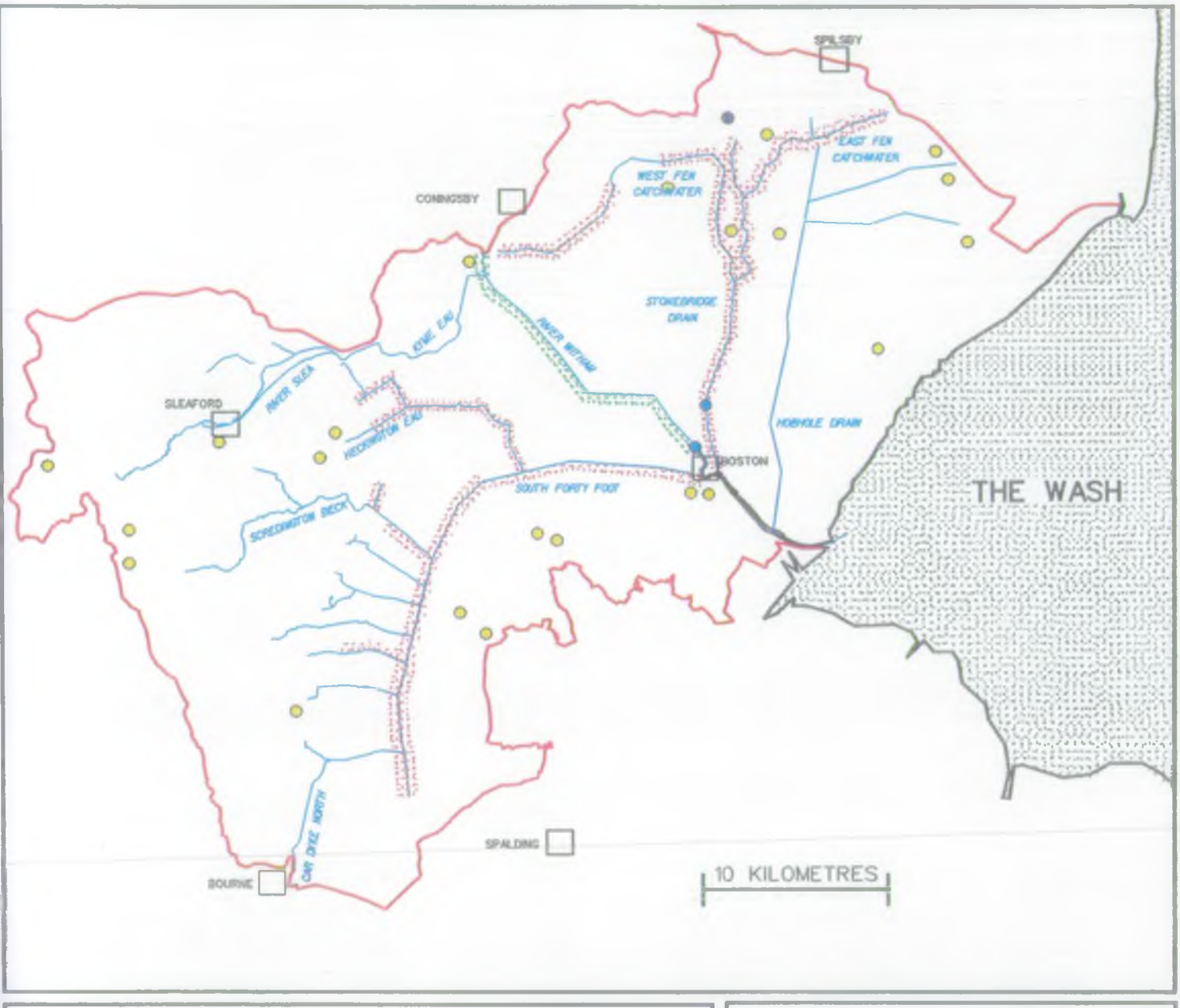
Map No. 10 shows popular angling facilities in the catchment.

Local Perspective

The NRA aims to undertake fish population surveys on major rivers and drains on a three year rolling programme. Within this catchment, fisheries surveys have been conducted on the Stonebridge Drain, Hobhole Drain, West Fen Drain System, South Forty Foot Drain, Main River Witham, River Slea and Kyme Eau.

THE LOWER WITHAM CATCHMENT MANAGEMENT PLAN

MAP NUMBER 10
JUNE 1995



KEY

- CATCHMENT BOUNDARY
- TIDAL DEFENCES
- MAIN RIVER

- BOSTON & DISTRICT ANGLING ASSOCIATION
- WITHAM & DISTRICT JOINT ANGLING FEDERATION
- COARSE FISHING LAKES
- TROUT FISHING LAKE (Hagnaby Priory)
- DISABLED ANGLING FACILITIES

POPULAR ANGLING WATERS

National Rivers Authority

Anglian Region
Northern Area
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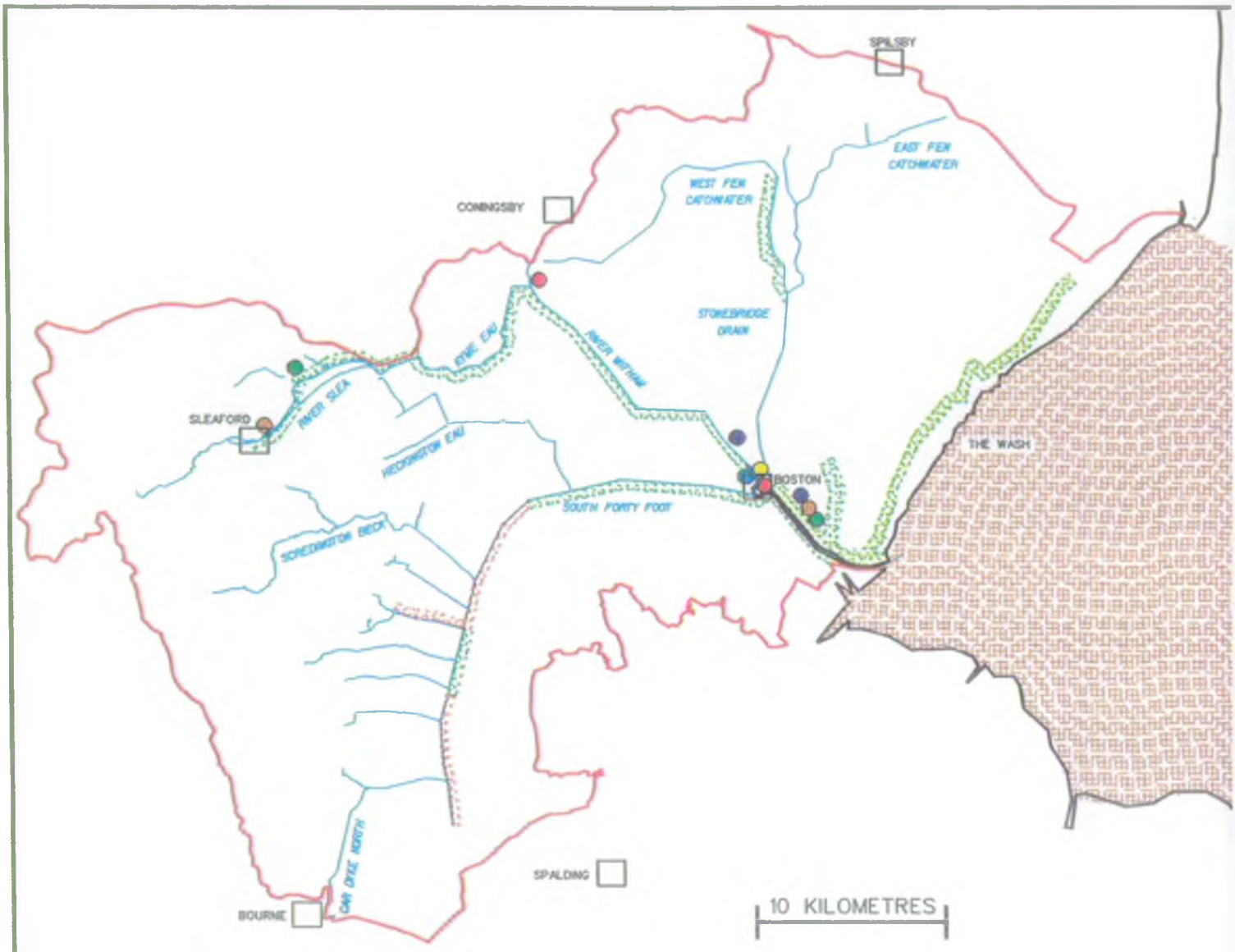
THE LOWER WITHAM CATCHMENT MANAGEMENT PLAN

MAP NUMBER 11
JUNE 1995



KEY

- CATCHMENT BOUNDARY
- TIDAL DEFENCES
- MAIN RIVER
- SSSI AND RAMSAR/SPA
- HORSE RIDING
- BIRD WATCHING
- WALKING
- NATURE RESERVE OR CONSERVATION SITE WITH RECREATIONAL USE
- HISTORICAL ATTRACTION
- PICNIC SITE
- CANOEING CENTRE
- YACHTING CENTRE
- BOATING CENTRE

RECREATION ACTIVITIES

National Rivers Authority
Anglian Region
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Lincoln
LN1 1TF
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Fax: (01522) 512927

Traditionally, fisheries classification has been based purely on fish biomass, ie grams per square metre. This scheme has now been extended to include physical river features, namely width and gradient. The rivers are now graded on an A to E scale for both biomass and species richness. (Appendix 1)

Most of the river and drain systems contain a high biomass of coarse fish. These results reflect the rich lowland nature of the waters contained within this catchment which provide ideal conditions for coarse fish species.

The fish species present in the lowland rivers and drains are indicative of the nature and habitat of such rivers with roach and common bream being the dominant species.

Historically the River Slea supported native brown trout and this species is still present, however, evidence that the population is sustainable has yet to be gathered. The species may depend upon artificial stocking to maintain their presence.

3.6.2 RECREATION AND AMENITY

General

This use deals with all recreational activities associated with the water environment. The NRA has a duty to generally promote the use of inland and coastal waters and land associated with them for the purpose of recreation.

Map No. 11 shows recreational activities in the catchment.

Local Perspective

The water environment in the catchment is extensively used for recreational purposes, including angling, sailing, canoeing and general recreational and amenity access for walking, horse-riding and relaxation. Facilities are located adjacent to many waterways, enabling these recreational activities to function.

The coastline and marshland adjacent to the Wash offers access to internationally important Nature Reserves and bird watching areas. Near Boston the Cut End bird hide offers spectacular views over the Wash.

The Pilgrim Fathers Memorial near Boston attracts significant numbers of visitors annually and marks an important site linked to early colonisers of the Americas.

Throughout the catchment there are numerous enclosed stillwaters which are used for angling activities, including both coarse and salmonid fish species.

Public Access

Many people live adjacent to watercourses and sea defences in the catchment and many more visit for general recreational activities. The visual appearance and colour of waters is therefore very important to these users. The significance of the amenity value may range from high amenity, eg. a watercourse passing through an area often frequented by the Public, to a low amenity watercourse, eg. a watercourse passing through remote countryside.

Many river banks in the catchment have access available to the general public, both for angling activities and more general recreational pursuits, such as walking.

Angling

Freshwater fishing is carried out extensively throughout the catchment on both rivers and lakes. The catchment contains some of the areas' premier coarse fisheries. These attract many visiting anglers and have provided excellent angling opportunities historically and to the present day. Access for disabled people is provided on the River Witham and Stonebridge Drain.

Angling activities are managed by the two major angling clubs that control waters within the area, namely Boston Angling Association and the Witham and District Joint Anglers Federation. The former control angling on the Stonebridge Drain and the South Forty Foot Drain.

Throughout the catchment the Inland Drainage Board waters provide free fishing sites, arrangements between the Boston Angling Association and the Witham Fourth Internal Drainage Board allows the club to organise match sessions on the Hobhole Drain.

Angling activities on stillwaters are popular throughout the catchment and provide an important tourist attraction, at Hagnaby Priory a stillwater trout lake provides sport for the game angler.

3.6.3 CONSERVATION - ECOLOGY

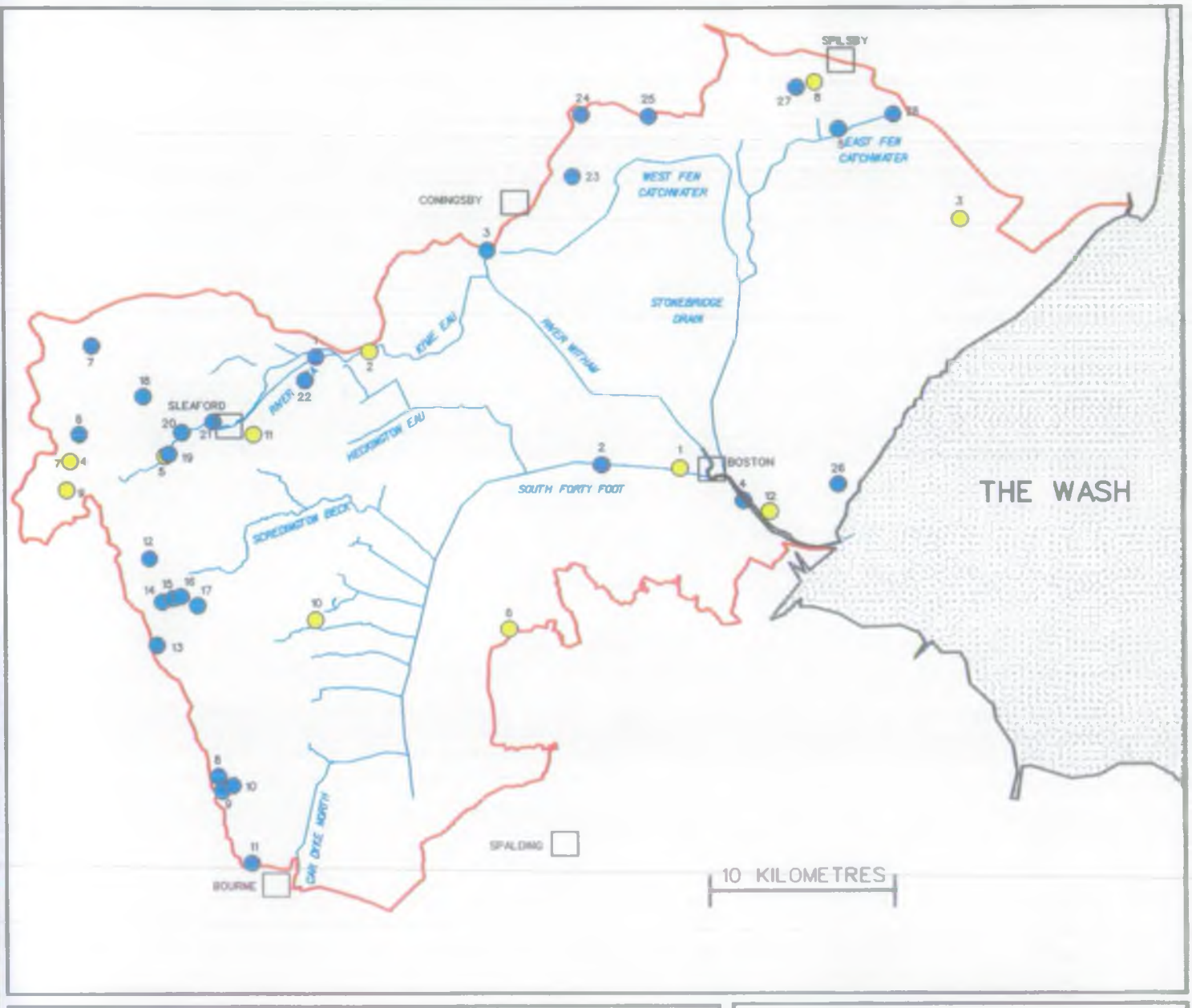
General

The NRA has a statutory duty when exercising all its functions to further the conservation of flora and fauna. This includes wildlife such as kingfishers, may-flies, and water violets, which are truly dependent upon the river for their existence, and those species which simply exploit the river corridor, such as owls. In formulating its own proposals or considering proposals from other parties, the NRA must take into account:-

- The protection of areas formally designated as being of particularly high conservation value, eg RAMSAR sites, Special Protection Areas (SPA), Environmentally Sensitive Areas (ESA), National Nature Reserves (NNR) and Sites of Special Scientific Interest (SSSI).

THE LOWER WITHAM CATCHMENT MANAGEMENT PLAN

MAP NUMBER 12
JUNE 1995



KEY

- CATCHMENT BOUNDARY
- TIDAL DEFENCES
- MAIN RIVER

- NATURE RESERVES
- SITE OF NATURE CONSERVATION INTEREST

SITES OF NATURE CONSERVATION INTEREST AND NATURE RESERVES

National Rivers Authority
Anglian Region
Northern Area
Harvey Street
Lincoln
LN1 1TF
Tel: (01522) 513100
Fax: (01522) 512927

NATURE RESERVES

1. BAPTIST CEMETERY
2. EWERBY POND
3. FRISKNEY DECOY WOOD
4. MOOR CLOSES (SSSI)
5. RAUCEBY WARREN (SSSI)
6. THE YEWS
7. ANCASTER VALLEY (SSSI)
8. KEAL CARR (SSSI)
9. DUKE'S COVERT & COPPER HILL VERGES (SSSI)
10. HORBLING LANE
11. KIRKBY-LA-THORPE PIT
12. HOBHOLE BANK

SITES OF NATURE CONSERVATION INTEREST

1. COBBLER'S LOCK SEDGE & REED BEDS
2. HUBBERT'S BRIDGE CLAY PIT
3. MILL DRAIN, TATTERSHALL
4. BOSTON (LANDWARD SIDE OF SEA BANK) SLIPPERY GOWT
5. TOYNTON FENSIDE
6. GRANTHAM VERGE - ANCASTER
7. CRANWELL GRASSLAND
8. CALLANS LANE WOOD
9. CALLANS LANE WOOD: PASTURE WOOD
10. CALLANS LANE WOOD: THORNY WOOD
11. BOURNE WOOD
12. DEMBELBY THORNS
13. PICKWORTH ROAD VERGE
14. NEWTON & HACEBY WOODS: HACEBY LITTLE WOOD
15. NEWTON & HACEBY WOODS: HACEBY GREAT WOOD
16. NEWTON & HACEBY WOODS: NEWTON WOOD
17. WALCOT VERGES
18. HEATH FARM VERGE, NORTH RAUCEBY
19. MEADOW EAST OF RAUCEBY WARREN
20. BULLYWELLS QUARRY
21. SLEAFORD DROVE MEADOWS
22. EVEDON WOOD
23. ST HELEN'S WOOD
24. HALTHAM WOOD
25. REVESBY: WILKSBY PLANTATION
26. FREISTON SHORE
27. EAST KEAL CLAY PIT
28. FEN BRIDGE DRAIN (EAST FEN CATCHWATER)

- The protection of those sites which, although valuable in ecological terms, are not formally protected, eg County Trust Nature Reserves and Sites of Nature Conservation Interest (SNCI).

- Consultations with outside organisations where NRA work or consent is likely to impact on the sites above.

The Government, through the Countryside Commission, is now encouraging farmers to combine their commercial farming practices with conservation awareness. The scheme, called Countryside Stewardship, allows farmers financial compensation for returning land to a more natural state. This has obvious environmental benefits and in some instances flood defence benefits for the NRA.

Map Nos. 12 and No. 13 show details of conservation interest in the catchment.

Local Perspective

The NRA has undertaken River Corridor Surveys on main river watercourses to establish the degree of plant, bird and habitat diversity. The diversity of flora and habitat gives an indication of the overall health of the water environment.

Modifications to the river systems for land drainage purposes have resulted in a limited variety of "in-channel" habitat and aquatic plant diversity. Over the centuries the water environment has been transformed from one of large areas of reedswamp shallow lagoons and wooded islands interwoven with a network of meandering river channels, to one which characterises the fens we know today, comprising a vast desolate and flat landscape with grid pattern of drains cut and heavily maintained for functional purposes.

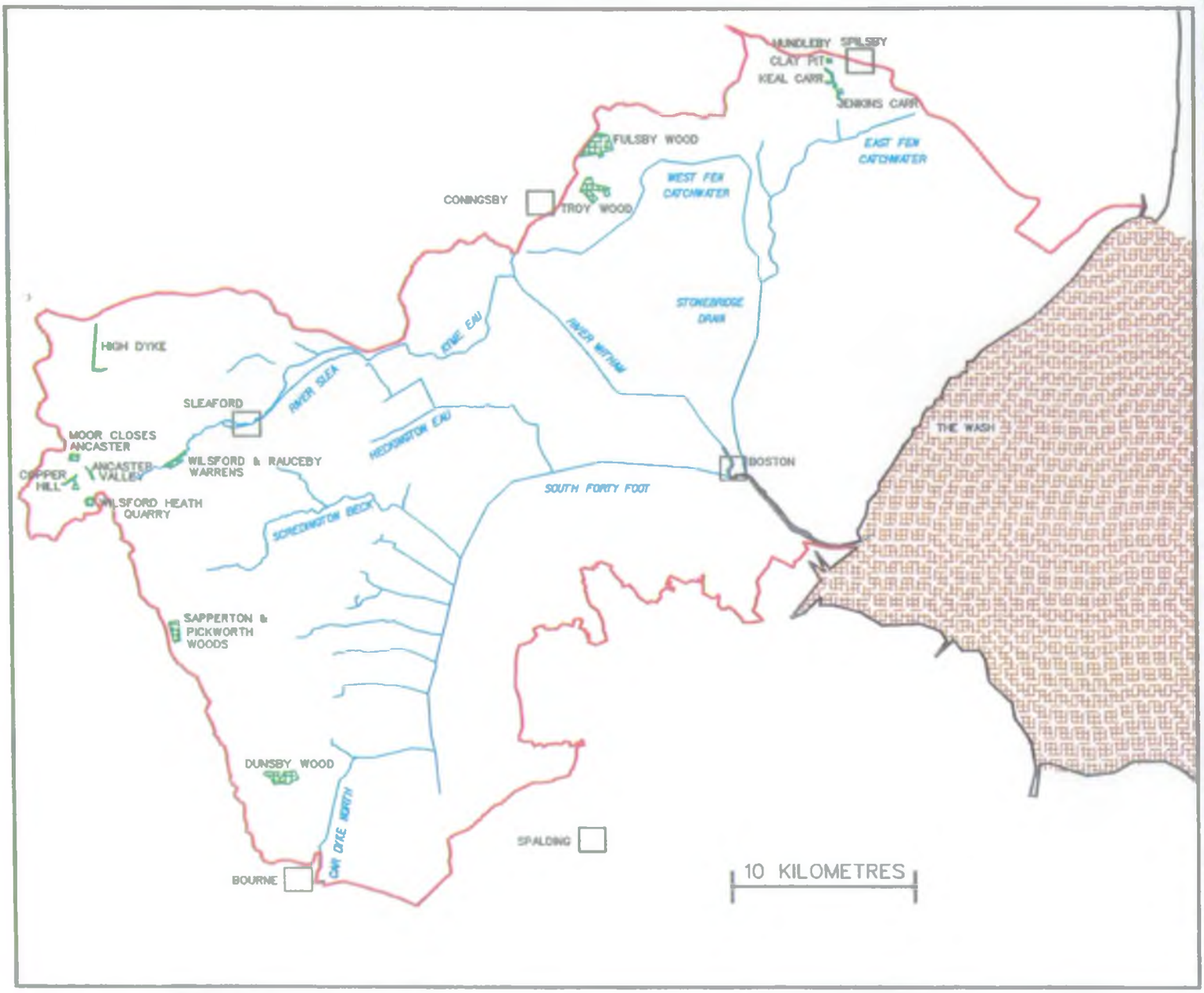
3.6.4 CONSERVATION ARCHAEOLOGY

General

The landscape of Britain contains a rich heritage of historic and archaeological features. These include megalithic monuments, Roman remains, castles, deserted villages, ecclesiastical buildings, great halls and bridges. Some sites protected or managed for their historic interest are also valuable for wildlife, and as a result can form important habitats. Archaeologically, rivers, lakes and alluvium-covered areas are important because of the types of site preserved, and the possibility of anaerobic conditions permitting the preservation of organic materials. Of all landscape environments, rivers, lakes and alluvium spreads are possibly the least well documented archaeologically, probably because, until disturbed, remains preserved in these areas are among the best protected in the country.

