HUMBER ESTUARY CATCHMENT MANAGEMENT PLAN CONSULTATION REPORT

NRA

National Rivers Authority

JULY 1994

THE NRA'S VISION FOR THE HUMBER ESTUARY

Established in 1989 the National Rivers Authority has as its role that of "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 and estuary catchments is essential to its future management.

Catchment Management Plans are a vehicle to achieve improvements in the water environment. By using public consultation they will allow input from others and provide commitment from all parties to achieving action on important issues.

The Humber Estuary receives run-off from the Trent and Yorkshire Ouse river systems, a fifth of the area of England. This is the largest catchment of any UK estuary. The Humber itself is a valuable resource for the community, fisheries and wildlife and is of international importance for a number of species of birds. The location of the Estuary and the size of the inputs of freshwater makes the Humber of great significance in relation to the environmental management of the North Sea.

The NRA's vision for the Humber Catchment during the lifetime of this Plan is to work towards the sustainable management of the Humber, balancing the legitimate interests of all who use the Estuary. To achieve this vision the following actions are considered necessary

- To maintain and enhance the National and International status of the Estuary for its bird population and conservation interest.
- To improve existing flood defences to accommodate rising sea levels and to maintain and/or improve their structural integrity.
- To reduce the discharge of dangerous substances to the North Sea.
- To improve water quality of the Tidal Ouse.
- To restore a run of migratory salmonids, ie. sea trout and salmon, through the Humber Estuary.
- To set Minimum Residual Flows for the Trent and Ouse which balance all water related interests.
- To ensure that the recreational potential of the Humber Estuary is fulfilled.

- To work with all relevant parties to implement the principles of sustainable development particularly by establishing stronger links with local communities and their representatives.

- To balance the needs of industrial, urban and agricultural development with the requirements of the Humber wetlands and sites of archaeological importance.

- To provide a management strategy to ensure a sustainable population of shrimp, shellfish and lugworm and thereby protect this valuable link in the food chain .

- To improve our knowledge of the relationship between sedimentary processes, rising sea levels and the natural boundaries of the Estuary.

The health of the North Sea has increasingly been called into question in recent years. On occasion it has been alleged that the Humber has contributed to a decline in that health. Sometimes it has been difficult to refute the allegations; either due to their non-specific nature, or due to the limited availability of counter-balancing evidence. The NRA's vision for the future for the waters of the Humber and adjacent North Sea is one where these allegations can no longer be made because:

- The record shows reducing domestic and trade effluent loads being discharged to these waters.

- The results of chemical monitoring show the restoration of water quality achieved over the past decades are being maintained and that further improvements are occurring.

- The results of biological monitoring show a healthy and diverse life throughout the waters and their sediments.

- The widespread publication of the results of monitoring and of effluent reduction programmes creates a general awareness of the well being of the Humber and the surrounding parts of the North Sea.

The North Sea impinges on the catchment in other ways:

- It can breach sea defences causing flooding of the large areas of Humberside that are at or below sea level.

- It creates productive fisheries both within the Humber and in adjacent coastal waters.

- It provides a transport link leading to the development of ports and associated industry.

The NRA will exercise its responsibilities to prevent and mitigate flooding, to promote the health of the North Sea fishery and to regulate industry.

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1 CONCEPT

The National Rivers Authority 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, including the protection of people and property.
- Flood warning.
- Effective management of water resources.
- Maintenance, improvement and development of fisheries.
- Conservation and enhancement of the natural water environment.
- Promotion of water based recreation including navigation.

To achieve success in all these areas the NRA works with industry, commerce, local authorities, farming, the general public and others 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 future generations.

Catchments are subject to increasing use by a variety of activities. Many of these interact and some conflicts arise. 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 and to emergencies resulting from flooding.

- Control pollution by working with dischargers to achieve improvements and monitor effluent compliance with appropriate standards.

- Maintain existing and invest in new assets to provide flood protection and provide other NRA services.

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

- Develop fisheries, promote recreation, navigation and conservation.

- Influence planning authorities to control development so as to avoid conflict with and create opportunities to further NRA objectives and initiatives through Town and Country Planning Liaison.

- To assess, manage, plan and conserve water resources.

Public Consultation

The publication of this report marks the start of a four month period of formal consultation enabling external organisations and the general public to work with the NRA in planning the future of the water environment of the Humber Estuary.

This report describes the catchment, reviews the state of the water environment and identifies the uses and issues which need to be addressed. It does not define in detail the action plans. The issues and options presented to achieve the NRA's vision for the Humber Estuary are the initial thoughts of the NRA and do not constitute policy statements.

Through detailed consultation with all interested organisations the consultation process will enable the NRA to:

- Confirm the range and extent of catchment resources, uses and activities.

- Obtain views on the issues facing the water environment identified in the report.

- Begin the process of identifying and agreeing action plans.
- Ensure decisions on the future management of the catchment are based on a wide range of views from interested parties.

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

- Is the vision realistic, affordable and achievable?
- Are there any issues which have not been addressed?
- What are the opinions of consultees on the options proposed?
- Have the issues been adequately assessed?
- How should the development of strategies and action plans be progressed?

Following the consultation period which ends on 31 October 1994 all comments will be considered in detail before producing a definitive Catchment Management Plan. The final plan will define both a strategy for the future management of the catchment and a series of action plans for the NRA working with others to implement.

In light of the actions identified, project groups will be established to implement and monitor the action plans. An annual review of progress against the actions identified in the catchment will be made by the NRA. The review will assess progress made by all relevant groups, organisations and individuals identified within the plan.

During the consultation period please send any comments in writing to the address below

Bill Forbes
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Humber Estuary Catchment Management Plan
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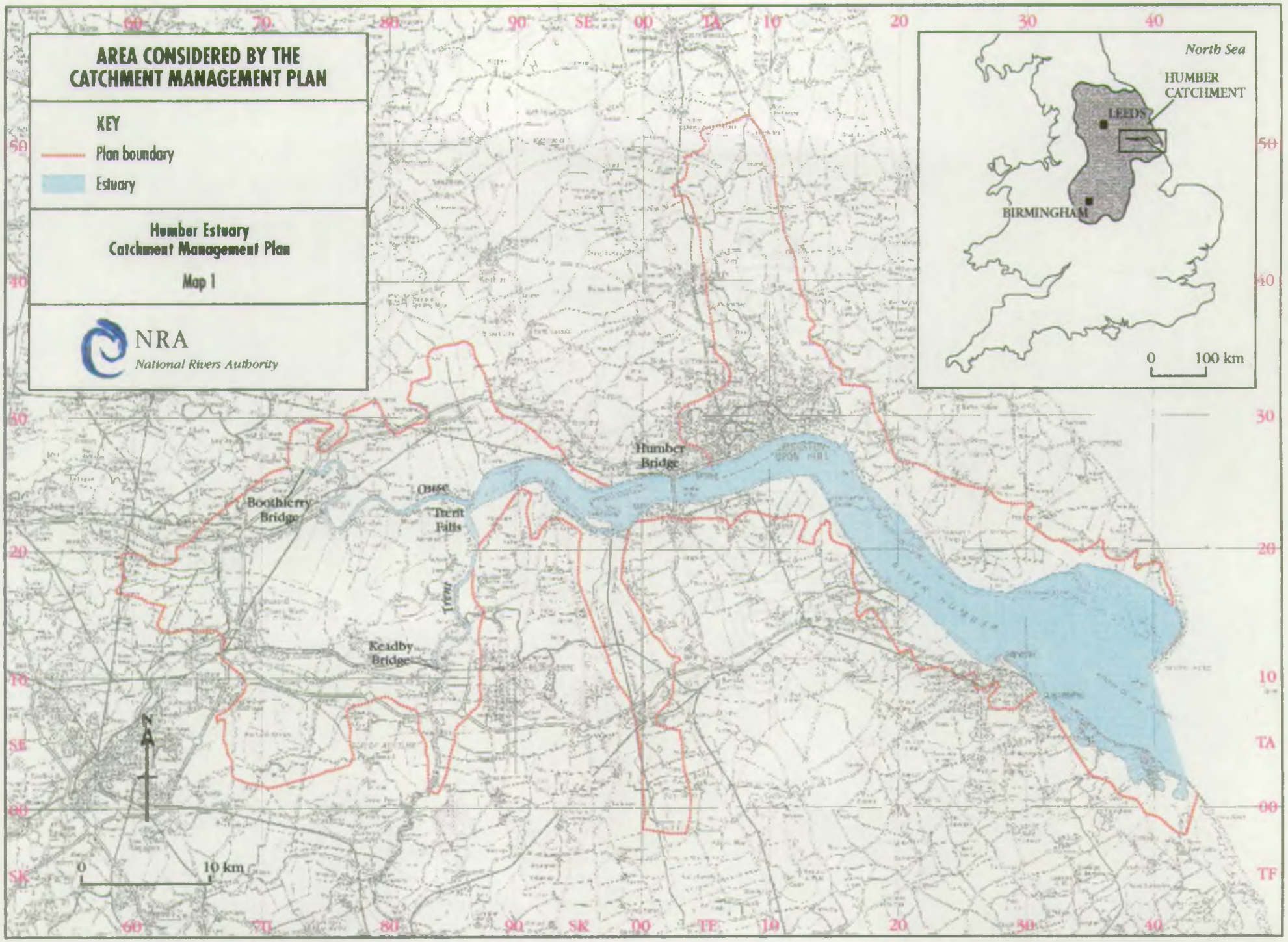
Leeds
LS12 6DD

All comments should be received by October 31 1994

Note: Whilst every effort has been made to ensure the accuracy of information in this Plan it may contain some errors or omissions which be will be pleased to correct.


AREA CONSIDERED BY THE CATCHMENT MANAGEMENT PLAN
KEY
Plan boundary
Estuary
Humber Estuary Catchment Management Plan
Map 1
NRA
National Rivers Authority
North Sea
HUMBER CATCHMENT
LEEDS
BIRMINGHAM
0
100 km
Humber Bridge
Ouse
Trent Falls
Trent
Boothferry Bridge
Keadby Bridge
RIVER HUMBER
N
0
10 km

2 OVERVIEW

2.1 INTRODUCTION

The Plan covers the area down to the mouth of the Humber Estuary which is conventionally taken as a line drawn between Spurn Point and Donna Nook, to the upstream points of salt penetration which are Keadby Bridge on the River Trent and Boothferry Bridge on the River Ouse (see Map 1). For flood defence purposes only the plan area has been extended on the River Ouse up to Aires Mouth as this provides a natural flood defence boundary.

Consideration is given to the impact of a range of activities that either have occurred or may occur within the flood plain, i.e. the area that potentially would be flooded at high water. An assessment of the importance of the Humber Estuary in terms of the quality of the North Sea is also provided.

Clearly the catchment under consideration is not a normal river catchment and contains somewhat artificial boundaries. The impact of tributaries of the Ouse and Trent, and also those rivers discharging from the north and south banks to the Humber itself are considered. Adjacent catchments will be considered in more detail in their own Catchment Management Plans produced by the National Rivers Authority within the next three years. (Appendix 5 provides further details).

The Humber Estuary receives run-off from the Trent and Yorkshire Ouse river systems, a fifth of the area of England. This is the largest catchment of any UK estuary. Within the total catchment much of the country's coal output, electricity generating capacity and manufacturing industry are concentrated. Major inputs of industrial and municipal effluent arise in the non-tidal catchment of the Ouse and Trent river systems. However the polluting inputs which originate directly from industry on the Humbers banks are not inconsiderable and the direct discharges of sewage in various stages of treatment from Hull, Cleethorpes and other Humberside towns have appreciable, albeit relatively local significance.

The Humber itself is a valuable resource for the community, fisheries and wildlife, and is of international importance for a number of species of birds. The Estuary supports massive numbers of birds on the intertidal mudflats and saltmarshes, both during migratory passage and as their winter residence. In terms of numbers, the Humber is one of the top five estuaries in the United Kingdom, with the majority of birds recorded on the mudflats which fringe the south banks.

The location of the Estuary and the size of the input of freshwater makes the Humber of great significance in relation to the environmental management of the North Sea. Until recent years the management and control of water quality in estuaries in England and Wales has

a lower priority than river pollution control. The reasons for this may be debated but one factor of significance was undoubtedly the widely held view that any pollution within an estuary was generally diluted to insignificance by the practically "infinite" capacity of the adjacent coastal waters to dilute and disperse. This general misconception, particularly in the case of the shallow North Sea, has now been replaced by a general and widespread concern for the wider environmental impact of the pollution of rivers, estuaries and coastal waters.

A mathematical model of water quality for the Humber Estuary has been developed which has proved to be invaluable for understanding and predicting changes in water quality within the Estuary and is an essential management tool for policy decisions. The model was developed primarily to predict the concentration of dissolved oxygen within the Estuary but has since been further developed for applications involving other parameters. It is now used to study; the causes of existing pollution, the most effective means of achieving Environmental Quality Standards (EQS's), consent conditions for new discharges and the effect of abstraction from non-tidal rivers.

In determining monitoring and management strategies for the Humber Catchment, it should be recognised that in the Estuary it is the biological life that is the most valuable resource, whereas in the tributaries the resource is the fresh water itself.

Fortunately the National Rivers Authority inherited a long history of coordinated scientific monitoring of the quality of the Humber Estuary. There is now some 30 years experience of coordinated chemical and biological monitoring which forms an invaluable database with which to detect genuine trends in water quality and on which to base future water quality management decisions and policy.

The Humber Estuary is very productive biologically with at least 180 species of invertebrates being recorded. The high silt content of the water results in layers of mud on the Estuary bed and it is in this layer of mud that very high densities of individuals are to be found, up to 300,000 individuals/m^2. This abundance is reflected in the number of predators which are found on the Estuary, notably birds and fish.

The rarity and wide range of habitats which supports such large populations of plants and animals has meant that the Humber Estuary is an area of great nature conservation interest which has been recognised by a range of national and international designations. These designations include Sites of Special Scientific Interest (SSSIs), a proposed RAMSAR site which classifies the Estuary as a 'Wetland of International Importance', and as a Special Protection Area (SPA) under a European Community Council Directive on the Conservation of Wild Birds. These designations place statutory duties on owners to consult about their activities and the effect of these on the nature conservation interest, to promote conservation of particular sites and the wise use of wetlands and to take special measures to conserve the habitat of certain rare or vulnerable species, and regularly occurring migratory species. The range of nature conservation interest extends to involvement not only of statutory bodies such as English Nature and the National

Rivers Authority but to District and County Councils, voluntary bodies and many other interested groups.

However, other demands are imposed on the Estuary, some of which potentially conflict. For instance, physical changes as a result of land drainage have taken place over several centuries and it is estimated by Jones (1992)[1] that 78% of the original saltmarsh has now been drained, although a substantial area has been preserved. In addition, over 5,000 hectares of intertidal wetland (31%) has been reclaimed as dry land.

Much work has taken place to ensure protection of low lying property, land and people from flooding. Flood defence works may alter the characteristics of the land enclosed and also have an effect on the coastal processes within the Estuary. Hence the NRA is pursuing a holistic strategy for improving the Humber tidal defences based on an understanding of the physical processes operating within the Estuary. This will take into account the many uses of the Estuary, particularly its importance to nature conservation and wildlife.

An area of some 805 km^2 within the catchment lies below high spring tide level and is therefore potentially at risk from tidal inundation. This area includes parts of Grimsby, Cleethorpes, Hull and Goole and the highly industrialised section along the south bank between East Halton and Grimsby plus much high grade agricultural land.

The defences which have been constructed to protect this area, a mix of earth/clay banks and hard defences have been largely rebuilt since the 1953 tidal surge when an area over 35 km^2 was flooded. The condition of many of the defences is now giving cause for concern, not only because of their age and condition but also because of rising sea levels which increases the potential for overtopping of the defences and accelerates the rate of deterioration. This scenario is further exacerbated by the changes in sedimentary processes which result in a net loss of material to the Estuary that would otherwise have built up and maintained beach and foreshore levels.

Assessments are being made of the environmental impacts of future flood defence work as it is vital that protection and enhancement of the Humber should form an integral part of any proposals.

The Humber supports populations of fish which are typical of estuaries subject to varying salinities and tidal scour. There are good populations of plaice, goby, whiting and sole and the Estuary is particularly important as a nursery area for flat-fish. Although there is a small scale commercial fishery, it is as a nursery area that the Humber is of most importance to commercial fisheries. For example, it has been estimated that 3% of the North Sea Plaice population use the Humber as a nursery.

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[1]The Regional & International Setting of the Humber - Jones 1992

The Humber is one of Britains largest shipping complexes and the banks have a number of industrial developments. The large population associated with the urban and industrial development creates further pressures with demand for water based recreational facilities, both on the Estuary and in the immediate coastal area.

The need to recognise the existing varying uses and potential changes in the future has focused attention on the requirement for the many organisations and interests on the Estuary to work together and it is anticipated that this Plan will help in this process.

2.2 WATER RESOURCES

The long term average flow from the entire catchment draining to the Humber Estuary is approximately 19 000 megalitres per day (Ml/day).

The key Water Resource issue for the Humber Estuary is to establish a methodology to determine the minimum residual flow to tide necessary, in order to strike the right balance between the needs of abstractors on tidal rivers feeding the Estuary and other users, and those of the environment. This is particularly relevant at present as there are a number of potential new abstraction proposals to take water from the tidal stretches flowing to the Humber Estuary.

Minimum Residual Flows (MRF's) or flow control rules are needed to set limits within which the available resources of the river can be allocated and any proposals for abstractions planned. These limits must be adequate to ensure the environmental health of the river, to provide adequate dilution of effluent to meet water quality standards and to appropriately satisfy all or most of the needs of existing river users.

An MRF is a target river flow; it cannot necessarily be maintained by the NRA (or anyone else) and under drought conditions river flows may naturally fall lower.

Calculation of flows to the Estuary is made difficult by the absence of gauged information from some catchments upstream of the Plan area. This problem is most significant at low flows and leads to inadequate knowledge on which to base decisions for managing water resources

2.2.1 River Ouse

The natural flow patterns of the major rivers which contribute to the Ouse have been modified by human influence within their catchments resulting in changed flow patterns which reflect these influences.

In the case of the North Yorkshire rivers, Derwent, Ouse and Wharfe, they have been utilised to supply water for public consumption within their own catchment and also to supply the industrialised southern part of the county. This has been made possible through the direct abstraction from the river and by building reservoirs for storage in the upper parts of the catchments. The main effect of this is upon dry weather flows when prescribed flows have to be operated at strategic parts within each catchment. This will result in a reduction in flows to the Humber but should enable the dry weather flows (Q_{95}) to be protected.

The reverse of this happens on the industrialised rivers of the southern part of the catchment; Aire, Calder and Don. They have an enhanced dry weather flow due to the treated effluents from the industrial conurbations of West and South Yorkshire and much of this water is

The Northumbria & Yorkshire Region of the NRA will commission a Water Resources Strategy which will review the balance between future supply and demand within the region.

2.2.2 River Trent

The area draining to the River Trent at Keadby Bridge comprises almost the whole of the Trent basin, whilst the areas draining to the river within the area of this Plan are the subcatchments of the Old River Don (Paupers Drain) and Adlingfleet Drain to the west and the narrow area centred on Burton-upon-Stather to the east. The Trent's channel is entrained between primary flood defences and it is therefore treated as a separate subcatchment for abstraction control and land drainage. The land on both sides of the Trent is very low lying marsh land only 2 metres above sea level.

Until quite recently the Trent has not been considered suitable for direct abstraction for public water supply. Within the fluvial and upper tidal reaches large quantities of water are licensed for abstraction, with some power stations able to take in excess of the dry weather flow. However most of the water is returned to the river close to the point of abstraction and therefore controls on flows and abstractions have not been considered necessary. The potential for further abstractions from the tidal reaches but above the saline limit, has been recognised and this water could be exported from the Trent catchment.

Over the last 150 years the artificial component of total freshwater flows has increased. This is due to the import of water for public supply from the Severn basin with susequent discharge to the Trent catchment. At low flows the artificial component can comprise half of the total flow. Changes in natural flow are not well documented. Severn-Trent Region is undertaking a study to produce information on naturalised flows.

The approximate contributions of flow of freshwater to the Humber from the Ouse and Trent are shown in Table 1.

Table 1 Contribution of Freshwater Flow to The Humber from The Ouse and Trent Catchments.

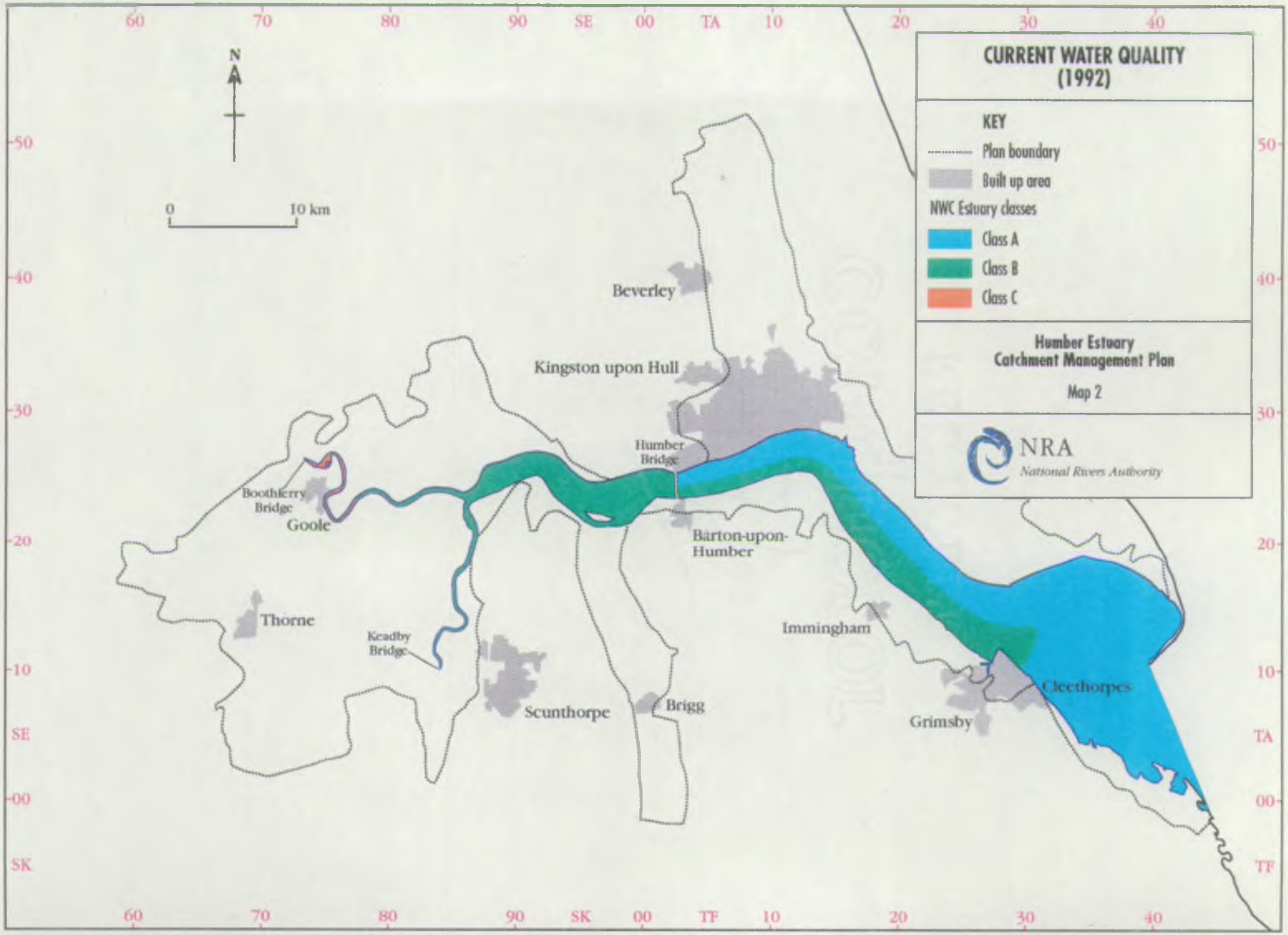
Parameter	Ouse Catchment		Trent Catchment	
	Flow	**Period of Record**	**Flow**	**Period of Record**
Long Term average MDF	11 440	1960-92	7 590	1969-92
Mean Summer Flow (Apr-Sep)	6 200	1960-92	5 290	1969-92
Mean Winter Flow (Oct-Mar)	14 450	1960-92	9 910	1969-92
Q_{95} Flow	2 120	1960-92	2 340	1969-92

Notes: All flows expressed in megalitres per day Ml/d
MDF = Mean Daily Flow
Q_{95} Flow = The flow which is exceeded for 95% of the time

2.2.3 River Humber

Other flows to the Humber Estuary are small and relatively insignificant compared to the Ouse and Trent River flows. The only river of a reasonable size that drains the north bank area is the River Hull. The base flow from this is affected by abstraction for public water consumption. On the south bank.

The River Ancholme is the only main river input to the Estuary. Other small watercourses contribute very small flows, namely the Laceby Beck and East Halton Beck. The River Ancholme is augmented during summer months to meet abstraction demands and contributes only a small residual flow to the Estuary in summer months. The river outfall to tide at its confluence with the Estuary is carefully managed to exclude saline incursion.


CURRENT WATER QUALITY
(1992)
KEY
Plan boundary
Built up area
NWC Estuary classes
Class A
Class B
Class C
Humber Estuary
Catchment Management Plan
Map 2
NRA
National Rivers Authority
N
0
10 km
Beverley
Kingston upon Hull
Humber Bridge
Boothferry Bridge
Goole
Barton-upon-Humber
Thorne
Keadby Bridge
Immingham
Scunthorpe
Brigg
Grimsby
Cleethorpes
60
70
80
90
SE
00
TA
10
20
30
40
50
SK
TF

2.3 WATER QUALITY

The overall quality of the Humber Estuary is largely determined by the quality of the rivers draining via the Ouse and Trent river systems. The relevant rivers and the Estuary are currently classified according to the scheme of the former National Water Council. Details of the classification schemes and the current status with reference to a range of chemical parameters are provided in Appendix 2. Currently, Water Quality Objectives (statutory) for estuaries have not been finalised and for consistency the NWC scheme has been used throughout this plan.

The current status of the Estuary and its tributaries with reference to the above classification scheme is provided in Map 2.

The classification scheme, targets in map form and targets for other chemical parameters are provided in section 3.2.

To mitigate the impact of pollution incidents within the Estuary, a control strategy has been co-ordinated by Humberside Council's Emergency Planning Officer based at Wawne in North Humberside. The resources of the NRA, Local Authorities and the Marine Pollution Control Unit can be and have been utilised. It is recognised that a different coordinator may be required if the current proposals for local government reorganisation are implemented.

2.3.1 River Ouse

The Yorkshire Ouse drains the major industrial conurbations of West and South Yorkshire as well as the rural areas of North Yorkshire. The water quality of the Tidal Ouse is largely affected by the quality of the rivers which feed it, in particular the Rivers Aire, Calder and Don which pass through those major conurbations.

Chemical Quality

The chemical quality of the tidal reaches of the River Ouse from Naburn Weir to Boothferry Bridge, varies from Class 2 to Class 4 under the NWC Classification Scheme. This compares with a River Quality Objective (RQO) for these reaches of the river of Class 2. From Boothferry Bridge to Trent Falls the quality of the river is in Classes B and C under the NWC Classification of Estuaries, compared with an objective of Class B (see 3.2).

One of the main factors determining the current poor quality of the lower Ouse is low dissolved oxygen levels. The Tidal Ouse from Selby to Blacktoft, a distance of 40 km, fails to comply with the requirements of the dissolved oxygen standard i.e. that the tidal river should contain at least 40% saturation of dissolved oxygen for 95% of the time.

During any particular year there is a very marked seasonal variation in dissolved oxygen concentration, particularly in the most polluted stretches of the River Ouse and its tributaries,

where very low dissolved oxygen concentrations (sometimes approaching zero) are observed during the summer months. These are generally coincident with high temperatures and low flows but are also affected by high concentrations of suspended organic matter.

Dissolved oxygen levels have been low in the Tidal Ouse for many years, largely due to the poor quality of effluent discharged from sewage treatment works on its tributaries, particularly the Aire and Don, plus some strong industrial organic discharges in the Selby area.

Sewage effluent also discharges to the main River Ouse at Naburn, Barlby, Selby and Goole. With the exception of Naburn, only partial treatment of sewage is afforded at these sites and at Goole in particular discharges of screened sewage have a marked effect, contributing to a reduction in the quality of the river from Class 3 to Class 4 for 23 kilometres of its length downstream.

Large scale improvements are in progress at several of these sewage treatment works, for example at Esholt (Bradford) and Knostrop (Leeds) on the River Aire and at Blackburn Meadows (Sheffield) on the River Don. Further treatment will be required at Selby, Thorne and Goole in order to comply with the Urban Wastewater Treatment Directive.

Industrial discharges to the Tidal Ouse also contribute to the pollutant load on the river. However, over the last decade several significant improvements have been made to industrial discharges. These have been realised by either the installation of on-site effluent treatment plants or the overall reduction in output of effluent.

In some cases reduced levels of industrial production or changes in manufacturing trades have caused an appreciable reduction in pollutant load discharged. In particular, there has been a significant reduction in BOD (biochemical oxygen demand) load from a citric acid manufacturing plant (Haarmann & Reimer) through the provision of treatment.

The concentrations of metals and pesticides in the Tidal Ouse are all at a relatively low level and meet the Environmental Quality Standards.

Biological Quality

Biological information from the rivers entering the Humber via the Ouse reflects the poor quality of the water draining from the Southern Yorkshire conurbations.

The tidal rivers show little species diversity and are generally dominated by Oligochaete worms and/or brackish water "shrimps". The abundance of species is variable and appears to be related to the nature of the substrate rather than water quality. Compacting or shifting sediments tend to preclude the establishment of higher population densities.

In comparison with long-term averages there has been little change in species diversity or abundance in this part of the catchment.

2.3.2 River Trent

The River Trent, having a catchment area of 10,435 km^2 and draining the central part of England, provides approximately 40% of the fresh water flow to the Humber Estuary. The Trent flow to the Estuary is composed primarily of the main non-tidal river with the addition of a relatively small contribution from a number of tributaries in the tidal stretch.

Chemical Quality

The Lower Trent to Keadby Bridge currently meets its RQO of Class 2 under the NWC River Classification Scheme and complies with the freshwater EQS for tidal waters. From Keadby to Trent Falls the river meets its objective which is Class B under the NWC Classification Scheme for Estuaries, providing a reasonable quality input to the Estuary.

In the past, organic pollution from the Trent contributed to the depletion of dissolved oxygen in the Humber Estuary. A steady increase in dissolved oxygen concentrations has occurred over the past 30 years reflecting the general improvement in the quality of the Trent with the removal of substantial pollution loads from sewage and industrial effluents.

Low dissolved oxygen levels now recorded between Keadby and Trent Falls are attributed to deoxygenated water from the Ouse and Upper Humber being pushed up river on the incoming tide. Failures in EQS have occurred when high tides coincide with low freshwater flows (see Appendix 2).

Discharges of sewage and industrial effluent to the Trent downstream of Keadby Bridge comply with their current consent limits. The most significant of these, coke oven effluent from British Steel, is also sampled for specific dangerous substances (described in section 3.2.3). No significant levels of these compounds have been detected and most are below the limits of detection.

