

MIDDLE LEE CATCHMENT MANAGEMENT PLAN CONSULTATION REPORT



NRA

National Rivers Authority

Thames Region

September 1994

Middle Lee

CATCHMENT MANAGEMENT PLAN

Consultation Report
September 1994

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ACKNOWLEDGEMENTS

- (1) All those organisations, groups and individuals who responded to the NRA during the period of informal liaison. A detailed review of this process is given in Appendix II.
- (2) Ordnance Survey on whose maps some of the information shown on the synoptic maps is based. (Crown Copyright Reserved Licence No. WU29859X).

NOTE

- (1) Whilst every effort has been made to ensure the accuracy of information in this report, it may contain errors or omissions which we will be pleased to correct.
- (2) Information from this report may be freely used provided it is acknowledged.

DRAFT CATCHMENT VISION FOR THE MIDDLE LEE

The primarily rural nature of the area is reflected in the character and setting of the rivers. Even the large conurbations of Harlow and Bishop's Stortford have largely allowed the local rivers space to breathe and function. The openness and natural state of many parts of the Rivers Rib, Ash and Stort is in contrast, however, to the distinct but much altered River Lee corridor between Hertford and Hoddesdon.

The Chalk aquifer under the catchment is a source of water for local domestic and industrial needs. It is also the source of the Rivers Ash, Rib and Stort. Many local villages and towns, such as Puckeridge and Standon on the River Rib, Much Hadham on the River Ash, and Bishop's Stortford on the River Stort have developed around these traditionally good quality waters. The area has also prospered from the good quality of the agricultural land but the post-war period has seen a marked reduction in the ecological value of local rivers and wetlands as a result of agricultural policies and practices, urban development and extensive land drainage activity. Key objectives will be to:

- ensure that the quality and quantity of water in aquifers is not compromised
- review and report on the interactions between groundwater, river flows and related uses and activities on the Rivers Ash, Rib and Stort by 1996
- restore the ecological diversity and landscape character of 50 km of river bank in the catchment by 2010.

Of primary importance is the Stort Valley Corridor. This is a valuable natural resource comprising sensitive ecological habitats, a landscape of considerable diversity and value, and areas which are popular for informal recreation and general amenity. The Stort Navigation is of particular historical significance and provides a valuable opportunity for recreational cruising. However, ensuring that the corridor has a sustainable future will need positive action. Key objectives will be to:

- ensure the closest possible liaison between relevant local authorities in Hertfordshire and Essex, British Waterways, National Rivers Authority, English Nature, landowners and other interested parties
- develop an agreed strategy for the corridor for public endorsement by all interested parties by 1997
- implement all improvements identified in the Otter Habitat Survey for the corridor by 2005.

In its short length between Hertford and Hoddesdon the River Lee supports habitats of a high quality, a busy navigation, important flood control structures, formal and informal recreation facilities (managed by the Lee Valley Regional Park and British Waterways), mineral extraction, communications links and an important public water supply abstraction at New Gauge. Opportunities to extend and improve the management of existing facilities need to be carefully balanced with conservation interests. Key objectives will be to:

- review flood defence standards on the River Lee and implement all justifiable works by 2005
- extend the range and capacity of formal water recreation facilities in parallel with conservation enhancements in a sustainable way
- secure a management agreement for Kings Mead between Hertford and Ware by 1995.

SECTION 1 MANAGING THE WATER ENVIRONMENT

The purpose of this section is to highlight the importance of integrated management of the water environment and to outline the key role of the NRA. It describes the Catchment Management Planning process and the purpose of this consultation report.

1 MANAGING THE WATER ENVIRONMENT

1.1 Our Water Environment

The quality of our water environment and the way in which it is managed matter to all of us.

Our health depends on the availability and purity of water supplies and the way we dispose of waste water. Thames Region is highly populated and sees the greatest use and reuse of water of any part of the country. These pressures call for the strict control of water abstraction and effluent disposal.

Many householders and businesses rely on flood alleviation works and flood warning schemes to reduce the risk of flooding. Visitors as well as local communities benefit from the amenity and recreational opportunities offered by the Region's rivers, canals and lakes.

The water environment also supports a wide variety of habitats which are home to a range of plants and animals. Conservation and enhancement of these is fundamental to the well being of the Region's natural resources.

This document is the first step in a process called catchment management planning initiated by the National Rivers Authority (NRA), which provides a focus for those concerned with the future health of the water environment of the Middle Lee catchment.

1.2 The NRA Role

Established in 1989, the NRA is the principal agency responsible for safeguarding and improving the water environment in England and Wales. Our role is defined in our Mission statement shown on the inside of the front cover and embraces statutory responsibilities for:

- water resources
- water quality and pollution control
- flood defences
- fisheries, recreation, conservation and navigation.

We have placed a particular emphasis on planning for environmental sustainability and improvement through an integrated approach to river catchment management. This approach recognises the need to influence and work in partnership with others.

We therefore recognise the need to work with local communities, landowners, interest groups, industry and other agencies whose activities and interests interact with or include the water environment. The roles and responsibilities of some of the key agencies are described in Appendix I, as are the NRA's responsibilities, aims and objectives.

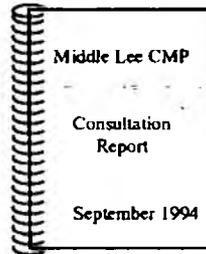
1.3 Catchment Management Plans

The water environment (e.g. estuaries, coastal waters, rivers, streams, lakes, ponds, underground water, springs) is subject to a wide variety of uses which invariably interact and sometimes conflict with each other. Our catchment management planning process (outlined on diagram opposite) has been developed to help manage these interactions and conflicts for the overall benefit of the water environment and its users.

1 MANAGING THE WATER ENVIRONMENT

STEPS IN THE CMP PROCESS

STEP 1



The NRA produce a Consultation Report. This will include:

- a full description of the catchment's resources, uses and activities
- a review of the status of the water environment
- identification of issues
- a draft vision, strategy and options to tackle the issues

STEP 2



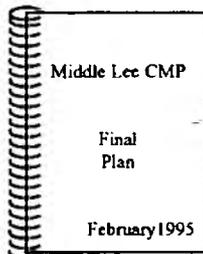
From September to December 1994 organisations, groups and individuals interested in the future of the catchment can make comments to the NRA.

STEP 3



During winter 1994/95 there will be discussions between the NRA and key groups and individuals over key issues.

STEP 4



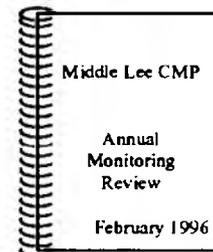
The NRA will produce the Final Plan in February 1995.

- This will include:
- a summary of the catchment's resources, uses and activities
 - an agreed vision, strategy and detailed action plans
 - a description of future monitoring regime for action plans

STEP 7

After 5 years (or sooner if circumstances dictate) the NRA will fully review the CMP starting with consultation

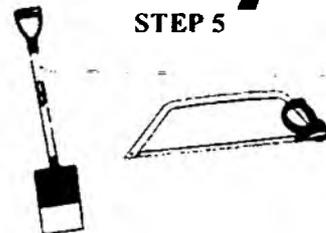
STEP 6



The NRA will produce a monitoring plan each year. This will include:

- an update on the status of the water environment
- progress achieved on the Action Plans
- a review of the appropriateness of the Final Plan.

STEP 5



IMPLEMENTATION

The NRA will implement through its own actions and the persuasion of others the actions contained in the Final Plan.

1 MANAGING THE WATER ENVIRONMENT

1.3 *Catchment Management Plans (continued)*

The purposes of a Catchment Management Plan (CMP) are to:

- focus attention on the water environment of a specific river catchment
- involve all interested parties in planning for the future well being of that catchment
- agree a vision for the catchment which helps to guide all our activities over the next 10 to 20 years
- establish an integrated strategy and plan of action for managing and improving the catchment over the next five years.

Preparation of a CMP involves a number of activities which are described in detail in the figure on page 7. This document, the Consultation Report, is the first output from the process and not the finished Plan.

1.4 *The Consultation Report*

A summary of the content of this Consultation Report is shown opposite.

This report does not firmly establish a vision for the catchment or define in detail the action plans and guiding policy objectives to tackle the key issues for the water environment. Rather it describes the catchment, reviews the state of the water environment and identifies what we see as the key issues facing it.

The draft catchment vision, supporting policy objectives and potential actions we present here will only be finalised once we have had an opportunity to review and consider your response to this Consultation Report.

We have produced this document through internal discussion, informal liaison with a wide range of organisations (see Appendix II for details) and a desk study of reports produced by organisations such as local authorities.