THE LOWER WITHAM CATCHMENT MANAGEMENT PLAN

MAP NUMBER 13
JUNE 1995



KEY

- CATCHMENT BOUNDARY
- TIDAL DEFENCES
- MAIN RIVER

- SITE OF SPECIAL SCIENTIFIC INTEREST
- SITE OF SPECIAL SCIENTIFIC INTEREST AND RAMSAR/SPECIAL PROTECTION AREA

SITES OF SPECIAL SCIENTIFIC INTEREST (SSSI)

National Rivers Authority

Anglian Region
Northern Area
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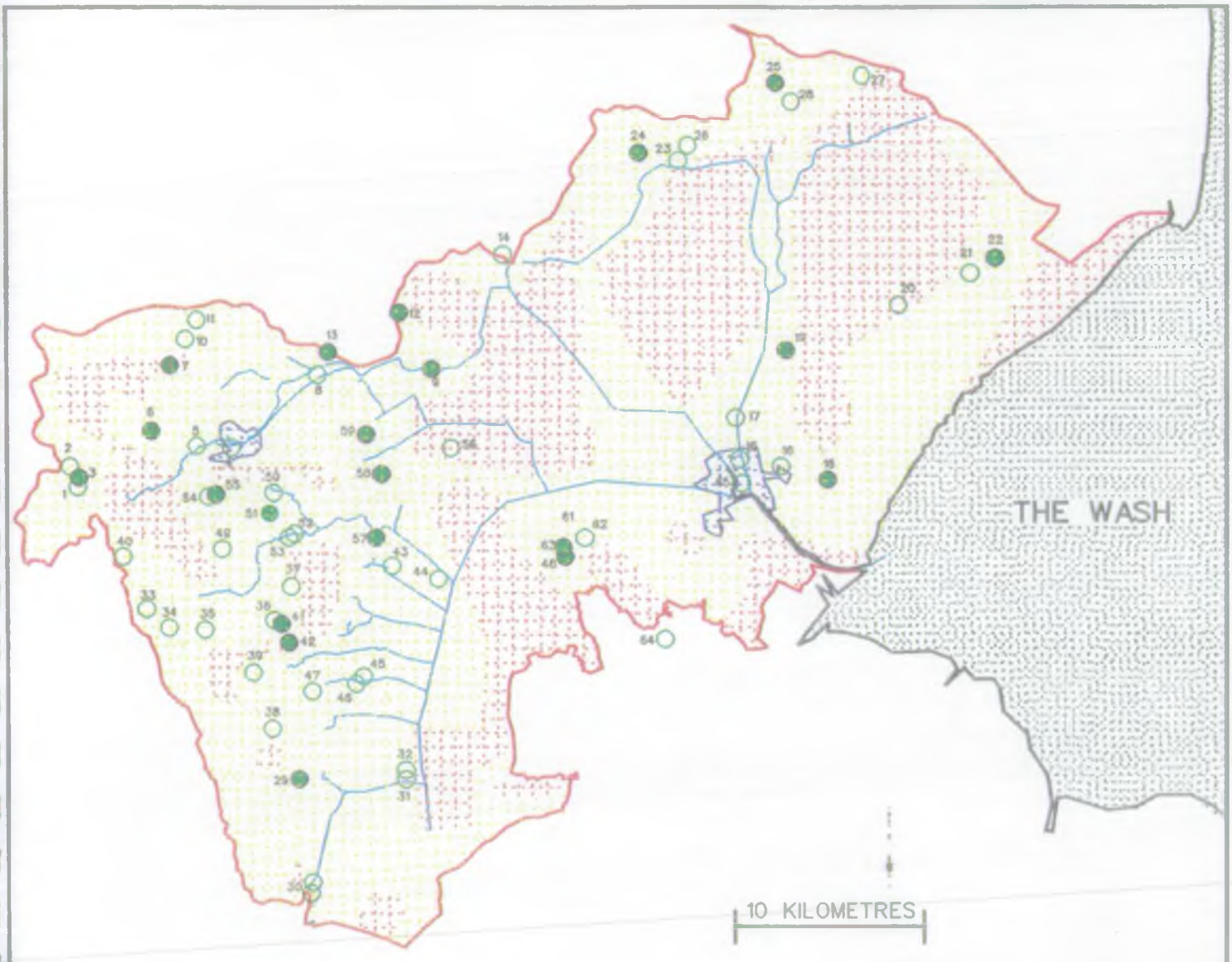
THE LOWER WITHAM CATCHMENT MANAGEMENT PLAN

MAP NUMBER 14
JUNE 1995



KEY

- CATCHMENT BOUNDARY
- TIDAL DEFENCES
- MAIN RIVER

SCHEDULED MONUMENTS

- NEW AND REVISED
- AWAITING ASSESSMENT

- HISTORIC CORE
- AREAS OF GREAT ARCHAEOLOGICAL INTEREST
- AREAS OF LOWER ARCHAEOLOGICAL INTEREST

ARCHAEOLOGICAL SITES

National Rivers Authority
Anglian Region
Northern Area
Harvey Street
Lincoln
LN1 1TF
Tel: (01522) 513100
Fax: (01522) 512927

SCHEDULED MONUMENTS

1. ANCASTER CASTLE
2. ROMAN MARCHING CAMP
3. ANCASTER VILLAGE CROSS
4. SLEAFORD CASTLE
5. SETTLEMENT AND ENCLOSURE, HOLDINGHAM
6. NORTH RAUCEBY VILLAGE CROSS
7. CRANWELL VILLAGE CROSS
8. HAVERHOLME PRIORY
9. REMAINS OF MEDIEVAL MONASTERY MOATED MANOR HOUSE, FISHPONDS, AND POST MEDIEVAL GARDEN
10. DUNSBY DESERTED MEDIEVAL VILLAGE
11. BRAUNCEWELL DESERTED MEDIEVEL VILLAGE
12. NORTH KYME VILLAGE CROSS
13. CHURCH YARD CROSS, ST EDITH'S CHURCHYARD
14. DOG DYKE PUMPING STATION
15. HOSPITAL, BRIDGE LANE FOOTBRIDGE
16. ROCHFORD TOWER
17. COWBRIDGE IRON FOOTBRIDGE LANE
18. CHURCHYARD CROSS, ST JAMES' CHURCHYARD
19. CHURCHYARD CROSS, ST MARGARET'S CHURCHYARD MOUNDS IN BUTT LEES
20. "KINGS HILL" CROSS
21. ABBEY HILLS MOAT HOLME HOUSE
22. MOATED SITE 300M NORTH-EAST OF ALL SAINTS CHURCH CHURCHYARD
23. REVESBY ABBEY
24. CHURCHYARD CROSS, ST HELEN'S CHURCHYARD
25. BOLINGBROKE CASTLE
26. TWO ROUND BARROWS WEST OF HOME FARM
27. ERESBY HALL (SITE OF)
28. ANGLO-SAXON CEMETERY, HALL HILL
29. RIPPINGALE VILLAGE CROSS
30. CAR DYKE, SOUTH OF DYKE
31. SETTLEMENT BETWEEN RIPPINGALE RUNNING DIKE AND LONG DROVE
32. SETTLEMENT BETWEEN LONG DROVE AND DOWSBY DRAIN
33. ROMAN VILLA, HACEBY
34. HACEBY MOATED SITE
35. ROUND BARROW AT NEWTON
36. THREEKINGHAM BEACON
37. SPANBY MOATED SITE
38. ASLACKBY CASTLE
39. FOLKINGHAM CASTLE
40. HEYDOUR CASTLE
41. CHURCHYARD CROSS, ST PETER'S CHURCHYARD
42. SITE OF ANGLO-SAXON NUNNERY AND MEDIEVAL CHAPEL, STOW GREEN
43. CAR DYKE, ROMAN CANAL AT HELPRINGHAM
44. ROMAN SALTERN IN HELPRINGHAM FEN
45. BRONZE AGE SALTERN
46. MOAT SITE NORTH-EAST OF SEMPRINGHAM HOUSE FARM
47. SEMPRINGHAM PRIORY (SITE OF)
48. STUMP CROSS
49. BARROW IN ASWARBY PARK
50. SITE OF MAREHAM GRANGE
51. BOUNDARY CROSS, MAREHAM
52. NORTH BECK PACKHORSE BRIDGE
53. HALL CLOSE MOAT AND EARTHWORKS
54. SITE OF CHAPEL AND TWO
55. SILD WILLOUGHBY VILLAGE
56. SETTLEMENT SITE 600M EAST OF
57. HELPRINGHAM VILLAGE CROSS
58. CHURCHYARD CROSS, ST PETER'S
59. CHURCHYARD CROSS, ST OSWALD'S CHURCHYARD
60. EWERBY VILLAGE CROSS
61. THE MAN WAR INGS
62. SWINESHEAD ABBEY
63. BUTTER CROSS, SWINESHEAD
64. RECTANGULAR EARTHWORK, WYBERTON WEST ROAD
65. HUSSEY TOWER

The NRA has a duty to have regard to features of archaeological and historic interest during all aspects of NRA work under Section 16(1) of the Water Resources Act 1991. However, the principle legislation affecting monuments in England is contained in the Ancient Monuments and Archaeological Areas Act 1979, which was subsequently amended by the National Heritage Act 1983. The Secretary of State is required to compile and maintain a schedule of monuments to which statutory protection is afforded.

Historic landscapes within the catchment are designated by English Heritage, whilst Scheduled Monuments (SM's) are designated by the Department of National Heritage on advice from English Heritage. Other historical and archaeological sites may fall within areas designated as Environmentally Sensitive Areas by MAFF, or be covered by the Countryside Stewardship agreement with the Countryside Commission.

The County Archaeologist classifies land using four levels of archaeological importance:

- "scheduled ancient momuments" are afforded legal protection;
- "Historic Cores", which include Boston, Sleaford, and those villages whose origins are medieval or earlier;
- "Areas of great archaeological interest", where there are a considerable number of known sites;
- "Areas of lower archaeological interest", where relatively few archaeological sites exist or have been identified.

These classifications are shown on Map 14.

From an operational perspective, the NRA follow the necessary consultation procedures pertaining to each of these classifications, this includes consulting with the County Archaeologist on any scheme which involves the movement of soil or changes in water levels.

Local Perspective

The County Council in the area maintains a detailed list of known archaeological sites on the Sites and Monuments Record (SMR). The SMR is updated as fresh information is made available as a result of new excavation and survey work. The NRA recognises the County SMR as the primary source of archaeological information and advice and will consult them as a matter of course regarding such data.

Any new designations will be notified to the NRA who will ensure accurate, up to date listings are maintained.

There are 65 Scheduled Monuments in the catchment which are of national importance. In addition, numerous non-statutory sites exist which have been identified as valuable or potentially valuable.

The NRA aims to improve links with County Archaeologists and other appropriate organisations. Wherever possible, the NRA will continue to seek to protect sites associated with watercourses from direct damage and from drying out.

3.6.5 NAVIGATION

The River Witham has been in use as a navigation since pre-Roman times; it forms a link between those other navigable rivers which outfall into the Wash with the Midlands and Yorkshire via the Fossdyke Canal.

Historically the network of drains now maintained by Internal Drainage Boards were used extensively by farmers to transport crops through the Port of Boston to other parts of the country. The inland navigation channels today are used almost exclusively for recreational purposes. Currently there are proposals to restore the River Slea navigation to Sleaford.

The statutory navigation authority on the River Witham is British Waterways - the NRA have a responsibility to maintain a minimum water depth of 5 feet in the channel for navigation purposes. The Witham Fourth IDB are the statutory navigation authority on the Witham Fourth Navigable Drains.

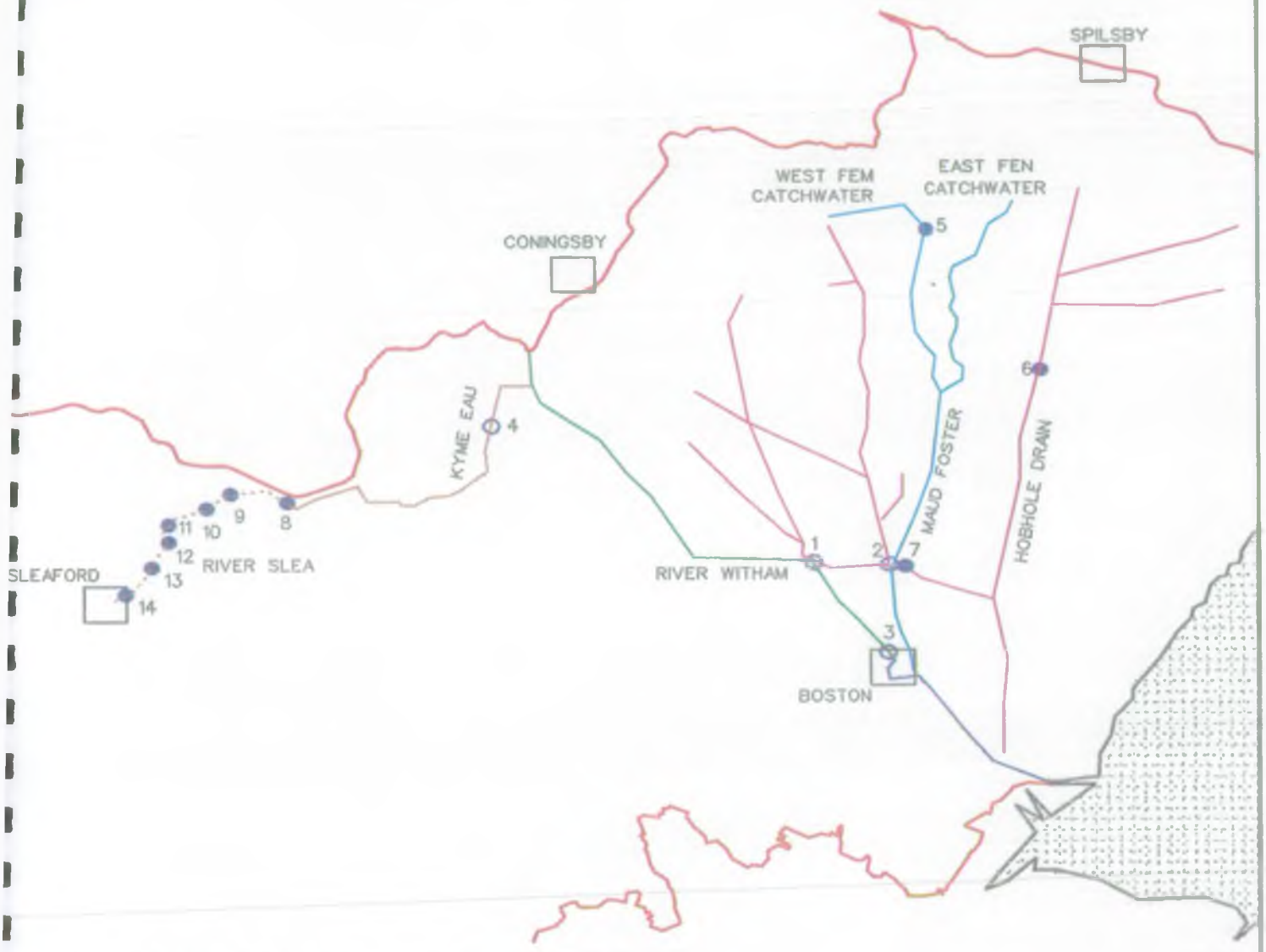
Navigation use is also made of the Maud Foster system (including Stonebridge Drain and the East and West Fen catchwaters) however there is no statutory navigable authority for these waters.

The Port of Boston is the Navigation Authority on the tidal length of the River Witham. The docks handle vessels of up to 3,000 tonnes and a small fishing fleet also operates from the Port, goods imported through the docks include timber and fruit; those exported goods are primarily agricultural in origin. Waterbased recreational activities, such as canoeing and sailing also take place around the Boston area.

Map No. 15 shows navigable waters in the catchment.

THE LOWER WITHAM CATCHMENT MANAGEMENT PLAN

MAP NUMBER 15
JUNE 1995



FOR SCHEDULE OF LOCKS SEE OVER THE PAGE

KEY

- CATCHMENT BOUNDARY
- TIDAL DEFENCES

NAVIGATION AUTHORITIES

- RIVER WITHAM (British Waterways)
- TIDAL RIVER WITHAM (Port of Boston)
- WITHAM NAVIGABLE DRAINS
- UNCLEAR
- RIVER SLEA
- EXISTING NAVIGABLE LENGTH
- PROPOSED NAVIGATION

LOCKS

- OPERATIONAL
- NON OPERATIONAL

NAVIGATIONS

National Rivers Authority
Anglian Region
Northern Area
Harvey Street
Lincoln
LN1 1TF
Tel: (01522) 513100
Fax: (01522) 512927

LOCATION OF LOCKS

OPERATIONAL LOCKS		OPERATING AUTHORITY
1.	ANTONS GOWT	BRITISH WATERWAYS
2.	COWBRIDGE	WITHAM FOURTH INTERNAL DRAINAGE BOARD
3.	GRAND SLUICE	BRITISH WATERWAYS
4.	BOTTOM LOCK	-
NON-OPERATIONAL LOCKS		
5.	HAGNABY	-
6.	LADE BANK	WITHAM FOURTH INTERNAL DRAINAGE BOARD
7.	EAST FEN	WITHAM FOURTH INTERNAL DRAINAGE BOARD
8.	COBBLERS	-
9.	HAVERHOLME	-
10.	WHITE COTTAGE	-
11.	EVEDON MILL	-
12.	CORN MILL	-
13.	BONE MILL	-
14.	COGGLESFORD	-

4. CURRENT STATUS

4.1 WATER RESOURCES

General

This section summarises the total licensed and actual abstractions of water within the catchment compared with the available resource. Future demands for water are also considered.

The principal water resources in the catchment are water from the River Witham and groundwater abstracted from the limestone aquifer in the western part of the catchment. Springs which are fed from the limestone are dependent upon the availability of groundwater.

The water resources of the southern and central limestone are fully committed to existing licences. No additional water from the aquifer is available.

Local Perspective

4.4.1 Groundwater

For the purposes of this document when referring to the water resources of the limestone aquifer, the limestone aquifer extending from the Stamford area to a line north of Sleaford is considered, and not just the aquifer contained within the boundary of this catchment plan.

The limestone aquifer is fully developed for abstraction predominantly for public water supply and some agricultural use. Recharge (replenishment by rainfall) to the limestone aquifer occurs outside this catchment plan area to the south and west in the catchments of the rivers Glen. In general the balance of recharge minus abstraction forms the residual resources available to meet springflows.

The limestone aquifer has been the subject of considerable investigation and study and a mathematical model has been developed to improve understanding of aquifer behaviour (Map No. 16 shows the area considered by this groundwater model). The model of the limestone aquifer system allows the simulation of groundwater levels, aquifer springflows given different recharge to the aquifer, and different levels of abstraction. The model has recently been refined and extended and the balance shown in Table 3 indicates preliminary figures from the groundwater model.

TABLE 3 - WATER RESOURCES BALANCE (SOUTHERN /CENTRAL LIMESTONE)

Aquifer inputs(I)/outputs(O) in tcmd	Dry/Drought (c. 1 in 10yr)	Average
Recharge available (I)	137	225
Licensed abstraction (O)	96.1	96.1
Total flow to springs (O)	40.9	128
Current abstraction (O)	79	79
Total flow to springs (O)	58	146

Note:
- tcmd means thousand cubic metres per day.
- Recharge and abstraction figures relate to the whole of the southern/central limestone aquifer to a point just north of Sleaford.
- Effective resource available (from recharge) are derived from the southern/central limestone distributed groundwater model.
- Total estimated environmental needs are c. 60 tcmd on average.

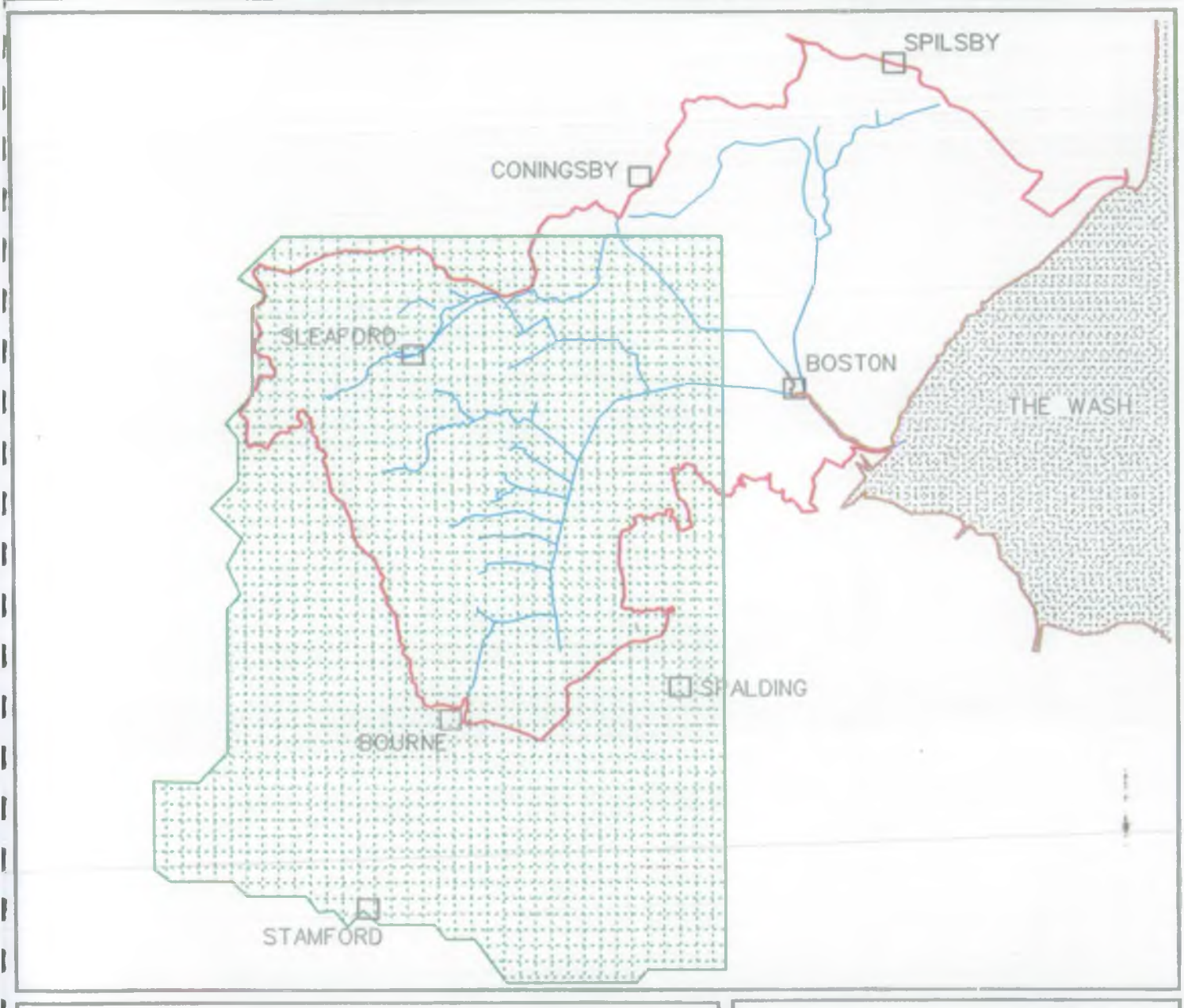
From an initial consideration of data shown in Table 3 it is clear that under average recharge conditions there are sufficient resources available to meet abstraction and river needs both under conditions of current and licensed abstraction. However, one characteristic of the limestone is that it recharges very quickly and also discharges to springs very readily. In general, this leads to strong baseflows to rivers and springs in winter and poor baseflows during summer months as the limestone has discharged much of its storage to springs during winter. With this in mind, under drought conditions this can lead to periods of little or no flow in some watercourses.

The figures used in Table 3 are based upon consideration of the gross recharge available for abstraction. In the Anglian Regional Water Resources Strategy the NRA reduces the gross limestone recharge by 40% to reflect the inadequacy of aquifer storage to fully even out year to year variations in recharge. The reduced quantity is referred to as 'effective resource' and it is this which is reliably available for allocation to either abstraction or to the environment.

During the recent drought (1988 - 1992), taking advantage of the unusually low groundwater levels, the NRA carried out works to seal or control 30 wild boreholes across the Fen area of the South Forty Foot catchment. These boreholes had historically overflowed under artesian pressure from the limestone aquifer in an uncontrolled way (hence the term 'wild') into local watercourses and ditches. Action was taken to seal/control the borehole flow in order to conserve the high quality groundwater resources of the limestone aquifer. A small controlled discharge was left at borehole sites where it was felt that the aquatic flora and fauna may have been impacted by a total cessation of overflow.