The concentrations of metals, pesticides and other organic compounds are all at low level and well below the EQS for tidal rivers. Levels of copper discharging to the Humber from the Trent have reduced in recent years following operational changes at several power stations in the catchment.

Control conditions have been formulated under the Environmental Protection Act 1990 for a discharge of direct cooling water from a new gas fired power station at Keadby. These conditions will ensure that water quality is maintained and that temperature in the river is controlled to allow the passage of migratory fish.

All classified watercourses discharging to the Trent downstream of Keadby currently meet their NWC Target Classes, the largest of these, the River Torne, is Class 2.

Biological Quality

Biological monitoring has been undertaken in the Keadby area and near Trent Falls.

The benthic invertebrate fauna was found to be dominated by a brackish water "shrimp" (*Gammarus zaddachi*). The only other invertebrates to be found were the mollusc *Sphaerium sp* (pea mussel) and a single oligochaete worm. The shrimps appeared to be most abundant at the lower end of the river, where perhaps the salinity was at an optimum level. Such high numbers of the crustacean would provide an ample source of food for fish in the area.

2.3.3 River Humber

Chemical Quality

The overall quality of the Humber Estuary is determined largely by the quality of the rivers draining via the Yorkshire Ouse and Trent system. Thus the quality of these freshwater inputs is of crucial importance to the Estuary. The Trent river input is of fair quality and meets its Non-Statutory River Quality Objective Standards, but the input from the Ouse system requires considerable improvement.

The Humber Estuary has been classified according to the National Scheme given in Appendix 2. The Estuary from Trent Falls to Hull is Class B (fair quality) as is the southern half to Grimsby. The north section of the Humber from Hull seawards and the remaining parts of the Estuary are Class A (good).

The most serious pollution problem is the severe depletion of dissolved oxygen in the tidal Ouse. This is a long standing problem and is caused by discharges of inadequately treated sewage and industrial effluents into the lower reaches of the Ouse system as described in section 2.3.1. A steady improvement in dissolved oxygen concentration has occurred during the past 30 years, although substantial further improvement is necessary. Dissolved oxygen targets are achieved elsewhere in the Estuary, improving towards its mouth as increasing dilution with well oxygenated sea water becomes available (Figures 1 & 2).

Figure 1 Comparison of Dissolved Oxygen Profiles in the Ouse - Humber System 1964 - 68, 1977 - 81 and 1980 - 90

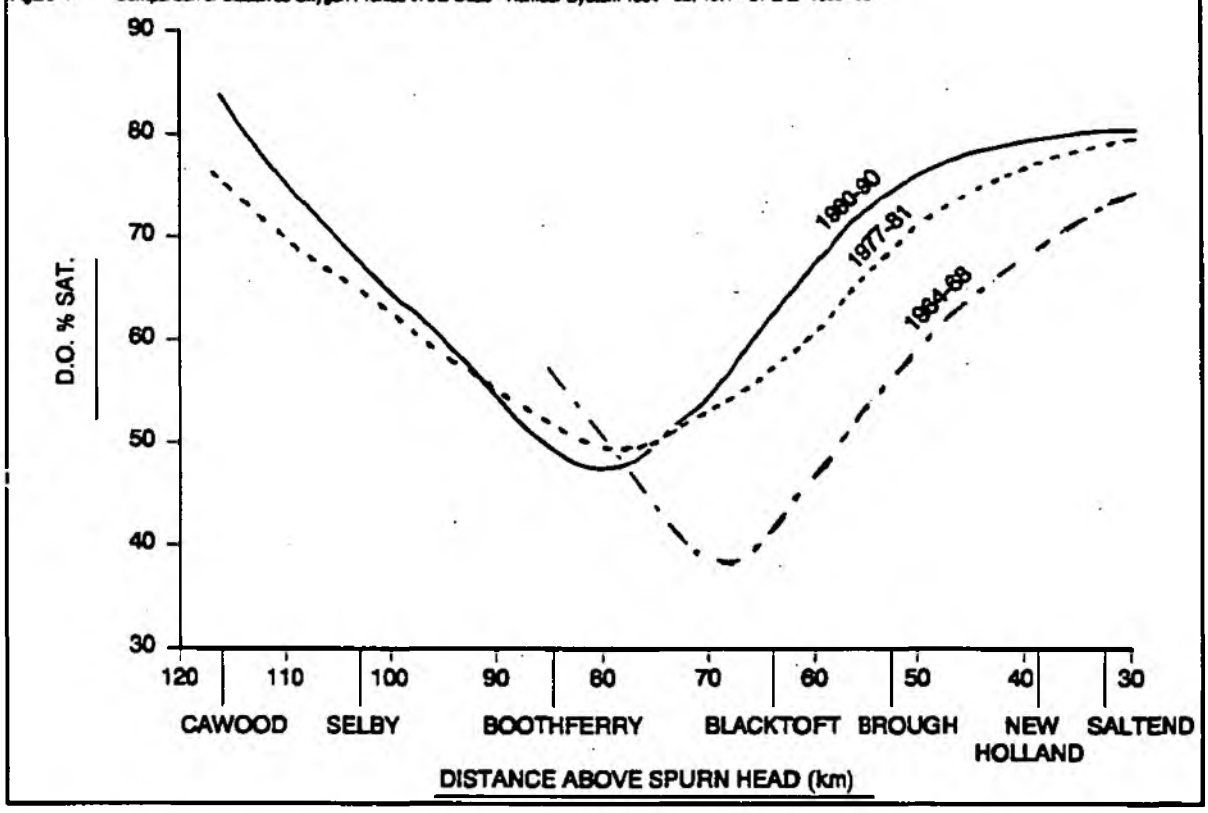
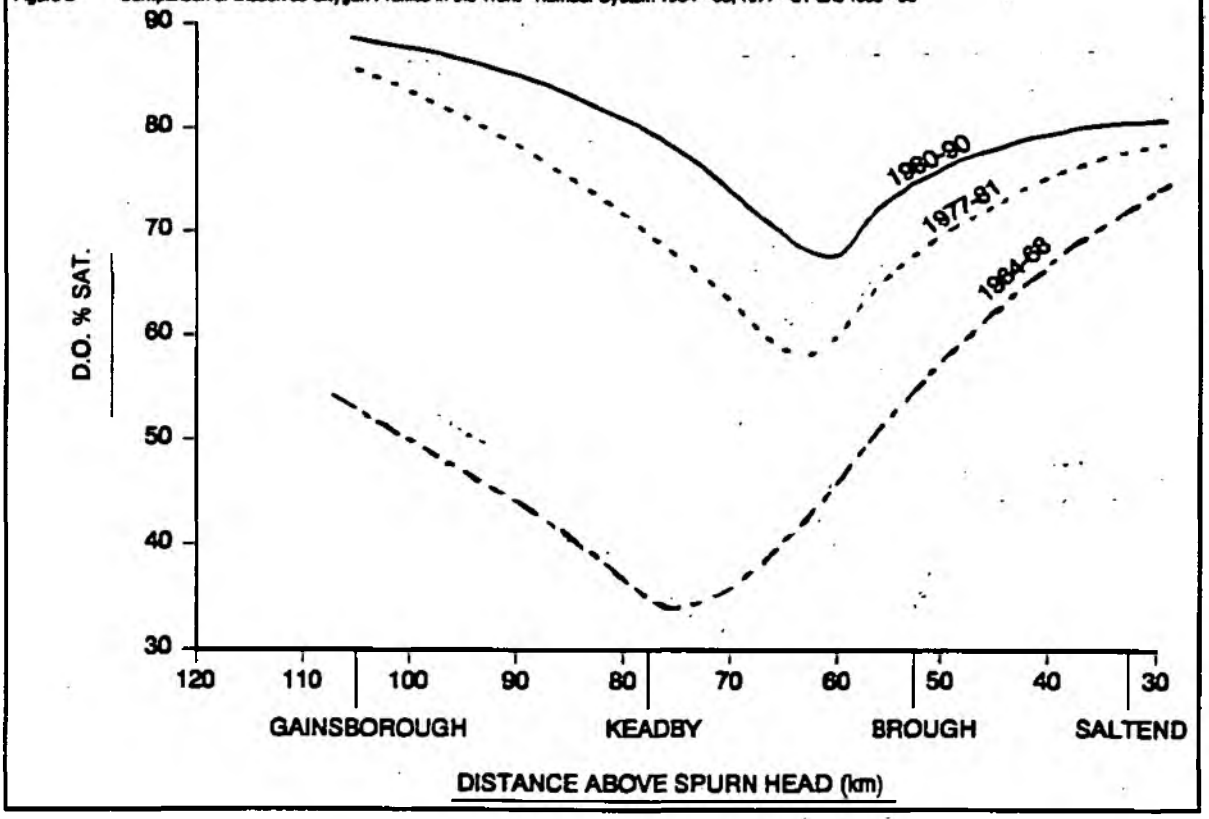


Figure 2 Comparison of Dissolved Oxygen Profiles in the Trent - Humber System 1964 - 68, 1977 - 81 and 1980 - 90



There are known to be substantial discharges of metals to the Estuary. However the dilution available ensures that the concentrations for all metals (except copper) are well below the appropriate EQS's throughout the Estuary system. Levels are however high as compared to most other estuaries (Appendix 2).

Sediments within the Estuary have been analysed for metals on a regular basis and although there are no EQS values set for sediments, the variation in metal concentrations does provide useful evidence of any local contamination. The general tendency appears to be for sediments obtained from the tidal rivers to contain lower concentrations of metal than those from the estuarine waters, although there is considerable variability within the data. Sediments in the Estuary appear to be well mixed although local elevation of arsenic and chromium levels is observed around the major industrial inputs of these metals.

The concentration of pesticides and other organic compounds monitored in the Estuary are all at very low levels and well below the relevant EQSs (Appendix 2)..

There is a relatively high level of nutrients, nitrogen and phosphorous within the Humber system derived from both sewage and industrial sources. However, no problems associated with eutrophication e.g. algal blooms, have been identified. This is hardly surprising since the turbid Estuary prevents the penetration of light into the water column necessary to promote such blooms. There are presently no EQS values stipulated for nutrients within the Estuary.

Biological Quality

Since the Humber spans almost the full range of salinity from freshwater to seawater it is both necessary and convenient to divide it into longitudinal sectors for the purposes of description. It must also be appreciated that whilst the majority of the Estuary is permanently submerged, about one third of its area is intertidal, with important implications for ecology and wildlife.

1. <u>Upper Humber (Trent Falls to Humber Bridge)</u>

This sector is characterised by narrow, highly mobile channels and wide expanses of sand and mudflats of varying stability. The channel systems support only a very restricted crustacean fauna predominantly mysids (ghost shrimps), and *Gammarus spp.* In contrast the intertidal flats support high densities of several invertebrate species, especially towards the upper tidal levels. The fauna consists mainly of oligochaete worms, although some brackish water polychaetes are present and together with the crustacean (amphipod) *Corophium*, become increasingly important in the more saline parts of this zone. This comparatively rich intertidal fauna is evidently a vital factor in supporting the extensive flocks of wildfowl and wading birds for which this area of the Estuary is renowned.

2. Middle Humber (Bridge to Saltend/South Killingholme)

This sector is predominantly shallow and sandy fringed by relatively narrow mud-banks. In the shallow subtidal area the fauna is both sparse and restricted in variety. The most noticeable feature of this naturally poor fauna is a polychaete worm *Capitella capitata* which has been widely associated with effects of organic enrichment. Repeated observations of the link between the distribution of this pollution indicator species and the likely dispersal of Hull sewage are therefore thought to be more than coincidental. The intertidal fauna represents a transition between the distinctly brackish fauna of the upper Humber and the increasingly marine fauna of the lower and outer reaches. In recent years it has been the main area for the establishment of very large populations of the amphipod *Corophium*. Although of relatively small width, mud-flats on the south of the Estuary still support significant numbers of wading birds.

3. Lower Humber (Saltend/South Killingholme to Hawkins Pt./Cleethorpes)

This sector of the Estuary comprises some of the deepest natural channels with a scoured (even rock) bed, together with large (mainly muddy) shoal areas such as Stallinborough Flat and Burcom Shoal and increasingly extensive mud-flats, such as Pyewipe. Predictably the fierce currents encountered in the channels precludes the establishment of any appreciable biological community. In contrast the shoal areas, particularly off the southern shore support a rich and varied fauna consistent with the higher salinity of this sector. A comparatively wide range of polychaete worms are present together with at least one species of bivalve mollusc and several types of crustacea. Particularly high abundances of some worm species are encountered on the clay "reef" of Stallingborough Flat, and the Burcom Shoal supports sufficiently generous numbers of invertebrates (principally worms) to sustain a fishery for much-prized Dover Sole.

As with the shoal areas, the fairly extensive mud-flats support a wider range of invertebrates than in the less saline reaches of the Estuary, including two potentially important species of mollusc. Both worms and molluscs are usually present in appreciable densities and provide food for both wading birds and (when covered by the tide) several species of flatfish. One of the mollusc species (*Hydrobia ulvae*) is considered to be an important item in the diet of Shellduck which are frequently seen on the Pyewipe flats. Specific investigations have shown localised areas of impoverished or disturbed benthic communities, both subtidally and intertidally, associated with discharges of sewage and industrial effluents.

On the south bank of the Estuary in this sector (as well as the downstream half of the previous sector), extensive quantities of stone have been tipped in the process of constructing flood protection banks. These boulders have facilitated the establishment of a limited but (in recent years) quite flourishing "rocky shore community". The most noticeable components of this community are crustaceans, especially common shore

crabs and barnacles, together with an often vigorous cover of the common seaweed - *Fucus vesiculosus* (bladder wrack). (The latter is in fact present on much of the southern shore as far up as the Humber Bridge, along with different species of barnacles).

4. Outer Humber (Hawkins Point/Cleethorpes to Spurn Point/Donna Nook)

This sector of the Estuary shows an increasingly marine type of fauna. It is predominantly sandy both subtidally and intertidally except for the vast expanse of mud within Spurn Bight and the shoal area between the Bight and the Sunk Dredged Channel. Current strengths constrain the variety and abundance of invertebrates within the channel systems. However, in areas away from the more severe influences of water movements comparatively rich communities have established with over 30 invertebrate species being consistently recorded at the outermost NRA sampling location. These include an extended variety of polychaete worms and a wider selection of crustacea and molluscs. Such species are generally typical of cleaner, sandy marine habitats. Although the marine influence and coarser sediment leads to an often wider variety and different assemblage of benthic invertebrates, the "high energy" nature of sandy regimes also invariably results in lower densities of organisms than in the mud-dwelling communities upstream. Never the less, it is clear that the intertidal flats of the outer Estuary are a very important area for bird-life and it is also believed that the shallow margins of this sector of the Estuary provide a significant nursery ground for certain flat-fish.

Migrant cod are commercially fished on a small scale in the outer Humber during winter months. There is also a largely recreational cockle fishery. Mussels are present, but their distribution is extremely limited due to lack of suitable ground for attachment. These three species are mentioned because of their public/commercial interest - they are not (with the possible exception of cockles) particularly significant in terms of the overall ecology of the Estuary.

2.3.4 North Sea

The Humber is the biggest freshwater input to the North Sea from the English coast. As such it carries a significant load of nutrients and more dangerous substances into the North Sea. However it also provides a major breeding and nursery area for commercially important North Sea fisheries.

The Humber Estuary, taken as a whole, is of good quality and is biologically healthy. However in recent years there has been increasing concern about the North Sea and, in particular, the vulnerable shallow southern part to which the Humber discharges. In response to this concern, the UK Government has adopted a precautionary approach towards the discharge of certain

particularly dangerous substances (see Appendix 3). Under this approach irrespective of whether actual damage or adverse effect can be demonstrated, the amounts of these substances which are discharged to the North Sea are to be reduced to at least half their 1985 level by 1995.

For some substances, particularly zinc and chromium, the Humber Estuary contribution to the North Sea is a substantial percentage of that from the whole of the English North Sea coast. Figure 3 shows the amounts of each of these substances that are discharged to the North Sea from England (Berwick on Tweed to Dover) and the amount of each of those substances that comes from the Humber.

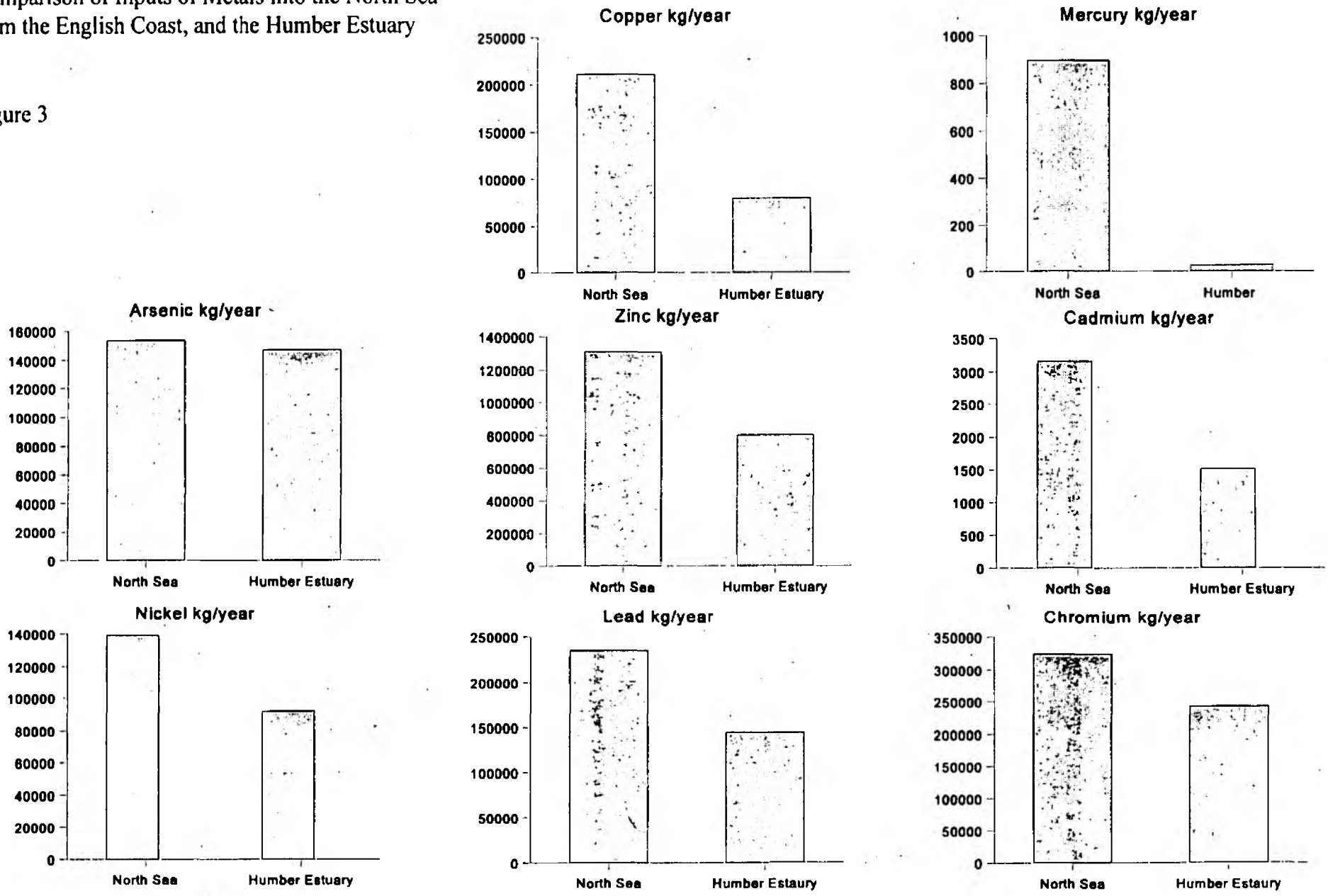
The commitment to halve loads by 1995 applies irrespective of whether the main sources are discrete (ie a factory effluent) or diffuse (ie run off from agricultural land). As a result and as part of normal ongoing pollution control work, discussions have been held with a number of the larger effluent dischargers about how their effluent loads might be reduced. Consequently, several effluent treatment plants have either already been commissioned or are being built which will achieve a substantial reduction in the loads of Red List/Annex 1A substances discharged to the Humber; particular examples are SCM, Tioxide and Ciba Geigy. Courtaulds on the south bank, and BP Chemicals Ltd and British Aerospace on the north bank have introduced waste minimisation procedures aimed at reducing their effluent loads. All the above companies and others have been subject to Integrated Pollution control (IPC) Authorisations issued by Her Majesty's Inspectorate of Pollution (HMIP) in which the NRA has stipulated conditions to be included to protect the water environment.

The recession has adversely affected some Humberside industries with ones such as Capper Pass shutting completely. Monitoring has indicated that one side effect of the closure has been the reduction of Arsenic and Cadmium loads discharged to the Humber system. Whilst such closures are most undesirable for the general well being of Humberside the effluent load reductions that ensue do enable the UK to meet its North Sea targets more easily.

In addition to contributing a substantial load of dangerous substances to the North Sea, the Humber Estuary also contributes a substantial nutrient load and Figure 4 shows this as a proportion of the total nutrient load flowing to the North Sea from the English coast. Large amounts of nutrients in coastal waters can give rise to excessive growth of plankton, which as they die can be washed ashore as unpleasant scums, foams or mats of rotting vegetation. So far most of the problems with excessive plankton growth in the North Sea have been on the eastern side (Wadden Sea, Kattegatt etc.) although there are occasional 'red tides' and similar plankton induced episodes on the English side. The nutrient input from the Humber to the North Sea is not believed to be a problem. However in recent years more comprehensive monitoring of nutrients has been introduced both to quantify input loads better and to determine actual nutrient levels in coastal waters more thoroughly through the different seasons. Map 3 shows the location of the nutrient monitoring points in the Humber and adjacent coastal

Comparison of Inputs of Metals into the North Sea from the English Coast, and the Humber Estuary

Figure 3



Comparison of Inputs of Nutrients into the North Sea from the English Coast, and the Humber Estuary

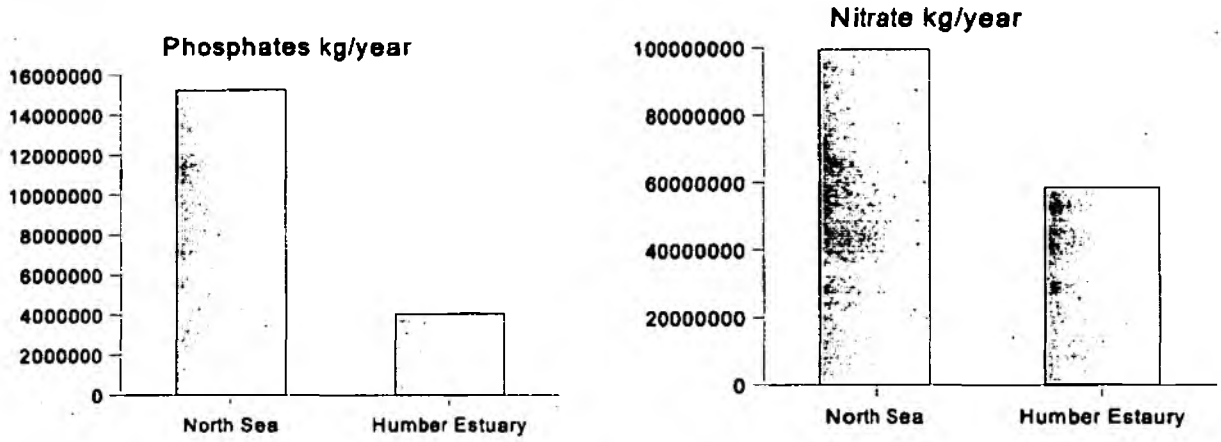


Figure 4

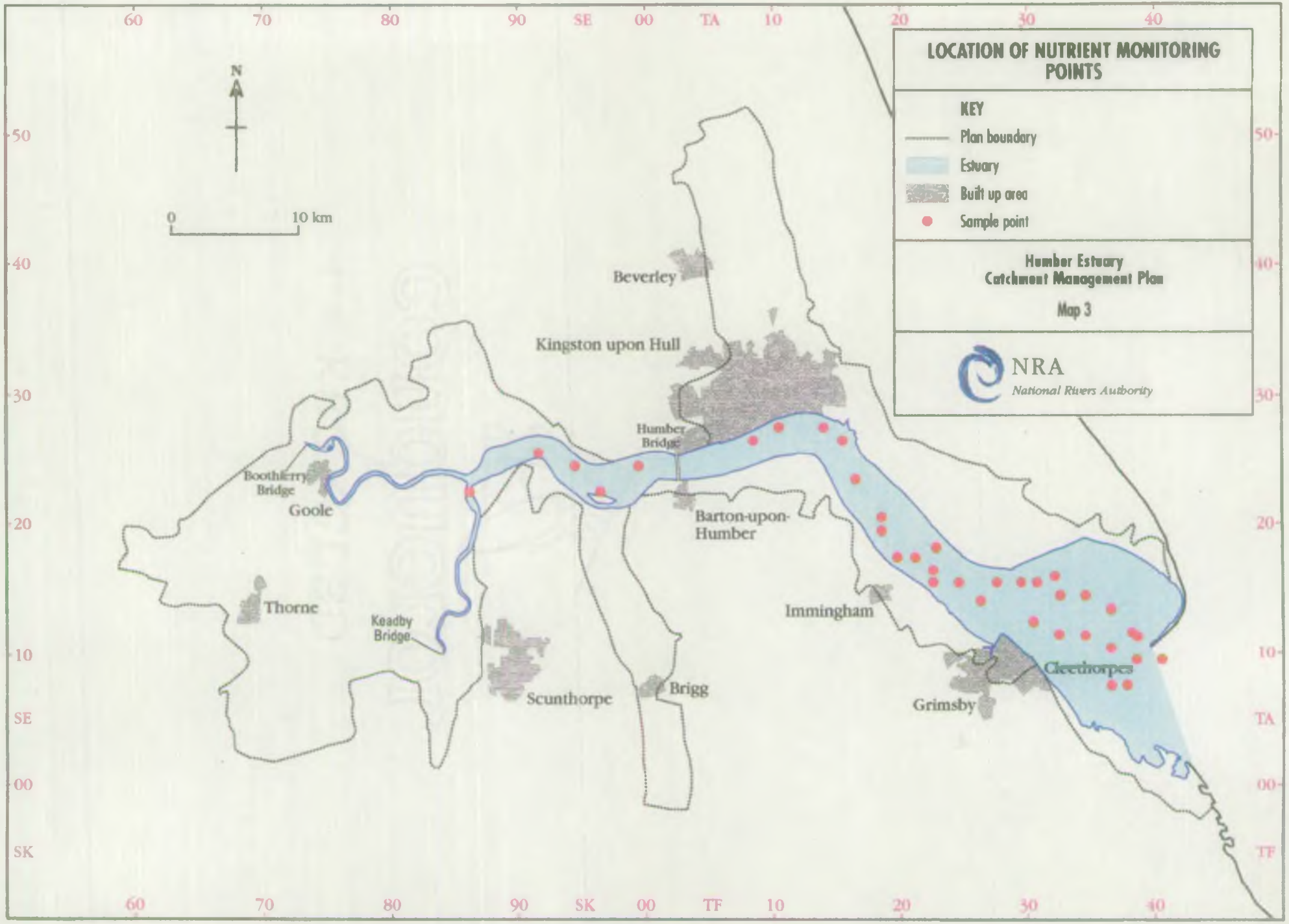
References

The Quality of the Humber Estuary 1980 - 1990

National Rivers Authority 1993

The Water Quality Of the Humber Estuary 1992

Humber Estuary Committee of the National Rivers Authority October 1993


LOCATION OF NUTRIENT MONITORING POINTS
KEY
Plan boundary
Estuary
Built up area
Sample point
Humber Estuary
Catchment Management Plan
Map 3
NRA
National Rivers Authority
N
0
10 km
Beverley
Kingston upon Hull
Humber Bridge
Boothferry Bridge
Goole
Barton-upon-Humber
Thorne
Keadby Bridge
Immingham
Scunthorpe
Brigg
Grimsby
Cleethorpes
60
70
80
90
SE
00
TA
10
20
30
40
50
SK
TF

2.4 FLOOD DEFENCE

2.4.1 Background

For the function of Flood Defence the Humber Estuary Catchment has been extended up the River Ouse to Aires Mouth, an identifiable river feature for flood defence purposes.

Flood defences are built in order to protect people and property from flooding, those along the Humber Estuary date back to the 17th Century. In 1953 hundreds of people within the catchment were affected by widespread flooding to residential, commercial and industrial property. Currently approximately 400,000 people live and many more work in the flood plain behind the defences of the Humber Estuary and are therefore at risk from future tidal flooding.

The NRA has a general supervisory role relating to all flood defence matters and a duty to carry out surveys to ascertain flood defence needs. It has powers with regard to flood defences rather than an obligation to provide them. These permissive powers, which are discretionary are to maintain and improve existing defences and to construct new defences.

Funding to carry out this work is obtained from a number of sources; by precept on the council tax, by grant in aid from MAFF, by contributions from IDB's, through the General Drainage Charge System and in appropriate cases contributions from third parties.

In practice the NRA's operational role within the Estuary is limited to constructing and maintaining lengths of defence for which it assumes a responsibility. It should be noted that some lengths of defence in this catchment remain the responsibility of riparian owners including Crown Estate Commissioners, Local Authorities and Associated British Ports (Map 4). This complexity of ownership and responsibilities means that the integrity of the Estuary defences are not totally within the direct control of the NRA and there is therefore a risk of inconsistent and inadequate standards of defence being provided. In addition where the NRA does directly exercise its powers, the land on which the majority of defences stand is not in NRA ownership. In this respect the Authority relies heavily on its regulatory powers under the Water Resources Act 1991 to control the activities of other parties, such as wharf owners and farmers, who might inadvertently put the defences at risk.

In an effort to reduce and minimise conflict with other bodies and interests the NRA liaises widely when executing its Flood Defence functions. In particular, much effort is put in to ensure works are carried out without detriment to the environment and that wherever possible environmental enhancements are made.

The aims of the NRA with regard to tidal flood defences are:

(i) To provide adequate defences for people and property against tidal flooding. The standard of protection to be appropriate to land use wherever economically viable.

(ii) To maintain existing flood defences ensuring adequacy of purpose.

(iii) To carry out maintenance and new works with due regard to environmental needs.

(iv) To provide adequate arrangements for flood forecasting and warning.

