

SOUTH ESSEX CATCHMENT MANAGEMENT PLAN CONSULTATION REPORT



NRA

*National Rivers Authority
Anglian Region*

NOVEMBER 1995

CATCHMENT KEY DETAILS

GENERAL	Land Area	1841.54 km ²
	Population 1990	678,000
	Projected to year 2001	694,000

Main Towns and Populations

Southend-on-Sea (Municipal Borough)	167,200
Canvey Island	35,600
Basildon (Municipal Borough)	96,400
Stanford-le Hope/Benfleet/ Hadleigh/Thundersley	49,600
Corringham	32,300
Grays	48,100
Rayleigh	28,000

(Data from Essex County Council, Planning Department)

Groundwater

No additional water available

Surface Water

No additional summer water. Limited winter water available subject to cessation conditions to safeguard the water environment and other water users.

Public Water Supply Abstractions

Essex & Suffolk Water: There are two Chalk public water supply abstractions in the catchment. These are located at Linford and Stifford, and are licensed to abstract 3728 ML/a (1 ML/a = 1 million litres)

WATER RESOURCES

ADMINISTRATIVE DETAILS

County Council:

Essex

Borough/District Councils:

Basildon	Brentwood
Castle Point	Chelmsford
Maldon	Rochford
Southend-on-Sea	Thurrock

Unitary Authority:

London Borough of Havering

NRA

Anglian Region - Eastern Area
Thames Region (covering discharges to the Thames Estuary)

Water Utilities

Anglian Water Services (AWS)
Essex & Suffolk Water (ESW)

Sewage Treatment Works

Anglian Water Services (AWS)

Significant Sewage Works

Wickford, Upminster, Rochford, (population equivalent > 10,000)
Rayleigh East, Rayleigh West,
Woodham Ferrers

Significant Sewage Works

(discharging to Thames estuary & monitored by NRA Thames Region)
Basildon, Benfleet, Canvey, Tilbury, Canvey Island, Southend-on-Sea, Stanford-le-Hope (shortly to be diverted to Tilbury STW)

Internal Drainage Boards

None

Flood Defence Committees

Essex Local Flood Defence Committee

Length of Designated Main River

Fluvial	313.6 km
Tidal	101.4 km

Length of Main River Embankment

Fluvial	4.5 km
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Length of NRA Tidal Defences

Area at risk from tidal flooding	97.5 km ²
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Area at risk from fluvial flooding	27.1 km ²
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FLOOD DEFENCE

The Anglian Region of the NRA has no statutory Navigation responsibility within this plan area. On the coast this responsibility lies with the Port of London Authority and the Crouch Harbour Authority.

NAVIGATION

Length of coarse fishery	11.7 km
Length of trout fishery	0 km

FISHERIES

Well in excess of 100 reservoirs, lakes and ponds throughout the catchment area are also used actively for freshwater angling. The total is not known precisely.

Length of River in General Quality

Assessment classifications 1992 to 1994:-

Class A	0.0 km	Class B	0.0 km
Class C	30.0 km	Class D	92.0 km
Class E	34.0 km	Class F	10.0 km

WATER QUALITY

Length of estuary on Coastal and Estuarine Working Party Grades:-

Grade A:	14.0 km	Grade B:	41.3 km
Grade C:	0.0 km	Grade D:	0.0 km

CONSERVATION

Number of SSSIs	22
Number of water dependent SSSIs	7
Number of National Natural Reserves	2
Number of Ramsar Sites	4
Number of ESAs	1
Number of Special Protection Areas	4
Number of proposed SPAs/Ramsar Sites	1
Number of Local Nature Reserves	6
Number of County Wildlife Sites	345

THE NRA'S VISION FOR THE SOUTH ESSEX CATCHMENT

This catchment contains the Rivers Crouch, Roach and Mardyke, the drainage network within Canvey Island, and the numerous smaller rivers, many of which drain directly to the sea or the Thames Estuary. The land use is primarily agricultural, but substantial urban and industrial areas form much of the coastal fringe between Southend-on-Sea and Purfleet. Significant industry is associated with the major towns of Basildon and Wickford, with large populations at Billericay and Burnham-on-Crouch.

Key objectives in the catchment over the next ten years are to:

- Manage water resources in an environmentally sustainable way, balancing the needs of the water environment and those of all legitimate water users.
- Manage water resources to meet demands for water taking account of both human needs and those of the water environment. In the short term the NRA sees demands being met by a combination of measures including demand management initiatives and more efficient use of water by industry and agriculture. In the longer term, the NRA sees future rises in demand being met from outside the catchment, relying on increased imports from supplemented supplies to Abberton and Hanningfield reservoirs, and subsequent distribution southwards through Essex and Suffolk Water's mains network.
- Improve compliance of rivers with their water quality target classifications.
- Achieve a reduction in the number of pollution incidents arising from industrial estate surface water systems, through pollution prevention campaigns.
- Achieve an improvement in bacterial quality in waters associated with shellfisheries and water contact sports.
- Ensure protection of the quality of groundwater in the Thurrock area, used for public supply.
- Develop the amenity and recreational potential of inland and coastal waters and their associated lands. This is being encouraged, for example, by extension and improvement of the footpath network beside watercourses; and also by improving disabled access.
- Further the conservation and enhancement of fisheries, wildlife, landscape, and archaeological features by undertaking river restoration schemes, and ensuring that environmental protection and enhancements are incorporated in all maintenance and capital works.
- Maintain, develop and improve fisheries through careful monitoring, liaison and cooperation with all interested parties. Pursue and achieve appropriate target classes for rivers, and protect fish stocks.
- Maintain and improve, where appropriate, the flood flow carrying capacity of the Catchment's rivers and the defence standards of the seawalls. In so doing the NRA will take into account coastal processes, economic factors and the care and enhancement of the environment. Examples of such initiatives are the Essex Shoreline Management Plan and resulting Sea Wall Strategy, and capital improvements to sea defences on the Roach.
- Develop Water Level Management Plans to protect and enhance valuable and sensitive environmental areas.

It is our intention to work in partnership with all relevant agencies and representative organisations, to achieve an integrated approach to managing the catchment. This report, and the ensuing period of public consultation, seeks to ensure that required improvements are carried out and future demands are catered for, in an environmentally sustainable manner.

MAP OF THE CATCHMENT





FOREWORD

Established in 1989 the National Rivers Authority has as its role the "Guardians of the Water Environment". As such it is committed to protecting and improving the water environment in its broadest sense. Establishing a sound planning base for the development of river catchments is essential to good future management.

Integrated Catchment Management Planning plays an increasingly important role in the management of the water environment. Demands upon catchments are many and varied, and conflicts require careful consideration. The enhancement of the water environment is one of the main aims of consultation with individuals and organisations having an interest in the catchment.

This report examines the Rivers Crouch, Roach, Mardyke, their tributaries, their catchments, their offshore tidal waters, and adjacent coastal and Thames estuary frontages. The shoreline limits are Purfleet in the Thames Estuary and the Dengie Peninsula.

Also within the area of this Plan are some of the country's most important saltmarsh and mudflat environments which support internationally important bird populations.

The dry nature of this catchment, together with its high water demand, make water resource requirements a high priority. Tight water quality control is therefore essential to maintain the quality of the limited water available for the varied catchment uses.

This report shows our initial view of the issue facing the catchment. I would welcome your views on the future management of the plan area:-

- *Have all the important water related issues been identified?*
- *Have all the options and solutions to issues been identified?*
- *Which issues and options do you support or oppose?*
- *Do you have any other information or ideas you wish to express?*

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Regional General Manager

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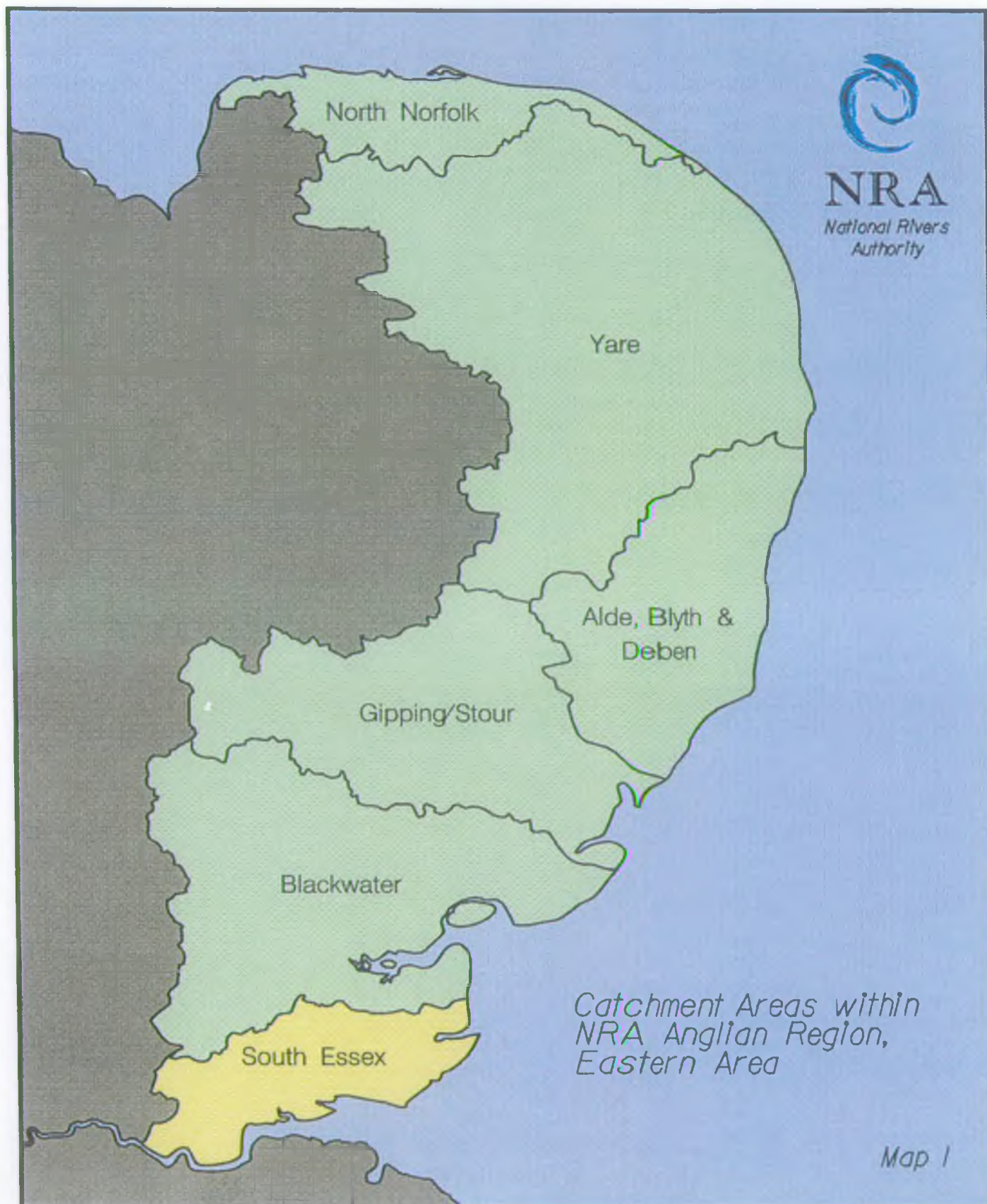
This document includes relevant information about the catchment and lists the issues we have identified and which need to be addressed. Following the public consultation period, an Action Plan will be produced which will balance the catchment's conflicting demands and will set out targets for action by the NRA and others over the coming years.

This is your opportunity to influence our future plans.

Correspondence should be addressed to:-

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Anglian Region, Cobham Road, Ipswich, IP3 9JE.

Final date for responses is 29 February, 1996.



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1.0 CONCEPT

1.1 The National Rivers Authority

The National Rivers Authority (NRA) is the major environmental protection agency responsible for safeguarding and improving the natural water environment in England and Wales. The nature of its responsibilities are wide reaching and include:-

- Control of pollution and improving the quality of rivers, groundwaters and coastal waters.
- Flood defence.
- Flood warning.
- Effective management of water resources.
- Maintenance, development and improvement of fisheries.
- Conservation of the natural environment, within the flood plain.
- Promotion of water based recreation including navigation.

To achieve success in all these areas the NRA works with industry, commerce, farming, Local Authorities, other statutory and non statutory agencies and the general public. The aim is to promote environmental awareness and to enforce appropriate environmental standards.

Catchment management assists the NRA to use its authority and work with others to ensure that the rivers, lakes, coastal and underground waters are protected and, where possible, improved for the benefit of present and future generations.

River catchments are subject to increasing use by a variety of activities. Many of these interact and conflicts are inevitable. The competing requirements and interests of users and beneficiaries must be balanced.

The NRA will use its resources to:-

- Respond promptly to all reported pollution incidents.
- Control pollution by working with dischargers to achieve improvement and monitor effluent compliance against appropriate standards.
- Monitor, survey and investigate the existing quality of controlled waters to determine short and long term changes.
- Maintain existing and invest in new assets to provide flood protection, where economically justified and environmentally feasible; and to develop water resources and provide other NRA services, where sustainable.
- Assess, manage, plan and conserve water resources.

- Determine, monitor, enforce and review the conditions in water abstraction licences, discharge consents and land drainage consents to achieve operational objectives.
- Promote recreation, navigation and conservation.
- Maintain, develop and improve fisheries.
- Influence planning authorities to control development so as to avoid conflict with NRA objectives and initiatives through Town and Country planning liaison.

Within the National Rivers Authority are many specialist functions each who have their own specialist terms and abbreviations. The use of jargon within this report has been avoided whenever possible. Some abbreviations are used to avoid lengthy repetition of terms. Within the Appendices is a Glossary and a key to abbreviations.

1.2 Scope and Process of Catchment Management Planning

This draft catchment plan consolidates the policies, objectives and options for the South Essex catchment for the overall improvement of the water environment. It must be emphasised that the Catchment Management Plan is not an end in itself. Its purpose is to provide a comprehensive guide to the present status and vision for the Catchment. It is the essential first step in providing the basis for drawing up a plan of action. The timetable for the planning process is given in the table overleaf. The plan is drawn up as follows:-

Uses of the Catchment

For the identified uses of the water environment, objectives for each use are identified and targets set, (where applicable), for Water Quality, Water Quantity, Flood Defence and Physical Features, and Fisheries.

Catchment Targets

By examining the targets for individual uses, overall targets for Water Quality, Water Quantity and Physical Features are determined for the catchment.

Current Shortfalls, Issues and Options

Having set targets it is then possible to view the current state of the catchment and identify shortfalls, and options for their remediation. The benefits and disadvantages of each option are detailed together with responsibility for their implementation.

The draft Plan is then released for public consultation. Comments on the objectives/targets and issues/options are invited before an Action Plan for the Catchment is produced.

The issues and options as presented are the preliminary views of the NRA Anglian Region following preliminary external consultations, and do not constitute policy statements. Following the consultation period all comments will be drawn together

and considered in drawing up the Action Plan which will then be reviewed annually.

The need for co-operation of water users and all water related organisations cannot be overstated. The NRA seeks partnership with all parties to obtain a balanced programme of improvements to the water environment.

The Catchment Management Planning (CMP) Process

<u>Timescale</u>	<u>Steps</u>
0 months	1. Set up a Catchment Panel Group.
	2. Preliminary external consultations and meetings.
	3. Identify and describe catchment uses.
	4. Identify catchment targets.
	5. Compare current status with catchment targets.
	6. Identify catchment issues and options.
	7. Internal consultation with Catchment Panel.
6 months	8. Public launch and external consultation.
9 months	9. Draw up Action Plan for the CMP in consultation with the Catchment Panel.
12 months	
Periodic Review	10. Monitor progress towards target objectives and review the CMP in consultation with the Catchment Panel.

The Essex Catchment Panel are overseeing the production of this plan. There are 21 independent members on this panel, each has particular interests in the local water environment but none is a direct employee of the National Rivers Authority. The Panel members are:-

Mr Jeffrey Jenkinson MVO (Chairman)

Mr Paul Bradford
Mr Peter Holloway
Mr Chris Lofts
Mr Andrew Overall
Ms Carol Reid
Mr Humphrey Squier
Cdr Bill Twist OBE

Mr Chris Durdin
Mr Brian Isaacs
Dr Clive Mansfield
Ms Celia Richardson
Mr Christopher Stephenson
Mr David Weston
Mr Ken Green MBE

Mr Hugh Gray
Mr John Joyce
Dr Chris Mason
Mr David Pyman
Dr Diana Simpson
Mr Dick Strachan

1.3 Limitations

The Catchment Management Plan will inevitably be subject to some limitations, the major examples of which are as follows:-

Where improvement works are required to overcome catchment issues, these will, in many cases, be in part or wholly the responsibility of other organisations or individuals. The NRA may have no powers to control the necessary actions directly. The responsible party may be a company who may see little or no financial benefit in carrying out the actions, a water utility whose capital spend is affected by OFWAT, or a Local Authority with restricted budgets.

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

Land use within this plan area is obviously a major contributor to the state of this catchment. In area terms, the largest land use is agriculture. In cases where farming practice will need to change to permit the catchment improvements to proceed, it will be necessary to obtain the support of the landowners concerned and for them to make such changes voluntarily.

While these limitations will inevitably hamper the achievement of some of the plan objectives, it is essential that these objectives should still be set and striven for. Alternative means of achieving them might be identified, or the very fact of their identification and publication might bring the necessary pressure to encourage those involved either individually or collectively to work towards their achievement. Public participation in this Plan will increase awareness of water related issues and lead to involvement in, and a feeling of ownership of, their water environment.

It should further be noted that by the time a South Essex Action Plan is published following consultation on this report, the NRA will be subsumed within the Environment Agency.

2.0 OVERVIEW

2.1 Introduction (Refer to Map 2)

The Catchment Plan area contains the Rivers Crouch, Roach and Mardyke, the drainage network within Canvey Island, and numerous smaller rivers, many of which drain directly to the sea or the Thames Estuary. The plan lies within the county of Essex, excepting a small area within the London Borough of Havering.

Land use is primarily agricultural, but substantial urban and industrial areas form much of the coastal fringe between Southend-on-Sea and Purfleet. Significant industry is associated with the major towns of Basildon and Wickford, with additional large populations at Billericay and Burnham-on-Crouch. Port facilities are generally concentrated along the Thames estuary frontage.

The threat of tidal or freshwater flooding is ever-present though major flood defence works over the past twenty years have increased the standards of protection, most notably with the construction of the Thames Tidal Defence Scheme with its associated barriers. Most at risk are the rural sea walls which protect important agricultural and wetland areas, nature conservation habitats, together with people and property.

The rivers and estuaries support a wide range of uses, which give rise to many possible conflicts. There is some industrial use of water, together with a range of industrial discharges to both freshwater and tidal reaches. Agricultural interests make significant abstractions for spray irrigation in the summer months, as well as exerting a major influence on the management of water quality.

Large parts of the catchment enjoy the protection afforded by special conservation or landscape designations. There are a number of Sites of Special Scientific Interest, National Nature Reserves and County Wildlife Sites throughout the area. New agricultural policies leading to grants for "set-aside" land and to the existence of the Essex Coast Environmentally Sensitive Area (ESA), are exerting an ever increasing influence on future land use planning.

In the Thurrock area there are two groundwater abstractions serving public water supplies although much of the local demand is met from water supplied from outside the catchment.

Major recreational and amenity uses are further characteristics of the area. The estuaries provide sheltered waters allowing a variety of boating activities, focusing particularly on Burnham-on-Crouch.

This plan shows how the NRA proposes to discharge its responsibilities throughout this complex catchment. In doing so, it seeks to recognise all legitimate interests, and to reconcile uses which might conflict.



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Map 2

2.2

Boundaries

(Refer to Maps 3, 4 & 5)

Within this South Essex Catchment the NRA's Anglian Region has statutory responsibilities between the shoreline limits of the Dengie Peninsula in the north-east, and the west bank of the Mardyke at Purfleet in the Thames Estuary. Inland, the western limit is the watershed of the Mardyke (this is the boundary with the NRA's Thames Region); to the north the landward limit is the watershed of the River Crouch and its tributaries.

The NRA's Thames Region manages the whole of the River Thames and its estuary. The demarcation limit is a line drawn from Haven Point near Great Wakering to Warden Point on the Isle of Sheppey. The water quality of all creeks within these limits, including the backwaters round Canvey Island and the waters within Tilbury Dock, is also the responsibility of Thames Region.

There is a number of management plans covering the Thames Estuary and adjacent land. These include the Thames Estuary Management Plan (EMP), Thames Tideway CMP and the North Kent CMP. The finalised EMP will be published by English Nature in October 1996. The North Kent Consultation Report and Thames Tideway Action Plan, will be published in the Spring and Autumn of 1996, respectively. Appropriate interfacing between plans should ensure that all relevant issues are considered, and that procedures for the implementation of identified actions are agreed.

Anglian Region's Water Quality responsibilities for tidal waters extend from the coastline to a three mile offshore limit and are addressed in this report. Water quality issues on all other rivers and estuaries, and within the land area of this plan are addressed by the Anglian Region.

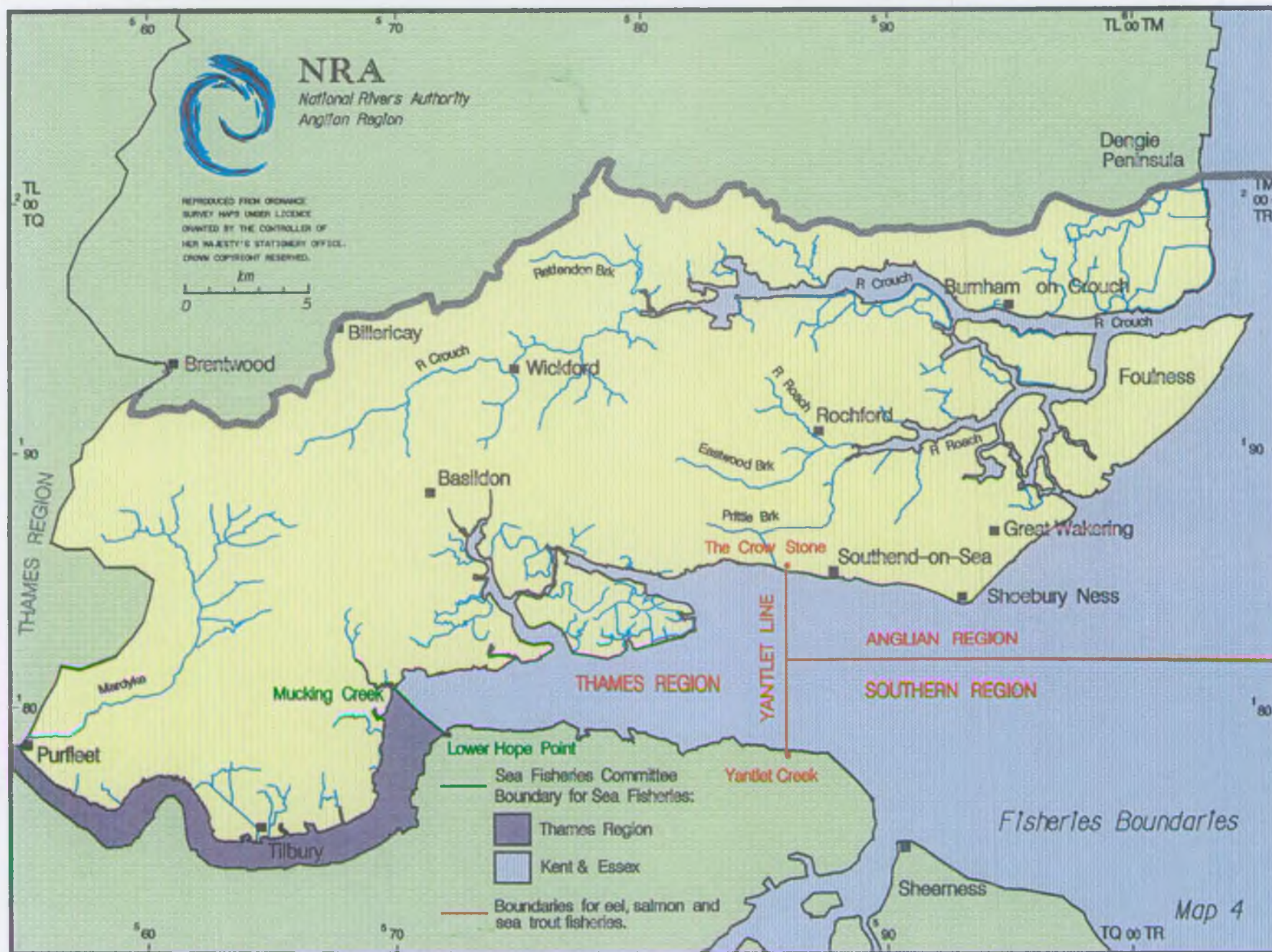
Fisheries responsibilities in the Thames Estuary are divided between the Kent and Essex Sea Fisheries Committee and three NRA Regions (Anglian, Southern and Thames).

The NRA Regions are responsible for eel, salmon and migratory trout fisheries up to the 6 mile limit. The areas of jurisdiction of the Anglian and Southern Regions extend downstream from a line drawn across the Thames from the London Stone North Level in Kent to the Crow Stone in Essex (the Yantlet Line), with the boundary between them being defined at right angles to the mid point of that line. Thames Region takes over responsibility upstream of the Yantlet Line, for both the Thames Estuary itself, and for all tidal waters feeding in to it.

Sea fisheries powers are exercised by the Kent and Essex Sea Fisheries Committee, and by the NRA Thames Region. The boundary between the areas of sea fisheries jurisdiction runs from Lower Hope Point to the mouth of Mucking Creek. The Anglian and Southern Regions have no sea fisheries powers as such, but the regulation of coastal water quality by all three Regions is obviously of great importance to fisheries interests.

Only those fisheries issues and responsibilities which fall under the jurisdiction of the NRA Anglian Region are addressed in this report.







Map 5

For Flood Defence purposes, the NRA's powers generally cover the whole land area of the catchment and extend to the low water mark of medium tides, though Byelaw powers extend further in some circumstances.

The NRA has no powers over Ministry of Defence lands; these are predominantly Foulness Island and land near Great Wakering and Shoeburyness.

2.3 Land Use

2.3.1 Agriculture (Refer to Map 6)

2.3.1.1 Land Quality

Over 42,000 hectares of agricultural land lie within the area of this plan. Significant areas of high quality agricultural land are to be found on the reclaimed marshes of the Dengie Peninsula, the land around Rochford and the River Roach, and on the plains near Bulphan in the Mardyke sub-catchment. A breakdown of the Catchment Plan area is shown below:-

Grades 1 & 2	13.8%
Grade 3	54.4%*
Grade 4	6.0%
Grade 5	0%
Non Agricultural	6.8%
Urban, Industrial etc	19%

* of which c.18% is likely to be grade 3a (1995 MAFF data)

Grades 1, 2, and 3a (the better grade 3 land) are considered to be among the best and most versatile agricultural land. Nationally only about one third of agricultural land is of this quality.

2.3.1.2 Farming Practice

Agricultural land use within the Catchment in 1993 was:-

Grassland	8917 Hectares
Rough Grazing	1289 Hectares
Crops and Fallow	25867 Hectares
Farm Woodland	530 Hectares
Other Land	1389 Hectares
Set-Aside	4694 Hectares

(1993 MAFF data)

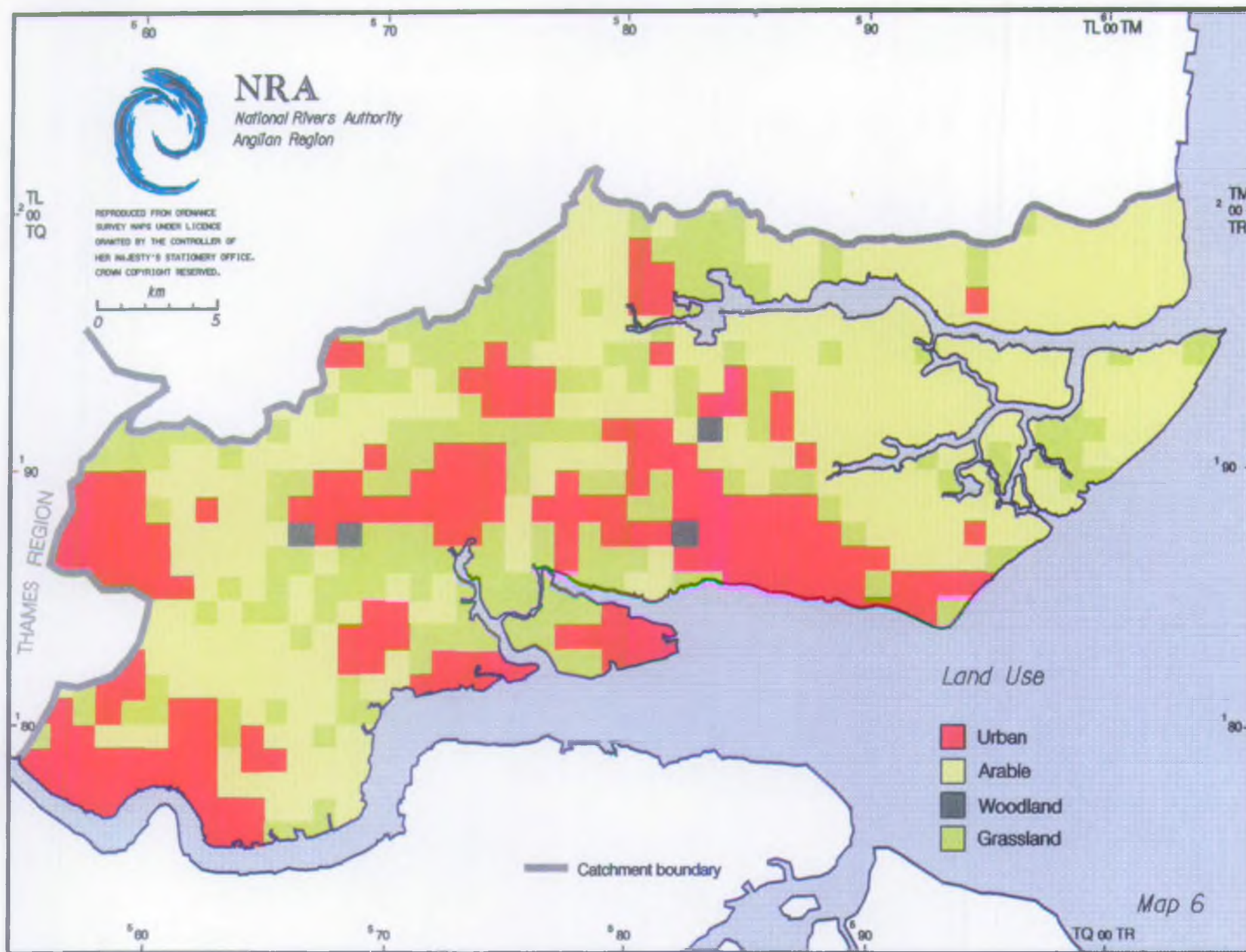
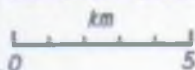
Approximately 58% of the agricultural area in the Catchment is in arable rotation of cereals (wheat and barley etc) and break crops (potatoes, sugarbeet, field beans and peas, oilseed rape, linseed etc). Cereals are the largest land use at nearly 40% of the total agricultural area.

Recent trends have seen a reduction in cereal areas within the Catchment by as



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much as 25%. This is largely as a result of the *Common Agricultural Policy* reform measures, which require all but the smallest farms to set aside a percentage of land growing cereals, oilseed and protein crops (12% in 1994/95). On land that is set-aside, agricultural crop production cannot take place for the duration of the set-aside period. In addition, farmers are not allowed to apply artificial fertiliser or pesticides, apart from the odd application of non-residual herbicide.

Grassland for livestock represents just over 20% of the total agricultural area. Cattle numbers have declined on average by nearly 40% in the last decade. Dairy herds have declined by up to 50%. The number of pigs reared has suffered a similar decline, however, sheep numbers have actually increased by as much as 30% over the same period, although still representing a smaller sector than either cattle or pigs. Poultry numbers have declined by up to 14% since 1983.

In addition to its importance for food production, agriculture helps to maintain the rural economy in some of the relatively remote areas of the countryside for example: farming supplies, storage and food processing/packaging, agricultural engineering and contracting services.

2.3.2 Urbanisation

The total population in the catchment is approximately 678,000 with 611,000 being located in the main towns and the remainder in the villages, hamlets and isolated farm settlements.

Beside agriculture, land in the catchment has both industrial and commercial uses; ranging from power stations, dock related import and export of goods, oil refining and storage, and manufacturing industry on the Thames-side boundary. Other commercial use includes light industrial / commercial business parks, warehousing and distribution industries and retail superstores associated with the towns on the outer perimeter of London's suburban catchment.

Growth is identified within the Structure Plans and Local Plans covering the catchment but is generally limited to the towns and main villages.

2.3.3 Military Uses

The Ministry of Defence has significant land holdings at Foulness, Rushley Island, Potton Island and an area along the coastline at Shoeburyness. The Ministry defence Test and Evaluation Organisation utilises these areas for research and the testing of weapons and associated munitions. Many of the trial sites on Foulness are located near to the sea walls and some utilise the tidal shoreline. The NRA endeavours to maintain contact with the Ministry of Defence on matters of sewage disposal and potential water abstraction, however these are not licensed due to Crown exemptions.

In the area of tidal flood defence there is on-going liaison between the Ministry and the NRA. An example of this is the recent co-operation over the continuity of tidal defence at the Havengore Bridge, where NRA and Ministry seawalls abut. When the NRA improved the standard of its Great Wakering tidal defences, the Ministry agreed to maintain the new standard of service by improving its reach.

Flood Defence cooperation must be further enhanced for mutual benefit as the Shoreline Management Plans are developed. The interaction of coastal processes along the entire Plan coastline needs to be considered as a whole, regardless of landowner.

A recent example of environmental cooperation between the Authority and the Ministry of Defence is over the production of the Water Level Management Plan for Rushley Island which is nearing completion.

An increasing area of public concern is the land use change which is liable to result from selling off Ministry of Defence property. Within this Plan area there is potential conflict between the environmental values of the current lands and the savings to the taxpayer of their disposal for development. In this field the NRA will closely monitor the situation and act to enhance and maintain the value of the local water environment.

2.4 Water Quality

Industry and agriculture play important roles within this catchment. Significant urban areas also exist, particularly in the southern part of the catchment area. Consequently it is important that measures to prevent pollution are enforced to ensure that pollution from these activities is kept to a minimum. The majority of sewage effluent and surface water generated by the large urban population, however, is discharged to tidal waters, principally the Thames Estuary but also, to some extent, the Crouch and Roach Estuaries.

There are no public drinking water supply abstractions from surface waters within the plan area. Groundwater is abstracted for public supply at two sites, (in the Thurrock area), Linford and Stifford, and it is essential that the quality of these sources be protected.

The watercourses within this catchment are all relatively small and have very low summer flows. Most of the watercourses are also affected by heavy urbanisation which can give rise to problems with the surface water drainage both in terms of quantity and quality.

Large fluctuations in water flow and depth associated with the very quick run-off of rain falling on impermeable areas can cause rapid changes within the receiving watercourse. Water quality is also often affected by pollution events. Such events can be either accidental spillages or deliberate discharges or in many cases the polluter may be unaware of the effect on rivers due to misconnections within the sewerage system. This type of pollution is difficult to trace and control, and requires disproportionate enforcement resources.

These factors combine to give rather poor water quality in freshwater streams within the catchment. This has historically resulted in a low perception of the viable river uses and consequently rather undemanding target quality objectives.

Further investigation as to the improvement of these targets would seem warranted and during this consultation comments with regard to the enhancement of the potential uses and aspirations for any particular watercourses of river stretches would be welcomed.

Estuarial waters within the catchment are widely used for recreation. Certain of these areas are also designated shellfisheries within the terms of the *EC Shellfish Waters Directive 79/923/EEC* and the *EC Shellfish Hygiene Directive 91/492/EEC*. These uses demand a high standard of water quality.