THE LOWER WITHAM CATCHMENT MANAGEMENT PLAN

MAP NUMBER 16
APRIL 1995



KEY

- CATCHMENT BOUNDARY
- TIDAL DEFENCES
- MAIN RIVER
- AREA OF GROUNDWATER MODEL

AREA OF GROUNDWATER MODEL FOR THE SOUTHERN/CENTRAL LIMESTONE AQUIFER

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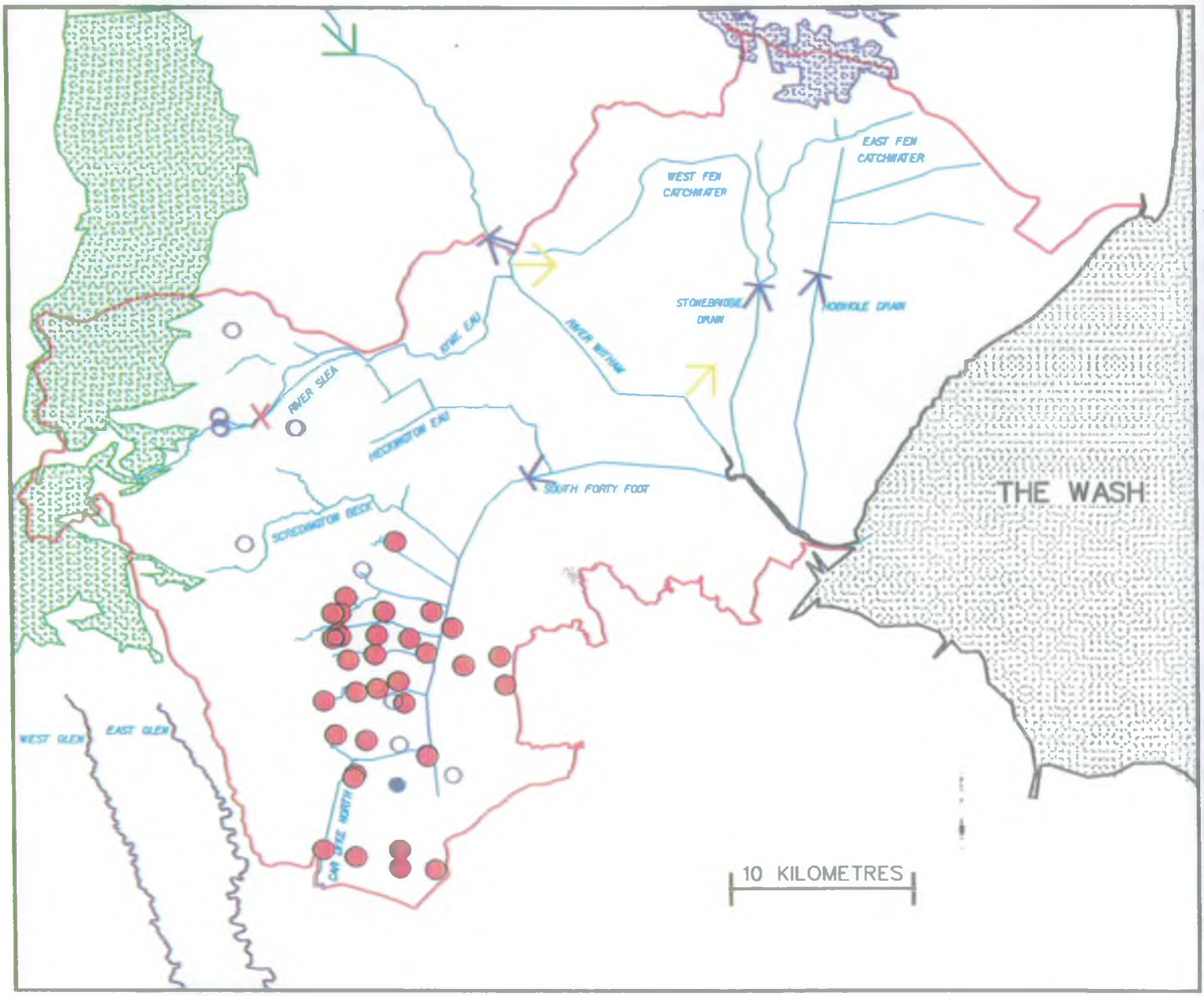
THE LOWER WITHAM CATCHMENT MANAGEMENT PLAN

MAP NUMBER 17
JUNE 1995



KEY

- CATCHMENT BOUNDARY
- TIDAL DEFENCES
- WATERCOURSE
- MAXIMUM RECORDED EXTENT OF SALINE INTRUSION
- WILD BOREHOLES CONTROLLED BY THE NRA
- PUBLIC WATER SUPPLY ABSTRACTION POINT
- PROPOSED PWS ABSTRACTION POINT
- RIVER SLEA AUGUMENTATION POINT
- LINCOLNSHIRE LIMESTONE
- SPILSBY SANDSTONE
- AUGUMENTATION TO WITHAM FROM THE RIVER TRENT
- WATER TRANSFER FROM THE WITHAM

WATER RESOURCE DETAILS

National Rivers Authority
Anglian Region
Northern Area
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Fax: (01522) 512927

It has emerged that a small number of agricultural abstractors that were partially dependent upon the overflow from the wild boreholes have been adversely affected by these reduced flows.

With regard to public water supplies in the catchment Anglian Water Services are developing a new abstraction source in the Haconby Fen area. This source is being developed to ensure security of water supplies for the area supplied to the west. Anglian Water Services seek to increase abstraction in this area (Aslackby to West Pinchbeck area) within their overall existing licensed entitlement for the whole of the southern limestone. The NRA will be investigating the impact of the proposed development using the mathematical model of the aquifer system.

4.1.2 Surface water

Surface water in the catchment can be split into three different areas, flows from the limestone in the west, east of the Witham and the Witham itself. The following refers to each area in turn.

The appearance and at times, lack of flow, in the River Slea through Sleaford has for some time been a local concern. To alleviate this situation the NRA have constructed a river augmentation borehole on the west side of Sleaford. The borehole was commissioned towards the end of 1994 and will be used to augment the river in order to maintain river levels through the town of Sleaford. Operational experience with the augmentation will be required in order to assess the performance and effects of the augmentation through a period when the river would otherwise be dry. This performance will be assessed over the next two years and the possible need for local bed lining will be reviewed subsequently. Some further local monitoring is proposed in order to improve the NRA's understanding of the interaction (leakage) between the limestone and overlying deposits. It is considered that this information will help in the local understanding of the aquifer system. The augmentation scheme should not be relied upon to sustain a flow downstream of Sleaford.

To the east of the River Witham, the indigenous water resources of the East and West Fens are small and fully committed to existing licences. Transfers of water are made into the area from the Witham under licence (Water Transfer Ltd) and water is subsequently reabstracted for use. The River Witham is supported by the NRA's River Trent to Witham transfer scheme. The current allocation of water to Water Transfer is sufficient to meet current needs within the period of the plan. Further demand for water in this area will have to be met from transfers from the Witham.

At times of low summer flows saline incursion into the lower reaches of the Witham can occur. The cause of the salinity is largely leakage through the tidal doors in Boston. The NRA can augment (increase) the flow of the Witham by transfers of water from the River Trent at Torksey on the Fossdyke canal. When operating this river transfer scheme to augment the Witham for subsequent abstraction , the NRA manages the river in such a way as to maintain a positive flow to tide to exclude where possible the threat from saline incursion. Failure to manage saline incursion can lead to water quality that is not suitable for applying to crops.

Effective management of river transfers and management of saline intrusion is made difficult by the lack of flow monitoring equipment in the River Witham. The requirement for such will become more important should the rate of river transfers increase. Increasing river transfers will be dependent upon future demands for water in this and the Upper Witham catchments.

4.1.3 Water Demands

a) **Public Water Supplies**

Public water supplies for the area to the east of the Witham are met from abstraction from the Spilsby sandstone in the Louth catchment to the north east. Water from the Limestone supplies much of the rest of the catchment.

The most recent forecasts for growth in demand for public water supplies are very low; the NRA's 'low' growth forecast is for the increase to be less than 1% per annum to 2015. With the introduction of a number of demand management initiatives (eg leakage reductions through mains rehabilitation) the latest water company forecasts are for no growth at all over the next 20 years. Current licence entitlements are considered sufficient to meet forecast demands.

b) **Agricultural Demand**

Recent research indicates that demand for water for agricultural irrigation will increase by c 1.7% per annum to 2001 and thereafter at a rate of 1% per annum. For this catchment agricultural demand may increase from c. 3,780 tcm (70% of current licensed entitlement) to c 5,000 tcm by 2021.

Demand for water to the east of the Witham can be met from NRA river transfers. In the catchment of the South Forty Foot increases in demand will have to be met by storage of winter water for summer use.

The Anglian Regional Water Resources strategy states that no additional resources are available from the limestone aquifer.

Map No. 17 shows key water resource details.

4.2 CURRENT STATUS WATER QUALITY

This section considers the status of the Catchment with respect to the quality of rivers, estuaries, coastal and ground waters. Water quality protection is maintained and improved using a number of methods:

(i) Through the issue of Discharge Consents - Consents are issued to those persons and organisations who discharge effluents. Consents specify the quality of effluent and conditions under which they are permitted to be discharged.

(ii) By the regular biological and chemical monitoring of surface water and groundwater quality.

(iii) By the regular chemical monitoring of discharges.

(iv) By influencing development proposals through the planning process.

(v) By liaison with HMIP in respect of authorisation of prescribed processes under the Environmental Protection Act and with the Waste Regulatory Authority regarding Waste Management Licences.

(vi) Setting water quality targets for local Water Quality management needs.

The main influences upon water quality in this Catchment are: (in no priority)

- the use of water for effluent disposal from sewage treatment works
- the use by the agricultural industry of fertilizers which (a) enrich surface water with nutrients and contribute to their eutrophic conditions and (b) have led to the contamination of groundwater with nitrates
- low summer flows
- saline intrusion - the ingress of salt water into freshwater systems during periods of low flow.

4.2.1 Surface Water

The water quality of the principal watercourses is classified using the General Quality Assessment Scheme (GQA). This is used to make periodic assessments of the quality of river water in order to monitor trends. The Scheme comprises 4 components - general chemistry, nutrients, aesthetics and biology - each providing a discrete 'window' upon the quality of river stretches. The general chemistry component of the GQA is in current use and comprises 6 tiered grades - Grade A Good to Grade F Poor - defined by standards for dissolved oxygen, Bio-chemical Oxygen Demand (BOD) and total ammonia. The remaining 3 "windows" are still under development and will be applied when available.

River Quality Surveys carried out for the years 1992-1994, inclusive, indicate the Catchment was mostly of fair quality, (Grade C/D), though areas of poor quality (Grade E) were noted. These are as follows:-

- The Old River Slea below Sleaford. The quality of this watercourse is affected by the discharge from Sleaford Sewage Treatment Works. This is accentuated during dry years when there is reduced dilution.

- The Frampton Town Drain - this is affected by the discharge from Frampton Sewage Treatment Works and by eutrophication. Reduced dilution during dry years will also affect water quality.

- The Hobhole Drain below Lade Bank, which is affected by saline intrusion and eutrophication.

Map No. 18 shows water quality in the catchment as classified using the General Quality Assessment Scheme.

In addition to the above, biological monitoring by the NRA has been undertaken and the data analysed using the Lincoln Quality Index System. This confirms water quality is generally of fair quality with some good quality in the upper reaches of the South Forty Foot Drain and in the River Witham. Biological data would indicate that the only poor watercourse in the Catchment is the Old River Slea below Sleaford STW.

Map No. 19 shows this analysis.

A general quality assessment has not yet been developed for estuarine waters and the Classification of Estuaries Working Party scheme is used. This takes into account biological, aesthetic and chemical data (dissolved oxygen), and comprises 4 tiered classes, A (Good) to D (Poor). The scheme shows the Witham Haven to be Class A, good quality (see Appendix 2).

4.2.2 Eutrophication

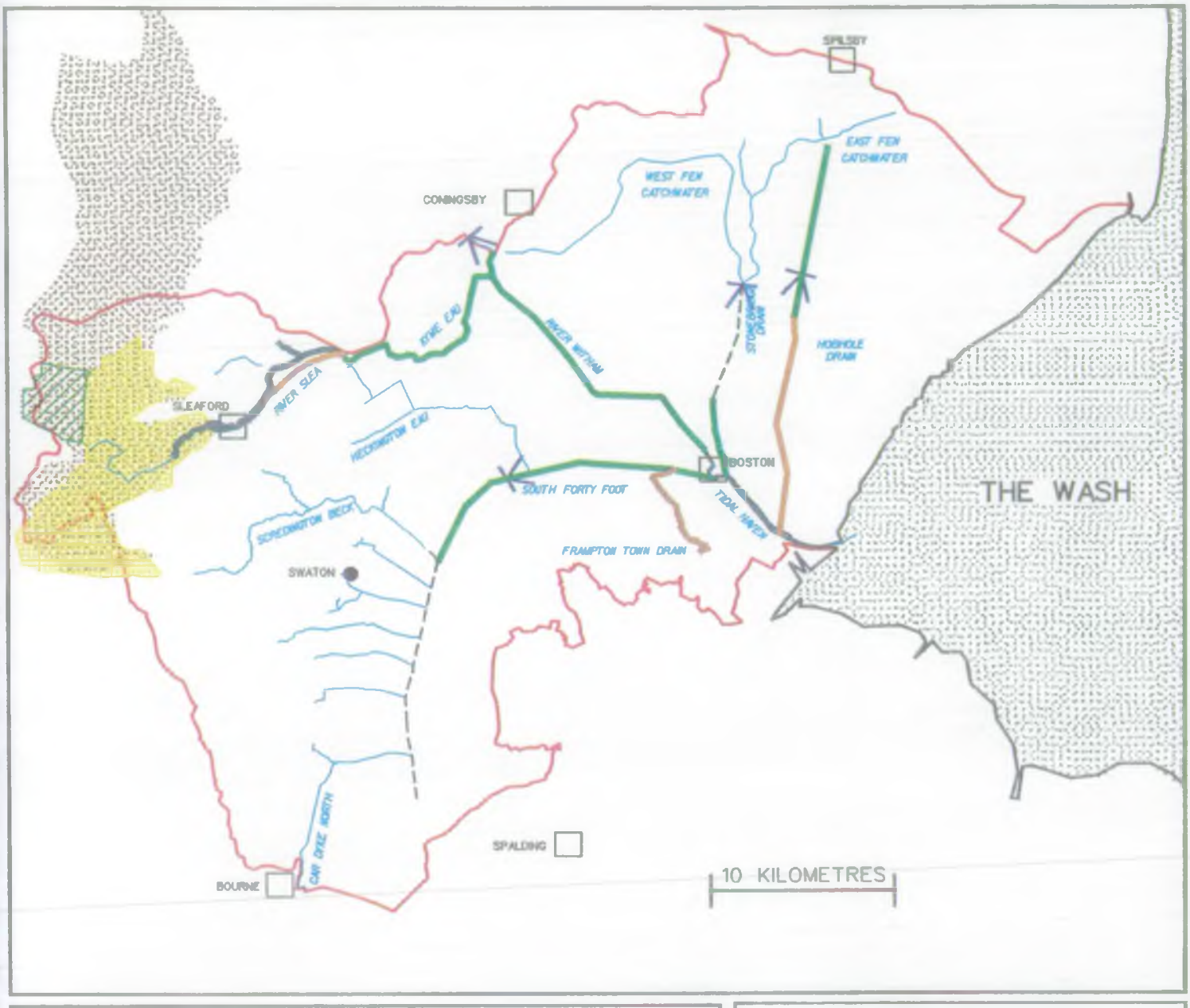
A general water quality concern within the Catchment is that of eutrophication. Eutrophication is the enrichment of water by nutrients, causing an accelerated growth of algae and higher forms of plant life to produce an undesirable disturbance to the balance of organisms present in the water and to the quality of the water concerned.

Sources of nutrient can be from both agricultural land and sewage treatment works. However, the slow moving nature of the watercourses in the Catchment can significantly enhance algal growth and therefore increase the effects of eutrophication.

Under the Urban Waste Water Treatment Directive watercourses can be classified as Eutrophic Sensitive Areas. However, only waters receiving direct/indirect discharges from sewage treatment works greater than 10,000 population equivalent can be considered, and strong supporting evidence must be available which demonstrates these waters are eutrophic. A comprehensive set of biological/chemical criteria are available to confirm eutrophic status.

THE LOWER WITHAM CATCHMENT MANAGEMENT PLAN

MAP NUMBER 18
JUNE 1995



KEY

- CATCHMENT BOUNDARY
- TIDAL DEFENCES
- WATERCOURSE
- MAXIMUM RECORDED EXTENT OF SALINE INTRUSION

- A, B: GOOD
- C, D: FAIR
- E: POOR
- F: BAD
- WATERS TO BE ASSESSED FROM 1995

NITRATE PROTECTION ZONES

- PROPOSED NVZ
- NSA
- PROPOSED EXTENTION TO NSA

RIVER QUALITY 1994 GENERAL QUALITY ASSESSMENT
(CHEMISTRY COMPONENT ONLY)

National Rivers Authority

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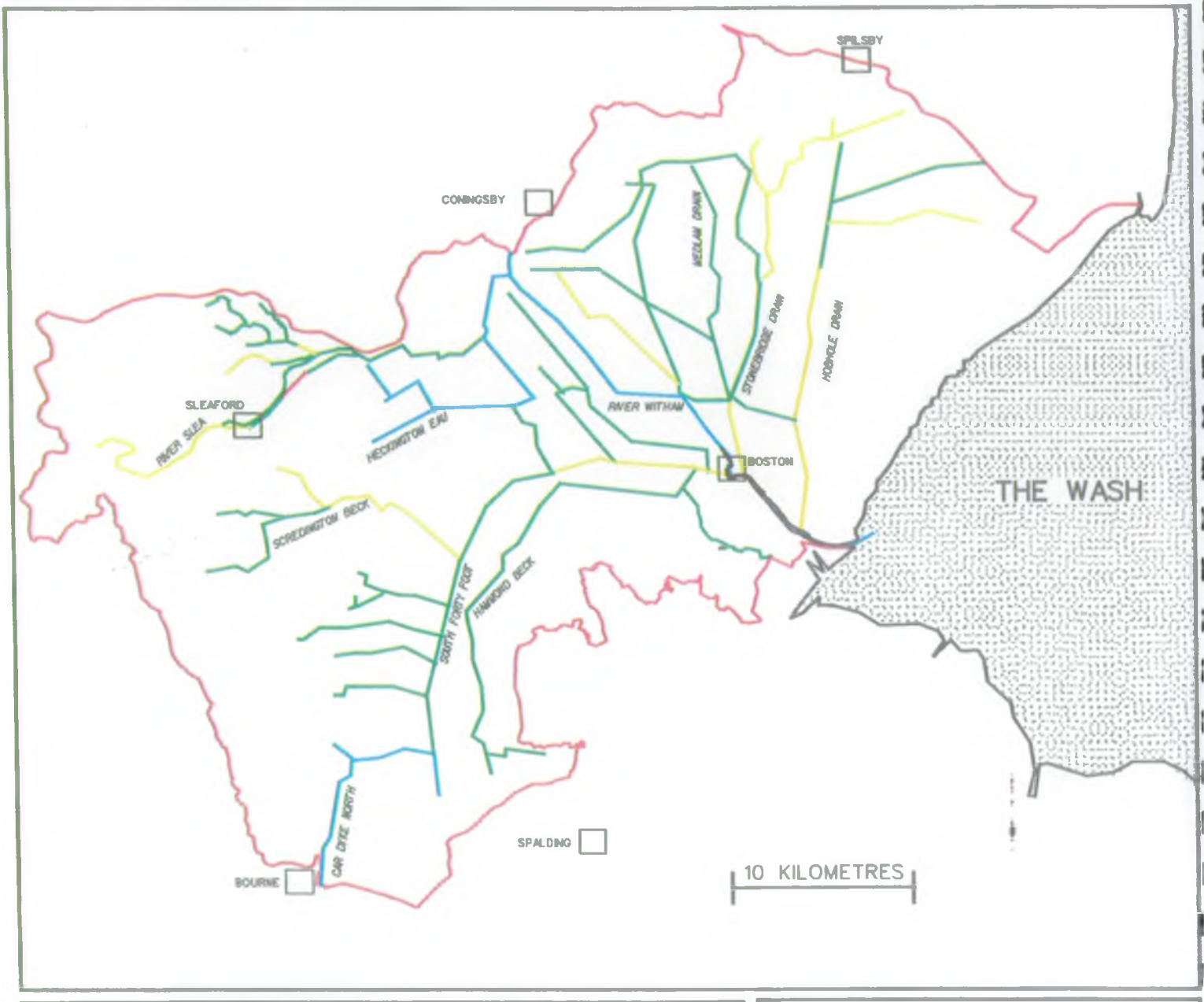
THE LOWER WITHAM CATCHMENT MANAGEMENT PLAN

MAP NUMBER 19
JUNE 1995



KEY

- CATCHMENT BOUNDARY
- TIDAL DEFENCES

LINCOLN QUALITY INDEX

- EXCELLENT
- GOOD
- MODERATE
- POOR

BIOLOGICAL WATER QUALITY

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The River Witham, from Marston, Grantham, to Grand Sluice, Boston, was put forward to the Department of the Environment in 1993 as a candidate for designation as an Eutrophic Sensitive Area. The Department of the Environment has recently decided not enough evidence is available to support designation and has asked the NRA to undertake further data gathering. This is being done. In addition, the NRA are collecting data to support the designation of the Kyme Eau as an Eutrophic Sensitive Area.

Eutrophic Sensitive Area designation requires nutrient removal at all sewage works greater than 10,000 population equivalent that contribute to the levels of nutrients in the designated area either directly or indirectly via tributaries. The requirement to provide this additional treatment is however dependant on the impact of nutrient removal in the discharge being assessed as significant.

There are a number of other local water quality issues not reflected in the GQA:

- The quality of the lower reaches of some watercourses - notably the Witham, South Forty Foot Drain and Maud Foster system are adversely affected by saline intrusion. This affects both flora and fauna and can make water unusable for irrigation purposes.

- A number of small watercourses and ditches within the area suffer from localised pollution from inadequate village sewage disposal systems, a typical example of which is at Swaton. Such problems manifest themselves in terms of their smell and appearance. They are difficult to resolve because of the cost to individual property owners and/or the sewage undertaker which can be prohibitive.

- There is an aesthetic water quality problem in the Witham Haven caused by discharges of crude sewage from premises on the High Street, Boston. The NRA is currently negotiating with Boston Borough Council and Anglian Water Services regarding the provision of a new foul sewer for this part of the town.

- Intermittent pollution to watercourses near the Slippery Gowt Landfill Site in Boston occur because it is unable to contain the leachate generated within the site.

- In urban areas such as Boston and Sleaford, there is a problem caused by the general accumulation of litter along watercourses and 'fly tipping'. Both are visually and environmentally unacceptable and can increase the risk of localised flooding by forming blockages at culverts. Responsibility for addressing this problem does not lie with any single organisation.

- Inadequate oil storage facilities at industrial and agricultural sites throughout the Catchment leads to a considerable number of pollutions each year. During 1994 there were 9 serious oil pollution incidents which had a significant impact upon water quality.

- Surface water run-off from a site carrying out timber preservation operations has, in the past, resulted in pollution and sediment contamination of the watercourses downstream, including the Town's Drain, Boston. Extensive work has been undertaken by the company in recent years which has resulted in a significant reduction in the pollution potential for the site. These improvement measures include the treatment prior to discharge of all contaminated foul and surface water arising from the site.

- The combined sewer outflow from London Road Pumping Station in Boston discharges to the River Witham at an unacceptable frequency. This happens as a consequence of development in the vicinity, discharging increasing volumes to an infrastructure not designed to handle such.

Map No. 20 shows some of the water quality problems around Boston.

4.2.3 Water Quality Objectives

In addition to the General Quality Assessment Scheme used by the NRA to periodically assess water quality, the NRA also uses the Water Quality Objective (WQO) scheme to provide water quality targets which fulfil local water quality needs. (In time this will become statutory.)

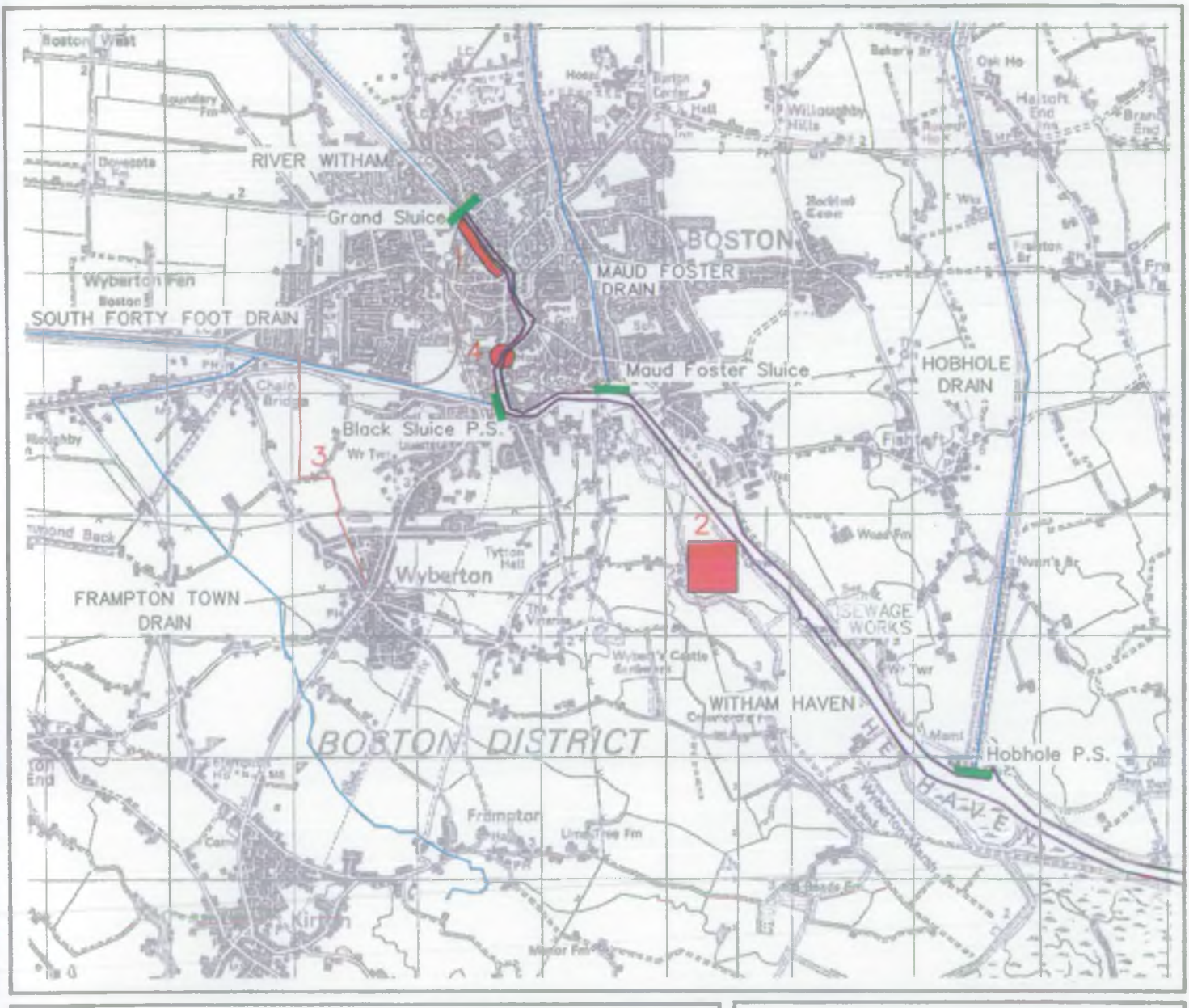
A Use-Related Scheme

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 (RE) Use Class only; the standards for further uses are still under development. For each stretch, a target WQO will be proposed, including a date by which this level of water quality should be achieved. Until WQOs are formally established by the Secretary of State, they will be applied on an non-statutory basis.