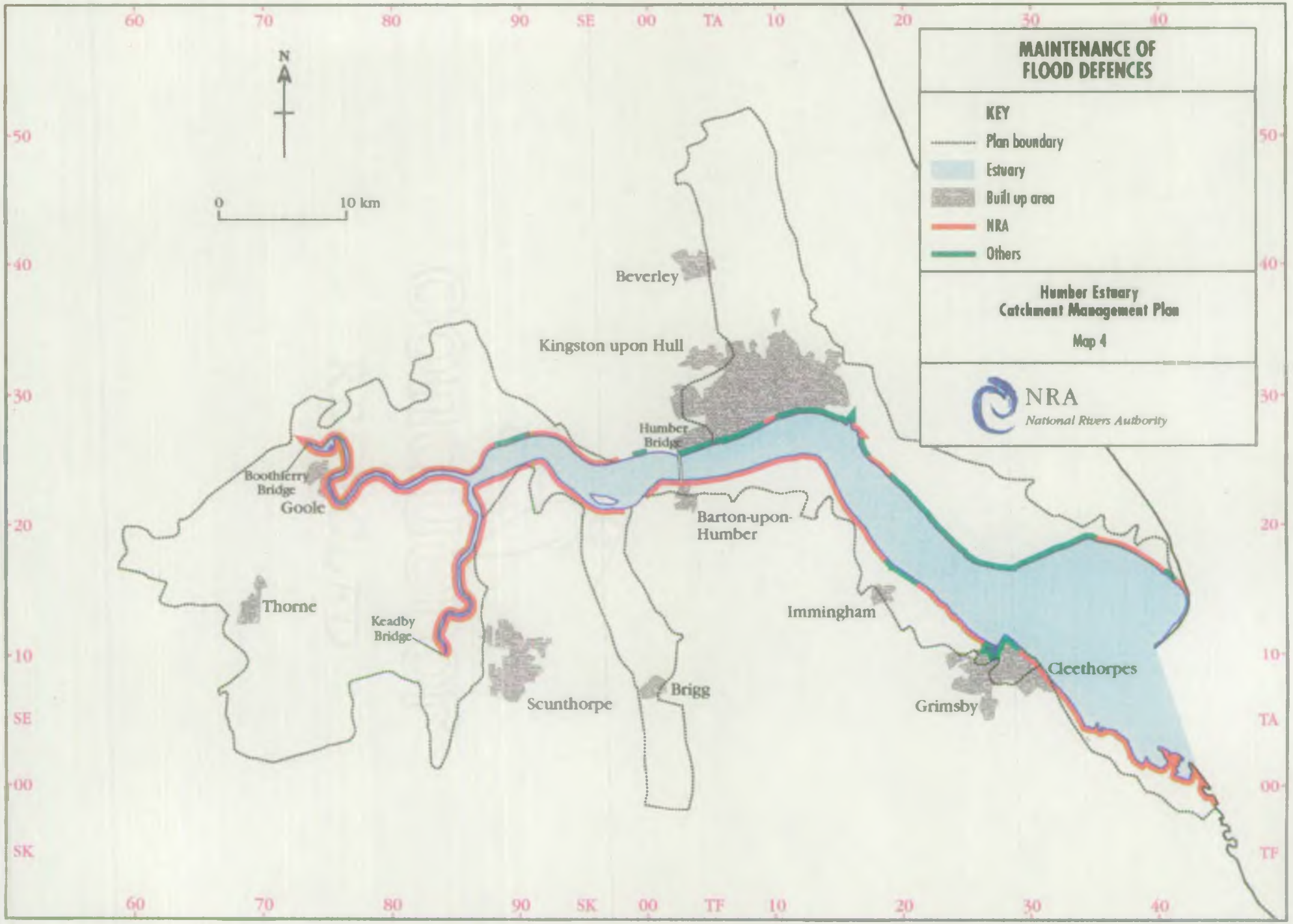
(v) To provide an emergency response to effectively operate flood defence systems

Flood events are described in terms of the frequency at which on average, floods of a certain severity are exceeded. This is expressed as a return period, e.g. 1 in 50 years. The effectiveness of defences can be measured in terms of the return period up to which flooding is prevented. Generally the level of defence constructed and maintained by the NRA will depend upon the type of land being protected, so for example urban flood defences are built to a higher standard than defences for agricultural land.

2.4.2 Local Perspective

Map 5 indicates that area of land which is at risk of tidal flooding, this constitutes an area of some 805 sq. kms and includes the conurbations of Hull, Grimsby and Goole part of the M180 and M62 motorways and the main railway line to Hull. The average height of the land within the flood plain is between 2m and 3m ODN, this compares with highest annual predicted tides of 4.0m ODN at Immingham 4.4m ODN at Hull and 5.1m ODN at Goole. These tide levels may be raised significantly during extreme tidal surges and the integrity of the flood defences is therefore paramount particularly along those lengths which protect urban and industrial development.

The existing defences in the Estuary vary widely in both their type and size. The smallest defences are relatively low earth banks. The most complex is the Hull Barrier which is lowered at times of high risk. Between these extremes the defences may incorporate revetment works to prevent erosion, armouring to resist wave attack and flood walls to give the required crest level. Much of the existing defences is fronted by mud flats and saltmarsh some of which are designated as Sites of Special Scientific Interest (SSSIs) and soon to be designated Special Protection Areas (SPAs) and RAMSAR sites (see 2.7). Any works to the defences must include due consideration of the effect upon these conservation areas.


MAINTENANCE OF FLOOD DEFENCES
KEY
Plan boundary
Estuary
Built up area
NRA
Others
Humber Estuary Catchment Management Plan
Map 4
NRA
National Rivers Authority
N
0
10 km
Beverley
Kingston upon Hull
Humber Bridge
Boothferry Bridge
Goole
Barton-upon-Humber
Thorne
Keadby Bridge
Immingham
Cleethorpes
Brigg
Scunthorpe
Grimsby
60
70
80
90
SE
00
TA
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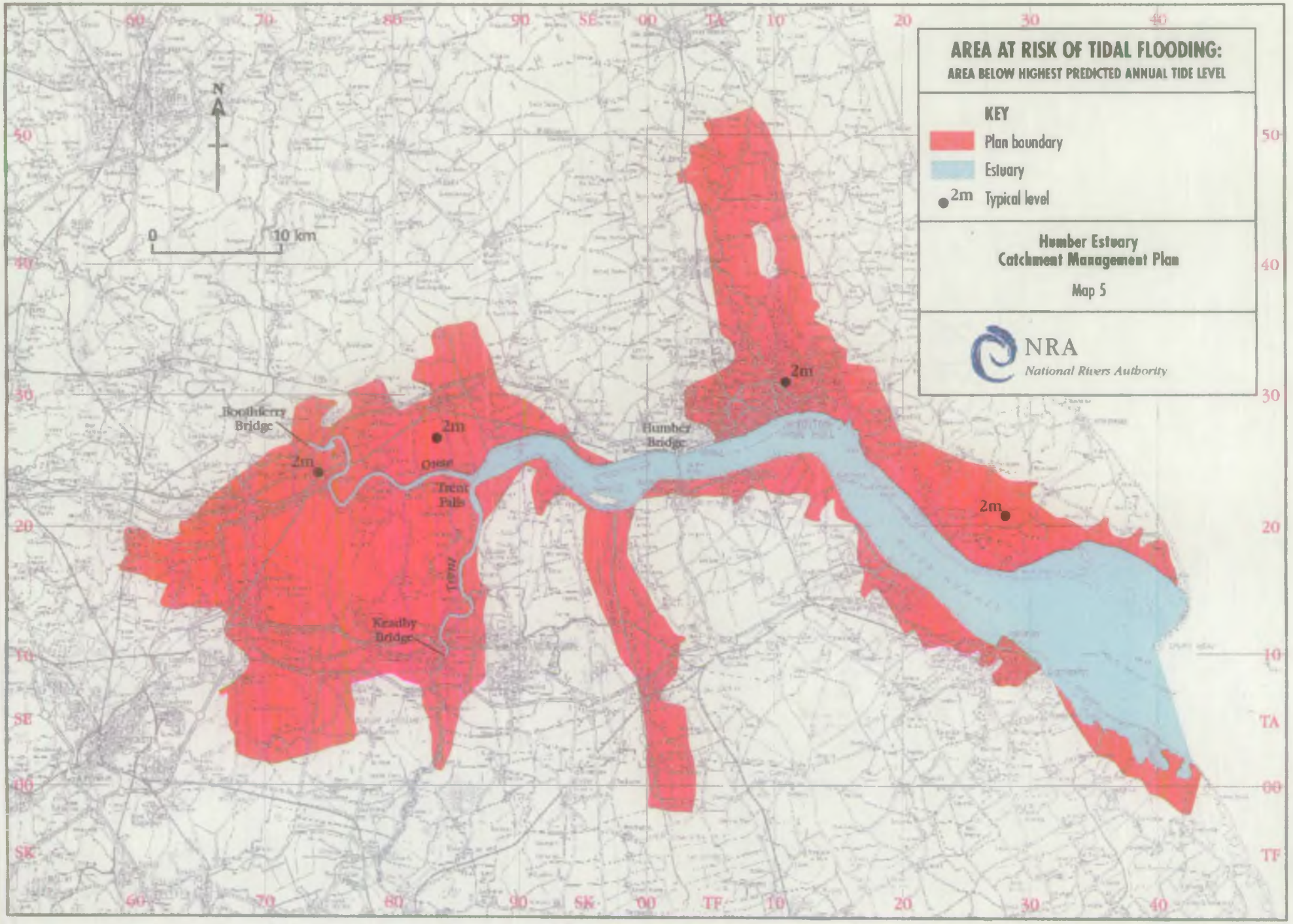
40
50
SK
TF

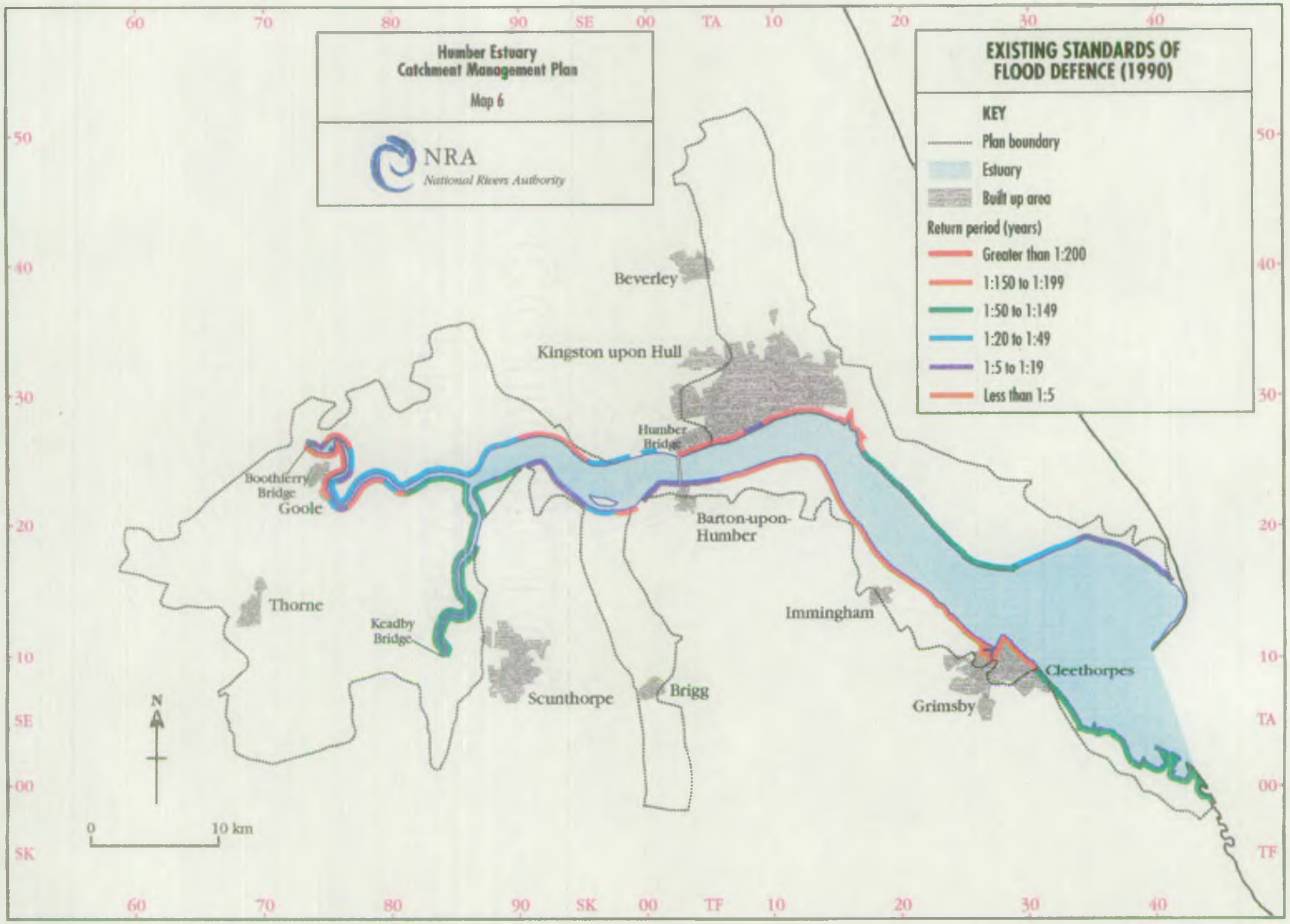

AREA AT RISK OF TIDAL FLOODING:
AREA BELOW HIGHEST PREDICTED ANNUAL TIDE LEVEL
KEY
Plan boundary
Estuary
2m Typical level
Humber Estuary
Catchment Management Plan
Map 5
NRA
National Rivers Authority
N
0
10 km
Boothferry Bridge
Ouse
Trent Falls
Trent
Keadby Bridge
Humber Bridge
2m
2m
2m
2m
60
70
80
90
SE
00
TA
10
20
30
40
50
SK
TF

All man made structures need both maintenance and renewal and this is of particular importance in such a hostile environment as the Humber Estuary. The defences are regularly inspected and maintained. Maintenance encompasses a range of activities from grass cutting and vermin control on the earth banks, and repairs to pitching on revetments, to the complex procedures necessary to maintain the Hull Barrier.

Map 6 shows the existing levels of protection for the Humber Estuary. The defence levels shown indicate the frequency with which occasional wave action is likely to overtop the defence. Where the defences are earthen floodbanks, overtopping greater than by occasional wave action would lead to breaching of the floodbank and consequent flooding. It should be noted that in Hull, defences are formed largely by the docks which will initially contain any overtopping, effectively raising the standard of defence to about 1 in 50 years for most areas landward of the docks.

Historically structures have been replaced following a major failure. The 1953 East Coast flooding resulted in significant upgrading of the Humber defences. Many of these defences are reaching the end of their effective life and will require increasing repair and eventual replacement. Overtaking this deterioration of the existing defences are the effects of rising sea levels and loss of foreshore which are steadily and continuously reducing the standard of protection given. Current strategy studies will define the extent and timing of the renewal of the defences in the Estuary.

The NRA needs to ensure that the changes in the Estuary that will occur with time are correctly anticipated. As outlined, the Estuary is a complex entity and the ability to analyse the geomorphology of the Estuary with confidence is presently limited. A model that would reliably predict the natural development of the Estuary and the effects of options such as managed retreat would be an excellent aid to decision making. However whilst techniques are developing in modelling, the practicality and feasibility of producing such a tool remain to be established. In the mean time techniques will have to be used to ensure that appropriate flood defences along the Estuary are maintained. The criteria used in designing these and future defences is that such structures should be technically sound, economically worthwhile and environmentally acceptable.


Humber Estuary
Catchment Management Plan
Map 6
NRA
National Rivers Authority
EXISTING STANDARDS OF FLOOD DEFENCE (1990)
KEY
Plan boundary
Estuary
Built up area
Return period (years)
Greater than 1:200
1:150 to 1:199
1:50 to 1:149
1:20 to 1:49
1:5 to 1:19
Less than 1:5
Beverley
Kingston upon Hull
Humber Bridge
Boothferry Bridge
Goole
Barton-upon-Humber
Thorne
Keadby Bridge
Immingham
Scunthorpe
Brigg
Cleethorpes
Grimsby
N
0
10 km
60
70
80
90
SE
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2.4.3 Sea Level Change

It has been estimated there has been a rise in sea level relative to land levels of 215mm over the last 60 years in the Estuary. For the future it is anticipated that the sinking of land will continue and there will be a further rise in sea levels as a result of global warming. The two likely impacts of a continuing and increasing rise in sea level are:

(i) That the combined effect of changes in land level and the predicted rise in sea level due to global warming will be a 6mm per year rise in relative sea level to the year 2030. This would result in a gradual lowering of the standard of the defences and a consequent increased risk of flooding.

(ii) As sea level rises there may be a reduction in the area of inter-tidal mud flats and salt marshes if their accretion does not keep pace with the rise. This will result in increased wave height and thus wave energy acting upon the defences, effectively reducing the level of protection, increasing the frequency and likelihood of overtopping & breaching and increasing the wear and tear upon the defences.

Changes in Sedimentary Processes

In order to maintain adequate navigation channels, the Navigation Authority, Associated British Ports (ABP) undertake a major annual dredging programme, the material from which is dumped on the south side of the Estuary. An external source of sediment to the Estuary is material which drifts down from the Holderness coast. It is thought that this may be affected by current and future coast protection works north of the Estuary. The net effect of this movement of sediment is not known for certain but there is evidence that there is now a negative balance on sediment supply which it is anticipated will have an adverse impact upon foreshore levels.

In order to clarify the uncertainty that changes in sea level and sedimentary processes will have upon the flood defences, the NRA is preparing a report on which its strategy for the Humber Estuary will be based.

2.4.4 Flood Warning

The NRA operates a flood warning service whereby the Police and other organisations are advised in advance of areas likely to be affected by flooding. The warnings are phased and colour coded indicating the anticipated severity of an event and its likely impact on land and property.

The phased warnings are:-

Yellow	Some wind borne spray is forecast
Amber	Some isolated flooding can be expected but mainly wind blown spray
Red	Significant numbers of properties and major roads at risk

The Storm Tide Warning Service operated by the Meteorological Office is the basis of the Tidal Flood Warning Service provided by the NRA.

The Met. Office are able to predict by mathematical modelling, the effects of atmospheric influences on the North Sea and alert the NRA of storm conditions and surge tides likely to approach warning thresholds.

The NRA then interprets this information together with observed data in relation to particular frontages and issues colour phase warnings to the appropriate police forces whilst monitoring actual sea levels and wave conditions during the event.

2.4.5 Emergency Response

The NRA provides an emergency work force capable of responding to emergency situations with a return period of up to 1 in 10 years. Plans exist to augment resources for more severe flood events.

2.5 RECREATION AND NAVIGATION

2.5.1 Recreation

Use of the Humber Estuary for sport and recreation remains comparatively undeveloped partly because waters are difficult for navigation as a result of shifting sand banks, high levels of commercial shipping and strong tidal currents.

Specific locations such as Cleethorpes Beach, the Humber Country Park, Humber Bridge and Spurn Head attract significant numbers of visitors, particularly the latter in relation to the Estuary's importance for waders and wildfowl numbers and the spectacular 'geography' of the peninsula. The Humber Bridge itself attracts a large number of visitors and viewing points are available to the public. A small visitor centre exists but there is opportunity to expand the facilities. This would also provide an opportunity to focus on the importance of the Estuary for its significant commercial, industrial, educational and nature conservation interests, increasing the profile of the Estuary and raising awareness of the complex interactions and issues which exist.

Recreational Fishing

Sea angling by beach casting, is common along both banks where access to the foreshore is comparatively easy. Two sea angling organisations are based in Grimsby. Quality coarse fishing takes place on the rivers, drains and streams entering the Estuary from both banks. In addition, the ponds and clay pits along the south bank are heavily fished for coarse fish. The high quality flounder fishery on drains entering from the north bank has now declined as a result of water quality problems and obstructions to migration.

Sailing & Other Water Sports

There are four sailing clubs using mainly the lower and middle Estuary. In addition there are a number of moorings near river outlets including a Marina at Hull and on the River Ancholme at Ferriby. There are some instances of access from the Estuary to the freshwater rivers, through some of the small havens which occur, becoming difficult from time to time. This is largely due to the build up of silt on the downstream side of the locks. This is particularly noticeable at times of low river flow. Cruising in the Estuary and in the navigable lower sections of rivers entering into it is common and inland water sailing takes place adjacent to the Estuary. Other waterborne activities are fairly restricted although canoeing, water skiing, windsurfing and rowing also occur either within the Estuary or on adjacent inland waters. The Estuary is an established venue for power boat racing which is becoming increasingly popular.

Other Activities

Organised wildfowling takes place at a number of locations in the lower Estuary and

in the upper reaches in parts of the Wildfowl refuge. Increasing use is made of the banks by horse riders.

Informal walking and picnicking takes place but designated routes have also been set up particularly in the Humber Bridge Country Park as well as the Wolds/Viking Way. There are a number of public rights of way, however access to some parts of the shore is poor.

2.5.2 Navigation

The navigation authority for the Humber Estuary and the River Trent downstream of Gainsborough is Associated British Ports (ABP). To provide sufficient depths for safe navigation the company carry out an extensive programme of depth monitoring and dredging. In 1992 and 1993 this dredging amounted to approximately seven million cubic metres of material.

No significant dredging is carried out in the River Trent downstream of Gainsborough or in the River Humber upstream of Immingham, apart from the docks, wharves and their immediate approaches. In the lower Humber, the Sunk Dredged Channel is dredged each year to maintain access for vessels to the bulk oil, gas and cargo terminals at Immingham.

Navigation therefore depends on the maintenance of navigable channels. The constantly shifting sand and mud banks does mean that the dredged channels have to be identified by a network of buoys and lights which are frequently repositioned to reflect the changing position of the navigable channels.

This dredging is a major financial commitment by ABP who believe that the quantity of material which has to be moved is related to the freshwater flows and is sensitive to small changes in flow rates. A proper understanding of sedimentary processes including the effects of dredging and disposal of material within the Humber would be extremely beneficial to ABP and a number of other organisations

Not only is the Estuary a major navigation in its own right with approximately 15,000 ship arrivals per year, navigation extends beyond the tidal reaches of the main rivers. Navigation is possible on the River Trent as far as Nottingham and on the Ouse beyond York, but for sea going vessels it is only as far as Gainsborough and Selby respectively. The length of commercial navigation is also extended by the system of inland canals.

The three major ports on the Humber are Immingham, Hull and Grimsby whilst the smaller port of Goole is further upstream on the Ouse.

In total, the navigable waters of the Humber system account for 10% of Britain's seaborne trade.

2.6 FISHERIES

2.6.1 Species Composition

Specific studies on fish populations of the Humber have been mainly confined to the status of the commercial fishery with little information available on the nature of the resident fish community.

The Ministry of Agriculture, Fisheries and Food have carried out surveys in the Estuary and have recorded 76 species of fish, of which a small number were esturial, the remainder being mainly marine.

Additional survey work has been undertaken by the University of Hull in association with the NRA. This has demonstrated that the fishery is typical of an east coast estuary but has highlighted the need for further investigations.

In the tidal rivers insufficient monitoring has taken place to give more than an indication of which species are present. Sand goby, eels and sticklebacks are known to be present.

2.6.2 Structure, Distribution and Abundance of Fish

The distribution of fish within the Humber is largely controlled by physico-chemical factors, including salinity and tidal scour, although the shallow marginal habitats generally support the greatest diversity and abundance of fish. The abundance and diversity of fish increases towards the mouth of the Estuary.

The Humber plays an important role as a nursery and over wintering area for species of marine fish. For example the sandflats of the outer Estuary serve as a significant nursery area for flatfish with an estimated 3% of North Sea plaice utilising the outer Estuary for this purpose. In addition, the rich food supply supports large numbers of adult and juvenile marine fish.

The assessment of trends in fish populations within the Humber is difficult because only a limited amount of data is available. The three most abundant species are plaice, dab and sand goby. The data for both plaice and dabs exhibit a two yearly cycle of high and low catches. It is not known what factors outside the Humber influence the abundance of these species within the Estuary itself. The sand goby is an estuarine species which is relatively abundant in the Humber. Its population exhibits cycles of abundance which are different from the two other species.

2.6.3 Commercial Fisheries

The commercial fisheries are mainly of local importance and carried out on a part time basis only but can be divided into three target groups:

i) Migratory

Eels are found throughout the Estuary and in most of the adjacent rivers and drains feeding into it. Fishing activity takes place mainly between April and October using fyke nets, eel criggs and pots but it is difficult to indicate the level of catches and any changes in abundance which may have taken place. Twelve licences were issued for 1993 to eight fishermen to operate from the north bank to use 66 fyke nets and 32 strings of crigg nets. The Anglian region of the NRA on the south bank does not licence eel fishermen downstream of the tidal limits.

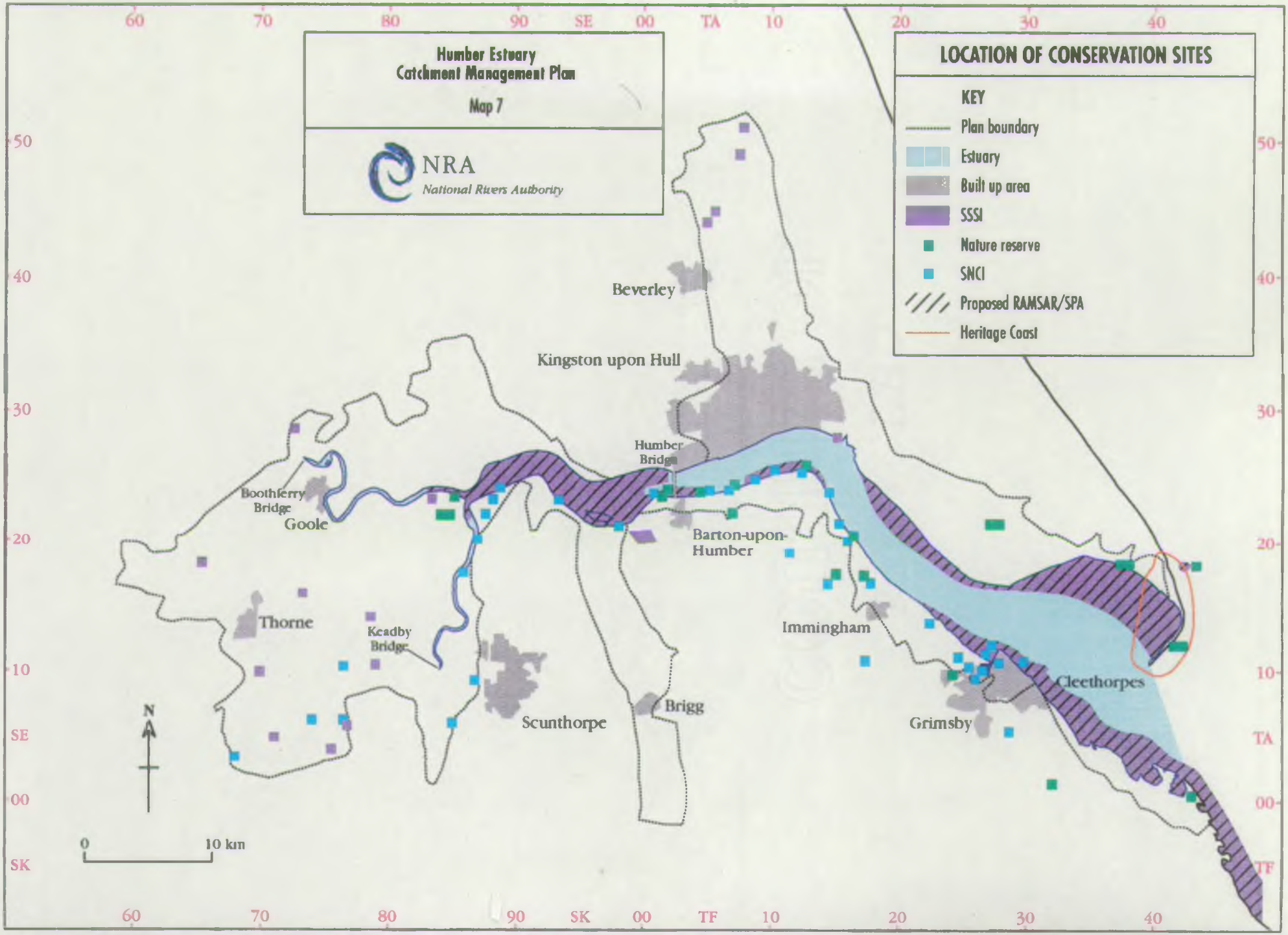
There is evidence of salmonids in the Estuary and salmon have been observed in the Ouse, Wharfe and Trent catchments but there is no indication of stocks improving and no commercial fishery exists. There is potential for these rivers to develop salmonid fisheries but the dissolved oxygen sag at Trent Falls in particular and localised elevated water temperatures pose significant barriers to fish migration. In addition there are substantial physical barriers in the freshwater systems which need to be addressed as part of any overall plan to restore the salmonid fisheries to these rivers. A feasibility study is scheduled to take place in 1994 which will determine the potential of the River Trent as a salmonid fishery. A migratory salmonid strategy for the Northumbria & Yorkshire Region is also currently being developed.

ii) Saltwater Fish

Sole and cod are the principal target species although catches for the latter have declined. Long lining and set lining are the main methods of capture.

iii) Shellfish

Shrimp are fished from Immingham to South Ferriby and activity also takes place for cockles, mussels and oysters but the level of activity is reduced compared to previous years. This is largely caused by over exploitation in the 1970's, leading to a decline in stocks which have never recovered.


Humber Estuary
Catchment Management Plan
Map 7
NRA
National Rivers Authority
LOCATION OF CONSERVATION SITES
KEY
Plan boundary
Estuary
Built up area
SSSI
Nature reserve
SNCI
Proposed RAMSAR/SPA
Heritage Coast
Beverley
Kingston upon Hull
Humber Bridge
Boothferry Bridge
Goole
Barton-upon-Humber
Thorne
Keadby Bridge
Immingham
Cleethorpes
Scunthorpe
Brigg
Grimsby
N
0
10 km
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2.7 CONSERVATION

The Humber Estuary is of international importance for a number of species of birds. Consequently a large number of local, national and international designations cover the Humber.

Under international designations the entire Humber Estuary qualifies as a Special Protection Area (SPA) and the Humber flats, marshes and coast have been proposed as Ramsar sites under the Ramsar Convention on Wetlands of International Importance.

There are 7 Sites of Special Scientific Interest (SSSIs), designated nationally which are associated closely with the Estuary. These are listed in Appendix 1. In addition, there are a further 16 sites within the plan boundary.

In close proximity, there are two Yorkshire Wildlife Trusts reserves and seven Lincolnshire and South Humberside Trust reserves plus a further fourteen sites identified as being of conservation interest.

In addition, part of the north bank is designated a Heritage Coast, Blacktoft Sands and Tetney Marshes are RSPB reserves, part of the Upper Humber SSSI is a wildfowl refuge and there are at least another 45 sites within the flood protection zone identified as being of nature conservation or geological interest. Major conservation sites are shown on Map 7.

The variety of habitats available are an important factor in the conservation status of the Estuary but there has been a significant impact on the abundance of these habitats (particularly brackish and freshwater wetlands) during the history of the Estuary. Some habitats are relatively species poor, e.g.. earth embankments. Opportunities for enhancement and restoration of habitats must be considered in all catchment proposals.

2.7.1 Birds

Many of the Humbers designations relate to its international importance for bird populations, particularly migrating and wintering waterfowl. It is one of the five most important estuaries for birds in Britain and one of the ten most important in Europe. The majority of the birds are recorded on the mud flats which fringe both banks.