In order to protect these uses and interests, a comprehensive sampling programme, to monitor water quality, is undertaken throughout the catchment. At regular intervals the results of this sampling are assessed and reported according to a new national classification system - the General Quality Assessment (GQA). It is based upon a limited range of criteria; biological oxygen demand, dissolved oxygen and ammonia (see Appendix X).

It should be noted that discharges to the Thames Estuary and the water quality of the Estuary itself are monitored by NRA Thames Region, and are therefore not covered in depth in this plan.

2.5 Hydrology and Hydrogeology (Refer to Map 7)

Average annual rainfall varies from 600mm in the west of the catchment, to 547mm in the east. The yearly evapotranspiration averages 385mm to the west and 446mm to the east. Most of the evapotranspiration occurs during the summer months.

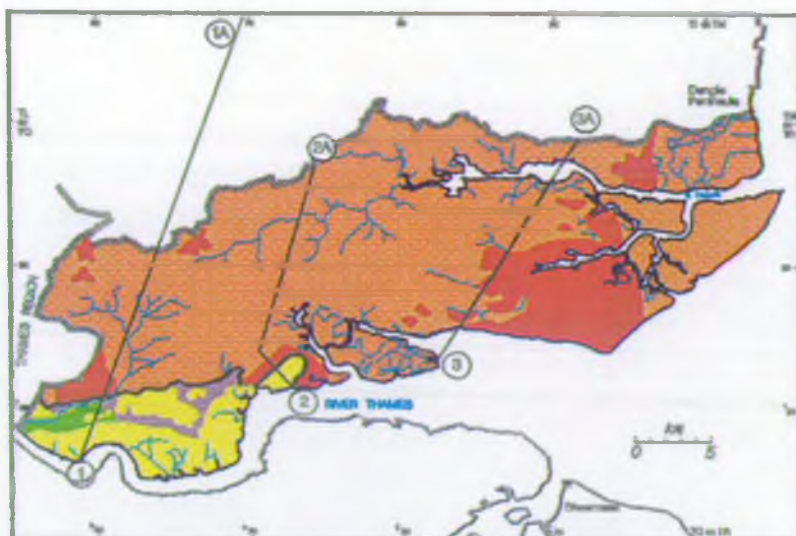
The Catchment is divided into five sub-catchments with the major rivers being the Roach, Crouch and Mardyke. Flows in the rivers respond rapidly to rainfall due to the impermeable nature of the soils. In general, the rivers and main aquifers are not connected and natural flows in the summer tend to be small.

The geology in this area consists of Chalk, which is overlain by London Clay. The Clay layer acts to prevent rain water re-charging the chalk, limiting its use for water resource development. To the south east of the area however the chalk is exposed, allowing some recharge to the aquifer.

There are limited Gravel deposits covering the London Clay. These may provide a local resource suitable for small scale development as well as providing some baseflow to the watercourses in the Roach catchment.

Hydrogeologically, the chalk water movement is in a south easterly direction, with water levels lowering from +10 metres AOD to -20 metres AOD in the south east. In certain areas, such as Burnham and Rayleigh, water levels are recovering following, excessive abstraction which ended in early 1970, at a rate of 0.6 and 1.0 metre per year respectively. In other areas chalk water levels are static (Stanford-le-hope, East Tilbury), or only rising slightly (Thurrock, 0.06 m/yr.).

Groundwater quality varies from being good in the Stanford-le-Hope and North Thurrock area to being poorer (saline waters) further north and south. The poorest quality waters occur in the Roach sub-catchment and part of the Crouch catchment, where chloride and sodium concentrations are high.



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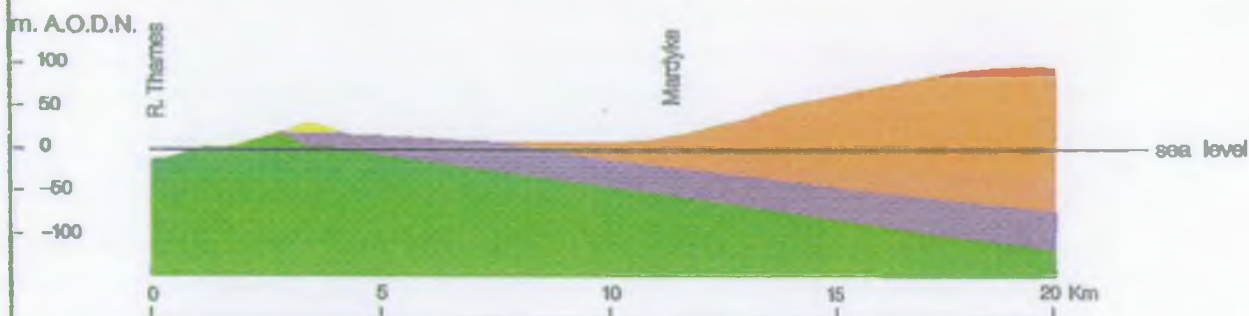
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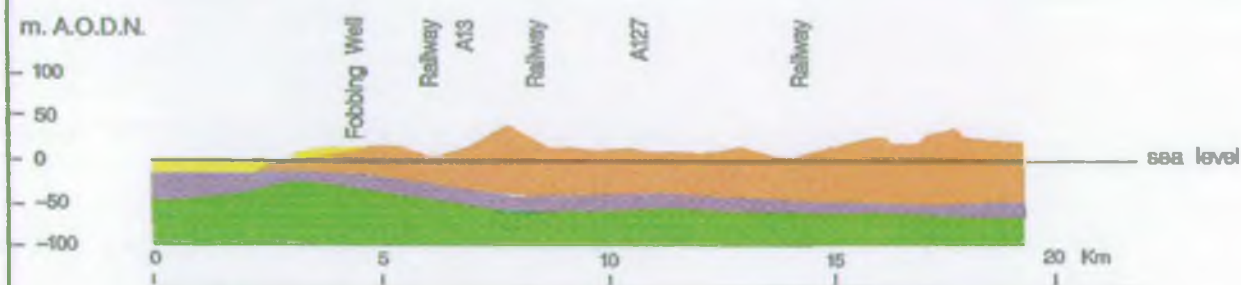
Hydrogeology



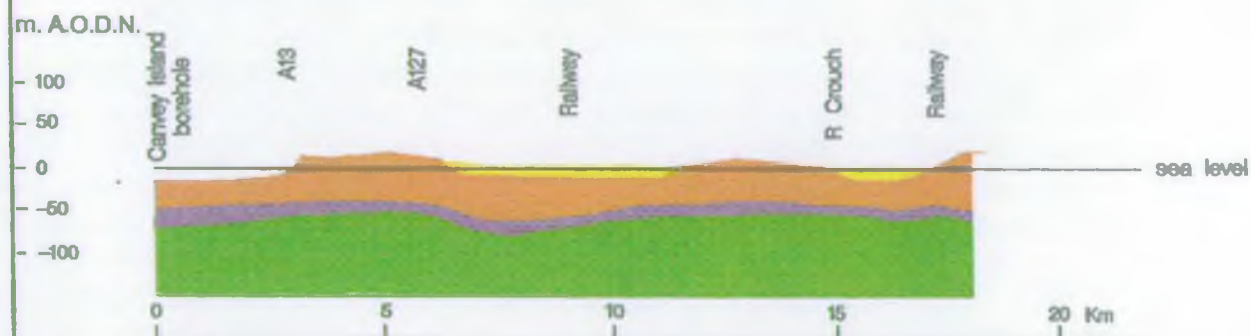
③ — ③A Lines of sections



SECTION 1 - 1A



SECTION 2 - 2A



SECTION 3 - 3A

Map 7

2.6 Hydrometric Network

There is an extensive network of hydrometric monitoring stations within the catchment, covering rainfall, river flows, groundwater levels, salinity, tide levels and wind speed parameters. Where these are needed for flood warning purposes the gauges are connected to the Authority's telemetry system, which is currently being replaced by a more advanced system.

2.7 Water Resources

The NRA has to balance the varied and competing needs for water resources. These include human needs, such as potable water supply, industry and agriculture, as well as those of the water environment such as rivers, springs and wetlands.

Water resources within the catchment are derived from both surface and groundwater sources. Overall availability is assessed by reference to river flow and the long term average recharge to the aquifer from rainfall. Current demands for public water supplies are heavily dependent on water imported into the catchment from the neighbouring Thames Region and the Essex reservoirs, Hanningfield and Abberton, located outside the catchment to the north which are themselves augmented by the Ely Ouse to Essex Transfer Scheme.

People wanting to abstract water for commercial reasons have to apply to the Authority for a licence. Licences are issued under the *Water Resources Act 1991*, previously the *Water Resources Act 1963*, and are subject to strict checks to ensure that they do not affect existing users or environmental considerations. Conditions may be applied to a licence to control when and how water can be abstracted.

- Groundwater resources within the catchment are fully committed and the area is classified as having "No Water Available".
- Surface water is also heavily utilised and there is no further summer surface water available. Some additional surface water may be available during winter periods when river flows are naturally higher and abstractors are encouraged to store this in reservoirs for summer use. As a further incentive, winter abstraction charges are significantly lower than summer rates.

2.8 Flood Defence

Flood Defence deals with the provision of effective defences for people and property against flooding from rivers and the sea. Normally flooding is a result of extreme climatic conditions, such as very heavy rainfall or tidal surges. 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. A similar approach is used to measure the effectiveness of flood defences and the level of protection is given as the likelihood of the defences being overwhelmed. It is clear that different types of land use, for example, urban areas such as Thameside and pasture found on the rural frontages on the Crouch and Roach, justify different levels of effectiveness for the defences (the Thameside scheme provides protection to 1:1000 years standard. In addition, it is recognised that the standard of flood protection offered by any particular defence is likely to decrease if maintenance is not undertaken.

Flood defence capital improvements fall into two categories, tidal and fluvial. Tidal flooding has a higher priority due to the potential threat to human life and the more damaging effect of saline water. Fluvial improvements within this catchment are likely to be limited to the replacement and automation of river control structures at the end of their useful life, although there are few such structures in South Essex.

In addition to engineering studies most schemes are subject to benefit/cost analysis and an environmental assessment in order to demonstrate compliance with the following criteria:-

- Economic viability
- Technical soundness
- Environmental acceptability

Subject to the above criteria being met, schemes are then funded on a priority basis with currently up to 65% grant aid from the Ministry of Agriculture, Fisheries and Food, and the balance being funded by a levy on the County Councils. (Proposed major capital expenditure within the Catchment is listed in Appendix I).

Planned preventative maintenance to coastal frontages, river channels and control structures forms part of the annual routine maintenance programme. These works help preserve the integrity of the sea and tidal defences and maintain the flood discharge capacity of the Main Rivers. All works are carried out in accordance with guidelines to ensure that maintenance is sympathetic to the environment, by limiting damage and wherever possible, carrying out positive conservation enhancement works as part of the operations works. Although this catchment has some major urban/industrial areas, the Thames, Crouch and Roach have some internationally important conservation sites.

The programme is funded principally by a levy on the County Councils and supported by General Drainage Charge contributions within the Essex Flood Defence Committee area.

2.9 Fisheries, Recreation, Conservation, and Navigation

2.9.1 Fisheries

Freshwater fisheries based on reservoirs, lakes, and ponds occur throughout the catchment, and represent a very significant resource. They are dominated by coarse fish, although put and take trout waters also occur. There are no river fisheries other than the Mardyke, which unfortunately does not support very good stocks at present.

High population densities within the catchment itself, its proximity to London, and the popularity of angling as a sport, combine to ensure that there is always a great demand for angling opportunities, on both fresh and tidal waters. Many of the inland fisheries are very heavily used as a result.

Fish farming is not a significant industry within the plan area. Registered fish farm sites are all believed to be concerned only with the pond fish trade, and not with the production of fish for food or restocking purposes. There are extensive and

important commercial eel fisheries in tidal waters all around the coastline, but inland eel fishing is very rarely practised.

Commercial shellfisheries are an especially important feature. These primarily involve oysters, cockles and mussels, although many whelks and winkles are also taken. The Crouch and Roach Estuaries are the principal shellfishery areas for the laying of oysters, whilst cockle fishing is concentrated on the Maplin and Chapman Sands, and off the Southend Flats.

Fisheries of all types are dependent on both the quality and quantity of water; their protection is an important statutory duty undertaken by the NRA. It will be difficult, however, to improve the length and class of freshwater rivers (for fishery use) due to their relatively short lengths, and characteristic low flows, under normal conditions.

2.9.2 Recreation

The catchment also provides some of the best locations for water-based recreation on the coast. For example Burnham-on-Crouch is one of the foremost centres in the United Kingdom for yachting and dinghy sailing.

The population density of the area is high and informal recreation pursuits are very popular due to the landscape value and the range and diversity of wildlife. Of the Country Parks within the catchment, five have over 45,000 visitors per annum with Thorndon Country Park receiving 590,000 people in 1990.

2.9.3 Conservation

Many areas within this catchment enjoy protection under statutory designations due to the importance of the conservation value of the different habitats in South Essex. The catchment contains many Sites of Special Scientific Interest. These designations may be given where meadows have botanical importance due to either diverse or unique wildlife, notably in brackish environments along the shoreline and down to the low water mark. Elsewhere some of these sites are listed for their geological or archaeological features.

Other national and international site designations exist within the catchment, such as Special Protection Areas, National Nature Reserves and Ramsar sites. These are all overseen by English Nature.

2.9.4 Navigation

The NRA Anglian Region has no statutory navigation responsibility within this plan area. Responsibility lies with the Port of London Authority and the Crouch Harbour Authority.

3.0 CATCHMENT USES

3.1 Development - Housing And Commerce

3.1.1 General

Development must be considered when assessing the use of a river catchment. This use relates to existing and future residential, commercial and industrial development which is identified in adopted and draft county structure and district local plans (see Appendix VII). The existing Essex County Council Structure Plan covers most of the South Essex CMP up to the year 2001 and incorporates the First Alteration which was approved by the Secretary of State in July 1991. A second alteration is being considered at this time by the Secretary of State. The remainder of the area is included within the Havering Unitary Development Plan which was adopted in March 1993.

The replacement plan both consolidates strategic planning policies and the alterations into one document and takes into consideration the Regional Guidance for the South East (March 1994) and the planning framework for the Thames Gateway (East Thames Corridor).

The replacement plan is designed to accommodate sustainable economic growth, by limiting travel needs between home and work, and to set environmental capacity limits i.e. irreversible or unacceptable loss or damage to the environment. The implementation of issues (both in the existing and replacement plan) are formulated into the policies of the Local Plans by the planning authorities. There is a requirement to monitor a number of external factors e.g. national/regional economies, the attractiveness of the area for growth based on improved communication with Europe and implementation of EC and Government policies to reduce "greenhouse gases".

The NRA is a statutory consultee under planning legislation and advises county and Local Authorities on development proposals which may have an effect on matters relevant to the NRA.

The NRA seeks to pursue its aims and policies in relation to development through the planning consultation process. Although the final decision on planning matters rests with the planning authority, government guidelines advise on the need to consider the NRA's concerns in determining proposals.

Irrespective of obtaining planning consent the NRA may use its powers to control the nature of certain development proposals.

3.1.2 Local Perspective (Refer to Map 8)

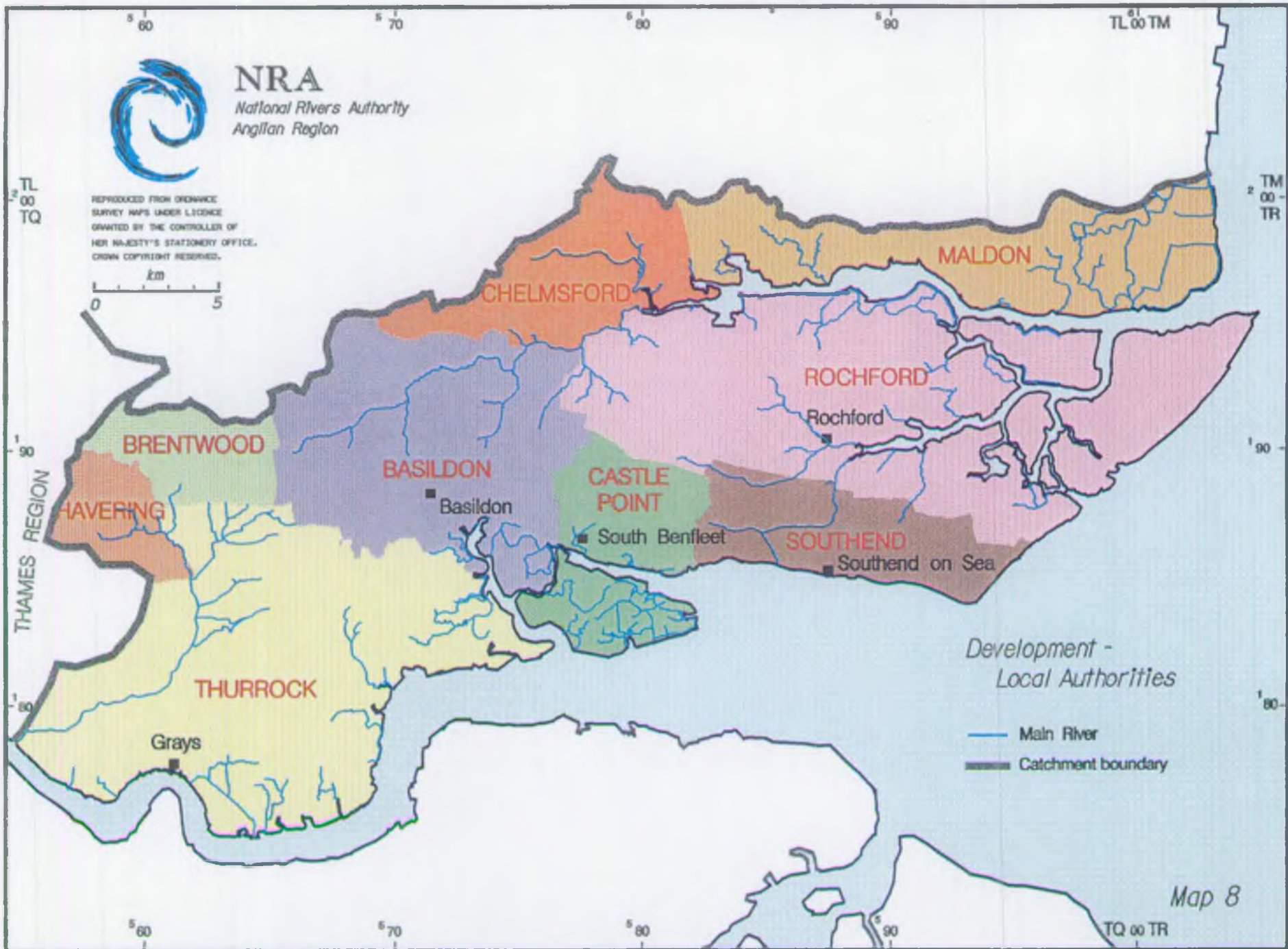
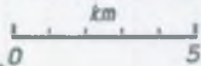
The catchment covers parts of the Borough/District Councils of Maldon, Chelmsford, Rochford, Castle Point, Thurrock, Havering, Southend-on-Sea, Basildon and Brentwood.

Population, Housing and Settlement indicated within the Essex County Structure Plan recognises a need for growth and provides for a potential increase in housing



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within the catchment area of approximately 6,385 new houses by the year 2001. Since the end of the Second World War, Essex has experienced the fastest rate of growth of any county within the United Kingdom.

Within this catchment, former tiny villages such as Basildon have grown into major towns, and more recently the Chafford Hundred development at Grays has become the biggest private housing project in Britain, providing thousands of new homes as well as schools, shops and a railway station. Complementing these growth areas, the nearby Thurrock Lakeside development has become one of the biggest shopping complexes in Europe.

Employment growth provided by commercial and industrial development is also recognised as a need within the County Structure Plan. Provision is made for development sites within the catchment area, where 176 hectares are earmarked for development up to the year 2001.

Much of the growth is likely to be accommodated in the existing towns and main villages, although it is expected that some will be provided by limited infilling within existing rural settlements.

Protection against flooding from rivers and the sea, protection of water resources and the protection of ground and surface waters from pollution are of particular importance in the catchment.

3.1.3 Development - Objectives

Flood Defence

- To ensure that new development is not at risk from flooding and does not put other areas at risk of flooding which could endanger life and damage property.
- To ensure that any work which is needed to reduce the risk of flooding created by a new development is paid for by the developer and not the public.

Conservation and Enhancement of the Water Environment

- To protect the water environment from any detriment caused by development.
- To enhance the water environment in conjunction with development.

Water Quality

- To protect inland, coastal and groundwaters from pollution.
- To ensure that adequate pollution prevention methods are incorporated into new developments and are consistent with the NRA's *Policy and Practice for the Protection of Groundwater*.

Water Quantity

- To ensure that development does not cause unacceptable effects on surface water and ground water sources and to protect the rights of those who are

currently licensed to abstract water.

3.1.4 Development - Policy Summary

Flood Defence

- The NRA would normally resist allocation of land for development, including the raising of land, where such development may impede the flow of flood water, or increase the risk of flooding elsewhere or increase the number of people or properties at risk both in respect of fluvial and tidal sites. Should development be approved which would adversely affect flood defence standards, or which would be at flood risk themselves, the developer should fund all compensation works which the NRA deems necessary prior to commencement of the project.
- To be pro-active and avoid confrontation, the NRA seeks to agree development opportunities and visions with County, Borough and District planning authorities at the Structure and Local Plan stages of the planning process. In this way then individual planning applications can proceed with minimum detriment to, and preferably enhancement of the flood defence infrastructure.

Conservation and Enhancement of the Water Environment

- The NRA would normally resist allocation of land for development which is likely to have an adverse effect on fisheries, nature conservation, landscape and recreation in river corridors, coastal margins and other waterside areas.
- Early negotiation with planning authorities over their Structure and Local Plans is sought to avoid unnecessary confrontations at detailed planning stages.

Water Quality

- The NRA would normally resist development, including changes in land use, which is likely to pose an unacceptable risk to the quality of ground and surface water.
- As with the above policies, early discussions with planning authorities is advocated to promote safe development and encourage good practice.

Water Quantity

- The NRA would normally resist development, including changes in land use, which is likely to have a detrimental impact on water resources.
- As with the above policies, early discussions with planning authorities is advocated to promote safe development and encourage good practice.

3.2 Agriculture

3.2.1 General

With more than 80% of the land in England and Wales used for agriculture, there

is significant scope for effects on the water environment. Pollution of surface and groundwaters, soil erosion, land drainage and stock damage to river banks can cause environmental problems.

The NRA has duties and powers to:

- control pollution from agricultural sources under the provisions of the *Water Resources Act 1991*
- prevent pollution from certain agricultural practices through the enforcement of the *Control of Pollution (Silage, Slurry and Agricultural Fuel Oil) Regulations 1991*
- promote the designation of water protection zones and prohibition of certain activities within them. Nitrate Sensitive Areas are an example of this.

Additionally through its liaison with external organisations and Research and Development initiatives the NRA is committed to:

- assessing the impact of agriculture on water quality, prioritising our work where there is poor documentation of any impact
- developing procedures for inspecting farms so that pollution can be prevented
- promoting the "Code of Good Agricultural Practice" and further developing best practices to prevent pollution from the storage and disposal of agricultural wastes, and from the management of agricultural land. This work will include development of the use of managed "buffer zones" and agri-environment schemes to prevent pollution
- promoting appropriate livestock management to protect the river corridor
- developing a public relations plan to educate farmers and improve public awareness of pollution associated with agriculture
- improving procedures to consult, collaborate and influence agricultural organisations such as MAFF and WOAD, to maximise environmental benefit from pollution prevention activities.

3.2.2 Local Perspective (Refer to Map 9)

The majority of the rural catchment consists of Grade 3 agricultural land but significant pockets of high quality Grade 1 and 2 land exist on the Dengie Peninsula, Foulness Island, adjacent to the tidal River Roach, and around Orsett in the Mardyke sub-catchment.

There are a total of 710 registered holdings in the Catchment, over 60% of which are part-time concerns. The number of holdings in the Catchment has increased by nearly 5% in the last decade, mainly due to a 10% increase in numbers of full-time holdings. More than 60% of all holdings are now less than 20 hectares, approximately 20% are between 20 - 100 hectares, the remainder are over 100 hectares. Numbers of holdings below 20 hectares in size have increased over the

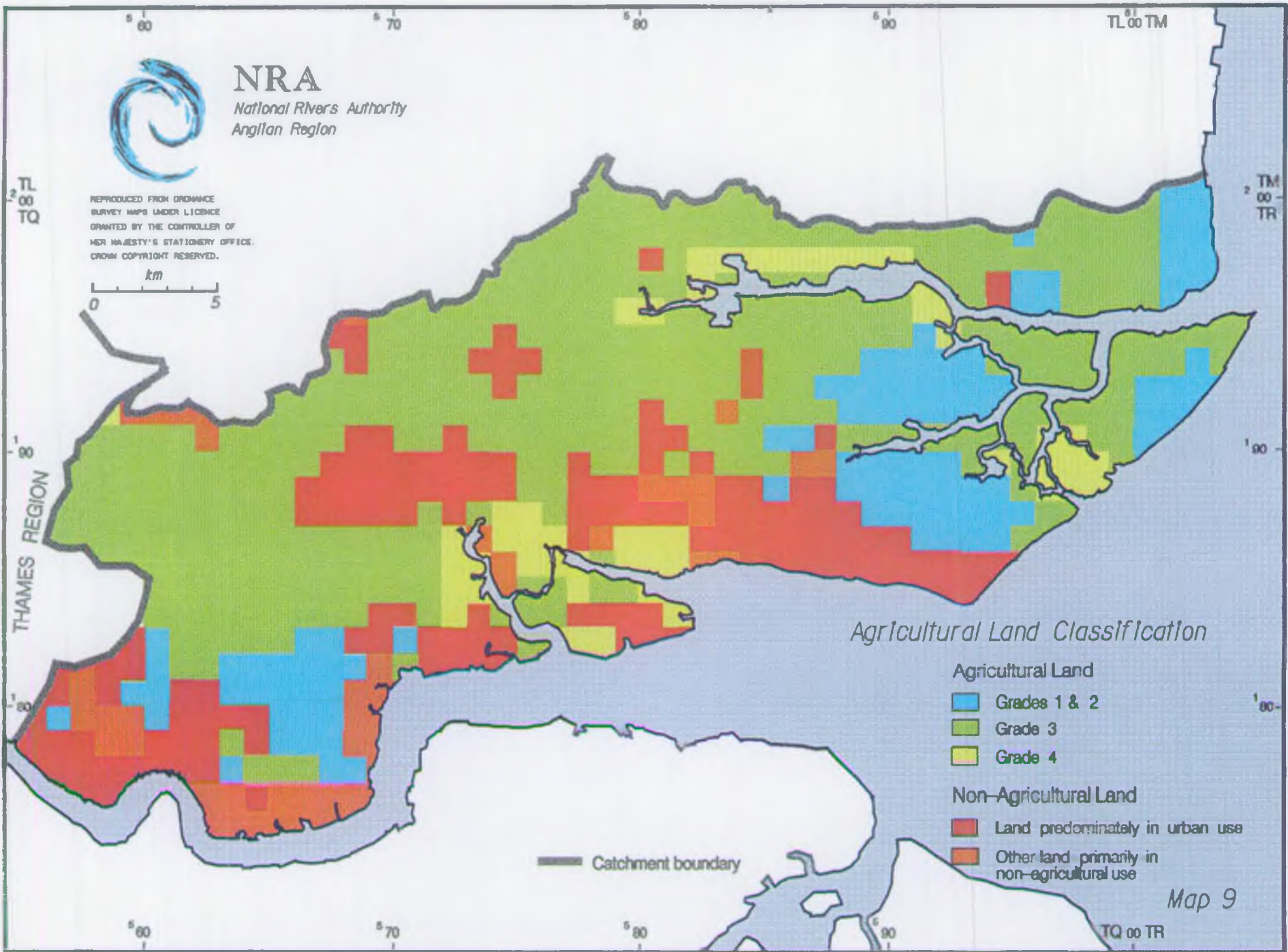


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last decade, whereas numbers of holdings above this size have decreased.

With regard to the type of agriculture carried out on full-time holdings, approximately 30% are mainly arable cropping, 31% are in horticulture production, an increase of over 80% in the last decade, and nearly 25% are mainly cattle and sheep, an increase over the last decade of over 30%. Dairy farms, however, have declined by nearly 45% in 10 years and there are now only 20 full-time holdings left. Pigs and poultry have similarly declined.

The type of agriculture carried out on part-time holdings includes general cropping, horticulture, pigs, poultry, cattle and sheep.

3.2.2.1 Pollution Control

The NRA carries out regular pollution prevention visits to agricultural concerns. Advice is given to address existing polluting practices, and to prevent possible future pollution through the adoption of best practice. Pollution sources encountered vary, and include, inadequate oil storage, run-off from solid manure heaps, unsatisfactory slurry storage systems, contaminated yard drainage, milking parlour washings and drainage from silage clamps.

Nitrate from agricultural sources arises as a result of nitrate leaching from soils. The amount of nitrate lost will depend on the weather, soil type and farming system. The nitrate may be present in the form of inorganic fertilisers or organic manures and will also be released if permanent grassland is ploughed up.

Nitrate also reaches water from a variety of other sources including sewage effluent, leaking sewers, septic tanks and the use of urea for de-icing runways on some airfields. Nitrogen is also deposited from the atmosphere, though undoubtedly in rural areas, agriculture is the primary source.

Nitrate Vulnerable Zones (NVZ) have recently been proposed by MAFF, and include measures to reduce nitrate pollution from agricultural sources. Catchment areas surrounding public abstraction points of both surface and groundwater supplies are in the process of being designated NVZ where water supply exceeds 50 mg Nitrate/l or in the case of groundwater are likely to exceed this limit by 2010. Farmers will be restricted in the amount of organic manure they can apply to the land and on sandy and shallow soils further restrictions will apply governing periods of application. Although no NVZ have been designated in the Catchment area the *EC Nitrate Directive 91/676/EEC* requires member states to review the situation every 4 years with the next review due in 1996.

3.2.3 Objectives

- To prevent and control the pollution of surface and groundwaters from agricultural activities.
- To encourage agricultural practices that improve the river environment.

3.3 Effluent Disposal

3.3.1 General

Discharges of effluent are controlled by issuing and enforcing consents. These consents issued by the NRA or its predecessors, stipulate limits on the quality and quantity of the material released. Consents are calculated by taking into account upstream water quality, the dilution available in the receiving watercourse and the desired quality of 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, including relevant EC Directives and Water Quality Objectives.

Results of the monitoring of the treated effluent from all discharges are available from the *Water Resources Act 1991* register at NRA Regional Headquarters, Peterborough.

Crown discharges are exempt under the legislation from the consenting requirements which apply to all other discharges. However the NRA does set discharge standards in Discharge Agreements which the Crown has given a commitment to comply with.

Discharges from certain activities or processes can be controlled by Her Majesty's Inspectorate of Pollution (HMIP) under the *Environmental Protection Act 1990*. In cases where all of the waste-water on a site is from a prescribed process the NRA consent may be revoked and control of the site is taken over by HMIP.

In addition to consented discharges a significant amount of pollution in watercourses can be caused by surface water drainage from urban areas and also spillages from a range of domestic, commercial, agricultural and industrial activities. Many of these pollution incidents could be prevented. Many industrial estates have site drainage connected directly to surface waters. This is often not appreciated by site operators who may assume all drains are connected to the foul sewer. The NRA is pro-active in making pollution prevention site visits to identify high risk areas and offer pollution prevention advice.

The NRA has discretionary powers to issue 'notices' which can set conditions for discharges, of surface water to watercourses or effluent discharges to land. Where the risk of pollution is high a 'notice' may be served on an individual prohibiting a discharge.

3.3.2 Local Perspective

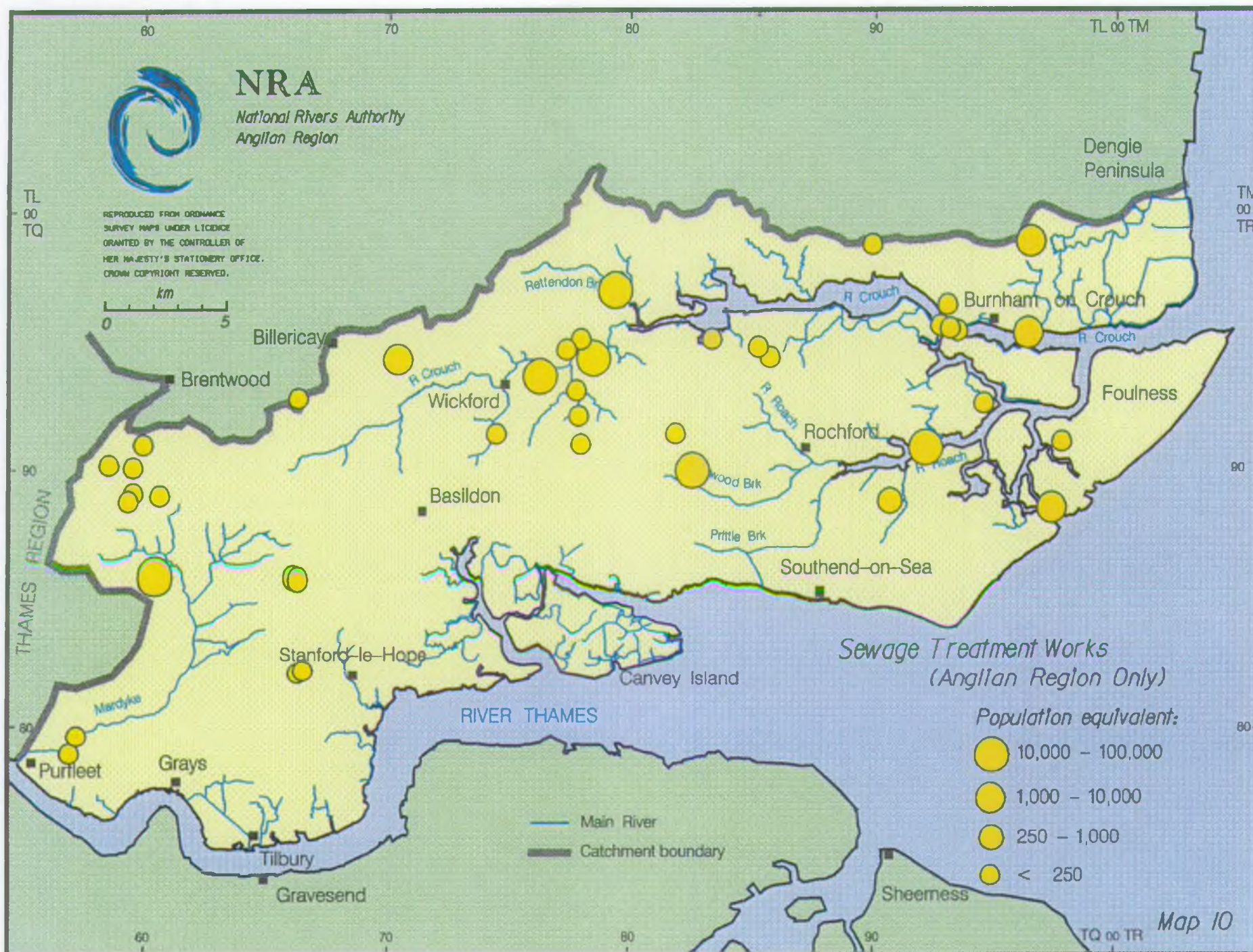
3.3.2.1 Sewage Treatment Works (Refer to Map 10)

Continuous Effluents

There are 22 sewage treatment works operated by Anglian Water Services within the catchment. Seven of these (Basildon, Benfleet, Canvey, Pitsea, Southend, Stanford le Hope and Tilbury) discharge directly to the Thames Estuary and associated creeks and are monitored by the NRA's Thames Region which oversees



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water quality in the Thames Estuary.