THE LOWER WITHAM CATCHMENT MANAGEMENT PLAN

MAP NUMBER 20
APRIL 1995



KEY

WATERCOURSE

1 DISCHARGES OF RAW SEWAGE TO THE WITHAM HAVEN

2 SLIPPERY GOWT LANDFILL SITE

3 TOWN DRAIN BOSTON AFFECTED BY SURFACE WATER RUN-OFF

4 COMBINED SEWER OVERFLOW - LONDON ROAD PUMPING STATION

IMPACTS ON THE WATER QUALITY IN THE BOSTON AREA

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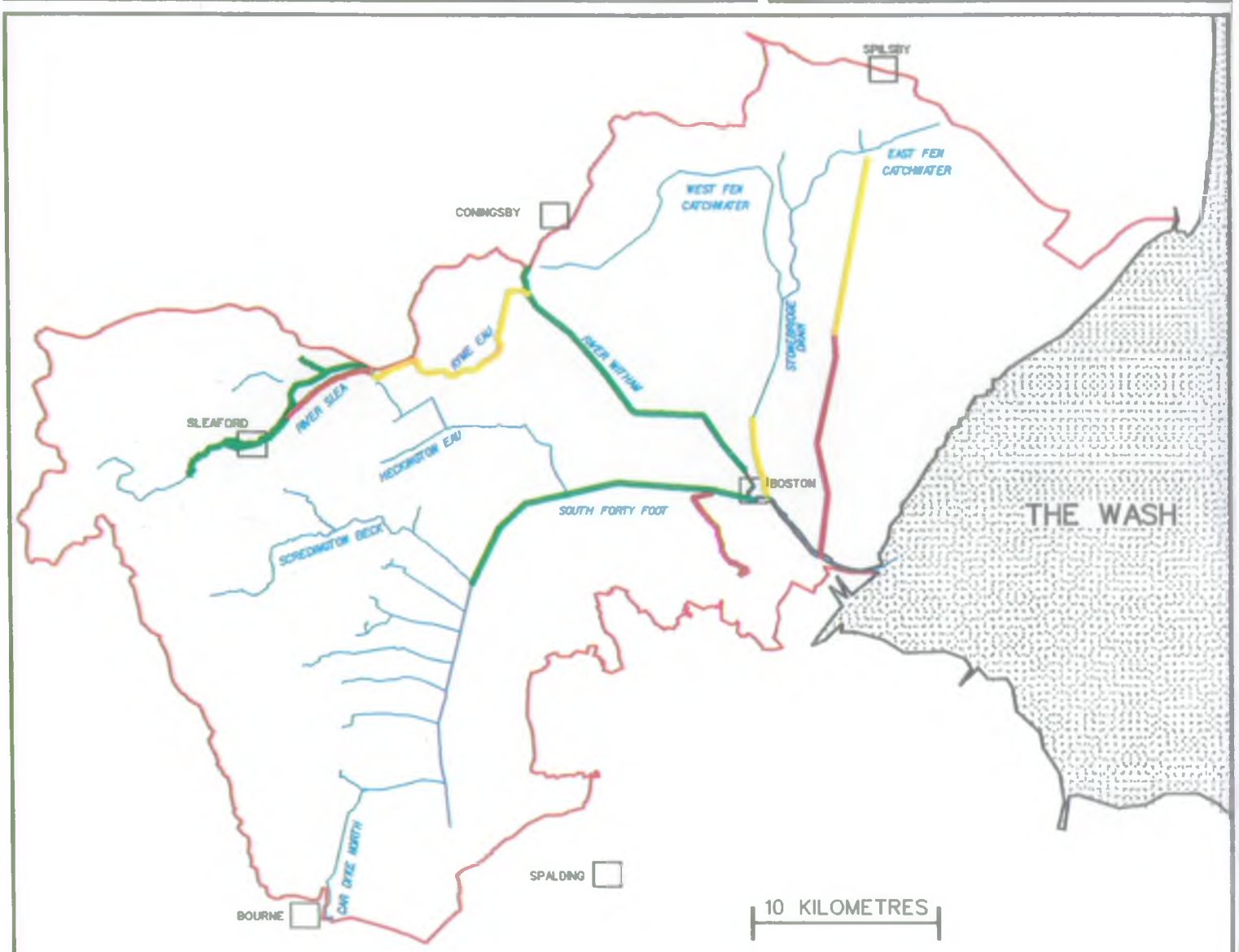
THE LOWER WITHAM CATCHMENT MANAGEMENT PLAN

MAP NUMBER 21
JUNE 1995



KEY

- CATCHMENT BOUNDARY
- TIDAL DEFENCES
- WATERCOURSE

RIVER ECOSYSTEM CLASS

- CLASS 1
- CLASS 2
- CLASS 3
- CLASS 4
- CLASS 5

PROPOSED WATER QUALITY OBJECTIVES

(RIVER ECOSYSTEM CLASSIFICATION)

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RE Use Class

There are five Classes within the RE 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 RE Classes are based on the chemical water quality requirements of different types of ecosystem (Appendix 3), and consequently, the types of fisheries they are capable of supporting. Until the WQOs are formally established, they will equate to the former use related River Quality Objectives (RQOs).

Map No. 21 shows the proposed water quality objectives under the River Ecosystem Classification.

For the Lower Witham Catchment all watercourses currently meet the Water Quality Objectives that have been proposed at this time.

The existing water quality of the Lower Hobhole Drain supports a healthy fish biomass and reasonable fish species diversity. Its poor chemical quality reflects its eutrophic nature and intermittent saline intrusion. It is unlikely that any significant improvement in chemical quality can be achieved during the life of this Plan.

Both the Frampton Town's drain and the Old River Slea are affected by discharges from sewage treatment works (Frampton and Sleaford Sewage Treatment Works respectively). Despite recent investment at both of these sewage treatment works in recent years, which have resulted in an overall improvement in effluent quality at both works, the receiving watercourses continue to be of poor quality.

The long-term targets for both of these stretches is RE Class 4. It is however unlikely that investment will be targeted at either of these sewage treatment works in the near future since investment is now based on Nationally agreed priorities, in accordance with Government policy and National guidelines for investment. These guidelines are aimed at enabling the UK to comply with the requirements of the EC Urban Wastewater Treatment Directive (91/271/EEC) and in particular bringing about improvements in estuary quality where necessary. For the foreseeable future therefore conservative RE Classes (RE Class 5) must be set for the Frampton Town's drain and the Old River Slea, which reflect the current chemical quality. It should however be noted that some improvements in water quality may yet be seen in these stretches since the overall impact of recent improvements may not yet be fully apparent.

Non Use-related Scheme for Dangerous Substances

European legislation (the Dangerous Substances Directive; 76/464/EEC and associated Directives) already establishes statutory WQOs for certain Dangerous Substances, see Appendix 4. Dangerous Substances are defined as substances which due to their toxicity, persistence and tendency to bioaccumulate can have a deleterious effect on the aquatic environment if present in sufficient quantities. These objectives apply to all river stretches. The target standards are known as Environmental Quality Standards and are aimed at protecting all aquatic life. Standards are set at European Community level, apply to all member states and are set at a level independent of the intended use to which a river stretch may be put. Compliance is assessed against these standards on a calender year basis.

The discharge of contaminated surface water run-off from a site carrying out timber preservation operations currently causes the tributary of the Town's Drain adjacent to the site to fail statutory Environmental Quality Standards for Dieldrin and Lindane (Appendix 5). The first full year for compliance assessment of water quality against the statutory quality objectives since the improvements were completed at the site will be 1995.

4.2.4 GROUNDWATER

A large part of the Lower Witham Catchment overlies the Lincolnshire Limestone Aquifer, a water resource of strategic importance to the area. The aquifer is well protected by overlying clay deposits in the central and eastern areas of the Catchment. To the west however, where the aquifer outcrops, it is given little protection by the thin soils and is vulnerable to diffuse sources of pollution.

Agricultural activities within the western part of the Catchment have led to the presence of high nitrate concentrations in the groundwater. In places, nitrate concentrations exceed 50 mgl^{-1} which is the EC Drinking Water limit. The EC Nitrate Directive requires compulsory controls in areas where nitrate levels exceed the EC limit or are at risk of doing so. There are 72 areas currently being considered throughout England and Wales for designation as Nitrate Vulnerable Zones, the central and southern Lincolnshire Limestone is one such zone. In Nitrate Vulnerable Zones farmers will be required to comply with good agricultural practice, additional agricultural constraints are currently being considered by the Government.

Nitrate Sensitive Areas (NSAs) form a supplement to these controls by providing a voluntary scheme which compensates for measures going significantly beyond good agricultural practice. All NSAs are within Nitrate Vulnerable Zones, often being a discrete part of the wider zone. The original NSA boundary for the Lincolnshire Limestone was defined in 1990; in 1995 this was reviewed using more sophisticated modelling techniques, resulting in proposals to extend the boundary to the west of Sleaford. Significant changes in farming practice throughout the NSAs is expected to lead to water quality improvements by reducing nitrate leaching. The NVZs are envisaged as long-term solutions to halt and reverse rising nitrate levels.

In addition to nitrates there are other potential risks to groundwater quality arising from ongoing development activity such as the storage of polluting materials and the installation of septic tanks. Since 1992 the NRA has been implementing its Groundwater Protection Policy, by which it seeks to discourage inappropriate developments where groundwater is most vulnerable to pollution.

Map No. 18 shows the location of Nitrate Vulnerable Zones and Sensitive Areas within the catchment.

4.3 FLOOD DEFENCE

This Catchment is predominantly low lying fen with highland areas bounding the north and western edges. The Wash provides the eastern boundary with low lying fen extending south beyond the Catchment as far as Cambridge. The larger proportion of this Catchment lies below high tide level and is protected from flooding by sea and tidal defences.

4.3.1 Fluvial Defences

Within the Catchment - apart from a small number of upland watercourses, two distinct types of drainage systems exist, both of which are entirely artificial.

The main arterial watercourses which carry highland water across the low lying fens have been constructed with raised banks. They discharge into the Wash through structures which prevent tidal waters from entering the freshwater system. As well as containing flood flows these embanked channels also provide channel storage under tide lock conditions. When high flows and tide lock conditions occur simultaneously, the waters may have to be pumped out of the system.

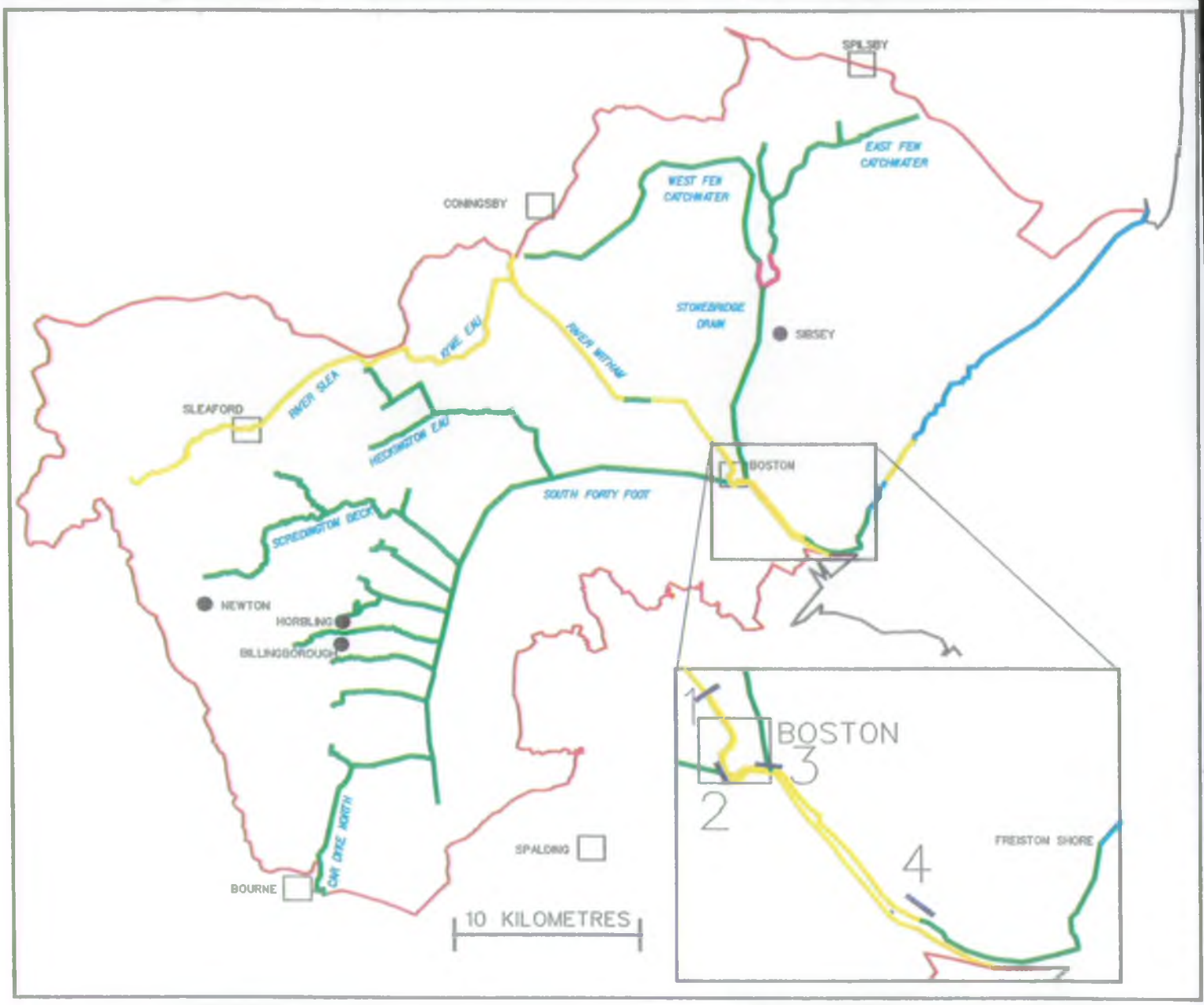
These arterial watercourses are generally maintained by the NRA. Along specific lengths of the River Witham and South Forty Foot Drain the ownership and responsibility for maintenance lies with British Rail Property Services.

Land drainage and flood protection in the lowland areas is provided by a network of drains maintained by the Witham Fourth, Black Sluice and Witham Third Internal Drainage Boards. The Black Sluice and Witham Third Drainage Boards pump their waters into the River Witham and South Forty Foot Drain - the Witham Fourth discharge their water via the Hobhole Drain; water from low lying land areas in the East Fen have to be lifted six feet into the Hobhole Drain for their eventual discharge. Along the coastal fringe some lowland water is pumped directly into the Wash by IDB pumps.

Current standards of flood protection are provided in accordance with NRA standards of service and guidelines set by MAFF. Generally, the current standard of defence is considered to be adequate for the land use protected with the exception of short lengths along the Lower Witham and Maud Foster system:

THE LOWER WITHAM CATCHMENT MANAGEMENT PLAN

MAP NUMBER 22
JUNE 1995



KEY

CATCHMENT BOUNDARY

RETURN PERIOD IN YEARS TIDAL		FLUVIAL
150 - 199		> 100
50 - 149		51 - 100
20 - 49		21 - 50
5 - 19		11 - 20
< 5		< 10

1 WITHAM OUTFALL (GRAND SLUICE)
2 SOUTH FORTY FOOT OUTFALL
3 MAUD FOSTER OUTFALL
4 HOBHOLE OUTFALL

EXISTING STANDARDS OF FLOOD PROTECTION

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- Numerous flood events over the past years have resulted in very high water levels at what is considered to be relatively low flood return frequencies in the River Witham. This situation probably arises as a consequence of changes in Catchment characteristics. A study to address this concern has been initiated by the NRA.

- Lengths of the Maud Foster system which carries flows from the East and Fen Catchwater system currently offer a level of flood protection against a 1:10 year event. Survey work undertaken indicates there is excessive siltation in the river. The channel has not been dredged for at least 50 years. Bank erosion in the system particularly between Sibsey and Cowbridge also threatens its continued effectiveness as a flood defence. Bank failure which manifests itself as slips along the South Forty Foot Drain threatens to reduce that drain's standard of flood defence.

- Along the South Forty Foot Drain bank failure which manifests itself as slips threatens to reduce the existing standard of defence.

Localised land drainage problems occur in watercourses outside internal drainage districts caused by piecemeal development, inadequate maintenance and the occasional unauthorised culverting of watercourses. The riparian owners who are responsible to maintain the flow of these watercourses may be either unaware, unwilling or unable to undertake their responsibilities. Examples of such problems occur in Newton, Billingborough and Horbling.

Looking beyond the horizon of this Plan, major refurbishment of the three river outfalls at Grand Sluice, Black Sluice and Maud Foster will be required to maintain existing standards of service.

Map No. 22 shows existing standards of flood protection for both fluvial and tidal defences.

4.3.2 Tidal and Sea Defences

The existing sea and tidal defences in this Catchment, with the exception of those in the town of Boston, consist of earth embankments. The banks fronting the Wash are protected by a relatively high and accreting saltmarsh. Those along the tidal Haven suffer localised erosion. Through Boston there is a mixture of hard defences - steel piles, brick and concrete walls.

Existing standards of protection against sea and tidal flooding are shown on Map 21. These standards relate to the overall standard of protection afforded by a combination of private and NRA maintained defence structures. The tidal defence standards shown indicate the frequency with which occasional wave action is likely to overtop the defence. Overtopping much greater than this could lead to a failure of the defence and consequential flooding. Studies indicate that the current standard of protection afforded varies from a 1:20 to a 1:150 year event. As sea levels rise, these standards will fall, particularly between the Hobhole Outfall and Freiston Shore, if no improvement works are undertaken.

Due to successive land reclamation schemes along the Wash a number of banks now exist providing varying standards of protection. The designated first line sea defence, for which the NRA is responsible, may have one and sometimes two privately maintained banks in front of it. These defences, which protect highly productive agricultural land, will be considered in the Shoreline Management Plan and Wash Bank Strategy which the NRA have recently initiated. These studies will produce a strategy for sea and tidal defences along the Wash coast between Wainfleet and Boston. This strategy will also encompass the issue of rising sea levels. It is estimated that the change in sea level relative to land to the year 2030 will be 6mm p.a. ie. a rise of 210mm (8 inches).

Existing flood defences in Boston provide a level of protection for a 1 in 100 year tide event with sufficient freeboard to allow for the rise in sea levels into the next century. The proposals to build a sea lock for Boston in the mouth of the Haven in addition to its commercial benefits could also provide protection from tidal flooding - however, its potentially adverse impact upon land drainage will also be addressed.

Some lengths of tidal defence through Boston consist of brick river walls forming part of private dwellings and commercial property. Ownership of these walls and their maintenance rests with the property owners.

4.3.3 FLOOD WARNING

The Catchment includes some areas which in severe events are at risk of tidal or fluvial inundation. The NRA operates a flood warning service whereby the police, the councils and media are advised of areas likely to be affected by flooding. These warnings are phased to indicate the severity of the event and its impact on land and property.

To be effective warnings need to be timely and accurate. Warnings are based upon forecasts utilising data on rainfall, river flow, river level and tide monitoring systems. A Regional telemetry system (ARTS) has recently been commissioned and will improve the reliability and accuracy of warnings provided. Further extensions to the system will enable greater refinement to the quality of warnings available.

In respect of tidal and fluvial warnings, the standards of warning do meet the required level of service in known problem areas.

4.4 FISHERIES, RECREATION, CONSERVATION & NAVIGATION

4.4.1 Fisheries

All the rivers in the Catchment contain coarse fish populations, most of these sampled by the NRA in its 3 yearly programme contained a high fish biomass. This reflects the rich lowland nature of the watercourses which generally provide ideal conditions for the growth and survival of juvenile coarse fish because of their ponded nature in summer months.

In the 18th Century salmon and burbot were abundant in the River Witham, in more recent years (1950) there was a sustainable trout population in the River Slea. Today, the burbot is extinct and the River Slea's population of Brown Trout has diminished to the extent that it has had to be stocked to maintain its viability.

The River Slea is also conspicuous for its low fish biomass (see Table 4) which reflects the environmental stress on this system caused by successive droughts and to some extent by the demand for groundwater resources. An augmentation scheme for the Slea has recently been commissioned. This scheme was designed to maintain river levels only - not to sustain a trout fishery, however, an environmental benefit may also result.

TABLE 4 - FISH BIOMASS

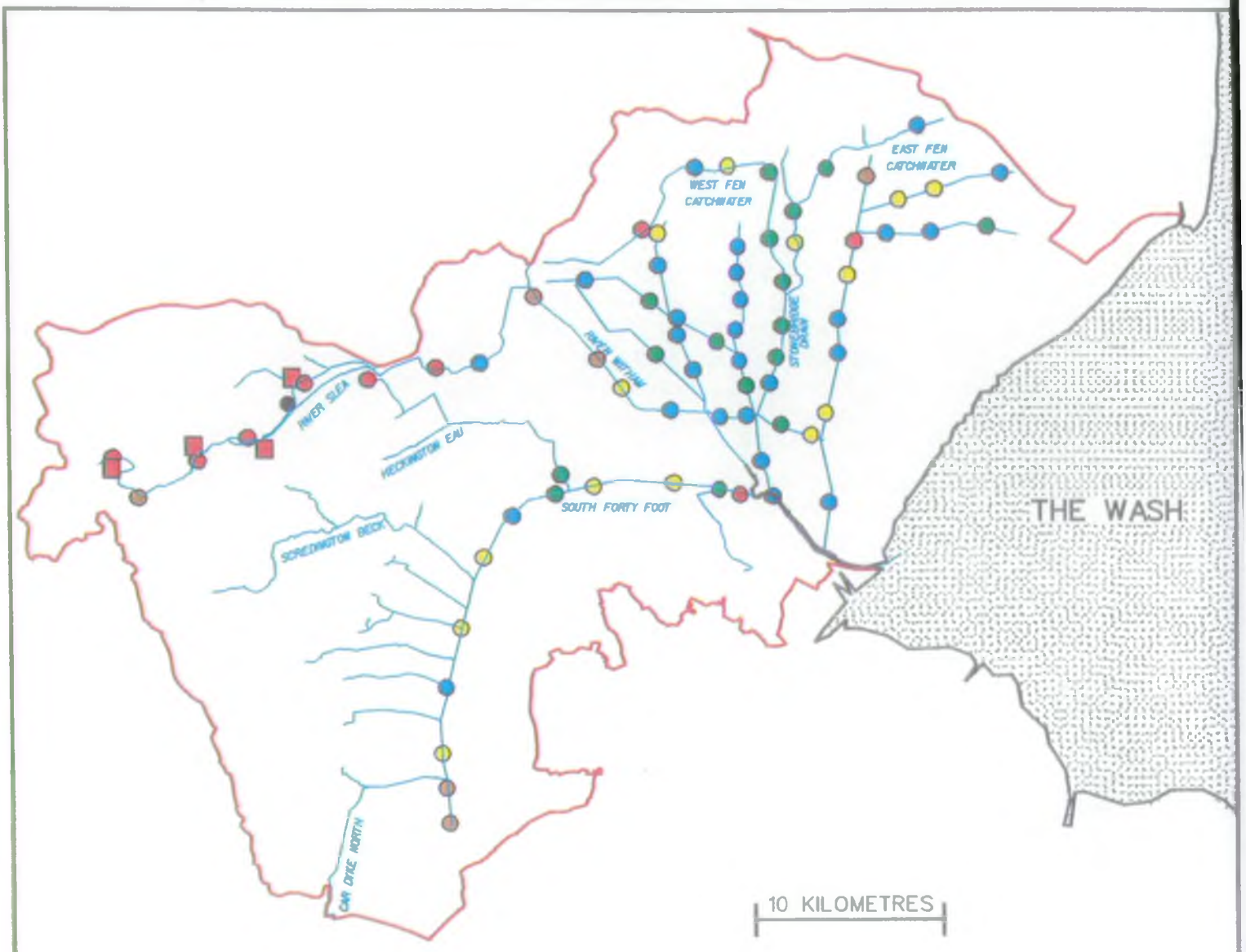
Examples of current fishery status in terms of fish biomass (grams per square metre):		**Absolute Fish Biomass Class**
Stonebridge Drain	48.20 gm2 (1993)	A
Hobhole Drain (Upper)	21.90 gm^2 (1993)	B
(Lower)	27.70 gm^2 (1993)	B
West Fen Drain	38.80 gm^2 (1993)	A
South Forty Foot Drain	32.40 gm^2 (1990)	B
Main River Witham	16.67 gm^2 (1994)	C
River Slea	2.50 gm^2 (1994)	E
Kyme Eau	14.70 gm^2 (1994)	C

The lower reaches of a number of watercourses in the Catchment, notably the Witham, the Hobhole Drain and the South Forth Foot Drain, suffer from saline intrusion during periods of low flows causing fish mortalities. Fish populations also suffer during periods of high flow when they are flushed or pumped out into the tidal length of the River Witham. During the winter months fish inhabiting the lowland systems are affected by the low winter levels maintained in many watercourses which also imposes additional stress on other freshwater organisms.