The value of the Humber is not primarily for the occurrence of rarities but for the large number of wildfowl and waders which regularly use the intertidal mudflats and saltmarshes. Seventeen species meet the criteria for EC Directive 79/409 on the Conservation of Wild Birds which qualifies the area as an SPA. Ten of these species also qualify under 3c of the 'Ramsar' convention on Wetlands of International Importance. In the five year period 1984/85 to 1988/89 the average peak count on the Humber Flats, Marshes and Coast was 104,758 birds, comprising 19,774 wildfowl and 84,984 waders, qualifying these sites under criteria 3a of the 'Ramsar

Convention'. In addition, many species of birds occur within the Humber in sufficient number to satisfy the criteria for national importance.

The importance of the Estuary for wintering birds is further emphasised when the number of Red Data birds is considered. Red Data waders and wildfowl occur regularly on the Humber in winter or on migration. Included in this are 8 Red Data species with breeding populations. (Red Data species are those species of British avifauna which are classified as rare, under threat or important according to set criteria).

The Humber Estuary has a wide range of habitats, the majority of which have an ornithological importance. The mud flats are the most important for they provide an abundant source of food and safe areas to roost. They are used by both passage and wintering wildfowl and waders often in numbers of national and international importance.

Adjacent habitats on the landward side of the banks can also be of regional or national significance, since bird populations can be fluid between these adjacent sites. Reed beds, gravel and borrowpits, brackish ditches, hedgerows and scrub also provide valuable habitats for a variety of birds in the catchment.

The mudflats and surrounding habitats of the Humber are of constant ornithological interest all the year round since they provide sources of food, safe roosts and breeding sites for waterfowl and passerine species. Thus the sites require careful management to ensure that at sensitive times disturbance is kept to a minimum or prevented altogether. This management includes taking into account the timing of engineering works and the possible deleterious effect of works within the Estuary on these habitats.

2.7.2 Invertebrates

The saltmarshes, sand dunes and banks have populations of several scarce, notable, rare or locally important species.

The very high number of worms, crustacea and molluscs which occur mainly in the intertidal areas are significant factors in the importance of the Estuary for its ecology and wildlife. National and international conservation designations are linked to the sustainability of these populations.

2.7.3 Mammals

Seals

The Humber supports a small (circa 800) but important seal population, mainly on the south side

at Donna Nook, which is maintaining its number following an epidemic of phocid distemper in 1988.

Other Mammals

At least 28 other species of mammals have been recorded, including Britain's largest summer roost of Noctule bats, at North Ferriby.

2.7.4 Archaeology

There are a large number of sites of archaeological interest in and around the flood protection zone with most sites located in the urban areas of Grimsby and Barton-upon-Humber.

Van de Noort and Davies (1993) demonstrate the quality and quantity of the archaeological reserve of the Humber Wetlands and the threat to this resource from a range of activities and processes. They recommend a range of work aimed at identifying, recording, protecting and evaluating archaeological resources to ensure the preservation and conservation of the most important archaeological sites.

There are 39 scheduled ancient monuments, (see Appendix 1) 135 listed buildings, 7 conservation areas and a further 716 sites of interest in the Humberside County Council Sites and Monument Record.

2.8 DEVELOPMENT

For the purposes of this section of the Humber Estuary Plan the catchment has been taken to be that area of land as defined in the Flood Defence section 2.4.1 (Map 5). The Crown Estate Commissioners are generally the owners of estuary beds in Britain, however in 1868 the Humber Estuary was leased for 999 years by the Crown to a body which has since "evolved" into Associated British Ports. The Crown Estates Commissioners have maintained control of two areas on the north bank although several small areas on the south bank have been sold to other bodies.

2.8.1 General

The NRAs participation in the town and country planning process is essentially at two level; to input into the production of development plans, and to comment on specific development proposals. The NRA continues to seek and develop understanding and professional working relationships with local planning authorities and developers for the environmental benefit of the community at large.

Guidance for land use including future residential, commercial and industrial development is contained in Development Plans, ie. County Structure Plans, District Development Plans and Unitary Development Plans. These plans set out the policies against which the planning authorities consider development proposals. Structure Plans and Part 1 Urban Development Plans set out the general framework - Local Plans and Urban Development Plans Part 2 provide the detail

The NRA is a statutory consultee for some types of development under the Town and Country Planning General Development Order and advises County and Local Authorities on proposals which may have an impact on matters relevant to the NRA, although the final decision on planning matters rests with the planning authority. If the development requires an abstraction from, or involves impoundment of controlled waters or discharges thereto, or entails work on or near a watercourse or sea defence then a consent or licence may be required from the NRA.

The NRA's purpose in participating in the planning process is to protect the public and the water environment from any adverse effects associated with development and land use change. The NRA will therefore oppose any specific development that conflicts with this purpose and will seek to persuade the Local Authorities to adopt their policies for protecting both the public and the environment.

In providing advice to Planning Authorities the NRA will encompass all proposals which may affect the water environment. As part of the Structure and Local Plans procedure, all Local Authorities have been provided with "NRA Guidance notes for Local Planning Authorities on

the methods of protecting the water environment through Development Plans". This provides a useful basis for discussion and agreement on policies to suit individual plans.

The range of issues to which the NRA would give consideration may include:

(a) development in the flood plain.

(b) development which might impact on ground or surface water quality.

(c) development in the catchment including the foreshore which might impact on flora and fauna.

(d) development which might impact on water resources.

(e) development of recreational facilities along the bank of the Estuary.

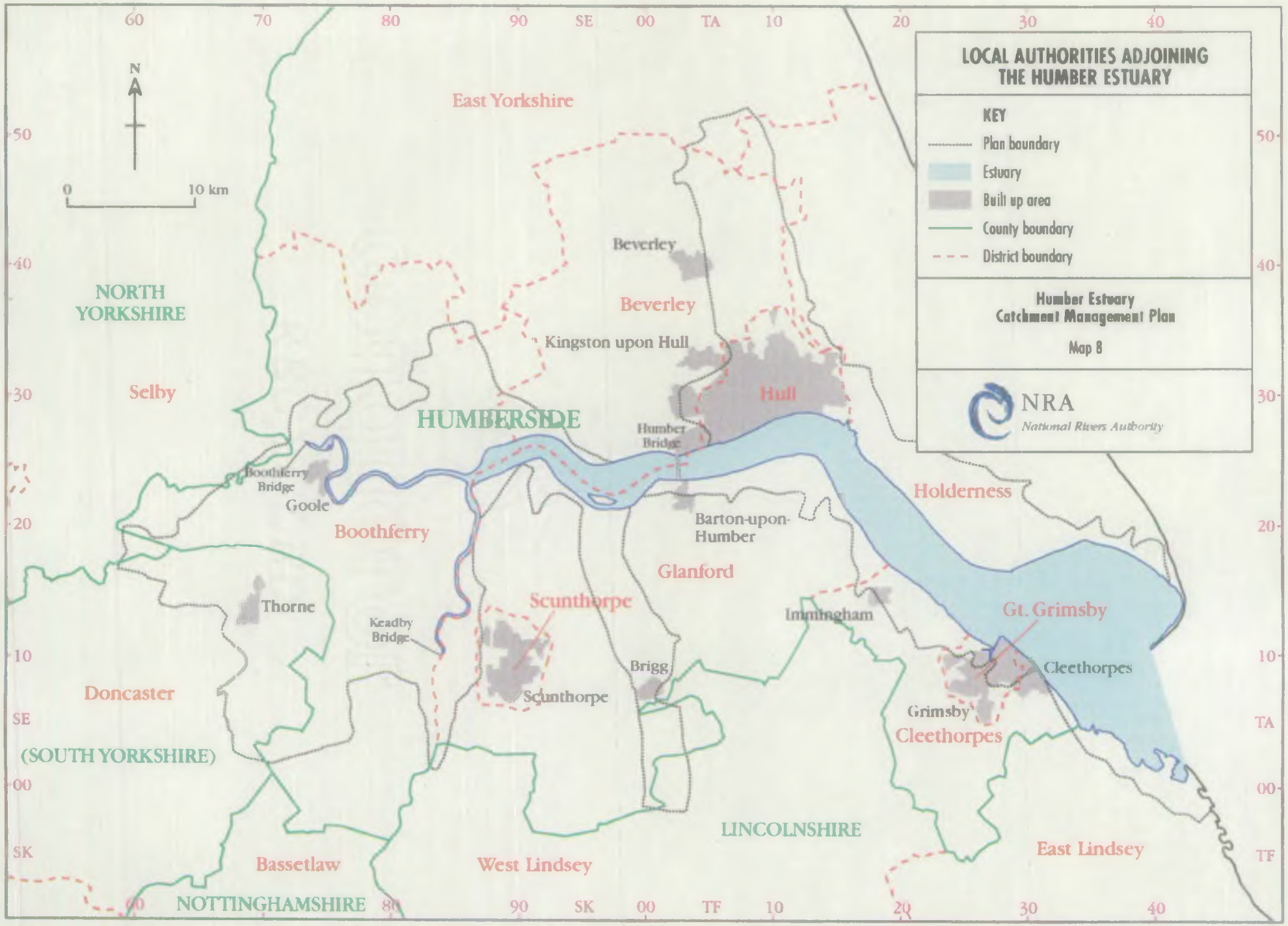
(f) changes in agricultural land use.

(g) development which might affect the integrity or maintenance of flood defences.

Each of the Local Planning Authorities (LPAs) concerned with this Catchment have produced Development Plans on which the NRA has been consulted; the plans are listed in Table 2 and the LPAs are shown in Map 8

Table 2 Local Planning Authorities and Development Plans

LOCAL PLANNING AUTHORITY	DEVELOPMENT PLANS TITLE	STATUS AND CONSULTATION DATE
Yorkshire and Humberside Planning Region	Regional Planning Guidance	Consultation draft of Planning Conference's advice to Secretary of State (July 1993)
Humberside CC	Humberside Structure Plan (Revision) Mineral Local Plan	Consultation Draft (March 1994) Consultation Draft Expected (June 1994)
Beverley	Beverley Borough Local Council	Deposit Draft (September 1993)
Boothferry	Boothferry Borough Local Plan	Consultation Draft (October 1993)
Cleethorpes	Cleethorpes Borough Development Plan	Consultation Draft Expected (May 1994)
East Yorkshire	Borough-Wide Local Plan	Consultation Draft (January 1994)
Great Grimsby	Great Grimsby Local Plan	Republished Consultation Draft Expected (May/June 1994)
Glanford	Glanford Local Plan	Consultation Draft expected (Summer 1994)
Holderness	District -Wide Local Plan	Consultation Draft expected (June 1994)
Kingston-upon-Hull	City -Wide District Development Plan	Consultation Draft expected (June 1994)
Scunthorpe	Scunthorpe Borough Local Plan	Consultation Draft (May 1993)
Lincolnshire CC	Lincolnshire Structure Plan Alteration No. 3	Deposit Draft (Oct 1993)
West Lindsey	West Lindsey Local Plan	Deposit Draft (March 1994)
East Lindsey	East Lindsey Local Plan	Adoption expected (October 1994)
North Yorkshire CC	County Structure Plan Green Belt Local Plan	Draft Third Alteration Result of Public Enquiry Expected (April 1994) Public Enquiry Inspector Report received recommendations being reviewed by NYCC
Selby	District-Wide Local Plan	Consultation Draft (May/June 1994)
Nottinghamshire CC	Nottinghamshire Structure Plan Review No. 2 Nottinghamshire Mineral Local Plan	Consultation Draft (July 1993) Deposit Draft (Sep 1993)
Bassetlaw	Bassetlaw District Local Plan	Consultation Draft (Dec 1993)
South Yorkshire (Doncaster)	Doncaster Urban Development Plan	Deposit Draft (Oct 1992)


LOCAL AUTHORITIES ADJOINING THE HUMBER ESTUARY
KEY
Plan boundary
Estuary
Built up area
County boundary
District boundary
Humber Estuary Catchment Management Plan
Map 8
NRA
National Rivers Authority
N
0
10 km
East Yorkshire
NORTH YORKSHIRE
Selby
HUMBERSIDE
Beverley
Beverley
Kingston upon Hull
Hull
Humber Bridge
Boothferry Bridge
Goole
Boothferry
Barton-upon-Humber
Holderness
Glanford
Thorne
Keadby Bridge
Scunthorpe
Scunthorpe
Immingham
Gt. Grimsby
Brigg
Cleethorpes
Grimsby
Cleethorpes
Doncaster
(SOUTH YORKSHIRE)
LINCOLNSHIRE
East Lindsey
Bassetlaw
West Lindsey
NOTTINGHAMSHIRE
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2.8.2 Local Perspective

The Humber Estuary catchment lies predominantly within the administrative boundary of Humberside County Council with a small area within the Lincolnshire boundary. Parts of the catchment enjoy Development and Intermediate Area Status, designated by the Department of the Environment.

The rate and type of industrial and residential development is difficult to predict to any degree of certainty, however it is not anticipated that the pattern will change significantly over the next 10-15 years.

The Estuary itself is the third largest shipping complex in Britain. The availability of large flat areas adjacent to the deep water navigation and the proximity of water for abstraction and effluent disposal gives the Humber Bank significant potential for further expansion. The area is served by a road infrastructure providing motorways along both banks and by rail links to the electrified east coast main line. (Map 9)

The need to take account of this and the potential for conflict with existing uses of the Estuary, particularly those of nature conservation will be a matter primarily for Local Authorities to decide upon. It is hoped that the NRA can help in the decision making processes by providing adequate information on a variety of aspects of any proposals.

Industry

Both banks of the Estuary are extensively developed, along the South Bank a 15km length between the ports of Grimsby and Immingham and the jetties at North and South Killingholme is now one of the major concentrations of industrial activity within the region. Industrial activity features two oil refineries, major chemical industries and two power stations at Killingholme with a further planned at Stallingborough. There are massive areas of land allocated to the storage of chemicals including hazardous waste. Along the North Bank, docks occupy a 4½km length through Hull behind which lies an array of industry typical of a large sea port, fishing, petrochemicals etc. Other notable industrial activity along the Estuary includes that of British Aerospace at Brough, the docks at Goole and the Kimberly Clark works at Barton on Humber and along the Trent the gas fired power station under construction at Keadby and the chemical storage and blending plants at Grove and Gunness wharves.

Agriculture

Agriculture throughout the catchment is mainly arable with the occasional intensive farming practice such as piggeries, poultry and horticulture. At the head of the Estuary the MAFF land classification is predominantly grade 1, along the north bank it is predominantly grade 2 and predominantly grade 3 along the south bank. The land is low lying and relies upon artificial

drainage provided by internal drainage boards. As an industry agriculture is a significant employer, its decline over recent years looks set to continue with a predicted 10% loss of jobs by 2001 (1991 base). This is reflected by the uptake of the set-aside scheme by farmers over recent years.

Urban Development

The catchments main urban centres are Grimsby/Cleethorpes and Hull with populations of approximately 110,000 and 270,000 respectively. The south bank in particular has seen a high population growth over the past 25 years although a proportion of the population serving the industry lives outside the catchment boundary.

Potential Concerns

The NRA has identified the following as having the potential to cause concern within this catchment.

i) .The development of contaminated areas of land.

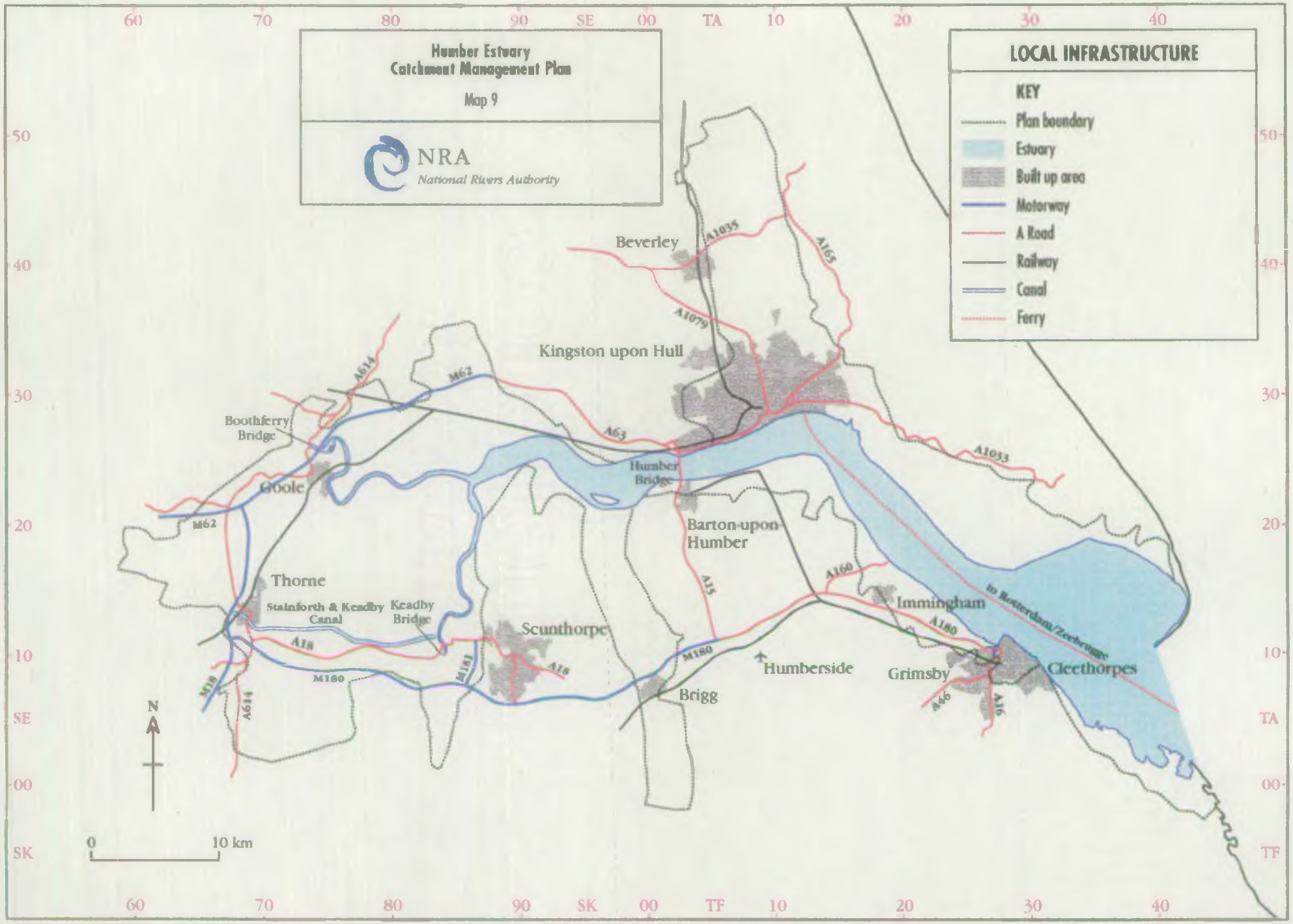
ii) The storage of chemicals in the catchment - the NRA's regulatory powers are not sufficient to require appropriate infrastructure provisions (to prevent contamination of ground water and surface water).

iii) The reclamation of land for industrial or agricultural purposes.

iv) The development of wharves and marinas along the Estuary.

v) The potential further expansion of industry along the banks of the Estuary to the detriment of flora and fauna.

vi) Pipelines (especially oil and gas).


Humber Estuary
Catchment Management Plan
Map 9
NRA
National Rivers Authority
LOCAL INFRASTRUCTURE
KEY
Plan boundary
Estuary
Built up area
Motorway
A Road
Railway
Canal
Ferry
Beverley
Kingston upon Hull
Boothferry Bridge
Goole
Thorne
Stainforth & Keadby Canal
Keadby Bridge
Scunthorpe
Humber Bridge
Barton-upon-Humber
Immingham
Humberside
Grimsby
Cleethorpes
Brigg
to Rotterdam/Zeebrugge
M62
M18
M180
M181
A614
A18
A63
A1035
A1079
A165
A1033
A15
A160
A180
A46
A16
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10 km
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3 CATCHMENT TARGETS

The NRA's vision for the Humber Catchment during the lifetime of this Plan is to work towards the sustainable management of the Humber, balancing the legitimate interests of all who use the Estuary. To achieve this vision the following actions are considered necessary

- To maintain and enhance the National and International status of the Estuary for its bird population and conservation interest.
- To improve existing flood defences to accommodate rising sea levels and to maintain and/or improve their structural integrity.
- To reduce the discharge of dangerous substances to the North Sea.
- To improve water quality of the Tidal Ouse.
- To restore a run of migratory salmonids, ie. sea trout and salmon, through the Humber Estuary.
- To set Minimum Residual Flows for the Trent and Ouse which balance all water related interests.
- To ensure that the recreational potential of the Humber Estuary is fulfilled.
- To work with all relevant parties to implement the principles of sustainable development particularly by establishing stronger links with local communities and their representatives.
- To balance the needs of industrial, urban and agricultural development with the requirements of the Humber wetlands and sites of archaeological importance.
- To provide a management strategy to ensure a sustainable population of shrimp, shellfish and lugworm and thereby protect this valuable link in the food chain .
- To improve our knowledge of the relationship between sedimentary processes, rising sea levels and the natural boundaries of the Estuary.

The health of the North Sea has increasingly been called into question in recent years. On occasion it has been alleged that the Humber has contributed to a decline in that health. Sometimes it has been difficult to refute the allegations; either due to their non-specific nature, or due to the limited availability of counter-balancing evidence. The NRA's vision for the future for the waters of the Humber and adjacent North Sea is one where these allegations can no longer be made because:

- The record shows reducing domestic and trade effluent loads being discharged to these waters.

- The results of chemical monitoring show the restoration of water quality achieved over the past decades are being maintained and that further improvements are occurring.

- The results of biological monitoring show a healthy and diverse life throughout the waters and their sediments.

- The widespread publication of the results of monitoring and of effluent reduction programmes creates a general awareness of the well being of the Humber and the surrounding parts of the North Sea.

The North Sea impinges on the catchment in other ways:

- It can breach sea defences causing flooding of the large areas of Humberside that are at or below sea level.

- It creates productive fisheries both within the Humber and in adjacent coastal waters.

- It provides a transport link leading to the development of ports and associated industry.

The NRA will exercise it's responsibilities to prevent and mitigate flooding, to promote the health of the North Sea fishery and to regulate industry.

3.1 WATER RESOURCES

This section considers the requirement for meeting existing and future water abstraction demand in the catchment whilst protecting existing uses and users of water.

A key target for the Humber Estuary is to establish what Minimum Residual Flow (MRF) to tide is necessary in order to strike the right balance between the needs of abstractors on tidal rivers feeding the Estuary and other users, and those of the environment.

An MRF is a target river flow; it cannot necessarily be maintained by the NRA (or anyone else) and under drought conditions river flows may naturally fall lower.

MRF's or flow control rules are needed to set limits within which the available resources of the river can be allocated and any proposals for abstractions planned. These limits must be adequate to ensure the environmental health of the river, by providing adequate dilution of effluent to meet water quality standards and to appropriately satisfy all or most of the needs of existing river users.

This now requires investigation to;

- Provide a methodology for establishing MRF's
- Consider the balance between abstractive and in-river (estuary) needs
- Improve the extent and accuracy of measurement of flows to the Estuary.

3.1.1 River Humber

The future objectives for this catchment are related to each NRA statutory objective.

To protect surface waters from over commitment and ensure abstraction does not have an unacceptable effect on existing abstractors and environmental waters.

- To set MRF's and minimum control levels (MCL's) to protect river flows for environmental protection and to afford protection to downstream abstractors.
- To maintain flow regimes to protect conservation interests and low flows.
- To preserve flood flows for channel cleansing.

An example of work being carried out to meet these broad objectives is a recently completed study which suggested that a minimum residual flow at Trent Falls of about 2300 Ml/d would be sufficient to protect the interests of the Humber Estuary. However within the Trent Estuary the report suggested one scenario for determining a flow control rule for the Trent based on a minimum residual flow at North Muskham of 2650 Ml/d. These provisional figures require further study.

The study considered the critical use related to this flow to be navigation, whilst ensuring other uses were protected; these included environmental needs, water quality standards and effluent dilution, power stations, water supply, recreation, fisheries, agriculture, industry and flood defence.

Setting MRF's for the Ouse and refining the work done on the Trent are considered to be the major Water Resource issues for this catchment.

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

- To meet existing in-catchment water demands to defined standards of reliability.
- To produce a water resource strategy to define how future demands will be met.

To ensure the proper use of water resources.

- To ensure existing in-catchment protected rights to abstract water and established environmental needs are protected before allocating water for further abstraction.

3.2 WATER QUALITY

The current methods used to classify river and estuary water quality are provided in Appendix 2. The objective classes in terms of these classification schemes are provided in Map 10. Other Environmental Quality Standards (EQS) are provided in Table 3..

The shortfalls against these objectives are provided in Appendix 4.

These target water quality classes are principally use related. The Plan's vision therefore is to maintain and/or improve water quality to achieve the objective classes and thereby maintain and/ or realise all the potential uses for the Humber system. Achieving the water quality targets will cost a considerable sum of money and it is helpful when comparing costs and benefits to assess the benefits in terms of the maintenance or realisation of uses.

The uses or objectives which relate to the above water quality targets are as follows:

Freshwater Inputs:

- Water suitable for potable supply after advanced treatment
- Supporting reasonably good coarse fisheries
- Moderate amenity value

Estuaries:

Biological Quality

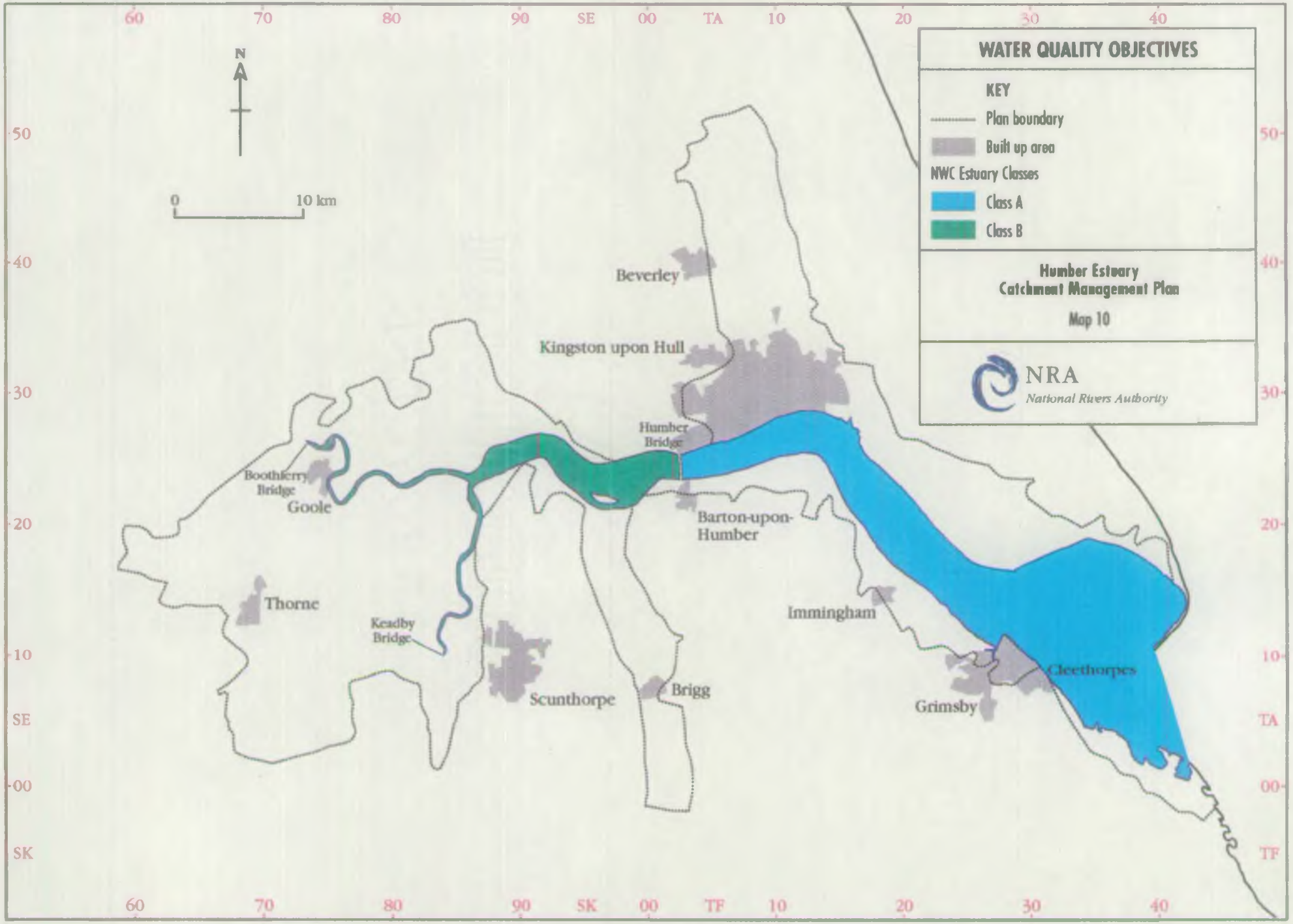
- Allows the passage to and from freshwater of all relevant species of migratory fish when this is not prevented by physical barriers.
- Supports a residential fish population which is broadly consistent with the physical and hydrographical conditions.
- Supports a benthic community which is broadly consistent with the physical and hydrographical conditions.
- Absence of substantially elevated levels in the biota of persistent toxic or tainting substances from whatever source.

Table 3 Humber Environmental Quality Standards

(Annual average in µg/l except where indicated)

Determinands	Tidal Rivers (to saline limit)	Estuary	Notes
Temperature	25°C (95% ile)	25°C (95% ile)	
pH range	5.5 - 9.0 (95%ile)	6.0 - 8.5 (95%ile)	(3)
Unionised Ammonia	0.021 mg/l (95% ile)	0.021 mg/l (95% ile)	
Mercury	1 (total)	0.3 (dissolved)	(1)
Cadmium	5 (total)	2.5 (dissolved)	(1)
Arsenic	50 (dissolved)	25 (dissolved)	(3)
Chromium (III & VI)	250 (dissolved)	15 (dissolved)	(3)
Copper (II)	28 (dissolved)	5 (dissolved)	(2) (3)
Lead	250 (dissolved)	25 (dissolved)	(3)
Nickel	200 (dissolved)	30 (dissolved)	(3)
Zinc	500 (total)	40 (dissolved)	(3)
Iron	1000 (dissolved)	1000 (dissolved)	(3)
HCH	0.1 (total)	0.02 (total)	(1)
DDT (all isomers)	0.025 (total)	0.025 (total)	(1)
DDT (pp isomers)	0.01 (total)	0.01 (total)	(1)
Carbon Tetrachloride	12 (total)	12 (total)	(1)
PCP	2 (total)	2 (total)	(1)

(1) Mandatory Statutory Quality Objective laid down in 1989 regulations (SI 2286)
(2)Higher values acceptable where acclimation expected or substance present in organic complexes.
(3) National Evironmental Quality Standard for List II substances as required by EC Dangerous Substances Directive.


WATER QUALITY OBJECTIVES
KEY
Plan boundary
Built up area
NWC Estuary Classes
Class A
Class B
Humber Estuary
Catchment Management Plan
Map 10
NRA
National Rivers Authority
N
0
10 km
Beverley
Kingston upon Hull
Humber Bridge
Boothferry Bridge
Goole
Barton-upon-Humber
Thorne
Keadby Bridge
Immingham
Cleethorpes
Scunthorpe
Brigg
Grimsby
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Aesthetic Quality

- Estuaries or zones of estuaries which receive inputs which cause a certain amount of pollution but do not seriously interfere with estuary usage.