Of the remaining 15 sewage treatment works, six serve population equivalents in excess of 10,000 people. These are Rayleigh East, Rayleigh West, Rochford, Upminster, Wickford and South Woodham Ferrers. The effluent from all these works currently complies with their present legal consent limits on quality. Rochford, Wickford and Woodham Ferrers also comply with the limits that are required to meet river quality objectives.

In addition, there is a considerable number of sewage treatment works operated by commercial undertakings, Local Authorities and private householders. The 15 AWS and 25 larger private discharges are shown on the map and are graded according to the size of the population served by the individual works.

The Crouch and Roach estuaries receive effluents from towns with populations in excess of 10,000, which allows them to be considered as candidate Sensitive Areas (Eutrophic) under the *EC Urban Waste Water Treatment Directive 91/271/EEC*. However, current quality indicates that they are not sufficiently eutrophic to warrant the necessary data collection required to support the case for designation. Currently, none of the freshwater rivers is designated as Eutrophic Sensitive Areas under the directive but the status of the Mardyke is under regular review.

Intermittent discharges

Associated with the larger STWs are many sewage pumping stations, most of which have consented emergency overflows. In addition a number of storm overflows are found on combined sewer systems as well as at some pumping stations. These discharges are only permitted where damage to installations or property would result without the presence of the overflow.

Within the catchment, the industrial areas at Progress Road, Eastwood, Southfields Industrial Estate, Laindon, and Cranes Farm Road and Courtaulds Road, Basildon give particular cause for concern. The surface water discharges from these areas are made via surface water sewers under the control of Anglian Water Services. However, resources have been committed by Anglian Water Services in their Strategic Business Plan to improve the quality of the discharges from the Southfields Industrial Estate at Laindon and the Courtaulds Road site in Basildon.

3.3.2.3 Industrial Discharges (Refer to Map 11)

Continuous Effluents

Within the catchment, (other than direct to the Thames Estuary), 4 significant industrial discharges enter controlled waters; the location of these discharges is shown on Map 11. In addition, there are several dewatering discharges from mineral extractions.

Intermittent Discharges

Surface water runoff from industrial sites can have a significant effect on water quality. Site operators and developers are encouraged to protect surface water by



providing adequate pollution prevention measures **such** as bunding oil and chemical tanks and installing oil interceptors where appropriate. Many industrial sites have separate drainage systems for foul and surface water. Site operators may discharge, often unknowingly, material to a drain which **discharges** directly to surface waters. This can cause significant pollution problems.

3.3.3 Objectives

Water Quality

- To ensure that all consent conditions are met.
- To ensure consent conditions prevent **contravention** of EC Directives and adequately safeguard river water quality.
- To establish compliance with EC Directives and quality standards by monitoring of effluent and controlled waters, **and** taking action in the event of non-compliance.
- To continue to maintain and improve water **quality** by setting and reviewing discharge consents as appropriate.

Water Quantity

- To ensure that river flow characteristics do **not** fall below those used for determining the quality limits on consents to **discharge**.
- To ensure that undue reliance is not placed on **effluent** to maintain minimum river flows.

3.4 Landfill Sites

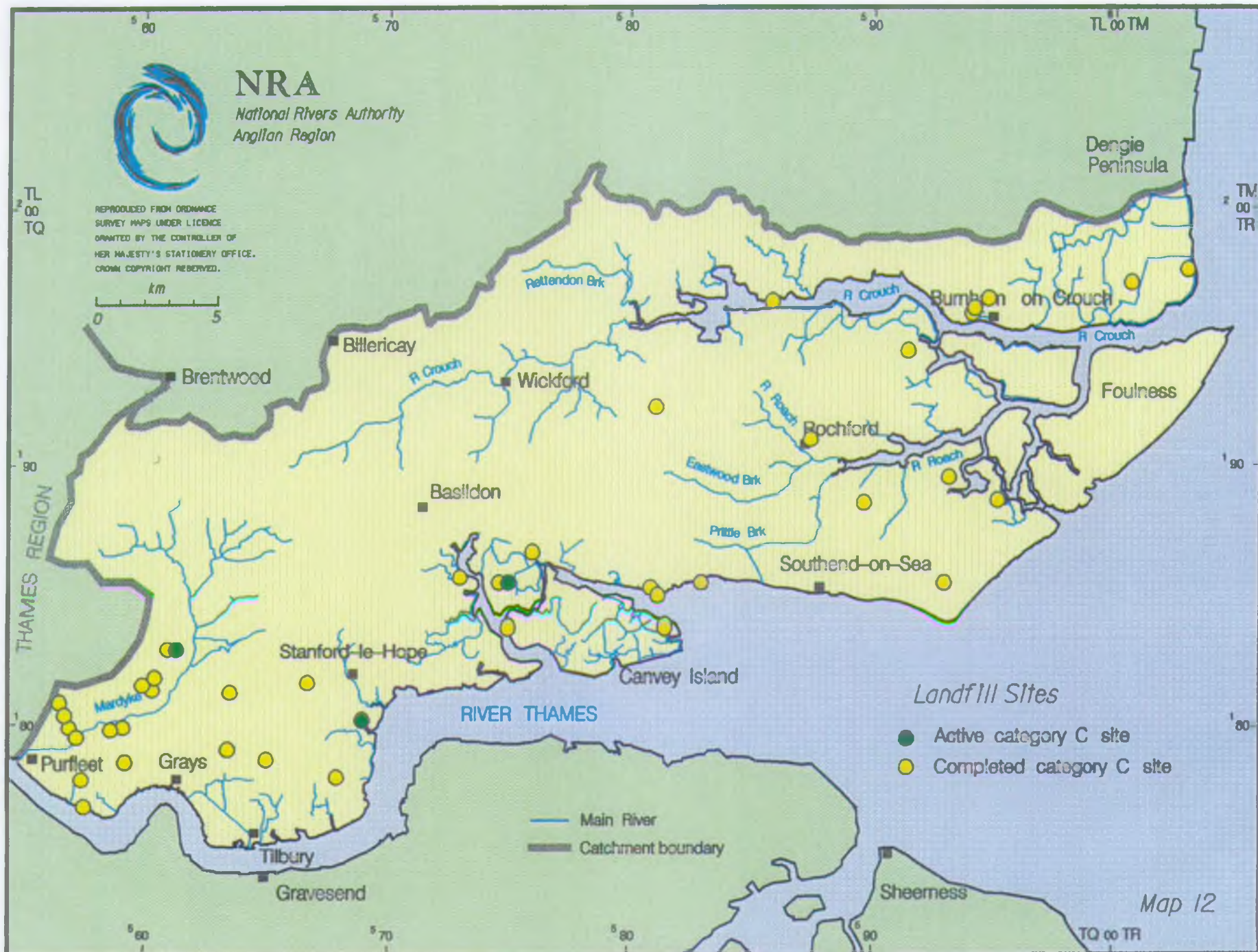
3.4.1 General

The NRA is a statutory consultee of Waste **Regulation** Authorities (WRAs) throughout the life of any landfill site. It is also a **statutory** consultee of Planning Authorities under the Town and Country Planning **Acts**. A valid planning permission is required before a Waste Management **Licence** may be issued. Until recently, the planning permission was the means by **which** aftercare provision on closed landfill sites could be regulated. However, **since** 1 May 1994, conditions relating to aftercare as well as operational matters, **may** be included in the waste management licence.

It is recognised that a wide range of waste management **operations** require a Waste Management Licence. These include scrap yards, **transfer** stations, incinerators, waste storage facilities etc. Often the greatest threat **to** surface and groundwater quality is posed by landfill activities.

3.4.2 Local Perspective (Refer to Map 12)

Historically the majority of landfill sites were operated **on** the "dilute and disperse



principle", but this practice has not been adopted for about 25 years. In this method the polluting liquid, known as leachate, emerging from the base of a site and into the underlying strata, was considered to be improved by natural attenuation processes and to be diluted by the general movement of groundwater passing under the site. Unfortunately it is now known that in some instances the dilution and attenuation processes were insufficient for rendering the leachate innocuous. Currently these sites do not affect any abstractions within the catchment. In future it is likely that the majority of landfill sites will be constructed as "containment" sites whereby the waste management licence will specify the engineering measures which must be taken to minimise the escape of any leachate generated. In addition, monitoring boreholes will be required around each site in order to assess the integrity of these leachate containment measures.

Landfill sites are licensed to accept various categories of non hazardous waste. Category A consists of dry inert material such as top soil, concrete and bricks. Category B wastes may contain substances which decompose slowly such as wood, paper and wool. Category C wastes include materials which decompose rapidly such as domestic wastes, animal carcasses and food processing waste. Within the area there are two active sites licensed to accept hazardous waste, Pitsea and Mucking. There are also two completed hazardous sites, East Tilbury and the Thurrock Waste Management and Land Reclamation Centre (Stablex Ltd.). There is a considerable number of active and completed category C sites. Active category B and C, together with significant completed category C sites are marked on the map.

In addition to landfill sites, there is a number of areas of land in the catchment which have been contaminated by past industrial activities. Sites of demolished gas works are an example. Identification of these sites is required in order to assess the implications of future development and remedial works. Future Local Authority registers identifying these sites and remedial works required to prevent contamination (the *Environment Act 1995* refers) will be of use in this respect.

3.4.3 Objectives

- To ensure that all landfill activity does not compromise water quality or water resources and proceeds in accordance with advice laid down in the NRA's National and Regional groundwater protection policies.
- To ensure compliance with *EC Protection of the Quality of Groundwater Directive 80/68/EEC*.
- To ensure, by liaison with Planning Authorities, that advice is given on development proposals which may impact on ground and surface waters.

3.5 Mineral Extraction

3.5.1 General

Mineral extraction can affect both groundwater quantity and quality. Generally minerals are located in the river valleys and their removal affects the water balance of the river. Water storage for the aquifer is lost and, as a result river replenishment is decreased, particularly during periods of low flow.

During extraction de-watering can cause suspended solids to be discharged to rivers and the industrial nature of the activity poses other pollution risks such as oil contamination. Any lake created by extraction can, if directly connected to the river, seed the river with algal material causing unacceptable changes in the downstream water quality. De-watering may also have an impact on water resources and water features in the area, (wells, boreholes, springs, lakes and streams), possibly leading to a loss of resource and detrimental impact on water features. It is therefore important to control the location of de-watering and subsequent disposal of water. The effect of site restoration is also of great importance to water resources. Backfilling with low permeability material will decrease the storage capacity of the aquifer, and leaving the site to open water will cause the loss of resource due to evaporation losses being greater than precipitation gains. However, many disused gravel pits do create valuable conservation habitats and recreational areas and therefore can provide benefits.

3.5.2 Local Perspective (Refer to Map 13)

The county of Essex holds significant sand and gravel resources, with production in 1987 of approximately seven million tonnes.

The map indicates existing mineral extraction sites, but does not necessarily indicate if these sites are still active; however, the distribution of the sites and the predominance of the sites in the river valleys is clearly shown.

In accordance with the Town and Country Planning Acts, Essex County Council produced the 1991 *Minerals Subject Plan*; this explains the provisions for future extraction and proposed policies to guide that process. The NRA has been consulted on the Plan and is consulted as a statutory consultee regarding individual planning permissions which include restoration proposals.

The 1991 *Minerals Subject Plan* identified six possible sand and gravel extraction sites within the catchment area, with the potential for a maximum yield of approximately 4.85 million tonnes. The National Rivers Authority is unaware of how many (if any at all) have been implemented to date, however it is known that the 1994 first review of the Minerals Subject Plan identified an available land bank, higher than projected usage, such that there has been no need to propose additional sites within this catchment, post 1997.

The Essex County Council's, Minerals Local Plan, Review One is in its Consultation Draft stage. This document dated October 1994 identifies four existing marine wharves which import minerals into the catchment; Purfleet Wharf, Gibbs Wharf and Stone Terminal riverside locations in Thurrock and Cross Walls Berth within Tilbury Docks. The document also identifies two existing combined rail depot / wharves at Purfleet and West Thurrock. As well as these existing sites the Plan outlines eleven further potential sites.

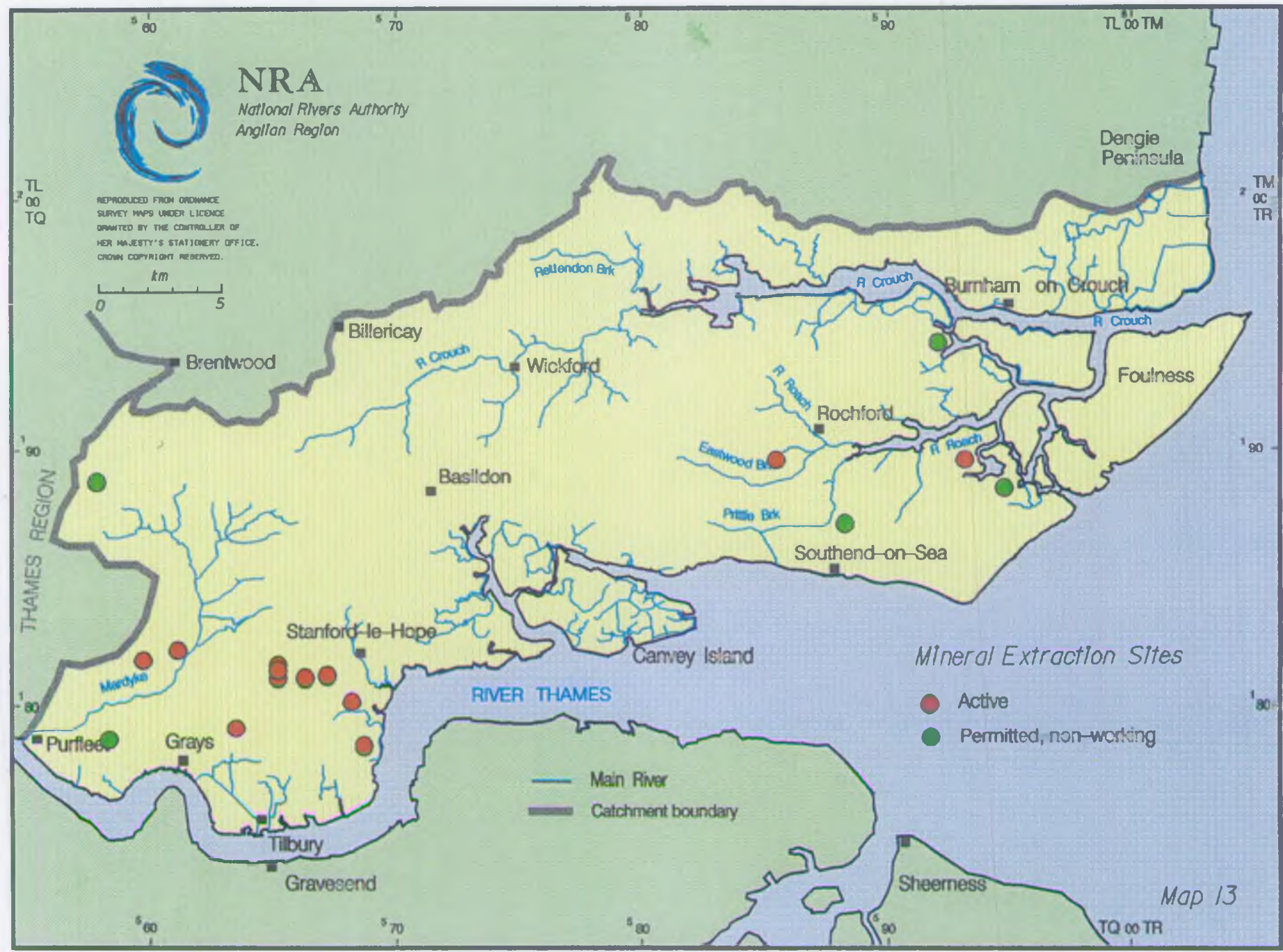
3.5.3 Objectives

Wherever possible, groundwater resources will be conserved and protected. The NRA will seek to persuade the County Councils to impose conditions in line with the NRA's groundwater protection policy on associated planning permissions.



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Mineral Extraction Sites

- Active
- Permitted, non-working

— Main River
— Catchment boundary

Map 13

Water Quality

- To ensure no deterioration of groundwater or surface water quality.
- To ensure that any discharge of mineral processing water is in line with consent limits and that de-watering and other activities do not cause pollution.

Water Quantity

- To ensure that de-watering and mineral extraction does not cause unacceptable effects on surface and groundwater resources.
- To ensure that existing rights of those who abstract water are protected.

Physical Features

- To ensure that worked out sites are reinstated with an enhanced value to the environment and/or recreational facilities.
- To minimise the loss of flood plain habitats of conservation value.
- To control activities both during the extraction and restoration stages to avoid increased flood risks.

3.6 Potable Water Supply**3.6.1 General**
(Refer to Map 14)

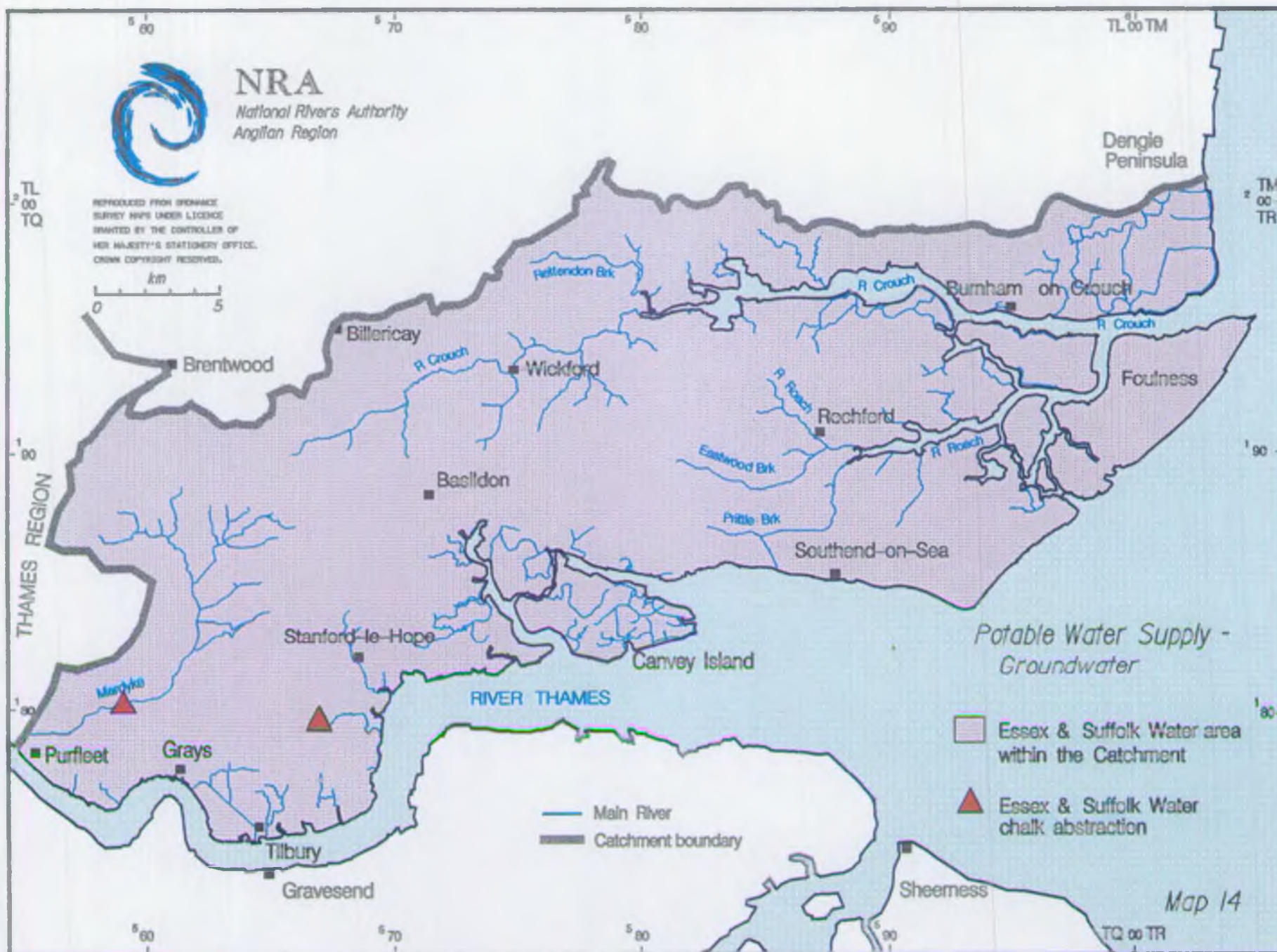
This use relates to the abstraction of water for public consumption (ie. drinking, washing etc). There is no water abstracted from surface water sources (rivers, springs or lakes) and only limited amounts from groundwater sources where water is abstracted from wells and boreholes constructed into certain underground rocks called aquifers. The main source of groundwater in this catchment is the Chalk aquifer although small amounts are also derived from the overlying Gravels.

Groundwater abstractions are made by Essex & Suffolk Water. In addition, some individual householders also abstract water from wells or boreholes for their own domestic use. Abstractions are controlled by abstraction licences issued by the NRA or its predecessors. Abstractions made by private individuals for their own domestic use would only require a licence if the abstraction is greater than 20 cubic metres per day.

3.6.2 Local Perspective

There are two Chalk borehole sites licensed in the catchment for public water supply both owned by Essex & Suffolk Water. The total quantity of water licensed for abstraction is 3,778 Ml/a (millions of litres per annum).

The water company operates a comprehensive water supply mains network but to meet demand relies heavily on imported supplies. Groundwater abstraction sites at Linford and Stifford meet demands locally. Up until the mid 1980s the water



company owned several other groundwater abstraction sites in and around the Southend area but these have since been relinquished because of poor water quality, associated with salt water contamination. Due to the limited water resource availability, Essex & Suffolk Water meets demands in the area from a combination of sources. These include bulk imports of raw water provided by neighbouring Thames Water Utilities via pipeline through Chigwell, and from water stored in the Hanningfield and Abberton reservoirs located outside the catchment. These reservoirs are supported by the NRA's Ely Ouse to Essex Transfer Scheme which transfers surplus water from Norfolk for subsequent treatment and distribution in this catchment and other parts of Essex.

Water resources in the area are currently committed fully. Developments to meet future predicted rises demand will therefore have to be met from outside the catchment, relying on increased imports from supplemented supplies to Hanningfield and Abberton reservoirs and subsequent distribution southwards through the water company's mains network. The recently produced regional water resources strategy, *Water Resources in Anglia*, expands on this.

3.6.3 Objectives

Water Quality

- Standards are set in accordance with EC Directives and proposed Statutory Quality Objectives. For surface water this is the *EC Surface Water intended for Drinking Water Abstraction Directive 75/440/EC*.
- To protect existing licensed groundwater public potable water abstractions from pollution using protection zones.
- To protect all groundwater as a potential future resource in accordance with the NRA groundwater protection policy.

Water Quantity

- To manage water resources to achieve the right balance between the needs of the environment and those of the abstractors.
- In terms of level of service, the NRA follows the present policy of operational standards given by Ofwat (the Water Industry Regulator) for public water supply. These are:
 - A hosepipe ban on average not more than once every 10 years,
 - The need for voluntary savings of water on average not more than once in 20 years,
 - The risk of rota cuts or use of standpipes on average not more than once in 100 years.

3.7 Agricultural and Industrial Abstraction

3.7.1 General

This use relates to the abstraction of water from ground and surface sources for agricultural and industrial uses including spray irrigation, general agriculture (stock watering, crop spraying etc), industrial processes, cooling and mineral washing. All such uses, except for general agriculture abstractions of less than 20 cubic metres per day, from surface sources require a licence from the NRA.

3.7.2 Local Perspective (Refer to Maps 15 & 16)

3.7.2.1 Spray Irrigation

Crop watering by spray irrigation is widely practised across the catchment, however groundwater abstractions tend to be concentrated in the Roach sub-catchment. Overall there is a total of 13 groundwater licences which permit abstraction for this use, and 54 surface Spray Irrigation Licences. The surface geology of the catchment lends itself well to the construction of winter storage reservoirs and this is evident in the high proportion of such schemes in Essex compared with other parts of the country. The total quantities licensed are 1,700 Ml/a from surface water and 250 Ml/a from groundwater.

This use is virtually wholly consumed, ie not returned to the system after use, and therefore considered a loss to the resource.

It is estimated that future demand up to the year 2000 for this use is likely to increase by 2% per year, reducing to around 1.25% thereafter. Groundwater and summer surface resources in the catchment are considered to be fully committed to existing licences and any further demand is likely to be met from further winter storage.

3.7.2.2 General Agriculture

There are 38 general agricultural licences in the area. These are all groundwater sources licensed to abstract a total of 141 Ml/a. In the main these are small abstractions having little impact either locally or on overall resources.

3.7.2.3 Fisheries

There are three surface water abstractions for fisheries uses in the area. These have little consumptive use, apart the losses attributed to evaporation, and only represent an abstraction quantity of 11.3 Ml/a.

3.7.2.4 Industrial and Cooling

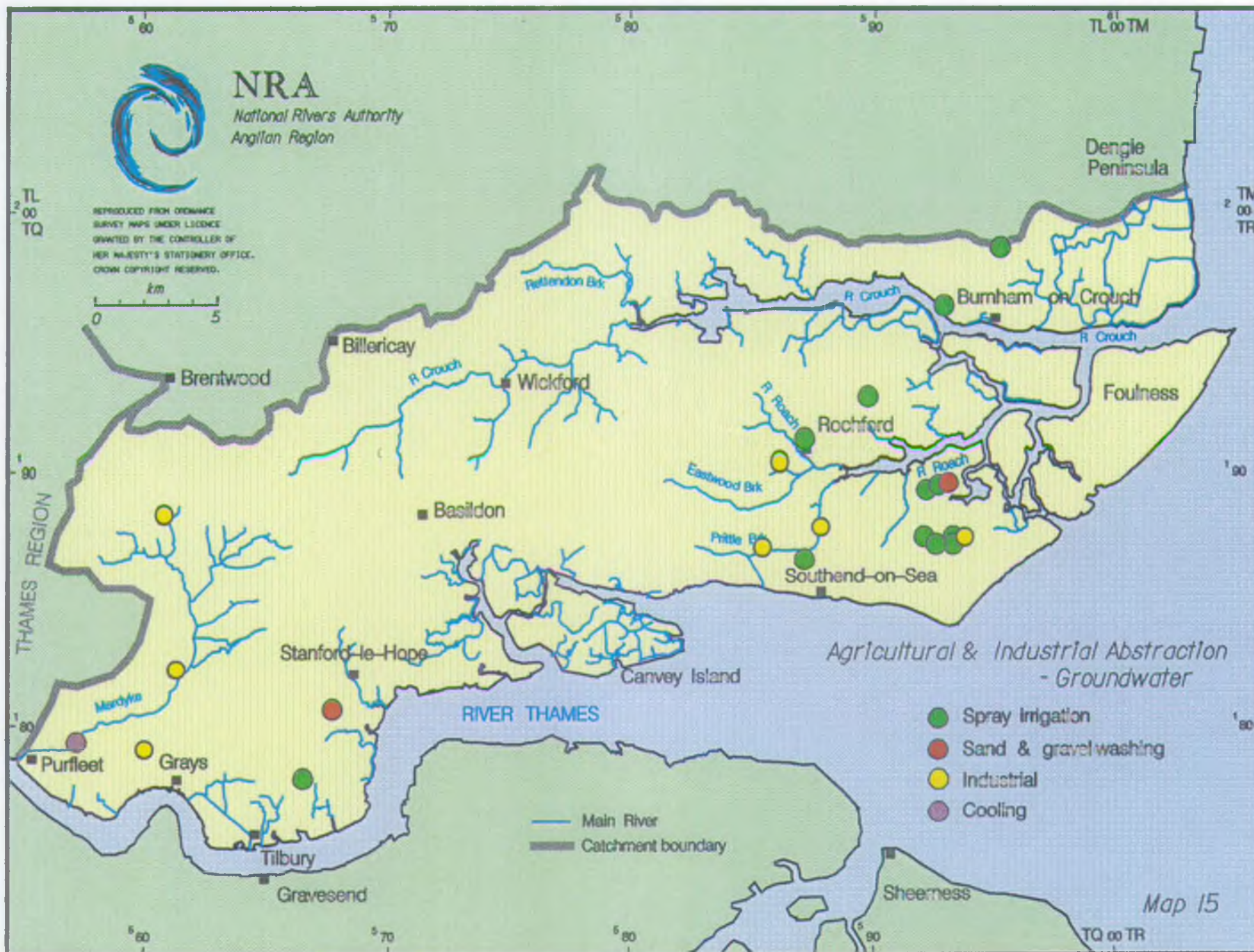
There are twelve industrial licences in the area. Nine of these are groundwater licences and three surface water sources, abstracting 1,837 Ml/a and 3,756 Ml/a respectively. There are also four cooling licences in south Essex. One of these is licensed to abstract water from groundwater and three from surface waters. Abstraction quantities are 1,200 Ml/a and 281,134 Ml/a respectively. All surface



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cooling licences abstract saline tidal water, with little impact on freshwater resources.

Other commercial uses of water in the area are groundwater abstraction for sand and gravel washing and mineral processing. This represents a quantity of 2,288.2Ml/a, from a total of five licences.

Water used in industrial processes generally represents an overall loss, but uses such as cooling or mineral washing result in a high proportion being returned to the system. Over half that licensed from groundwater is allocated to National Power for use only in emergencies if conventional supplies provided by Essex and Suffolk Water fail.

3.8 Flood Defence

3.8.1 General

This catchment use reflects the NRA's aim for flood defence which is the protection of people and property against the risk of flooding from rivers and the sea.

The use is divided into the following categories :-

- Sea Defences
- Fluvial Rivers
- Flood Warning

Section 105 of the *Water Resources Act 1991* requires the NRA to exercise a general supervision over all matters relating to flood defence. For the purposes of management, certain watercourses are formally designated as "Statutory Main River". On Main River, the NRA has special 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.

For watercourses which are not designated as Main River, Local Authorities have powers under the *Land Drainage Act 1991*, to maintain or improve existing works or construct new works. These powers are permissive and do not relieve riparian owners from any obligations to which they were subject by reason of "tenure, custom, prescription or otherwise", before the commencement of the 1991 legislation. However, the NRA has sole responsibility for consenting structures such as culverts which affect flow in non-main rivers.

Any works which may affect the flow in a watercourse require the consent of the NRA under either Section 109 of the *Water Resources Act 1991* or Section 23 of the *Land Drainage Act 1991*. The NRA operates Byelaws which additionally require the issuing of consents for works which may affect the effectiveness and operation of its assets. Such approval is required for works on or adjacent to seawalls, flood embankments, floodparks etc. In some circumstances Harbour Authorities and Crown Estates are exempt from the Byelaws, but the NRA seeks to agree all works in such cases. By exercise of these powers the NRA seeks to ensure that standards of flood defence and drainage are not compromised, and where possible they are enhanced.

3.8.2 Local Perspective (Refer to Maps 17 & 18)

3.8.2.1 Sea and Tidal Defences

Much of the land bordering the tidal waters is low lying and protected by sea defences. Tidal surges with their origins in the North Sea, can give extremely high water levels, particularly at times of spring tides. The sea defences need to be heavily revetted to prevent damage caused by high water levels and accompanying large waves. The problem of wave damage is increasing as saltmarshes and foreshore levels erode allowing the large waves to be sustained close inshore.

All the urban frontages are protected by NRA maintained sea defences with the exception of Southend, Foulness and Shoeburyness, which have defences provided by the Local Authority and Ministry of Defence.

The NRA do not maintain the sea wall fronting Mucking Landfill site. Historically the original company, Surridges, obtained consent to raise the level of the whole area, including seaward of the existing sea wall. In this situation, the Authority's predecessors passed the responsibility for maintenance to the Company and subsequent owners.

There are two sections of the River Crouch frontage, along with Bridgemarsh Island, which are not maintained by the NRA. These sections were abandoned many years ago due to the fact they were considered uneconomic to maintain. On the north bank the area between North Fambridge and Hyde Marsh consists of saltings backed by high ground formed by the Wickford/Southminster Railway embankment; and on the south bank the sea wall from Beckney Farm to Brandy Hole which consists of a large area of saltings, backed by high ground and an embankment carrying a British Gas pipeline. Within the River Crouch is an area called Bridgemarsh Island: the tidal flood defences here were abandoned in 1928/29.

The Thames-side frontage of South Essex benefits from some of the best tidal defences in the country, following major capital investment to raise protection standards over the period 1972 to 1983. This was achieved as part of the tidal defence improvements for the Thames Estuary including the City of London, and was a major scheme in 1983.

The scheme involved the raising of sea walls between the Mardyke and Leigh on Sea, and included the construction of four major tidal barriers. These barriers are located at Tilbury Dock, Fobbing Horse, Easthaven and Benfleet; the latter two protect Canvey Island. The new works consist mainly of raised and strengthened existing enhancements, and involved the use of earth fill to landward, rock fill on the riverward side and either reinforced concrete crest walls or deep steel piling. Some 120 flood dams also had to be constructed to allow access through the defences for business and pleasure. All these works have been constructed in order to prevent a similar disaster to that experienced on 31 January / 1 February 1953, when 59 Essex people drowned on Thames-side and 25,000 had to be rescued by boat and evacuated to high ground.

Wave attack is a major problem on the Dengie frontage, the south part of which lies within the area of this plan: but because there are few properties at risk, reduced



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Flood Defence

- Main River
- Catchment boundary
- N.R.A. maintained coastline
- Non N.R.A. maintained coastline
- High ground
- N.R.A. flood park

Map 17

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economic benefits mean less expensive solutions have to be found. The construction of offshore wave breaks, and salting regeneration schemes have been undertaken in an attempt to reduce the wave heights near the shore and reduce, or even reverse, the present general trend of salting erosion.

Maintenance activities on the sea defences are generally concentrated on the seaward face, repairing the blockwork revetment and lowering the sea wall toe as the foreshore erodes. Repair techniques are continually evolving as new equipment and materials become available. All new working methods are economically and environmentally tested to ensure that risks to the high conservation value of the estuary are minimised.

During the life of this plan, the NRA must make important decisions upon its strategy for maintaining tidal defences to the MAFF target standards (Appendix VI refers). With sea level rise currently estimated at 6mm per year, the NRA may not be able to economically justify major capital expenditure on maintaining the standard of some rural seawalls. Consideration will always be given to increasing their standards, but simply maintaining the current seawalls at existing levels, and in some instances realigning to a new defence line may be necessary.

3.8.2.2 Freshwater Rivers

The main fluvial rivers are the Mardyke, Crouch and Roach. Other significant systems are the Eastwood Brook, Prittle Brook and Stanford Brook. Several large urban areas lie on these rivers; Southend, Wickford and Rayleigh have had schemes completed to provide flood protection. The rural lengths of channel generally pass through agricultural land, predominantly arable. The natural river flood plain is a vital part of the flood protection regime. If it is lost then water levels will rise, usually damaging property and infrastructure.

The fluvial rivers are generally of a natural channel section, and require little more in the way of maintenance other than annual weed cutting and selective desilting, with any unstable trees being removed or pollarded. During floods, blockage patrols keep gates and bridges clear.

Canvey Island is surrounded by sea walls and forms a natural "dish" in the middle, all below mean high water. As a result, to evacuate surface water there is an intricate system of low and high channels, flood parks and pumping stations. The 12 pumping stations are regularly patrolled by NRA employees during winter months and form an essential part of the protection from fluvial flooding. Another fluvial scheme of interest is the Tilbury Drainage Scheme. This consists of a flood relief channel around Tilbury town, which comes into operation when storm flows trigger an automatic gate, diverting water to the Worlds End pumping station.