Maps 23 and 24 show details of fish species richness and fish biomass.

THE LOWER WITHAM CATCHMENT MANAGEMENT PLAN

MAP NUMBER 23
JUNE 1995



KEY

- CATCHMENT BOUNDARY
- TIDAL DEFENCES
- WATERCOURSE

COARSE FISH CLASS	SALMONIDS
A	
B	
C	
D	
E	■
F	

For further details see appendix 1

TOTAL FISH BIOMASS

National Rivers Authority

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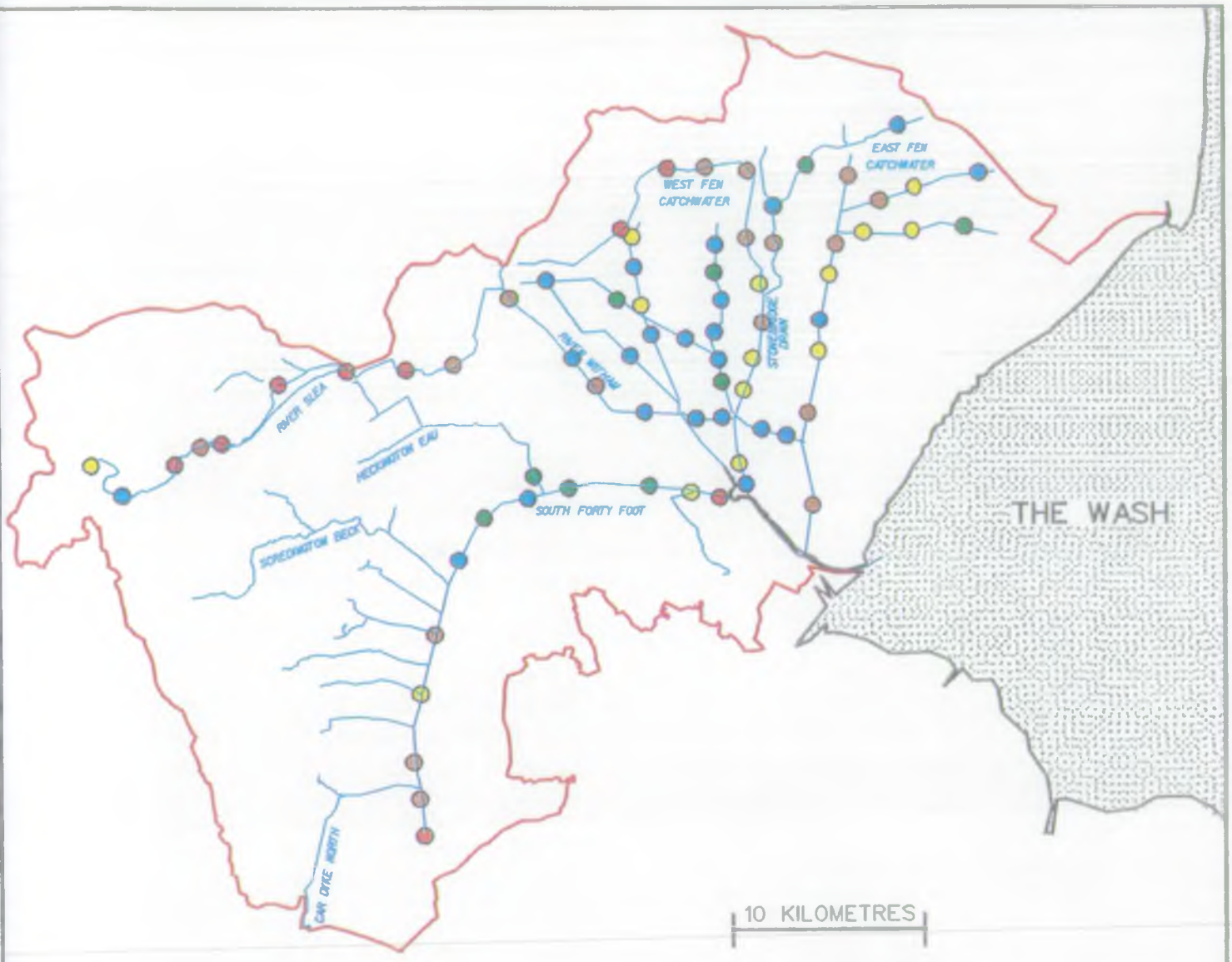
THE LOWER WITHAM CATCHMENT MANAGEMENT PLAN

MAP NUMBER 24
JUNE 1995



KEY

- CATCHMENT BOUNDARY
- TIDAL DEFENCES
- WATERCOURSE

CLASS

- A
- B
- C
- D
- E

For further details see appendix 1

FISH SPECIES RICHNESS

National Rivers Authority
Anglian Region
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4.4.2 Recreation

The water environment is extensively used for recreational purposes, the coastline and adjacent marshland to the Wash offers access to internationally important Nature Reserves and bird watching areas. A new Country park to be known as the Witham Way Country Park, is planned for the left, 'railway' bank of the River Witham.

Many river banks in the catchment have access available to the general public, both for angling activities and more general recreational pursuits, such as walking. Additional walks are planned that will enable significant lengths of the River Witham to be traversed along in the narrow country park area proposed for the left bank, near Boston.

Freshwater fishing is carried out extensively throughout the Catchment on both rivers and lakes. The Catchment contains some of the areas' premier coarse fisheries. These attract many visiting anglers and have provided excellent angling opportunities historically and to the present day.

Throughout the Catchment, the many Inland Drainage Board waters provide free fishing sites and arrangements between the Boston Angling Association and the Internal Drainage Board allows the club to organise match sessions on the Hobhole Drain.

Angling activities on stillwaters are popular throughout the Catchment. This area of Lincolnshire benefits from the numerous stillwaters - lakes, ponds and reservoirs which are managed as 'sport fisheries'. During periods of drought some of these stillwater fisheries can suffer through water loss and associated high water temperatures.

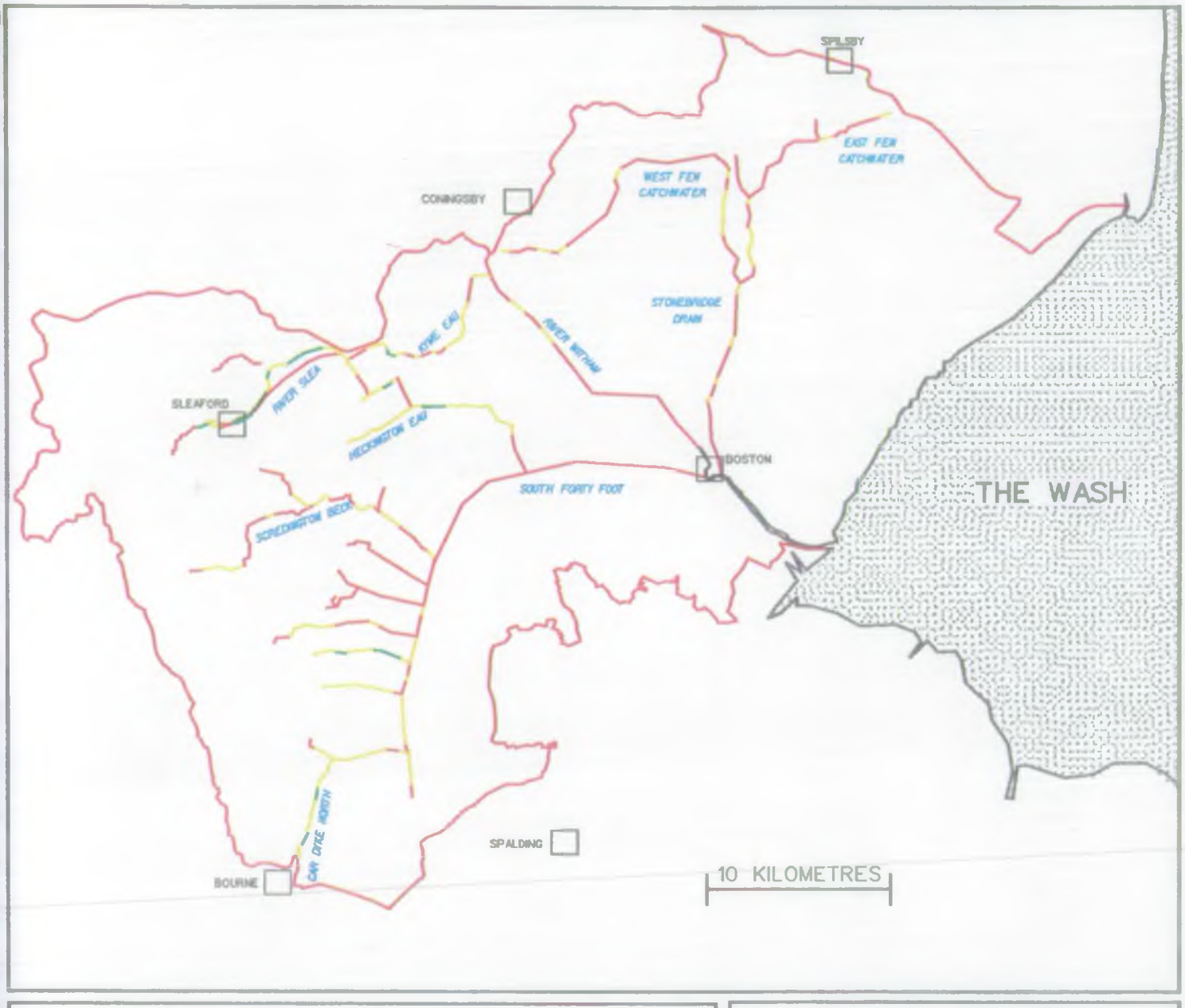
4.4.3 Conservation

The largest proportion of the Lower Witham Catchment consists primarily of reclaimed fresh and saltwater wetlands which were formally part of the extensive East Anglian Fenlands. The 'Fen' of reedswamp, shallow lagoons and high saltmarsh has largely gone, though the wide flat areas of alluvial silts and peaty soils, are still described as 'Fenland'. The existing fens are now dominated by well drained, intensive and productive farmland. Watercourses in this portion of the Catchment are highly modified or totally manmade, created mostly over the last two centuries in a series of large drainage schemes. Rivers are straight and trapezoidal in section with highland carriers embanked, and subsequently heavily maintained.

Upland zones within the Catchment consist of a rolling sandstone landscape in the North, between Coningsby and Spilsby, and in the West gently undulating limestone between Sleaford and Bourne. These areas of mixed farming include some sizeable woodlands, some of which are Sites of Special Scientific Interest (SSSI) eg Dunsby, Fulsby and Troy wood. Here, watercourse flows may be described as 'fast' supporting gravel beds with pool and riffle sequences. These may suffer from low flows in the summer months, eg. River Slea.

THE LOWER WITHAM CATCHMENT MANAGEMENT PLAN

MAP NUMBER 25
JUNE 1995



KEY

- CATCHMENT BOUNDARY
- TIDAL DEFENCES

>20 SPECIES	HIGH
10-19 SPECIES	AVERAGE
1-9 SPECIES	LOW

UNIT OF MEASURMENT:
NUMBER OF SPECIES PER 500m LENGTH OF WATERCOURSE SURVEYED

RIVER CHANNEL AQUATIC PLANT DIVERSITY

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Anglian Region
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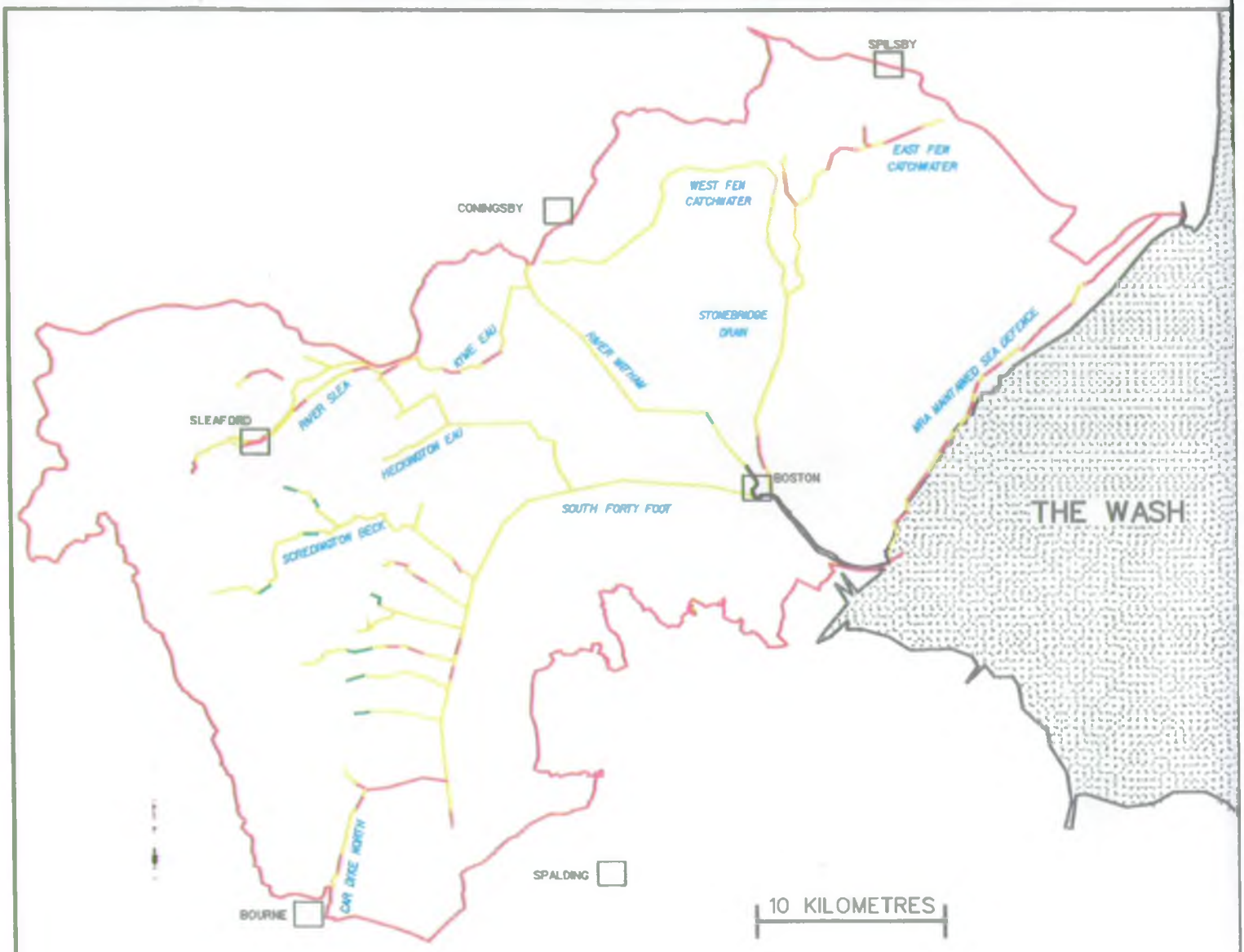
THE LOWER WITHAM CATCHMENT MANAGEMENT PLAN

MAP NUMBER 26
JUNE 1995



KEY

- CATCHMENT BOUNDARY
- TIDAL DEFENCES

>90 SPECIES	HIGH
51-89 SPECIES	AVERAGE
<50 SPECIES	LOW

UNIT OF MEASURMENT:
NUMBER OF SPECIES PER 500m LENGTH OF WATERCOURSE SURVEYED

PLANT DIVERSITY ALONG RIVER CORRIDOR AND TIDAL DEFENCES

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The East of the Catchment is boarded by the saltmarshes and mudflats of the Wash. Although reduced from its original size, this area is still extensive and of international importance for its wildfowl and wading birds. This status is recognised by its designation as a Ramsar site and Special Protection Area.

River Corridor Surveys were carried out in 1993 and 1994 to establish the extent of plant, animal and habitat diversity. These features are indicative of the overall health of the water environment. The general diversity of river channel habitat and aquatic plant diversity is low, reflecting the impact of past modifications, current maintenance and water level management regimes.

Parts of the Catchwater system, Lower Witham and South Forty Foot are particularly impoverished, having nine aquatic plant species or less per 500m recorded section. In total, 61% of the Catchment fell into this low category. The River Slea is an exception to this trend with 36% containing twenty or more species per section and only 20% in the low category.

Only 2% of surveyed river and tidal defence corridor had over 90 species of plant per section, these were primarily in upland areas. 82% of corridor falls between 51-89 species per 500m section.

Biological water quality monitoring revealed the presence of two threatened species of snail in the catchment.

- The pea mussel, Sphaeruim solidum, is categorised as endangered (RDB1), and the only British population of this snail is found in a 15km stretch of the Witham, between Brothertoft and Kirkstead, and some of its tributary drains. While no immediate threat to this population is apparent, the restriction of this species to one stretch of a single river, places the entire British population at risk.

- Less threatened, though still very rare in Britain, is the valve snail, Valvata macrostoma, currently categorised as vulnerable (RDB2). This species occurs very sporadically in the Lower Witham, and some of its associated tributaries. This species is thought to be particularly vulnerable to severe habitat disturbance, such as dredging, and to the effects of eutrophication.

Map Nos. 25 and 26 show river channel aquatic plant species diversity and plant diversity along river corridors and tidal defences.

4.4.4 Navigation

Within this Catchment, canoeing and sailing activities take place around the Boston area. The main River Witham is used for larger boating events, these may include organised cruises or boat racing events. The Witham provides an important link with the River Trent and many pleasure craft take advantage of this popular route. Each year the Inland Waterways Association hold a rally at South Kyme on the River Slea/Kyme Eau.

The use of the River Slea as a navigable waterway may be extended if proposals to restore the Slea Navigation come to fruition. Whilst the NRA welcomes initiatives which increase the recreational use of the water environment it is also conscious of the potential impact of such proposals on other uses.

The national licensing required makes it difficult to establish the numbers of boats making use of the Witham. However, during peak periods boat movements through the lock at Grand Sluice average 250 boats per month. This reflects the level of movement between this navigation and the Wash. resident craft from local sailing and motor clubs also use the system and these numbers are augmented by those coming onto the navigation using reciprocal licensing arrangements.

Between Lincoln and Boston there is scope for expansion by navigation users - it is currently under utilised and perhaps this is a reflection of the embanked nature of the river, which makes the navigation less attractive than others. Sanitary facilities are well served - there are Elsan disposal facilities at Boston within the catchment and at Bardney and Lincoln. Liaison between the NRA and British Waterways is good, through the forum of the Inland Navigation Seminar the two "authorities" work together to seek out "best operational practices".

4.5 LAND USE/DEVELOPMENT

GENERAL

Changes in land use and development have perhaps the single most influence upon the water environment. The NRA is well placed to influence certain factors affecting the water environment through its own regulatory controls, particularly along the river corridor but it has no direct control over the mechanisms which determine land use change. These are largely controlled by local Planning Authorities (LPA's).

The NRA's strategic plans for the future management of the water environment CMP's need to co-ordinate with LPA's strategic plans ie Development Plans. Any development upon which the NRA is consulted whether through the formal planning process or otherwise, provides an opportunity for the NRA to enhance the interests of the water environment.

LOCAL PERSPECTIVE

The catchment is situated within the administrative boundaries of Lincolnshire County Council, Boston Borough Council and the District Councils of East Lindsey, North Kesteven, South Holland and South Kesteven.

Each of the LPAs within the catchment have produced Local Plans on which the NRA have been consulted. The Lincolnshire Structure Plan currently being produced will succeed the existing Plan and cover the period to the year 2011. Local Plans currently being produced will cover the period to the year 2001. Subsequent Local Plans will be produced by District Councils to cover the period to the year 2011. The current state of those plans is shown in Table 5.

TABLE 5 - STRUCTURE AND LOCAL PLANS

PLANNING AUTHORITY	DEVELOPMENT PLAN TITLE	STATUS
LINCOLNSHIRE COUNTY COUNCIL	Lincolnshire Structure Plan	Consultation Draft due 1996
EAST LINDSEY DISTRICT COUNCIL	East Lindsey Local Plan	Adoption due Sept 1995.
NORTH KESTEVEN DISTRICT COUNCIL	North Kesteven Local Plan	Modification Draft March 1995. Adoption due Dec 1995.
SOUTH KESTEVEN DISTRICT COUNCIL	South Kesteven Local Plan	Adoption due July 1995.
SOUTH HOLLAND DISTRICT COUNCIL	South Holland Local Plan	Deposit draft due Sept 1995.
BOSTON BOROUGH COUNCIL	Boston Borough Local Plan	Deposit draft due Sept 1995.

As at June 1995

Key development features of the catchment are:

- Growth of urban areas and large rural villages.
- Larger residential developments adjacent to urban areas.
- Industrial development at Sleaford and Boston, together with smaller industrial estates at the larger villages.
- Proposed roads such as A52 - Northern Bypass, Boston
  M11 - Extension
- Change of use or diversification; such as golf courses and recreational facilities such as the Witham Way and Havenside Country Parks.
- The proposed development of the Boston Sea Lock.

To ensure the water environment is adequately protected will require close co-operation between the NRA, Planners, and Developers. In particular, the development of a strategic approach to infrastructure planning and development, together with the adoption of NRA Policies and Guidance Notes would assist substantially in ensuring appropriate development and protection of the water environment.

To enable the LPAs to fulfil their obligation with regard to the concept of sustainability, and in order to meet the NRA's duty to protect the water environment, the NRA has produced and distributed to all Planning Authorities its "Guidance Notes for Local Planning Authorities on the Methods of Protecting the Water Environment through Development Plans".

The assimilation of these policies into Development Plans has been achieved with a variable degree of success, limited in part by the timing and ongoing Development Plan process by individual LPAs. The NRA recognises the need for improvement in liaison with LPAs.

A planning related characteristic of the catchment is the actual and potential piecemeal development of land. The cumulative effect of piecemeal development results in risks to ground and surface water quality, flood defence and conservation interests. Examples range from infill development in rural villages to growth of existing housing/industrial areas in larger villages and urban areas which results in no infrastructure works or uncoordinated works to provide drainage or sewage disposal.

The implementation of strategic planning and holistic infrastructure development could reduce overall infrastructure costs and ensure protection of the water environment.

5. CATCHMENT TARGETS

5.1 INTRODUCTION

This section identifies the NRA's principal aims and broad strategies in relation to it's main responsibilities of water resources and water quality management, flood defence, fisheries, recreation, conservation and navigation. These aims will be pursued in a proactive manner by the NRA, they will necessitate the balancing of costs against benefits within the integrated system of catchment management, taking the needs of all users and NRA interests into account.

5.2 WATER RESOURCES

5.2.1 PRINCIPAL AIM

The NRA's principal aim in relation to water resources is to:

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

To achieve this aim, the NRA seeks to:

- plan for the sustainable development of water resources, developing criteria to assess reasonable needs of abstractors and of the environment;
- collect, validate, store and provide hydrometric data and environmental data in order to assess water resources;
- apply a consistent approach to abstraction licensing;
- implement a consistent approach to the resolution of inherited problems caused by authorised over-abstraction;
- work with other organisations to protect the quality of our water resources.

5.2.2 SPECIFIC TARGETS

In implementing this strategy in the Lower Witham Catchment a number of criteria are relevant:

- to protect the Southern Limestone aquifer and surface waters from over-commitment and ensure that abstraction does not have an unacceptable effect on existing abstractors and environmental waters;

- to protect water related conservation sites and environmental flows from over-commitment of resources and set minimum flows and minimum levels wherever necessary and ensure their compliance;

- to augment and/or redistribute water resources, where appropriate, to meet existing catchment water demands to the following standards of reliability:

- Public Water Supply	a hosepipe ban not more than once in every 10 years on average.
	voluntary restrictions required not more than once in every 20 years on average.
	rota cuts or standpipe required not more than once in every 100 years on average.
- Spray Irrigation	shortages not more than once in every 12 years on average.
- Other Agricultural, Environmental and Industrial.	no specific target level of reliability.

- to apply the principle of sustainability of water resources and where the impact of abstraction is uncertain, take a precautionary approach;

- to ensure all water abstraction demands are fully justified and to require environmental reports to accompany licence applications where appropriate;

- to encourage efficient water uses, re-use of water where appropriate and effective leakage control;

- to seek to maximise use of effluents;

- to encourage the development of winter storage reservoirs to meet irrigation demand where appropriate;

- to identify environmental water needs and balance the interests of the abstraction with those of the environment;

- to revoke licences or reduce authorised quantities where there is no need for the original licensed quantities;

- to develop a policy for the identification of groundwater protection zones;

5.3 WATER QUALITY

5.3.1 PRINCIPLE AIMS

The NRA's principal aims in relation to water quality are to:

- achieve a continuing overall improvement in the quality of rivers, estuaries, ground and coastal waters through the control of pollution;
- ensure that dischargers pay the costs of the consequences of the discharges.