Chemical Quality

- Dissolved oxygen exceeding 40% saturation upstream of the Humber Bridge.
- Dissolved oxygen exceeding 60% saturation downstream of the Humber Bridge.

The above objectives and standards should be read in conjunction with the Humber Environmental Quality Objectives in Section 3.2.3 below and the Humber Environmental Quality Standards in Table 3. These constitute the Water Quality vision for this catchment.

Environmental Quality Objectives (EQOs) and related Environmental Quality Standards (EQS's) have been inherited by the NRA for the rivers and the Humber itself. EQS's are set out in Appendix 2. It will be necessary to review these objectives when The Secretary of State for the Environment introduces Water Quality Objectives (statutory) for estuaries as provided for by the Water Resources Act 1991.

3.2.1 River Ouse

The River Ouse from Boothferry Bridge to Trent Falls is required to comply with the objectives outlined by The Humber Estuary Committee in 1983 and which were inherited by the NRA. The tidal River Ouse has a target of Class B under the NWC classification of estuaries.

3.2.2 River Trent

The River Trent from Keadby to Trent Falls is also required to comply with the Humber Estuary Committee conditions outlined in 1983. The River Trent has a target of Class B under the NWC classification of estuaries.

3.2.3 Humber Environmental Quality Objectives

A generalised set of environmental quality objectives for the Humber Estuary was set by the Humber Estuary Committee in 1983, based on the need to protect the existing uses of the Estuary and on the recommendations of the third report of the Royal Commission on Environmental Pollution (1972). These objectives were as follows:

- The protection of all the existing defined uses of the Estuary system.

- The ability to support on the mud bottom the biota necessary for sustaining sea fisheries;.

- The ability to allow the passage of migratory fish at all stages of the tide.

Areas of the Humber Estuary are used in a number of ways. The uses in these areas which should be protected are as follows; nature conservation, commercial fishing and angling, tourism and amenity, bathing, boating and water skiing, navigation and abstraction for industrial and agricultural use.

The objectives were adopted informally by the former regional water authorities with the intention that they should be met by 1995, relative to a list of EQSs as shown in Table 3. The standards were based on the best scientific information available at the time or where applicable, on mandatory limits specified by either the European Community or UK legislation. This is discussed further in Appendix 3.

The EC Bathing Water Directive (76/160/EEC) is relevant to standards in the Humber Estuary at Cleethorpes. This directive lays down microbiological standards for bathing waters, principally in terms of total and faecal coliform levels. The waters at Cleethorpes do not comply with the necessary standards but full compliance is expected to be achieved by 1995 as a result of major improvements to the sewerage system and the provision of sewage treatment, carried out by Anglian Water Services Ltd.

The EC Directive relating to waste from the titanium dioxide industry (78/176/EEC) is particularly relevant to the Humber Estuary because two of the three UK factories manufacturing titanium dioxide are located on the south bank of the Humber. The discharges from these two factories have been studied in depth by the former Anglian Water Authority and this has been well documented in a report by the National Rivers Authority.[2]

The EC Directive on Urban Waste Water Treatment (91/271/EEC) will set standards for the treatment of all municipal sewage discharging to fresh, estuarine and coastal waters. The effect of this Directive in the Humber Estuary will be significant in future years and will require several discharges to be substantially improved.

United Kingdom and European controls and the derivation of Environmental Quality Standards for discharges to the Humber Estuary are discussed in more detail in Appendix 3.

[2]Discharges of Waste under the EC Titanium Dioxide Directive Report by the NRA, March 1993. Water Quality Series 10.

3.3.1 Flood Defence

Indicative Standards of Protection

The indicative standard of protection used by the NRA for an area of land is a notional target defined in MAFF guidance notes which varies according to its existing use. There are 5 bands which range from high density urban development to low productivity agricultural land (see below). For each of these bands an Indicative Standard of Protection has been identified which is expressed as a return period in years, ie the frequency at which on average, floods of a certain severity are exceeded. A defence built to a 1 in 20 year standard implies that a flood event exceeding that height would be exceeded about 5 times in 100 years.

The five bands for tidal areas are defined as:-

Current Land Use	Indicative Standard of Protection (Return Period in Years)
High density urban containing significant amount of both residential and non-residential property.	200
Medium density urban. Lower density than above, may also include some agricultural land.	150
Low density or rural communities with limited number of properties at risk. Highly productive agricultural land.	50
Generally arable farming with isolated properties. Medium productivity agricultural land.	20
Predominantly extensive grass with very few properties at risk. Low productivity agricultural land.	5

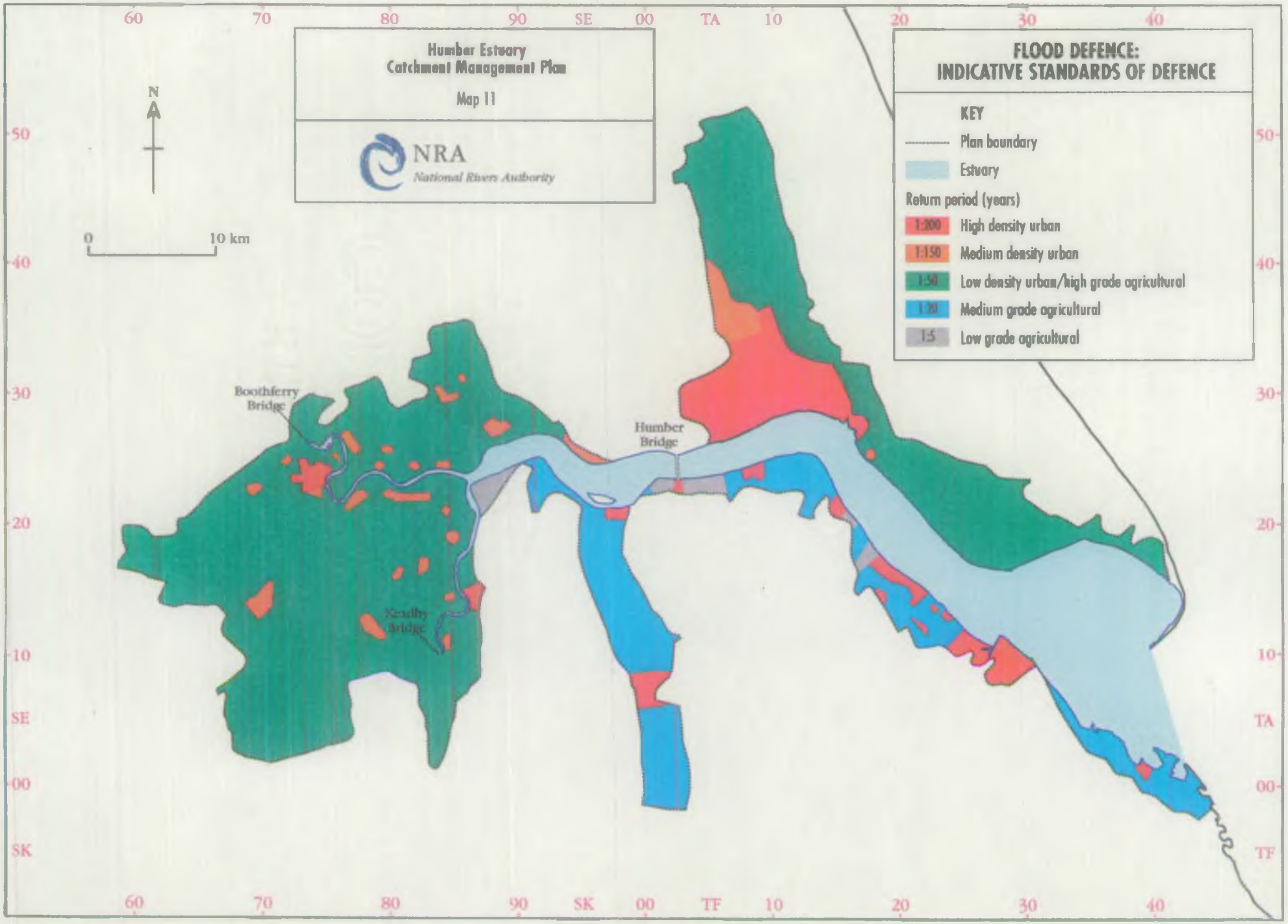
Simplified Land Use Classification

The land use classification map (Map 11) identifies 5 categories of land use from "high density urban" to "low grade agricultural". Since the land use category is the determinand for the indicative standard of defence, it is necessary to ensure that meaningful areas are defined where a number of different categorised areas are present. Map 12 shows the flood area from Barrow to Grimsby. The 'Detailed Land Use Classification' shows land uses as presently defined, however this area and others around the Estuary are very low lying with no internal flood defences and an extensive drainage network. Accordingly, the area is being reassessed based on generalised flood cells and this reassessment is presented as the "Simplified Land Use Classification"

It should be noted that indicative standards do not represent an entitlement to protection or a minimum level to be aimed at, they are a starting point on which the NRA assess the economics of providing defences along differing lengths of the Estuary dependant upon land use immediately behind.

Design Standards of Protection

The indicative standard of protection takes account only of the nature of the risk and the current land use of the area at risk. Once it is decided a flood defence improvement scheme is required for a given location a range of options will be considered by the NRA. Each of these options has to be evaluated. The capital, maintenance and environmental costs of any works to the defences must be contrasted with the benefits of providing that level of protection. Options may also be considered for different levels of protection. Usually the most economic option which yields the desired level of protection would be chosen, although a lesser level of defence may be accepted if the indicative standard cannot be justified when comparing costs against benefits. (Conversely there are occasions when a higher level of defence might be justified.) The consequence of this is that a level of protection ultimately chosen, i.e. the design standard, may not always be consistent with the indicative standard.


Humber Estuary
Catchment Management Plan
Map 11
NRA
National Rivers Authority
FLOOD DEFENCE:
INDICATIVE STANDARDS OF DEFENCE
KEY
Plan boundary
Estuary
Return period (years)
1:200 High density urban
1:150 Medium density urban
1:50 Low density urban/high grade agricultural
1:20 Medium grade agricultural
1:5 Low grade agricultural
N
0
10 km
Boothferry Bridge
Humber Bridge
Scunthorpe Bridge
60
70
80
90
SE
00
TA
10
20
30
40
50
SK
TF

PRACTICAL APPLICATION OF LAND USE CLASSIFICATIONS

KEY

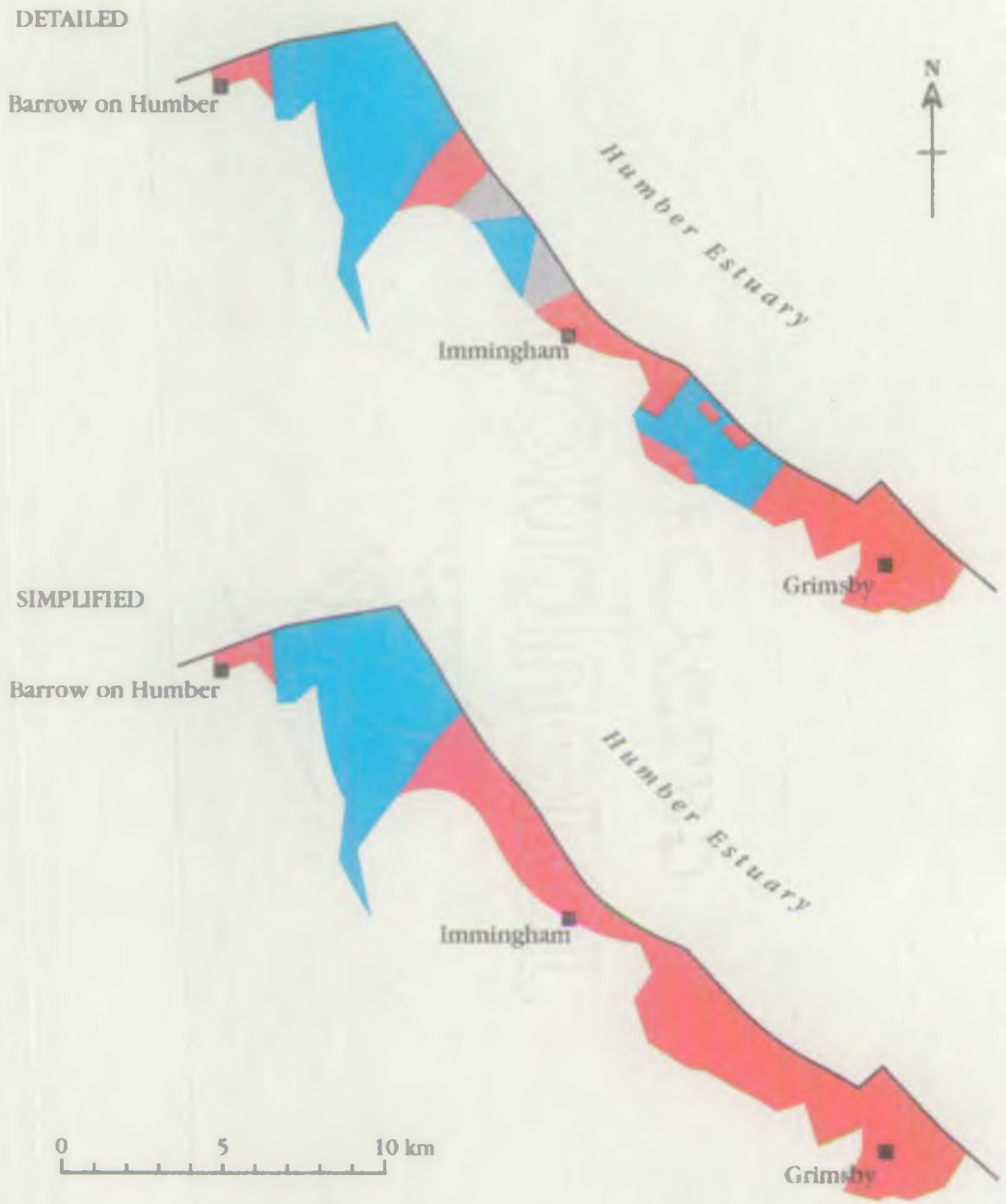
Return period (years)

- High density urban
- Medium density urban
- Low density urban/high grade agricultural
- Medium grade agricultural
- Low grade agricultural

Humber Estuary Catchment Management Plan

Map 12

NRA
National Rivers Authority



Future Planning

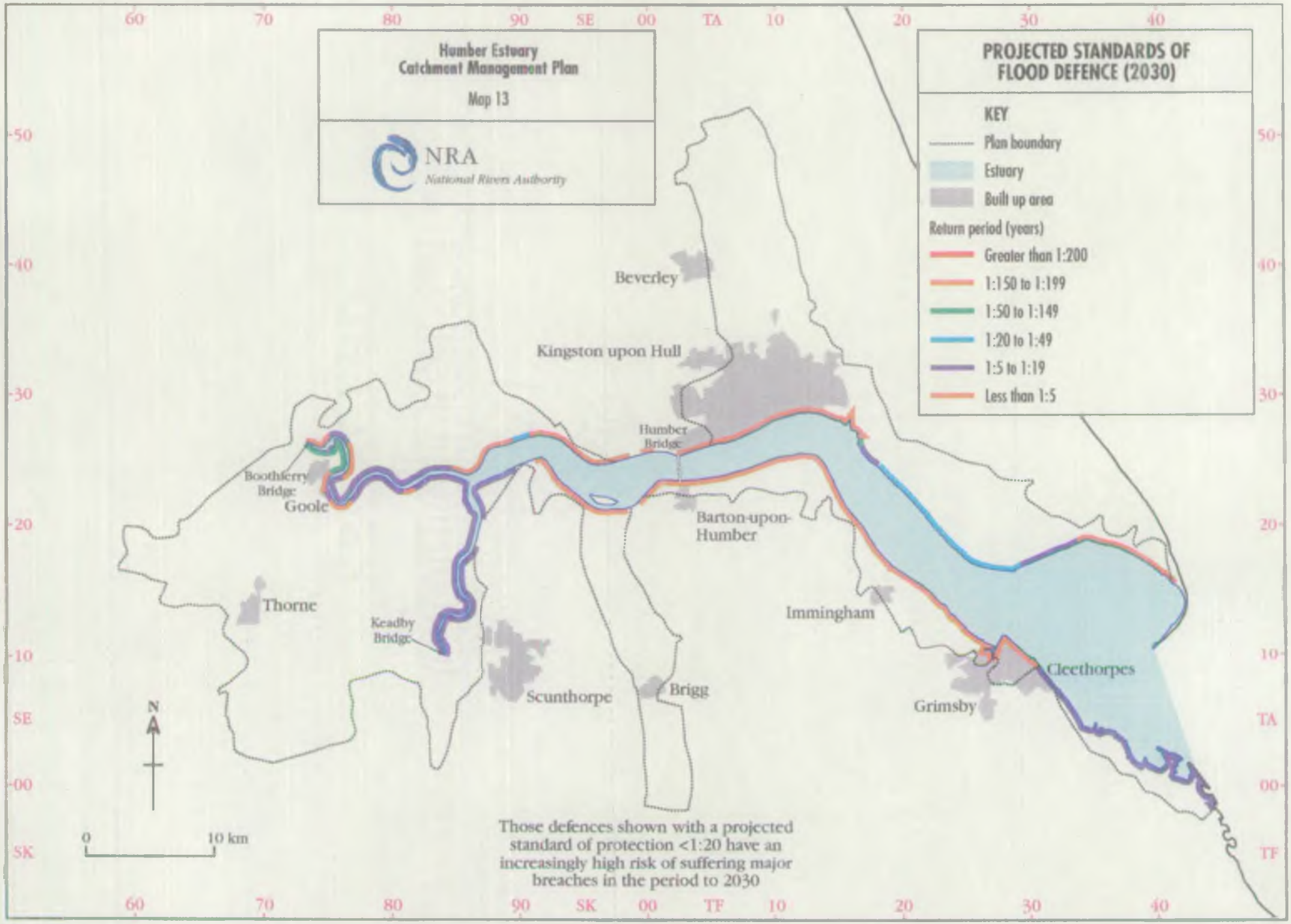
The NRA's flood defence planning horizon is 2030 by when it is anticipated that the NRA will have completed the works to be identified in the Humber Estuary Flood Defence Strategy. The strategy will take into account the full effects of global warming and sea level rise in accordance with current predictions. In formulating this strategy, consultation with all interested parties will take place in order that the right balance is struck between the competing needs of the Estuary.

By 2030 it is envisaged that the minimum level of protection afforded will be in accordance with MAFF indicative standards, providing the necessary benefits can be substantiated. In the longer term the NRA will monitor sea level rise in order to ensure any necessary works post 2030 are implemented.

The NRA is aware that existing levels of defence do not necessarily meet indicative standards in all cases and this will be exacerbated by rising sea levels. The Humber Estuary Flood Defence Strategy currently being prepared will deal with these issues. Ahead of this strategy being produced, works of a more immediate nature are being undertaken to lessen the risk of flooding to people and property where defences are known to be at risk of failure. Examples are in Goole and at Salt End on the north bank and East Halton Skitter Outfall on the south bank.

The current level of protection for all frontages along the Estuary has been calculated using probability analysis of extreme water levels and waves. This analysis has established both existing levels of protection and that area of land behind the defences which would be at risk of flooding should the defences fail. A comparison of the existing standard of defence as shown in Map 6 in section 2.4.2 with the indicative standard for each frontage shown in Map 11, identifies the present lengths where there are shortfalls in the defences. It suggests that currently some 102km of the defences provide a standard of protection less than the indicative standard. These shortfalls in standards relate not only to defences providing protection to agricultural land but also to residential and industrial land (including oil refineries).

Looking forward in time, the effects of sea level rise on extreme water levels have been calculated to 2030 and the standard of protection provided by the existing defences recalculated. Map 13 shows the projected effect of these predictions and indicates the considerable lengths of frontage where the standards of protection would significantly fall without the ongoing investment in tidal defences. If no improvement works were undertaken to the year 2030 then 213 kms of defences would provide an inadequate standard of protection.


Humber Estuary
Catchment Management Plan
Map 13
NRA
National Rivers Authority
PROJECTED STANDARDS OF FLOOD DEFENCE (2030)
KEY
Plan boundary
Estuary
Built up area
Return period (years)
Greater than 1:200
1:150 to 1:199
1:50 to 1:149
1:20 to 1:49
1:5 to 1:19
Less than 1:5
Beverley
Kingston upon Hull
Humber Bridge
Boothferry Bridge
Goole
Barton-upon-Humber
Thorne
Keadby Bridge
Immingham
Cleethorpes
Scunthorpe
Brigg
Grimsby
N
0
10 km
Those defences shown with a projected standard of protection <1:20 have an increasingly high risk of suffering major breaches in the period to 2030
60
70
80
90
SE
00
TA
10
20
30
40
50
SK
TF

3.3.2 Development

Development Objectives

In setting objectives regarding development in relation to the Humber Estuary the NRA recognises the standing of the Estuary as an asset of international importance in both economic, development and environmental terms. Our objectives are to:

- Protect the Estuary and its related environment from any detriment due to development.
- Maintain and enhance the estuarial environment in conjunction with development.
- Ensure that new development is provided with appropriate flood protection and does not increase flood risk elsewhere which could endanger life and damage property.
- Ensure any works which are needed to reduce flood risk created by land use changes is paid for by the developer and not the public.
- Protect inland, coastal and groundwaters from pollution.
- Esure that adequate pollution prevention measures are incorporated into development and that development is appropriately situated and is consistent with the NRA Groundwater Protection Policy.
- Protect surface waters and groundwaters from derogation arising from development.

3.3.3 Fisheries, Recreation, Conservation and Navigation (FRCN)

These targets are set with the background of the significant importance of the Humber Estuary for its nature conservation value in particular, which is recognised worldwide by the international, as well as national designations for which it qualifies. The requirement to maintain this status is of paramount importance. The NRA will consult, liaise and work with other organisations with a responsibility in the Humber to ensure that this is achieved.

The Fisheries, Recreation and Conservation targets for the Humber Estuary are in line with the national NRA strategies for fisheries, recreation and conservation. The following sections provide details of the broad strategy for each function followed by the specific targets for the Humber Estuary.

Fisheries

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

- Maintain, improve and develop fisheries

To achieve this aim the NRA seeks to :

- Protect and conserve salmon, trout, freshwater fish, eel and where appropriate, coastal fisheries.
- Regulate fisheries through the enforcement of a consistent series of licences, orders bylaws and consents.
- Monitor the fisheries status of rivers and inland estuary and where appropriate coastal waters.
- Formulate policies to maintain, improve and develop fisheries and restore and rehabilitate damaged fisheries.
- Provide an efficient and effective fisheries service which is responsive to the needs of its customers and which is based on a sound charging system.

This requires an efficient balancing of costs and benefits within an integrated system of catchment management, taking the needs of all users and all NRA functions into account. The targets specifically identified for the Humber Estuary are;

i) Review the regulation of the eel fishery.

ii) Restore the flounder fishery of the drains and watercourses entering the Estuary.

iii) Promote the re-establishment of a self-sustaining salmonid population.

iv) Ensure a better knowledge of the fish populations of the Estuary and the tidal rivers entering it.

v) Ensure a sustainable exploitation of shellfish and lugworm.

vi) Ensure an adequate understanding of the bioaccumulation of persistent and potentially toxic substances.

Conservation

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

- To conserve and enhance wildlife, landscape and archaeological features associated with inland and coastal waters of England and Wales.

This will be achieved, either directly through the Authority's own operational and regulatory activities, or by influencing the activities of others.

The NRA's conservation strategy will continue to be based on three strategic objectives to:

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

The targets specifically identified for the Humber Estuary are to:

i) Ensure as far as possible that the form of defences for the Estuary is in equilibrium with physical processes.

ii) Maintain and/or improve the conservation value and status of coastal corridors.

iii) Reconcile potentially conflicting interests between conservation and recreational activities and other users.

iv) Establish an adequate baseline of information on historic and archaeological features to ensure that work carried out around the Estuary avoids damage so far as possible.

v) Protect wherever possible the historic and archaeological value of the Estuary.

vi) Conserve and enhance wherever possible the nature conservation value of the Estuary and surrounding area.

vii) Establish effective environmental monitoring in association with future flood defence works.

Recreation

The NRA's principal aims in relation to recreation are to;

- Develop the amenity and recreational potential of inland and coastal waters and associated lands.
- Maintain, develop and improve recreational use of NRA sites.
- Take account of recreation in proposals relating to any NRA function.
- Promote the use of water and associated land for recreation purposes.

The targets specifically identified for the Humber Estuary are to;

i) Accommodate a full range of types of recreation and maximum use of the Estuary to a level consistent with the protection of the natural resources, the amenity of the area, the welfare of the community and the satisfactory operation of all activities.

ii) Ensure access to freshwater systems for recreational craft is adequate.

iii) Promote managed access to embankments whenever possible.

iv) Ensure that the educational potential of the Estuary is fully developed.

4 ISSUES AND OPTIONS

4.1 General

The catchment management planning process allows the differences between a vision of the catchment and a perception of its current status to be identified. These differences, or shortfalls in achieving this vision become issues within the Plan. Consequently, an issue, being a statement of a shortfall can appear rather negative. The catchment management process however is anything but negative as it is the vehicle for achieving our vision of the catchment within a planned timescale.

Through the preparation of this Plan we have been able to identify a number of issues which require consideration by all those interested in the future of the Catchment's natural water environment. The options which are described represent a range of alternative courses of action. and are generally not mutually exclusive. Some options may be more appropriate in one part of the Estuary than others. The options which are considered feasible will only be implemented following full project appraisal including a thorough analysis of costs and benefits.

The final Action Plan may include a combination of the options shown or further options identified during the consultation period.

Each issue is presented in the following manner:

1. A short description of the **issue**.

2. An attempt to determine the **options** to address the issue.

3. An assessment of the **advantages** and **disadvantages** associated with a particular option.

4.2 ISSUES AND OPTIONS

ISSUE 1 : A methodology is required to set Minimum Residual Flows to the Estuary to take account of all water uses.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
R&D to define methodology and NRA to develop a River Minimum Flow Objective policy.	NRA	Methods established to enable MRF's to be set.	Potentially protracted process to develop and refine sustainable methods to ensure striking a balance of all interests, on all rivers. Costs.
Regions to develop and use existing/new methods.	NRA	Methods available sooner/ or already in existence. Specific to local geography and interests.	No 'NRA' method Not cost effective nationally. No consistent NRA approach.
Central R & D just to develop broad framework/concept. Regions implement within that framework	NRA Regions	Ability to adopt flexible approach to local circumstances, within broad framework concepts.	
Do Nothing		No cost.	No agreed framework available to deal with often conflicting requirements of the water environment from different interests.

ISSUE 2 : To set Minimum Residual Flows for the Trent and Ouse which balance all water uses.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Set MRFs	NRA	Water related interests balanced. Framework laid down in which applications for abstraction and discharge can be determined. Wide public consultation ensures ownership/co-operation and agreement.	Potential difficulty in striking balance for all interests at all times. Potential straight-jacket effect of general methodology in local circumstances.
Do nothing.		Flexibility to manage different interests.	Poor framework in which to deal with applications for water abstraction and discharge and to sustain/improve FRCN interests.