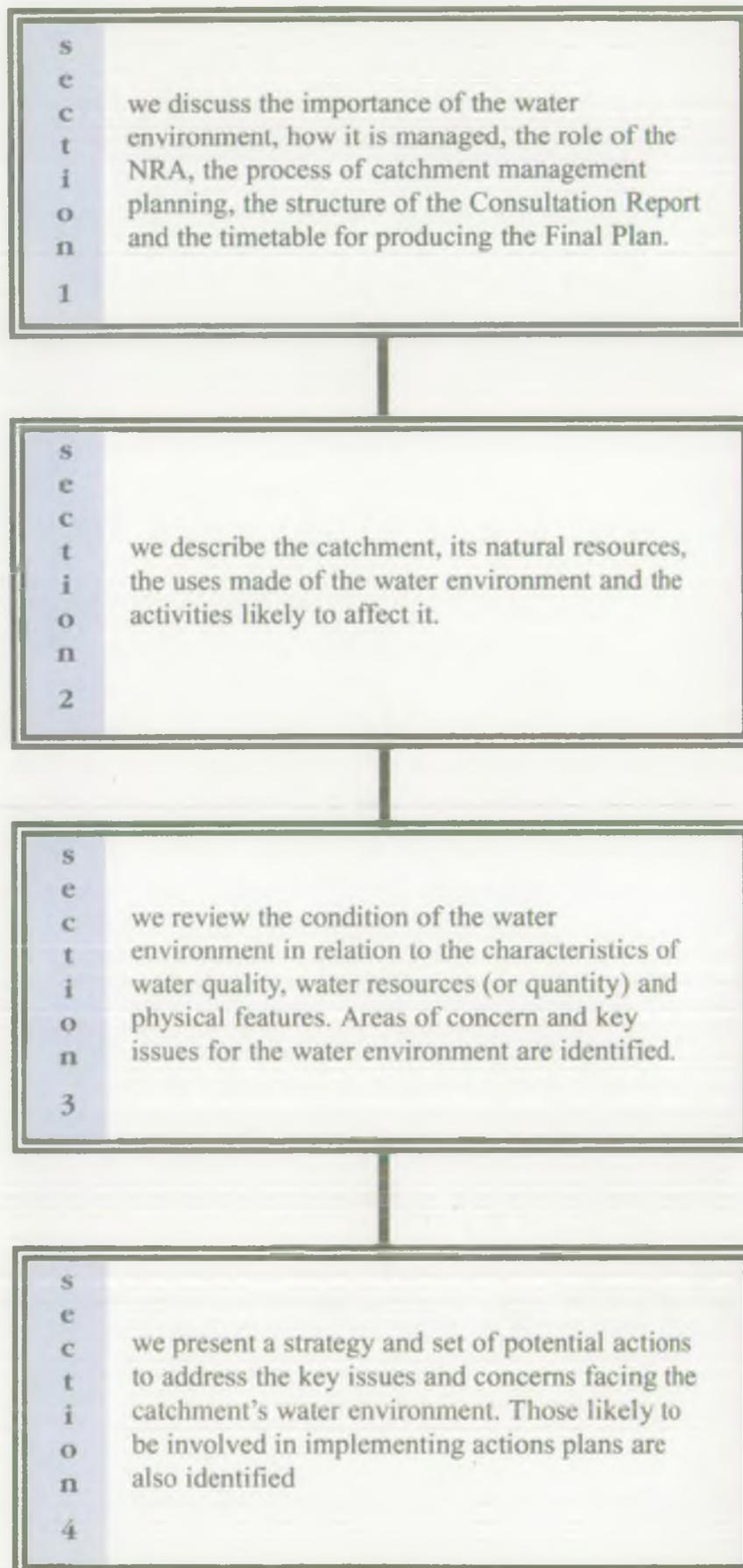
1.5 *The Consultation Process*

The NRA has a pivotal role to play in the management of the water environment, and recognises the importance of liaison with all interested parties. Through this Consultation Report we want to obtain a consensus internally and externally. We are particularly interested to hear people's views on the following aspects of the consultation report:

- the descriptions of resources, uses and activities in the catchment
- the assessments of issues arising within the catchment
- the way forward for the Action Plan.

1 MANAGING THE WATER ENVIRONMENT

CONTENT OF CONSULTATION REPORT



1 MANAGING THE WATER ENVIRONMENT

1.5 *The Consultation Process (continued)*

Our consultation phase includes:

- a formal launch to an invited audience on 23rd September 1994 in Ware
- two open public meetings:
 - 7pm, 11th October 1994**
East Herts District Council,
Bishop's Stortford.
 - 7pm, 13th October 1994**
Priory Timber Annex,
Ware Town Council, Ware.
- distribution of this report and summary leaflet to key organisations, groups and individuals
- placing of information in public libraries and other public areas
- publicity through contact with local media.

At the end of the consultation period we will consider all comments and produce a Final Plan. This will define a strategy for future management of the catchment and a series of actions plans for the NRA and others for implementation.

If you wish to comment please do so by 1 December 1994. The Final Plan for the Middle Lee catchment is due for publication in February 1995.

Please submit comments to:

Craig Woolhouse
National Rivers Authority Thames Region
The Grange
97 Crossbrook Street
Waltham Cross
Herts, EN8 8HE.

For further information please contact Judith Gannon (Catchment Planning Officer) or Craig Woolhouse (Catchment Manager) on 0992-645032.

SECTION 2 DESCRIPTION OF RESOURCES, USES AND ACTIVITIES

The purpose of this section is to review the physical resources of the catchment, the uses we make of the water environment and the activities likely to affect it. In most cases the description involves a brief summary of the available information and a synoptic map. Support documents (see Appendix III) may be available to those wishing to know more.

2.1 OVERVIEW OF CATCHMENT

The Middle Lee catchment is largely rural with the villages of Buckland, Barkway, Langley, Elsenham and Takeley marking the upper reaches. Significant urban areas include Bishop's Stortford, Harlow, Ware, Sawbridgeworth, Stansted Mountfitchet and parts of Hertford and Hoddesdon. The area has good road and rail links to London and East Anglia, and contains London's third airport, Stansted; factors which have resulted in significant and constant development pressures. Much of the land around the significant urban areas is now designated as Green Belt under the Town and Country Planning legislation. This helps to prevent the spread of urbanisation through the countryside.

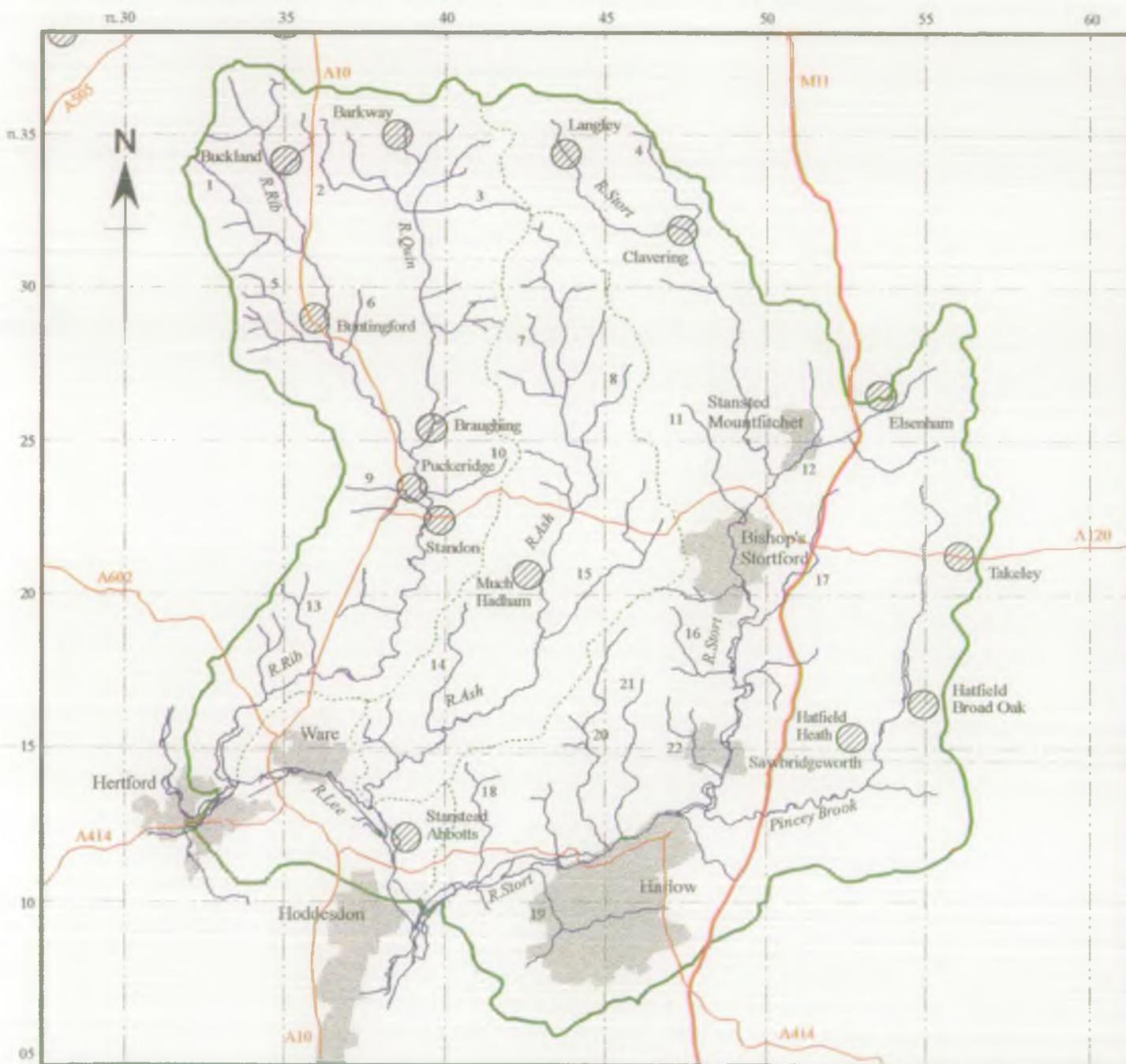
Major uses of water include abstractions for private use and for public water supply, the latter from groundwater sources only except for the abstraction at New Gauge on the River Lee between Hertford and Ware. These abstractions are concentrated around the River Lee in the south of the catchment, and Bishop's Stortford. The rivers are used for effluent disposal and several sewage treatment works are sited on the catchment, the largest being at Bishop's Stortford. During periods of dry weather, sewage effluent may be the main or only source of flow for some stretches, such as the River Rib downstream of Buntingford. Despite this fact, recent quality surveys indicate water quality to be predominantly "good" with Pincey Brook and some reaches of the Rivers Rib and Stort being of a "fair" quality.