3.8.2.3 Flood Warning

The NRA provides information and advice to Essex County Police Force, as part of the Storm Tide Warning Service. The Storm Tide Warning Service is run by the Meteorological Office at Bracknell and monitors and predicts tidal surge conditions in the North Sea that may affect the east coast of England. This gives them sufficiently advanced warnings of areas likely to be affected by tidal and/or fluvial flooding, in order that effective actions can be taken. The NRA operates 24 hour



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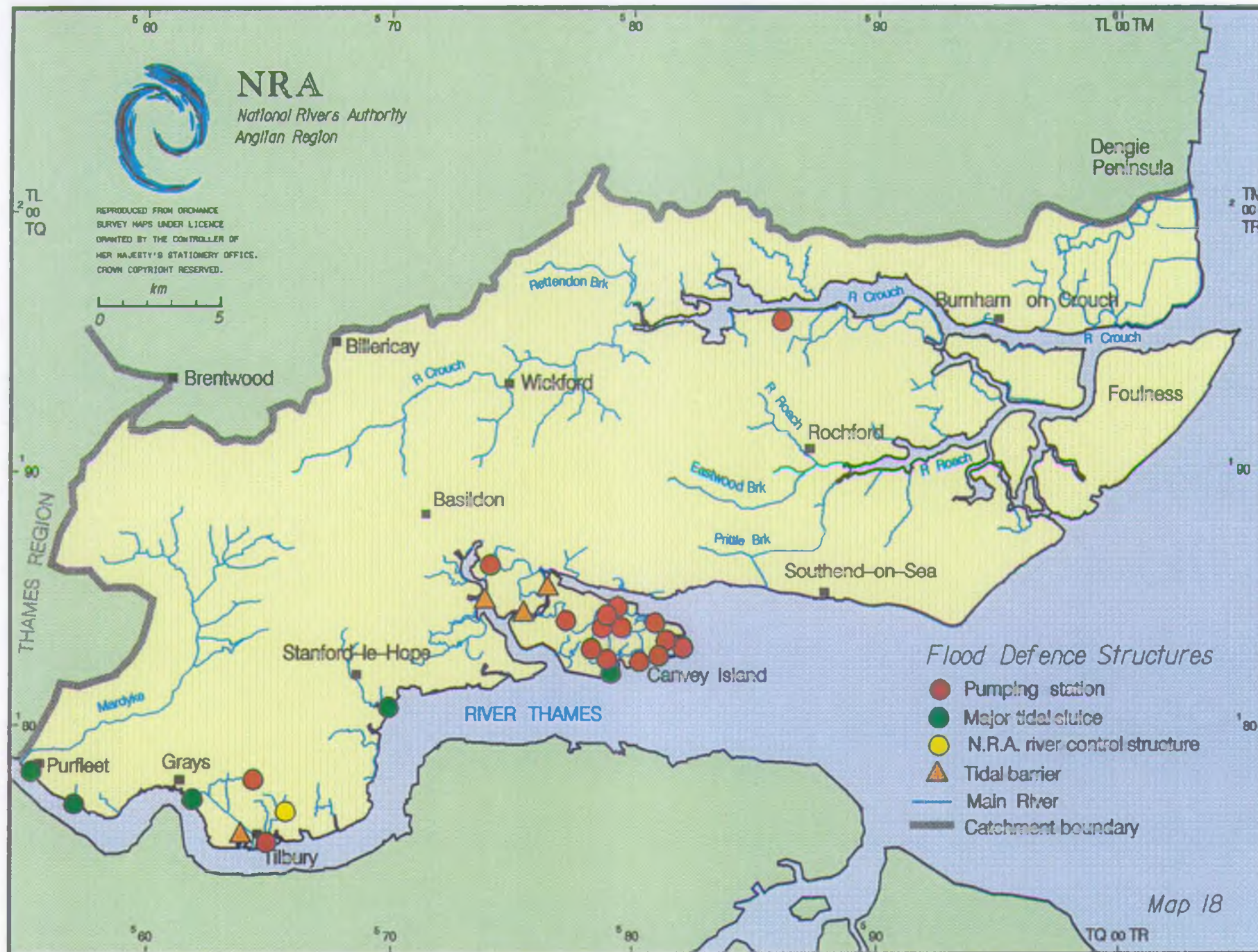
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Map 18

Flood Defence Structures

- Pumping station
- Major tidal sluice
- N.R.A. river control structure
- ▲ Tidal barrier
- Main River
- Catchment boundary



Flood Duty Rotas. The Duty Officer monitors rainfall, river levels, flows and tidal surges using the NRA network of gauges forming the telemetry system. This provides him with information to monitor and predict flood risk whether during office hours or from home. When appropriate, public warnings are issued.

3.8.3 Objectives

Physical Features

- To provide an effective defence for people and property against flooding from rivers and the sea. The standard of protection to be economically viable, technically sound and environmentally acceptable.
- To provide adequate arrangements for flood forecasting and warning.
- To provide an emergency response to flood events.
- To maintain river channel structures and sea defences to protect people and property to the appropriate standard and take account of environmental needs and requirements.
- To ensure the effective operation of barriers, washlands, sluices and other control structures.
- To identify and implement environmental enhancement opportunities.

3.9 Surface Water Drainage

3.9.1 General

This concerns the provision for the passage and disposal of surface water from the catchment via watercourses and sewers to the tidal estuary or sea frontage.

3.9.2 Local Perspective

The catchment falls generally into two main types of drainage rural, and urban.

3.9.2.1 Rural

Most of the rural area is found at Bulphan and is flat arable land with slow flowing watercourses. Another large rural area is north of Rochford at Canewdon to Barling. Most of this land is low lying and protected by major sea walls. Much of the arable land has sub-surface drainage which causes fairly rapid run-off to the ditches and watercourse. This also tends to increase chemical run-off and contributes to the diffuse pollution problem.

3.9.2.2 Urban

The surface water drainage in the large towns varies considerably. Areas that have been recently constructed or redeveloped generally incorporate systems which balance and control the rate of discharge to the rivers. In older parts of towns sewer overloading can occur at times of heavy rainfall (due to the high volume of

storm water), and may cause flooding in receiving watercourses.

Smaller watercourses, such as the Eastwood Brook, can be quite "flashy" responding rapidly to rainfall and falling quickly afterwards.

3.9.3 Objectives

Water Quality

- To ensure that adequate precautions are taken to prevent contamination of surface water from roads, urban and industrial areas.
- To ensure that surface water discharges are of a suitable quality for the receiving watercourses.
- To explore with other agencies techniques for controlling diffuse sources of nutrients (nitrogen and phosphorus).
- To ensure that watercourses are of a suitable quality for their various uses.

Physical Features

- To ensure that discharges to watercourses from new development are controlled adequately so as to avoid surface water flooding problems.
- To maintain the drainage effectiveness of watercourses to meet flood defence requirements and take account of nature conservation interests.

3.10 Water Mills

The catchment does not have any traditional mills using river flows as the energy source. There were three tidal mills built at Battlesbridge, Stambridge and Great Wakering. Unfortunately both Stambridge and Great Wakering have been destroyed by fire. Battlesbridge has mostly been demolished although the present owner has restored part of the mill system to demonstrate how it was originally operated.

3.11 Hydropower

There are no recognised hydropower uses in the catchment. It is likely that any development of this power source would be for domestic supply only, due to the low gradient of most rivers.

3.12 Fisheries - Freshwater

3.12.1 General

Under Section 114 of the *Water Resources Act 1991*, the NRA has a duty to maintain, develop and improve fisheries. Section 2 of the same Act confers a more general duty to further the conservation of flora and fauna, which is important for bank-side and in stream habitats. Fish populations are affected both by the quality and the quantity of water, and by the physical suitability and structure of the aquatic ecosystem. The presence of a thriving fish stock is therefore one of the best possible

indicators of a satisfactory water environment.

Freshwater fisheries use covers:-

- 1) Game fisheries - those supporting breeding populations of salmonid fish.
(Not represented anywhere in this catchment)
- 2) Coarse fisheries - those supporting breeding populations of coarse fish.
- 3) Maintained fisheries - those supporting non-breeding populations of fish maintained solely for recreational exploitation.
(Represented mainly by "put-and-take" rainbow trout fisheries)
- 4) Fish Farms - those sites supporting the artificial propagation and growing-on of fish under controlled conditions for commercial and/or management purposes, or providing holding or transit facilities in connection with the live fish trade.

3.12.2 Local Perspective (Refer to Map 19)

With the exception of the Mardyke there are no significant fluvial fisheries within the plan area. Fish population surveys are carried out on the Mardyke, and all other rivers throughout the Anglian Region, once every three years. Extensive data on the fish populations are therefore available, and these are used to derive a fisheries classification scheme based on the biomass of the stocks present. This is expressed as weight of fish supported, in grams per square metre of water surface area.

The Mardyke falls within the bottom Biomass Class D ($0-5\text{gm}^{-2}$), and supports only a depressed coarse fishery dominated by eels. Other species present include roach, rudd, crucian carp and three-spined sticklebacks. Small numbers of flounder are found in the extreme downstream reaches of the river, by the Mardyke Sluice.

Reservoirs, lakes and ponds supporting fish stocks occur throughout the area; there are too many of them to identify individually. Little precise data exist on these stocks, although it is abundantly clear that they represent a very important and large scale resource. Maintained "put and take" rainbow trout fisheries are included in this category.

One freshwater site in the area is registered in accordance with the *Registration of Fish Farming and Shellfish Farming Businesses Order 1985*. This site is concerned only with the pond fish trade.

3.12.3 Freshwater Fisheries Requirements

The overall requirement is to sustain coarse fish populations appropriate to the fluvial fisheries within the catchment area. Due regard should also be given to the maintenance of the smaller species of fish in minor watercourses, and of all species of fish in reservoirs, lakes, ponds and fish farm sites.



3.12.4 Objectives

Water Quality

- No rivers within the plan area are designated under the *EC Freshwater Fisheries Directive 78/659/EEC*. However, all stretches of river containing potentially viable fisheries are to be protected against any adverse effect on their stocks. There are no defined water quality objectives for enclosed freshwater lakes, reservoirs and ponds, but these should also be protected from any quality impacts that may adversely affect their fisheries use.

Water Quantity

- River flows should be adequate to sustain coarse fishery uses as appropriate. Control structures should be operated so as to minimise the impact of flow and level changes, and of saline incursions. Water levels in reservoirs, lakes and ponds supporting fish stocks should not be subject to derogation by third party interests.

Physical Features

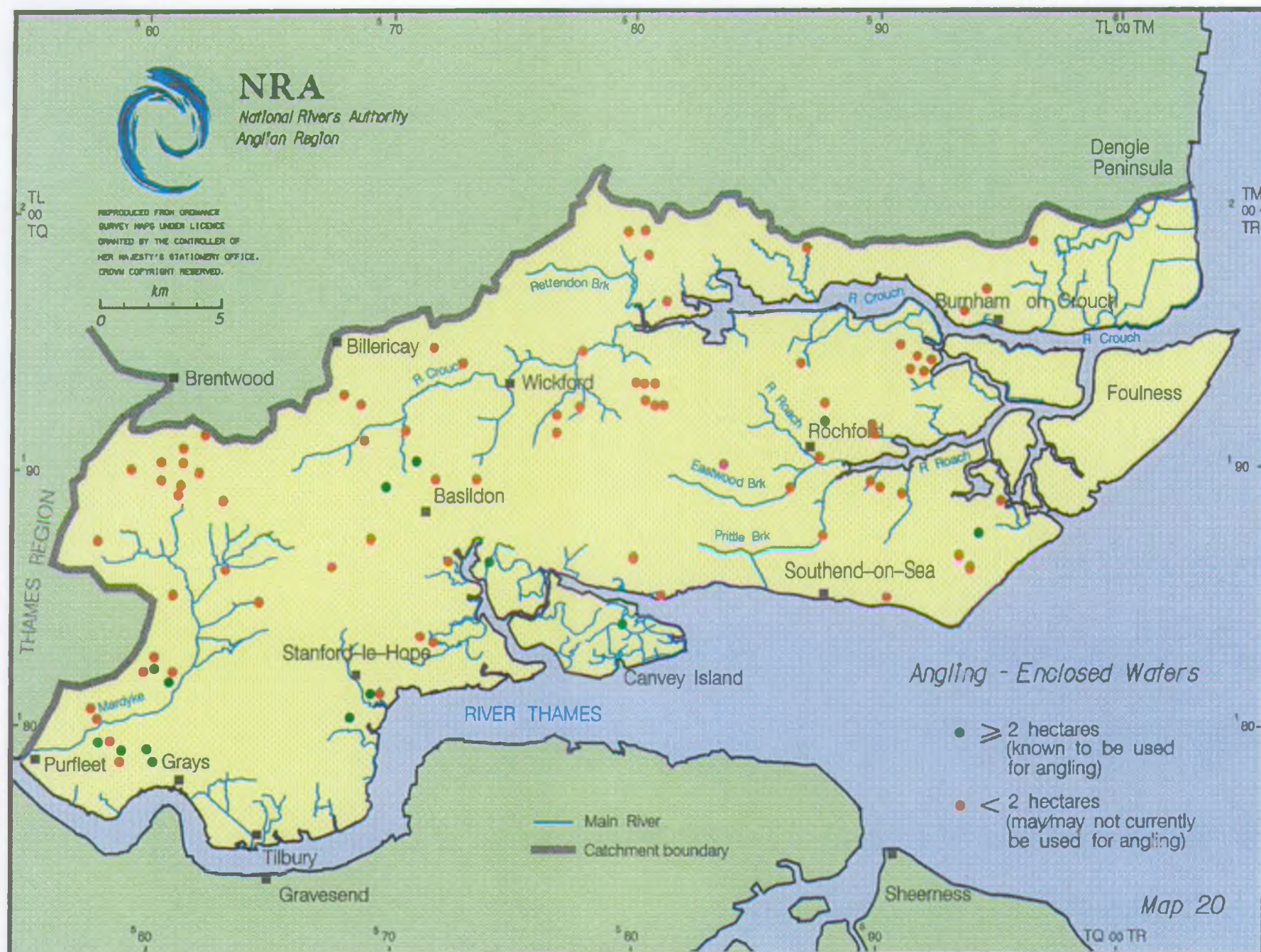
- A diversity of natural (and artificial) features should be maintained, so as to ensure the best possible variety of both river and lake habitats, and consequently to contribute to optimum fish production. These features should include variable depth and channel profiles, weed beds, and marginal vegetation up to and including trees.
- River maintenance operations should be designed to have the minimum possible impact on fish populations, and to ensure that the physical habitat is not adversely affected.
- Opportunities for enhancement works on all waters should be acted on wherever possible.

3.13 Angling (Refer to Map 20)

3.13.1 General

The NRA has a duty under Section 25 of the *Salmon and Freshwater Fisheries Act 1975* to regulate the taking of salmon, trout, freshwater fish and eels by rod and line for recreational (or commercial) purposes, by means of a system of licensing. Although they do not themselves refer to licensing the *Anglian Region Fisheries Byelaws* define the area of the Authority's jurisdiction, and specify demarcation points, generally at the limits of tidal waters, downstream of which licences are no longer required. Strictly speaking, this is only because freshwater fish do not generally occur in tidal waters in the plan area; it is not due to any exemption from the licensing requirement.

In addition to their rod licence, freshwater anglers also require permission to fish from the owner or controller of the fishing rights on the water in question.



The capture of brackish or salt water species in estuaries and coastal waters is not regulated by licensing or other means, although certain byelaws enacted by various statutory bodies can impinge on its conduct. There is a public right to fish in virtually all tidal waters, which was established by *Magna Carta*.

Freshwater angling use covers all interests concerned with the taking of fish by rod and line from all inland waters, upstream of the demarcation points.

Saltwater angling use covers all interests concerned with the taking of fish by rod and line from estuaries and coastal waters, downstream from demarcation points.

3.13.2 Local Perspective

Angling is a common and widespread recreational activity throughout the catchment area, and is widely practised on freshwater lakes, reservoirs and ponds, on estuaries, and at sea. There is very little, if any, angling on freshwater rivers due to their generally small scale, and to the very poor fish stocks which they currently support.

3.13.2.1 Freshwater

Most freshwater angling takes place under the auspices of clubs or syndicates, of which there are approximately 30 examples known to have interests in the catchment area. Their fishery holdings comprise of farm reservoirs, disused and flooded mineral workings, and a variety of lakes or ponds. Membership can range from tens to thousands per club. Some of the larger clubs control a wide range of waters, which may be owned, leased or rented.

An increasing number of still waters is open to anglers on a commercial ticket basis. These venues vary enormously in scale, and like club waters, they have a wide range of origins.

Although there are more than one hundred angling venues within the catchment, none of them is freely available to the public.

The majority of anglers are interested in the pursuit of coarse fish, such as bream, carp, roach, perch, pike and tench. In some instances anglers will simply try to catch what they can, but other individuals develop particular specialisms, and only fish for single species such as carp or pike. Fly fishing for trout is perhaps the most widespread and distinctive specialist category. Competitive match fishing is widely practised, although for the most part angling is non competitive in nature.

3.13.2.2 Saltwater

The existence of a public right to fish in tidal waters means that most saltwater angling takes place on an informal basis. Sea angling clubs exist either in their own right, or as wings of larger organisations with interests in all aspects of the sport. These clubs concentrate primarily on social, commercial and competitive matters, since they cannot undertake ownership or management of waters in the same way as their freshwater counterparts.

Saltwater angling can and does take place from the shore in almost any location

where access is possible. The extensive saltings and mudflats that occur along much of the coast can inhibit angling at low water, and lead to a concentration of activity at or around high tide.

Angling from both privately owned and commercially chartered vessels is commonplace in the main estuarine reaches and along the open sea coasts. Charter boats operate primarily from Burnham-on-Crouch and Southend-on-Sea.

Unlike freshwater species, the majority of saltwater fish are regarded as palatable and are retained for the table upon capture. Bass are probably the most highly prized quarry in this respect. Other species regularly taken include cod, whiting, skate, stingray, sole, dogfish, tope and grey mullet. A significant number of freshwater eels are also caught in saltwaters.

Digging of baits along the foreshore for saltwater fishing is a controversial activity which can be damaging, particularly if undertaken mechanically and/or on a commercial scale. Bait digging within coastal SSSIs and NNRs can threaten their conservation value by reducing the food resource available to other wildlife.

3.13.3 Angling Requirements

The principal requirement is to provide and sustain suitable and safe conditions for the pursuit of successful angling in all environments where appropriate fish stocks can exist.

3.13.4 Objectives

Water Quality

- All waters used for freshwater fisheries should comply with the quality objectives appropriate to those uses. These objectives will also safeguard their angling value. All angling waters should also be aesthetically acceptable, and free of surface films, litter, excessive vegetation growths, discolorations and unpleasant odours.

Water Quantity

- All waters used for freshwater angling are to comply with the quantity objectives appropriate to their freshwater fisheries use.
- River water levels should be maintained within satisfactory limits, especially at times of marked flow change.

Physical Features

- Sufficient access points to all kinds of waters used for angling should be maintained, to include adequate access for the disabled.
- The management and maintenance of all waterside environments used for angling should reflect the requirements of the sport as well as those of other legitimate interests.

3.14 Fisheries - Commercial and Marine

3.14.1 General

The NRA is responsible for regulating commercial fishing for eels, salmon and migratory trout in all waters, in accordance with Section 25 of the *Salmon and Freshwater Fisheries Act 1975*. It is also responsible for implementing the *EC Shellfish Waters Directive 79/923/EEC* in tidal waters.

The control and management of marine fin fisheries and crustacean shellfisheries in the catchment is undertaken by MAFF and/or the Kent and Essex Sea Fisheries Committee.

3.14.2 Local Perspective

3.14.2.1 Eels, Salmon and Migratory Trout

Extensive commercial eel fisheries exist in the catchment, primarily downstream of the demarcation points specified in the *Anglian Region Fisheries Byelaws*.

Commercial eel fishing upstream of the demarcations is regulated by a system of licensing. It may only be conducted with the permission of the owner or controller of the fishing rights, and in accordance with the *Anglian Region Fisheries Byelaws*. It is rarely, if ever, practised within the plan area.

Seawards of the demarcation points, eel fishing is excused from licence duties and is effectively free of any constraints or regulations defined by the *Anglian Region Fisheries Byelaws* (see section 4.4.2 below). Offshore, eels are caught primarily by trawling, often by boats operating in pairs. The inshore fishery makes extensive use of fyke nets. Eels can be caught in tidal waters throughout the plan area.

Fyke netting for eels is a traditional practice, long thought to have no significant impact on other stocks. Some concern has been expressed recently, however, over chance and unregulated capture of species such as dover sole by fyke net fisherman. The extent to which this occurs is not fully known, despite some recent investigations by NRA Thames Region.

Eel trawling involves the use of nets of smaller mesh than normally are allowed for other forms of fishing. This can be controversial if the bycatch includes a significant proportion of marine fin fish too small to be taken legally as the intended catch. Trawling for eels in tidal waters is influenced, but not specifically regulated, by the Kent and Essex Sea Fisheries Committee Byelaws governing the carriage of nets by fishing vessels. *EC Regulation 3094/86*, which is enforced by the Sea Fisheries Committee, imposes some more specific controls on eel fishing, although these are limited in both their scope and extent.

Salmon and migratory trout do not occur in any of the catchment's freshwaters. Commercial fishing for them in all waters seawards of the demarcation points is outlawed by the *Anglian Region Fisheries Byelaws*, in order to protect stocks migrating through to other localities. The Thames salmon are the best known example here, although runs of migratory trout to the north Kent rivers could also benefit.

Fish stocks of all types have exhibited a marked recovery throughout the Thames Estuary in recent years, due to the significant improvements made in both water quality and pollution control. This has led to a considerable upsurge in commercial fishing activity, which may have implications for the regulatory and enforcement effort required to protect salmonid stocks. It has also led to an increased concern over the possible damage done to juvenile stocks of bass, sole and smelt by eel trawling.

3.14.2.2 Shellfisheries (Refer to Map 21)

There are extensive and important molluscan shellfisheries in the Crouch and Roach estuaries, around the Maplin Sands, and off Southend-on-Sea. These fisheries primarily involve bivalve molluscs, and particularly oysters and cockles.

Oysterages differ from other shellfisheries in that they now depend largely on the deliberate laying of juvenile stocks for subsequent harvesting, once they have reached a marketable size. The sheltered coastal waters are well suited to these fisheries, which have been exploited for hundreds of years.

Four shellfishery sites in the catchment are registered in accordance with the *Registration of Fish Farming and Shellfish Farming Businesses Order 1985*.

The sedentary and filter feeding habits of all bivalve molluscs means that they are prone to the accumulation of particulate pollutants and micro-organisms, which can render them unfit for human consumption. Regular monitoring of tidal waters, and of the shellfish themselves, is therefore required to ensure that the appropriate food hygiene standards can be met.

Within the Crouch and Roach estuaries the oyster fisheries are currently classified A or B, under the *EC Shellfish Hygiene Directive 91/492/EEC*. That is they may either go direct for human consumption (Class A), or they must be heat treated, depurated or relaid before consumption (Class B). In the Thames Estuary, where mussels and cockles are harvested, classifications range from B to C. Where a C classification occurs, the shellfish must be relaid for at least two months in cleaner water, or heat treated. See Appendices XIII and XIV.

3.14.2.3 Whiteweeding

'Whiteweed' (actually the sedentary, colonial hydroid *Sertularia* sp.) is harvested from the offshore banks by the local fishermen, mainly from around the Maplin Sands and the entrances to the Crouch and Thames Estuaries. The major markets for whiteweed are in America, where it is used for decorative purposes. The level of activity is dependent upon its abundance at any one time, and on the profits in conventional fishing.

3.14.3 **Commercial and Marine Fisheries Requirements**

The requirements of commercial fisheries are that the biological, chemical and physical characteristics of the fishing areas are maintained and managed in such a way as to allow the exploitation of the commercially viable stocks on a long term and sustainable basis.



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THAMES REGION

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Purfleet

Grays

Tilbury

Gravesend

Stanford-le-Hope

Basildon

Wickford

Billericay

Brentwood

Pettendon Brk

R Crouch

Eastwood Brk

Pittle Brk

Southend-on-Sea

Rochford

Burnham on Crouch

Dengie
Peninsula

Foulness

Canvey Island

RIVER THAMES

— Main River
— Catchment boundary

Shellfisheries
■ EC Shellfish Waters Directive
designated areas
■ Oyster harvesting area
■ Cockle harvesting area

Sheerness

Map 21

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3.14.4 Objectives

- Protection of the eel fisheries depends mainly on safeguards for the freshwater stages of their life cycle. These are identical to those defined for freshwater fisheries in general, and are dealt with earlier. The objectives outlined below are therefore confined to tidal waters.

Water Quality

- Water Quality Objectives for tidal waters are likely to be formulated nationally to protect both local and migratory fish populations of all species. Water Quality in the commercial fishery areas would then be maintained or improved to meet these objectives.
- A large part of the Roach Estuary is a designated shellfishery under the *EC Shellfish Waters Directive 79/923/EEC*. These areas must comply with the quality limits laid down in the Directive. The data for 1993 and 1994 show that in general the estuary is compliant with the Directive, although Eastend Paglesham failed the criteria for copper and zinc in 1993.
- A number of shellfisheries in both the Crouch and Roach are also classified under the *EC Shellfish Hygiene Directive 91/492/EEC*. Shellfish taken for sale from these classified areas must comply with the quality limits laid down in this Directive.
- There are no current plans to improve or extend the areas currently designated / classified under either of these Directives.

Water Quantity

- It is not possible to specify water quantity objectives for tidal waters, beyond the maintenance of minimum residual freshwater flows at tidal limits, wherever such flows are prescribed.

Physical Features

- The management and maintenance of all aquatic environments used for commercial fisheries should reflect the needs of the industry, as well as those of other legitimate interests.
- Every effort must be made to ensure that offshore industries and coastal developments (including sea defences) do not disrupt the physical habitat in any way which threatens the long term viability of commercially exploited fish or shellfish stocks.

3.15 Ports, Harbours and Commercial Navigation

3.15.1 General (Refer to Map 22)

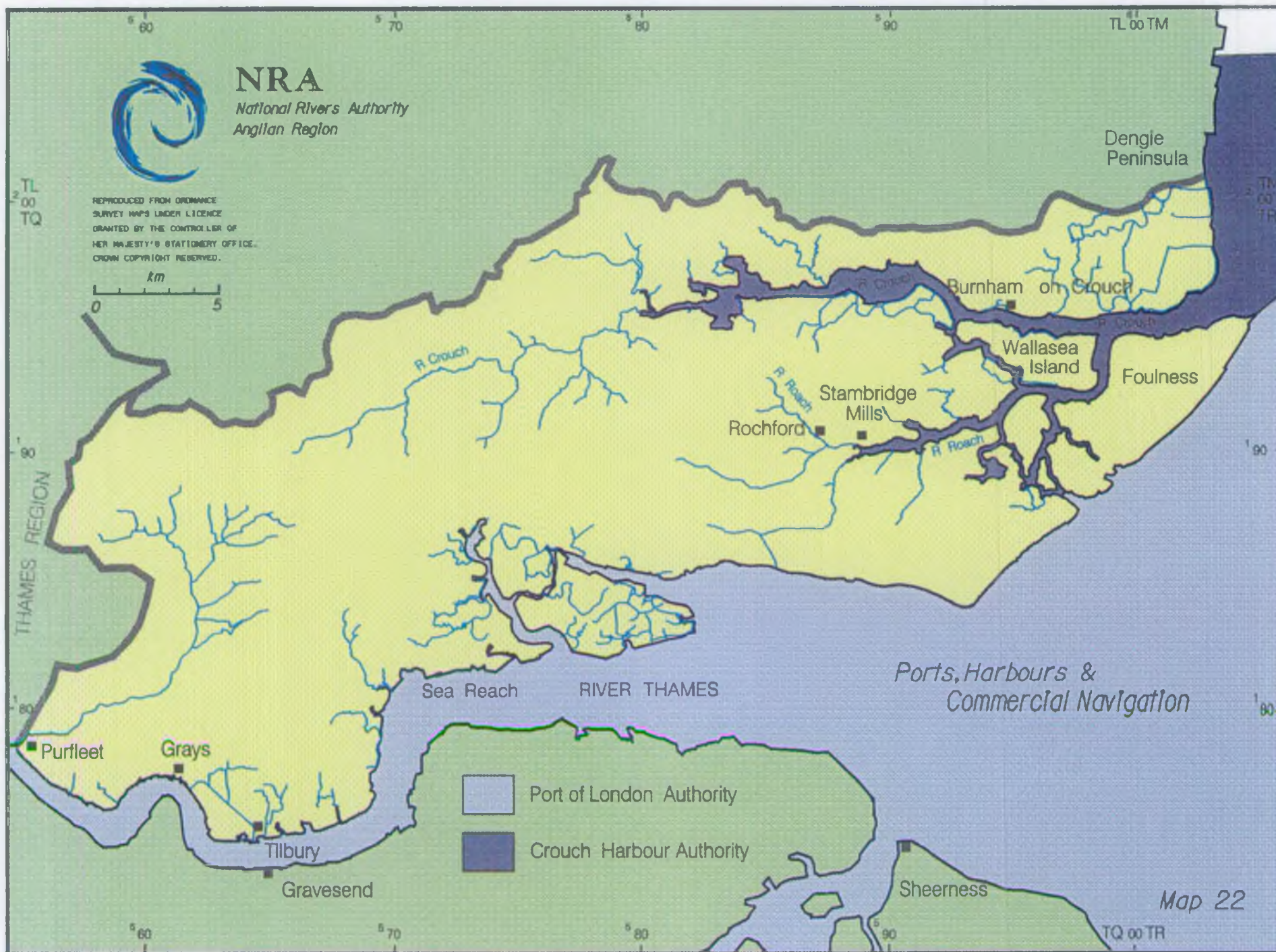
Within the direct jurisdiction of this plan only the tidal Rivers Crouch and Roach are used for commercial navigation. The tidal River Crouch has commercial activity



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up to Wallasea Island where timber is imported. There is limited commercial navigation on the tidal River Roach up to Stambridge Mills.

The tidal Thames, adjacent to the area covered by this plan, however, is a major commercial navigation. There is much ship movement to and from the berths at the refineries and oil storage depots in Sea Reach and to the many riverside wharves at Purfleet and Grays. Tilbury Docks is also an important impounded dock area.

Besides the large vessels using the tidal Thames there is still a significant amount of local and coastal traffic although this has greatly decreased over the last three decades. London's refuse is still shipped by lighter to the waste disposal / landfill sites in the lower reaches.

The responsibility for navigation within the catchment falls to the Port of London Authority (PLA) and the Crouch Harbour Authority. Their geographical areas are shown on Map 22.

3.15.1.1 Port of London Authority

The PLA has jurisdiction over the entire tidal Thames, from Teddington to the Gunfleet Old Tower in the Outer Thames Estuary, a length of ninety five miles. It was established under the *Port of London Act 1908* and is currently the largest UK port in terms of tonnage of cargo entering and leaving the port.

The PLA's wide powers include the regulation of navigation, licensing of riverworks and dredging and hydrographic surveying. The registration of lighters, tugs and boats for hire and the raising and removal of sunken vessels are also the responsibility of the PLA. Statutory duties given to the Authority under several Acts empower it to control pilotage, to regulate the movement of dangerous substances in bulk and to investigate and clean up oil pollution. Many of these duties are carried out and regulated by means of byelaws. The PLA owns much of the river bed and foreshore within its area of jurisdiction.

Navigation Service centres at Gravesend and Woolwich continuously monitor the movements of vessels within the PLA area.

3.15.1.2 Crouch Harbour Authority

The Crouch Harbour Authority was established in 1975 under the *Crouch Harbour Act 1974*. Its duties include the regulation, maintenance and improvement of the harbour and the navigation thereof. It also has a responsibility for the conservation and enhancement of the natural beauty and amenity of the countryside.

Many activities on the river are controlled by the Crouch Harbour Authority. Dredging and development work must be licensed, as must houseboats and all moorings. The Authority also regulates recreational activities by means of byelaws. Considerable portions of the river bed, particularly in the River Crouch, are owned or leased by the Authority.

3.15.2 Objectives

To ensure that commercial navigation on the estuaries does not adversely affect

water quality.

3.16 Conservation - Ecology

3.16.1 General

This use specifically relates to the promotion, protection, maintenance and enhancement of flora, fauna and physical features of conservation and ecological importance.

3.16.2 Local Perspectives (Refer to Map 23)

The value of Essex in terms of conservation lies in the intricate mosaic of wildlife habitats found around the coast, from mud flats and salt marsh to grazing marsh and woodland. Each of the different habitats support rare and characteristic plants and animals, in some cases of national and international importance. But each is also under threat, highlighting the need for effective conservation management. There are many areas designated by statute for their conservation value and Appendix II gives a comprehensive listing of SSSIs and other conservation locations which are protected by statute in South Essex. The NRA has a statutory duty to protect these sites but it must also be remembered that South Essex is full of smaller sites with high conservation value like County Wildlife Sites and small local nature reserves.

3.16.2.1 Rivers Crouch, Roach and Prittle Brook

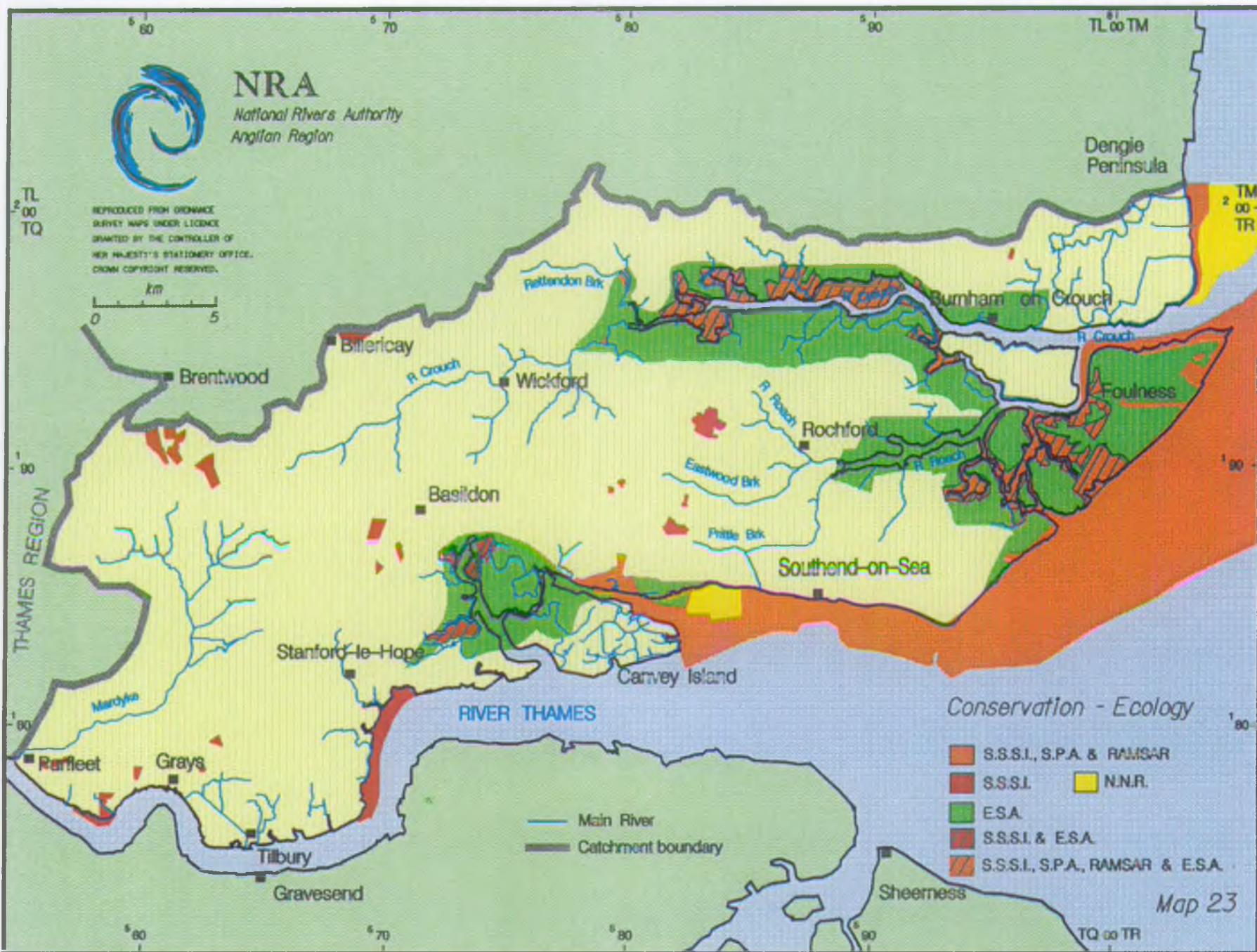
The upper valley of these rivers comprise extensive areas of ancient coppiced woodland. Norsey Wood SSSI, in the Crouch valley, is a mixed chestnut coppice derived from acid oak woodland. Additional interest is formed by the spring lines which give rise to acid flushes and four ponds. These support a diverse wetland flora, including several species that are uncommon or of restricted distribution in Essex. Due to its size, historic management, varied soils and topography, it has a good diversity of habitats and associated flora and fauna, making it one of the best woods of its type in Essex. To the south of Rayleigh Brook, a tributary of the River Roach, Hockley Woods, are a contiguous group of ancient woodlands. The population of sessile oak is thought to be the largest in eastern England. Great Wood & Dodd's Grove SSSI is one of the best examples of ancient woodland in south Essex.