To achieve these aims the NRA seeks to:

- maintain waters that are already of high quality;
- improve waters of poorer quality;
- ensure all waters are of an appropriate quality for their agreed uses;
- provide advice to individuals and developers on measures to be taken to reduce the risk of pollution at their sites.
- prosecute polluters and recover the costs of restoration from them;
- devise charging schemes that allocate the costs of maintaining and improving water quality fairly and provide incentive to reduce pollution;

5.3.2 SPECIFIC TARGETS

In implementing its aims in the Lower Witham Catchment a number of specific targets are relevant:

- to ensure that water quality is maintained and where necessary improved to meet EC Directives, and River Ecosystem Classes as part of Water Quality Objectives. The NRA's proposed River Ecosystem Classes are shown on Map 21;
- to ensure that discharge consents adequately safeguard water quality and prevent exceedance of EC Directives and Water Quality Objectives;
- to ensure, through an effective system of monitoring (by NRA and/or others) compliance of waters with EC standards, compliance of effluents with consents, compliance with EC Directives on substances discharged to groundwaters and compliance with landfill site licences;

- to ensure landfill activity does not compromise water quality or water resources and that the restoration of all sites is to an acceptable environmental standard;

- to implement and enforce groundwater protection zones and the NRA's Groundwater Protection Policy to protect aquifers and water sources from contamination, and the effects of development including mineral extraction;

- to ensure that point source pollution of ground and surface waters is prevented and/or controlled wherever possible;

- to prevent/control diffuse pollution so as to protect water quality;

- to maintain links with local groups and national bodies to ensure watercourses are cleared of litter and then kept clean;

- to implement effective pollution alleviation and prevention measures to reduce the incidence and impact of pollutions;

- to maintain strong links with government regulators and developers to ensure potentially polluting activities are controlled wherever possible;

- to seek to prevent potential pollution from the redevelopment of contaminated land;

- to maintain strong links with MAFF on the implementation of Nitrate Sensitive Areas and Nitrate Vulnerable Zones;

5.4 FLOOD DEFENCE

5.4.1 PRINCIPAL AIMS

The NRA's principal aims in relation to flood defence are to:

- reduce the risks to people and the developed and natural environment against flooding from rivers and from the sea;
- provide adequate arrangements for flood forecasting and warning.

To achieve these aims the NRA seeks to:

- maintain fluvial and tidal defences and structures to appropriate standards;
- develop and implement the flood defences strategy through a systematic approach for assessing capital and maintenance requirements and develop medium and long-term plans for those defences owned and maintained by the NRA;
- encourage development of information technology and extension of facilities which will further improve the procedure for warning of, and responding to, emergencies;
- support Research & Development which will assist in identifying future flood defence needs;
- review best practices for all operational methods and the identification and justification of work, thus increasing efficiency and enhancing value for money;
- heighten general awareness of both Planning Authorities and developers of the need to control development in flood plains;
- identify opportunities for the enhancement of environmental, recreational and amenity facilities when undertaking flood defence works.

5.4.2 TARGET STANDARDS OF DEFENCE

Notional target standards of protection from tidal and fluvial defences are provided by NRA standards of service targets and MAFF guidance notes of indicative standards of protection for different types of land use. These notes also give guidance on economic justification.

The 5 bands of land use are shown in Table 5.

TABLE 6

FLOOD DEFENCE - STANDARDS OF SERVICE		
LAND USE BAND	TARGET STANDARD OF PROTECTION (RETURN PERIOD)	
	FLUVIAL	TIDAL
High density urban containing significant amount of both residential and non-residential property	1:50 - 1:100	1:100 - 1:200
Medium density urban. Lower density than above, may also include some agricultural land.	1:25 - 1:100	1:50 - 1:200
Low density or rural communities with limited number of properties at risk. Highly productive agricultural land.	1:5 - 1:50	1:10 - 1:100
General arable farming with isolated properties. Medium productivity agricultural land.	1:1.25 - 1:10	1:2.5 - 1:20
Predominantly extensive grass with very few properties at risk. Low productivity agricultural land.	<1:2.5	<1:5

It should be noted that these standards are indicative only and do not represent an entitlement to protection. They are a starting point on which the NRA assesses the economics of providing defences, depending on the land use it will protect.

Once it is decided a flood defence improvement scheme is required for a given location, a range of options will be considered by the NRA. Each of these options has to be evaluated. The capital, maintenance and environmental costs of any works to the defences must be contrasted with the benefits of providing the level of protection. Options may also be considered for different levels of protection. Usually the most economic and environmentally acceptable option which yields the desired level of protection would be chosen, although a lesser level of defence may be accepted if the indicative standard cannot be justified when comparing costs against benefits. The consequence of this is that a level of protection ultimately chosen ie. the design standard, may not always be consistent with the indicative standard.

5.4.3 SPECIFIC TARGETS

In implementing its principal aims in the Lower Witham Catchment a number of specific targets are relevant:

- to maintain and improve the standards of tidal defence to accommodate future changes in sea level rise;
- to operate and maintain river systems and associated structures to achieve effective and efficient land drainage;
- to operate an effective flood warning service and pass warning messages to the police;
- to seek to ensure that new development does not increase flood risk in the catchment;
- ensure opportunities for conservation, recreation and enhancement of the environment are identified and implemented where justified.

5.5 FISHERIES, RECREATION, CONSERVATION AND NAVIGATION

5.5.1 FISHERIES

Principal Aim

The NRA's principal aim in relation to fisheries is to:

- maintain, improve and develop fisheries.

To achieve this aim the NRA seeks to:

- protect and conserve trout, freshwater, eel and, where appropriate, coastal fisheries;
- regulate fisheries through the enforcement of a consistent service of licences, orders, byelaws and consents;
- monitor the fisheries status of rivers and inland, estuary and, where appropriate, coastal waters;
- formulate policies to maintain, improve and develop fisheries and restore and rehabilitate damaged fisheries;

- provide an efficient and effective fisheries service which is responsive to the needs of its customers and which is based on a sound charging system.

Specific Targets

In implementing the broad strategy in the Lower Witham Catchment a number of specific targets are relevant:

- to sustain a natural fish population appropriate to the catchment and achieve Class A in terms of both biomass and species richness;
- to maintain regular monitoring and re-appraisal of the fisheries resource;
- to ensure that fisheries are not adversely affected by water resources, flood defence and other developments and ensure active involvement in determining the requirements of Environmental Impact Assessments and the auditing of Environmental Statements;
- to ensure there is a variety of habitat, including pool/riffle sequences and reedbeds for feeding, spawning etc. and to ensure the presence of bankside vegetation to provide adequate shade and cover;
- to maintain where practicable, a variable flow regime where the monthly average reflects the natural flow conditions in the river and flows do not decline below the historic monthly 95 percentile flows, except during extreme drought conditions;
- to respond efficiently to emergency incidents involving issues to fish, seeking to prevent or limit fish losses;
- to minimise the deleterious impact of river maintenance operations on habitat diversity.

5.5.2 RECREATION

Principal Aim

The NRA's principal aim in relation to recreation is to:

- develop the amenity and recreational potential of inland and coastal waters and associated lands.

To achieve this aim the NRA seeks to:

- maintain, develop and improve recreational use of NRA sites;
- take account of recreation in proposals relating to any NRA functions;
- promote the use of water and associated land for recreation purposes.

Specific Targets

In implementing the broad strategy in the Lower Witham Catchment a number of specific targets are relevant:

- to maintain and improve water quality in order that the amenity value of the watercourses may be enhanced and protected;
- to maximise public access to land in NRA ownership (subject to consideration of constraints), places of natural beauty and to buildings, sites of archaeological, architectural and historic interest;
- to promote the use of river corridors as a recreational facility without compromising other uses;
- to safeguard existing recreational uses and, where practicable, incorporate recreational facilities into schemes being designed for other reasons.

In pursuance of these aims the NRA seeks to:

- take into account the needs of persons who are sick or disabled;
- maintain and enhance the diversity of natural river features and other riverine habitats;
- maintain and enhance the diversity of aquatic vegetation and of the river corridor in general;
- take account of recreational use when setting water quality objectives, and minimum flows/levels and when determining planning applications and applications for effluent discharge or abstraction;
- provide suitable and safe access for angling and encourage the development of new fisheries;
- protect and enhance fish status.

5.5.3 CONSERVATION

Principal Aim

The NRA's principal aim in relation to conservation is:

- to conserve and enhance wildlife, landscape and archaeological features associated with inland and coastal waters.

To achieve this aim the NRA seeks to:

- assess and monitor the conservation interest of inland and coastal waters and associated lands;
- ensure that the NRA's regulatory, operational and advisory activities take full account of the need to sustain and further conservation;
- promote conservation to enhance the quality of the aquatic and related environment for the benefit of wildlife and people.

Specific Targets

In implementing the broad strategy in the Lower Witham Catchment a number of specific targets are relevant:

- to monitor habitats and associated flora and fauna of inland waters and associated lands, together with landscape and archaeological features;
- to assess the conservation interests of inland and coastal waters, and their potential, and work closely with others to target resources to protect the sites of the highest conservation interest and, wherever possible, rehabilitate degraded rivers and wetlands;
- to evaluate the impacts of applications for abstraction licences and discharge, land drainage and fisheries consents and ensure that conservation and archaeological interests are protected;
- to minimise the impact of the NRA's operational and regulatory activities and implement enhancement measures wherever possible;
- to maintain a variable flow regime in an appropriate channel cross section where the monthly average flow reflects the natural flow conditions in the river and flows do not decline below the historic monthly 95 percentile flows, except during extreme drought conditions;
- to maintain ground and surface water quality and level so that sensitive wetland ecosystems are protected;
- to maintain and enhance the diversity of aquatic vegetation, natural river features and other riverine habitats and the river corridor in general;
- to require internal and external development proposals to be subject to Environmental Assessment;
- to work with planners and developers to ensure that conservation interests are taken fully into account.

5.5.4 NAVIGATION

Principal Aim

The NRA's principal aim in relation to navigation is to:

- improve and maintain inland waters and their facilities for use by the public where the NRA is the navigation authority.

To achieve this aim the NRA seeks to:

- contribute to the development of an overall navigation strategy for England and Wales;
- regulate NRA navigations through the enforcement of a consistent series of licences, orders, byelaws and statutes;
- maintain and improve the NRA navigation fairway, facilities and standards;
- recover from users the costs of providing specific navigation facilities and a reasonable proportion of the costs of maintaining the navigation.

Specific Targets

The NRA has one specific target relevant to this Catchment and in accordance with its statutory obligation:

- To maintain a 5 feet depth of water in the River Witham to facilitate its use as a navigation.

5.6 LAND USE/DEVELOPMENT

Principal Aim

The NRA's principal aim in relation to development control is:

- to seek and develop understanding and professional working relationships with Local Planning Authorities and developers to protect the water environment.

To achieve this aim the NRA seeks to:

- maintain effective links with Local Planning Authorities to ensure an NRA input into planning applications and development plans;
- protect the water environment from problems caused by development by active involvement in determining the requirements of Environmental Assessments (EEC/337).

- to develop procedures and techniques to assess the implications of major developments and to allow audit of Environmental Statements.

- utilise the planning liaison procedure to enhance the water environment's interests.

Specific Targets

In seeking to implement the broad strategy in the Lower Witham Catchment two specific targets are relevant:

- to promote the adoption of the NRA's "Guidance Notes for Local Planning Authorities on the Methods of Protecting the Water Environment through Development Plans";

- to promote a strategic approach to infrastructure development.

6. ISSUES AND OPTIONS

The catchment planning process seeks to identify all the water environment related problems in this catchment and their possible solutions.

This section presents the issues and options identified by the NRA in previously undertaken consultation with other interested parties - including planning authorities, conservation groups and farming and industrial representatives. They are presented to you in anticipation that you would like to express an opinion on the issues and options identified; that you may be aware of issues that our pre-consultation has not brought to light or of options to solve issues which should be considered.

The issues and options are deliberately not presented in any order of priority and are not costed out, the options should not be regarded as mutually exclusive. In further management of these problems the NRA and others identified in their solution will undertake cost benefit analysis of all practicable solutions. The practicality of resourcing and solving some issues means that a number of issues identified will take a considerable length of time to resolve.

The ultimate success of catchment planning depends on a healthy partnership between the NRA, industry, other Government agencies and the public being developed.

ISSUE 1

THE QUALITY OF THE LOWER REACHES OF CERTAIN WATERCOURSES IS ADVERSELY AFFECTED BY SALINE INTRUSION DURING PERIODS OF LOW FLOW.

PRINCIPAL RIVERS AFFECTED ARE THE WITHAM, HOBHOLE, MAUD FOSTER, AND SOUTH FORTY FOOT.

BACKGROUND

During extended periods of low flows, salinity levels in a number of watercourses rise. Freshwater fish have a limited ability to adapt to this and if the change is too rapid it can cause fish mortalities. The flora of the watercourses are similarly affected. Excessive salinity is a particular concern for the agricultural industry as the poor water quality may become unsuitable for spray irrigation purposes. The primary source of this salinity is from leakage around and through tidal structures and through sea banks, although salinity may also arise from areas of land once used as "salt-pans".

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Reduce leakage through tidal structures.	NRA/Internal Drainage Boards/British Waterways	Reduced levels of saline intrusion. Improved reliability for abstractors.	Costs. Partial solution.
Install pumps to pump saline water back to the Haven. (River Witham only).	NRA	Reduced levels of saline intrusion. Improved reliability for abstractors.	Costs. Partial solution.
Increase residual flows by river transfer schemes.	NRA	Reduced levels of saline intrusion. Improved reliability for abstractors.	Costs. Only marginal benefits will occur, limited to River Witham.
Install bubble curtains.	NRA	Reduced levels of saline intrusion. Improved reliability for abstractors. Tried and tested.	High maintenance and running costs.
Construct bed weirs to limit the extent of the intrusion.	NRA/Internal Drainage Boards	Reduced levels of saline intrusion. Improved reliability for abstractors. Tried and tested.	May affect the channel's drainage ability. May affect navigation.
Do nothing.	NRA/Internal Drainage Boards		Increased problem with salinity.

ISSUE 2

FISH POPULATIONS IN THE SOUTH FORTY FOOT RIVER AND RIVER WITHAM SUFFER DURING PERIODS OF HIGH FLOW.

BACKGROUND

The lower reaches of the South Forty Foot and River Witham are trapezoidal channels offering few features behind which fish can shelter during periods of high flow. Under such conditions, many fish are swept out to sea where they perish.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Construct tyre reefs to provide shelter.	NRA	Immediate effect. Tried and tested. Known to work. Relatively cheap.	Artificial feature. Difficult to assess their impact.
Construct fish shelters into river banks.	NRA	May also provide over-wintering shelter. Can be easily sampled to assess its impact.	Untried. Cost.
Construct wet berms to diversify habitat during routine drainage improvements.	NRA	Natural solution. Provides habitat diversity and spawning sites.	Expensive.
Review Flood Control procedures.	NRA	May reduce the incidence of fish losses.	Degree of success uncertain.

ISSUE 3

THE CATCHMENT HAS LOST NEARLY ALL OF ITS NATURAL FENLAND HABITAT.

BACKGROUND

Intensive agricultural practises have resulted in fenland being drained over the last two centuries to increase its productivity and economic value. The consequence of this has been the loss of an environmentally important habitat along with its associated flora and fauna.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
The NRA should encourage any practical schemes which seek to restore natural fenland habitat.	NRA/Landowners/ Fisheries & Wildlife Advisory Group/ Countryside Commission	Increased diversity of flora and fauna and habitat. Possible flood defence benefit. Reduction in flood peak timing.	Cost.
The NRA should consider the feasibility of enhancing habitat during both routine maintenance works and capital works.	NRA	Increased diversity of flora and fauna and habitat. Associated Flood Defence benefits of Washlands.	Cost of flood defence works may increase.

ISSUE 4

AREAS OF RIVER CHANNEL AND RIVER CORRIDOR HAVE BEEN IDENTIFIED AS HAVING LOW PLANT SPECIES DIVERSITY.

BACKGROUND

Intensively managed rivers are subject to works aimed primarily at supporting the land drainage function. The resultant river channel lacks features that influence the plant community it could support. The ecological value of the wetted margin of these rivers is degraded and of little significance.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Restore and enhance during routine Flood Defence maintenance or Capital Works without loss of Channel capacity.	NRA	Increased plant and habitat diversity. Environmental gain to other higher organisms ie fish. Ecological stability.	Cost of Flood Defence works is increased.
Encourage landowners to restore wetland and riparian habitats (Countryside Stewardship, Set Aside Schemes, etc).	NRA/Landowners/ Countryside Commission/ Ministry of Agriculture, Fisheries & Food Farming & Wildlife Advisory Group	Increased plant and habitat diversity. Shared Costs. Grants/funding may be available from other bodies. Recreation and amenity value enhanced.	Cost.
Encourage farmers to graze embanked watercourses with stock on selected sites.	NRA	Increased plant species diversity. Reduced maintenance costs for NRA.	Conflict of interests between tenant and other river users.

ISSUE 5

THE PROPOSALS BY THE SLEAFORD NAVIGATION SOCIETY TO RESTORE THE SLEA NAVIGATION ARE CONSTRAINED BY WATER RESOURCES, WATER QUALITY, FLOOD DEFENCE AND ENVIRONMENTAL CONCERNS.

BACKGROUND

The restoration of the Slea as far as Sleaford is a keenly sought aim by boating groups and commercial interests. The NRA is keen to support initiatives which increase the water based recreational value of this Catchment. It does, however, have to balance that interest against those others - flood defence, water quality, conservation and fisheries, which could all suffer as a consequence of such a scheme. Not least of the NRA's concerns is the apparent non-availability of water to facilitate such a navigation.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
NRA to liaise with the Slea Navigation Society to ensure that NRA interests are protected, and concerns understood.	NRA/Slea Navigation Society	The needs of the water environment will be appropriately balanced.	None
Carry out an environmental assessment to establish the impact of these proposals upon the water environment.	Slea Navigation Society	The implications of the problems will be understood more fully. This will ensure all the needs of the water environment will be identified.	None.

ISSUE 6

LOW FLOWS IN THE RIVER SLEA BETWEEN ANCASTER AND SLEAFORD HAVE A DETRIMENTAL EFFECT ON THE TROUT FISHERY

BACKGROUND

In recent years springs forming the source of the River Slea have periodically failed causing river flow in certain sections to cease and water quality in some sections to fail. The impact of these low flows is on its flora and fauna - particularly the brown trout which have traditionally spawned but which periodically have to be rescued and restocked. Low natural flows may be accentuated by levels of water abstraction in the area.

An augmentation scheme for the Slea has recently been commissioned however, this was primarily designed to maintain river levels through Sleaford and not to sustain a viable trout fishery. Environmental benefit may also derive from this work.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Augment the River Slea from the borehole in accordance with existing operational practices and monitor its impact.	NRA	Fish populations downstream of the augmentation may be sustained through periods of low flow.	Cost. There may be insufficient water during periods of drought.
Consider reducing abstraction levels/switching abstraction sources.	Anglian Water Services	Fish populations may benefit from increased flows which would follow reduced abstraction to the west of Sleaford. There may be benefits to the abstractors.	Impact of switching abstraction sources is unknown. Costs to Anglian Water Services may exceed benefits.
Accept existing situation.		None.	Sustainability of the trout population is at risk.

ISSUE 7

THE FISH POPULATION OF INTERNAL DRAINAGE BOARD DRAINS AND THE SOUTH FORTY FOOT DRAIN ARE ADVERSELY AFFECTED BY LOW RIVER LEVELS DURING THE WINTER MONTHS.

BACKGROUND

The management of some of the large fenland drains in this Catchment involves the practice of holding levels low. This practice impacts on the ecology of these drains and can cause fish population to congregate in very high densities in any available deep areas eg where pumped water is discharged into the South Forty Foot.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Increase depth of water by dredging operations.	NRA/Internal Drainage Boards	Provides suitable conditions for fish survival during winter months. Benefits for anglers. Flood defence benefits.	Cost. Increased risk of bank slippage. Negative environmental impacts of dredging.
Review water level control levels and the impact on flood defence of increasing winter retention levels.	NRA/Internal Drainage Boards	Provides suitable conditions for fish survival during winter months. Environmental benefit - protection of marginal plant growth. Habitat would provide protection for fish from predators.	Increased flood risk. High cost to drainage authorities of increased pumping.

ISSUE 8

THE PROPOSED DEVELOPMENT OF BOSTON LOCK WILL HAVE SIGNIFICANT IMPLICATIONS FOR THE WATER ENVIRONMENT

BACKGROUND

Proposals are under way to consider the feasibility or otherwise of constructing a sea lock for Boston. This will obviously have implications for the NRA in terms of its flood defence, land drainage, water quality and conservation interests. A number of other issues in this plan are impacted upon by these proposals.

It is important that the NRA involves itself with the planning of this project to take maximum benefit from opportunities this project might bring.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
NRA to ensure its interests are adequately represented by maintaining close liaison with the relevant organisations.	NRA/Relevant Organisations	Protection of NRA interests.	None

ISSUE 9

THE LEVEL OF PROTECTION PROVIDED BY EXISTING TIDAL DEFENCES ON THE WITHAM HAVEN AGAINST FLOODING IS BEING REDUCED BY RISING SEA LEVELS.

BACKGROUND

Along the Lincolnshire coastline sea levels relative to land levels are rising at an estimated 6mm per annum. The cumulative effect of this to the year 2030 is a 210mm rise in levels.

Existing sea defences have taken this rise in sea level into account, however, by early next century the defence levels will have been eroded and the prospect of raising the defence still higher will have to be considered.

The proposals to construct a sea lock for Boston could affect this requirement if, for example, it were to be designed with the dual purpose of providing a first line defence against high tide levels.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Accept the lower standard of protection.	NRA/Ministry of Agriculture, Fisheries & Food	None.	Increased risk of flooding.
Improve standard of defence to the justifiable design standard.	NRA/Ministry of Agriculture, Fisheries & Food	Acceptable standard of flood protection provided.	Cost.
Construct barrier in Haven (in association with Boston Lock). See Issue 8	NRA/Ministry of Agriculture, Fisheries & Food/Lincolnshire County Council/Boston Borough Council/ Port of Boston	Acceptable standard of protection provided against tidal flooding. Possible improvement to fluvial flood protection. Possible environmental improvement to Boston Town.	Cost. Possible adverse impact on land drainage. Possible adverse environmental impact to Haven channel.

ISSUE 10

NITRATE CONCENTRATIONS IN GROUNDWATERS EXCEED, OR ARE EXPECTED TO EXCEED 50 MILLIGRAMMES PER LITRE.

BACKGROUND

In the west of the Catchment where the limestone aquifer outcrops, it is given little protection by the thin soils and is highly vulnerable to diffuse sources of pollution. Agricultural practices within this part of the Catchment ie the use of fertilisers has led to the presence of high concentrations of nitrates in the groundwaters.

The EC Drinking Water Directive for Nitrates requires compulsory controls where levels exceed or are at risk of exceeding the 50mg/litre standard set. The zones identified on Map 18 have been designated as Nitrate Vulnerable Zones and Nitrate Sensitive Areas by the Ministry of Agriculture Fisheries and Food.

Through this designation the Ministry aim to change farming practices and water quality improvements are expected to follow.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Designate/implement Nitrate Protection Zones and Nitrate Sensitive Areas.	Ministry of Agriculture, Fisheries & Food	Reduces nitrate concentrations in groundwaters. Reduces the need to remove nitrates from drinking water sources.	Cost. Impact on agricultural activity.

ISSUE 11

A) THE LEVEL OF PROTECTION AGAINST TIDAL FLOODING ALONG THE COAST IS BEING REDUCED BY RISING SEA LEVELS.

B) LAND RECLAMATION HAS TAKEN PLACE AND PRIVATE SEA DEFENCES CONSTRUCTED, RESULTING IN DIVERSE RESPONSIBILITIES FOR SEA DEFENCES.

BACKGROUND

Existing standards of defence against tidal flooding along some lengths of the coastline between Boston and Wainfleet are below the NRA Standards of Service target. Rising sea levels will further impact upon their effectiveness.

This issue is complicated further as a consequence of successive land reclamation schemes by farmers which have resulted in one and sometimes two private sea defence structures being constructed, in front of those maintained by the NRA, affording different standards of flood protection.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
The NRA should develop a strategy to define a sustainable line of defence. This will consider options such as: Accepting lower standards of defence against flooding. Improving standards to a justifiable design standard based on Ministry of Agriculture, Fisheries & Food indicative standards. Managed retreat.	NRA/Ministry of Agriculture, Fisheries & Food/Private defence owners	This will provide a co-ordinated and consistent approach towards flood defences.	None.

ISSUE 12

THE STANDARD OF FLOOD DEFENCE ALONG THE LOWER RIVER WITHAM IS BELIEVED TO BE INADEQUATE.