The catchment has many sites related to the water environment that are of ecological importance. Amwell Magna (nr. Stanstead Abbots), Rye Meads (nr. Hoddesdon), Kings Mead (between Hertford and Ware), Hunsdon Mead (nr. Harlow) and Spellbrook flood lagoon (south of Bishop's Stortford) are of particular note. Some of the old gravel pits around Amwell Magna are also interesting in conservation terms and some are now nature reserves. Although there are no nationally recognised areas of landscape value, several areas have been designated as being of county-wide importance by Herts and Essex County Councils.

Several river stretches are designated as cyprinid or salmonid waters under the EC Directive 78/659/EEC and support many species of fish. The old river loops of the Rivers Lee and Stort offer more diverse habitats and faster flows than the adjacent navigations and thus have higher fisheries' quality. Amwell Magna is an historically important trout fishery. The Rivers Stort and Lee in particular provide important amenity and recreation opportunities within the catchment. The Lee Valley Regional Park, which embraces the floodplain of the River Lee downstream of Ware and the lower reaches of the River Stort, offers several water based facilities. British Waterways (BW) markets the Lee and Stort Navigations for recreational use, including angling; a sport that is widespread throughout the catchment.

Most of the land drained by the River Stort to the south and east of Bishop's Stortford lies on London Clay, with the remainder of the catchment lying predominantly on Upper Chalk. Clayey soils dominate the catchment and have been extensively drained by farmers. The majority of agricultural land is used for growing crops such as barley and wheat. With the introduction of set-aside, a proportion of land is slowly being taken out of use, a move that should also reduce the use of fertilizers and pesticides.

Several schemes to alleviate flooding have been carried out, preventing major flooding in areas such as Hertford, Ware, Hoddesdon (which are all protected by the Lee Flood Relief Channel completed in 1978), and Bishop's Stortford. Assessment of future flood defence needs is on going, particularly on the River Stort, and further works are programmed for areas where standards of protection are not currently met.



KEY

	Watercourse	<p>List of Watercourses :</p> <table border="0"> <tr> <td>1. Sandon Tributary</td> <td>12. Stansted Brook</td> </tr> <tr> <td>2. Reed End Tributaries</td> <td>13. Wadesmill Bourne</td> </tr> <tr> <td>3. Meesden Tributary</td> <td>14. Nimney Bourne</td> </tr> <tr> <td>4. Stickling Green Brook</td> <td>15. Bury Green</td> </tr> <tr> <td>5. Thistley Vale</td> <td>16. Spell Brook</td> </tr> <tr> <td>6. Haley Hill Ditch</td> <td>17. Great Hallingbury Brook</td> </tr> <tr> <td>7. Furneux Pelham Tributary</td> <td>18. Hunsdon Brook</td> </tr> <tr> <td>8. Patmore Hall Tributary</td> <td>19. Canon's Brook</td> </tr> <tr> <td>9. Puckeridge Tributaries</td> <td>20. Fiddlers Brook</td> </tr> <tr> <td>10. Braughing Warren Bourne</td> <td>21. Pole Hole Brook</td> </tr> <tr> <td>11. Farnham Bourne</td> <td>22. Sawbridgeworth Brook</td> </tr> </table>	1. Sandon Tributary	12. Stansted Brook	2. Reed End Tributaries	13. Wadesmill Bourne	3. Meesden Tributary	14. Nimney Bourne	4. Stickling Green Brook	15. Bury Green	5. Thistley Vale	16. Spell Brook	6. Haley Hill Ditch	17. Great Hallingbury Brook	7. Furneux Pelham Tributary	18. Hunsdon Brook	8. Patmore Hall Tributary	19. Canon's Brook	9. Puckeridge Tributaries	20. Fiddlers Brook	10. Braughing Warren Bourne	21. Pole Hole Brook	11. Farnham Bourne	22. Sawbridgeworth Brook		Urban area
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	Catchment Boundary		Village / Small Town																							
	Sub Catchment Boundary	<p>Scale (approx)</p>																								
	Primary 'A' Road																									
	Motorway																									

2.2 LOCAL AUTHORITIES

The following table summarises the distribution of the catchment area of 550 sq. km amongst County Councils and Local Authorities falling within the catchment boundary. The proportional distribution of the catchment's population of 189 400 is shown in brackets.

County Councils		District Councils	
Hertfordshire	61.9% (50%)	East Herts DC North Herts DC Broxbourne BC	55.7% (47.1%) 6.0% (1.0%) 0.2% (1.9%)
Essex	38.05% (50%)	Uttlesford DC Harlow DC Epping Forest DC	27.2% (9.1%) 4.65% (38.0%) 6.2% (2.9%)
Cambridgeshire	0.05% (0%)	South Cambridgeshire DC	0.05% (0%)

County Councils and District Councils produce statutory land use development plans. These and the Regional Planning Guidance for the South-East (Dept of Environment, March 1994) provide the means of establishing possible future land use trends which may effect the water environment. The following are the current revisions of relevant land use development plans:

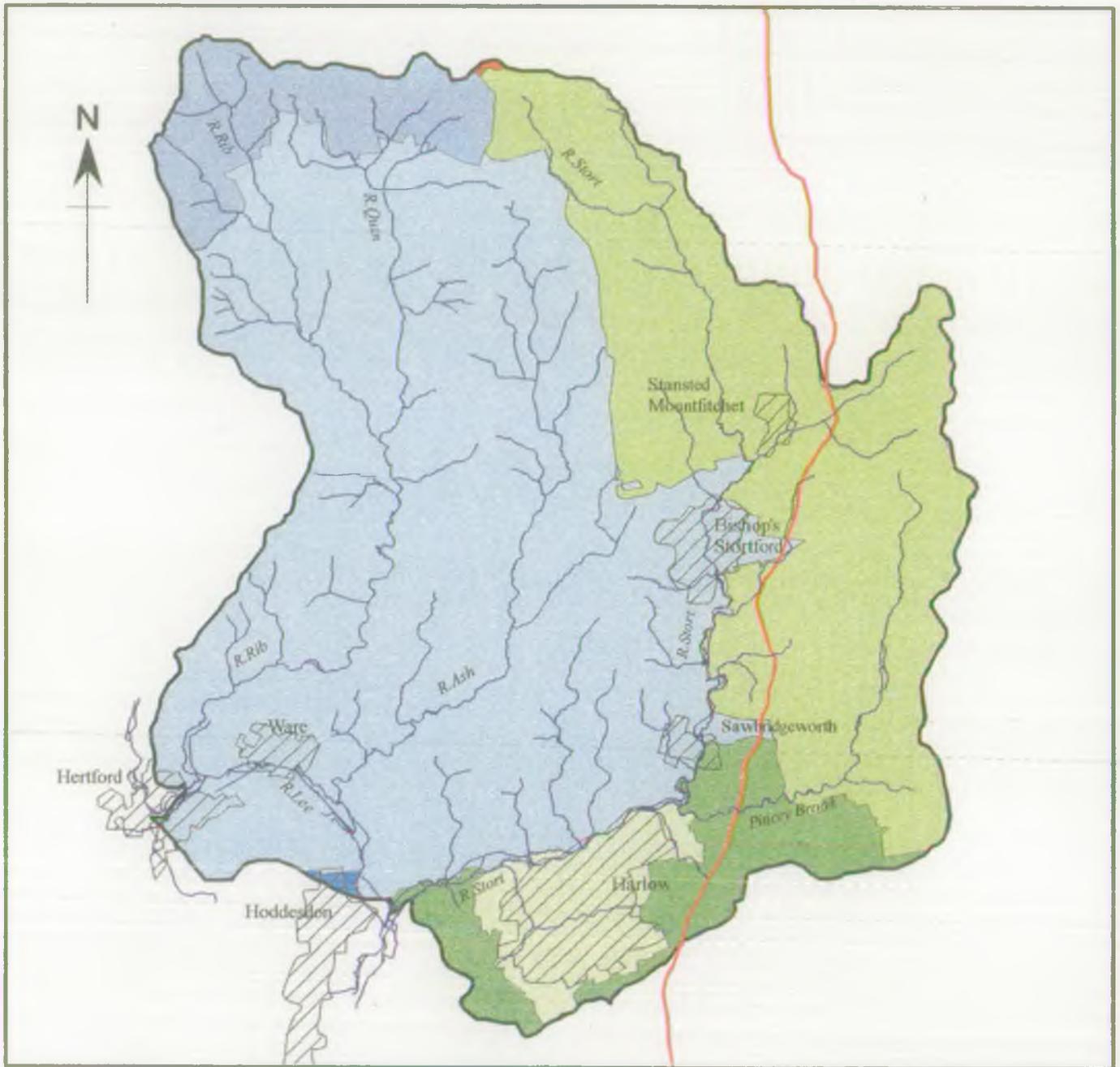
<u>Structure Plans</u>	Hertfordshire Essex	Consultation May 1994 Consultation June 1994
<u>District Plans</u>	East Herts North Herts Broxbourne Uttlesford Harlow Epping Forest	Adopted March 1993 (Annual Reviews in progress) Adopted July 1993 (Annual Reviews in progress) Deposit March 1992 (Post-Inquiry modifications in progress) Deposit June 1992 (Awaiting Inspectors Report) Deposit October 1990 (Post-Inquiry modifications in progress) Deposit July 1994

Town and Country Planning issues are covered in further detail in Sections 2.16, 2.17 and 3.3.

Other strategies relevant to the water environment include:

1. Hertfordshire's Countryside Strategy (Herts CC, 1991)
2. An Environmental Strategy for Hertfordshire (Herts CC, Dec 1993)
3. Heritage Protection Policy for Essex (ECC, undated)
4. Zone 4 Water Recreation Strategy (Eastern Council for Sport & Recreation, July 1994)

Since the United Nations Earth Summit in June 1992, local authorities have been considering their response to Agenda 21 which encourages wider access to environmental information, greater community participation in decision making, and the adoption of sustainable development principles. A number of environmental audits and strategies have now been produced by relevant councils and the NRA will continue to assist authorities in this area.