3.16.2.2 Pitsea Fleet

This sub-catchment contains a mosaic of habitats, including unimproved and acid grassland, ancient and oak coppice-with-standards woodland, wet and dry heathland and herb-rich meadow.

3.16.2.3 Mardyke

Sites of particular note within the Mardyke sub-catchment are predominantly redundant pits or mines, protected for their geological and archaeological importance. Since the cessation of mineral extractions at Gray's Chalk Pit a diverse habitat including woodland, scrub and calcareous grassland has colonised the site, supporting an important assemblage of invertebrate fauna. Abandoned pits such as



Deneholes SSSI, also provide important underground refuge for hibernating bats.

3.16.2.4 Coast

The coast comprises an extensive complex of estuaries and intertidal sand and mudflats, salt marsh, grazing marsh, grassland, beaches, and scrubland. The interaction of estuary and the sea creates a wealth of distinctive wildlife habitats which support many rare plants and animals. In contrast with the more extensive estuaries elsewhere in the catchment, the Crouch forms a rather narrow estuarine habitat. Where the saltmarsh has not been embanked, such as at Woodham Fen and the upper sections of Paglesham Pool, the natural transition from saltmarsh to grassland occurs, uninterrupted by a sea wall. This uninterrupted transition is extremely rare along the Essex coast.

The coast supports both internationally and nationally important numbers of wintering wildfowl and waders, Foulness alone having twelve bird species in these categories. In recognition of this, the River Crouch Marshes, Dengie, and Foulness have all been designated as SPA/Ramsar sites. Benfleet & Southend Marshes has SPA and Ramsar designations and part is a National Nature Reserve.

Much of the coast, specifically Dengie Flat, the River Crouch Marshes and Foulness, has also been identified as qualifying as a Special Area of Conservation under the *EC Habitats Directive*. This confers extra obligations on the UK government and its agencies, including the NRA, to ensure that the area retains a 'favourable conservation status'.

However much of the intertidal area is deteriorating as a wildlife habitat. Sea level rise, combined with largely static sea defences, creates what is known as 'coastal squeeze' between a rising low water mark and sea defences. The most visible manifestation of this is eroding saltmarshes, which themselves are important in protecting sea defences by reducing wave attack. In the period 1973-1988, 27% of saltmarshes on the Crouch and 23% of saltmarshes on the Essex Thames were lost due to erosion. Managed retreat of sea defences is favoured to re-establish lost and disappearing intertidal habitats. Experiments are in progress on the adjacent Blackwater but none as yet in the South Essex catchment.

3.16.2.5 Environmentally Sensitive Area

The Essex Coast ESA was launched in March 1994 and includes 260 square kilometres of coastal area, from Canvey Island in the south up to the River Stour (the southern part lying within this plan area). The ESA scheme was introduced to safeguard areas of countryside where the landscape, wildlife, or historic interest is of national importance. Much of the Essex scheme is extensively managed grazing marsh, with a network of ditches and dykes, and large areas of adjoining arable land. The wildlife found in the grass habitat to the landward side complement those of the saltmarsh, mudflats, and beaches to the seaward side.

3.16.2.6 Water Level Management Plans

Water Level Management Plans (WLMPs) were introduced by the Ministry of Agriculture, Fisheries and Food during 1994. They provide a means by which water level requirements for a range of activities in a particular area, including

agriculture, flood defence and conservation, can be balanced and integrated. WLMPs are to be produced, in the first instance, for wetland dependent SSSIs according to priorities assigned by English Nature. In reaching an agreement English Nature will seek to ensure that the nature conservation interest for which the SSSI was notified is not damaged. The NRA will prepare WLMPs for other nationally important wetland conservation areas over the next five years. Designations to be covered include Scheduled Ancient Monuments (SAMs), National Parks and those Environmentally Sensitive Areas (ESAs) which have provisions relating to water level management.

The NRA will produce WLMPs where it is the Operating Authority and has control over structures influencing water levels. The NRA will, however, liaise closely with other bodies which also have responsibility for drawing up WLMPs. Where a large number of sites require WLMPs to be drawn up during the year, Interim Management Statements may be produced before the full plan is agreed. Further details of plans being prepared for the South Essex catchment are provided in Appendix VIII.

3.16.3 Objectives

Water Quality

- To improve or maintain water quality to ensure that sensitive ecosystems do not deteriorate.
- To prevent groundwater from deteriorating and adversely affecting wetland SSSIs, and other sites of nature conservation interest.
- To work with other agencies to promote and maintain dykes and ditches in the catchments ESAs.

Water Quantity

- To ensure that abstraction does not have an unacceptable effect on the environment.
- To identify and promote the understanding of flows necessary to sustain conservation and ecological interest.

Physical Features

- To identify and promote the understanding of natural and man-made features which provide conservation and ecological interest.
- To ensure maintenance, enhancement and restoration of those features which provide conservation and ecological interest.
- To ensure protection, enhancement and restoration of habitat features during the design and the implementation of flood defence schemes.
- To ensure that, where appropriate, river management promotes the achievements of ESA and Countryside Stewardship schemes.

3.17 Archaeology

3.17.1 General

Important archaeological remains are designated scheduled "ancient" monuments. Despite the term "ancient" monuments the legislation does not prescribe that a monument should be a particular age in order to qualify for scheduling. Scheduled ancient monuments can have a public interest by reason of their historic architectural tradition, artistic or archaeological value.

3.17.2 Local Perspective (Refer to Map 24)

The river valleys of the Crouch-Roach and Thames within the South Essex catchment have a valuable archaeological interest. Evidence of the earliest human occupation in Britain, the Palaeolithic period, has been shown by many flint implements recorded in the Thames estuary gravels. Numerous Mesolithic sites and deposits are known in the area, particularly along the estuaries, but also at inland sites. The rivers are a source of food, and the fertile light soils probably attracted the first farmers during the Neolithic period. Continuous settlement in the area since these times has led to a varied example of archaeological remains. There are 29 Scheduled Ancient Monuments (SAMs) designated by English Heritage and listed in Appendix III. The NRA has a statutory duty to help protect these SAMs but it must not be forgotten that there are valuable archaeological features and artefacts throughout South Essex, many as yet undiscovered.

3.17.2.1 River Crouch

Three main areas of archaeological interest are found in the upper valley of the River Crouch. Norsey Wood is designated for its remains of a late Iron Age settlement but also as a medieval deer park. The other two sites in Basildon are designated for their homestead moats. There are also some earthworks of note near Southminster which suggest a possible encampment.

3.17.2.2 River Roach and Tributaries

The River Roach sub-catchment has a number of archaeological features, mostly from Roman through to the medieval period. Earlier remains include a possible hillfort and a Cluniac Priory, both found at Prittlewell, and also Plumberow Mount which is an earthwork located near Rochford.

One designated site towards the top of Prittle Brook is the site of a Roman villa at Daws Heath whilst the River Roach has a Scheduled Ancient Monument of Roman cremations and burials found at Shelford Creek. Three Medieval scheduled sites positioned throughout the upper Roach sub-catchment are the 12th century Rayleigh Castle, the 14th century Southchurch Hall, and Rochford Hall built in the 16th century.

3.17.2.3 Pitsea Fleet

Traces of past salt processing are highlighted by mounds of waste material from the extraction method, known locally as red hills which are Roman in origin.



3.17.2.4 Mardvke

A range of archaeological evidence from most periods back to Neolithic times suggests continuous human occupation in the Thames Estuary since then. A Neolithic settlement at Orsett is shown by a causewayed enclosure which used to be a ritual site.

Bronze Age activity is known from the Thames Estuary with evidence of the Baker Street cropmark complex. The Iron Age period saw a rapid increase in population and with it an increasing complexity of social organisation. Iron Age settlements, farmsteads, and paddocks have been identified on the fertile gravel terraces typical in this sub-catchment.

A tumulus found at South Ockendon contains evidence of Romano-British burial. There are Saxon archaeological remains of palaces belonging to Bishops; Ring and Bailey earthwork, near Orsett, site of the Bishop of London's palace and the West Tilbury earthwork, site of Bishop Cedda's palace built in 623 AD.

South Ockendon Old Hall (including moat, fish ponds, and barn) and Deneholes created by mining originate from the Medieval period. Designations of more modern heritage include Purfleet Barracks, Bowater Farm World War II battery, and the East Tilbury battery.

3.17.2.5 Coast

In coastal and estuarine areas a number of site types is found: Red Hills (Iron Age and Roman salt production sites), medieval sea walls, shipwrecks, oyster pits, intertidal wooden structures (such as fish weirs) and coastal defences. The earliest sea walls in Essex date from the Middle Ages and some examples have survived to the present day.

Scheduled sites along the coastline are all of a military origin. The earliest of which is a Danish camp at Shoebury, built 894 AD, of which two sections of rampart still remain. Coal House Fort and Tilbury Fort date back to King Henry VIII, both built in 1539 as a coastal defence during the invasion fear of the time. The two forts were expanded and rearmed in later centuries. The main designated site of archaeological interest is Hadleigh Castle, a medieval castle built in the 13th century.

During the Second World War the Essex coast was seen as a likely route for a German attack on London and so was heavily protected with structures such as pillboxes, and anti-aircraft forts constructed offshore. Examples of these structures are presently being recorded by Essex County Council for their future preservation.

3.17.3 Objectives

Water Quality

- To ensure that water quality does not adversely affect the landscape and archaeological value of the land adjacent to watercourses.

Water Quantity

- To ensure that due regard is given to the water requirements of archaeological features.

Physical Features

- To ensure that river management does not adversely affect sites of archaeological importance.
- To protect and enhance important landscape features within the river corridors.

3.18 Amenity, Landscape and Recreation

3.18.1 General

3.18.1.1 Rivers

In this catchment area the Mardyke is the longest freshwater river system stretching from each of its two sources at Langdon Hills and Cranham, to the confluence at Purfleet in the Thames estuary. Two-thirds of the lengths of both the Rivers Roach and Crouch are estuarial. Rayleigh is the source of Eastwood Brook which flows into the River Roach after which it is tidally influenced. The Crouch extends from its source in Little Burstead, south of Billericay, to the railway crossing east of Battlesbridge, thereafter it too becomes estuarial.

The upper stretches of the Crouch-Roach complex are densely populated with intensive farming in rural areas. The rivers flow down into significant estuaries and coastal areas with particular wildlife value, specifically due to the nationally and internationally important numbers of waterfowl to be found.

3.18.1.2 Estuaries

The extensive network of creeks, estuaries and mud flats in the South Essex catchment has provided a unique habitat and a resource of great value. The catchment also contains the Dengie Flat, Crouch-Roach Estuary, Maplin Sands, Southend Flats, and the Thames Estuary; which English Nature has identified as requiring management plans, under the *Estuaries Initiative 1993/94*.

The range in type of estuary is indicative of the wide range of wildlife that is to be found in the catchment. The open coast sites of Dengie and Maplin with generally coarser sediment are important for knot and grey plover, whilst muddy, inner estuarine areas are characteristic of dunlin, redshank, and ringed plover. Wintering waterfowl occur in internationally important numbers in the Thames Estuary (average 133,875 birds over the winter period, 1987-1992), Dengie Flats (26,802 birds), and the Crouch-Roach Estuary (24,640 birds). The estuaries are strategic locations on migration routes for these and many other species of wildfowl.

The recreational and amenity potential of the estuaries are increasing greatly, this puts pressure on the resource and an integrated approach to management in these areas is very important.

3.18.1.3 Recreation

The demand and use of the countryside for recreation has increased. At the same time the countryside has been subjected to more intensive production processes, particularly by arable farming, than ever before. Open space is a scarce and precious resource in the extensive urban environment in the area of South Essex. Country Parks have been created by both County and District Councils in association with the Countryside Commission and have proved very popular with the public and are extremely well used. Five such Country Parks are found within the South Essex catchment and are listed below:

Country Parks	Hectares	Visitors 1990 (approx)	Features
Grange Waters	14	N/K	Windsurf/canoe/jetski
Hadleigh Castle	185	47,000	Fields/woods
Langdon Hills	137	566,000	Fields/woods/riding
Thorndon	151	590,000	Woods/riding/fishing
Wat Tyler	49	100,000 (approx)	Nature trails/museum

(The Essex Environment, ECC May 1992)

Essex Wildlife Trust in association with County and District Councils, designate areas as County Wildlife Sites (CWS). These sites are of local importance for conservation. The South Essex catchment has 345 CWS and 19 Essex Wildlife Trust nature reserves.

The landscape value and the range and diversity of flora and fauna are important to the enjoyment of recreation. The management of recreation in the Essex countryside is diverse and represented by different organisations. The Essex County Council holds the main responsibility for enhancing the region's recreational amenity.

Five Countryside Management Projects have been established within the South Essex catchment, three of which are only partly in the area:

Thames Chase Community Forest - The area stretches from Bulphan, east of the Mardyke, to the west of Romford which is not within the South Essex catchment area. The project is a joint initiative including the Countryside Commission, Forestry Commission, Essex County Council, Thurrock and Brentwood District Councils in Essex, and the London Borough Councils of Barking & Dagenham and Havering.

Chelmsford Countryways - A joint scheme operated by Chelmsford Borough Council and the Training and Enterprise Council to clear existing rights of way. The southernmost area lies within the River Crouch catchment.

Brentwood Countryside Management Service - Initially funded by the Countryside Commission and is now operated by Brentwood District Council; the project was set up to promote the natural environment and informal recreation.

Basildon Countryside Service - Set up and core funded by Basildon District Council with support from the Community Programme and local voluntary groups; the project has established a network of circular walks, footpaths, landscaping and conservation activities.

Roach Valley Conservation Zone - Set up and core funded by Rochford District Council; the area covers a distinct area between the headwaters of the Roach at Rayleigh and the mudflats of the estuary at Foulness.

3.18.1.4 Access

The abundance of footpaths within Essex as a whole is such that Essex County Council has produced a *Directory of Walks and Rides* which gives details of scenic local walks and where to obtain further information about each walk. Two long distance walks are promoted in this Directory. The London Countryway is 205 mile walk which is a complete circuit of the capital through the Home Counties. The route passes south-east from Epping Forest through the Essex marshes to cross the Thames via the Tilbury-Gravesend ferry. The Greenway Challenge Walk is the other long distance route, a 32 mile circular walk, which is held annually for charity. The route takes in Norsey Wood Nature Reserve and the Wat Tyler Country Park.

Some walks in the South Essex catchment have been purposefully adapted for wheelchair access. The pathways around Benfleet Marshes and Hadleigh Castle Country Park, have been designed to suit a person in a wheelchair. Wat Tyler Country Park in Basildon has also adapted nature trails, a bird hide, and a view point. At Norsey Wood, SSSI and County Wildlife Site, the wildlife trails have been altered for wheelchair use.

The sea walls are some of the most popular walks in the area. Although the county of Essex lacks a continuous coastal footpath much of the coast is suitable and managed for this purpose. The Crouch and Roach valleys provide some very attractive walks besides these estuaries.

Most of the Essex bank of the Thames is industrial but some pockets of unspoilt country and some attractive recreational areas remain. The coastal walk from Tilbury past Coal House Point towards Mucking Flats SSSI incorporates views over saltmarsh, mudflats, grazing marsh, and the Thames estuary with its valuable archaeological heritage.

Due to the industries that are located in South Essex and especially along the Thames estuary, there is always development pressure on the open and unspoilt countryside adjacent to these sites. There is a constant need to work in collaboration with conservation and recreational organisations to ensure a unified response to planning proposals and at times agree appropriate mitigation works.

3.18.1.5 Wildfowling

Wildfowling is a traditional sport which has been practised in the area since the 18th century. There is extensive wildfowling interest in the Roach estuary area, particularly at Barton Hall, Paglesham Creek, Havengore Island, Rushley Island and New England Island. There are thirteen British Association for Shooting and

Conservation (BASC) affiliated clubs in Essex. These clubs hold and manage wildfowling over some 13,000 acres of coastland, a part of which is within the catchment area, either through ownership of land or by the holding of sporting or management rights.

The shooting season lasts from the 1 September to the following 31 January, with shooting of birds below the high water mark permissible until 20 February. Since most activity is concentrated in the winter months this helps reduce conflicts with users participating in recreational water sports.

3.18.2 Local Perspective (Refer to Map 25)

The Essex river valleys of the Crouch and Roach and the middle reaches of the Thames estuary have considerable amenity and recreational value. The proximity of these valuable landscapes to large urban conurbations increases their popularity but also increases pressure on the area as a recreational resource. A survey carried out by the Countryside Commission concluded that at least 76% of England's population visited the countryside in 1990. The dominant pastimes associated with these trips are informal activities such as drives, picnics, long walks, visiting the coast and informal sport.

3.19 Water Contact Sports

3.19.1 General

This use includes water skiing, sailing, sailboarding, SCUBA diving jet skiing and, of course, swimming. There are three sites in the catchment designated under the *EC Bathing Water Directive 76/160/EEC* in the vicinity of Southend-on-Sea. These were among the first waters in the country to be designated and are monitored by the NRA's Thames Region which oversees the water quality of the entire Thames estuary. No other specific water quality requirements, related to these uses in fresh or marine waters, currently exist.

It should be noted that there is always a risk associated with all water contact sports in rivers and the sea. Water in its natural state is untreated and contains a large number of micro-organisms as well as dissolved chemicals and particles of suspended solids (silt, mud etc.). Most of these are of natural origin. The risk of contracting illness from untreated water is exceedingly small but can be reduced further by taking simple hygienic precautions.

Other obvious, but remote, risks connected with all water contact sports and activities are drowning and hypothermia and participants should abide by the guidelines produced by the respective national organisations for their sport.

3.19.2 Local Perspective (Refer to Map 26)

3.19.2.1 Estuary and Coastal

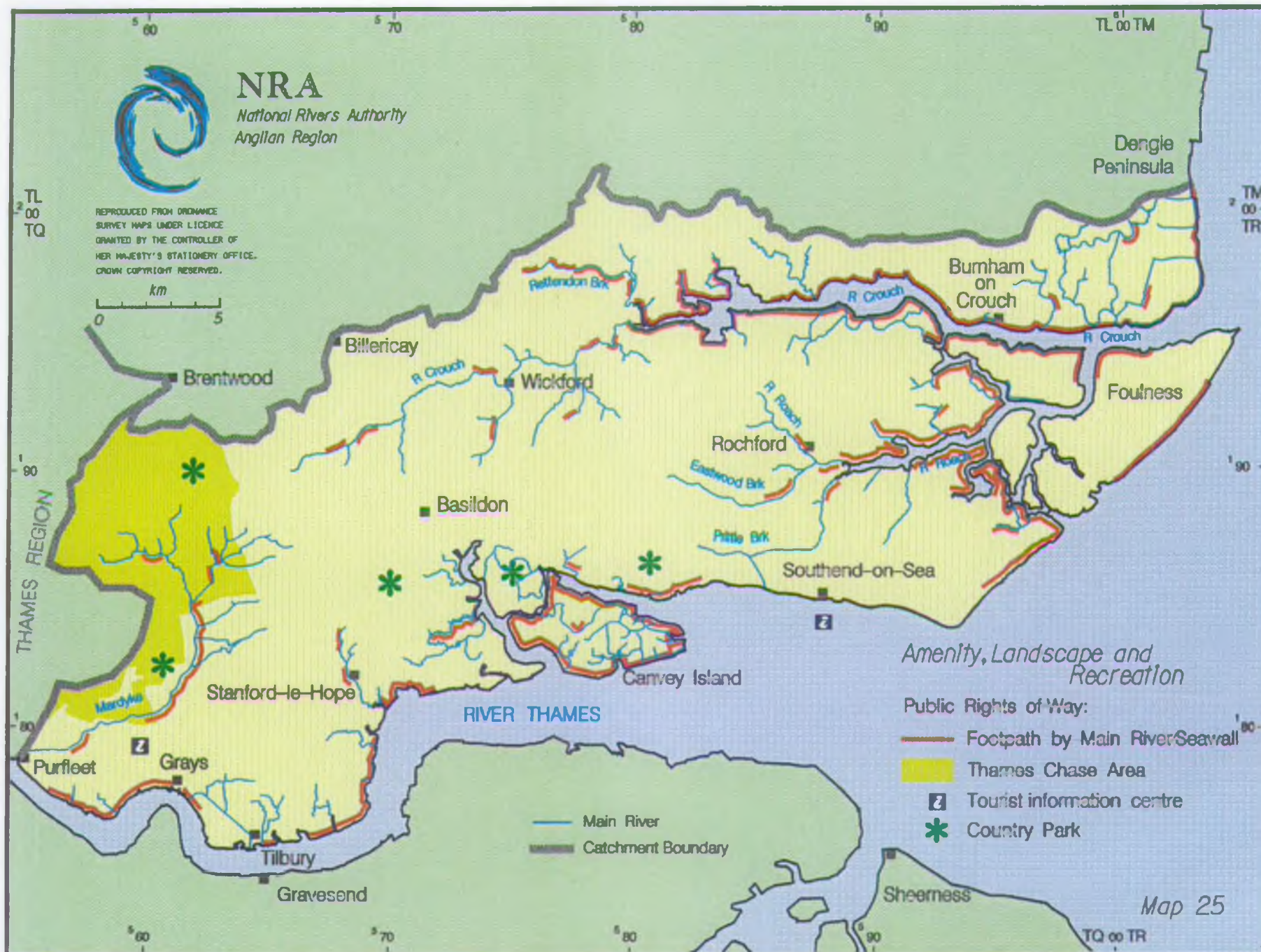
Although the popular coastal bathing beaches in the catchment do not fall within the jurisdiction of this plan, it is felt they should be mentioned. There are three EC



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*Amenity, Landscape and
Recreation*

Public Rights of Way:

— Footpath by Main River/Seawall

Thames Chase Area

Z Tourist information centre

* Country Park

— Main River
— Catchment Boundary

Map 25



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Dengie
Peninsula

Foulness

Water Contact Sports

E.C. designated
bathing water

Water skiing

Dinghy sailing

Windsurfing

Jet skiing

— Main River
 Catchment boundary

Main River

Catchment boundary

Southend-on-Sea
Thorpe Bay

Shoebury East

Westcliff Bay

Westcliff Bay

Stanford-le-Hope

Canvey Island

RIVER THAMES

Washburn



Grays

History

Gravesend

Sheerness

Map 26

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designated bathing waters:- Westcliff-on-Sea, Thorpe Bay, and Shoebury East, all in the Southend-on-Sea area. Water quality is monitored throughout the bathing season for compliance with EC standards. The bathing water in Thorpe Bay was the only one of these that failed to reach the EC standard of 95% compliance in 1994, it passed on 90% of the surveys. This was the first time since 1991 that the water from any of the three beaches had failed to comply.

A wide range of other water contact sports is enjoyed in the marine and estuarine waters of this catchment. There is little opportunity for increased recreational use in the upper section of the Crouch estuary which is heavily congested with water craft. At Marsh Farm, South Woodham Ferrers, is the base of the largest water ski and power boat club in the country. Two other sites have been designated as water ski stretches in the Crouch estuary. The other designated water ski sites are Marsh End Sand, Hadleigh Ray, and Holehaven Creek to the east, north, and west of Canvey Island respectively. Two areas are designated for personal water craft (jetskis) use, Fobbing Creek and off Camper Road, Southend-on-Sea.

Dinghy sailing takes place in the lower Crouch (from Battlesbridge to the coast), lower Roach estuary, Southend-on-Sea, Stanford Marshes, and Benfleet Creek north of Canvey Island. Windsurfing has increased in popularity over the last 10 years and is competing for popularity with dinghy sailing. Windsurfing is practised at Burnham-on-Crouch, Southend-on-Sea, and Canvey Island. The foreshore at Southend is zoned for individual sports to minimise conflicts that may arise, especially between bathers and other users.

3.19.2.2 Inland

Several inland facilities exist for water sport recreation in the South Essex catchment. Personal water craft facilities exist at Basildon on Aquatels Lake. Lake Meadows, Northland Park, Basildon and Bushey Pit Lake, West Thurrock all allow boating activities. Grangewaters Water Sports Centre at Ockendon offers a wide range of water sports, while water skiing and SCUBA diving facilities are provided at the Lakeside complex at Thurrock.

3.19.3 **Objectives**

Water Quality

- Whilst the NRA has no statutory powers in respect of non-designated bathing waters and waters used for other immersion activities, it will endeavour to maintain or improve water quality to meet future quality objectives when they have been nationally derived.

3.20 Navigation - Recreation

3.20.1 **General**

Popular coastal and estuarial sailing opportunities exist in this catchment with over 5,750 moorings present in south Essex. The county has 17,300 participating members of sailing clubs that are affiliated to the 84 sailing clubs in the area. However, members only account for 21% of all sailing, motor sports and windsurfing participants according to the Essex County Council's survey in 1988.

Participation is therefore not often indicative or associated with the governing bodies of the sport.

3.20.2 Local Perspective (Refer to Map 27)

3.20.2.1 Inland

In general none of the rivers is suitable for sailing upstream of their tidal limits.

3.20.2.2 Coast and Estuaries

The coast of Essex is used extensively for a variety of recreational pursuits. The estuaries in the catchment are all used heavily for sailing purposes and are second only to the Solent area in their national importance. Dinghies and cruisers of all kinds are raced and cruised in all the estuaries. The area is also the scene for a number of national and international sailing events.

Yachting is the major recreational use of the Crouch estuary and the town of Burnham-on-Crouch remains one of the foremost sailing centres in the United Kingdom with its clubs, boatyards, marina and ancillary services. Southend-on-Sea is also recognised as one of the main yachting centres within the area.

Moorings in the area are administered by a number of organisations including Essex County Council, the District Councils, the harbour authorities, and the remaining moorings are private/freehold. The private moorings are administered by Sailing Clubs and other independent organisations. The location and number of moorings are highlighted in Table 1.

There are four marinas in this catchment, and from a survey undertaken by the Crouch Harbour Authority for the four marinas in the Crouch/Roach area there is spare capacity for additional boats at these sites.

Table 1

Moorings Areas in the South Essex Catchment

Location	Number
Burnham-on-Crouch	776
Bridgemarsh	110
North Fambridge	245
South Woodham Ferrers	45
Battlesbridge	18
Brandy Hole	251
Essex Marina	304
Paglesham	120
Potton Island area	125
Monkton	12
Southend-on-sea	250
Canvey Island	80

Source: Crouch Harbour Authority & Yacht Clubs



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As a general rule there are two types of moorings. "Swing moorings" are those out in estuaries requiring the use of tenders or launches to reach the boat and 'mud moorings' whereby boats are stranded at low tide in the estuary or on the shoreline. Berths are more applicable to purpose-built marinas (for example floating pontoons and stagings) and bank-side moorings.

A combined effort from all interested parties is required in the future to protect and develop leisure, sport and countryside activities. If demand for recreational activities is to grow within the catchment in the future it must be efficiently managed to protect the conservation and wildlife areas.

3.21 Communication and Transportation

3.21.1 General

This catchment area is strategically important in terms of its use for communication and transportation. Promotion of the Government's initiative "Thames Gateway" (formerly the "East Thames Corridor"), will intensify communication and transportation systems. These uses can be broadly split into the following categories:-

- Roads
- Railways
- Shipping
- Aviation
- Power Transmission
- Telecommunications
- Pipe networks

3.21.2 Local Perspective (Refer to Map 28)

3.21.2.1 Roads

There is an intensive network of roads within this catchment. These serve the large local population and form a national transportation system linking London and the south-east to East Anglia (A12), the Midlands (M11 / A14) and the North-East (A1). Within the catchment the most significant primary roads are:-

- M25 motorway from Upminster to the River Thames Crossing at Thurrock.
- A13 road from Purfleet to Southend.
- A127 trunk road from Upminster to Southend.
- A130 road from Rettendon to Canvey Island.

Designs for the widening of the M25, for improvements to the A13, and A130, and for the option of a lower Thames crossing will, if undertaken, require significant NRA input to ensure the water environment is adequately protected, and enhanced wherever possible.



Roads are generally impermeable and their surface water run-off is greater than that occurring from natural earth. Excess water causes flooding, particularly in upland areas where watercourses are small. Pollution from spillage and accidents can wash into roadside ditches and enter rivers and the aquifer. Siltation of adjacent watercourses sometimes occurs from fine road deposits being washed off the highway. Where new routes will cross contaminated land, pollution can be caused if the contaminants are disturbed; this might be by excavation or by de-watering. In the planning consultation process, the NRA analyses these problems and risks, and advises on measures to avoid damage to the water environment.

Where culverts or bridges are required to permit overcrossing of watercourses, and where structures such as highway drainage outfalls need to be built in watercourses, the developer or highway authority has to obtain statutory consents from the NRA. A consent will only be granted following an examination of ability to pass flood flows, the adequacy of pollution control measures, and environmental suitability. Consents are additionally required for works on, and adjacent to tidal and freshwater flood defences.

3.21.2.2 Railways

The main line is the London Liverpool Street to Norwich route which passes along the catchment's north-west boundary. This is a main regional route carrying freight and passengers to and from London. Significant numbers of daily commuters use this route which is serviced by further local lines running to Southend and Southminster. Additional commuter lines run between Shoeburyness and London Fenchurch Street, from Tilbury and Purfleet. Though freight use has significantly declined in recent years, several Thames-side oil refineries and power stations, together with many chemical works and local industries still have links to the rail network. The London Underground network and the Docklands Light Railway serve part of the catchment's commuter needs, but their eastern limits fall outside the area of this plan at Upminster and Beckton respectively.

The most challenging development in railway transportation will be the high speed rail link from Dover and the Continent to London St. Pancras. This is planned to emerge from a Thames tunnel just upstream of Grays, pass beneath the northern approaches of the Thurrock Bridge, before entering a tunnel and passing Purfleet then running eastwards to its London Terminal. The commercial success of this enterprise might produce further railway investment, with Stratford (just out of this plan area to the west) being a possible freight and passenger terminal; however this would require significant future private investment. Such an enterprise will significantly boost the catchment opportunities identified in the "Thames Gateway" strategy.

The NRA monitors plans for railway construction because ground disturbance and de-watering can cause migration of leachate from contaminated land into the aquifer. Watercourse bridges and culverts need to be of adequate flood carrying capacity, and where routes undercross or overcross tidal and freshwater flood defences, the standard of these must not be reduced; NRA statutory consent is required in these instances. In the operation of railway systems the NRA seeks adequate precautions to be taken with the use of trackside herbicides and pesticides, because there is a potential for the trackside drainage systems to pollute adjacent watercourses and the aquifer.

3.21.2.3 Shipping

Along the Thames-side frontage between Purfleet and Grays there are many working wharves importing and exporting a variety of commodities.

The main catchment port of Tilbury was operated by the Port of London Authority, though after a management buyout in 1992, it is now run a private sector operation. The first dock was built privately and opened in 1886 and was successively enlarged to accommodate larger international tonnages. Whilst the old up-river Port of London and its associated riverside wharves became increasingly uneconomic to manage, Tilbury grew and prospered. Major imports and exports are grain, cars, timber, paper, cement, frozen foods, news print, and scrap metal. At Tilbury there is also an international passenger cruise terminal.

At Mucking there is a significant import of London household refuse which is brought to the site in barges, unloaded by crane and used as landfill on the large adjacent licensed site. Also at East Tilbury, coal is imported to the adjacent power station.

On the north bank of the River Thames at Shellhaven, Thames Haven, Coryton and Canvey Island are significant oil and petroleum refineries, processing plants and storage depots. Ocean going tankers regularly service the various companies on this stretch of frontage. Until the early 1990s, bulk methane was delivered regularly to the British Gas terminal on Canvey Island but this shipping has now ceased.

Other significant coastal and estuary areas with shipping interests are Rochford (animal food-stuffs), and Wallasea (timber).

In the medium term no significant increase in shipping use is foreseen within the catchment. However, there remains a significant spare capacity at Tilbury's London

International Cruise Terminal to handle passenger traffic.

In 1995 the Department of Transport published *"Coastal Superquarries: Options for Wharf Facilities on the Lower Thames"*. This feasibility report lists a possible network of deepwater wharves on the Thames Estuary which could, with investment and new road and rail infrastructure, allow large scale import of aggregates from north-west European superquarries. Sites at West Thurrock, Grays, Tilbury, Shellhaven and Canvey Island, within this plan area, are amongst those identified as worthy of further study. In the long term this potential shipping terminal use, together with its associated transport infrastructure, could greatly expand the shipping activity serving the catchment.

Docks, wharves and jetties should be designed either to avoid damaging existing flood defences or to incorporate new flood walls and maintain continuity of any existing defence. Wherever possible, jetties should cross over flood defences to avoid the need for new flood gates because these are both a maintenance and operational liability. Handling materials and oils adjacent to water inevitably leads to occasional spillage and pollution. Adequate contingency plans should be available to enable swift, effective pollution control measures to be taken; the NRA also has staff and equipment to assist on such occasions. Shipping movements

cause water turbulence and wave wash; these can lead to erosion of the foreshore and to damage of the facework of tidal defences. The NRA seeks anti-scour protection where new works may endanger its flood defences.

3.21.2.4 Aviation

The only airport in this plan area is Southend-on-Sea which has services to the Channel Islands: significant numbers of light aircraft also use the facilities there.

The three London Airports of Stansted, Heathrow and Gatwick bring prosperity to the catchment by providing excellent services for passengers and significant import / export services. Some ten miles to the west of the catchment boundary lies London City Airport in the heart of the former dockland. Use of this new facility grows annually and may assist the future economic development of adjacent areas.

In the late 1960s plans were proposed for an international airport on the Maplin Sands off Foulness; this was dropped for both economic and environmental reasons: such a scheme would have had a very significant impact on the catchment. Although speculation remains about the option of a fourth London Airport, and a fifth terminal at Heathrow, little significant increase in aviation related use is foreseen within the catchment.

In the construction of new airports, the NRA would ensure that the surface water run-off are adequately attenuated to avoid sudden high discharges to adjacent watercourses, and adequate precautions would need to be taken when disturbing contaminated land. Airports store oils and aviation fuel, and occasional spillage does occur. Adequate oil interception facilities should be provided to isolate spillage before pollution occurs to either watercourses or the aquifer. Though not a problem at Southend airport, de-icing fluid used on planes and runways is a concern to the NRA since this might pollute watercourses and the aquifer.

3.21.2.5 Power Transmission

Due to the large population and the nature of the industrialised Thames-side frontage, significant overhead power distribution is clearly evident. At East Tilbury power is generated at a coal fired unit. Until December 1994 a further coal fired unit operated at West Thurrock. Overhead distribution is by means of 400kv power lines which feed the National Grid: lower voltage distribution networks feed this power across the catchment. There is also an extensive network of underground oil filled high voltage cables transferring electricity across the catchment area. These do on occasion cause pollution due to breakdown or accidental fracture. The NRA is consulted on transmission proposals and its main concern is that construction does not cause pollution by disturbing contaminated land. In addition the NRA seeks to ensure that overhead cables give adequate clearance to permit undercrossing by its heavy engineering plant, and that underground cables are waymarked and designed to take heavy plant loads where there is a need to pass in order to undertake statutory duties. The NRA is also concerned about the impact on landscape and the environment of pylons and cables in, and close to, conservation areas.