BACKGROUND

The flood defence standards for lengths of the Lower Witham between Lincoln and Boston including its major tributaries are below the NRA Standards of Service targets. This has arisen in part as a consequence of the high flows the Witham has experienced in recent times due to changes in the catchment's characteristics. A study to assess the situation and to put forward options to resolve the situation has been initiated and its outcome is awaited.

The proposals to develop a Sea Lock for the Port of Boston will have significant implications for flood defences.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
NRA to clarify the scale of the problem and to develop and implement an appropriate strategy. This will have to consider options such as:			
Raising bank levels to improve the standard of defence.	NRA/Ministry of Agriculture, Fisheries & Food/Railtrack/ British Rail	Reduced risk of flooding. Provide a consistent standard of defence. Possible environmental benefits.	Cost.
Construct Flood Storage Reservoirs/ Washlands to attenuate high flows.	NRA/Ministry of Agriculture, Fisheries & Food	Reduced risk of flooding. Provide a consistent standard of defence. Possible environmental benefits.	Cost.
Accept existing standard of defence.	NRA/Ministry of Agriculture, Fisheries & Food		Increased risk of flooding.

ISSUE 13

LOCALLY INADEQUATE RIPARIAN DRAINAGE SYSTEMS EXIST OUTSIDE INTERNAL DRAINAGE BOARD AREAS. UNAUTHORISED CULVERTING, A LACK OF MAINTENANCE AND CONTINUING DEVELOPMENT GIVE RISE TO LAND DRAINAGE PROBLEMS.

BACKGROUND

Localised flooding results as a consequence of insufficient maintenance of riparian watercourses, inappropriate culverting and the insufficient capacity of watercourses to accommodate the increased surface water run-off which follows 'uncontrolled' development.

Ultimately, the responsibility to deal with these problems lie with the riparian owner. Local Authorities who have supervisory powers to resolve this problem are increasingly reluctant to do so because of its resource implications and/or the lack of expertise.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Enmain watercourses.	NRA/Ministry of Agriculture, Fisheries & Food	Management rests with responsible body.	Lengthy process not appropriate to NRA role.
Extend Internal Drainage Board area.	NRA/Ministry of Agriculture, Fisheries & Food/Internal Drainage Boards	Management rests with responsible body.	Cost. Lengthy process not appropriate in all cases.
District Councils to use their powers to resolve problems.	Local Authorities	Management rests with responsible body.	Cost. Lack of appropriate resource or expertise.
Riparian owners to undertake their maintenance responsibilities.	Private owners		Disjointed approach. Not always practicable.
NRA to ensure new development incorporates appropriate provisions for land drainage.	NRA/Developers.	Future drainage problems are minimised. Costs built into development costs.	Does not address the ongoing maintenance needs.
NRA to liaise with Local Authorities to develop on agreed approach towards this problem.	NRA/Local Planning Authorities/Internal Drainage Boards	Future drainage problems are minimised.	None.

ISSUE 15

INADEQUATE LOCAL SEWERAGE SYSTEMS RESULT IN LOCALISED POLLUTION AND HAVE PUBLIC HEALTH IMPLICATIONS.

BACKGROUND

A number of small watercourses and ditches suffer from localised pollution because of inadequate village sewage disposal systems - a typical example of such is Swaton, where discharges to the watercourse are made from septic tank overflows. The problem manifests itself in terms of smell and appearance.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
District Councils to requisition sewerage schemes for villages affected.	District Councils/ Individual Property owners/NRA	Improvement in water quality. Co-ordinated approach.	Costs.
Individual householders to provide adequate sewage disposal facilities.	Property owners/ Developers/NRA	Improvement in water quality.	Piecemeal, unco-ordinated approach to the problem. Numerous small sewage plants provide less satisfactory effluent treatment than one large plant.
Cooperative investment in Package Treatment Plant.	Property owners/ Developers/NRA	Improvement in water quality. Co-ordinated approach.	Legal problems. Such initiatives can suffer difficulties arising from joint ownership regarding future maintenance.

ISSUE 14

THE STANDARD OF FLOOD PROTECTION ALONG THE MAUD FOSTER SYSTEM IS INADEQUATE.

BACKGROUND

The standard of flood protection along lengths of the Maud Foster system approximates to a 1:10 year return period. The river is heavily silted up, not having been dredged for 50 years. A program of de-silting the watercourse started in 1994.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Improve the drainage capability of the system by:			
Dredging drainage channels.	NRA	Maintain optimum drainage efficiency. Environmental opportunities.	Cost.
Undertaking bank improvements.	NRA	Maintains the standard of flood protection.	May increase the risk of flooding elsewhere.
Installing a pumping station at its outfall.	NRA	Improved control of river levels.	Economic justification.
Provide flood washlands/ widen channels and develop berms.	NRA	Improved standard of flood protection. Environmental benefits.	Economic justification.
Accept existing standard of defence.	NRA	None.	Increased risk of flooding.

ISSUE 16

THE AESTHETIC QUALITY OF THE WITHAM HAVEN IN BOSTON IS AFFECTED BY THE DISCHARGE OF RAW SEWAGE FROM PRIVATE PROPERTIES.

BACKGROUND

A number of properties in High Street, Boston have historically discharged their foul water directly to the Witham Haven, there being no suitable foul sewer to connect to. This discharge of crude sewage creates an aesthetic problem in the Witham Haven.

Anglian Water Services and Boston Borough Council are currently in negotiation to resolve this problem. If not resolved, this will have greater water quality implications if or when the 'Boston Sea Lock' is developed.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Properties to be connected to new foul sewer.	Anglian Water Services/ Boston Borough Council	Improved aesthetic quality. Co-ordinated approach. Permanent solution could be achieved in a short timescale. Facilitates further development.	Cost.
Individual properties to provide their own effluent treatment.	Discharger/NRA	Improved aesthetic quality.	Piecemeal approach. Unlikely to achieve a comprehensive solution.

ISSUE 17

INADEQUATE OIL STORAGE FACILITIES WITHIN THE CATCHMENT LEAD TO SERIOUS OIL POLLUTIONS AFFECTING WATER QUALITY

BACKGROUND

Water quality within the Catchment is intermittently affected by localised pollution incidents. Many of these incidents are oil related.

Numerous industrial and agricultural sites within the Catchment have oil storage facilities which are not adequately bunded. Accidental spillage or leakage from such tanks and occasional acts of vandalism causes pollution and subsequently environmental damage.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Carry out pro-active pollution prevention campaigns to identify potential sources of pollutants, and seek the co-operation of site operators.	NRA/Dischargers/ Developers	Reduced frequency of pollution incidents. Improved water quality. Cost savings on pollution incident investigations.	Cost of implementing pollution protection measures.
Persuade local authorities to include oil prevention measures when granting planning permission (Cross ref Issue 20).	NRA/Local Authority	Reduced frequency of pollution incidents. Improved water quality. Cost savings on pollution incident investigations.	Cost of implementing pollution protection measures. Increased enforcement required.
Increase enforcement of pollution control legislation when dealing with individual incidents.	NRA	Possible reduction in incident frequency. Some improvement in water quality. Follows 'polluter pays' principle.	Reactive and Piecemeal approach. Enforcement is not always appropriate.
Seek additional regulatory powers to require pollution prevention works, on those industrial sites not covered by pollution control legislation.	NRA/Department of the Environment	Reduced frequency of pollution incidents. Improved water quality. Cost savings on pollution incident remedial works.	Increased enforcement required. Legislative delay.

ISSUE 18

LITTER ACCUMULATION OCCURS IN WATERCOURSES CLOSE TO URBAN AREAS.

BACKGROUND

In urban areas such as Boston and Sleaford, the general accumulation and dumping of litter along watercourses is visually and environmentally unacceptable. There is an added risk of flooding where such debris causes blockages of culverts and weed screens.

Responsibility for addressing this problem is not clear and may involve a number of bodies working together towards a solution.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Awareness campaigns (signs).	NRA/Local Councils	Low cost. Some improvements.	Limited effectiveness.
Litter removal.	NRA/Local Councils/ Local Groups/ Angling Clubs/ Landowners	Aesthetic improvement.	Cost.
Joint ventures between NRA and district/parish councils to provide rubbish bins etc.	NRA/District/Parish Councils	Shares the responsibility and costs of the problem. Pro-active.	None.

ISSUE 19

LAND CONTAMINATED AS A RESULT OF PAST INDUSTRIAL PRACTICES CAUSES THE WATER QUALITY IN THE TOWNS DRAIN IN BOSTON TO FAIL THE EC DANGEROUS SUBSTANCES DIRECTIVE.

BACKGROUND

Water quality in the Towns Drain in Boston currently fails statutory Environmental Quality Standards for 'dieldrin' and 'gamma HCH' of the EC Dangerous Substance Directives (Dangerous Substance Directive 76/464/EEC). This has arisen due to the pollution of surface water from land contaminated with wood preservation chemicals. Extensive work has been carried out on the site to remedy the situation.

The first full year for compliance assessment since the improvements were completed at the site will be 1995.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Contain any further spillages. Provide continuing treatment to contaminated surface water.	Discharger.	Improved water quality. Follows the 'polluter pays' principle.	Cost to the company.
Continue to monitor the situation: - surface water discharges from site - water quality in surrounding watercourses - sediment in Town's Drain/London Road Drain	NRA	Ensures sufficient information is obtained to satisfy statutory reporting requirements. Improvements can be monitored and the need for further remediation measures can be ascertained. Monitoring costs are recovered via the NRA's Charges for Discharges Scheme. Follows the "polluter pays" principle.	Cost to the company.

ISSUE 20

A) THE NRA'S VIEWS ARE NOT ALWAYS ADEQUATELY REFLECTED IN PLANNING MATTERS.

BACKGROUND

During the Planning Process the NRA, as a statutory consultee, comments upon development proposals and asks for its comments to be reflected in their planning decision. A lack of understanding by the Planning Authorities of NRA powers and by the NRA of Planning Authorities' planning criteria - occasionally leads to development proposals without appropriate constraints, placing the water environment at unnecessary risk.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
NRA to increase its influence in the planning process:		Ensures sustainable development. Minimises risks to the water environment from development.	None.
a) influence the formulation of National and Regional Planning Policy	NRA at a National Level/Department of the Environment	Provides a co-ordinated national approach. Provides consistency.	None.
b) seek the inclusion of NRA Guidance Notes and give regard to Catchment Management Plan issues in development plans	NRA/Planning Authorities/ Department of the Environment	Provides clear guidance to developers on the acceptable uses of land.	None.
c) agree the inclusion of NRA comments into planning decisions.	NRA/Planning Authorities/ Department of the Environment	Reduces the chance of inappropriate land use.	None.
NRA to become more pro-active in its planning liaison activity.	NRA	Long-term benefits. Environmental gain.	Short-term costs.

ISSUE 20

B) THE CUMULATIVE EFFECT OF PIECEMEAL DEVELOPMENT HAS AN ADVERSE EFFECT ON FLOOD DEFENCE, WATER QUALITY, AND CONSERVATIVE INTERESTS.

BACKGROUND

Piecemeal development - which involves a change in land use, occurs daily throughout the Catchment. When such development takes place it may involve the installation of septic tanks, discharge of surface water to ditches and/or their culverting. All of these are likely to change the characteristic of the Catchment. They will bring marginal increases in surface water run off, decreases in water quality and impacts on the water environment. Over time the cumulative effect of such development can lead to serious problems because the appropriate infrastructures have not been developed accordingly, water quality and land drainage problems then become apparent.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
NRA to encourage local planning authorities to adopt a strategic approach and fund infrastructure costs.	NRA/Local Planning Authority	Strategic approach. Reduced risk to water environment. Lower overall infrastructure costs.	Cost to Local Planning Authority. Not always practical.
NRA to encourage local planning authorities to adopt strategic approach and require developers to fund infrastructure costs.	NRA/Local Planning Authority/Developers	Strategic approach. Reduced risk to water environment. Lower overall infrastructure costs.	Cost to developers. Difficult to control the funding and timing. Not always practical.
Allow piecemeal development to continue.	Local Planning Authority		Deterioration of the water environment.
NRA to undertake works and recover costs from developers.	NRA	Strategic approach. Reduced risk to water environment. Lower overall infrastructure costs.	NRA would have to raise the capital. It might be difficult to recover the costs. Lack of powers. Not always appropriate.

ISSUE 21

A) THE INCREASED USE OF THE MAUD FOSTER FOR NAVIGATION PURPOSES COULD GIVE RISE TO FLOOD DEFENCE AND WATER RESOURCE DIFFICULTIES.

B) THE BODY RESPONSIBLE FOR NAVIGATION FOR THE MAUD FOSTER AND WEST FEN CATCHWATER DRAINS IS UNCLEAR.

BACKGROUND

The NRA perceives an increased use of the Maud Foster for navigational purposes. In principle, the NRA supports the increased recreational use of waterways provided that use is controlled. Legislation defining which body is responsible for this "navigation" is unclear. Control needs to be exerted upon the navigation users to ensure boat movements from the River Witham during periods of low flow do not have an adverse effect upon water resources and to ensure boats are securely attended to or removed from the system during winter months when they could pose a problem during flood events.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Undertake survey to establish the scale of boat use and its implications for the NRA.	NRA/Internal Drainage Boards/Others	Better understanding of the problem.	Cost.
The operating authority should manage the use of the navigation using its existing powers.	Internal Drainage Boards/Others	Effective operation of the navigation.	Legislative powers may not be sufficient. Operating authority may not be willing to accept its responsibilities.
Establish who is responsible for the navigation in the Maud Foster and East & West Fen Catchwater Drains.	Internal Drainage Boards/Others	Operational responsibility will become clear.	

ISSUE 22

BANK EROSION ON THE MAUD FOSTER AND SOUTH FORTY FOOT IS REDUCING THEIR STANDARD OF DEFENCE.

BACKGROUND

Bank protection in the form of revetment systems installed on these drains are reaching the end of their effective lives. Progressive failure of the revetment is leading to bank slips and local erosion causing excessive siltation within the channel area. Where raised flood banks are subjected to erosion the risk of a complete bank failure and flooding is increased.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Carry out bank repairs.	NRA	Maintain standards of defence. Environmental improvement opportunity. Allow continued use of channel for navigation.	Economic justification.
Allow deterioration of defence.	NRA		Reduction in standards of service.

ISSUE 23

THE RIVER WITHAM HAVEN CHANNEL IS SUFFERING FROM BANK EROSION.

BACKGROUND

Tidal defences along the Witham Haven are formed of earth banks raised to protect the adjacent low lying land.

The Haven channel, which is subjected to tides, wave action and boat wash is suffering from erosion which, if allowed to continue, would undermine the stability of the defences.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Undertake remedial works.	NRA/Ministry of Agriculture, Fisheries & Food	Maintain standards of flood defence. Maintain navigation channel.	Economic justification.
Allow deterioration of defence.	NRA/Ministry of Agriculture, Fisheries & Food		Reduction in standard of flood defence and increase in flood risk.

ISSUE 24

THE LACK OF FLOW INFORMATION ON THE RIVER WITHAM HAMPERS THE NRA'S ABILITY TO MANAGE RESIDUAL FLOWS TO TIDE AND SALINE INTRUSION IN BOTH THE WITHAM ITSELF AND WATERCOURSES IN THE EAST AND WEST FEN DRAINAGE SYSTEM.

BACKGROUND

At times of low summer flows, saline intrusion into the lower reaches of the Witham can occur. The cause of the salinity is largely leakage through the tidal doors in Boston. The NRA can augment (increase) the flow of the Witham by transfers of water from the River Trent at Torksey via the Fossdyke canal. When operating the NRA's river transfer scheme at Torksey to augment the Witham for subsequent abstraction, the NRA manages the river in such a way as to maintain a positive flow to tide to exclude where possible, the threat from saline intrusion. There are currently no river gauging stations on the Lower Witham which could assist in managing the control of river flows.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Construct a flow gauging station.	NRA	Provides information on low flows to ensure an appropriate residual flow to tide; to manage saline intrusion to a minimum and provide efficient operation of river transfers. Effective management of transfers will be required as the rate of river transfers increases to meet rising demands. Improved information for flood warning purposes.	Cost.
Do nothing.			Ineffective management of resources that will become more critical as demands increase.

ISSUE 25

THE QUALITY OF WATERCOURSES IN THE CATCHMENT ARE ADVERSELY AFFECTED BY EUTROPHICATION.

BACKGROUND

Eutrophication arises as a consequence of the enrichment of water with nutrients, from the surface water run-off from agricultural land and sewage treatment discharges, and the slow moving nature of watercourses in this Catchment.

Under the Urban Waste Water Treatment Directive watercourses can be designated as sensitive. This would then place an obligation on the water undertaker to undertake nutrient stripping at sewage treatment works. However, only waters receiving discharges from sewage treatment works for populations greater than 10,000 can be considered for such. In this Catchment, using this criteria only the River Witham and River Slea/Kyme Eau can be considered. Eutrophication is a difficult problem to solve - there are no quick or immediate solutions.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Gather more data from rivers which receive nutrient inputs from large sewage treatment works and press for their designation as "sensitive" under the Urban Waste Water Treatment Directive.	NRA/Department of the Environment	Data collected will demonstrate the effects of eutrophication. Designation as sensitive would necessitate further treatment of sewage by Anglian Water Services culminating in reduced levels of nutrient. Possible reduction in eutrophication.	Cost.
Promote good agricultural practises to reduce nutrient input into the watercourse.	NRA/Ministry of Agriculture, Fisheries & Food/National Farmers' Union/Fisheries & Wildlife Advisory Group	Possible reduction in eutrophication.	

ISSUE 26

AGRICULTURAL ABSTRACTION AND THE LOCAL WATERCOURSE ENVIRONMENT MAY BE IMPACTED UPON BY THE REDUCED FLOWS FROM WILD BOREHOLES DURING SUMMER IN MINOR WATERCOURSES DRAINING TO THE SOUTH FORTY FOOT RIVER.

BACKGROUND

During the (1988 - 1992) drought, (taking advantage of the unusually low groundwater levels) the NRA carried out works to seal or control 30 wild boreholes across the Fen area of the South Forty Foot catchment. These boreholes had historically overflowed under artesian pressure from the limestone aquifer in an uncontrolled way (hence the term 'wild') into local watercourses and ditches. Action was taken to seal/control the borehole flow in order to conserve the high quality groundwater resources of the limestone aquifer

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Review the current use of wild borehole discharge (in both abstraction and environmental terms) and make provision for additional water release if necessary. Draw up operational rules to manage flows from selected boreholes.	NRA	Safeguarding the local water environment and existing water users rights.	
Do Nothing.			Existing water users and the local environment will be adversely affected.

ISSUE 27

THE "DILUTE AND DISPERSE" PRINCIPLE OF OPERATION AT THE SLIPPERY GOWT LANDFILL CAUSES INTERMITTENT POLLUTION OF LOCAL WATERCOURSES AND MAY HAVE OTHER ENVIRONMENTAL IMPLICATIONS.

BACKGROUND

Slippery Gowt Landfill was developed at a time when it was not considered necessary to contain leachates within landfill sites. It was accepted practice to allow leachates to move away from sites, and become diluted in the environment. There are now doubts as to the suitability of this method of leachate management.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Operators to carry out hydrogeological studies to provide a full explanation of dilute and disperse mechanism and identify all possible environmental impacts.	Site operator	A better understanding of the movement of leachate and its environmental impact, will be gained.	Cost.
Operators to improve leachate management.	Site operator	Prevent incidents of pollution.	Cost.

ISSUE 28

THE STORM SEWER OVERFLOW AT LONDON ROAD PUMPING STATION IN BOSTON WHICH DISCHARGES TO THE HAVEN OPERATES AT AN UNACCEPTABLE FREQUENCY.

BACKGROUND

Development over a number of years in Boston has increased the load upon the existing infrastructure for foul sewage. The existing system is not of the required capacity and will overflow rapidly following storm conditions.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Improve sewerage system.	Anglian Water Services	Improved water quality in Tidal Haven.	Cost.

FISHERIES CLASSIFICATION SYSTEMS

Fish population surveys are normally undertaken on a 3 year rolling programme which covers the principal rivers/drains in the Area.

The data collected has been used to calculate the following classification systems, which are part of a national fisheries classification system. This system will enable fisheries throughout England and Wales to be compared in a standard way, taking into account broad habitat types.

BIOMASS AND DENSITY CLASSIFICATION

Absolute

This system compares coarse fish abundance in terms of a g/100m² for the total coarse fish population. For salmonid species abundance is gauged in terms of No/100m².

The class or grades are:

COARSE SPECIES	g.100m²	SALMONID SPECIES	No. 100m⁻²
A	3291 or 33 gm⁻²	A	62
B	1935 or 19.4gm⁻²	B	43
C	1029 or 10.3 gm⁻²	C	31
D	371 or 3.7 gm⁻²	D	18
E	0	E	0
F	No coarse fish caught	F	No salmonid fish caught

Figure 1

Relative

This system uses the biomass data for coarse fish without eels. Consideration of the river gradient and width zone means that fish abundance is compared at the site to be classified with all other sites in the same broad habitat.

Example 1

Data:		
	Width	4.2 metres
	Gradient	1.5m km
	Total biomass	2000 g/100m²

From Fig.1 this means CLASS B status is achieved.

The advantage of the relative system is that it includes information on river features and natural bias in the data. For example, an upland stream would not be expected to achieve a biomass much greater than 1000 g/100m² whereas a large lowland river system would be expected to achieve a biomass greater than 3000 g/100m².

The classes described by this scheme are:-

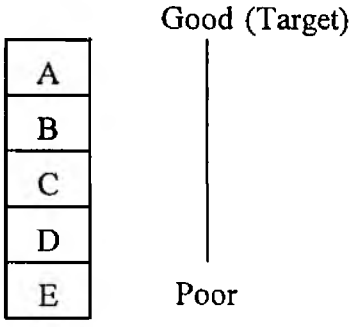


Figure 2

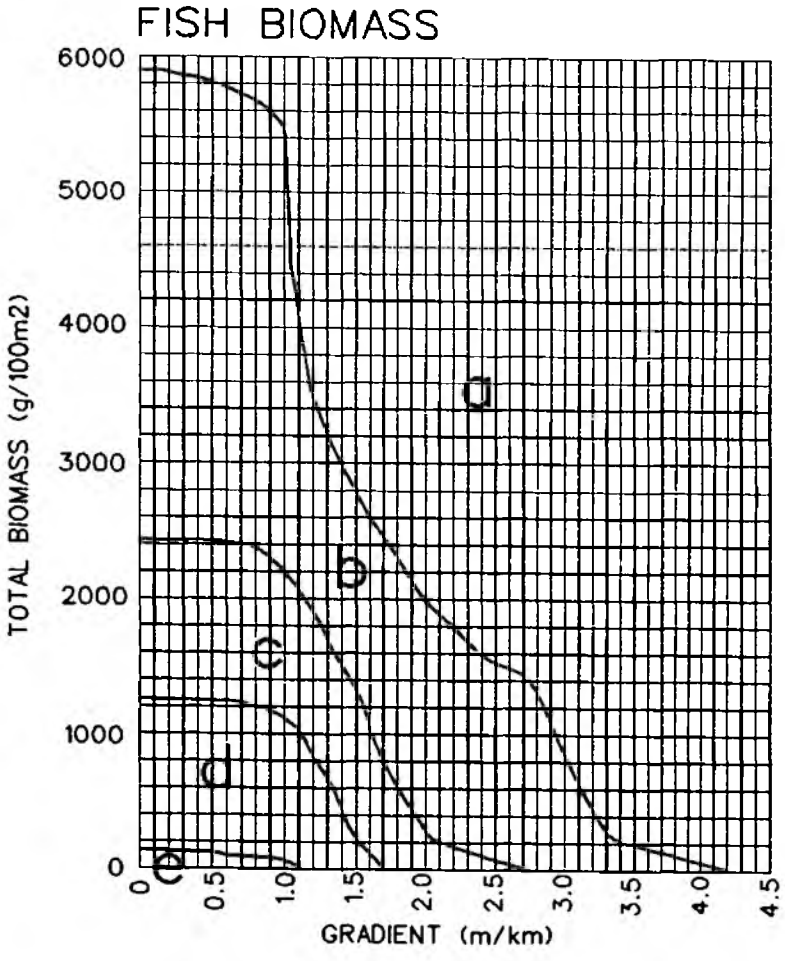


Figure 3

SPECIES RICHNESS

Species richness refers to the total number of individual species occurring within the survey area. This is a relative measure as river gradient and width zone are taken into account.

River width is classified into 1 of 4 zones:

Zone 1	
	4m
Zone 2	
	6m
Zone 3	
	9m
Zone 4	

Figure 4

For example:

Data:	Width	30.m
	Gradient	10m.km
	Total number of species	6

Using Figure 2 the species richness classification is A.

In a natural river system the lowland reaches would be expected to support a greater number of fish species than upland reaches. By incorporating river width and gradient into the 'species richness' classification this bias is largely removed.