KEY

	Watercourse	HERTFORDSHIRE		ESSEX		CAMBRIDGESHIRE	
	Catchment Boundary		East Herts DC		Utlesford DC		South Cambridge DC
	Motorway		North Herts DC		Harlow DC	Scale (approx) 	
	Urban area		Broxbourne BC		Epping Forest DC		

2.3 TOPOGRAPHY

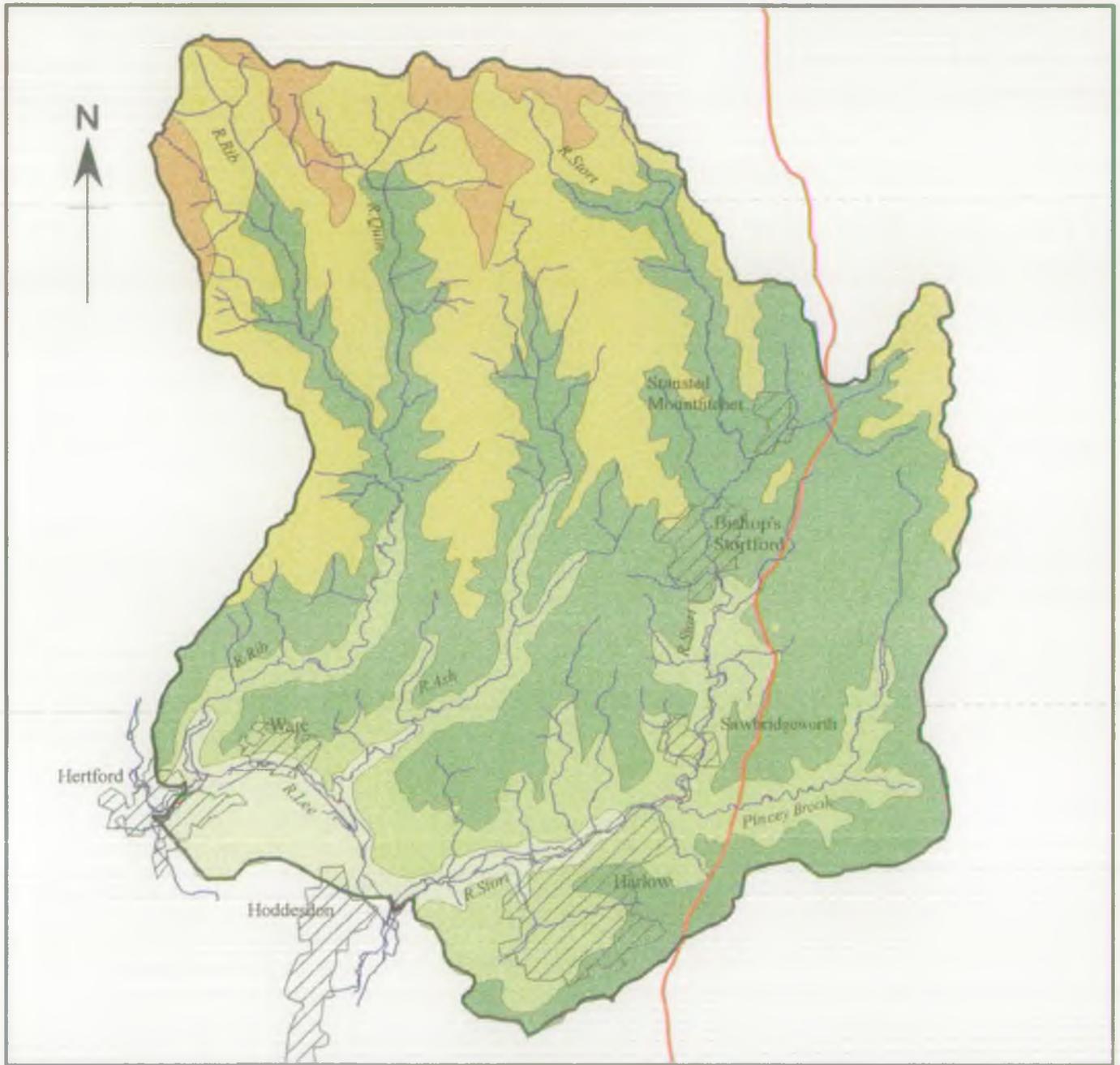
We have defined the boundary of the catchment to include all land which drains surface water run off to the River Lee from Hertford to north-east of Hoddesdon at Feildes Weir, which marks the confluence of the Rivers Lee and Stort. This includes land drained by the River Lee tributaries, the Rivers Rib, Ash and Stort which join the River Lee in this section. All three of these main tributaries drain from the north and bend round in a south-westerly direction to meet the River Lee.

Highest areas are found to the north of the catchment with a level of 167 m AOD (Above Ordnance Datum) to the east of Therfield (National Grid Reference: TL333372). Other parts of the catchment rising above 130m AOD include areas around Nuthampstead (TL404346) and land between and south of Anstey and Meesden (TL430326). The lower lying land is situated to the south of the catchment and along the River Lee corridor.

The eastern half of the catchment is drained by the River Stort which is the largest of the three main tributaries. This tributary drains from High Wood (north of Langley) and Little Chishill (TL419372) in the extreme north of the catchment; Takeley and White Roothing or White Roding (TL564134) in the east; and all of Harlow in the south. From its source to its confluence with the River Lee, it falls approximately 110 m, from 139 m AOD to approximately 30 m AOD.

From the northern extremes of the catchment, land slopes gradually down to the River Lee corridor with little significant changes in level, though slightly steeper gradients can be seen along the main tributary valleys. Possibly the steepest part is within the River Rib catchment between Youngsbury and Thundridge.

Much of the rest of the catchment consists of large expanses of relatively flat ground. This is one of the factors which has led to extensive use of the land for growing cereal crops.



KEY

	Watercourse	GROUND LEVELS				
	Catchment Boundary		Under 40 m		100 to 130 m	
	Motorway		40 to 70 m		Over 130 m	Scale (approx) 0 ————— 5 km
	Urban area		70 to 100 m	All Values in metres AOD (Above Ordnance Datum)		

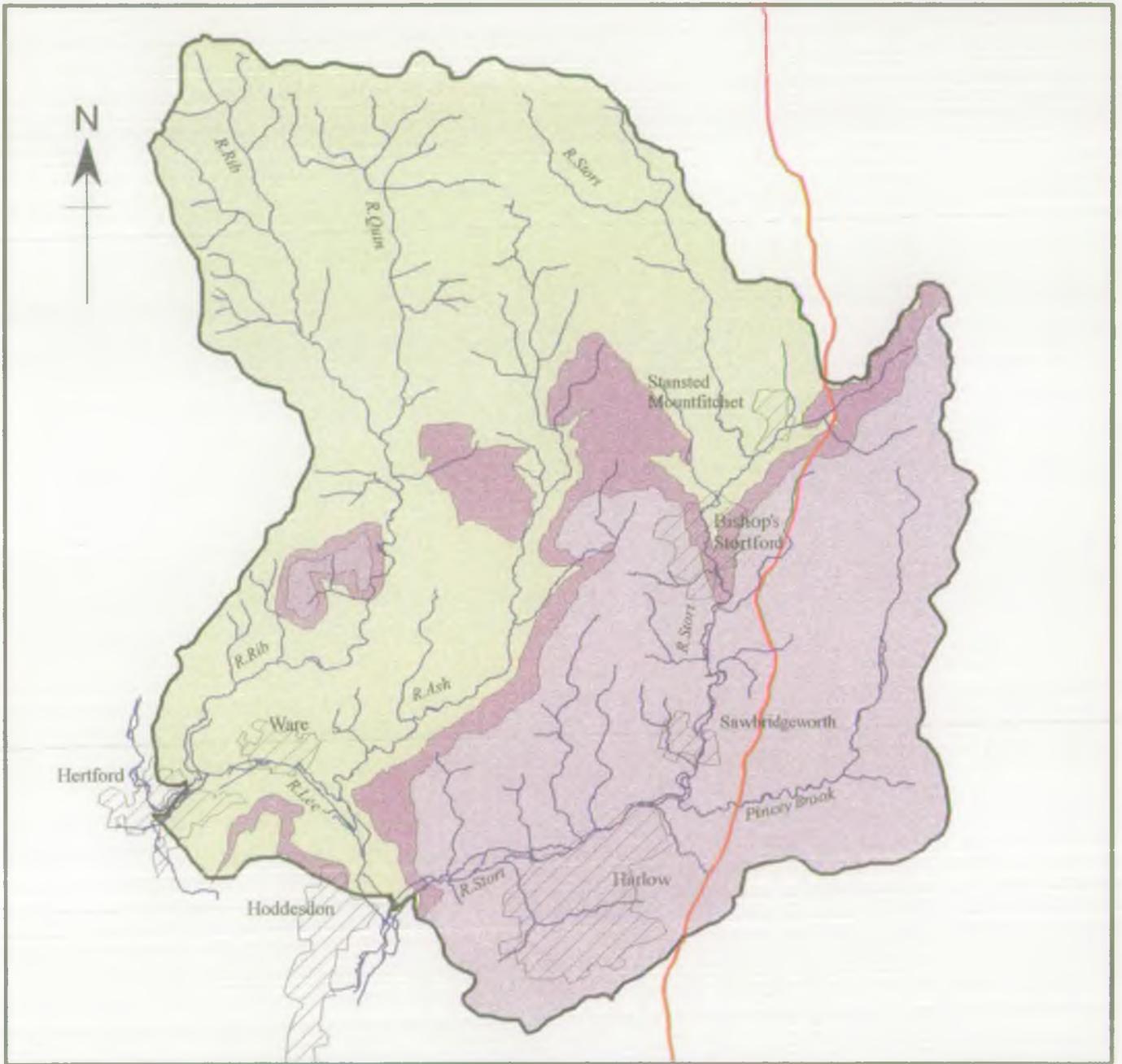
2.4 GEOLOGY

The Middle Lee catchment forms part of the northern limit of the London Basin syncline. The structure of this syncline (or natural trough) is such that the strata dip gently southeastwards.