ISSUE 3: The level of accuracy of gauging of feshwater flows to the Estuary needs to be improved.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Ouse: Calibration and continuous upgrading of quality of flow measurements at the tidal limits.	NRA	Small improvement in accuracy of measurement	Cost to NRA
Trent: Improve N.Muskham from open channel rated sections to ultrasonic flow gauge.	NRA	Improved accuracy of measurement Improved control of abstractions under licences with flow restrictions	Cost to NRA
Do nothing			Insufficiently accurate measurement of flows to the Estuary

ISSUE 4: Water quality of the Tidal Ouse requires improvement.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Reduce effluent loads	NRA Yorkshire Water Industry	Achieve objectives	Cost to dischargers
Increase river flows	NRA	Increased dilution	Restriction of abstractions Cost of augmentation

ISSUE 5: Cleethorpes bathing beach fails the European Bathing Water Directive

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Improve sewerage and sewage treatment at Cleethorpes *	NRA Anglian Water Services	Bathing water complies with targets	Cost

* This is a commited scheme, completion 1995

ISSUE 6: Reduce the discharge of dangerous substances ultimately to the North Sea.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Reduce discharges of dangerous substances in effluents by application of:	NRA HMIP Dischargers	Reduce concentration in food chain Reduce input to North Sea Achieve EQS	Cost
a)Best available techniques			Cost to industry increases as concentration decreases
b)Waste minimisation programmes		Reduce costs to industry	Viability decreases as concentration decreases
c)Integrated Pollution Control			
Do nothing			UK fails to meet its commitment to the Ministerial declaration on the North Sea

ISSUE 7: Nutrient data are inadequate to determine the eutrophic status of the Humber Estuary and its adjacent coastal waters for Urban Waste Water Directive and North Sea Declaration purposes.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Use existing NRA nutrient data to establish status	NRA	Quick Cheap	Uses only some of the existing data. High risk of wrong result
Use all data readily available from NRA, MAFF (JoNuS project)[3] and PML (LOIS project)[4]	NRA	Makes best judgement of status currently possible	Risk of wrong result due to short time frame of data
Continue existing monitoring for three more years	NRA PML	Create a five year data set on which to judge status. Reduces risk of bias due to 1992 or 1993 being abnormal year	No final decision for three years No reduction in monitoring costs
Increase monitoring	NRA PML	Shortens time frame within which a decision could be made. Increases robustness of decision	Increased cost
Do nothing		No new expenditure on monitoring. Existing expenditure is reduced	Very high risk of wrong result and inappropriate expenditure on effluent improvement

[3]Joint Nutrient Study

[4]Plymouth Marine Laboratory (Land Ocean Interaction Study)

ISSUE 8: Different standards of flood protection are ascribed to adjacent lengths of flood defences because the responsibility for flood defences rests with a number of organisations.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Form a unitary authority to be responsible for all sea/tidal defences	NRA Government	Consistency of purpose and standards One stop shop for customers	Resource and set up costs Legislative change required
Liaise with other bodies and try to mutually agree approach and standards	NRA Riparian owners Local Authorities	Consistency of purpose and standards One stop shop for customers	Limitations of existing legislation. Obtaining third party commitment to increased investment.
Do nothing		No resource implications	An uncoordinated and inconsistent approach toward determining standards and levels of defence will remain

ISSUE 9: a) Existing defences will need to be substantially improved if the NRA is to maintain standards to accommodate rising sea levels.

b) The structural integrity of the defences needs improving to lessen the risk of flooding due to their failure through reaching the end of their useful life.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Improve existing defences to the justifiable design standard	NRA ABP Industry Crown Estates	This will optimise the level of protection	Cost May have adverse effect on other coastal processes
Accept the reduced standard of protection and maintain at the reduced standard	NRA ABP Industry Crown Estates	Lower cost than above option in the short term	Increased risk of overtopping Increased likelihood of sudden failure with consequent risk to life and property. Effectiveness of flood warning will decrease.
Consider managed retreat	NRA ABP Industry Crown Estates Government	Possible environmental gain.	Possible environmental loss. Detrimental to landowners and the community Limited option, not always appropriate. Legal framework unclear Effect on coastal processes is unknown.
Patch and repair defences / do little	NRA Others	Maintains the status quo	Possible environmental loss. Detrimental to landowners and community Limited option, not always appropriate. Effect on coastal processes is unknown

ISSUE 10: Defences need to be protected from increased wave attack brought about by the erosion of the foreshore

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Improve existing defence	NRA Others	Maintains existing level of protection	Cost May have an adverse effect on other coastal processes
Undertake works to the foreshore	NRA Others	Maintains existing level of protection Maintains environmental benefit of foreshore	Environmentally contentious
Consider managed retreat	NRA ABP Industry Crown Estates Government	Possible environmental gain	Possible environmental loss Detrimental to landowners and the community Limited option, not always appropriate Legal framework unclear Effect on coastal processes is unknown
Do nothing	NRA Government	Possible environmental gains	As above Reduced standard of protection

ISSUE 11: Insufficient information exists on the relationship between sedimentary processes, freshwater flow, rising sea levels and Estuary boundaries

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Initiate a study to predict the impact on flood defences, navigable channels and estuarine habitats	NRA English Nature ABP Local Authorities MAFF	Improved knowledge of impact will aid the decision making of all parties Could produce a coordinated approach by interested parties	The long term cost/benefit of any study is indeterminate Lack of any suitable modelling techniques
Wait and see		There may be greater benefit to all parties by waiting for improved understanding of the processes involved. Provides time for a management framework for the Estuary to be established.	May be long term cost disadvantages Reduced level of protection Reactive works may prove more expensive Environmental loss Increased possibility of breaches with consequent risk to life and property Continued high cost of dredging

ISSUE 12: Coastal erosion along the Holderness Coast is linked to the overall sediment balance in the Humber Estuary. Demands to provide coastal protection along that coastline may conflict with the flood defence and environmental needs of the Estuary.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Initiate a study to evaluate the extent of the problem	NRA Others	Improved knowledge will aid the decision-making of all parties	The long term cost-benefit of any study is indeterminate. Lack of suitable modelling techniques
Wait and see		There may be greater benefit to all parties by waiting for improved understanding of the processes involved Provides time for a management framework for the Estuary to be established	May be long term disadvantages Reduced level of protection Reactive works may prove more expensive. Environmental loss Increased possibility of breaches with consequent risk to life and property

ISSUE 13: Development and upgrading of land behind defences may be inconsistent with the current level of protection afforded

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Liaise with Planning Authorities to ensure there is consistency between Structure Plans and Catchment Management Plans	NRA Planning Authorities	Consistent approach	
Encourage appropriate development in low risk areas	Local Planning Authorities NRA	Environmental benefits Reduced risk to new development	
Improve the standards of the defence	NRA Others		
a) Through Developer contributions		Developer pays	Cost to individual companies may be too high
b) Through Local Council funding		Coordinated approach can be most realistic and appropriate way of obtaining development funds.	Competing Local Authority priorities
c) Through NRA funding			Unrealistic

ISSUE 14: Opportunities exist to improve the conservation value of the Estuary

Sub-issue 1: Embankment of the Estuary has lead to the loss of complex wetland habitats such as saltmarshes.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Managed retreat to natural profile or new line of defence.	Landowner NRA MAFF Countryside Commission Govt.	Restoration of wetland habitats. Full integration of salt to freshwater flora and fauna.	Cost. Limited number of viable sites. Full impact unknown Effects on rural economy
Managed creation of new habitats on landward side of bank on the back of capital and maintenance schemes e.g. borrow pits, tidal storage/flushing reservoirs.	NRA Landowner MAFF Countryside Commission	Restoration of freshwater habitats. Increased integration of bird fauna e.g. high tide feeding roosting sites.	Cost. Partial solution.
Maximisation of existing wetland habitats through joint projects e.g. Barton Claypits.	NRA English Nature Landowners County Trust Local Authorities Countryside Commission	Maintenance / enhancement of target species e.g. bittern, bearded tit etc. Development of management expertise.	Cost. Partial solution.
Encourage landowners to restore/create wetlands and grazing marshes on either side of embankments.	Landowners NRA MAFF Countryside Commission	Restoration of wetland habitats. Increase integration of bird fauna.	Cost. Partial solution.

Sub-issue 2: Opportunities exist to improve the habitat diversity of coastal corridors.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
New embankments or repair to existing structures to be to a varying profile with less steep slopes.	NRA Riparian owners District Councils Crown Estates MAFF	Suitable for hay cropping. Increased environmental asset.	Cost.
Review the design and management of NRA banks.	NRA MAFF	Identify conservation improvements.	Cost.
Restore and enhance during maintenance or capital works.	NRA	Increased environmental asset.	Cost.

ISSUE 15: Silt build up in havens restricts access to recreational craft and inhibits land drainage

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Creation of tidal storage/flushing lagoons to prevent silt build-up.	NRA Recreational Interests IDB's	Improves recreational access Increases salt/brackish wetland habitats. Maintenance / enhancement of target (rare) brackish species. Increases integration of bird, fish fauna between fresh and salt water. Maintains natural estuarine channels.	Cost. Saline intrusion into freshwater habitats. Ongoing maintenance
Dredging tidal channels.	NRA ABP	Short term cost. Improves recreational access Improved drainage	Temporary solution. Access problems. Loss/disturbance to environment/habitat
Re-align tidal channels with training walls.	NRA	Speed flows to scarify channel. Improve access for future dredging. Improves recreational access	Cost. Loss/disturbance to environment/habitats. Will not maintain silt free channel in low flow conditions.
Pumped freshwater outfall to tide.	NRA	Maintain adequate outfall.	Cost. Long term effect on Haven morphology and does not solve access for craft.

ISSUE 16: Industrial, urban and agricultural development may have an adverse effect on the local environment, for example loss of Humber wetlands and sites of archaeological importance.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Work with other interested parties to create coordinated land-use strategies	Local Authorities NRA English Nature Landowners	Maintain/enhance the water environment - 1991 Water Resources Act. Maintain bio-diversity. Protect important archaeological sites.	Cost/time.
Develop zonal restrictions.	NRA Local Authorities Landowners Developers	Strategic approach. Conserve and create wetlands. Conserve important archaeological sites.	Restriction to some development.
Encourage landowners to create sanctuary areas.	Land owners NRA English Nature Countryside Commission Local Authorities	Reduced disturbance. Benefits to other flora and fauna.	Cost. Limitation on development

ISSUE 17: Managed exploitation of shrimp, shellfish and lugworm would allow sustainable development and protect natural predators e.g. birds and fish

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Research/monitor.	Sea Fisheries Committee MAFF NRA	This will lead to a better understanding of the Estuary's fisheries. Lead to sustainable exploitation.	Time to react to known over exploitation.
Investigate methods of Regulation	Sea Fisheries Committee MAFF NRA	Target suitable and effective regulation	
Zone areas for exploitation.	Sea Fisheries Committee MAFF NRA	Protect sanctuary areas. Strategic approach to exploitation.	Restriction to Commercial Fisheries.
Develop Marine Nature Reserves	MAFF NRA	Protect sanctuary areas. Strategic approach to exploitation	Restriction to Commercial Fisheries.

ISSUE 18: The suitability of fish and shellfish for human consumption has been reduced by bacteria and other contaminants.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Research/Monitor	Environmental Health MAFF NRA Research establishments	Assess suitable consumption levels.	Cost. Potential restriction on Commercial Fisheries.
Improve quality of effluent	NRA Dischargers	Reduced contamination	Cost to dischargers
Do nothing		No expenditure	Potential health risk

ISSUE 19: Flounder populations have declined on watercourses where free access from the Estuary has been restricted

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Construct 'fish passes' as appropriate'	NRA MAFF	Develop free passage for fish species	Cost
Do nothing		No expenditure	No re-establishment of flounder population

ISSUE 20: Insufficient information exists on fish species in tidal rivers and the Humber Estuary

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Research/study fish populations	Sea Fisheries Committees	Improved understanding	Cost
Do nothing		No expenditure	Less understanding No data for management

ISSUE 21: The run of migratory salmon through the Humber Estuary has declined since the 19th century

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Improve water quality around Trent Falls and Lower River Ouse to facilitate free passage.	NRA Effluent dischargers.	General environmental benefit.	Cost to Dischargers
Provide free passage at obstructions at all stages of the tide.	NRA	Passage for migratory fish to spawning grounds.	Cost.
Control exploitation via Net Limitation order or by laws.	NRA North Eastern Sea Fisheries Committee	Limit exploitation until recovery is strong enough to support sustainable fishery.	
Develop a Humber Salmonid recovery group.	NRA	Co-ordinate the recovery of migratory fish.	

ISSUE 22: The recreational potential of the Estuary is not fully developed.

Sub-issue 1: A coordinated strategy for the development of recreational uses of the Estuary is required.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Study present and potential uses.	NRA Local Authorities Sports Council	Better understanding of present and future requirements.	Cost.

Sub-issue 2: Footpath access is restricted on some embankments particularly to disabled persons.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Provide better footpaths using small stone material.	NRA Local Authorities Sports Council	Provide better access to all users.	Cost. May provide access for inappropriate users
Provide better gate access.	NRA Local Authorities Sports Council	Provide better access to all users.	Cost.
Provide car parks	NRA Local Authorities	Provide better access to all users.	Cost.

Sub-issue 3: Potential conflicts exist between recreational activities and other users

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Work with other interested parties to develop management strategies.	County Councils Local Councils NRA Recreational organisations	Strategic approach Reduce conflicts Protect sensitive areas	

ISSUE 23: The educational value of the Estuary has significant potential for future development.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Assess the Educational Potential	NRA Local Councils	Maximise educational potential.	Cost
Increased involvement in existing facilities	NRA Others	Greater understanding	

ISSUE 24: Enforcement of the commercial eel fishery is not consistent.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Develop a coordinated and consistent approach to enforcement.	NRA	Improve understanding of exploitation. Develop consistent arrangements for eel fishermen.	Potential increase of restrictions on eel fishermen.

ISSUE 25: The potential to reclaim land along the Estuary poses a threat to its flora and fauna

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Control land reclamation through liaison with local planning authorities	NRA Local Planning Authorities	Controlled economic development Protection for flora and fauna	Changes to Estuary flow patterns may lead to siltation at havens Potential loss of habitat
Allow development without stringent controls	Local Planning Authorities NRA Developer	Unrestricted economic development	Loss of habitat, flora and fauna Siltation and erosion patterns may be changed
Discourage land reclamation	Local Planning Authorities NRA	No threat to flora and fauna No change to siltation and erosion patterns	Economic development hindered

ISSUE 26: Development on areas of contaminated land has the potential to pollute, but provides opportunity to clean up existing problems.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Persuade Local Authorities not to allow building on contaminated land.	NRA Local Planning Authorities Government	Risk of pollution not increased.	Does not permit land reclamation.
Ensure the pollutants within the site are effectively contained.	NRA Local Planning Authorities Developer	Reduced risk of pollution.	Cost Residual risk of pollution
Ensure the pollutants within the site are effectively removed	NRA Local Planning Authorities Developer	Reduced risk of pollution Cleans up existing problems	Cost
Seek legislative change	NRA Government	Reduced risk of pollution	Timescale of change for legislation

ISSUE 27: Development involving the controlled storage and transportation of hazardous materials within the catchment may create a pollution and health and safety risk.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
Ensure appropriate pollution prevention measures are in place	NRA Local Planning Authorities Developer/Operator	Reduced risk of pollution	Cost
Ensure high risk sites are situated in areas with appropriate flood protection	NRA Local Planning Authorities Developer	Reduced risk of pollution	Restriction of development
Ensure adequate emergency procedures are in place and publicised	NRA Emergency Services Local Authorities Developer/Site Owner	Effective response to emergency incidents	Cost

ISSUE 28: There is a need to improve liaison with local planning authorities in order that NRA recommendations are adequately considered in the planning process.

OPTIONS	RESPONSIBILITY	ADVANTAGES	DISADVANTAGES
To increase NRA influences in the planning process	Dept. of Environment NRA	Reduced planning and operational costs	
a) by contributing to the formulation of National Planning Policy	Dept. of Environment NRA	Clear guidance for landowners and developers on acceptable uses of land	
b) by seeking the inclusion of NRA policies into development plans	NRA Local Planning Authorities	New development/redevelopment would have regard to constraints aimed at conserving the water environment	
c)by agreeing the inclusion of NRA comments in planning application decisions	NRA Local Planning Authorities	Reduces chance of inappropriate use of land	
Encourage environmental enhancements as part of development/ redevelopment	NRA Developers	New development/ redevelopment would have regard to constraints aimed at conserving the water environment	

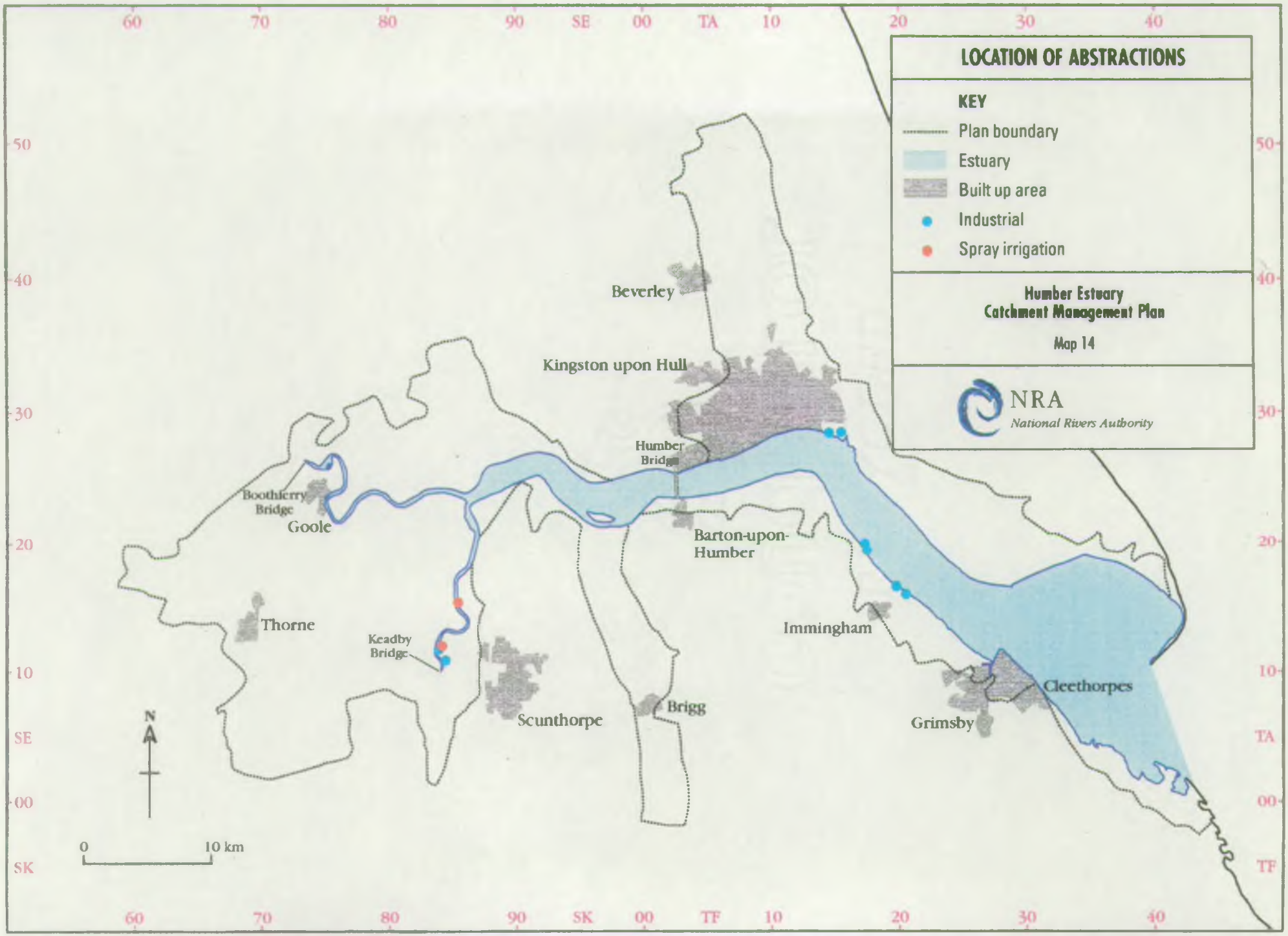
5 GLOSSARY

Abstraction	Removal of water from surface water or groundwater,usually by pumping.
Abstraction Licence	Licence issued by the NRA under s.38 of the Water Resources Act 1991 to permit water to be abstracted.
AOD	Above Ordnance Datum. Equivalent to mean sea level.
Avifauna	Birds
Benthic	Referring to life in or the Estuary/Sea bed
Biochemical Oxygen Demand (BOD)	A measure of the amount of oxygen consumed in water, usually as a result of organic pollution.
Combined Sewer Overflow (CSO)	An overflow structure which permits a discharge from the sewerage system during wet weather conditions.
Confluence	The point at which two rivers meet.
Consent (Discharge)	A statutory document issued by NRA under Schedule 10 of the Water Resources Act 1991 to indicate any limits and conditions on the discharge of an effluent to a controlled water.
Controlled Waste	Defined by Control of Pollution Act 1974, Part I Section 30. It includes household, industrial and commercial waste.
Controlled Waters	Defined by the Water Resources Act 1991 Part III Section 104. They include groundwaters, inland waters and
C.O.P.A	Control of Pollution Act 1974.
Criggs	A trap used to catch eels
Dangerous Substances	Substances defined by the European Commission as in need of special control because of their toxicity, bio-accumulation and persistence. The substances are classified as List I or List II according to the Dangerous Substances Directive.
Diffuse Pollution	Pollution from widespread activities with no one discrete source.

Dissolved Oxygen	The amount of oxygen dissolved in water. Oxygen is vital for life so this measurement is an important, but highly variable, indicator of the 'health' of a water. It is used to classify waters.
DoE	Department of the Environment.
DWF	Dry Weather Flow.
Environmental Prescribed Flow	That flow which should not be artificially reduced if the riverine environment is to be protected.
Environmental Quality Standard (EQS)	The quantity of a substance found in a body of water which should not be exceeded in order to protect a given use of the water body. An EQS is set by the European Community through EC Directives and the government.
Fyke Nets	A conical net used to trap eels
Flood Cell	A discrete area of land which is at risk of flooding should a breach or failure occur anywhere along the length of defences protecting that area.
Flood Plain	This includes all land adjacent to a watercourse over which water flows or would flow but for flood defences in times of flood.
Foreshore	The area lying above the high tide level
Groundwater Protection Policy	NRA policy relating to groundwater recharge areas to control activities having the potential to pollute underground water. Protection Policy
HMIP	Her Majesty's Inspectorate of Pollution.
House Equivalents (HE)	The average cost of damage to the average house when flooded.
IDB	Internal Drainage Board. An organisation with powers to carry out flood defence works independently of the NRA.
Intertidal	Refers to the region of the shore which lies between the highest and lowest tides
IPC Authorisation	An authorisation issued by Her Majesty's Inspectorate of Pollution prescribed by the Environmental Protection Act 1990 covering a process.

MAFF	Ministry of Agriculture, Fisheries and Food
Main River	Some but not all, watercourses are designated as 'Main River'. 'Main River' status of a watercourse must first be approved by MAFF. Statutory (legally binding) maps showing the exact length of 'Main River' are held by MAFF in London and the NRA in Regional Offices.The NRA has the power to carry out works to improve drainage or protect land and property against flooding on watercourses designated as 'Main River'. The NRA does not have the legal power to spend public funds on drainage or flood protection works on watercourses not designated as 'Main River'.
mg/l	Milligrammes per litre.
Ml/d	Megalitres per day
µg/l	Microgrammes per litre
Passerine Species	Belonging to an order of birds characterised by the perching habits, larks, finches, starling, sparrows.
Potable Water	Water of suitable quality for drinking.
Q95	Flow that is exceeded for 95% of the flow record.
RAMSAR	Wetland site of International Importance that is designated under the RAMSAR Convention
Recharge	Water which percolates downward from the surface into groundwater.
Red List/Annex 1A Substances	Following the second North Sea Conference in 1987, the UK Government issued a list of dangerous substances for control to the North Sea (Red List). The third North Sea Conference of 1990 modified this list (Annex 1A)
Residual Flow	The flow remaining in the watercourse after abstractions have taken place.
Return Period	Refers to the return period of a flood. Flood events are described in terms of the frequency at which, on average, a certain severity of flood is exceeded. This frequency is usually expressed as a return period in years, eg. 1 in 50 years.
RFFS	Regional Flow Forecasting System.

Riparian Owner	A person/organisation with property rights on a river bank.
River Quality Objective (RQO)	The level of water quality that a river should achieve in order to be suitable for its agreed uses.
RSPB	Royal Society for the Protection of Birds.
Salmonid Fish	Game fish eg. salmon, trout.
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 conservation value.
Subtidal	The area which is below low water mark which is coverered by water
STW	Sewage Treatment Works.
Strata	Layers of rock, including unconsolidated materials such as sands and gravel.
Sustainable	Capable of being maintained at a steady level without exhausting natural resources or causing ecological damage.
Trade Effluent	Effluent derived from a commercial process/premises.
Washlands	The area of the flood plain where water is stored in times of flood. Structures can be added to control the amount of water stored in the washland and to time its amount of water stored in the washland and to time its release to alleviate peak flood flows in areas downstream
WTW	Water Treatment Works.


LOCATION OF ABSTRACTIONS
KEY
Plan boundary
Estuary
Built up area
Industrial
Spray irrigation
Humber Estuary
Catchment Management Plan
Map 14
NRA
National Rivers Authority
Beverley
Kingston upon Hull
Humber Bridge
Boothferry Bridge
Goole
Barton-upon-Humber
Thorne
Keadby Bridge
Immingham
Cleethorpes
Scunthorpe
Brigg
Grimsby
N
0
10 km
60
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SK
TF

APPENDIX 1 CATCHMENT USES

Abstraction

There are 10 abstraction licences in the Humber Estuary and its tide effected length as shown on Map 14. Of these, 2 are used for spray irrigation, the remainder being for industrial or industrial cooling. There are 4 large industrial cooling water abstractions (two of which are Power stations) direct from the southern side of the Humber Estuary. These 4 abstractions are licensed for a total of 86,000 tcma. The majority of the water is returned to the Estuary, but at a higher temperature.

Currently, one further enquiry for abstraction from the tidal Estuary regarding cooling water for a new Power station has been discussed with the NRA.

Waste Water Disposal

Sewage Treatment Works

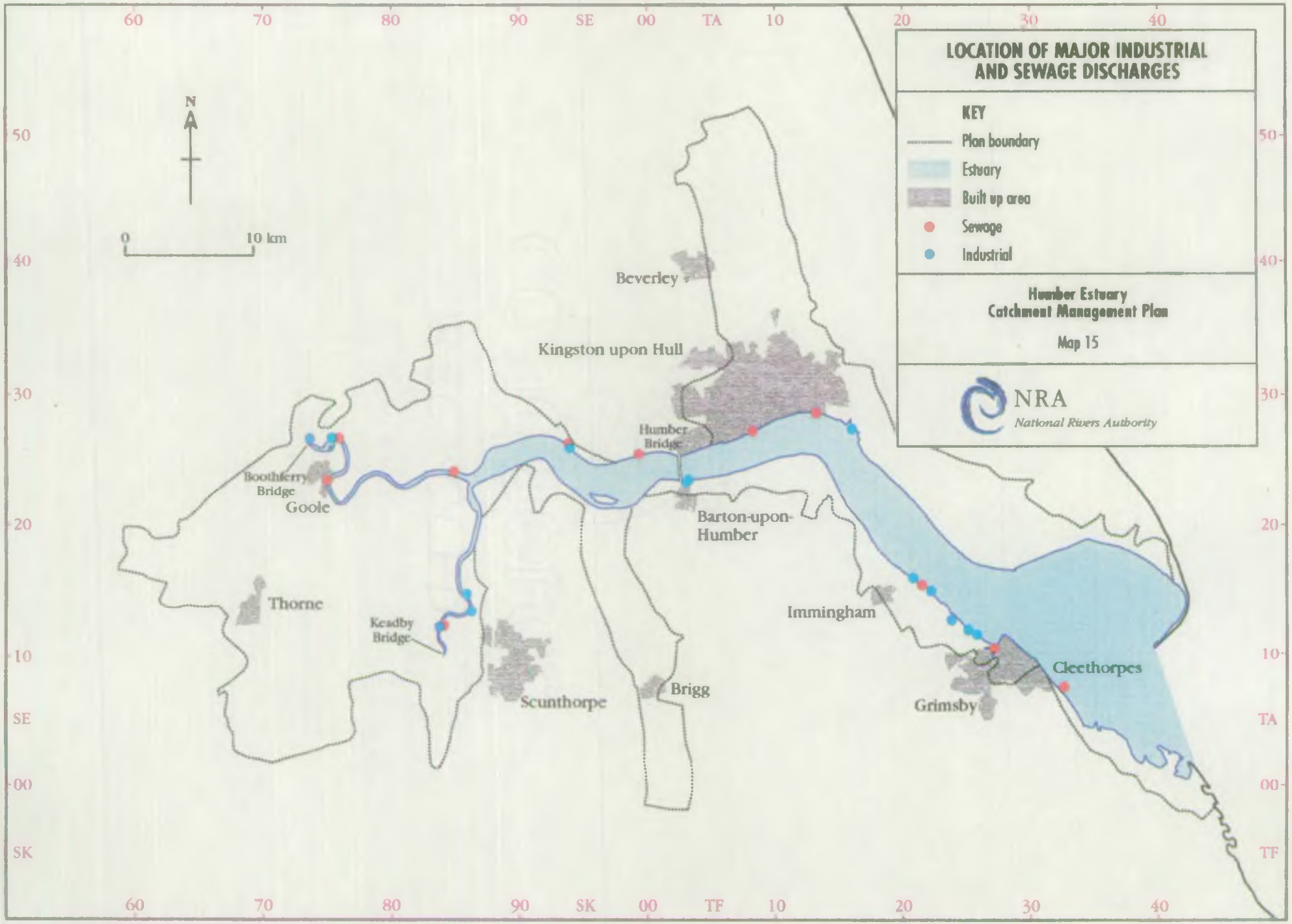
The major sewage treatment works in the catchments are shown on the Map 15. Details of the consent conditions regulating the performance of these works and the quality of the effluents being discharged are all contained on public registers maintained by the NRA at the appropriate regional office.

Industrial Discharges

The main industrial discharges in the catchment are also shown on Map 15. Details of the consent conditions regulating the performance of these works and the quality of the effluents being discharged are also contained on public registers maintained by the NRA at the appropriate regional office.

Diffuse Sources

Diffuse sources such as nitrates and pesticides will predominantly affect the quality of rivers discharging to the Humber catchment. This subject is considered in more detail therefore in the relevant catchment management plan.


LOCATION OF MAJOR INDUSTRIAL AND SEWAGE DISCHARGES
KEY
Plan boundary
Estuary
Built up area
Sewage
Industrial
Humber Estuary Catchment Management Plan
Map 15
NRA
National Rivers Authority
N
0
10 km
Beverley
Kingston upon Hull
Humber Bridge
Boothferry Bridge
Goole
Barton-upon-Humber
Thorne
Keadby Bridge
Immingham
Cleethorpes
Scunthorpe
Brigg
Grimsby
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Conservation & Recreation

The following provides further details of the current uses that have been discussed elsewhere in the document.

Locations of the major international and national designations shown in Map 7 are listed below.

Major SSSI's closely associated with the Estuary

Upper Humber
Earton & Barrow Clay Pits
The Grues
Pyewipe
Cleethorpes Coast & North Lincolnshire Coast
Spurn Head
The Lagoon

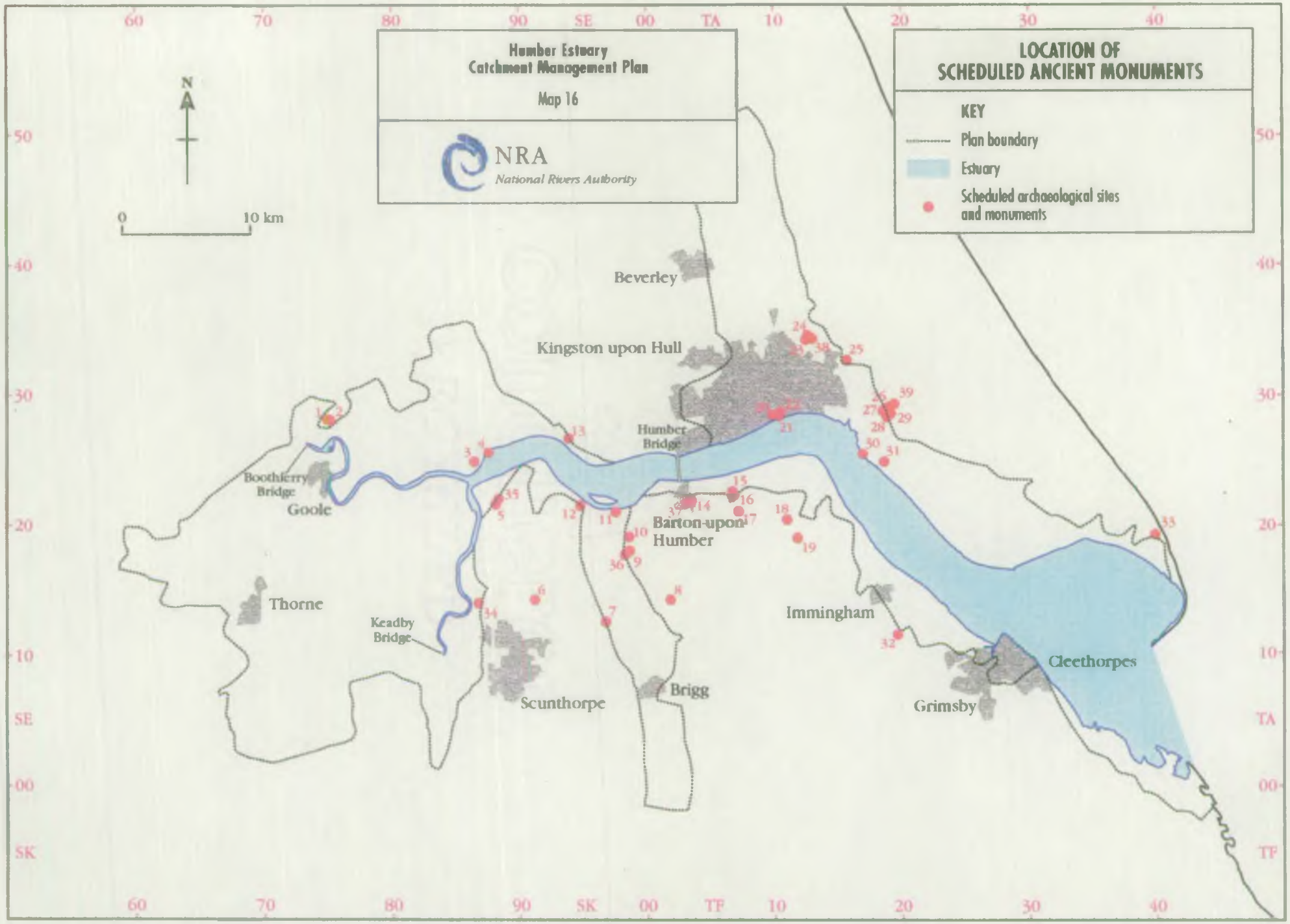
SSSI's Within Catchment Boundary

Thorne, Goole & Gowle Moors
Eastoff Meadow
Crowle Borrow Pits
Hatfield Moors
Belshaw
Epworth Turbary
South Ferriby Chalk Pits
River Hull Headwaters
Tophill Low
Leven Canal
Pulfin Bog
Beacon Lagoons
Rush Furlong
Went Ings Meadow
Barn Hill Meadow

Archaeology

Scheduled Ancient Monuments (SAM's) within the flood protection zone are shown in Map 16 and listed below.