Just to the north of the catchment at Bradwell Waterside is the only nuclear power station in Essex; this feeds into the national grid, together with London's power

plants to the west of the catchment boundary.

3.21.2.6 Telecommunications

With the proximity of London, and significant catchment need, telecommunications form an essential part of modern society. Major underground networks and overhead microwave transmissions serve the local, national and international needs of the catchment. The most recent advance in this area is the new network of fibre optic cables which is being installed to bring cable television and global information systems. This new network will offer innovative and enhanced communication opportunities which cannot be provided by the traditional cable systems.

If underground cables are to cross contaminated land, the NRA seeks to ensure that leachate does not escape and cause pollution of watercourses and the aquifer. To avoid damage by NRA construction or maintenance plant, adequate cover should be provided where underground services cross rivers and flood defences: statutory NRA consent is required for such crossings. Where cables cross the NRA's access routes, adequate headroom is required for safe passage of engineering plant, and underground cables should be waymarked and be of adequate strength to permit passage.

3.21.2.7 Pipe Networks

Though rarely visible, the catchment is laced with many networks of pipes supplying local and national needs. The most obvious of these are the local distribution systems for gas, public water supply and sewerage. However, nationally important networks do supply and convey such diverse commodities as bulk natural gas from the North Sea, aviation fuels, natural mineral oils, powders and clay slurries: some of these pipelines are hundreds of miles long.

Where underground services cross rivers and tidal defences, they should be waymarked and be of adequate strength to permit the passage of NRA heavy plant. All such crossings require statutory NRA consent. During construction, disturbance of contaminated ground must be controlled to avoid leachate being discharged to watercourses or the aquifer. Occasional fracture of pipelines can cause serious pollution incidents. The networks should have monitoring systems to immediately shut down pumps in the event of pressure loss, and where serious pollution could occur, the operator should have an emergency plan available to set in motion to minimise damaging environmental impacts.

3.21.3 **Objectives**

The NRA will seek to ensure that in the construction and operation of communication and transportation systems :-

- adequate measures are taken to prevent pollution of ground and surface waters.
- no detriment is caused to existing flood defence systems, and new infrastructure must be adequately protected against flooding.
- minimal environmental damage is incurred and compensatory environmental works and enhancements are undertaken.

- fisheries and angling interests are adequately protected.
- the ability of the NRA to undertake its statutory duties is not impeded.

4.0 CATCHMENT TARGETS

4.1 Catchment Targets - Water Quality

4.1.1 General

This section considers the overall quality requirements of the catchment.

The National Aim for water quality is to:

- Achieve a continuing improvement in the quality of controlled waters, through the control of pollution.

Water quality in the Anglian Region is assessed using the following criteria:

- Compliance with relevant EC Directives (including related Statutory Water Quality Objectives where these have been issued).
- Compliance with River Ecosystem (RE) Targets.
- Compliance with non-statutory Regional Water Quality Objectives.
- Biological target classes.
- Coastal and Estuarine Working Party (CEWP) target classes for saline waters

4.1.2 EC Directives

EC Directives set standards for relevant parameters which the Directives seek to control. All of the standards apply to UK waters. Some of the Directives' standards have already been formally incorporated into UK law via Statutory Instruments and Statutory Water Quality Objectives (Surface Water Abstraction, List I Dangerous Substances and Bathing Waters). There are plans to incorporate the remaining Directives in the future. In the meantime, the NRA regards all Directives' standards as targets that must be complied with.

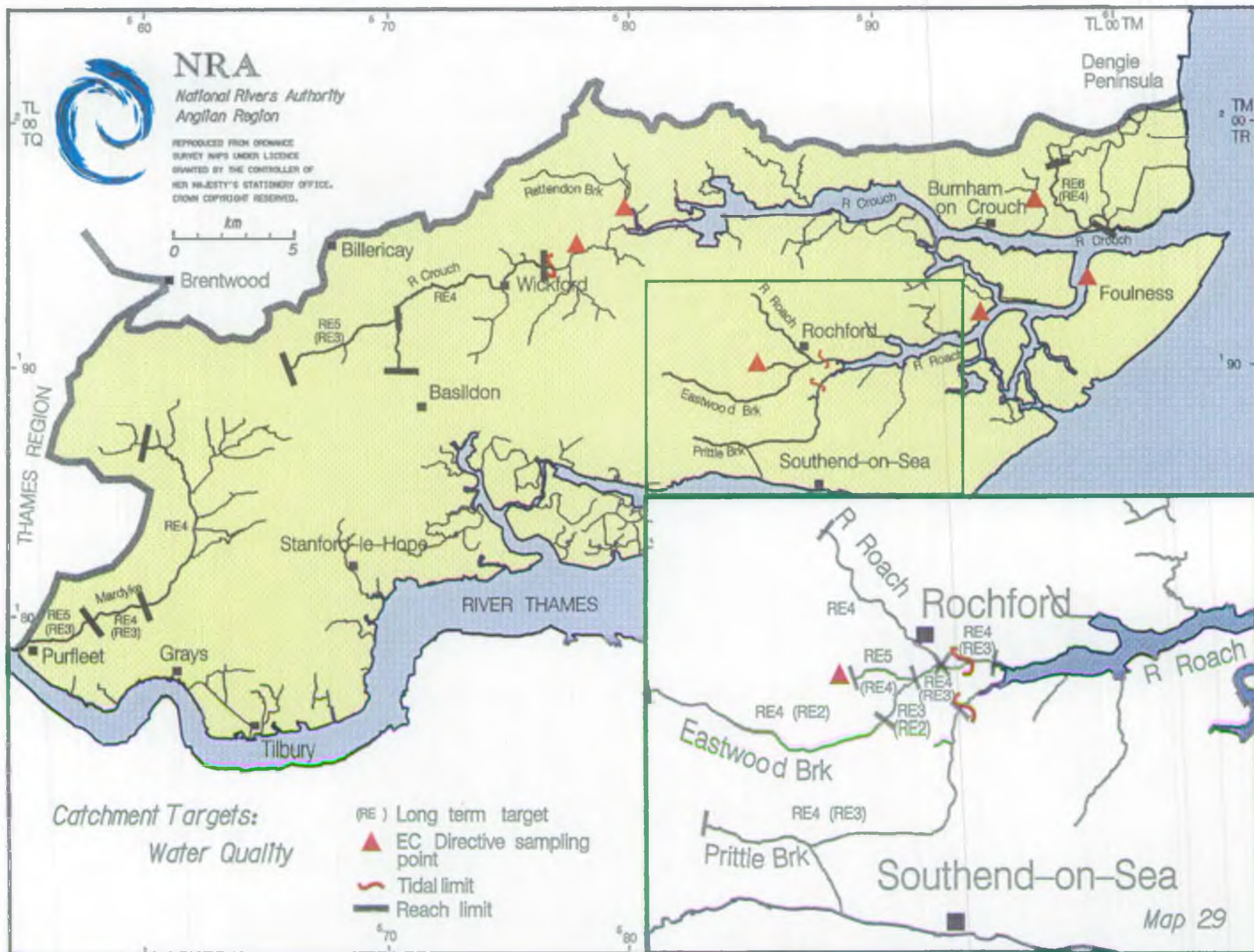
Appendix V lists relevant EC Directives.

4.1.3 River Quality Objectives (Refer to Map 29)

In order to ensure that water quality is maintained, and where necessary improved, the Department of the Environment has published proposals for a statutory scheme of Water Quality Objectives (WQOs), *River Quality: The Government's Proposals*.

The proposed scheme is based on the recognised use to which a river stretch may be put. These include:

- River Ecosystem
- Special Ecosystem



- Abstraction for Potable Supply
- Agricultural/Industrial Abstraction
- Water Sports

The standards defining the five tiered River Ecosystem use classes (RECs), which address the chemical quality requirements of different types of aquatic ecosystems, were introduced by the *Surface Waters (River Ecosystem) (Classification) Regulations 1994*. The criteria used in the RE classes are shown in Appendix IX.

Although the RECs do not refer to fish, the following descriptions may be helpful to gauge target water quality:

RE1	Water of very good quality suitable for all fish species
RE2	Water of good quality suitable for all fish species
RE3	Water of fair quality suitable for high class coarse fish populations
RE4	Water of fair quality suitable for coarse fish populations
RE5	Water of poor quality which is likely to limit coarse fish populations

Standards for the remaining uses are still under development.

For the non-tidal rivers in this plan RE targets are being used alongside EC Directives and, for components of the DoE scheme which are still under development, non-statutory Regional WQOs. For each stretch of river, a target RE class has been assigned. The targets have been derived by translating existing WQOs, and have taken into account planned investment in the catchment. These targets are considered achievable in the short to medium term (up to ten years).

Until WQOs are formally established by legal Notice served by the Secretary of State, they will be applied on a non-statutory basis.

For the estuaries, locally derived CEWP criteria (Appendix XI) and relevant EC Directives have been used as targets.

4.1.4 Biological Target Classes

Biological classification, by reference to the presence and abundance of species, complements the analysis carried out for some chemical parameters as an indication of water quality. Biological sampling may identify a past pollution incident which a spot chemical sample could fail to pick up provides an alternative indication of water quality to sampling and analysis for some chemical parameters. Biological sampling is undertaken regularly at 23 points on rivers throughout the catchment and the results are assessed against a prediction for the particular watercourse, see Appendix XII.

4.2 Catchment Targets - Water Quantity

4.2.1 General

This section considers the requirement to manage water resources, where possible, in such a way as to meet all reasonable demands, including those of the

environment, having due regard to overall costs.

Resource management is especially important in this catchment due to the high water demand and low resource availability. Management is achieved through the NRA's statutory duties:-

- To manage water resources to achieve the right balance between the needs of the environment and those of the abstractors.
- To ensure the proper use of water.
- To conserve water resources.
- To augment and/or redistribute water resources, where appropriate to meet water demands to appropriate standards of reliability.

The document *Water Resources in Anglia*, issued in September 1994, outlines the Region's water resources strategy over the next 30 years for providing secure water supplies and a better water environment.

The key options relevant to this catchment for meeting demands are:

- demand management
- the re-use of sewage treatment effluents in the adjacent Chelmer catchment providing the opportunity for reutilisation of existing resources.
- transferring more water from the north (via enhancements to the Ely Ouse) to the Essex Transfer Scheme for subsequent storage and distribution within the Essex area. This could be achieved either by -

Creating a new reservoir as part of enhancements to the Ely Ouse to Essex Transfer Scheme (the siting, sizing and timing of which are yet to be determined), or,

Making more water available for transfer into the catchment by reducing the minimal residual flow of the Ely Ouse at Denver in Norfolk for subsequent transfer to Essex via the Ely Ouse to Essex Transfer Scheme.

These options are currently under consideration and any outcome will have an effect on the future allocation and management of water resources in this catchment.

The future targets for this region and this catchment have been listed for each duty along with studies currently in hand.

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

NRA Anglian Region is actively reviewing the methodology used for the allocation of water resources between human and environmental uses. In addition, resource calculations are reviewed regularly. This provides the basis upon which licensing

policies are determined within the Region.

The NRA is progressing several studies to identify methodologies for evaluating River Flow Objectives (RFOs). Some of which may be applicable to the Mardyke, and other rivers in the catchment where flows are perceived to be inadequate. The objective of these studies is to define target flow regimes (not just the lowest) to which water resource management would aim, in order to meet defined environmental objectives.

The means by which the NRA will be better able to protect wetlands is currently being investigated by two Regional collaborative projects. This will provide a better understanding of the hydrology and ecology of wetlands. The studies *The Protection of East Anglian Wetlands* and *Hydrological Monitoring of Wetlands* are aimed at providing a general methodology for the protection of wetlands. However, it is recognised that there will still be a need for more site specific investigations where an individual wetland's hydrology is of particular concern. Meanwhile licensing procedures have been revised adopting the precautionary approach to assessing the impact of proposed abstractions on wetlands where there is limited or insufficient knowledge.

As demand continues to rise, plans are established for optimum water resource development. These are produced in collaboration with others; essentially water companies, abstractors of significant quantities and conservation bodies, etc. Groundwater simulation models are useful management tools for the allocation of water resources and could be used to simulate groundwater levels and impacts within the area based on various abstraction regimes at a variety of locations. Currently no such model exists for this catchment. Furthermore, justifying the need for the development of such a model may not at present prove cost effective as resources are fully committed with the exception of small local development opportunities in the Gravels. Modelling will not change this.

The NRA reviews and updates the Ely Ouse to Essex Flow Simulation Model. A review of Naturalised Flows, (ie. the flow that occurs naturally before either abstraction from or effluent discharge to the system) has recently been carried out to better assess yield potential and used to evaluate development options identified in the Regional Water Resources Strategy. This is fundamental as much of the water supplied to this catchment for meeting public water supply needs is routed through the Ely Ouse to Essex Transfer system. The transfer scheme supports the Essex reservoirs at Abberton and Hanningfield located to the north of the catchment for subsequent distribution in this catchment.

This model is used to simulate flow conditions in the Region's largest river to river transfer system. The transfer system is used to export water from Norfolk which would otherwise be lost to tide, via a network of rivers and tunnels to reservoirs located in Essex. These schemes are, and will continue to be, designed and operated to avoid their having any unacceptable environmental effects on receiving watercourses, and on the legitimate uses of the watercourse. An eighteen month study is currently under way to assess the existing impact of the Ely Ouse to Essex Transfer Scheme; this will identify the baseline conditions against which future enhancements can be assessed. In addition Essex and Suffolk Water are in discussion with the NRA with a view to reviewing, and carrying out further modelling of the Ely Ouse to Essex Transfer Scheme.

4.2.3 To ensure the proper use of water resources.

The NRA will give prior (and equal) priority to existing protected rights to abstract and to establish environmental needs before allocating any further water for abstraction. It is NRA policy not to allocate resources to abstraction in excess of the renewable resource.

The NRA must decide on whether the future requirement for water meets "reasonable needs". The consideration of alternative supplies or demand management must be shown as well as consideration of recycling. In areas where water resources are shown to be over exploited and/or affecting existing user rights, including the water environment, licence revocation will be considered.

Specific requirements according to each use, are as follows:

Public Water Supply

The planning horizon for the allocation of licences is currently the year 2021. It is not considered reasonable at this time to allocate additional water for needs beyond this.

The water companies must have demonstrated that they have carried out effective demand management, controlled leakage, and where water resources are under stress, at least considered metering of domestic use before extra water resources are allocated.

Spray Irrigation and Agriculture

The requirements of water needed with respect to the type of crops, soil conditions, stock types and numbers are taken into account.

Industrial

The industrial process is considered as well as the expected life of the plant along with consideration of water efficient appliances, the quality of water required and the possibilities for recycling.

4.2.4 To conserve water resources.

The NRA encourages the use of winter fill storage of surface water in farm reservoirs for subsequent use during the growing season.

Efficient water use is encouraged and where possible re-use promoted for purposes appropriate to the quality of the resource.

The 1988 - 1992 drought and the recent drought during the summer of 1995 has served to develop better practice of water resource management both by the NRA and abstractors. The promotion of efficient water use will continue in the future.

A future target for the whole of the NRA is to seek to revoke unused licences and to reduce under-used ones.

The NRA will set discharge consents appropriate to anticipated future flow regimes, rather than historic flow regimes.

There are benefits to water resources (ie the impact of abstraction upon river flows can be minimised) if discharge of water is made within the catchment as far upstream as possible. Water quality objectives however, will need to be satisfied.

4.2.5 To augment and/or redistribute water resources, where appropriate to meet water demands to appropriate standards of reliability.

The NRA already owns and operates a comprehensive raw water transfer scheme which indirectly supports a significant amount of demand in this catchment. River to river and/or groundwater to river support schemes will continue to be considered as a development option for meeting future demands and figures dominantly in the regional water resources strategy as an option for meeting future demands in the catchment.

Future abstractions likely to cause unacceptable effects on river flows or levels will not be authorised without appropriate river support or associated ameliorative works.

4.3 Catchment Targets - Flood Defence and Physical Features

4.3.1 General

This section relates to the need to maintain and develop the natural physical features of the catchment.

The NRA's flood defence aim is to provide effective defence for people and property against the risk of flooding from rivers and the sea and to provide adequate arrangements for flood forecasting and warning.

The targets in relation to physical features of this catchment therefore take into consideration both the NRA's statutory obligation to protect and enhance the geological and physiographic features and its aim to provide effective defence for people and property against the risk of flooding.

4.3.2 Target Standards of Service for Flood Defence.

Flood defence levels of service are well established and minimum standards of flood protection adopted by the Anglian Region are shown in Appendix VI. The standards applied are related to land use and need to be shown to be economically viable, technically sound and environmentally acceptable. A major part of the funding towards flood defence work is via MAFF grant in aid (65% in Essex). All new proposals need to meet the criteria laid down in MAFF's *Project Appraisal Guidance Notes* (PAGN) which works upwards from a "do nothing" option to the option which gives the maximum benefit : cost ratio. This may be below or above the minimum target standard. A Standards of Service exercise is being undertaken to determine the existing standard of service afforded by the flood defences within the catchment.

4.3.3 Infrastructure and Information

4.3.3.1 Essex Sea Walls Management Strategy

In 1990 the NRA produced a strategy for the Essex Rural Sea Walls which assessed the existing standard of some of the defences and considered the economic viability of sustaining or improving walls under MAFF rules.

The NRA is now building on the first plan with a view to developing a strategic plan for the future management of all the sea and estuarine defences under its control in Essex. The output from this strategy study will draw on existing information and will ensure that:

- An integrated management plan is developed which incorporates sound environmental principles.
- Broad opportunities for the conservation and enhancement of landscape, amenity and natural resources are identified.
- Future schemes are based on an understanding of natural processes and, as far as possible, work with these processes as identified in the Shoreline Management Plan.
- Chosen defence options are sustainable.
- There is a rational and realistic basis for the planning and prioritisation of future works.

4.3.3.2 Shoreline Management Plan (SMP)

A Shoreline Management Plan for the Essex frontage is also being produced and will in particular draw together information about natural processes, condition surveys and other available data related to existing defences. This information is integral to and will be fed into the overall *Essex Sea Walls Management Strategy*.

SMP's are promoted by MAFF to provide a sustainable strategy for managing the coastline. The plan includes NRA sea defence frontages and District Council coastal defences. The Essex Plan is being project managed by Tendring District Council, but addresses the need of NRA, Southend Borough Council, Thurrock District Council, Southend District Council, Maldon District Council, Colchester Borough Council. The sediment cells and sub-cells that define the geographic limits of the SMPs are not necessarily coincident with CMP boundaries.

The majority of the Essex Coast is eroding, and combined with secular sea level rise means that the sea walls are under pressure from eroding salting and foreshore loss. The plan identifies the coastal processes, land use and environmentally important sites and sets objectives to provide sustainable defence - Thameside is a major urban frontage and will require ongoing maintenance to provide protection to the urban infrastructure. Similarly, urban parts of the Crouch/Roach and high grade arable land will have to be protected into the next Century. However, to achieve a sustainable coast there may be a need to allow some areas of land to return to saltmarsh, where continued defence is uneconomic, and environmental

benefits could be achieved under a different management regime.

4.3.4 Development

To resist development in areas where the present flood protection standards would be inadequate for the proposal, and minimise the loss of flood plain including areas of conservation value.

4.3.5 Coastal and Estuarine

To participate in coastal zone management groups and continue an integrated approach to sea defence management, in particular:-

- Maintain existing flood defences to meet target standards of service where it is technically feasible, economically viable and environmentally acceptable.
- Utilise natural coastal processes.
- Maintain and enhance beach profiles and sea defences, where practicable.
- Ensure minimum disturbance to sensitive habitats during works, and identify opportunities to enhance conservation.
- Liaise with external organisations over protection of sensitive archaeological sites adjacent to NRA maintenance and minor capital works.
- Minimise saltmarsh loss and encourage growth where appropriate; and further the conservation of such sites.
- Further develop the recreational potential of coastal waters with improved liaison with appropriate organisations and water sport users.
- Incorporate, where possible, recreational facilities into programmes of flood defence works.
- Co-operate with other relevant authorities to enable marine bait digging to continue in ways which do not lead to conflict with other interests.

4.3.6 Non-Tidal Rivers

- Maintain the essential flood carrying capacity of river channels through regular maintenance (e.g. weed cutting and de-silting) while ensuring that practical physical features such as bankside trees and marginal vegetation are maintained by carrying out ecological surveys in advance of all maintenance work.
- Review the channel capacity of rivers in the catchment to assess the potential for incorporating features that can enhance the environmental value of the river.
- Identify areas where habitat enhancement would benefit fish populations and investigate how this can be carried out within existing economic constraints.

- Identify river stretches which could be conserved, enhanced or restored.
- Ensure as far as possible that river control structures, such as weirs and sluices, are operated in such a way as to minimise flooding and to maintain water levels appropriate for a diversity of users.
- Ensure, where practical, that the design and operation of river structures does not impede the passage of migratory fish species and takes account of the needs of all users.
- Minimise the loss of flood plain habitat of conservation value and look for opportunities to encourage landowners to put land adjacent to the river into one of the schemes promoted by the Countryside Commission or MAFF.
- Resist the connection of gravel pits and lakes to rivers if water quality problems could develop as a result.
- Explore with other agencies the potential for buffer zones.
- Liaise with external organisations over protection of sensitive archaeological sites adjacent to NRA maintenance and minor capital works.
- Balance and co-ordinate engineering and operational activities so that the successful pursuit of angling activities is not unnecessarily affected.
- Incorporate angling and fish habitat improvements into maintenance programmes, for example by the creation of new fish holding areas.
- Encourage the provision of access and other facilities for anglers, including the disabled, on both fresh and tidal waters. Preference will be given to those areas open to angling by all members of the public.

4.4 Catchment Targets - Fisheries

4.4.1 **Freshwater** (Refer to Map 30)

Catchment targets for freshwater fisheries revolve solely around stock levels in the rivers. This is because it is impractical for the NRA to set individual targets for the hundreds of still water fisheries which are known to occur, and because it is in any case more appropriate for targets on such waters to be set, if required, by the individuals or organisations responsible for their management.

For the rivers a local system of biomass target classes has been derived, against which the current status of the fisheries can be assessed. Surveys conducted every three years not only ensure that these assessments are as up to date as possible, but also provide new data which is used to refine and reinforce their validity.

The targets are founded on the assumption that all waters included in the fisheries survey programme are capable of supporting at least 5 gm⁻² of fish where physical conditions may be limiting, and at least 10 gm⁻² where no such limits are recognised. Thereafter, scope exists for setting increased targets where experience



has shown that greater stock levels have been sustained over a minimum seven year period, as represented by three consecutive surveys. The target classes thus provide both a minimum acceptable standard, and a means of ensuring that higher and regularly achieved standards are not allowed to erode unnoticed, through lack of an appropriate criterion.

All river lengths subject to fisheries survey are categorised into one of the three target classes. These are defined as follows:-

1) Waters where fish stocks may be subject to some physical habitat and/or flow limitation, and which have not reached a biomass of 10 gm^{-2} in three or more consecutive surveys since 1984; target biomass of at least 5 gm^{-2} . Class C.

2) Waters where fish stocks may be subject to some physical habitat and/or flow limitation, but which have reached a biomass of at least 10 gm^{-2} in three or more consecutive surveys since 1984;

or

Waters not subject to any known physical habitat or flow limitation, which have not reached a biomass of 20 gm^{-2} in three or more consecutive surveys since 1984; target biomass of at least 10 gm^{-2} . Class B.

3) All waters where fish stocks have reached a biomass of 20 gm^{-2} in three or more consecutive surveys since 1984; target biomass of at least 20 gm^{-2} . Class A.

Details of the target classes applicable within the plan area are shown on map 30. All these waters have been surveyed on at least three occasions, and consequently there are no limitations on the applicability of the target class system.

4.4.2 Commercial and Marine

The NRA (Anglian Region) has, at present, no direct involvement with commercial or marine fisheries work in tidal waters within this Catchment Area. This is due to the local excusal of eel fishing from licence duties, the absence of any byelaw constraints or regulations affecting eel fishing, and the illegality of taking salmon and migratory trout by any means other than rod and line.

Historically, this lack of involvement was justifiable in that returns from eel net licensing were low, whilst the fishery itself did not appear to impact on other areas of interest or to require regulation for its own protection. Furthermore, salmonid fish were so rarely if ever present that enforcement of the Byelaw prohibiting their capture by nets was not required.

With the recent recovery of smelt, bass and sole populations within the Thames Estuary and Tideway, it is becoming evident that more attention may need to be paid to the proper regulation of commercial and marine fisheries in order to protect valuable marine and estuarine stocks, as well as those of eels, salmon and sea trout.

The National Rivers Authority will therefore seek to use its fisheries powers, in cooperation with MAFF and the Kent and Essex Sea Fisheries Committee to obtain the best possible protection for fish stocks of all types, and will keep its Byelaws, activities and procedures under regular review to ensure that these objectives are achieved.

Responsibilities under the EC Shellfish Waters Directive 79/923/EEC are concerned with water quality rather than with the shellfish themselves, and are dealt with in section 4.1 above.

5.0 CATCHMENT ISSUES: IDENTIFICATION OF SHORTFALLS AND OPTIONS FOR REMEDIATION

5.1 Introduction

This section of the plan considers options to address catchment issues, and identified shortfalls. The options as presented are the initial thoughts of the Anglian Region of the NRA and do not constitute policy statements. It must be re-emphasised that at this stage, it is not the objective to present a detailed programme of action or to prioritise the issues and options identified. It is recognised that considerable consultation and negotiation will be necessary before an acceptable and practicable final report can be drawn up. This will be the next stage. Comments on the issues and options are therefore requested together with any new ideas/suggestions.

Wherever possible the body responsible for carrying out each option has been identified. In some cases this is identified as someone other than the NRA. However, the options as presented are intended as a plan to facilitate improvements to the water environment for the benefit of all users. Obviously this will entail many bodies and individuals working together to fulfil the aims and objectives as detailed in this Catchment Management Plan.

5.2 Water Quality (Refer to Map 31)

5.2.1 General

Having set water quality targets it is possible to assess the state of the catchment against the targets. Data from routine water sampling and biological surveys have been used to facilitate this comparison.

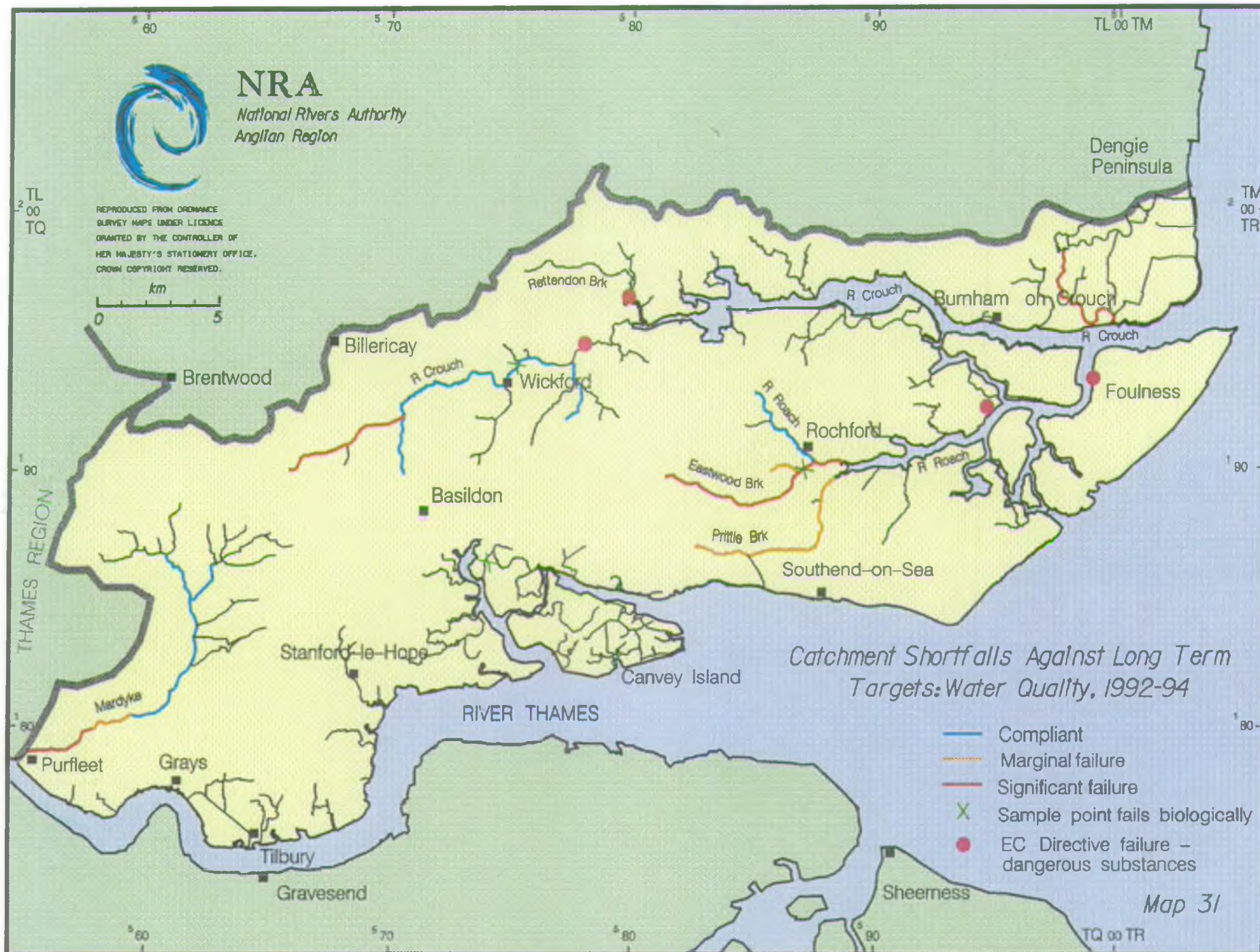
The map identifies failures to meet the use related targets, relevant EC Directives, River Ecosystem targets and biological targets.



NRA
National Rivers Authority
Anglian Region

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*Catchment Shortfalls Against Long Term
Targets: Water Quality, 1992-94*

- Compliant
- Marginal failure
- Significant failure
- X Sample point fails biologically
- EC Directive failure – dangerous substances

Map 31

5.2.2 Issues and Options

Issue No 1: Failure to meet River Ecosystem Class 3 for dissolved oxygen.
MARDYKE - STIFFORD BRIDGE - MARDYKE SLUICE

Depletion of dissolved oxygen may be due to a combination of sewage effluent, storm sewage discharges, excessive algae and/or macrophytes, agricultural sources, highway drainage and low flow conditions possibly exacerbated by surface water abstractions.

Options	Responsibility	Advantages	Disadvantages
1. Survey catchment to identify reasons	NRA	Identifies causes leading to remedial action	Cost-to-NRA Potential cost to polluters
2. River Flow Objectives to be assessed and maintained to take account of effluent dilution	NRA	Compliance with target levels	Cost to NRA
3. Study of flow regime related to the operation of the tidal sluice and local abstraction	NRA	May identify improvements to sluice operation and river management	Cost to NRA
4. Augment flow	NRA	Additional dilution of discharges and prevention of stagnation	Cost to NRA Possible increase in river salinity due to nature of groundwater augmentation source
5. Examine weed control techniques	NRA	Uncertain	Cost to NRA May need research
6. Evaluate highway run-off impact and undertake amelioration	NRA Highways Authority	Reduces polluted input	Cost to NRA and Highways Authority
7. Do nothing			Continued failure

Issue No 2: Failure to meet biological LQI target and achieve RIVPACS Class A or B.

MARDYKE - STIFFORD BRIDGE TO MARDYKE SLUICE
 OUTWOOD COMMON BROOK - Billericay to Crouch confluence
 RIVER CROUCH MEMORIAL PARK - WICKFORD
 PRITTLE BROOK - PRIORY PARK
 RAYLEIGH BROOK - upstream confluence with Eastwood Brook
 EASTWOOD BROOK - downstream confluence with Rayleigh Brook
 RIVER ROACH - ROCHFORD STATION

Thought to be due to a combination of factors including low dilution of sewage effluent, man-made watercourses, and surface water drainage from urban and industrial areas.

Options	Responsibility	Advantages	Disadvantages
1. Pollution prevention investigation	NRA AWS Estate owners Site occupants	Reduces pollution	Cost to NRA/AWS/Estate Owners Potential cost to polluters
2. Modifications to concrete channels	NRA Local Authority	Improves habitat and amenity	May not achieve objective Potential conflict with flood prevention Significant cost to NRA
3. Do nothing			Continued failure

Issue No 3: Occasional polluted conditions in the lower stretches of the River Crouch.
RIVER CROUCH - MEMORIAL PARK, WICKFORD

Due to discrete acute pollution incidents from industrial areas.

Options	Responsibility	Advantages	Disadvantages
1. Pollution prevention campaign within catchment	NRA	Reduces pollution	Cost to NRA Potential cost to polluters
2. Enhance public awareness by education using Pollution Prevention Guidelines and PR material	NRA	May reduce pollution	Cost to NRA
3. Do nothing			Continued failure

Issue No 4: Failure to meet River Ecosystem Class 3.
ROCHFORD RESERVOIR

Thought to be due to low dilution of sewage effluent, surface water drainage from industrial and urban areas and possible diffuse agricultural inputs.

Options	Responsibility	Advantages	Disadvantages
1. Pollution prevention investigation within industrial areas	NRA AWS Estate Owners	Reduces pollution	Cost to NRA/AWS Cost to potential polluters
2. Do nothing			Continued failure

Issue No 5: River fails to meet River Ecosystem Class 4.
GOLDSANDS BRIDGES BROOK - SOUTHMINSTER

Failure to meet both chemical and biological targets possibly due to low dilution of sewage effluent and/or agricultural drainage.

Options	Responsibility	Advantages	Disadvantages
1. River Flow Objective to be assessed and maintained to take account of effluent dilution	NRA	Compliance with target levels	Cost to NRA
2. Survey catchment to identify possible other causes	NRA	Identifies causes thus leading to remedial action	Cost to NRA Cost to potential polluters
3. Do nothing			Continued failure

Issue No 6: Concern over localised minor contamination of water in borrow ditches due to leachate generated from refuse incorporated in sea wall construction.

SOUTH FAMBRIDGE - SEA WALL BORROW DITCH
 DENGIE DEAL HALL - SEA WALL BORROW DITCH
 HADLEIGH MARSH - SEA WALL BORROW DITCH

Due to leachate generated from refuse incorporated in sea wall construction.

Options	Responsibility	Advantages	Disadvantages
1. Remove refuse from sea walls	NRA WRA	Eliminates short term problem and long term risk	Unlikely to qualify for grant aid Cost to NRA/WRA which may outweigh environmental benefit
2. Repair sea wall when leachate problems encountered	NRA ECC	Targets resources as appropriate	Does not remove long term risk especially in terms of major breach
3. Do nothing other than routine wall maintenance	NRA		Does not address problem

Issue No 7: Failure to meet biological LQI target and achieve RIVPACS Class A or B.

PITSEA HALL FLEET

Possibly due to polluting input but more likely due to unrealistic quality target in a marsh pond having little natural flow.

Options	Responsibility	Advantages	Disadvantages
1. Investigate catchment for quality of inputs to Fleet	NRA	Identifies problem areas	Cost to NRA
2. Review quality objectives	NRA	Identifies realistic quality target	None
3. Do nothing			Continued failure

Issue No 8: Concern over localised aesthetic and microbiological impact of Burnham STW.**LOWER CROUCH ESTUARY**

There is concern that the effluent discharge from Burnham STW, which contains bacteria and on occasion sewage derived litter, infringes on the extensive recreational use of the estuary at Burnham due to the location of the outfall within the moorings.

Options	Responsibility	Advantages	Disadvantages
1. Improve effluent from Burnham STW	AWS	Improves water quality in estuary	Cost to AWS; not supported by AMP2
2. Relocate effluent outfall	AWS	Improves dilution Protects amenity area	Cost to AWS Disruption to navigation/moorings
3. Do nothing			Does not improve quality of estuary

Issue No 9: Coastal and Estuarine Working Party Class B considered less than adequate for amenity and Shellfishery requirements.**ROACH ESTUARY****UPPER CROUCH ESTUARY**

Probably due to combination of factors including proportion of sewage effluent present, storm sewage overflows and drainage from industrial and urban areas.