Most of the catchment is covered by glacial and post-glacial drift deposits with Boulder Clay as the most common glacial deposit capping all of the higher ground. Beneath the drift, the area is underlain by Tertiary deposits to the south-east, south of a line roughly between Hertford and Stansted Mountfitchet, and by Upper Chalk elsewhere.

Dissection of the land by the rivers has exposed both the drift and solid geological sequences in the valleys. The drift deposits comprise glacial sands and gravels, head and alluvial deposits of glacial gravels and river terrace gravels. These deposits are an important mineral resource (see Section 2.17).

The Chalk is an important aquifer from which large quantities of water are abstracted (see Section 2.13), particularly in the River Lee valley. Small agricultural, industrial and domestic supplies are obtained from the superficial deposits, mainly from the glacial sand and gravels.



KEY

	Watercourse		Motorway		London Clay	<p>Scale (approx)</p> 
	Catchment Boundary		Urban area		Upper Chalk	
					Reading / Woolwich Beds	

2.5 SOILS

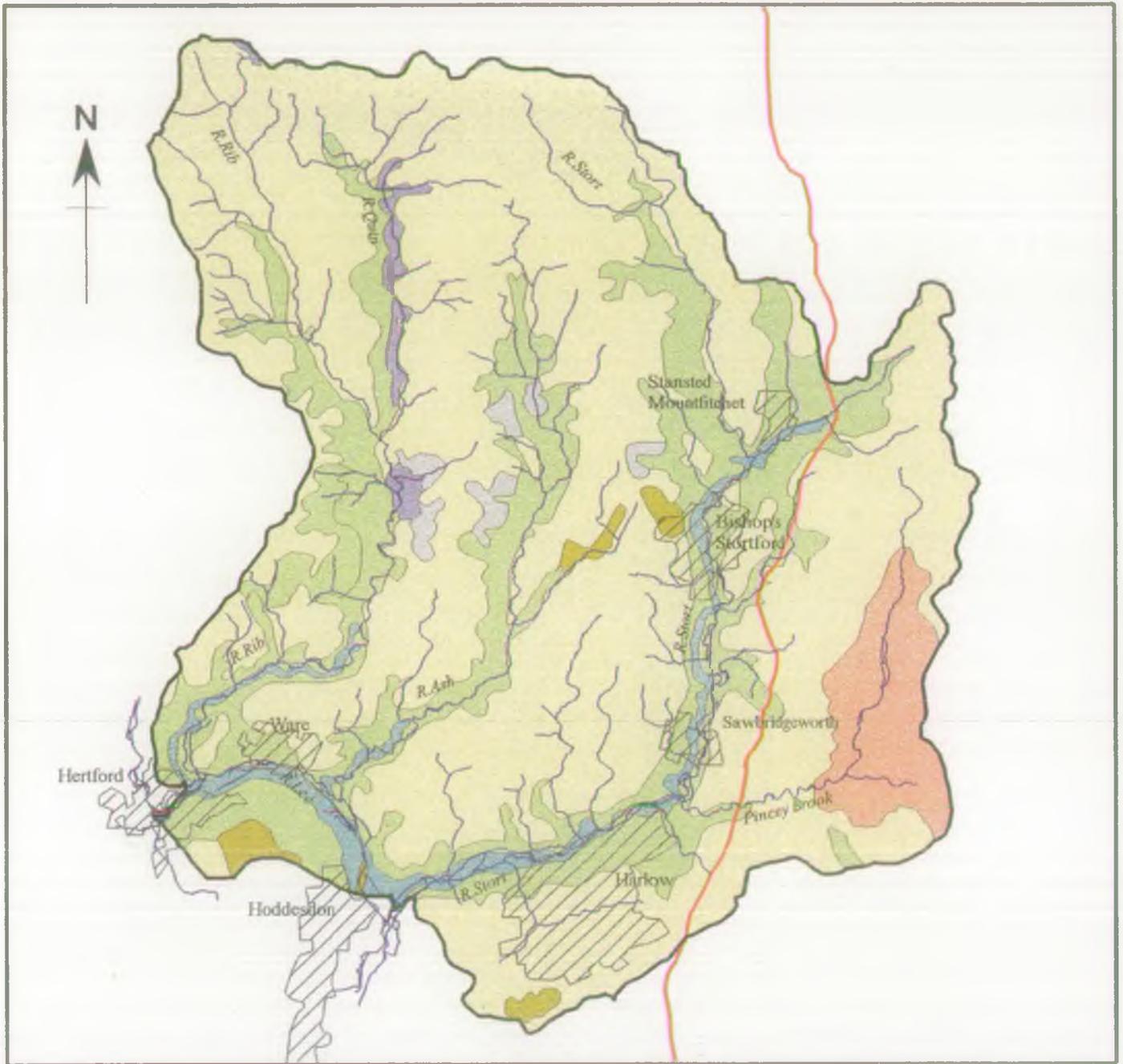
The soils of the catchment (see table below) reach depths of one to two metres and may be characterised by their texture, drainage status and permeability.

Soil Type	Description	Depth to impermeable layer	Depth to rock	Capacity of soil to store water	Likelihood of land drains	Rapid soil water flow mechanisms
1	Freely-drained, lime-rich loamy soils over chalk rubble; some very shallow soils	> 1m	Variable from 0.3m	High	Low	Some fissure flow to bedrock
2	Slowly-permeable, lime-rich clayey soils with slight winter waterlogging	<0.3m	> 1m	Low	High	Fissure flow to land drains
3	Freely-drained, lime-rich clayey soils, with only very slight winter waterlogging	> 1m	> 1m	Low	Moderate	Fissure flow to land drains where present
4	Freely-drained loamy over clayey, some loamy and sandy, substrate variable including gravel	> 1m	> 1m	Moderate	Low	Fissure flow to permeable drift
5	Loamy soils, with slowly permeable subsoil and slight winter waterlogging, locally coarse-textured	.5m	> 1m	Moderate	High	Fissure flow to land drains
6	Slowly permeable fine loamy over clayey and clayey soils with winter waterlogging	<0.5m	> 1m	Low	High	Fissure flow to land drains
7	Stoneless clayey soils in river alluvium, some lime-rich	<0.3m	> 1m	Low	High	Fissure flow to local groundwater table or drain

The catchment is dominated by clayey soils that have slowly permeable subsoil (Type 2). Winter waterlogging has encouraged farmers to artificially drain soils to remove surplus water. In summer, soil cracks open as they dry out and bypass flow to rivers is a significant possibility. Particularly severe winter waterlogging occurs in soils overlying London Clay at Puckeridge and south of Harlow (Type 6) as a consequence of slow subsoil permeability. The most marked soil variations occur along the three main tributary valleys where freely-drained loamy over clayey soils blanket the valley floors and side slopes (Types 4 and 5). In the lower reaches, and in the River Lee valley, alluvium has been deposited and there are stoneless clayey soils with a high winter water table (Type 7). Cultivation and erosion have exposed chalk on brows east of the River Quin resulting in shallow silty chalky soils (Type 1).

River flows and the quality of both ground and surface waters are strongly influenced by soil type. Stream response to rainfall will be most marked in areas dominated by soil types 2, 3, 6 and 7 where low water storage capacity and subsoil permeability inhibit vertical percolation and lead to the lateral movement of soil water either across the surface or within the soil. If in agricultural use, these soils normally contain land drains to enhance lateral flow. In soil types 4 and 5, natural infiltration rates should be higher although, with repeated cultivation, soil compaction and surface crusting can lead to artificially high rates of run-off from arable fields under autumn cultivation.

Soil type influences how contaminants might infiltrate through the soil layer. Rapid vertical soil drainage contributes most to aquifer recharge but can also transport dissolved substances out of the soil to groundwater. Soils that are shallow (Type 1), very permeable (Type 4) and/or allow preferential rapid water flow, all exhibit high rates of infiltration and percolation.



KEY

		SOIL TYPE				
	Watercourse					
	Catchment Boundary					
	Motorway					
	Urban area					
	1. Freely Drained Lime Rich Loam over Chalk		4. Freely Drained Loamy over Clayey		7. Stoneless Clayey in River Alluvium	
	2. Slowly Permeable Lime Rich Clayey		5. Loamy with Slowly Permeable Subsoil	Scale (approx) 0 ————— 5 km		
	3. Freely Drained Lime Rich Clayey		6. Slowly Permeable fine Loamy over Clayey			

2.6 HYDROGEOLOGY

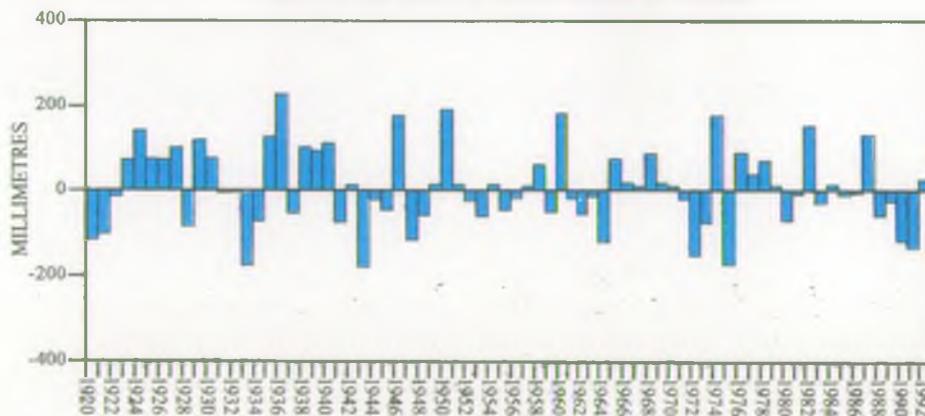
The Chalk, and in particular the Upper Chalk, is the major aquifer in the area. The matrix (or composition) of the chalk is permeable only to a very limited degree, and groundwater abstracted by pumps from boreholes flows through and is stored in a system of fissures or cracks in the rock. Fissures are better developed in the river valley floors and hence many boreholes are to be found in such locations.