1 Minster Church of SS Peter & Paul, Chapter House & School
2 The Bishop's Manor, Bishops Manor Park
3 Faxfleet Moated Site (Preceptory of the Knights Templars)
4 Weighton Lock
5 Earthwork in Countess Close - Alkborough
6 Sawcliffe Deserted Medievil Village and Moated Site - Roxby cum Risby
7 Thornholme Priory (remains of) - Appleby
8 Roman Site (370m) North East of Worlaby Church - Worlaby
9 Horkstow
10 Roman Villa -Horkstow
11 Ferriby Sluice - South Ferriby
12 Old Winteringham Roman Settlement - Winteringham
13 Roman Settlement & Fort, Brough
14 Site of Saxon Manor, Tyrwhitt Hall - Barton on Humber
15 " The Castles" Barrow Haven - Barrow on Humber
16 " The Castles" Barrow Haven - Barrow on Humber
17 Barrow on Humber Cross - Barrow on Humber
18 Moated Site and Chapel - Goxhill
19 Thornton Abbey - Thornton Curtis
20 Old Grammar School
21 Hull South Blockhouse (site of)
22 Hull Castle (site of)
23 Castle Hill, Swine (Branceholme Castle)
24 Round Barrow, NE of Swine Castle
25 ' Swan Hill ' Probable Motte
26 Ravenspurn Cross
27 Moated Hall & Chapel, Twyers Hill
28 Hedon Med / Pm Town
29 Possible Moated Orchard (site of), South of Twyers Lane
30 Fort, Camp & Battery, Paull Point
31 Tower of Paull Holme Manor House & Earthworks
32 Shrunken Medieval Village - Stallingborough
33 Easington Tithe Barn, South of Rectory Farm
34 Flixborough Saxon Nunnery
35 Julian's Bower (a circular labyrinth)- Alkborough
36 Site of Jacobean Manor House and Gardens - Horkstow
37 St Peter's Church -Barton on Humber
38 Round Barrow (Natural Mound) North East of Swine Castle
39 St Sepulchre's Hospital (site of & moat)


Humber Estuary
Catchment Management Plan
Map 16
NRA
National Rivers Authority
LOCATION OF
SCHEDULED ANCIENT MONUMENTS
KEY
Plan boundary
Estuary
Scheduled archaeological sites and monuments
N
0
10 km
Beverley
Kingston upon Hull
Humber Bridge
Boothferry Bridge
Goole
Barton-upon-Humber
Thorne
Keadby Bridge
Scunthorpe
Brigg
Immingham
Cleethorpes
Grimsby
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SK
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Recreation

Ports, marinas significant havens and moorings are shown on Map 17 and listed below.

1 Keadby. Commercial
Stainforth and Keadby Canal - pleasure boat Moorings

2 Gunness Wharfage, commercial

3 Flixborough Wharfages

4 South Ferriby, 40 boats, pump out, chemical disposal, water point available

5 New Holland Docks, Commercial Port (Bulk Services & Howarth Timber)

6 Hull. Commercial docks, boat services, remnants of fish docks and

7 Hull. Large marina. Principal facility for leisure craft on the north bank. Mooring, boat services, repair, accommodation.

8 Hull. North Sea Ferry Terminal. Passengers, containers to Europe - Rotterdam, Zeebrugge.

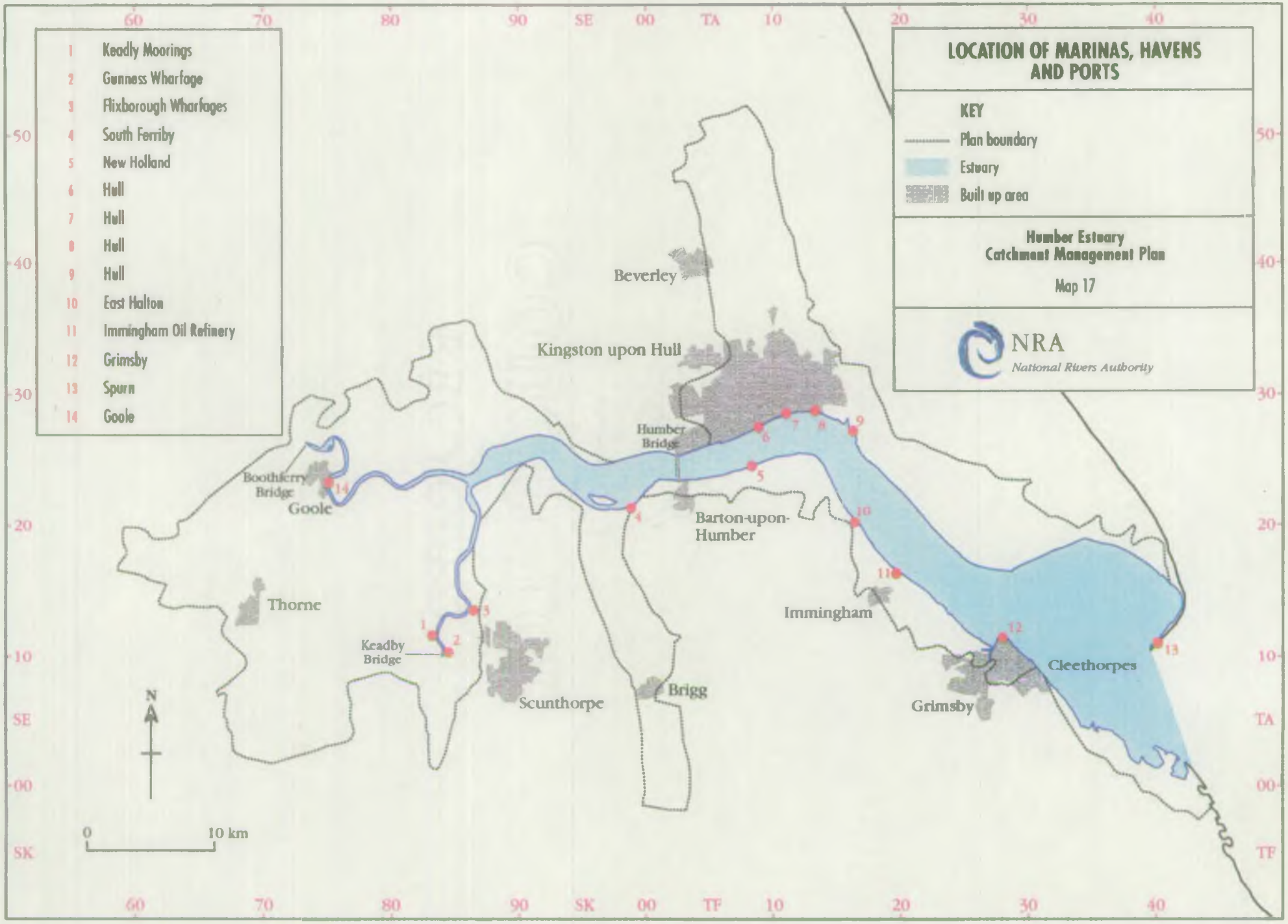
9 Paull -Terminal, jetties serving chemical industry complex.Hedon Haven mooring for small number of leisure craft occasionally.

11 Immingham Docks, Commercial Port

12 Grimsby Fish Docks, Commercial Port

13 Spurn. Lifeboat station, jetties only

14 Goole


LOCATION OF MARINAS, HAVENS AND PORTS
KEY
Plan boundary
Estuary
Built up area
Humber Estuary Catchment Management Plan
Map 17
NRA
National Rivers Authority
1 Keadly Moorings
2 Gunness Wharfage
3 Flixborough Wharfages
4 South Ferriby
5 New Holland
6 Hull
7 Hull
8 Hull
9 Hull
10 East Halton
11 Immingham Oil Refinery
12 Grimsby
13 Spurn
14 Goole
Beverley
Kingston upon Hull
Humber Bridge
Boothferry Bridge
Goole
Barton-upon-Humber
Thorne
Keadby Bridge
Scunthorpe
Brigg
Immingham
Cleethorpes
Grimsby
N
0
10 km

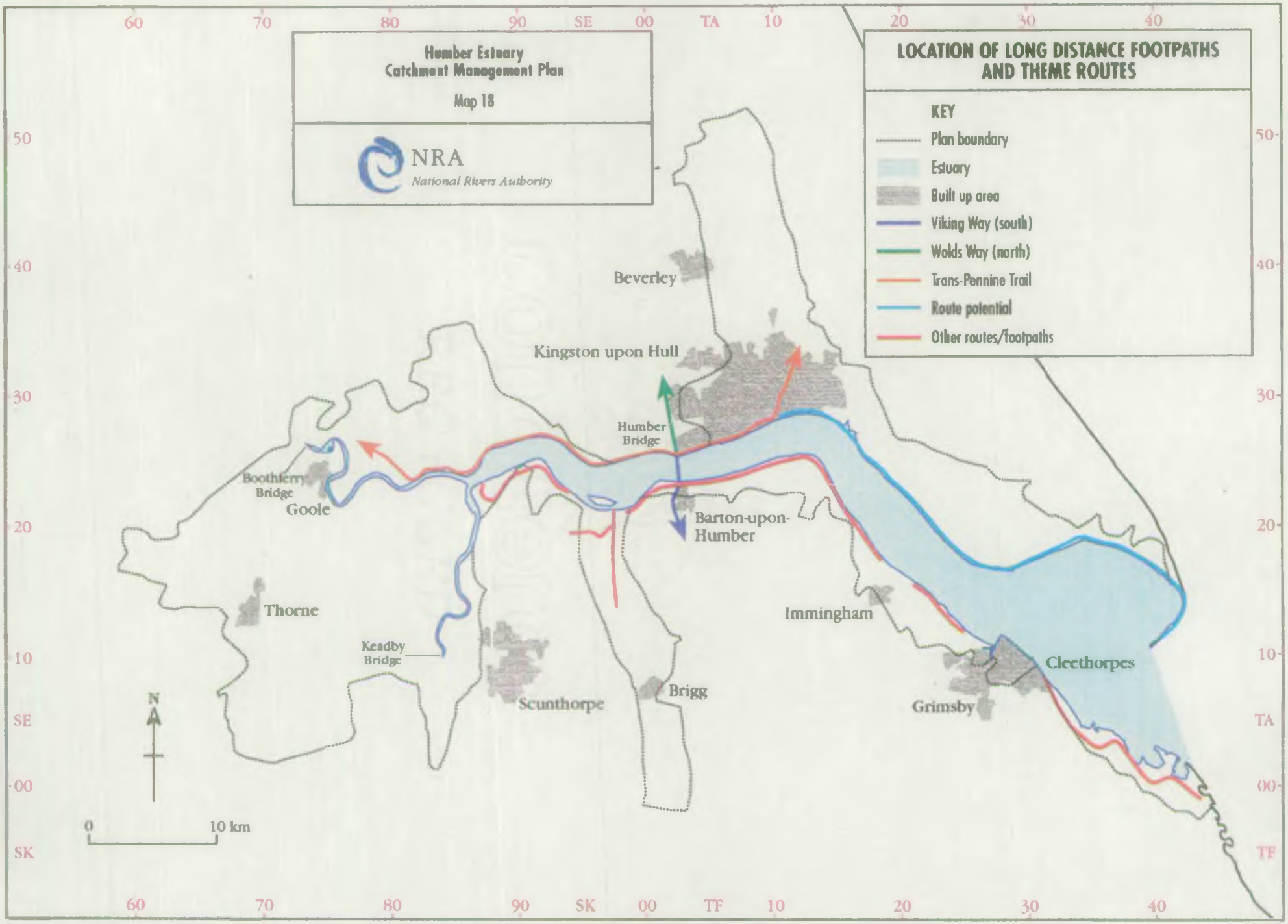
Major footpaths and routes are shown on Map 18 and detailed below

Long distance Routes

Transpennine Trail	Coast to coast route for walkers, cyclists & horseriders (Liverpool/ Hull/Withernsea). Follows north bank Howden to Hull
Wolds Way (N)	North towards Beverley form Humber Bridge crossing
Viking Way (S)	South from Humber Bridge crossing

Recreation sites are shown on Map 19 and detailed below.

1 Orchard Pond
2 BroughWelton Water, waterskiing
3 Hessle Humber Bridge & Country Park
4 HessleWhiting Mill, part restored wind mill
5 Target Lake
6 Barton Outdoor Pursuits Centre
7 Barton Broads
8 Hoe Hill Lake
9 Pasture House Fishery
10 Pelican Pond
11 HullMarina, boating services, tidal barrier
12 East Halton Fishing Lakes
13 Principal drain fishery (coarse or flounder)
14 Principal drain fishery (coarse or flounder)
15 Easington.Lagoons, Little Term colony, birdwatching, hides
16 Spurn HeadVisitor interest, YWT reserve, birdwatching, beach fishing
17 Homestead Pond
18 Cleethorpes Funfair
19 Tetney Angling Club


Humber Estuary
Catchment Management Plan
Map 18
NRA
National Rivers Authority
LOCATION OF LONG DISTANCE FOOTPATHS AND THEME ROUTES
KEY
Plan boundary
Estuary
Built up area
Viking Way (south)
Wolds Way (north)
Trans-Pennine Trail
Route potential
Other routes/footpaths
Beverley
Kingston upon Hull
Humber Bridge
Boothferry Bridge
Goole
Barton-upon-Humber
Thorne
Keadby Bridge
Scunthorpe
Brigg
Immingham
Cleethorpes
Grimsby
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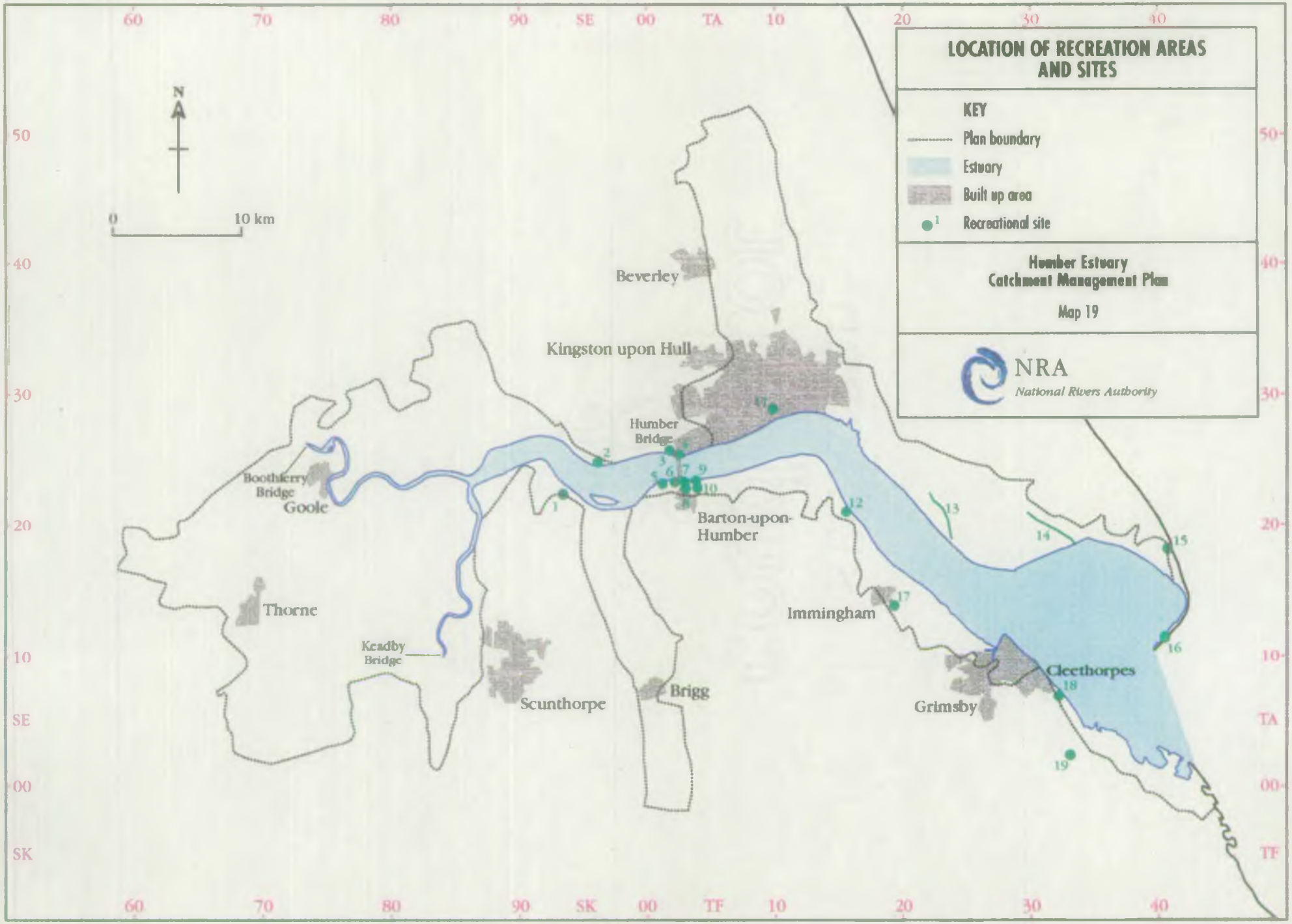
LOCATION OF RECREATION AREAS AND SITES
KEY
Plan boundary
Estuary
Built up area
Recreational site
Humber Estuary Catchment Management Plan
Map 19
NRA
National Rivers Authority
N
0
10 km
Beverley
Kingston upon Hull
Humber Bridge
Boothferry Bridge
Goole
Barton-upon-Humber
Thorne
Keadby Bridge
Scunthorpe
Brigg
Immingham
Grimsby
Cleethorpes
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APPENDIX 2 CATCHMENT CURRENT STATUS

1. Water Resources

Flow Measurement

The long term average river flow from the entire catchment flowing to the Humber Estuary is approximately 19000ml/d.

Flow control rules need to be related to fixed site gauging stations, and on the Trent a choice can be made between Colwick, east of Nottingham, and North Muskham, north of Newark.

Several of the Trent gauging stations, including Colwick and North Muskham are very insensitive to low flows. At both locations, water levels are measured in an impounded section and flow derived from a stage:discharge curve which is checked as often as conditions allow by current meter gauging. In such a large channel, with a long weir and a navigation lock acting as hydraulic control, at low flows the velocities are also low and therefore difficult to measure accurately.

The likely precision of low flow values must be borne in mind when interpreting data and making decisions on MRF's.

There are 13 flow measuring devices which are used to estimate/calculate the inflow into the Humber.

These can be split into three zones:-

a) Ouse Input, measured at Doncaster on the Don, Long Sandel Lock on the Sheffield & South Yorkshire Navigation (SSYN), Walden Stubbs on the Went, Beal on the Aire, Whitley Lock on the Aire & Calder Navigation, Flint Mill on the Wharfe, Skelton on the Ouse and Barmby Barrage on the Derwent

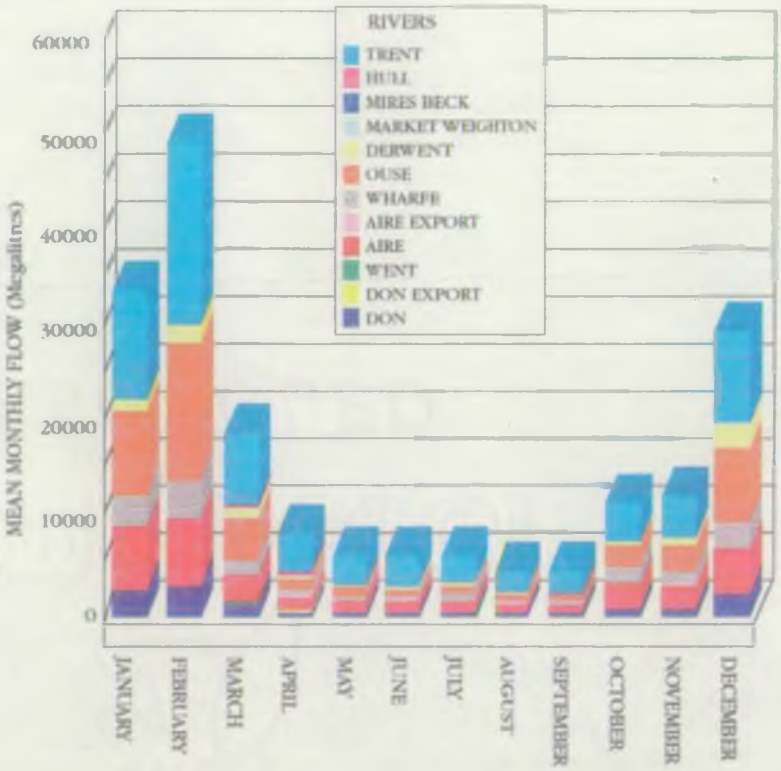
b) Trent Input at North Muskham.

c) North Humberside, measured at Wholsea Grange on the Market Weighton Canal, Holme House Farm on the Foulness, North Cave on the Mires Beck and Hempholme on the Hull.

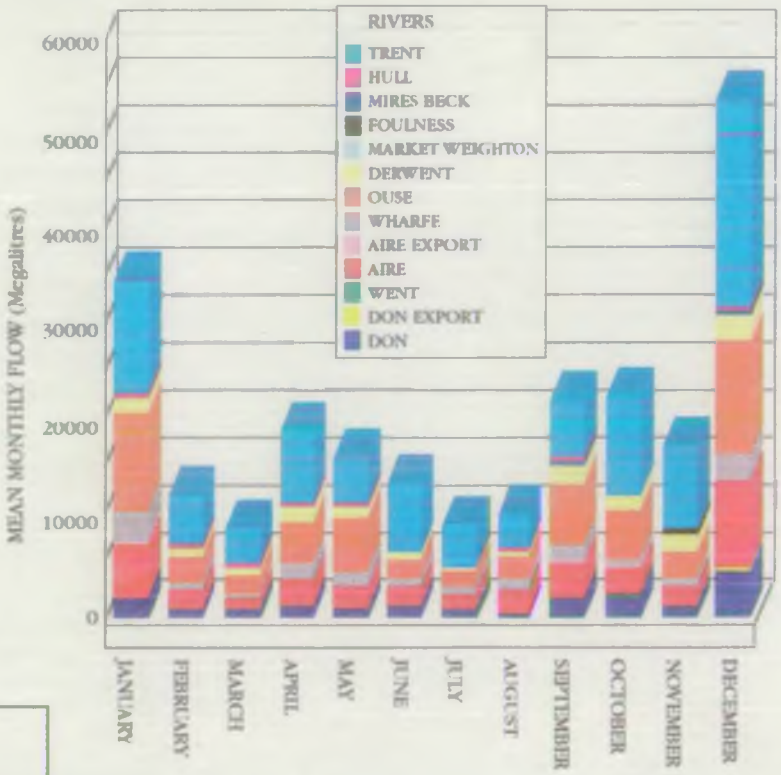
The major inflow of these are those from the Trent, Don, Aire, Derwent, Ouse and Wharfe. Graphical representations are given showing the mean monthly flow for 1990 and 1993. These also illustrate the fluctuations which do occur within each year as well as year upon year.

In Northumbria & Yorkshire Region there are prescribed flows applied to many of the measuring devices which are designed to ensure the protection of low flows. These are applied to licence abstractors to ensure that abstraction must stop when these flows are reached.

INFLOWS TO HUMBER ESTUARY (1990)



INFLOWS TO HUMBER ESTUARY (1993)



2. Water Quality

Table A1 is termed the "NWC River Quality Classification Scheme", ie. the scheme used for classifying rivers from their source to their saline limit.

Table A2 is termed the "NWC Scheme for Classifying Estuaries", ie. from the saline limit of rivers to the estuary mouth.

Table A1 - NWC River Quality Classification Scheme

RIVER CLASS	QUALITY CRITERIA	REMARKS	CURRENT POTENTIAL USES
1a Good Quality	1. 5 percentile Dissolved Oxygen saturation greater than 80%. 2. 95 percentile Biochemical Oxygen Demand not greater than 3 mg/l. 3. 95 percentile Ammonia not greater than 0.4 mg/l. 4. Where the water is abstracted for drinking water, it complies with requirements for A2*. 5. Non-toxic to fish in EIFAC terms (or best estimates if EIFAC figures are unavailable)	1. Mean Biochemical Oxygen Demand probably not greater than 1.5 mg/l. 2. No visible evidence of pollution	1. Waters of high quality suitable for potable supply abstractions. 2. Game or other high quality fisheries. 3. High amenity value
1b Good Quality	1. 5 percentile Dissolved Oxygen saturation greater than 60%. 2. 95 percentile Biochemical Oxygen Demand not greater than 5 mg/l. 3. 95 percentile Ammonia not greater than 0.9 mg/l. 4. Where the water is abstracted for drinking water, it complies with requirements for A2* 5. Non-toxic to fish in EIFAC terms (or best estimates if EIFAC figures are unavailable).	1. Mean Biochemical Oxygen Demand probably not greater than 2 mg/l. 2. Mean Ammonia probably not greater than 0.5 mg/l. 3. No visible evidence of pollution. 4. Water of high quality which cannot be placed in class 1a because of the effect of physical factors such as canalisation, low gradient or eutrophication.	Waters of less high quality than Class 1A but usable for substantially the same purposes.
2 Fair Quality	1. 5 percentile Dissolved Oxygen saturation greater than 40%. 2. 95 percentile Biochemical Oxygen Demand not greater than 9 mg/l. 3. Where the water is abstracted for drinking water, it complies with requirements for A3*. 4. Non-toxic to fish in EIFAC terms (or best estimates if EIFAC figures are unavailable).	1. Mean Biochemical Oxygen Demand probably not greater than 5 mg/l. 2. Water showing no physical signs of pollution other than humic colouration and a little foaming below weirs.	1. Waters suitable for potable supply after advanced treatment. 2. Supporting reasonably good coarse fisheries. 3. Moderate amenity value
3 Poor Quality	1. 5 percentile Dissolved Oxygen saturation greater than 10%. 2. 95 percentile Biochemical Oxygen Demand not greater than 17 mg/l. This may not apply if there is a high degree of re-aeration		Waters which are polluted to an extent that fish are absent or only sporadically present. May be used for low grade abstraction for industry. Considerable potential for further use if cleaned up.
4 Bad Quality	Waters which are inferior to Class 3 in terms of Dissolved Oxygen and likely to be anaerobic at times.		Waters which are grossly polluted and are likely to cause nuisance.
X	Dissolved Oxygen greater than 10% saturation.		Insignificant watercourses and ditches which are not usable, where the object is simply to prevent nuisance.