Options	Responsibility	Advantages	Disadvantages
1. Improve effluent from Rochford, Rayleigh West, Woodham Ferrers and Wickford STWs	AWS	Improve water quality in estuary	Cost to AWS; not supported by AMP2
2. Pollution prevention investigation within industrial areas	NRA/AWS	Reduces pollution	Cost to NRA/AWS Potential cost to polluters
3. Study to assess trophic state of Estuaries	NRA	May lead to identification as a Eutrophic Sensitive Area	Cost to NRA Potential cost to AWS of nutrient removal required
4. Improve trade effluent control with respect to toxic substances	AWS/Industry	Reduces pollution	Cost to AWS/Industry
5. Undertake urban drainage study and implement control of polluting input	NRA/AWS	Identifies shortfalls in system and optimises solutions	Cost to NRA/AWS
6. Do nothing			Does not improve quality of estuary

Issue No 10: Concern over contamination in groundwater from Waste Disposal activity.**LINFORD PUBLIC WATER SUPPLY**

There is concern that nearby waste disposal activities may jeopardize the security of abstraction for public water supply borehole at Linford.

Options	Responsibility	Advantages	Disadvantages
1. Discussion with site operators and County Waste Regulation Authority leading to remedial measures	Site Operator WRA	Resolves problem	Cost to site operators
2. Consider prosecutions	NRA	May act as warning to others	Will not overcome concerns Cost
3. Investigation to clarify issues	NRA/WRA	Targets concern and remedy	Cost to NRA/WRA
4. Do nothing			Does not resolve the problems Loss of public water supply source

Issue No 11: Bacterial contamination of recreation water.

There is concern that the general public may not always appreciate the health risks associated with the presence of bacteria and viruses. With the exception of EC designated bathing waters, there are no microbiological standards for recreational water uses such as sailboarding, dinghy sailing, swimming, etc.

Options	Responsibility	Advantages	Disadvantages
1. Improve effluent in terms of micro-organism levels from appropriate sewage treatment works	AWS	Improve quality in affected waters	Cost to AWS
2. Erect signs identifying "high risk" areas	NRA Local Authority	Allows public to make personal decision	May unnecessarily raise public concern Bad image for AWS
3. Do nothing			Does not improve quality of affected waters

Issue No 12: Migration of leachate in gravels.**PITSEA WASTE DISPOSAL SITE**

There is known to be leachate contamination from the site into the underlying Thames ballast aquifer which extends beyond the site boundary. This has not been considered significant because of the natural saline contamination of this water, however, the contamination could cause a breach of the *EC Groundwater Directive*. should contamination extend beyond the site.

Options	Responsibility	Advantages	Disadvantages
1. Discussion with site operator and County Waste Regulation Authority leading to remedial measures	Site Operator WRA	Resolves problem	Cost to site operators
2. Consider prosecution	NRA	May act as warning to others	Will not overcome problem Drain on resources
3. Do nothing			Does not resolve the problem

Issue No 13: Oil Contamination in chalk groundwater.**WEST THURROCK / PURFLEET**

Historically there have been a number of chemical spillages mainly oil within this area which have resulted in localised contamination of the chalk aquifer which outcrops in this part of the catchment.

The degree and extent of this contamination requires further investigation.

There have been several schemes for recovery and bioremediation by the oil companies involved in the past.

Options	Responsibility	Advantages	Disadvantages
1. Detailed survey to establish extent and degree of contamination-modelling may be an option	NRA and Site owners	Better understanding of extent of problem	Timescale Costs may outweigh results/benefits of survey - outcome unlikely to identify additional resource availability for development
2. Do nothing			Continued lack of understanding full extent of contamination

**Issue No 14: Concern over the quality of discharges from
Surface Water Sewers on industrial estates.**

A frequent problem within the catchment is the discharge of contaminated surface water from multi-purpose industrial estates. The position is complicated as the sewerage system is often owned by absentee landlords and receives drainage from many individual premises. Much effort and time is spent tracing intermittent pollution on estates with many occupiers.

AWS have committed resources in their Strategic Business Plan to improve the quality of discharges from the surface water sewers owned by them at two sites in the Basildon area, namely Southfields, Laindon and Courtaulds Road Industrial Estates.

Options	Responsibility	Advantages	Disadvantages
1. Prosecution when sources are proven	NRA	May effect an improvement	Action is taken after pollution has occurred Difficulty often in tracing source
2. Diversion of risk areas to foul sewer when available	NRA AWS	Reduces pollution	Cost to dischargers
3. Install pollution reduction measures on sewerage systems	AWS Estate Owner	Reduces/prevents pollution	Cost to AWS or estate owner
4. Pollution prevention campaign	NRA AWS Estate Owner	May affect an improvement if problems located	Cost to NRA AWS & Estate owner

5.3 Water Quantity

5.3.1 General

Having set targets for water quantity the issues identified below detail where there is a current shortfall.

5.3.2 Issues and Options

Issue No 15: In River Needs are not quantified and Minimum Acceptable Flows are not defined for the catchment's rivers.

Ecological and hydrological studies are required to establish minimum acceptable water level, flow and quality (ie. in-river needs) required to maintain the ecosystem. This is also essential for quantifying environmental demands to be used in groundwater balances for assessing water resources.

Legislation allows for the NRA to recommend Minimum Acceptable Flows (MAFs) to the DoE for approval. However due to the inherent difficulties in defining a MAF, none has been set Regionally or Nationally. However in some parts of the Region Hands Off Flows (HOFs) have been set at a critical point in the river system. In essence these are similar to MAFs but without legal status and only used for river management to guide licensing decisions.

The NRA are now developing the concept of river flow objectives (RFOs) which concentrate on defining a target flow regime (not just the lowest) to which water resource management could aim, in order to meet defined environmental objectives.

Options	Responsibility	Advantages	Disadvantages
1. Carry out ecological and in-river needs studies	NRA	Enables better protection and understanding of river ecology Improved resource management Verification of water resources availability	Cost and timescale Reduction in current HOFs may impact on water quality Increase in current HOFs would impact on water resource availability
2. Await outcome of National R&D Study on defining MAFs and other river flow objective studies	NRA	Better understanding of in-river needs National standardised approach identified for setting MAFs	Timescale Local issues could be "masked" by National approach
3. Do nothing			Inability to assess adequately water resource availability Need to rely on existing HOFs which may not be inappropriate Actual minimum flows in some stretches may continue to be perceived as inadequate

Issue No 16: Low flows in the Mardyke are perceived to be inadequate to meet river needs.

It is considered that actual flows may at times be inadequate in the Mardyke. These effects, perhaps more marked in Anglian rivers where flows tend to be sluggish due to their relative flat terrain, may, in part at least relate to factors of channel geometry rather than flow alone. This can cause water to stagnate and undesirable weed growth to develop with subsequent implications on the river environment and its aesthetics. The whole of the Mardyke suffers from these problems. The recent drought, 1988-92, further highlighted these concerns. Until flow requirements are quantified (see Issue 15), the adequacy of flows will remain uncertain and subject to debate.

Options	Responsibility	Advantages	Disadvantages
1. Set river flow objectives (RFOs), HOFs or MAFs	NRA	Improved resource management Provides better understanding of in-river needs Confirm/identify stretches of river concerned	Cost of investigations No progress can be made until review complete Any reduction in present minimum flows would have serious implications on discharge consents and the water environment
2. In-river needs study to assess actual requirements	NRA	Needed for setting river flow objectives (HOFs or MAFs)	Cost of studies
3. River engineering works eg. sympathetic channel modifications	NRA	Opportunity to improve flow and depth characteristics	Cost Extent of opportunities unknown
4. Await the outcome existing studies aimed at defining river flow objectives (RFOs)	NRA	Better understanding of in-river needs Standardised approach	Timescale
5. Augment flows at times of need e.g. river support utilising rising groundwater	NRA	Increased flow Better use of water resources	Need to identify "target" flow first Cost of developing scheme Need for operating procedures
6. Do nothing			Low Flow perception likely to remain

Issue No 17: There is a lack of detailed understanding of the working of the Essex Chalk and superficial aquifers.

The hydrogeology of the catchment is complex and not fully understood. The majority of the chalk aquifer, except in the Thurrock and Tilbury area is confined by a thick layer of London Clay, which effectively restricts natural recharge to the aquifer. The water stored in this aquifer is met by underflow of surplus recharge from catchments to the north, which are unconfined, and by recharge to the south of the area in Tilbury and Thurrock. There is a lack of understanding of how much water moves through the aquifer by this process and what quantities are involved. This makes management of water resources in this catchment difficult.

Development of a computer based simulation model would provide a better assessment of how the aquifer "works" and so enable better water resource management. The model could also be used to predict responses to varying development/abstraction scenarios and refine water allocation estimates. A model is unlikely to identify an overall surplus of water for the catchment but could identify areas of local surplus in areas such as the superficial gravel aquifers. The benefit of developing such a model at this time may be outweighed by the cost.

Options	Responsibility	Advantages	Disadvantages
1. Detailed investigation and modelling of system	NRA	Better understanding of how catchment aquifers respond to water resource developments and WQ implications	Timescale Costs may outweigh results/benefits of study - outcome unlikely to identify additional resource availability for development
2. Do nothing			Continued lack of detailed understanding of aquifer systems and interactions Poor management of water resources preventing optimum water resource management and development

Issue No 18: Available water resources within the catchment are inadequate to meet present and future demands compared against current resource assessments.

Demands for water in the Anglian Region are rising. Demand for public water supply is assessed by reference to predicted changes in population and consumption habits as well as considering the potential for demand management practices such as leakage control and metering policies. Other demands such as associated with industrial and agricultural growth, are also allowed for.

Groundwater resources are fully committed to existing abstractions and any future increases will have to be met from outside the catchment. In the long term this is likely to be through enhancement to the Ely Ouse Essex Transfer Scheme, which transfers surplus water from Norfolk to Essex. Surface water is only available in winter when river flows are naturally higher.

Options	Responsibility	Advantages	Disadvantages
1. Implement development recommendations identified in Regional Water Resources Strategy (<i>Re stated below EOETS enhancements</i>)	NRA/ WCOs/ Developer	Comprehensive and coordinated development approach Multi-disciplinary approach	Timescale Costs
2. Encourage genuine on-farm winter fill storage reservoirs, for agricultural use	NRA/ Abstractors	Does not deplete resources Efficient utilisation of existing water resources Provides more reliable supply Possible amenity/recreation opportunities	Cost to abstractor Subject to planning control
3. Enhance the existing Ely Ouse to Essex Transfer Scheme increasing supply reliability and Essex reservoir yield as identified in Regional Water Resources Strategy (Development of this option is outwith this remit, though relevant for supply augmentation)	NRA/ Abstractors/ ESW	Limited to rivers receiving support Optimises use of existing scheme Meets predicted demands	Environmental impact in adjacent catchments uncertain Could derogate existing sources at times of low flow Limited yield Reliability Cost
4. Encourage more water efficient agricultural practices	NRA/ MAFF/ NFU/ Countryside Commission/ Farmers	Minimal cost to NRA Effective use of Government subsidies	Limited in effect May require change in agricultural practice Cost to farmers
5. Demand Management	NRA/WCO	Reduces demand and delays future development expenditure	Installation cost if by metering Impact on local users
6. Revocation of under-used and unused licences	NRA/ WCO	Potential for environmental improvement and increased river flows Encourages use of winter water in preference Possible improved effluent standards in watercourse	Compensation costs Possible implications for existing abstractors

Issue No 19: Catchment areas for wetland sites of conservation value need to be identified.

Wetland sites exist where the geomorphology, geology and land use allow a concentration of surface and groundwater flows and levels. The proportions of these contributing factors will vary for each site adding to the complexity of the study of wetlands. The area of groundwater contributing to the wetland site can be defined as the wetland catchment area and can be used to help assess where water resource activities may impact on wetland sites.

Options	Responsibility	Advantages	Disadvantages
1. Environmental studies at sites of particular concern	NRA WCOs Conservation bodies	Better hydrological understanding of wetland behaviour Provides effective protection to wetlands Improved management opportunities	Timescale and cost Possible lack of National consistency in approach Possible implications for existing abstractors
2. Await outcome of existing studies aimed at providing a general methodology for the protection of wetlands	NRA	Consistent approach Cheaper than site specific studies	May not be appropriate for local issues - site specific investigations may still be necessary
3. Use empirical assessments	NRA	Quick	Danger of inaccuracy Subjective

Issue No 20: Implications of the impact of gravel/mineral extraction on groundwater levels and river flows.

Sand and gravel aquifers provide a natural form of water storage available to rivers in the South Essex Catchment. They release water slowly and therefore help to maintain river flows. Gravel extraction in valley areas or hillsides, such as along the Roach, affect this storage, often reducing the amount of water available to support river flows during dry periods.

Mineral developments can also have an impact on groundwater levels, causing them to lower, due to de-watering or evaporation effects, or raise them due to infilling of excavations with low permeability materials. Again these effects will impact on natural flow directions as well as water features such as wells, boreholes, springs, streams and lakes. It is therefore important that the impact of such extractions are fully understood so that the NRA and Local Authorities can quantify the storage losses and request the implementation of remedial compensatory works.

Options	Responsibility	Advantages	Disadvantages
1. Review NRA policy	NRA	Could include measures to protect against potential interference to river flows	Time and cost If policy adopted, NRA may still have limited powers to implement or enforce views
2. Developer to carry out local investigations where necessary	NRA to advise developer to implement	Impact predictions made and remediation measures can be adopted	Additional resources to enforce conditions
3. Do nothing			Interference to flows remain at risk

Issue No 21: Potential threat of increased saline intrusion contaminating groundwater resources.

In the past, saline intrusion has occurred due to the excessive abstraction of water from the Chalk aquifer in coastal regions. Since this period many licences have been revoked, such as that for a public supply borehole at Oakwood, and the NRA has maintained a policy of not issuing licences whilst resources are assessed unavailable. Continuation of this policy is likely to contain the situation, however, if more abstraction were allowed, further saline water could be drawn into the aquifer causing extended aquifer contamination.

Options	Responsibility	Advantages	Disadvantages
1. Continue existing groundwater abstraction policy i.e. no additional abstraction	-	No additional staff costs Likely to contain intrusion at existing level	Existing intrusion levels likely to remain Potential for increased contamination induced by existing abstractors taking up full licensed quantity
2. Instigate studies to examine the extent of the problem and identify ameliorative measures	NRA	Identifies extent of the problem + ameliorative measures for consideration	May not be cost effective Cost
3. Artificial recharge	NRA/ Developer	May offer some protection against contamination to existing abstractors	Unreliable source and insufficient quantities of water available for recharge Requires suitable geological conditions Unproven technique - may not be successful Long lead in time before remedial measures take effect Cost Potential to cause contamination

Issue No 22: Requirement for a management strategy for dealing with rising groundwater levels.

Since the revocation of many groundwater abstraction licences in South Essex, groundwater levels in the chalk have started to rise (though they are some way off their pre-abstraction levels). Where the chalk is confined by London Clay, this should not present any problems (in the short term). However where the chalk is unconfined water levels could rise to the ground surface. This could cause both flooding problems and structural problems to low lying developments.

Options	Responsibility	Advantage	Disadvantage
1. Discharge to river system e.g. Mardyke	NRA/ Developer	Helps mitigate the effects of flooding locally Could provide river support at times of low flow Increase surface water availability	Potential pollution risk Discharges cannot be guaranteed
2. Study to assess the extent of impact and identify management options. Including consideration of aquifer modelling	NRA	Provide effective management strategy	Costs may outweigh benefits
3. Discharge to sea outfalls	NRA/ Developer	Helps mitigate effects of flooding locally	Non utilisation of potential resource

5.4 Flood Defence and Physical Features

5.4.1 General

Having set target standards of service, the NRA has identified the issues below, where there are current shortfalls.

5.4.2 Issues and Options

Issue No 23: Excessive ingress of saltwater through sluices.

Some of the flapped tidal sluices allow seawater to seep back through the sluices over periods of high water. In some cases this may be aggravated by sub-soil leakage through underground gravel layers. This has been happening for many years in some locations. There is uncertainty as to the effect this is having on flora and fauna in the borrow ditches and on some of the larger watercourses such as the Mardyke.

However, on some of the smaller channels by marsh edges, a brackish zone of water can create important features which would not exist elsewhere. From a flood defence point of view this small amount of back leakage is insignificant; from an environmental point of view it is a mixed blessing.

Options	Responsibility	Advantages	Disadvantages
1. Prioritise and implement remedial measures to sluices on a phased basis	NRA Landowners	Prevents back drainage	High costs for uncertain benefits Will change nature of some coastal drains
2. Carry out study into extent of problem and establish advantages/dis-advantages for wildlife	NRA EN County Wildlife Organisations ESA Officer	Clearly defines extent and nature of ingress-determines if this is damaging or beneficial to the environment	Cost
3. Develop NRA policy on brackish habitats and implement works	NRA EN Landowners	Clears way ahead for NRA and landowners Funding can be identified	May make effective management of Land Drainage on flat coastal drains difficult
4. Do nothing			Damaging effects may not be resolved

Issue No 24 & No 25: Concern that flood defences may not meet NRA target standards, and concern over the effects of sea level rise on tidal defences.

Many of the defences date back hundreds of years. There have been many improvements made to the sea walls, particularly following the 1953 flood disaster. The combination of sea level rise and sinking of the land in south-east England, however, gives an effective annual sea level rise of 6mm per annum. This is also exacerbated by the erosion of beaches and foreshores together with salting decline. The result is increasing wave attack which damages defences and causes gradual reductions in the protection levels. Most urban frontages are now up to standard, for example, Thameside and Burnham town, though some rural walls offer reduced protection, such as those of the Crouch and Roach estuaries. Changes in agricultural practice and economics, however, make it difficult to justify conventional improvements to many rural frontages. Alternatives such as sustain, and in very few situations consideration of managed retreat, have now to be considered, however, all these options depend on cost benefit assessment. (Options to overcome or address these concerns are highlighted in the *Essex Shoreline Management Plan* and ensuing *Essex Sea Walls Management Strategy*).

Issue No 24: Concern that Flood Defences may not meet NRA target standards.

Options	Responsibility	Advantages	Disadvantages
1. Undertake Standards of Service exercise	NRA	Identifies existing conditions and shortfalls Integrated approach to defence needs Aids feasibility studies Provides data for planning and performance measures	Needs continually updating Cost implications
2. Continue to develop 10 year needs programme	NRA	Integrated approach to defence needs Known priorities and costs Aids capital investment Utilised resource economically	May identify more work than funding allows
3. Do nothing			Fragmented approach to Flood Defence needs Lack of priority

Issue No 25: Concern over the effects of sea level rise on tidal defences.

Options	Responsibility	Advantages	Disadvantages
1. Sustain defences at existing levels	NRA	Short term - cost savings	Standard of protection is reduced Loss of intertidal wildlife habitats Increased maintenance requirement Increased frequency of flooding
2. Managed retreat where economic, & technically and environmentally acceptable	NRA	Medium to long term - cost savings Development of saltmarsh as soft defence Environmental enhancement opportunities	Land becomes intertidal Loss of coastal frontage protection
3. Improve sea defences	NRA	Maintains target standards of protection	Loss of intertidal wildlife habitats Cost
4. Do nothing			Increased frequency of flooding Likelihood of sudden failure Increased risk to life and property Loss of intertidal wildlife habitats

Issue No 26: Suitability of refuse fill as a future sea defence material.

Several sites were chosen as suitable (on economic grounds) to form a sea defence using "refuse" as a fill material with a covering of clay to seal the material against the environment.

It is now recognised that this constitutes potential leachate problems and the possibility of a seaward face failure exposing the refuse fill and leading to pollution of the tidal waters. With rising relative sea levels, such refuse walls are exposed to more severe conditions and are an endless maintenance commitment.

The South Essex catchment will ultimately face a problem of local domestic refuse disposal and also of that imported from London. This material is unsuitable for sea walls.

Options	Responsibility	Advantages	Disadvantages
1. Continue to use as a construction material	NRA	Low initial cost Eases County Waste disposal problem	Long construction period High pollution risk Endless commitment to maintain in hostile environment High long-term costs Environmentally unacceptable
2. Continue to use traditional sea wall construction materials	NRA	More stable defence Relatively rapid construction process Easily modified and improved in the future Environmentally more acceptable for coastal environment	Moderate construction costs

Issue No 27: Concern over pollution potential of existing refuse fill sea walls.

The background has been identified in Issue 26 and the issue here is to consider the options available to eliminate or reduce the possibility of pollution. See also Issue No 6.

Options	Responsibility	Advantages	Disadvantages
1. Maintain existing fill sites	NRA/ECC	Retains sea defence at present standard Reduces risk of failure and consequent serious pollution	Continued leachate problems Increasing cost Increasing risk from sea level rise Endless commitment to maintenance
2. Remove existing refuse fill	NRA/ECC	Eliminates long term risk of pollution	Provide alternative sea defence High cost Find another site for refuse High risk of pollution during works
3. Monitor and evaluate impact	NRA/ECC	Quantifies clearly nature of risk Identifies possible modifications Provides possible warning of failure	Cost Does nothing to remove risk Endless commitment to maintain
4. Additional new works to modify or control problem	NRA/ECC	Limits risk of pollution and loss of defence	Cost Endless commitment to maintain Extensive monitoring Limited risk remains
5. Do nothing			Inevitable serious environmental pollution and flooding

Issue No 28: Concern over lack of continuity of tidal defence responsibility.

At present the NRA is not responsible for all the tidal defences covered by this management plan. Southend Borough Council have responsibility for the defences from Old Town Leigh to Shoebury, the Ministry of Defence from Shoebury to Great Wakering, including Foulness and Potton Islands, and two major landfill sites are responsible for their own defences. The last category has arisen where the planning permission has been granted to extend seaward beyond the original sea defences on the understanding that the private landowners accept responsibility for defences.

This situation now results in a potential variance in the standard and quality of the sea defences. It may be possible for the NRA defences to be outflanked and a failure occur in defences maintained by other parties. The Essex Shoreline Management Plan and resulting Sea Walls Strategy should address these problems and provide objectives for all future works.

Options	Responsibility	Advantages	Disadvantages
1. NRA to take over all tidal defence frontages	NRA	Common standard of tidal defence Single body for planning and implementation of schemes	Cost - presently paid for by other organisations
2. NRA monitor and advise third parties on standards	NRA Other landowners (MOD, District Councils etc.)	Minimal cost to NRA Requires no change of responsibility Helps provide common standard	No guarantee works are done on time or to standard Extended negotiations needed
3. Do nothing			Risk of failure of defences Inconsistent standards of defence Possible damaging effect on adjacent NRA defences

Issue No 29: Development control and the water environment. Development often increases risks to the water environment but NRA has only limited powers to impose conditions on development.

The NRA seeks to minimise the damaging impacts that new development can have upon the water environment. Development in flood risk areas will be discouraged, and the NRA will strongly resist plans involving the loss of fluvial floodplain; this is because the property will be put at unnecessary risk of flooding or will increase the risk of flooding to existing development. However, the statutory powers of the NRA and Country Planning Act legislation offers only limited scope to impose conditions on new development through Council planning processes. Locations within this catchment that are affected include Dengie and Southend.

Options	Responsibility	Advantages	Disadvantages
1. Encourage planning authorities to adopt NRA policies and guidance within their structure and local plans	Local Authorities NRA Developers Landowners	Ensures that matters for which the NRA are responsible are fully taken into account in all development proposals	Implications on Local Authority control Possible cost implications to landowners / developers
2. Do nothing			Uncontrolled development in flood risk areas and damage to the water environment

5.5 Conservation

5.5.1 General (Refer to Map 32)

The Authority has a responsibility to further conservation in its routine works, and through the identification of larger river restoration schemes. Improving access and enhancing opportunities for recreation, in both coastal and inland areas, is fully supported by the NRA.

Given these aims and objectives the following issues have been identified to address concerns in respect of both conservation and recreation.

5.5.2 Issues and Options

Issue No 30: Concern over the effects of past river management practices on the river environment.

Past land drainage activities have affected adversely the environmental value of certain channels. The maintenance and enhancement of habitat will therefore depend on more sympathetic management regimes.

An essential pre-requisite underpinning the NRA's strategic objectives to further conservation, is to develop and implement effective standard methods to describe, classify and monitor the conservation "resource".

A methodology based on analysis of the Rivers Environmental Database (REDS) has been used to help ascertain the environmental status of each river in the catchment and to identify conservation targets. Conservation targets for each 500m river sections are divided into the following three categories:

1. **Conserve:** includes all sections that are botanically valuable (ie possess a high plant diversity and/or rare plants and/or important plant communities).
2. **Enhance:** includes all sections that possess no rare species and have a high or average bird diversity but only an average botanical interest. Enhancement work should improve the ecological shortfalls whilst conserving the features of specific interest.
3. **Restore:** Ecologically degraded - includes all sections that possess a low plant diversity, no rarities and/or low bird diversity.

Of the Main River analysed, 92.5% requires conservation, 0.7% requires enhancement and 0% requires restoration. Piped and culverted sections accounted for 6.8% of the Main River analysed.

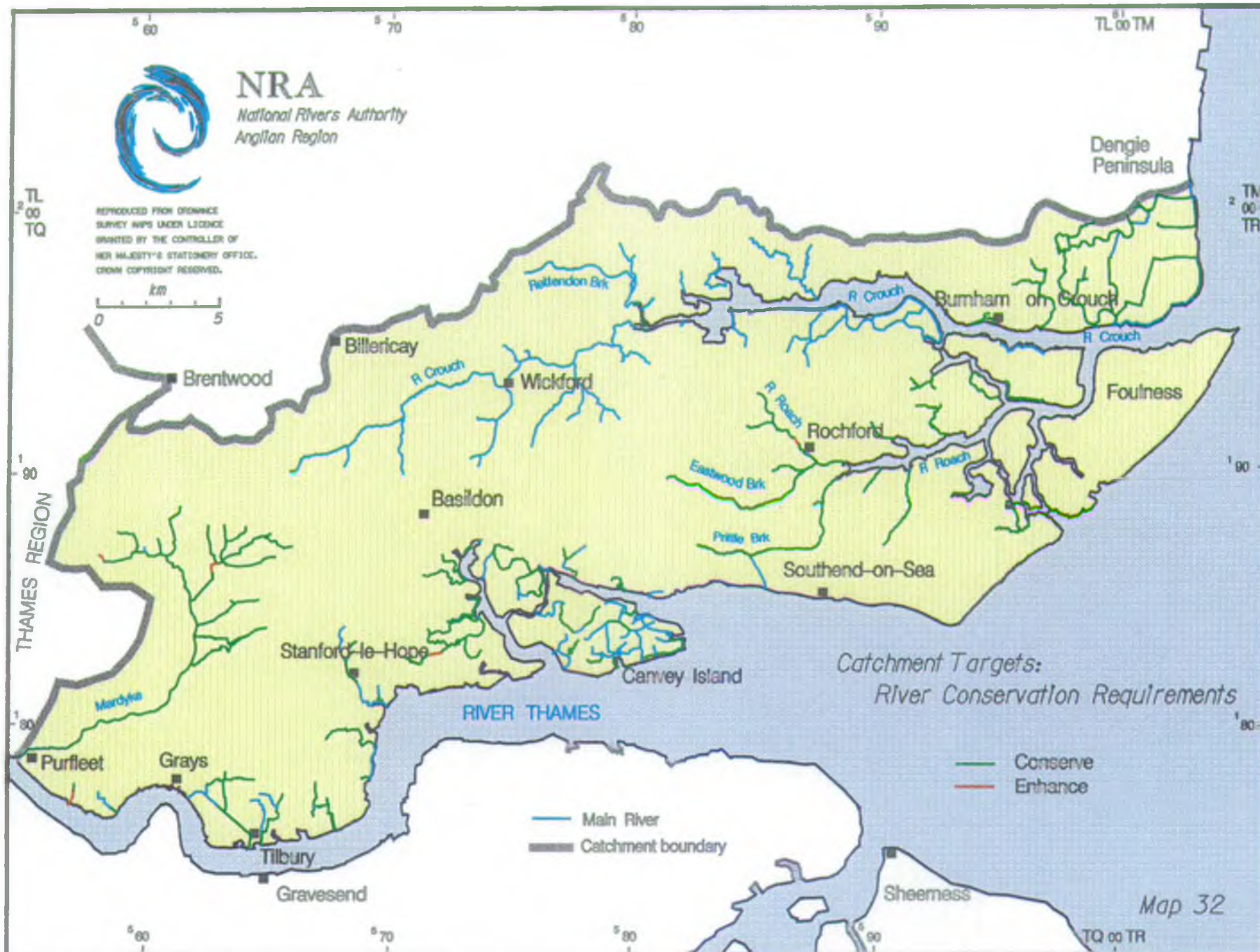
Given a sufficient lead-in time most of these requirements can be incorporated into the annual maintenance programme.

A standard, habitat-based River Corridor Survey (RCS) methodology has been



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developed and adopted as the *NRA Conservation Technical Handbook No.1*. It highlights important features within the corridor and identifies opportunities to rehabilitate and enhance degraded habitats. An NRA National River Habitat Survey methodology is currently being used to complement RCS, and classifies the environmental conditions of rivers with regard to physical features such as riffles, pools, wet shelves and cliffs.

Options	Responsibility	Advantages	Disadvantages
1. To develop and implement effective standard methods to describe classify and monitor the conservation resource	NRA	Provides basis for decisions making	Cost
2. Identify areas with potential for restoration and enhancement and determine costs e.g. Mardyke	NRA	Provides basis for decision making	Cost
3. Undertake restoration and enhancement schemes	NRA Landowners Conservation Bodies	Improves habitats and landscape	Cost Requires agreement of the landowner and lead in time to plan work

Issue No 31: Concern about the adverse effects of bait digging on the foreshore.

Bait digging is a frequent source of enquiry, controversy and complaint. Much of this stems from misunderstandings and/or ignorance of its legality, and of its actual or potential impacts, under various circumstances and in various locations. No single authority is responsible for its regulation, which makes it difficult for the public to obtain adequate information on the subject. This inhibits the dissemination of appropriate advice to interested parties. There is clearly a need to improve upon this unsatisfactory position.

Options	Responsibility	Advantages	Disadvantages
1. Promote liaison between all interested parties, and work towards a common understanding and jointly agreed position statement.	NRA, English Nature, Crown Estate Comm., Councils, Kent & Essex Sea Fisheries Comm., Essex Wildlife Trust, RSPB, Bait Digging Associations.	Promotes a common approach to a recurring problem. Improves public awareness.	Difficulty of coordinating the wide range of interested parties.
2. Promote a better and coherent management framework through a code of good practice, self regulating associations, and local byelaws, as appropriate.	NRA, English Nature, Crown Estate Comm., Councils, Kent & Essex Sea Fisheries Comm., Essex Wildlife Trust, RSPB, Bait Digging Associations.	Identifies bodies responsible for taking action. Provides cohesive management framework.	Difficulty of coordinating the wide range of interested parties.
3. Do nothing			Does not address problem.

Issue No 32: Concern about degradation of the traditional lowland landscape.

Landscape imparts a sense of place, plays a fundamental role in everyday life and is an immediate reflection of the ecology, habitat diversity and historical heritage. Many of the river corridors, including associated lands, have been subjected to a long history of change, increasingly since the 1940s. Activities such as land drainage, land clearance, quarrying, farming, industry, residential development and forestry have all played a part in natural landscape degradation.

Landscape conservation and management aims to maintain and increase diversity. To achieve this aim, an assessment and description of the landscape will be produced and appropriate management and enhancements progressed. The *NRA Conservation and Technical Handbook No 2* on River Landscape Assessment will provide a consistent framework which will assist the NRA in contributing to the restoration and enhancement of impoverished river valley landscapes within the catchment.

There is a need to work collaboratively with riparian owners, Local Authorities, and, Thames Chase and other conservation organisations to improve the status and management of riparian trees and bushes.

Options	Responsibility	Advantages	Disadvantages
1. To develop and implement effective standard methodology to describe classify and monitor the conservation resource	NRA	Provides basis for decision making	Cost
2. Identify areas with potential for landscape restoration and enhancement	NRA MAFF Wildlife Trusts Riparian Owners	Provides basis for decision making	Cost
3. Undertake restoration and enhancement schemes	NRA MAFF Wildlife Trusts Riparian Owners Councils Thames Chase	Improves habitats and landscape and meets NRA's responsibilities To promote conservation	Cost Requires agreement of the landowner and lead in time to plan work
4. NRA continue to develop a programme of riverside tree replacement and management within its maintenance operations	NRA Riparian Owners	Improvement of habitats and landscape Meets NRA's responsibility to promote conservation	Cost Possible conflict with Flood Defence requirements

Issue No 33: Requirement to identify a rolling programme of conservation and recreation opportunities at an early stage within the river maintenance programme.

In order to maximise conservation input to Flood Defence maintenance programmes a longer lead-in time is necessary. Given this lead-in time many of the conservation issues raised within this catchment can be dealt with by incorporating enhancements into routine maintenance.

Options	Responsibility	Advantages	Disadvantages
1. Extend the lead-in time for the Flood Defence maintenance programme to allow adequate liaison with landowners conservation and recreation bodies	NRA Landowners LFDC	Provides the required lead-in time to identify all conservation and recreation opportunities linked to NRA works	Requires longer term planning by Flood Defence and landowners
2. Do nothing			Inability to maximise opportunities for conservation and recreation

Issue No 34: Requirement to investigate opportunities for long term set-aside land as riparian buffer strips.

Many opportunities exist for the NRA to encourage landowners to put land adjacent to the river into one of the schemes promoted by the Countryside Commission or MAFF. This will enhance the river corridor through restoration of the floodplain and creation of buffer zones.

Options	Responsibility	Advantages	Disadvantages
1. Investigate possibilities of riparian buffer strips which coincide with long term set - aside Liaise with landowners, MAFF and ADAS	Landowners MAFF ADAS NRA	Significant improvement in river corridor habitats Gives potential access for NRA maintenance Reduction in pollution and nutrient run-off to rivers	May not be possible May be necessary to get agreement with several landowners
2. Identify suitable trial site	NRA Countryside Project	Trial site could indicate advantages of wider application	Cost Trial site will only reflect particular/local characteristics
3. Do nothing Await outcome of trial by MAFF			Possible missed opportunities

Issue No 35: Need to improve liaison with Essex County Council over protection of sensitive archaeological sites adjacent to NRA maintenance and minor capital works.

A system for contacting appropriate organisations when precise details of NRA work have been finalised is desirable to ensure that no sensitive archaeological sites are damaged. Many of the sites within this catchment are not scheduled but are still of significant historical interest.

Options	Responsibility	Advantages	Disadvantages
1. Improve procedures for contacting appropriate organisations when precise details of NRA works have been finalised	NRA Essex Councils English Heritage	Enhances protection given to archaeological sites and identifies possibilities to enhance archaeological interests of river valleys and foreshore	Requires time for identification of non-scheduled archaeological sites May delay NRA works
2. Evaluate results of national R&D study on current liaison practice	NRA	Consistent approach	Timescale
3. Do nothing			Continued risk of damage to archaeological sites

Issue No 36: Requirement to promote appropriate public access to rivers and sea walls in conjunction with other organisations.

Riverside footpaths could be improved by linking together the existing paths and promoting this access in conjunction with the appropriate organisations.

Collaboration with the River Valley Countryside Management Projects should continue. In this way there is close liaison with all interested parties that work collaboratively to enhance appropriate public access to rivers.

Options	Responsibility	Advantages	Disadvantages
1. Continue participation in Countryside Management projects and liaison with other bodies to work collaboratively to enhance appropriate public access to rivers	NRA Countryside Management Project Councils Countryside Commission	Meets NRA's recreation objectives Promotes wider public use of countryside especially appropriate public access to rivers	Needs co-operation of riparian landowners Limited opportunities
2. Investigate possible use of riparian set-aside land for use in enhancing public access to river via permissive paths	Landowners NRA Councils	Good use of set-aside land adjacent to rivers	Require landowners agreement
3. Do nothing			Failure to meet recreation objective

Issue No 37: There is a lack of public information boards detailing NRA activities.