Water levels in the Chalk aquifer depend not only on the amount of rain that falls but on the amount that percolates into the ground and locally, on the volume of water abstracted (see Section 2.13). Away from the valleys, recharge through the Boulder Clay is either vertically into the Chalk or horizontally through the overlying sands and gravels to the valleys where conditions are better suited for recharge.

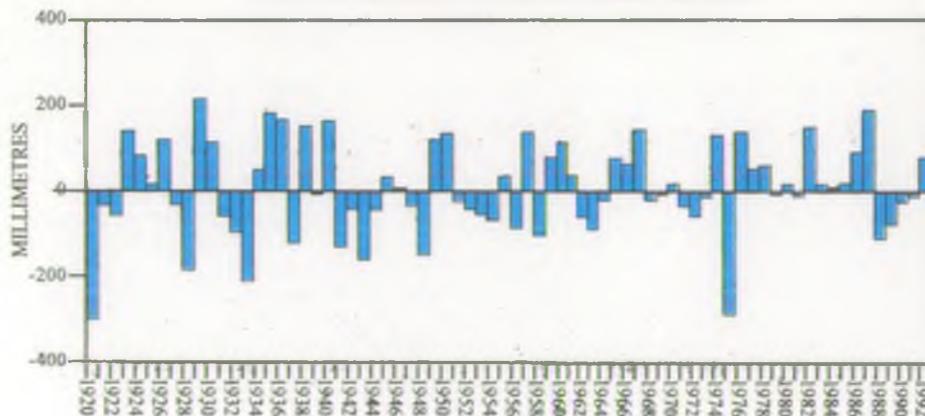
Infiltration rate through Boulder Clay is limited, surface water runoff from the Boulder Clay may also enter the aquifer via sands and gravels in the valley floors. In the south, the Chalk is confined by the overlying Tertiary strata (e.g. Boulder Clay, see Section 2.4). Recharge to the confined part of the Chalk aquifer is therefore via the southwards movement of groundwater flow.

Groundwater flows northwards out of the upper catchments of the Rivers Rib, Ash and Stort where the groundwater divide (which is different to the surface water or catchment divide) lies within the surface water catchment. The groundwater moves northwards into Anglian Region and flows out through spring sources which feed watercourses such as the River Cam. Further information is also given in Section 2.7.

YEARLY PERCOLATION FOR LEE CHALK -
ABOVE OR BELOW LONG TERM AVERAGE



YEARLY RAINFALL FOR LEE CHALK -
ABOVE OR BELOW LONG TERM AVERAGE





KEY

	Watercourse		Spring Source		Direction of Ground Water flow	<p>Scale (approx)</p> 
	Catchment Boundary		Regional Groundwater Divide		Ground Water Level Monitoring Stations	
	Urban area				Perennial Heads of Watercourses	

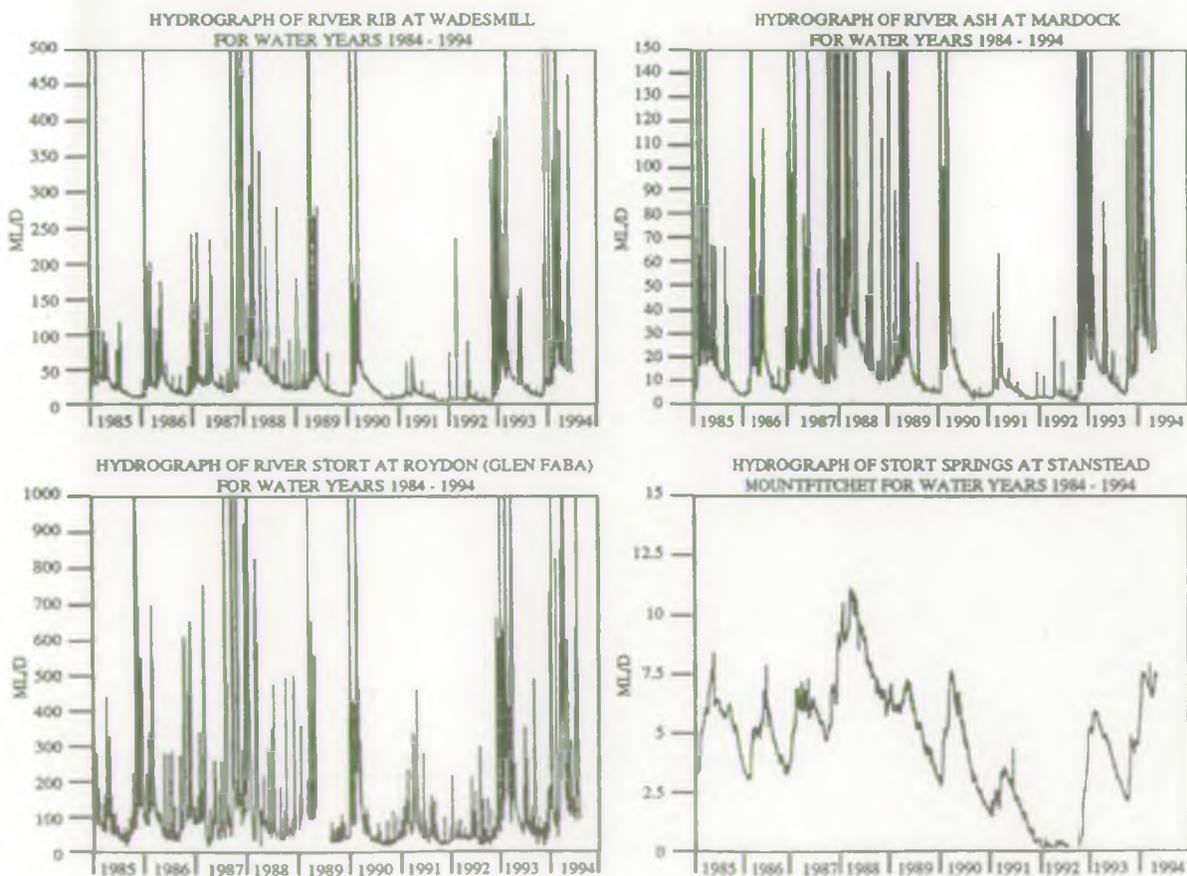
2.7 HYDROLOGY

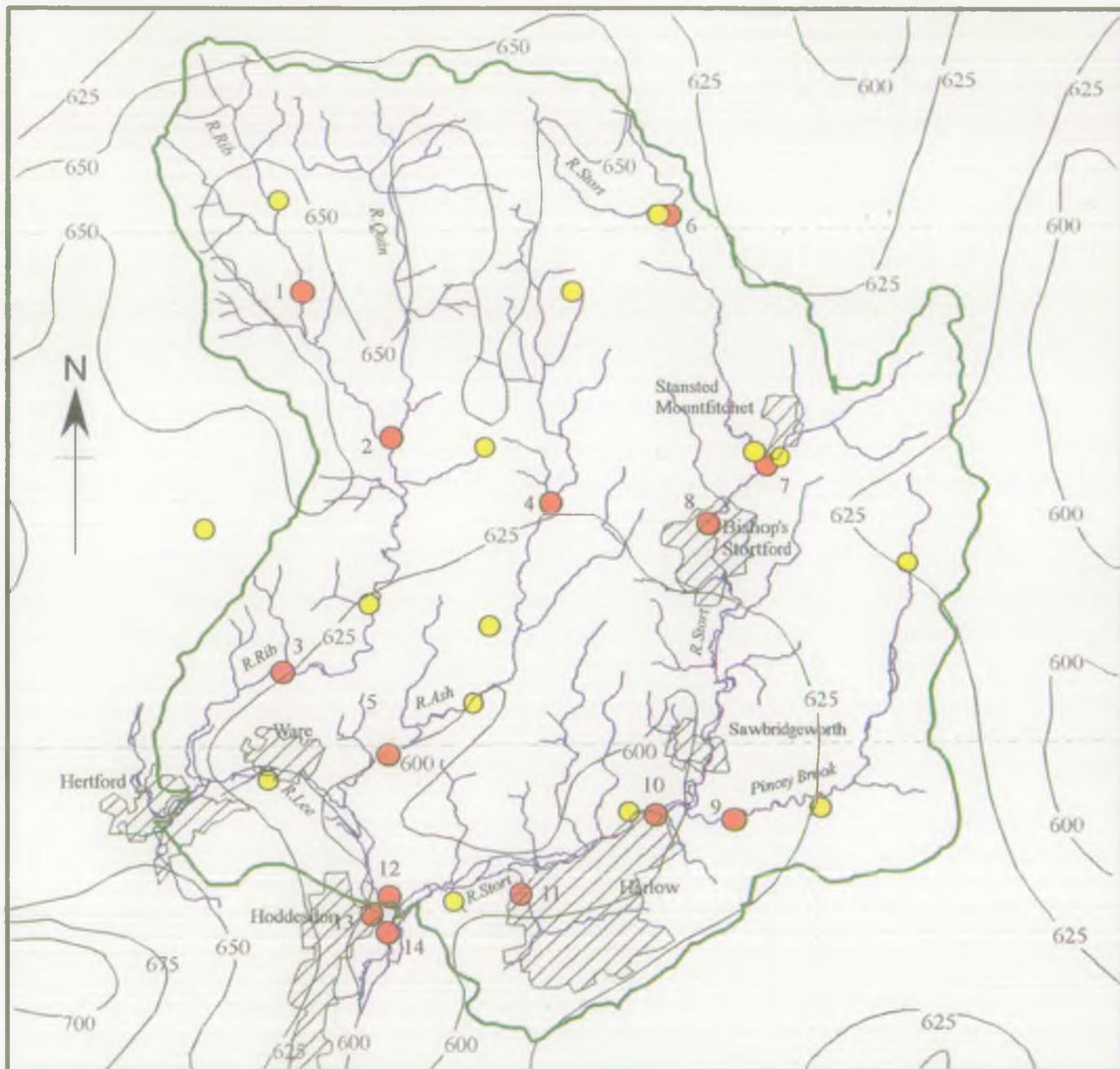
The River Rib and its tributaries have a surface water catchment of 152 km² of which 37 km² is above the groundwater divide. This catchment loses groundwater to the River Ash and the middle River Lee catchments. The furthest downstream gauging station is at Wadesmill (National Grid Reference: TL360174). The River Quin is gauged at Griggs Bridge (TL392248). The hydrograph of the River Rib at Wadesmill illustrates a groundwater fed river which has some surface water runoff from the boulder clay areas and a small amount of urban runoff.