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

Table A2 - NWC Scheme for Classifying Estuaries

DESCRIPTION	Points Awarded if the Estuary Meets this Description
Biological Quality (scores under a, b, c and d to be summed)	
a) Allows the passage to and from freshwater of all relevant species of migratory fish, when this is not prevented by physical barriers.	2
b) Supports a residential fish population which is broadly consistent with the physical and hydrographical conditions	2
c) Supports a benthic community which is broadly consistent with the physical and hydrographical conditions.	2
d) Absence of substantially elevated levels in the biota of persistent toxic or tainting substances from whatever source.	4
Maximum number of points	10
Aesthetic Quality	
a) Estuaries or zones of estuaries that either do not receive a significant polluting input or which receive inputs that do no 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 scales.	
Class A Good Quality 24 to 30 points Class B Fair Quality 16 to 23 points Class C Poor Quality 9 to 15 points Class D Bad Quality 0 to 8 points	

1992 HUMBER ROUTINE CHEMICAL SURVEY DATA
COMPARISON WITH ENVIRONMENTAL QUALITY STANDARDS

STATION	TEPERATURE °C			DISSOLVED OXYGEN (% SATURATION)			UNIONISED AMMONIA (mg/l)			pH RANGE		
	MAXIMUM			5 PERCENTILE			95 PERCENTILE					
	LOW TIDE	HIGH TIDE	ALL TIDES	LOW TIDE	HIGH TIDE	ALL TIDES	LOW TIDE	HIGH TIDE	ALL TIDES	LOW TIDE	HIGH TIDE	ALL TIDES
TIDAL RIVERS												
OUSE												
Cawood	20	19.5	20	87	21	21	0.0124	0.0024	0.0124	7.68 - 8.11	7.43 - 8.19	7.43 - 8.19
Selby	18.9	19	19	53	11	11	0.0073	0.0148	0.0148	7.42 - 7.86	7.53 - 7.87	7.42 - 7.87
Drax	18.5	19	19	29	24	24	0.0119	0.0069	0.0119	7.38 - 7.78	7.51 - 8.34	7.38 - 8.34
Boothferry	18	18	18	16	31	16	0.0347	0.0034	0.0347	7.41 - 8.09	7.41 - 7.69	7.41 - 8.09
Blacktoft	17.5	17.6	17.6	52	68	52	0.0036	0.0038	0.0038	7.57 - 7.88	7.57 - 7.99	7.57 - 7.99
AIRE												
Snaith	18	19.5	19.5	58	22	22	0.0368	0.0219	0.0368	7.26 - 7.63	7.17 - 7.62	7.17 - 7.63
DON												
Kirk Bramwith	18.9	18.9	18.9	70	68	68	0.0262	0.0383	0.0383	7.34 - 7.53	7.26 - 7.3	7.26 - 7.53
Rawcliffe	18	18	18	44	58	44	0.0468	0.0125	0.0468	7.4 - 7.77	7.36 - 7.93	7.36 - 7.93
TRENT												
Dunham	20	-	20	90	-	90	0.0090	-	0.0090	7.60 - 8.40	-	7.60 - 8.40
Gainsborough	19	20	20	84	66	66	0.0110	0.0120	0.012	7.7 -8.4	7.7 - 8.4	7.7 - 8.0
Keadby	19	18	19	65	63	63	0.0050	0.0030	0.0050	7.8 - 8.0	7.7 - 7.9	7.7 - 8.0
WHARFE												
Ryther	18.4	19.8	19.8	69	75	69	0.0080	0.0090	0.0090	7.53 - 8.47	7.05 - 8.47	7.05 - 8.47
EQS			25			40			0.021			5.5 - 9.0
ESTUARY												
Brough	-	17	17	-	62	62	-	0.038	0.0038	-	7.32 - 8.05	7.32 - 8.05
New Holland	17.9	17.5	17.9	80	80	80	0.0307	0.0183	0.0307	7.42 - 7.67	7.68 - 7.71	7.68 - 7.71
Albert Dock	17.8	17	17.8	71	72	71	0.0057	0.0028	0.0057	7.58 - 8.09	7.56 - 8.06	7.56 - 8.06
Saltend	18	17	18	83	74	74	0.0051	0.0039	0.0051	7.56 - 7.99	7.68 - 8.44	7.56 - 8.44
Killingholme	18.2	17.5	18.2	64	82	64	0.0234	0.0308	0.0308	7.4 - 7.7	7.23 - 7.70	7.23 - 7.70
Spurn	18	17	18	91	83	83	0.0504	0.0717	0.0717	7.47 - 8.46	7.36 - 8.57	7.36 - 8.57
EQS			25			60			0.021			6.0 - 8.5

Table A3

1992 HUMBER ROUTINE CHEMICAL CHEMICAL SURVEY DATA
COMPARISON WITH ENVIRONMENTAL QUALITY STANDARDS

STATION	NO OF SAMPLE	CADMIUM (ug/l)					MERCURY (ug/l)					CHROMIUM (ug/l)				
		NO OF LESS THAN (<)	MAX	MIN	RANGE OF MEAN	MEAN WITH < AT HALF LOD	NO OF LESS THAN (<)	MAX	MIN	RANGE OF MEAN	MEAN WITH < AT HALF LOD	NO OF LESS THAN (<)	MAX	MIN	RANGE OF MEAN	MEAN WITH < AT HALF LOD
TIDAL RIVERS																
OUSE																
Cawood	7	4	<0.68	<0.1	0.06-0.35	0.21	4	0.252	<0.1	0.07-0.22	0.15	5	1.9	<1.0	0.49-1.21	0.85
Selby	7	3	0.653	0.124	0.21-0.42	0.31	5	0.291	<0.1	0.06-0.21	0.13	4	1.6	<1.0	0.32-1.12	0.72
Drax	7	3	1.08	0.15	0.25-0.46	0.36	5	0.28	<0.1	0.06-0.22	0.14	1	2.9	<1.0	1.53-1.7	1.62
Boothferry	7	3	0.57	0.35	0.21-0.46	0.34	4	0.39	<0.1	0.11-0.25	0.18	2	2.72	<1.0	1.1-1.5	1.3
Blacktoft	7	0	1.45	0.44	-	0.81	3	<0.3	0.13	0.10-0.23	0.17	1	57.6	<1.0	13.5-13.7	13.6
AIRE																
Snaith	7	5	0.54	<0.5	0.09-0.51	0.31	3	0.27	0.14	0.11-0.24	0.17	1	5.39	<1.0	3.1-3.27	2.73
DON																
Kirk Bramwith	7	6	0.19	<0.1	0.1-0.51	0.3	-	-	-	-	-	3	1.7	<1.0	0.78-1.21	0.99
Rawcliffe	7	2	0.83	0.163	0.32-0.47	0.39	4	0.399	<0.1	0.13-0.27	0.19	1	2.16	<1.0	0.78-1.21	0.99
TRENT																
Dunaham	7	0	1.1	0.26	-	0.52	7	<0.1	<0.1	0-0.1	0.05	0	4.29	0.8	-	2.1
Gainsboro'	7	0	1.12	0.24	-	0.48	6	0.16	<0.1	0.02-0.11	0.06	0	2.91	1.09	-	1.72
Keadby	7	0	2.44	0.29	-	0.73	5	0.18	<0.1	0.04-0.11	0.07	0	5.32	1	-	2.06
WHARFE																
Ryther	7	4	0.52	<0.1	0.23-0.33	0.22	7	<0.3	<0.1	0-0.18	0.09	3	2.17	<1.0	0.64-1.24	0.99
EQS						**5.0T**					**1.0T**					**250D**
ESTUARY																
Brough	7	2	<0.5	<0.5	0-0.5	0.25	6	<0.3	<0.1	0-0.16	0.08	0	3.5	13.4	-	5.95
New Holland	7	5	0.45	0.28	0.13-0.29	0.22	6	0.18	<0.05	0.3-0.1	0.06	5	5.9	<1.5	1.13-2.2	1.82
Albert Dock	7	2	0.89	<0.5	0.3-0.63	0.46	7	<0.3	<0.1	0-0.19	0.095	0	20	2.4	-	11.12
Saltend	7	3	<0.5	<0.5	0-0.5	0.25	7	<0.3	<0.1	0-0.19	0.095	0	17	1.2	-	6.99
Killingholme	7	4	6.65	<0.25	1.03-1.18	1.11	7	0.07	<0.5	0.04-0.06	0.047	6	2.5	<1.5	0.31-1.63	0.97
Spurn	7	4	<0.5	<0.25	0-0.44	0.22	7	<0.3	<0.1	0-0.19	0.095	0	29	3.6	-	15.62
EQS						**2.5D**					**0.3D**					**15D**

Table A4

1992 HUMBER ROUTINE CHEMICAL CHEMICAL SURVEY DATA
COMPARISON WITH ENVIRONMENTAL QUALITY STANDARDS

STATION	NO OF SAMPLES	COPPER (ug/l)					NICKEL (ug/l)					LEAD (ug/l)				
		NO OF LESS THAN (<)	MAX	MIN	RANGE OF MEAN	MEAN WITH < AT HALF LOD	NO OF LESS THAN (<)	MAX	MIN	RANGE OF MEAN	MEAN WITH < AT HALF LOD	NO OF LESS THAN (<)	MAX	MIN	RANGE OF MEAN	MEAN WITH < AT HALF LOD
TIDAL RIVERS																
OUSE																
Cawood	7	1	5.34	1	2.22-2.46	2.29	3	7.85	<5.0	2.08-4.58	5.83	3	5.19	1	1.7-2.19	1.94
Selby	7	0	19	1.3	0	6.99	3	15.5	3.15	3.73-6.73	5.23	1	3.03	<1.0	1.98-2.23	2.1
Drax	7	0	19	4.9	-	9.14	3	7.51	<5.0	2.64-5.64	4.14	4	2.09	<1.0	0.56-1.23	1.23
Boothferry	7	0	9.71	3.9	-	6.09	2	7.48	<5.0	3.24-5.74	4.49	3	2.19	<1.0	0.7-1.3	1.15
Blacktoft	7	0	30.8	4.36	-	11.55	0	13.3	6.6	-	8.23	4	68.6	<1.0	13.7-14.5	14.12
AIRE																
Snaith	7	0	17.3	6.75	-	9.97	0	18.1	5	-	9.93	1	2.04	<1.0	1.32-1.46	1.39
DON																
Kirk Bramwith	7	0	13	3.12	-	7.08	1	36.8	<1.0	23.4-23.6	23.5	6	1.3	<1.0	0.19-1.04	0.61
Rawcliffe	7	0	8.33	3.53	-	5.48	0	17.7	5.7	-	8.88	6	1.63	<1.0	0.23-1.09	0.66
TRENT																
Dunham	7	0	11.9	7.16	-	8.23	0	38.1	11.1	-	21.35	1	1.63	<0.5	1.09-1.16	1.12
Gainsboro'	7	0	19.2	7.39	-	10.74	0	27.7	9.79	-	15.67	-	-	-	-	-
Keadby	7	0	14.6	7.62	-	10.71	0	17	9.55	-	12.46	2	7.09	<0.5	1.83-1.97	1.9
WHARFE																
Ryther	7	0	4.01	1.6	-	2.56	3	4.82	<5.0	1.2-4.96	3.08	1	2.53	<1.0	1.36-1.50	1.43
EQS						20D					200D					250D
ESTUARY																
Brough	7	4	10.8	<1.0	6.37-6.63	6.5	1	15	1.74	6.75-7.75	6.85	4	4.9	<1.0	0.98-1.78	1.38
New Holland	7	1	12	2.5	5.42-6.05	5.73	1	40	<3.0	12.3-12.7	12.52	7	<5.0	<2.5	0.2-5.4	1.41
Albert Dock	7	0	50.1	5.1	-	18.5	1	17.7	<5.0	9.16-10.2	9.66	3	<1.0	<1.0	0-1.0	0.5
Saltend	7	0	48.3	7.32	-	18.56	1	5.1	11.2	5.7-6.95	6.32	3	3.5	<1.0	0.87-1.63	1.25
Killingholme	7	0	13.06	0.66	-	5.22	2	95	<3.0	22.8-23.5	23.16	7	<2.5	<2.5	0-2.5	1.25
Spurn	7	0	94.7	9.82	-	26.64	3	20.3	<5.0	7.9-10.4	9.15	3	28	<1.0	6.37-6.87	6.62
EQS						5.0D					30D					25D

Table A5

1992 HUMBER ROUTINE CHEMICAL CHEMICAL SURVEY DATA
COMPARISON WITH ENVIRONMENTAL QUALITY STANDARDS

STATION	NO OF SAMPLE	ZINC (ug/l)					ARSENIC (ug/l)					IRON (ug/l)				
		NO OF LESS THAN (>)	MAX	MIN	RANGE OF MEAN	MEAN WITH < AT HALF LOD	NO OF LESS THAN (<)	MAX	MIN	RANGE OF MEAN	MEAN WITH < AT HALF LOD	NO OF LESS THAN (<)	MAX	MIN	RANGE OF MEAN	MEAN WITH < AT HALF LOD
TIDAL RIVERS																
OUSE																
Cawood	7	1	231	<20	85-88	87.04	5	<5	<5	0-5	2.50	1	241	<40	122-128	125
Selby	7	1	302	<20	93-96	94.60										
Drax	7	0	228	28	-	100.86	5	6.7	<5	1.7-5.3	3.53	1	165	<40	104-110	107
Boothferry	7	0	243	31	-	114.17	3	6.3	<5	2.5-5.5	4.00	0	224	48	-	123
Blacktoft	7	0	198	89	-	146.71	6	<5	<5	0-5	2.5	1	153	67	-	95
AIRE																
Snaith	7	0	366	33	-	111.43	6	6.4	<5	0.9-5.2	3.06	0	380	74	-	171
DON																
Kirk Bramwith	7	0	97	23	-	46.86						0	182	64	-	137
Rawcliffe	7	0	323	26	-	134.42	5	6.6	<5	1.67-5.24	3.46	1	443	<40	148-154	145
TRENT																
	7	0	109	37	-	63.00	0*	7.7*	1.6*	-	4.2*	2	42	<10	20.4-25.6	22.8
Gainsboro'	7	0	135	34	-	59.30	0*	21.8*	3.6*	-	8.6*	1	237	<10	55.5-57.2	56.3
Keadby	7	0	391	76.2	-	150.80	0*	45.6*	8.5*	-	22.73*	2	1010	<10	210-355	213.5
WHARFE																
Ryther	7	5	106	<20	24-38	30.7	0	6.7	5	-	5.34	2	132	<40	64-77	70
EQS						500T					50D					1000D
ESTUARY																
Brough	7	5	27	<20	7.3-21.34	14.43	6	281	<5	40-44.4	42.28	0	492	40	-	1132.71
New Holland	7	0	30	8.6	-	19.62	2	2.05	<0.5	1.1-1.2	1.18	3	100	<10	22.3-27.3	24.83
Albert Dock	7	5	31	<20	8.1-22.4	15.28	7	<5	<5	0-5	2.50	1	78	<40	48.7-54.4	51.57
Saltend	7	4	35	<20	10.7-20.6	17.33	7	<5	<5	0-5	2.5	1	129	<40	57.8-64.5	61.17
Killingholme	7	0	61	13	-	28.5	2	2.62	<0.5	1.08-1.21	1.09	5	15	0.42	2.2-9.34	5.77
Spurn	7	6	24	<20	3.4-20.6	12	7	<5	<5	0-5	2.5	1	270	<40	79-84.7	81.86
EQS						40D					26D					1000D

Table A6

1992 HUMBER ROUTINE CHEMICAL CHEMICAL SURVEY DATA
COMPARISON WITH ENVIRONMENTAL QUALITY STANDARDS

STATION	NO OF SAMPLE	Boron (ug/l)					vanadium (ug/l)					CHROMIUM (ug/l)				
		NO OF LESS THAN (>)	MAX	MIN	RANGE OF MEAN	MEAN WITH < AT HALF LOD	NO OF LESS THAN (<)	MAX	MIN	RANGE OF MEAN	MEAN WITH < AT HALF LOD	NO OF LESS THAN (<)	MAX	MIN	RANGE OF MEAN	MEAN WITH < AT HALF LOD
TIDAL RIVERS																
OUSE																
Cawood	7	0	147	43	-	92.3	2	79	3.67	20.7-30.7	25.7	5	<0.001	<0.001	0-0.001	0.0005
Selby	7	2	161	<50	68.5-88.5	78.5	3	105	4.21	21.8-33.8	27.8		<0.001	<0.001	0-0.001	0.0005
Drax	7	0	768	64.4	-	309.5	1	98	8.89	35.9-39.9	37.9		<0.001	<0.001	0-0.001	0.0005
Boothferry	7	0	1100	100	-	421.4	2	112	<20	48.58	53.7		0.009	0.005	-	0.007
Blacktoft	7	0	1700	189	-	950.2	1	96	<20	58.8-62.8	60.8		<0.001	<0.001	0-0.001	0.0005
AIRE																
Snaith	7	0	489	78	-	268	3	131	2.36	25.7-45.7	10.2		<0.001	<0.001	0-0.001	0.0005
DON																
Kirk Bramwith													<0.001	<0.001	0-0.001	0.0005
Rawcliffe	7	0	923	151	-	438	1	111	7.92	53.9-57.9	55.98		<0.001	<0.001	0-0.001	0.0005
TRENT																
	7	0	649	53	-	402	0	47.1	1.78	-	9.4		<0.005	<0.005	0-0.005	0.0025
Gainsboro'													<0.005	<0.005	0-0.005	0.0025
Keadby													<0.005	<0.005	0-0.005	0.0025
WHARFE																
Ryther							4	<20	<1	0-15.25	7.6		<0.001	<0.001	0-0.001	0.0005
EQS						1000T					60T					
ESTUARY																
Brough	7	0	2500	324	-	1344	2	80	<50	39.8-56.5	48.17		<0.001	<0.001	0-0.001	0.0005
New Holland													<0.004	<0.001	0-0.0006	0.0003
Albert Dock	7	0	3300	1272	-	2371	1	120	<50	76.2-84.5	80.33		<0.001	<0.001	0-0.001	0.0005
Saltend	7	0	4217	1114	-	3032	2	74	<50	31.5-56.5	44		<0.001	<0.001	0-0.001	0.0005
Killingholme																
Spurn	7	0	5743	1059	-	3788	1	71	<50	32.7-42.2	39		<0.001	<0.001	0-0.001	0.0005
EQS						7000T					100T					

Table A7

1992 HUMBER ROUTINE CHEMICAL CHEMICAL SURVEY DATA
COMPARISON WITH ENVIRONMENTAL QUALITY STANDARDS

STATION	NO OF SAMPLE	TOTAL DRINS (ug/l)					TOTAL HCH (+) (ug/l)					DDT (OP+PP) (ug/l)				
		NO OF LESS THAN (<)	MAX	MIN	RANGE OF MEAN	MEAN WITH < AT HALF LOD	NO OF LESS THAN (<)	MAX	MIN	RANGE OF MEAN	MEAN WITH < AT HALF LOD	NO OF LESS THAN (<)	MAX	MIN	RANGE OF MEAN	MEAN WITH < AT HALF LOD
TIDAL RIVERS																
OUSE																
Cawood	7	18	0.003	<0.001	0.0025-0.0014	0.0008	5	0.1	<0.001	0.0007-0.0014	0.023	28	<0.002	<0.002	0-0.002	0.001
Selby	7	18	0.003	<0.001	0.0025-0.0014	0.0008	5	0.101	<0.002	0-0.022	0.0225	28	<0.002	<0.002	0-0.002	0.001
Drax	7	25	0.004	<0.001	0.0003-0.0011	0.0005	5	0.015	<0.002	0.0007-0.006	0.007	28	<0.002	<0.002	0-0.002	0.001
Boothferry	7	21	0.009	<0.001	0.0018-0.0024	0.002										
Blacktoft	7	28	<0.002	<0.001	0-0.005	0.0025	7	<0.009	<0.002	0-0.004	0.0093	28	<0.002	<0.002	0-0.002	0.001
AIRE																
Snaith	7	21	0.004	0.002	0.0007-0.0017	0.001	1	0.024	0.001	0.0202-0.0203	0.0205					
DON																
Kirk Bramwith	7	28	<0.002	<0.001	0-0.005	0.0025										
Rawcliffe	7	27	0.002	<0.001	0.00007-0.005	0.0025	11	0.011	<0.002	0.0002-0.0057	0.0336	28	<0.002	<0.002	0-0.002	0.001
TRENT																
	7	28	<0.005	<0.005	0-0.005	0.0025	10	0.036	<0.01	0.003-0.00075	0.011					
Gainsboro'	7	28	<0.005	<0.005	0-0.005	0.0025	10	0.028	<0.01	0.004-0.015	0.008	26	0.005	<0.005	0.0007-0.005	0.015
Keadby	7	28	<0.005	<0.005	0-0.005	0.0025	12	<0.03	<0.01	0.0042-0.013	0.015	28	<0.005	<0.005	0-0.005	0.0025
WHARFE																
Ryther	7	24	0.002	<0.001	0.0001-0.001	0.0005	9	<0.008	<0.002	0.002-0.0033	0.0025	28	<0.002	<0.002	0-0.002	0.001
EQS																
ESTUARY																
Brough	7	27	0.001	<0.001	0.0004-0.005	0.0029	9	0.007	<0.002	0.005-0.0044	0.0038	24	0.009	<0.002	0.001-0.003	0.002
New Holland	7	28	<0.0003	<0.001	0-0.0012	0.0006	3	0.003	<0.0005	0.0008-0.003	0.0019	28	<0.0038	<0.001	0-0.0015	0.0008
Albert Dock	7	25	0.003	<0.0043	0.0002-0.005	0.003	9	<0.004	<0.002	0.0027-0.001	0.002	28	<0.002	<0.002	0-0.002	0.001
Saltend	7	28	<0.002	<0.001	0-0.006	0.003	9	<0.003	<0.002	0.0008-0.0023	0.0016	28	<0.002	<0.002	0-0.002	0.001
Killingholme	7	28	<0.004	<0.0005	0-0.0008	0.0004	9	<0.001	<0.001	0.009-0.011	0.0095	26	0.014	<0.001	0.002-0.022	0.0026
Spurn	7	28	<0.002	<0.001	0-0.006	0.003	10	<0.005	<0.002	0.001-0.0026	0.0018	28	<0.002	<0.002	0-0.002	0.001
EQS																

Table A8

RANGES AND CONCENTRATIONS OF DISSOLVED METALS IN ESTUARIES AND SEA WATER 1991 COMPARED TO HUMBER 1992 SURVEY DATA

		HUMBER	HUMBER SURVEY 1992	TEES	WEAR	TYNE	TWEED	NORTH SEA	ENGLISH CHANNEL	IRISH SEA	MERSEY
CADMIUM	RANGE	0.049-0.122	0.22 -1.39	0.02-0.042	0.013-0.025	0.011-0.126	0.007-0.011	0.010-0.032	0.011-0.018	0.018-0.081	0.009-0.052
	MEAN	0.120	0.57	0.30	0.020	0.08	0.01	0.018	0.015	0.030	0.030
COPPER	RANGE	0.75-2.80	5.22-26.64	1.30-10.30	0.33-1.3	0.30-1.61	0.58-4.67	0.24-0.83	0.2-0.48	0.33-1.50	1.4-3.3
	MEAN	2.22	13.52	3.80	0.83	1.03	2.01	0.48	0.32	0.69	2.50
NICKEL	RANGE	0.90-6.30	6.32-23.16	0.21-1.00	0.51-2.93	0.36-2.75	0.48-0.81	0.20-1.00	0.22-0.47	0.26-0.87	0.8-9.4
	MEAN	3.09	11.27	0.70	1.61	1.55	0.67	0.54	0.33	0.48	5.36
LEAD	RANGE	0.023-0.422	0.5-6.62	0.096-0.815	0.069-0.408	0.086-1.09	0.096-0.169	0.021-0.81	0.023-0.032	0.024-0.169	0.032-0.464
	MEAN	0.210	2.06	0.46	0.29	0.59	0.13	0.103	0.030	0.070	0.310
ZINC	RANGE	5.1-12.6	12.0-28.5	2.6-14.0	0.5-6.1	0.6-21.7	0.6-1.9	0.3-2.2	0.2-1.0	0.3-1.8	1.5-15.6
	MEAN	9.3	17.86	8.4	3.6	14.5	1.1	0.8	0.7	0.8	1.05

Table A9

All figures in ug/l
Data from MAFF (1993) Aquatic Environment Monitoring Report Number 36
Note: The Humber Survey Data 1992 are not directly comparable with the MAFF analyses since the Humber Survey data was obtained from land based sample sites whilst MAFF samples were collected in mid-estuary.

APPENDIX 3 CATCHMENT TARGETS

1. Water Resources

The catchment targets are as set out in Section 3 of the main report.

This document refers to the need to set a minimum flow for the Rivers Trent and Ouse. A number of 'flow' terms have been used and referred to in the report. For clarification the meanings are set out below.

Minimum Acceptable Flow (MAF)

These flows have a legal status as referred to in Sections 21 & 22 of the Water Resources Act 1991. (No Minimum Acceptable Flows have been set in this country)

Minimum Residual Flow (MRF)

This flow is similar in concept to Minimum Acceptable Flow but does not have the legal status. These flows are often used as control flows attached to conditions in abstraction licences. (Minimum Control Levels (MCL) are also used in abstraction licences.)

River Flow Objective (RFO)

This is a concept being developed for flows based on in river needs and seeks to define minimum acceptable flow regimes. It aims to get away from the single minimum flow concept and move to a target flow regime (or RFO) (ie specifying targets for the frequency with which each threshold flow should occur). Work is in the initial stages of research and development and the NRA intends to move towards policy formulation in this area.

Prescribed Flow

That flow which should not be artificially reduced if the riverine environment is to be protected.

2. Water Quality

Environmental Quality Standards (EQSs)

A comprehensive list of EQSs was provided in Table 3 in Section 3.2 of this report. Standards are based on the best scientific information available or where applicable on mandatory limits specified by either the European Community or UK legislation. Thus the limits set for mercury, cadmium and the organic compounds are based on Statutory Water Quality Objectives laid down in 1989 Regulations and the list for the remaining metals are those set by the EC Dangerous Substances Directive. It should be noted that in the case of copper, a higher value may be acceptable where acclimation is expected or the copper is present as an organic complex.

European Community Controls

There is particular concern in the European Community about the control of substances in the aquatic environment which are considered to be toxic, persistent and which accumulate in biological organisms. The principal EC Directive which controls these substances is the Dangerous Substances Directive (76/464/EEC) which applies to estuarine as well as to other bodies of water. This Directive classifies dangerous substances into two types. List 1 (commonly known as the Black List) contains substances which must be controlled by the adoption of community-wide limit values or by EQSs. The legislation for each specific substance is introduced by a separate "daughter" directive and to date such directives have been introduced for cadmium, mercury, HCH, DDT, PCP and carbon tetrachloride; all are therefore subject to control in the Humber Estuary. List 2 substances (the Grey List) may be controlled by United Kingdom EQSs and this list together with the Black List is shown in Table 10.

The EC Directives relating to bathing water quality, titanium dioxide industry and the Urban Waste Water Treatment Directive are all discussed in Section 3.2.

United Kingdom Controls

In 1989, following the second North Sea Conference, the United Kingdom Government issued its "Red List" of dangerous substances which must be controlled in order to protect UK estuaries and the North Sea. The Government proposed an integration of the United Kingdom's Environmental Quality Objectives (EQOs)/EQSs approach to discharge control with the uniform emission standards approach which is adopted in most other EC countries. This new procedure requires the progressive application of technology-based emission standards, using the "best available techniques not entailing excessive cost" (BATNEEC) with respect to prescribed industrial point sources. Diffuse sources are to be controlled by restrictions on the supply, use and disposal of dangerous materials. Under this approach any prescribed discharge containing a Red List substance must meet either a BATNEEC based standard or an EQS, whichever is more stringent.

The UK priority Red List has now been largely overtaken by the controls introduced under Part 1 of the Environmental Protection Act 1990 (EPA '90 list is very similar to the Red List but contains a number of subtle differences which substantially enlarge the number of substances which must be controlled. Thus it includes "all isomers of hexachlorocyclohexane" whereas the Red List specified

only the gamma isomers, and specifies all the isomers of DDT, specific compounds of pentachlorophenol and the isomers of triclorobenzene, whereas the Red List does not.

The BATNEEC controls were introduced as part of a system of Integrated Pollution Control (IPC), designed to develop an approach to pollution control which considers discharges to all media - air, water and land - in the context of the effect on the environment as a whole; this is known as the "Best Practicable Environmental Option" (BPEO). Under the EPA '90, Her Majesty's Inspectorate of Pollution (HMIP) are the authority responsible for enforcing IPC; however, the NRA is a statutory consultee with respect to all processes which involve releases into controlled waters, including the Humber Estuary.

Following the third North Sea Conference, a further list of some 36 substances, including those on the Red List, were designated as priority hazardous substances. The conference included an agreement to reduce by 50% or more the discharge of these substances to the North Sea via rivers and estuaries between the years of 1985 and 1995.

For dioxins, lead, cadmium and mercury, reductions of the order of 70% were agreed where available by BATNEEC. The third North Sea Conference also agreed common action to reduce specific groups of substances; thus specific pesticides and PCBs must be strictly controlled or phased out altogether.

Nutrients (nitrogen and phosphorus) are also required to be controlled where they are discharged into areas where they are likely to cause pollution. This is not considered to be the case in the Humber Estuary and therefore no controls on nutrients are considered necessary at present.

The Derivation of Environmental Quality Standards for Discharges to the Humber Estuary

The application of the EQO approach to tidal waters is more complex than its application to non-tidal freshwater rivers having uni-directional flow. Thus an important consideration when determining a particular environmental standard for a specific discharge is the shape, extent and dilution afforded by the effluent plume, bearing in mind the ebb and flow of the tidal waters into which the discharge is made. In this context, the concept of a "mixing zone" becomes important. A mixing zone may be considered to be the location around the point of discharge in which the discharge is diluted and in which the standard does not apply. The size of such a mixing zone is of obvious environmental importance, but the techniques necessary to define mixing zones require further development. In general, they should reflect the local prevailing conditions at the point of discharge. In particular, the tidal energy and turbulence of the Estuary is a vital factor and this will, in turn, depend on the freshwater flow, the tidal range, and the tidal excursion within the Estuary.

A number of possible methods of defining a mixing zone have been suggested (Sayers, 1986), as follows:

i) The length of the mixing zone may be defined as a fraction of the average tidal excursion at the point of discharge; in this case it is assumed that the generally elliptical shape of the plume would normally vary in size in proportion to its length, if the discharge is made from an open pipe.

ii) Where a discharge is made via a diffuser type system, the length of the plume is not the most appropriate parameter and the dimensions of the pool formed around the diffuser at low slack water is the most significant criterion; in these circumstances the depth of water available at slack low water is more relevant.

iii) The more direct method of defining a mixing zone is to base it on local biological effects, such effects may be the life on the bed of the Estuary around the discharge point or on caged biological organisms, such as mussels, located at strategic points around the discharge point. Whilst this direct method has much appeal the resources required to detect accurately the effects of pollution on biological organisms are very substantial and must be deployed for a considerable length of time.

Having considered the relevant factors affecting the mixing zone, its most practical application is often the determination of the design of the outfall for a given discharge.

Table 10 EC Dangerous Substances Directive List 1 and List 2

List 1 (Black List)

Mercury
Cadmium
Hexachlorocyclohexane (HCH)
DDT
Pentachlorophenol (PCP)
Carbon Tetrachloride
Aldrin
Dieldrin
Endrin
Isodrin
Hexachlorobenzene (HCB)
Chloroform
Trichloroethylene (TRI)
Tetrachloroethylene (PER)
Trichlorobenzene (TCB)

List 2 (Grey List)

1,2,-Dichloroethane
Lead
Chromium
Zinc
Copper
Nickel
Arsenic
Boron
Iron
pH
Vanadium
Tributyltin
Triphenyltin
PCSDs
Cyfluthrin
Sulcofuron
Flucofuron
Permethrin

APPENDIX 4 SHORTFALL AGAINST CATCHMENT TARGETS

The shortfalls against catchment targets are as follows:

1. A methodology is required to set Minimum Residual Flows for the river estuaries to take account of all water related interests.

2. To set minimum residual flows for the Trent and Ouse which balance all water related interests.

3. The accuracy of gauging freshwater flows to the Estuary needs to be improved.

4. Water Quality of the Tidal Ouse requires improvement

5. Cleethorpes bathing beach fails the European Bathing Water Directive

6. Reduce the Discharge of dangerous substances ultimately to the North Sea

7. Nutrient Data are inadequate to determine the eutrophic status of the Humber Estuary and its adjacent coastal waters for Urban Waste Water Directive and North Sea Declaration purposes.

8. Different standards of flood protection are ascribed to adjacent lengths of flood defences because the responsibility for flood defences rests with a number of organisations.

9a. Existing defences will need to be substantially improved if the NRA is to maintain standards to accommodate rising sea levels.

9b. The structural integrity of the defences needs improving to lessen the risk of flooding due to their failure through reaching the end of their useful life.

10. Defences need to be protected form increased wave attack brought about by the erosion of the foreshore.

11. Insufficient information exists on the relationship between sedimentary processes, freshwater flow, rising sea levels and Estuary boundaries.

12. Coastal erosion along the Holderness Coast is linked to the overall sediment balance in the Humber Estuary. Demands to provide coastal protection along that coastline may conflict with the flood defence and environmental needs of the Estuary.

13. Development and upgrading of land behind defences may be inconsistent with the current level of protection afforded.

14. Opportunities exist to improve the conservation value of the Estuary

15. Silt build up in havens restricts access to recreational craft and inhibits land drainage.

16. Industrial, urban and agricultural development may have an adverse effect on the local environment, for example loss of Humber wetlands and sites of archaeological importance.

17. Managed exploitation of shrimp, shellfish and lugworm would allow sustainable development and protect natural predators e.g. birds and fish.

18. The suitability of fish and shellfish for human consumption has been reduced by bacteria an d other contaminants.

19. Flounder populations have declined on watercourses where free access from the Estuary has been restricted.

20. Insufficient information exists on fish species in tidal rivers and the Humber Estuary.

21. The run of migratory salmon through the Humber Estuary has declined since the 19th century.

22. The recreational potential of the Estuary is not fully developed.

23. The educational value of the Estuary has significant potential for future development

24. Enforcement of the commercial eel fishery is not consistent.

25. The potential to reclaim land along the Estuary poses a threat to its flora and fauna.

26. Development on areas of contaminated land has the potential to pollute, but provides opportunity to clean up existing problems.

27. Development involving the controlled storage and transportation of hazardous materials within the catchment may create a pollution and health and safety risk.

28. There is a need to improve liaison with local planning authorities in order that NRA recommendations are adequately considered in the planning process.

APPENDIX 5 ADJACENT CATCHMENT MANAGEMENT PLANS AND TIMESCALES

Consultation Reports

Louth Catchment Management Plan	July 1992
Grimsby Catchment Management Plan	Autumn 1994
Hull Catchment Management Plan	Autumn 1994
Don, Rother & Dearne	June 1994
Swale, Ouse & Ure	May 1994
Ancholme Catchment Management Plan	1995
Lower Trent	August 1997

Final Plans

River Aire	Review 1994

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