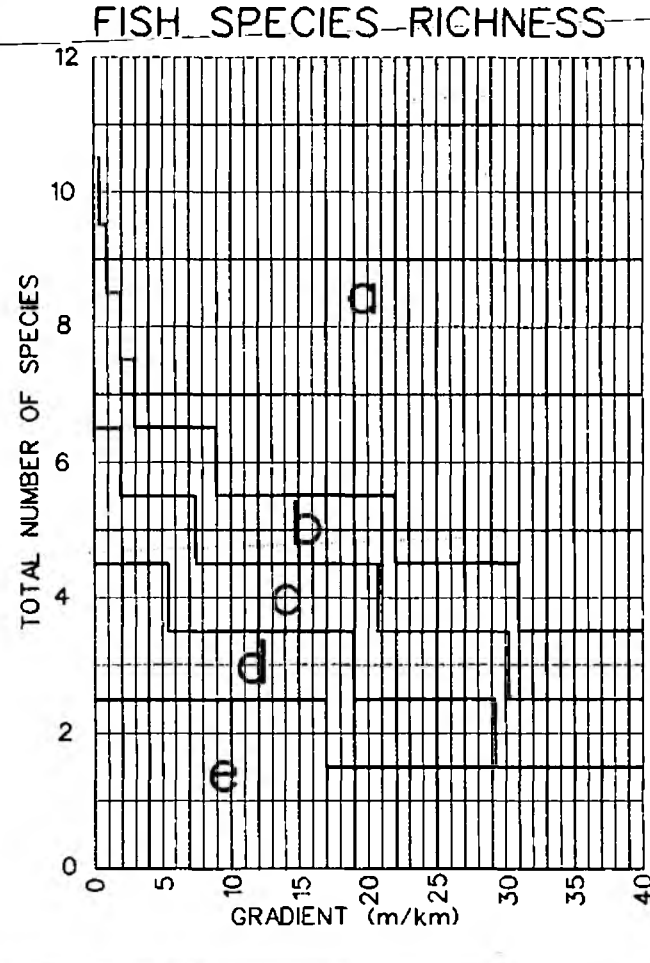


Figure 5

CLASSIFICATION OF ESTUARY WORKING PARTY SCHEME FOR WATER QUALITY

DESCRIPTION		POINTS AWARDED IF THE ESTUARY MEETS THIS DESCRIPTION
Biological Quality (scores under a, b, c, and d to be summed)		
a)	Allows the passage to and from freshwater of all relevant species of migratory fish, when this is not prevented by physical barriers.	2
b)	Supports a residential fish population which is broadly consistent with the physical and hydrographical conditions.	2
c)	Supports a benthic community which is broadly consistent with the physical and hydrographical conditions.	2
d)	Absence of substantially elevated levels in the biota of persistent toxic or tainting substances from whatever source.	4
Maximum number of points		10
Aesthetic Quality		
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
b)	Estuaries or zones of estuaries which receive inputs which cause a certain amount of pollution but do not seriously interfere with estuary usage.	6
c)	Estuaries or zones of estuaries which receive inputs which result in aesthetic pollution sufficiently serious to affect estuary usage.	3
d)	Estuaries or zones of estuaries which receive inputs which cause widespread public nuisance.	0
Water Quality (Score according to quality)		
Dissolved Oxygen exceeds the following saturation valves:		
	60%	10
	40%	6
	30%	5
	20%	4
	10%	3
	below 10%	0
The points awarded under each of the headings of biological, aesthetic, and water quality are summed. Waters are classified on the following scales.		
Class A	Good Quality	24 to 30 points
Class B	Fair Quality	16 to 23 points
Class C	Poor Quality	9 to 15 points
Class D	Bad Quality	0 to 8 points

RIVER ECOSYSTEM CLASSIFICATIONS

(1) Class	(2) Dissolved Oxygen % saturation 10 percentile	(3) BOD (ATU) mg/l 90 percentile	(4) Total Ammonia mg N/l 95 percentile	(5) Un-ionised Ammonia mg N/l 95 percentile	(6) pH lower limit as 5 percentile; upper limit as 95 percentile	(7) Hardness mg/l $CaCO_3$	(8) Dissolved Copper µg/l 95 percentile	(9) Total Zinc µg/l 95 percentile	Class Description
RE1	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
RE2	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
RE3	60	6.0	1.3	0.021	6.0 - 9.0	≤ 10 > 10 and ≤ 50 > 50 and ≤ 100 > 100	5 22 40 112	30 700 1000 2000	Water of fair quality suitable for high class coarse fish populations
RE4	50	8.0	2.5	-	6.0 - 9.0	≤ 10 > 10 and ≤ 50 > 50 and ≤ 100 > 100	5 22 40 112	30 700 1000 2000	Water of fair quality suitable for coarse fish populations
RE5	20	15.0	9.0	-	-	-	-	-	Water of poor quality which is likely to limit coarse fish populations

	LIST I	LIST II	RED LIST
METALS			
Mercury (Hg)	****		****(1)
Cadmium (Cd)	****		****(1)
Copper (Cu)		****	
Zinc (Zn)		****	
Lead (Pb)		****	
Tributyltin (TBT)			****
Triphenyltin (TPT)			****
Organotins		****	
Chromium (Cr)		****	
Nickel (Ni)		****	
Arsenic (As)		****	
Boron (B)		****	****
Vanadium (V)		****	
PCBs			****
PESTICIDES & ORGANOCHLORINES			
Hexachlorocyclohexane	****		
Gamma-HCH (Lindane)			****
DDT	****		****
Aldrin	****		****
Dieldrin	****		****
Endrin	****		****
Isodrin	****		
Trifluralin			****
Trichlorobenzene	****		****
Trichloroethylene	****		
Tetrachloroethylene	****		
Hexachlorobenzene	****		****
Hexachlorobutadiene	****		****
Carbon Tetrachloride	****		
Chloroform	****		
Endosulfan			****
Dichlorvos			****
Fenitrothion			****
Malathion			****
Azinphos-methyl			****
Atrazine			****
Simazine	****		****
Pentachlorophenol	****		****
1,2 Dichloroethane			****
Mothproofing Agents		****	
pH		****	

DANGEROUS SUBSTANCES

List I substances are regarded as particularly dangerous because of their toxicity, persistence and bioaccumulation. Pollution of the water environment by List I substances must be eliminated. The EC lays down standards for these substances. List II substances are less dangerous, but may still have a deleterious effect on the aquatic environment. Pollution by List II substances must be reduced. The EC Member States set standards for these in national law.

Red List substances, like those in Lists I and II are dangerous because of their toxicity, persistance and bioaccumulation. The government have agreed to reduce the input loads of Dangerous Substances to the North Sea by 50% by 1995 (using 1988 as a baseline).

ENVIRONMENTAL OUALITY STANDARD COMPLIANCE FOR THE TOWNS DRAIN IN 1993

Determinand	Units	No. of Samples	Results	Environmental Quality Standard
Gamma HCH (Lindane)	ng l^{-1}	12	189.875 AAT	100 ATT
Dieldrin	ng l^{-1}	12	85.33 ATT	10 ATT

Note: ng l^{-1} = Nanograms per litre

AAT = Annual Average Total Concentration

GLOSSARY

Abstraction	The removal of water from any source, either permanently or temporally.
Abstraction Licence	An authorisation granted by the NRA to allow the removal of water from a source of supply.
Algae	Microscopic (sometimes larger) plants, which may be floating or attached. Algae occur in still and flowing water.
Ammonia	A chemical compound found in water often as a result of pollution by sewage effluents. It is widely used to determine water quality. Ammonia detrimentally affect fish.
AMP2	An acronym for the second Assess Management Plan produced by the Water Companies for the Office of Water Services (OFWAT). It sets out the water industry investment programme for the period 1995 to 2005.
AOD (Above Ordnance Datum)	Land levels are measured relative to the average sea level at Newlyn in Cornwall. This average level is referred to as 'Ordnance Datum'. Contours on Ordnance Survey maps of the UK show heights in metres above Ordnance Datum.
Aquifer	A water bearing-stratum situated below ground level. The water contained in aquifers is known as groundwater.
Artesian	Groundwater which reaches the surface under it's own pressure.
Augmentation	The addition of water to a watercourse under artificial control. Usually to "top up" low flows in summer by either groundwater pumping or via reservoir release.
Biochemical Oxygen Demand (BOD)	A standard test which measures over 5 days the amount of oxygen taken up by aerobic bacteria to oxidise organic (and some inorganic) matter.
Bio-diversity	Diversity of biological life.
Biomass	Total quantity or weight of organisms in a given area or volume.
Borehole	Well sunk into a water bearing rock from which water will be pumped.
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.
Catchment	The total area from which a single river collects surface runoff.
Coarse Fish	Freshwater fish other than salmon and trout.
Combined Sewer Overflow (CSO)	An overflow structure which permits a discharge from the sewerage system during wet weather conditions.
Confluence	The point at which two rivers meet.
Consent (Discharge)	A statutory document issued by the NRA. It can authorise entry and indicate any limits and conditions on the discharge of an effluent to a controlled water. A drainage consent is an approval for specified structural works in areas under NRA control.
Controlled Waters	All rivers, canals, lakes, groundwaters, estuaries and coastal waters to three nautical miles from the shore, including the bed and channel which may for the time being be dry.

Culvert	Channel or conduit carrying water across or under a road, canal etc.
Cyprinid fish	Coarse fish eg.Roach, Dace and Bream.
Dangerous Substances	Substances defined by the European Commission as in need of special control. This is because they are toxic, accumulate and concentrate in plants and animals, or do not easily break down into less dangerous substances. They are classified as List I or List II.
Diffuse Source	Pollution from non-point sources.
District Local Plans	Statutory documents produced by District or Borough Councils to implement the development strategy set out in County Structure Plans. Specific land use allocations are identified.
DO (Dissolved Oxygen)	The amount of oxygen dissolved in water. Oxygen is vital for life so this measurement is an important test of the health of a river.
EC Directive	A type of legislation issued by the European Community which is binding on Member States in terms of the results to be achieved but which leaves to Member States the choice of methods.
Ecology	The study of relationships between an organism and its environment.
Ecosystem	A functioning, interacting system composed of one or more living organisms and their effective environment, in biological, chemical and physical sense.
Effective Rainfall	Total rainfall minus direct evaporation and the water used by plants for transpiration. This is equivalent to the total resource of a catchment.
Effluent	Liquid waste from Industrial, agricultural or sewage plants.
Enmain	Procedure in which the NRA assumes powers to maintain a watercourse.
Environmental Quality Standard (EQS)	That concentration of a substance which must not be exceeded if a specific use of the aquatic environment is to be maintained.
Environmentally Sensitive Area (ESA)	An area where traditional farming methods may be supported by grant aid from the Ministry of Agriculture, Fisheries and Food (MAFF) to support distinctive landscape, wildlife habitats or historic features.
Eutrophic	A description of water which is rich in nutrients. At worst, such waters are sometimes beset with unsightly growths of algae.
Fauna	Animal life.
Fish Biomass	A measure of the quality of a fishery as found in terms of surveys, weight by area ie g/m^2.
Flood Defences	Anything natural or artificial that protects against flooding, to a designed return period.
Flood Plain	This includes all land adjacent to a watercourse over which water flows or would flow but for flood defences in times of flood..
Flora	Plant life.
Fluvial	Relating to the river.
Gauging Station	A site where the flow of a river is measured.

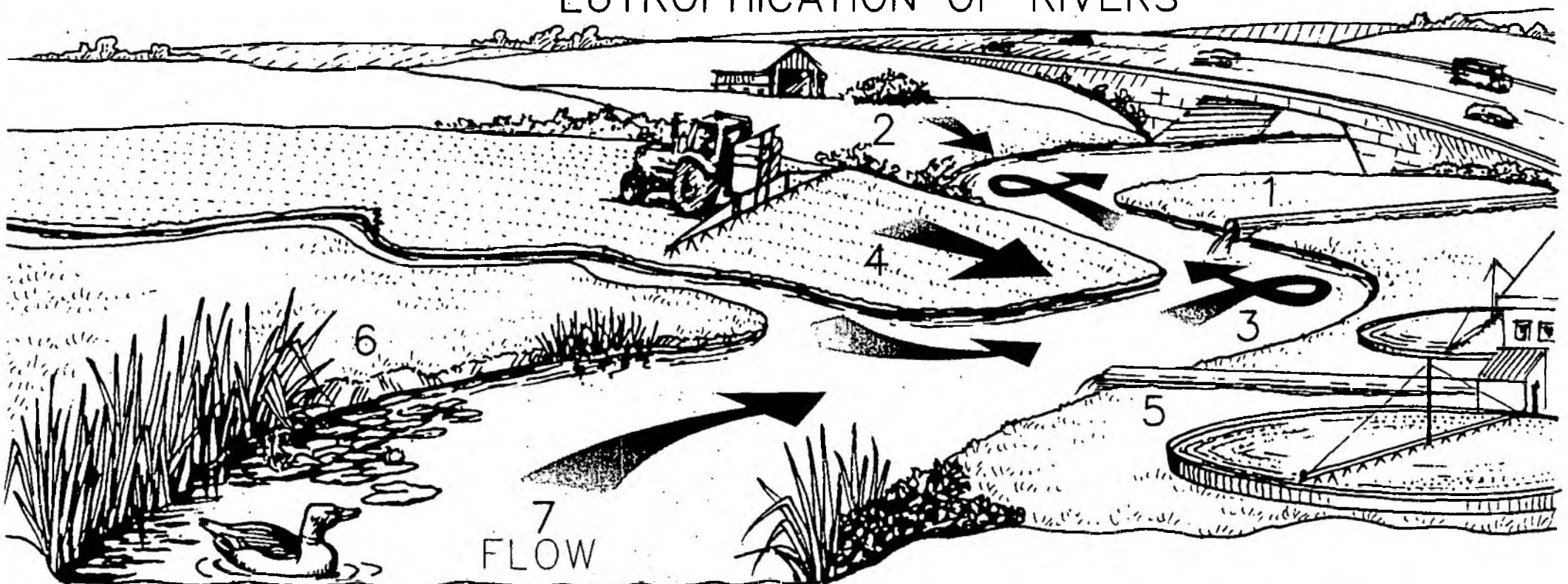
General Quality Assessment (GQA)	A new scheme replacing the NWC Classification system. It provides a means of assessing and reporting environmental water quality in a nationally consistent and objective way. The chemical grades for rivers introduced in 1994 uses BOD, Ammonia and Dissolved Oxygen limits for water quality between A (Good) and F (Bad). Other grades for estuarine and coastal waters are being developed and aesthetic components will be measured and graded by a system under trial now.
Geomorphology	Scientific study of land forms and of the processes that formed them.
Groundwater	Water which saturates a porous soil or rock substratum (or aquifer). Water held in storage below ground level.
Goundwater Protection Policy	NRA policy relating to groundwater recharge areas to control activities having the potential to pollute underground water.
Habitat	The customary and characteristic dwelling place of a species or community.
Highland Carrier	A watercourse carrying waters, which originate in upland areas, across low lying land before discharging to the sea, often embanked.
House Equivalents	System by which areas of land and property are allocated a value in terms of numbers of houses.
Hydrogeology	Branch of geology concerned with water within the Earth's crust.
Hydrology	The study of water on and below the earths surface.
Hydrometric	The measurement of water.
IPC Authorisation	An authorisation issued by Her Majesty's Inspectorate of Pollution prescribed by the Environmental Protection Act 1990 covering a Process.
Landfill	Site used for waste disposal into/onto land.
Leachate	Liquor formed by the act of leaching.
Leaching	Removal of soluble substances by action of water percolating through soil, waste or rock.
Main River	The watercourse shown on the statutory 'Main River maps' held by NRA and MAFF. The NRA has permissive powers to carry out works of maintenance and improvement on these rivers.
Managed Retreat	The deliberate abandoning of an existing tidal defence in order to obtain economic and ecological advantage. A new defence may be constructed landward of the old line.
Minimum Acceptable Flow (MAF)	The minimum acceptable flow as defined in Section 21 of the Water Resources Act 1991.
Minimum Residual Flow (MRF)	Target flow set locally and not legally defined.
Morphology	The form of the structure of plants and animals.
National Water Council Class (NWC Class)	A summary of the quality of river water based largely on the measured chemical for the purposes of classification and reporting. To be replaced at the end of 1994 by a "General Quality Assessment" scheme.
Natural Flow Regime	The river flow pattern experienced prior to the influence of man, with no abstraction from or discharges to the catchment.

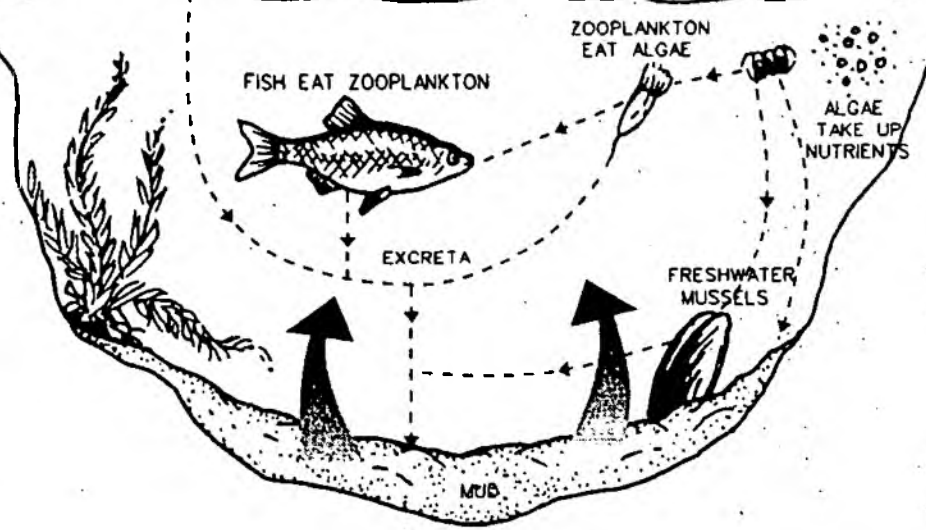
Nitrate Sensitive Areas (NSA) and Nitrate Vulnerable Zones (NVZ)	Land in areas where water sources exceed a 50mg/l nitrate limit or are forecast to by the year 2010 are designated NVZ's. Farmers are required to observe an action programme to reduce nitrate loss from their land in both NVZ's and NSA's. However, they do not receive compensation for such programmes where the land is designated on NVZ.
Outfall	The point at which a river discharges to the seas/estuary, it may also include an outfall structure to prevent sea waters backing up the system.
Percolation	The descent of water through soil pores and rock crevices.
Perennial Flow	River flow present through the entire year.
Permeability	The ease at which liquids (or gases) can pass through rocks or a layer of soil.
Potable	Water of a suitable quality for drinking.
Prescribed Flow	A flow set to protect lawful downstream users and the aquatic environment.
Q95	The flow of a river which is exceeded on average for 95% of the time.
RAMSAR	Wetland site of International Importance that is designated under the Ramsar convention.
Reach	A length of a river.
Recharge	Water which percolates downwards from the surface into groundwater.
Red Data Book Species	The most threatened species in Great Britain.
Red List Substance	Substance which has been selected for monitoring on the basis of its persistency toxicity and ability to bioaccumulate.
Regulated River	A river where the flow is augmented through the addition of water from another source.
Return Period	Refers to the return period of a flood. Flood events are described in terms of the frequency at which, on average, a certain severity of flood is exceeded. This frequency is usually expressed as a return period in years, eg. 1 in 50 years.
Riffle	A shallow area in a river where the substrate is composed of gravel and the flow is faster.
Riparian	Of, or on, land contiguous to the river.
Riparian Owner	Owner of riverbank and/or land adjacent to a river. Normally owns riverbed and rights to midline of channel.
River Corridor	The continuous area of river, river banks and immediately adjacent land alongside a river and its tributaries.
River Quality Objectives	The level of water quality that a river should achieve, in order to be suitable for its agreed use. Is being replaced by Water Quality Objectives (WQO's).
Saline waters	Water containing salts.
Salmonid Fish	Game fish eg. trout and salmon.
Scheduled Monument	The key sites nationally for archaeology, designated by the Secretary of State for National Heritage, through English Heritage.
Septic tank	A small tank receiving and treating sewage by bacteria.

Set-Aside	The EC set-aside scheme was first introduced for the crop year 1991/92 as part of the CAP reform to allow farmers to remove land from production by receiving compensation. Eligible crops are a wide range of arable crops, principally cereals.
Sewerage	System of sewers usually used to transport sewage to a sewage treatment works.
Site of Special Scientific Interest (SSSI)	A site given a statutory designation by English Nature or the Countryside Council for Wales because it is particularly important, on account of its nature conservation value.
Slurry	Animal waste in liquid form.
Soakaway	System for allowing water or effluent to soak into ground, commonly used in conjunction with septic tanks.
Source Protection Zones	Source Protection Zones are designed to protect potable water supplies against the effects of human activity.
Special Protection Area (SPA)	Statutory protected habitats for wild birds under EC Regulations.
Spray Irrigation	The watering of crops by spraying. Can have a high impact on water resources.
Storm Sewage Discharges	The discharge of untreated sewage in times of heavy rainfall and high flows.
Strata	A term applied to rocks that form layers or beds. Can also be applied to successive layers of any deposited substance eg. atmosphere, biological tissue.
Surface Water	Water collecting on and running off the surface of the ground.
Sustainable Development	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
S105 Surveys	Section 105 of the Water Resources Act allows for Standards of Service, Assets and Flood Risk Surveys.
Taxa	Groups of similarly classified animals and plants.
Telemetry	A means of directly collecting data from remote sites.
Topography	Physical features of a geographical area.
Trade Effluent	Effluent derived from a commercial process/premises.
Transfer Station	A place where refuse, collected from premises, is compacted into large containers and transported onward for disposal.
Underground Strata	A term used to signify geology under the surface soil layer. If groundwater exists, or if water is being discharged to the ground, the geology underneath the soil layer is known in the various Acts of Parliament as 'underground strata'.
Washlands	Extensive semi-natural area of flood plain adjacent to a river, where water is stored in time of flood. Structures can be added to control the amount of water stored in the washland and time its release to alleviate peak flood flows in areas downstream.
Water Quality Objectives (WQO)	Statutory water quality targets to secure specific formal minimum quality standards for specific stretches of water by given dates. A new component of these is introduced by "The Surface Waters (River Ecosystem Classification) Regulations 1994"; a classification scheme to be applied by NRA to the rivers and watercourses of England and Wales. Other existing standards operate already to give effect to various EC Directives for water quality.

Water Table	Top surface of the saturated zone within the aquifer.
Water Transfer Scheme	An infrastructure provided to transfer water from one river system to another.
Weir	A dam built across a river to raise upstream levels.
Wetland	An area of low lying land where the water table is at or near the surface for most of the time, leading to characteristic habitats.
Winter Storage Reservoir	Reservoirs built by farmers to store water during the winter months when it is "plentiful" for re-use during the summer.

EUTROPHICATION OF RIVERS





DECOMPOSITION & DISTURBANCE (EG DREDGING & FLOODS) OF MUD RELEASES PHOSPHORUS

1 DISCHARGE OF INPUTS SUCH AS SURFACE WATER FROM ROADS/STORM WATER OVERFLOWS
2 FARM WASTE (NITROGEN & PHOSPHATE)
3 NUTRIENTS 'SPIRAL' DOWN THE RIVER AND SETTLE INTO SEDIMENTS WHICH MAY BE RELEASED BY DISTURBANCE LATER
4 DIFFUSE RUN-OFF FROM LAND (MAIN SOURCE OF NITROGEN)
5 DISCHARGE OF EFFLUENT FROM STW (MAIN SOURCE OF PHOSPHORUS)
6 WATER PLANTS TAKE UP NUTRIENTS WHEN GROWING & RELEASE THEM WHEN THEY DIE BACK IN THE WINTER
7 VARIATIONS IN FLOW INFLUENCE SETTLING & RELEASE OF NUTRIENTS

THE INCREASED INPUTS OF NUTRIENTS (MAINLY NITROGEN & PHOSPHORUS) LEADS TO EXCESSIVE PLANT AND ALGAL GROWTH. THIS CAN RESULT IN DEOXYGENATION OF THE WATER DURING THE NIGHT & IT'S SUPERSATURATION DURING THE DAY

THE INCREASED ORGANIC MATTER LEADS TO INCREASED NUMBERS OF CERTAIN BOTTOM DWELLING INVERTEBRATES AND PLANTS AND AN OVERALL DECREASE IN SPECIES DIVERSITY. THIS CREATES AN IMBALANCE IN THE ECOLOGY OF THE WATERCOURSE.

CATCHMENT PLANNING TEAM

R Kisby		Project Leader
D Watling	)	Water Resources
A Court	)	
J Ulyatt		Flood Defence
D Fisher		Planning Liaison
I Forbes	)	Fisheries, Recreation, Conservation
N Bromidge	)	and Navigation
S Nugent		Water Quality

CATCHMENT PANEL MEMBERS

I Biddick	Humberside County Council
N Playne	County Landowners Association
G Keeping	Lincolnshire County Council
T Richards	Lincolnshire Anglers Consultative
T Grant	Witham Fourth Internal Drainage Board
T Wilson	Lincolshire Anglers Consultative
D Carnell	Inland Waterways Association
M Crick	Lincolnshire Wildlife Association
R Spaight	Salmon & Trout Association
T Coles	Institute of Environmental Assessment
R Harvey	British Waterways
R B Shields	East Lindsey District Council
C Middleton	West Lindsey District Council
J Shackles	English Nature
R Wardle	Countryside Commission
N Boast	Chemical Industries Association
D Dickson	National Federation of Anglers
P Bird	Eel Fishermen
P Thompson	Tioxide UK
P Fisher	RSPB
E Smith	Anglian Water Services Ltd
J Dodsworth	Lincolnshire LFDC