The River Ash has a surface water catchment of 86 km² and is almost wholly within the groundwater divide. Of this 66 km² is unconfined chalk and the remaining area is confined by the Tertiary deposits of London Clay and Reading Beds (see Section 2.4). It is believed that groundwater flows from this catchment into the River Stort catchment and a smaller amount flows into the middle River Lee catchment. The River Ash catchment is gauged at Mardock (TL393148). Like the River Rib, the hydrograph of the River Ash shows mainly a groundwater fed river with some surface runoff from the boulder clay and some urban runoff.

The River Stort catchment is 280 km² in area of which 11 km² is north of the groundwater divide. Some 200 km² of this catchment is comprised of Tertiary deposits confining the chalk aquifer. Groundwater flows from here into the confined chalk under London and that of the River Roding catchment to the east.

The hydrograph from the gauging station at Stort Springs (TL500246) shows a typical chalk stream profile and contrasts with the River Stort at Glen Faba (TL391092) which has a much more "flashy" profile showing the rapid reaction of the river in response to runoff from urban areas and the clay part of the catchment.





KEY

	Watercourse		Flow Gauge	
	Catchment Boundary	1. Buntingford 2. Griggs Bridge 3. Wadesmill 4. Little Hadham 5. Mardock 6. Clavinger 7. Gipsy Lane		
	Urban area	8. Grange Paddocks 9. Sheering Hall 10. Harlow Mill 11. Elizabeth Way 12. Rye Meads 13. Rye Bridge 14. Glen Feba		
	Annual Average Rainfall (mm)			Scale (approx) 0 ————— 5 km
	Rain Gauge			

2.8 ECOLOGY

Current Situation: Stretches of the rivers and valleys in the catchment contain a valuable combination of freshwater, marshland, grassland and woodland semi-natural habitats. The River Stort is of particular ecological interest as it supports a wide range of aquatic and semi-aquatic habitats. As a result, several nationally rare species can be found in the catchment (e.g. Shoveler, Snipe, Water Vole, River Water-dropwort and Marsh Dock).

There are Sites of Special Scientific Interest (SSSIs) designated by English Nature in the catchment several of which are water related. Four of these are adjacent to the Stort Navigation, one being a flood storage area (Spellbrook Flood Lagoon). Two former mineral extraction sites within the catchment have also been notified as SSSIs including Downfill Pit at Westmill, located close to the River Rib.

The catchment contains several water related Wildlife Trust Nature Reserves particularly along the River Stort corridor (e.g. Sawbridgeworth Marsh, also designated an SSSI), and two Local Nature Reserves. Other sites of considerable ecological importance are the numerous springs, ponds, fens, wet grassland and seasonal marshes. These sites are shown on the map opposite.

The River Stort and its immediate surroundings above Bishop's Stortford contain numerous springs and small wetlands which are unusual features in East Anglia. The lower reaches of the River Stort below Sawbridgeworth are also considered important as a north-south route for migratory birds that extends outwards from the artificial waters of the Lower River Lee.

The headwaters of the River Cam (north of the catchment) rise from groundwater fed chalk springs, flowing from below the north-eastern part of the catchment (see Section 2.6). These are the only example of calcareous wetland in Essex.

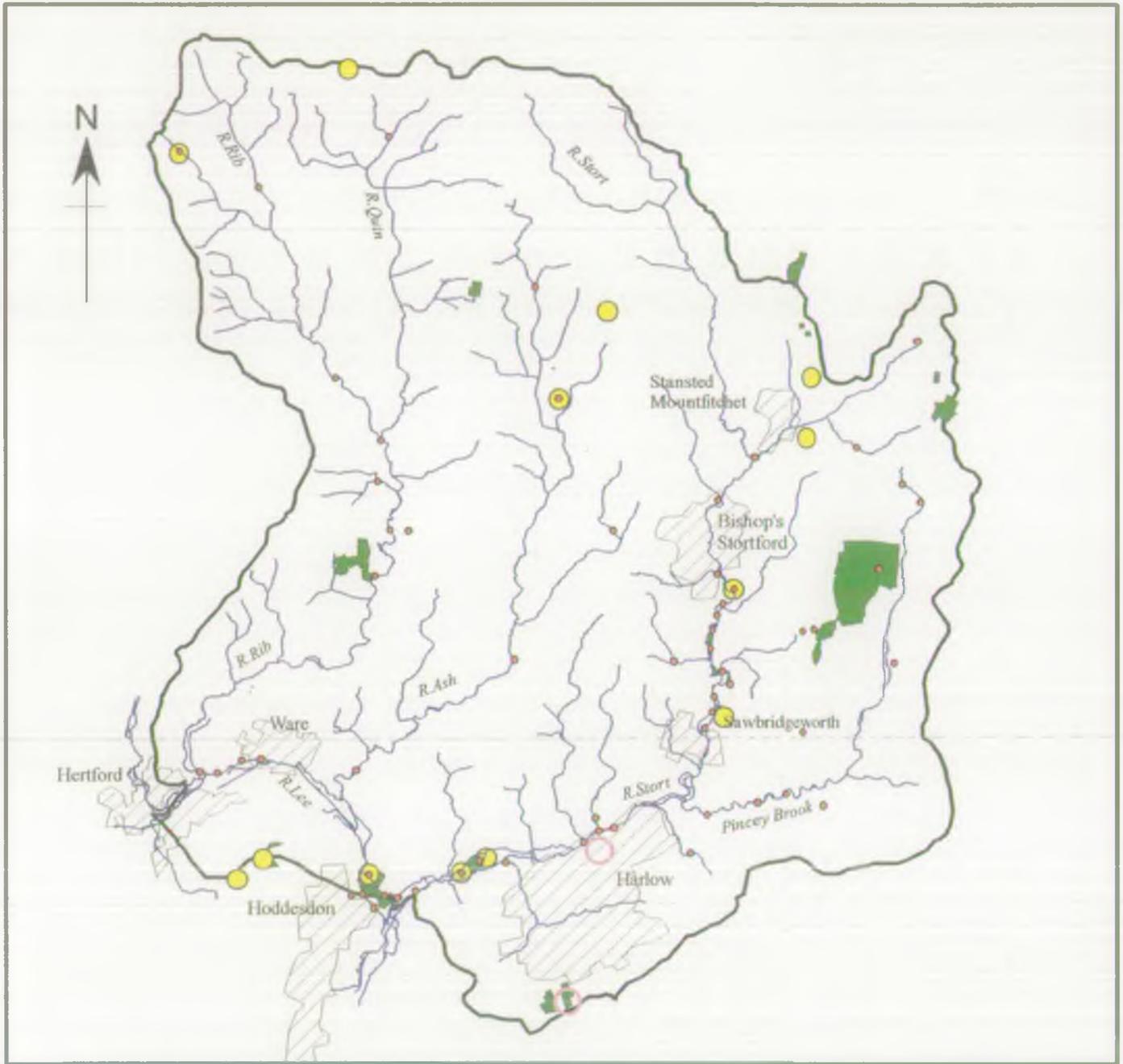
The River Ash also supports a wide variety of species. Macroinvertebrate sampling within the channel frequently results in some of the highest diversity scores in the Thames Region.

Future Situation: Protection of valuable sites on the catchment is vital if they are to retain their interest and importance and many parties are trying to promote a strategic approach.

Rye Meads SSSI has been identified as a potential Special Protection Area (SPA) under the EC Birds Directive (79/409/EEC) as it forms part of the internationally important chain of habitats for birds in the Lee Valley.

Hertfordshire County Council are promoting a more positive and strategic conservation role that involves the concerted action of a number of organisations. This is co-ordinated through an "Ecology Action Programme" with targets set for the restoration and rehabilitation of various types of habitat. There are a number of other important conservation initiatives that are in the process of being implemented, many of which have implications for water-related habitats. Schemes such as the Countryside Commission's Countryside Stewardship Scheme (Water landscapes) and the "Water Fringe Option" of the EC Habitats Scheme could, by encouraging low intensity agriculture and the reinstatement of grassland, have considerable future ecological benefits for the catchment.

It has also been recognised that conflicts between the conservation of rivers and their valley habitats can only be resolved through joint consultation procedures involving local planning authorities, the NRA, British Waterways, Water Companies and both farming interests and conservation bodies.



KEY

	Watercourse		Wetland Sites of Ecological Importance		Sites of Special Scientific Interest	<p>Scale (approx)</p> 
	Catchment Boundary		Local Nature Reserve		Wildlife Trust Nature Reserve	
	Urban Area					

2.9 FISHERIES

Current Situation: Several river reaches within the catchment are designated cyprinid fisheries under EC Directive 78/659/EEC. Parts of the Rivers Rib and the Quin are designated Salmonid Waters under the same directive. These are described further in Section 3.1 on Water Quality.