Information boards detailing the wildlife and flood protection value of NRA projects, could provide the public with much useful information. Boards could also be used to give details of collaborative projects undertaken with local conservation groups.

Options	Responsibility	Advantages	Disadvantages
1. Provide information boards and other interpretive material at suitable locations	NRA Local Conservation Group Landowners Councils	Better public information on NRA's activities and functions	Initial cost On-going maintenance cost
2. Do nothing			Missed opportunity for providing information and good publicity

Issue No 38: Need to improve liaison over local strategies in the area concerning recreational pursuits and estuary management.

There is a requirement to liaise with all the appropriate organisations over estuary management planning and recreational activities occurring on the rivers, estuaries and coast.

Estuary Management Plans are becoming increasingly important and the NRA needs to play a large role in the consultation and assimilation of information for these plans.

Within recreational pursuits, water sport users ought to be involved in management of these activities and not just the statutory organisations. There are many strategies concerning water sports and leisure pursuits in the countryside that are being devised locally and nationally. These strategies and the overriding common principles require combined efforts from all organisations in partnership. This will enable a unified and coherent approach to protecting and developing sport, leisure, wildlife and other countryside activities.

Options	Responsibility	Advantages	Disadvantages
1. Identify ways in which the NRA can assist with a liaison network to co-ordinate and plan recreational and estuarial strategies (The group would contain participants of the sporting activities to ensure a broad overall view)	NRA (Catchment Panels) Councils Sports Council English Nature All interested parties	Provides basis on which to plan and co-ordinate recreational and estuarial strategies Enhancement of NRA recreations profile Likely to generate ideas for collaborative funding	Time constraints Cost
2. Do nothing			Missed opportunity for enhancement

Issue No 39: Requirement to draw up Water Level Management Plans, where the NRA is the Operating Authority.

The NRA must produce WLMPs for six SSSIs in South Essex which will require fourteen individual plans. These are detailed in Appendix VIII.

Options	Responsibility	Advantages	Disadvantages
1. Draw up Water Level Management Plans (WLMPs) for wetland SSSIs according to the prioritisation by English Nature where NRA is the Operating Authority	NRA English Nature	Complies with MAFF requirement for WLMPs Conservation of wetland SSSIs Replaces verbal agreement for the management of site with a written plan	Cost - need for additional resources
2. Do nothing			Fails to meet requirements

5.6 Fisheries - Freshwater

5.6.1 General (Refer to Map 33)

The Mardyke is the only significant river fishery in the catchment area, and is the only one to be included within the rolling programme of fish population surveys.

The whole surveyed length of the Mardyke currently falls into biomass class D ($\leq 5 \text{ gm}^{-2}$), and consequently fails to reach its target class of C (5 to 10 gm^{-2}).

The very poor quality fish stocks in the Mardyke effectively mean that there is no freshwater river angling available anywhere within this catchment area. This position is unsatisfactory, and inevitably increases the demand for angling facilities on reservoirs, lakes and ponds.

5.6.2 Issues and Options

Issue No 40: Fish stocks in the Mardyke do not reach their target class.

Only poor Class D fish stocks (biomass $< 5 \text{ gm}^{-2}$) occur throughout the Mardyke. This may be due to a number of reasons, or combination of reasons, including high effluent volumes, poor quality surface water run off, low natural flows, saline intrusions and restricted physical habitat quality. It is unlikely that the full range of limiting factors has been accurately identified.

In general, water quality has improved since 1989, in line with better effluent discharge standards at Upminster Sewage Treatment Works. However, isolated cases of fish distress and mortality continue to be observed, although the causes have not always been identified specifically. If the fish stocks were better, then under current circumstances it is likely that this type of incident would be noted more frequently. During periods of low flow, the lack of dilution available to any effluents or pollutants entering the river undoubtedly contributes to the water quality problems experienced.

Options	Responsibility	Advantages	Disadvantages
1. Restock	NRA	Rapid action possible	Probability of failure if conditions are unsuitable
2. Address conditions already identified as limiting (see Issues 1,2,14,15,16,23 & 30)	NRA	Improved environmental conditions leading to fish stock enhancement	Cost Cost may out-weigh benefit Possibly incomplete solution
3. Investigate conditions to determine full range of limiting factors	NRA	Comprehensive problem definition leading to restoration plans	Cost Time delay Findings may be inconclusive
4. Implement in channel improvements to enhance physical habitat conditions	NRA	Improved conditions for fish, greater habitat diversity, and more conservation interest	Cost
5. Do nothing			Poor fish stocks likely to persist



5.7 Fisheries - Commercial and Marine

5.7.1 General

The NRA's responsibilities towards commercial and marine fisheries are complicated by the fact that three of its Regions share responsibility for the Thames Estuary. Each of these Regions has its own Fishery Byelaws, and its own requirements for the licensing of eel fishing. The boundaries between the Regions were established for administrative purposes, and were not intended to lead to disparate management regimes in different parts of an otherwise coherent area. Whilst each set of Byelaws and Licence fees may be appropriate in isolation, it is doubtful if there is any justification for the disparities which exist, particularly in view of the countrywide remit now exercised by the NRA.

The potential for conflicts of interest between eel, salmon and migratory trout fisheries, and those of other valuable marine and estuarine stocks such as bass and sole, is a possible consequence of the recently improved fortunes of the Thames Estuary fish stocks. The comparatively rare smelt now occurs in considerable numbers, and may require protection on conservation grounds alone.

Most commercial fisheries regulation is carried out by MAFF and by the Kent and Essex Sea Fisheries Committee, their powers in respect of eels, salmon and migratory trout fisheries are greater in comparison with those vested in the National Rivers Authority. There are no formal and well defined arrangements for regular liaison between MAFF, the Sea Fisheries Committee and the three interested Regions of the Authority. Furthermore, it is possible that a considerable shortfall exists in the collection, exchange and analysis of catch and other data required to reach optimum fisheries management decisions and policies for the Thames Estuary as a whole.

5.7.2 Issues and Options

Issue No 41: Optimum fisheries management policies for the Thames Estuary as a whole do not exist, and cannot be developed for isolated parts, such as that covered by this plan.

The changing circumstances of the Thames Estuary need to be reflected by a more coherent management approach by the various responsible bodies. This will need to include consideration of the various Byelaw, enforcement and licensing arrangements which apply, the potential conflicts which may arise between fisheries, and the adequacy of existing management data.

A move towards better coordination of fisheries management policies is timely, in view of the development of a Thames Estuary Management Plan, due to be published in March 1996.

Issue No 41 cont.

Options	Responsibility	Advantages	Disadvantages
1. Responsible Authorities to coordinate coherent fisheries management policies for the Thames Estuary as a whole	NRA (Anglian, Southern & Thames Regions) Kent & Essex Sea Fisheries Committee MAFF	Consistent Byelaw & Licensing Regimes applied Fisheries management policy & practice fully coordinated Conflicts between fisheries avoided &/or resolved	Cost Probable requirement for Byelaw revision
2. Do nothing		None	Disparate Byelaw and Licensing regimes will continue Unsatisfactorily coordinated fisheries management will persist Conflicts may arise between different fisheries interests which could not be resolved under the present arrangements

APPENDIX I

FLOOD DEFENCE**Proposed MAFF Grant Aided Capital Expenditure**
(South Essex Catchment)

Flood Defence Scheme:	1995 / 96	1996 / 97	1997 / 98
Thames Tidal Defences		250,000	400,000
Chadwell Cross Culvert		300,000	320,000
Steeple Stone Tidal Defences		500,000	
River Roach, Paglesham	850,000		
River Roach, Wallasea Island	10,000	100,000	500,000
River Crouch, Battlesbridge Maltings	-	225,000	350,000
Shoreline Management	90,000*	90,000*	90,000*

Extract from the NRA's Flood Defence Long Term Plan (Cost in £)

* Denotes that expenditure shown is not all within this plan area.

APPENDIX II

(Refer to Map 34)

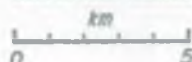
Licensed Water Abstractions

Sub-catchment		37/41	37/42	37/43	37/44	37/56
Spray Irrigation	GW		1	2	9	1
	SW	3	7	15	13	16
General Agriculture	GW	-	4	20	7	7
	SW	-	-	-	-	-
Industrial	GW	-	-	-	4	5
	SW	-	-	-	-	3
Cooling	GW	-	-	-	-	1
	SW	-	-	-	-	3
Sand & Gravel Washing	GW	-	-	2	1	2
	SW	-	-	-	-	-
Fisheries	GW	-	-	-	-	-
	SW	1	2	-	-	-
Public Water Supply	GW	-	-	-	-	2
	SW	-	-	-	-	-
Total	GW	-	4*	23*	21	15*
	SW	3*	9	15	13	22

N.B : Some irrigation and agricultural uses are linked under one licence. Therefore the Total figures may not be the sum of all the various uses. Catchments where there are linked licences are marked with * in the Total column.



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Map 34

APPENDIX III

SOUTH ESSEX CATCHMENT SSSIs

WATER DEPENDENT SITES

Basildon Meadows SSSI

TQ 705 870

Three unimproved herb-rich meadows lying on neutral soils. They are among the few areas of old pasture known to remain in the county.

Garrold's Meadow SSSI

TQ 823 888

Unimproved grassland which exhibits a diverse plant community, including several species that are uncommon or of restricted distribution in Essex.

Thundersley Great Common SSSI

TQ 793 891

The sloping topography supports a mosaic of wet and dry heathland, merging into acid grassland.

Benfleet & Southend Marshes SSSI, part NNR, Ramsar/SPA

TQ 854 847

Comprise an extensive series of salt marshes, mud-flats, scrub, and grassland which support a diverse fauna and flora. Wintering wildfowl and waders reach both nationally and internationally important numbers.

The Cliff, Burnham-on-Crouch SSSI

TQ 744 867

This interesting site has fossils of avifauna (birds) of the Lower Eocene age. Valuable in expanding the limited knowledge of small Eocene bird species and avian evolution.

Dengie SSSI, NNR, SPA/Ramsar

TM 045 030

Largest continuous example of saltmarsh and tidal mudflat in Essex. Internationally and nationally important wintering wildfowl and waders. Geomorphological interest.

Foulness SSSI, SPA/Ramsar

TR 030 905

Extensive intertidal sand-silt flats, saltmarsh, beaches, grazing marsh, and scrubland. The flats are of national and international importance for twelve species of wildfowl and waders.

Goldsands Road Pit SSSI

TQ 960 990

The site provides a valuable section in the "East Essex Gravels" deposited by the Thames-Medway which, flowed northeastwards across eastern Essex in the late Anglian age.

Mucking Flats & Marshes SSSI

TQ 696 785

Comprises an extensive stretch of Thames mudflats and saltmarsh, together with sea wall grassland. Wintering wildfowl and waders are important, both nationally and internationally.

Pitsea Marsh SSSI

TQ 744 867

The site comprises a mosaic of habitats, including scrub, grassland, reed bed and fen, open water and saltmarsh. Diverse invertebrate range including nationally rare species.

River Crouch Marshes SSSI, SPA/Ramsar

TQ 870 970

The fragmented areas of saltmarsh and grazing marsh are of great ornithological interest supporting five species of nationally and internationally important waterfowl species. Also

has an outstanding assemblage of nationally scarce coastal plants.

Vange & Fobbing Marshes SSSI

TQ 730 840

On the alluvial flood plain of the lower River Thames. Wide range of unimproved coastal grassland species and maritime herb, many of which are nationally rare.

West Thurrock Lagoon & Marshes SSSI

TQ 585 766

The combination of intertidal mudflats together with a large and secure high tide roost makes it one of the most important sites for wintering waders and wildfowl on the Inner Thames Estuary.

OTHER SITES

Globe Pit SSSI

TQ 625 783

Important site for the interrelationship of archaeology with geology in the correlation of the Lower Palaeolithic chronology with the Pleistocene Thames Terrace sequence.

Grays Chalk Pit SSSI

TQ 609 789

Since mineral extraction ceased in the 1920's natural colonisation has created woodland, scrub, and calcareous grassland, important for the assemblage of invertebrate fauna.

Great Wood & Dodd's Grove SSSI

TQ 819 877

Large area of coppice-with-standards oak woodland and the largest and best example of ancient woodland in South Essex.

Hangman's Wood SSSI

TQ 631 794

Deneholes, the remains of medieval chalk mines, provide the most important underground hibernation site for bats in Essex. Three species have been recorded.

Hockley Woods SSSI

TQ 833 917

One of the most extensive areas of ancient coppice woodland in South Essex.

Lion Pit SSSI

TQ 598 781

The site exhibits a complex sequence of Pleistocene Thames deposits which are of future interest.

Norsey Wood SSSI

TQ 686 955

A large mixed chestnut coppice derived from acid oak woodland. Due to its size, varied soils, and topography, it has a good variety of habitat which is rich in flora and fauna.

Purfleet Chalk Pits SSSI

TQ 560 784

Geological deposits where analysis has suggested a pre-Ipswichian interglacial age.

Thorndon Park SSSI

TQ 604 917

The site is an area of semi-natural broadleaved woodland and ancient parkland.

APPENDIX IV

SCHEDULED ANCIENT MONUMENTS (SAMs)**District: Basildon**

<u>SAM No.</u>	<u>Monument Title</u>	<u>Grid Ref.</u>
49	Iron Age settlement, Norsey Wood	TQ 687 955
76	Moated site and fishponds, Botelers	TQ 715 895
77	Moat at Basildon Hall	TQ 712 884

District: Castle Point

<u>SAM No.</u>	<u>Monument Title</u>	<u>Grid Ref.</u>
2	Hadleigh Castle	TQ 810 861
108	Roman fortlet (near Hadleigh)	TQ 806 868
150	Romano-British site, Dawes Heath	TQ 818 889
154	Red Hill, Canvey Island	TQ 779 843

District: Maldon

<u>SAM No.</u>	<u>Monument Title</u>	<u>Grid Ref.</u>
198	Crop mark site SW of Oldmoor	TQ 966 004
212	Earthworks, Pandole Wood	TQ 964 996

District: Rochford

<u>SAM NO.</u>	<u>Monument Title</u>	<u>Grid Ref.</u>
35	Earthwork, Plumberow Mount	TQ 839 938
39	Rayleigh Castle	TQ 805 909
41	Rochford Hall (uninhabited portions)	TQ 870 903
164	Roman burial, Shelford Creek	TQ 979 905

District: Southend-on-Sea

<u>SAM No.</u>	<u>Monument Title</u>	<u>Grid Ref.</u>
37	Prittlewell Priory	TQ 876 873
117	Prittlewell camp SE of Fossetts Farm	TQ 889 878
140	Danish camp, Shoeburyness	TQ 938 845
196	Southchurch Hall and moated site	TQ 894 855

District: Thurrock

<u>SAM No.</u>	<u>Monument Title</u>	<u>Grid Ref.</u>
36	Ring and Bailey earthwork, Orsett	TQ 641 822
40	Earthworks, West Tilbury	TQ 661 776
80	Tilbury Fort	TQ 651 754
129	Tumulus, South Ockendon	TQ 603 833
130	South Ockendon Old Hall, gatehouse & moat	TQ 603 831
131	Deneholes, Hangman's Wood	TQ 631 794
151	Purfleet barracks	TQ 549 786
153	Causewayed camp and cemetery, Orsett	TQ 653 806
174	Cropmark enclosure, Grey Goose Farm	TQ 628 810
179	Site of moated manor house, Aveley	TQ 568 801
12707	Coalhouse Fort	TQ 691 768
12708	East Tilbury battery	TQ 687 774
12709	Bowater Farm battery	TQ 679 771
24868	Anglo-Saxon cemetery, Heath Place	TQ 652 805
24869	Baker Street cropmark complex	TQ 639 815

(County List of Scheduled Monuments, Essex. March 1994)

APPENDIX V**EC DIRECTIVES**

1. EC Surface Water Abstraction Directive 75/440/EEC
2. EC Groundwater Directive 80/68/EEC
3. EC Urban Waste Water Treatment Directive 91/271/EEC
4. EC Nitrate Directive 91/676/EEC
5. EC Protection of the Quality of Groundwater Directive 80/68/EEC
6. EC Bathing Water Directive 76/160/EEC
7. EC Freshwater Fisheries Directive 78/659/EEC
8. EC Shellfish Waters Directive 79/923/EEC
9. EC Shellfish Hygiene Directive 91/492/EEC
10. EC Dangerous Substances Directive 76/464/EEC
11. EC Birds Directive 79/409/EEC
12. EC Habitats Directive 94/43/EEC

EC REGULATIONS

1. EC Council Regulation 3094/86, 7 October 1986. Laying Down Certain Technical Measures for the Conservation of Fishery Resources.

APPENDIX VI

INDICATIVE STANDARDS OF FLOOD PROTECTION

Current Land Use	Indicative standard of flood protection expressed as return periods in years	
	Fluvial	Tidal and Sea Defences
A	100	200
B	75	150
C	25	50
D	10	20
E	1	5

Band A

Areas of dense conurbations where widespread flooding would cause serious infrastructure failure and endanger life. Trunk roads and/or motorways and railways may be included in this band.

Band B

Predominantly urban areas, including housing, industry and commerce. The flood plain will include 'A' and 'B' class roads. Little agricultural land is likely to be present.

Band C

High grade agricultural land suitable for cereal and cash crops. Residential and industrial property, as well as roads, amenity and/or navigation interests may also be prominent.

Band D

Typical land use incorporating average gross - margin crops, and permanent pasture. Little residential or industrial property will be present. Conservation and water ecology interests may significantly influence the standard of service to be applied.

Band E

This covers areas which are generally of low grade land use. Residential or industrial property is unlikely to be present. Agricultural use is likely to be limited to horse paddocks, forestry and scrubby grazing land. Land within this category may have a high conservation value requiring a lower standard of service than would be expected otherwise. Flood storage washlands or land which is deliberately allowed to flood may fall into this band.

APPENDIX VII

STATUTORY LOCAL AND STRUCTURE PLANS

Current Status

Essex County Council	Structure Plan - Issues Report, Consultation Report.	October 1994
Basildon District Council	Inspector's Report on the Deposit Local Plan.	October 1995
Brentwood Borough Council	Local Plan - Proposed Modifications Deposit.	October 1994
Castle Point Borough Council	Second Schedule of Proposed Modifications.	October 1994
Chelmsford Borough Council	Inspector's Report on Deposit Draft.	January 1995
Havering London Borough	Adopted Unitary Development Plan.	March 1993
Maldon District Council	Local Plan - 1st Review. Statement of Modifications Inspector's Report, Decisions.	July 1995
Southend - on - Sea Borough Council	Local Plan - Adopted.	March 1994
Thurrock Borough Council	Awaiting decision of Secretary of State into Inquiry into Local Plan.	1995

APPENDIX VIII

WATER LEVEL MANAGEMENT PLANS

Water Level Management Plans being prepared for the South Essex catchment are detailed below. Plans for high priority sites are to be agreed by March 1996. Plans for medium and low priority sites will be drawn up by March 1997 and March 1998, respectively.

SSSI	PLAN	PRIORITY
Benfleet & Southend Marshes	Hadleigh Marshes	HIGH
Foulness	Rushley Island	HIGH
	Fleethead	HIGH
	Oxenham Farm	HIGH
River Crouch	Hogwell Marsh	HIGH
	Hyde Marshes	HIGH
	Lion Creek Reserve	HIGH
	Marsh Farm Country Park	HIGH
	Lower Raypits	HIGH
	Stoke's Hall Marsh	HIGH
Pitsea Marsh	1 Plan.	MEDIUM
Upper Colne Marshes	1 Plan.	MEDIUM
Vange and Fobbing Marshes	Fobbing Marshes	MEDIUM
	Vange Marshes	MEDIUM

APPENDIX IX

**RIVER ECOSYSTEM CLASSIFICATION:
WATER QUALITY CRITERIA**

Class	Dissolved Oxygen %saturation 10 percentile	BOD (ATU) mg/l 90 percentile	Total Ammonia mg N/l 90 percentile	Un-ionised Ammonia mg N/l 95 percentile	pH lower limit as 5 percentile; upper limit as 95 percentile	Hardness mg/l Ca CO ₃	Dissolved Copper ug/l 95 percentile	Total Zinc ug/l 95 percentile
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
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
RE3	60	6.0	1.3	0.021	6.0-9.0	≤ 10 > 10 and ≤ 50 > 50 and ≤ 100 > 100	5 22 40 112	300 700 1000 2000
RE4	50	8.0	2.5	-	6.0-9.0	≤ 10 > 10 and ≤ 50 > 50 and ≤ 100 > 100	5 22 40 112	300 700 1000 2000
R5	20	15.0	9.0	-	-	-	-	-

APPENDIX X

**GENERAL QUALITY ASSESSMENT:
CHEMICAL GRADING FOR RIVERS AND CANALS**

Water Quality	Grade	Dissolved Oxygen	Biochemical Oxygen Demand (ATU)	Ammonia
		(% saturation) 10 percentile	(mg/l) 90 percentile	(mg H/l) 90 percentile
Good	A	80	2.5	0.25
Fair	B	70	4	0.6
	C	60	6	1.3
Poor	D	50	8	2.5
Bad	E	20	15	9.0
	F**	-	-	-
* as suppressed by adding allyl thio-urea ** ie quality which does not meet the requirements of grade E in respect of one or more determinands				

APPENDIX XI

**COASTAL AND ESTUARINE WORKING PARTY (CEWP) TARGET CLASSES
FOR SALINE WATERS**

DESCRIPTION		Points awarded if the estuary meets this description
Biological Quality (scores under a, b, c & 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
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 values:-		
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 scale.		
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

APPENDIX XII

LENGTH (KM) OF RIVER IN GENERAL QUALITY ASSESSMENT
CLASSIFICATION 1992 - 1994

River Ecosystem	CATCHMENT				
	Quality	R. Crouch	R. Roach	Mardyke	All
Class A	Good	0	0	0	0
Class B		0	0	0	0
Class C	Fair	0	1	14	15
Class D		7	27.5	11.5	46
Class E	Poor	7	6	4	17
Class F	Bad	5	0	0	5
TOTAL		19	34.5	29.5	83

APPENDIX XIII

LENGTH (KM) OF ESTUARY IN COASTAL AND ESTUARINE WORKING
PARTY GRADES

Catchment	CEWP GRADE				
	A	B	C	D	TOTAL
R. Crouch	13.0	26.4	0.0	0.0	39.4
R. Roach	1.0	14.9	0.0	0.0	15.9

APPENDIX XIV

BIOLOGICAL CLASSIFICATION OF WATER QUALITY

Some invertebrates are more susceptible to pollution than others and so the presence of such sensitive species is a sign that water quality is good. Each biological sample is given a score according to the number and type of invertebrates present. This is known as the Biological Monitoring Working Party (BMWP) score. It assigns points to each taxon according to its sensitivity to pollution. For example, many mayfly nymphs and caddis larvae score ten points, water beetles score five, molluscs three and worms one. The BMWP score is thus the total score of all scoring taxon occurring at the site. The BMWP score is then divided by the number of scoring taxa to give the Average Score Per Taxon (ASPT). This gives an indication of the contribution made by each to the total. The higher these two scores, the cleaner the water. These two scores are ranked and assigned a rating of one to seven. The mean of these two ratings is called the Lincoln Quality Index (LQI). Thus each sampling site is given a LQI score, which is assessed against the target LQI for that site.

Another system used to assess biological quality is the River In Vertebrate Prediction And Classification System (RIVPACS). This is a computer programme developed by the Institute of Freshwater Ecology which can predict, from the physical and chemical characteristics of a site, the likely BMWP score which would be found assuming the site was unpolluted and undisturbed. A comparison is then made between the actual and predicted scores and the site classified between A and D; A if the fauna are close to that predicted, and thus unpolluted, and D if not.

APPENDIX XV

CLASSIFICATION OF SHELLFISH HARVESTING AREAS
AS REQUIRED BY THE EC SHELLFISH HYGIENE
DIRECTIVE 91/492/EEC (MAFF, SEPTEMBER 1995)

PRODUCTION AREA	BED NAME	SPECIES	CLASS	COMMENT
Crouch	Althorne Creek and Purleigh Shawl	<i>Ostera edulis</i>	B	
	Outer Crouch	<i>Ostera edulis</i>	B	
Roach	Paglesham Pool	<i>Crassostera gigas</i>	A	
	Middleway	<i>Ostera edulis</i>	A	
	Devils Reach, Quay Reach, Dunhopes and Pond Lays	<i>Ostera edulis</i>	B	
	All Beds	Mussels	B	Seasonal October to April inclusive
Thames Estuary	Mid and NE Maplin Sands, and The Barrows	Cockles	B	
	Chapman Sands, Leigh Foreshore, Southend Flats and East Shoebury Beacon	Mussels and Cockles	C	
	Yantlet Flats, Grain and Sheppy	Mussels and Cockles	B	

APPENDIX XVI

EC SHELLFISH HYGIENE DIRECTIVE 91/492/EEC
CLASSIFICATION CATEGORIES

CATEGORY	CRITERIA	COMMENTS
A	Less than 230 E.coli/100g flesh or less than 300 faecal coliforms	May go direct for human consumption if end product standard met
B	Less than 4,600 E.coli/100g flesh (in 90% of samples) or less than 6,000 faecal coliforms/100g flesh (in 90% of samples)	Must be depurated, heat treated or relaid to meet Category A
C	Less than 60,000 faecal coliforms/100g flesh	Must be relaid for a long period (at least two months) to meet Category A or B, or heat treated
D	Above 60,000 faecal coliforms/100g flesh	Harvesting prohibited

APPENDIX XVII

DOCUMENTS/INVESTIGATIONS CITED IN THE CONSULTATION REPORT

- | | |
|--|----------------------|
| 1. Catchment Management Plan | NRA |
| - Consultation Report | |
| - Action Plan | |
| - Annual Review | |
| 2. Shoreline Management Plan | NRA |
| 3. Water Level Management Plan | NRA |
| 4. Common Agricultural Policy Factsheet (Jan 1995) | MAFF |
| 5. Policy and Practice for the Protection of Groundwater
(with Regional Appendix - Anglian Region) (Dec 1992) | NRA |
| 6. Minerals Subject Plan (1991) | Essex County Council |
| 7. Minerals Local Plan, Review One (October 1994) | Essex County Council |
| 8. Water Resources in Anglia (Sept 1994) | NRA |
| 9. Anglian Region Fishery Byelaws (last modified 1995) | NRA |
| 10. Magna Carta (1215) | |
| 11. Estuaries Initiative 1993/4 | English Nature |
| 12. Directory of Walks and Ride (1992) | Essex County Council |
| 13. Determination of Minimum Acceptable Flows (In preparation) | NRA |
| 14. In River Assessment: Validation and Application (In preparation) | NRA |
| 15. The Protection of East Anglian Wetlands (1994) | NRA |
| 16. Hydrological Monitoring of Wetlands (Interim report, June 1995) | NRA |
| 17. Project Appraisal Guidance Notes (1993) | MAFF |
| 18. Essex Shoreline Management Plan (1995) | NRA |
| 19. Essex Sea Walls Management Strategy (In preparation) | NRA |
| 20. Conservation Technical Handbook No. 1
- River Corridor Surveys (Aug 1992) | NRA |
| 21. Conservation Technical Handbook No. 2
- River Landscape Assessment (April 1993) | NRA |

- | | |
|---|-------------------------|
| 22. County List of Scheduled Monuments, Essex (March 1994) | English Heritage |
| 23. The Essex Environment (May 1992) | Essex County Council |
| 24. Coastal Superquarries: Options for Wharf Facilities on the Lower Thames (1995) | Department of Transport |
| 25. River Quality: The Government's Proposals. A Consultation Paper (Dec 1992) | HMSO |
| 26. Control of Pollution (Silage, Slurry and Agricultural Fuel Oil) Regulations 199 | HMSO |
| 27. Surface Water (River Ecosystem) (Classification) Regulations 1994 | HMSO |
| 28. Water Resources Act 1963 | HMSO |
| 29. Water Resources Act 1991 | HMSO |
| 30. Environmental Protection Act 1990 | HMSO |
| 31. Environment Act 1995 | HMSO |
| 32. Land Drainage Act 1991 | HMSO |
| 33. Salmon and Freshwater Fisheries Act 1975 | HMSO |
| 34. Port of London Act 1908 | HMSO |
| 35. Crouch Harbour Act 1974 | HMSO |
| 36. Registration of Fish Farming and Shellfish Farming Businesses Order 1985 | HMSO |

GLOSSARY

AQUIFER - A water bearing-stratum situated below ground level. The water contained in aquifers is known as groundwater.

ASSET MANAGEMENT PLAN (VERSION 2) (AMP2) - The second set of Asset Management Plans produced by Water Companies. The Plans cover the Water Companies' known investment of existing and other obligations for the 10 year period 1995 to 2005. The NRA is involved in setting priorities for work necessary for environmental improvements within allowed expenditure limits. Charges are controlled by an independent regulator, the Director General of Water Services (OFWAT).

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.

BIOMASS - The weight of fish supported within a unit area.

BIVALVE - A twin-shelled mollusc.

BORROW DITCH - An excavation made in order to obtain material to construct an embankment, also known as a Delph ditch.

COARSE FISH - Freshwater fish not belonging to the salmon family, represented mainly by various cyprinid fish, together with pike, perch and eels.

CONSENT - 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.

DIFFUSE POLLUTION - Contamination from a non-point source.

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.

EOCENE - Geological period when London Clay, and Woolwich and Reading Beds were deposited.

EUTROPHIC - A description of water which is rich in nutrients. At worst, such waters are sometimes beset with unsightly growths of algae.

EVAPOTRANSPIRATION - The loss of moisture from the earth's surface, allied to transpiration from vegetation.

FLOOD DEFENCES - Anything natural or artificial that protects against flooding, to a designed return period.

FLOOD PARK - An area of land designed and designated to store excess surface water in times of flood, allowing a controlled discharge back into main river. It may be on the banks of the river or remote.

FLOOD PLAIN - An area liable to inundation in times of flood.

FYKE NET - A conical net used to trap eels.

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 - Topographical/physical features of the earth's surface.

GROUNDWATER - Water which saturates a porous soil or rock substratum (or aquifer). Water held in storage below ground level.

HANDS OFF FLOW - The flow below which abstraction must cease.

HYDROGEOLOGY - Study of the geological facets of the earth's water (e.g. groundwater).

LIGHTER - A barge with no means of propulsion.

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.

MAIN RIVER - Statutory length of river or watercourse over which NRA has permissive powers.

MINIMUM ACCEPTABLE FLOW (MAF) - The minimum acceptable flow as defined in Section 21 of the *Water Resources Act 1991*.

NATIONAL NATURE RESERVE (NNR) - An area of national importance for nature conservation.

NON-NRA MAINTAINED COASTLINE - This could be coastal defence or cliff fronting high ground, both the responsibility of maritime district councils; or sea defences which are by agreement maintained by a third party, such as the Ministry of Defence.

OFWAT - Office of Water Services.

POLLARD - To cut a tree so as to produce a close rounded head of young branches. The cut is made above the level reachable by grazing animals.

RAMSAR - Wetland site of International Importance that is designated under the Ramsar convention.

RECHARGE - Water which percolates downwards from the surface into groundwater.

REKETMENT - An anti-erosion surfacing.

RIFFLE - A shallow area in a river where the substrate is composed of gravel and the flow is faster.

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.

SALMONID FISH - A game fish of the salmon family eg. salmon, sea trout and brown trout.

SALTINGS - Meadowland or marsh that is periodically flooded by seawater.

SALTMARSH - Expanses of herbaceous plants in the intertidal zone.

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.

SPECIAL PROTECTION AREA (SPA) - Statutorily protected habitats for wild birds under an EC Directive.

STORM SEWAGE DISCHARGES - The discharge of untreated sewage in times of heavy rainfall and high flows.

SURFACE WATER - Water collecting on and running off the surface of the ground.

TELEMETRY - A means of directly collecting data from remote sites.

TRANSFER STATION - A place where refuse, collected from premises, is compacted into large containers and transported onward for disposal.

TRANSPIRATION - Loss of water through plant growth.

STATUTORY WATER QUALITY OBJECTIVES (SWQOs) - Statutory water quality targets to secure specific formal minimum quality standards for specific stretches of water by given dates. A 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.

WET SHELVES - An area of river bed just below water level.

WHITEWEED - A colonial and sedentary animal (actually the colonial hydroid *Sertularia* sp.) of plant like appearance and physical characteristics, used mainly for decorative purposes.

ABBREVIATIONS

ADAS	.... Agricultural Development Advisory Service
AMP2	.... Second Asset Management Plan
AOD	.... Above Ordnance Datum
AWS	.... Anglian Water Services
BASC	.... British Association for Shooting and Conservation
BOD	.... Biochemical Oxygen Demand
CEWP	.... Coastal and Estuarine Working Party
CMP	.... Catchment Management Plan
DC	.... District Council
DO	.... Dissolved Oxygen
DoE	.... Department of the Environment
EC/EU	.... European Community (European Union)
EN	.... English Nature
ESA	.... Environmentally Sensitive Area
ESW	.... Essex & Suffolk Water
gm ⁻²	.... Grams per square metre (a unit of biomass)
GQA	.... General Quality Assessment
HMSO	.... Her Majesty's Stationary Office
HOF	.... Hands Off Flow
km	.... Kilometre (a unit of length)
LA	.... Local Authority (County, Borough or District Council)
LFDC	.... Local Flood Defence Committee (Essex committee for this catchment)
m	.... Metre (a unit of length)
MAFF	.... The Ministry of Agriculture, Fisheries and Food
MAF	.... Minimum Acceptable Flow
Mgmt	.... Management
MI/a	.... Mega litres per annum (flow rate of millions of litres per year)
MI/d	.... Mega litres per day (flow rate of millions of litres per day)
NFU	.... National Farmers Union
NNR	.... National Nature Reserve
NRA	.... National Rivers Authority
NWC	.... National Water Council
OD	.... Ordnance Datum -Newlyn- the datum for all land level survey in Britain
R&D	.... Research and development
RCS	.... River Corridor Survey
RECs	.... River Ecosystem Classes
RSPB	.... The Royal Society for the Protection of Birds
RQO	.... River Quality Objective
SAM	.... Scheduled Ancient Monument
SPA	.... Special Protection Area
SSSI	.... Site of Special Scientific Interest
STW	.... Sewage treatment works
SWQO	.... Statutory Water Quality Objective
WOAD	.... Welsh Office for Agricultural Development
WQOs	.... Water Quality Objectives
WRA	.... Waste Regulation Authority

The National Rivers Authority

Guardians of the Water Environment

The National Rivers Authority is responsible for a wide range of regulatory and statutory duties connected with the water environment.

Created in 1989 under the Water Act it comprises a national policy body coordinating the activities of 8 regional groups.

The main functions of the NRA are:

- | | |
|--|--|
| <i>Water resources</i> | — The planning of resources to meet the water needs of the country; licensing companies, organisations and individuals to abstract water; and monitoring the licences. |
| <i>Environmental quality and Pollution Control</i> | — maintaining and improving water quality in rivers, estuaries and coastal seas; granting consents for discharges to the water environment; monitoring water quality; pollution control. |
| <i>Flood defence</i> | — the general supervision of flood defences; the carrying out of works on main rivers; sea defences. |
| <i>Fisheries</i> | — the maintenance, improvement and development of fisheries in inland waters including licensing, re-stocking and enforcement functions. |
| <i>Conservation</i> | — furthering the conservation of the water environment and protecting its amenity. |
| <i>Navigation and Recreation</i> | — navigation responsibilities in three regions — Anglian, Southern and Thames and the provision and maintenance of recreational facilities on rivers and waters under its control. |

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



NRA EMERGENCY HOTLINE

0800 80 70 60

24 hour emergency telephone line

Help the
NATIONAL RIVERS AUTHORITY
to protect the
water environment





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