The Lee and Stort Navigation fisheries are similar in that their qualities are restricted by both habitat type, flow rates and water quality. Dominant species are roach and perch with chub, pike, tench, bream and carp also present.

The old river loops associated with the navigations offer more diverse habitats, faster flowing waters and less disturbance so these tend to have high quality fisheries. Chub, dace and roach can be found in the backloops of the River Stort. The River Lee backloop known as the Amwell Magna, supports a high class coarse fishery below Tumbling Bay near Ware, and is also noted for its trout fishing. Major enhancements have taken place in a phased project to improve instream habitats on this reach. These have furthered its fisheries, biological and conservation value.

The River Ash joins the Amwell Magna reach south of Ware. Although fisheries survey data does not currently exist for the river, it is due to be surveyed in late 1994/early 1995 and is known to support brown trout.

The River Rib is a "bourne river" (see Section 2.7) above Buntingford at which point flows increase due to the discharge of treated effluent (see Section 2.14) and increased surface water run off. Self-sustaining brown trout populations can be found downstream from Buntingford on the River Rib and at Braughing on the River Quin, all the way to the River Lee confluence. The lower reaches of the River Rib support chub, dace, roach, perch and pike and a thriving minor species community.

There are many angling club still-water fisheries within the Lee and Stort river catchments utilising old gravel pits, though few can be found in the catchments of the Rivers Rib and Ash.

However, just north of Hertford, the large lake at Westmill Farm offers day-ticket trout angling. Angling on the Lee Navigation is controlled by the Lee Anglers Consortium with day tickets available for purchase on the river bank.

Future Situation: A full survey of the River Ash is due to be carried out in late 1994/early 1995.

Free movement and migration of fish is hampered by man-made obstructions such as mills and weirs. A fish pass has been proposed on the Papermill side loop of the River Rib at Standon, to improve fish passage on the Rivers Rib and Quin. Old weirs and sluices that have fallen into disrepair are being surveyed with a view to replacement or removal.



KEY

Watercourse	Fishery Type		Fishery Quality		
		Game		Good	
		Mixed		Moderate	
		Coarse		Poor	Scale (approx) 0 3 km
		Coarse (minor species only)		No Data due to Low Flow	

2.10 LANDSCAPE AND HERITAGE

Current Situation: No part of the catchment has been classified as a nationally important landscape i.e. "Area of Outstanding Natural Beauty". However, large expanses have been designated as either "Special Landscape Areas" (Essex CC) or "Landscape Conservation Areas" (Hertfordshire CC). On the southern fringe of the catchment, the landscape of the Lee Valley below Ware has become degraded and is in need of enhancement, hence its designation as a Landscape Development Area by Herts CC. Here, the removal of natural features has combined with the addition of unsympathetic man-made features to damage the traditional landscape character. These designations however, are currently being replaced. For instance, Hertfordshire's recent Landscape Strategy emphasises the particular characteristics of different areas and the elements to be enhanced and protected rather than the relative quality of areas. Three of the Counties six landscape types are present:

- East Herts Plateau (which covers the bulk of the catchment): this is an undulating area with a complex and widely dispersed mixture of fields, woodlands and settlement. (The boulder clay landscape tract identified by Essex CC covers most of the River Stort catchment and is very similar in character)
- Central River Valleys (River Lee around Hertford and Ware and lower River Stort valley): these contain many of the key settlements and communication links
- North Herts Ridge (uppermost parts of the Rivers Ash and Rib): this is an open and historically important landscape similar in character to the Chilterns.

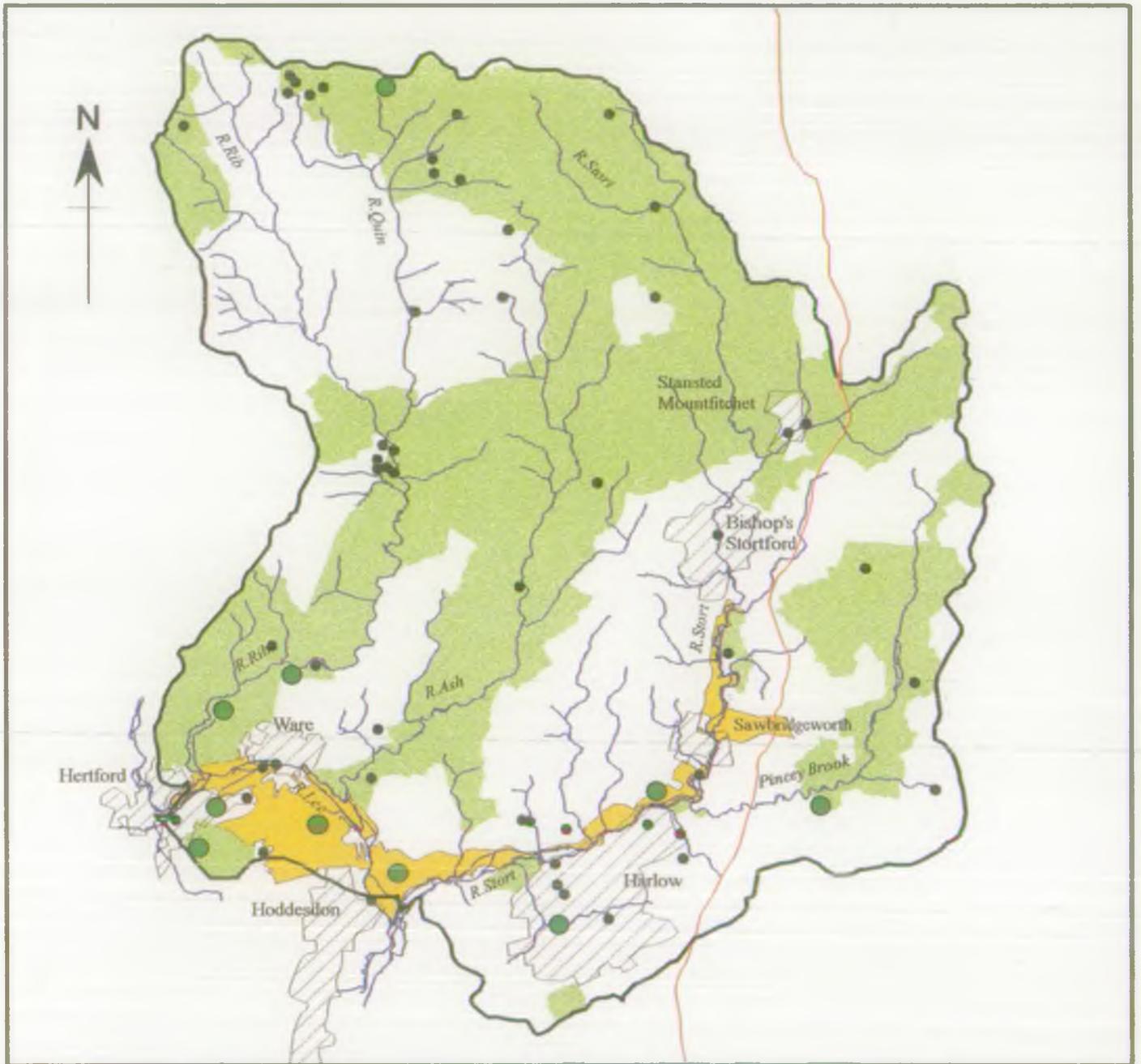
In addition to the many Scheduled Ancient Monuments, the catchment is also an area of considerable archaeological importance; in particular in the valleys which have been favoured locations for settlement for thousands of years. Archaeological investigations in the Stort and Lee river valleys in recent years have identified significant remains of human activity dating to both palaeolithic and mesolithic periods. At Braughing, work on the riverbank revealed waterlogged archaeological remains associated with the adjacent internationally important Late Pre-Roman Iron Age settlement. The catchment also contains several substantial Roman-British settlements such as those at Ware and Bishop's Stortford.

Several parks and gardens in the catchment are of historical importance and are on the non-statutory register prepared by English Heritage. Examples of these with water features include Amwell Grove and Youngsbury Park.

Future Situation: Hertfordshire County Council is to complete a new countrywide landscape survey during 1994, as part of their "Landscape Action Programme". The NRA is also to carry out a landscape assessment of the Middle Lee catchment river valleys in 1995-96.

It has also been recognised that the rural historic heritage is very fragile and requires careful management if it is to be adequately conserved. Hertfordshire County Council is currently addressing this through a Monuments Protection Programme (MPP) in conjunction with English Heritage, and through their Countryside Heritage Project.

Sites in the river valley can be vulnerable to damage, such as from flood defence work, and also from subtle changes in hydrology which can result in desiccation. Research into the effects of the latter is currently being funded by English Heritage.



KEY

	Watercourse		Landscape Development Area		Scheduled Ancient Monuments	<p>Scale (approx)</p> 
	Catchment Boundary		Historic Parks and Gardens			
	Motorway		Landscape Conservation Areas and Special Landscape Areas			
	Urban area					

2.11 NAVIGATION

Current Situation: The Rivers Lee and Stort are the only waterways in the catchment that are utilised for navigation, with the Lee Navigation designated as a Commercial Waterway under the 1968 Transport Act and the Stort Navigation a Cruising Waterway.

From the head of the navigation at Hertford, the River Lee flows for seven miles (through four locks) before crossing the southern boundary of the catchment. Parts of the River Lee were used for navigation in Roman times and during the First World War, enlargements were carried out to allow 100 ton boats to reach Ware and Hertford. In the 17th century the River Lee was established as a source of water supply for London, a role it still fulfils. British Waterways (BW) is the navigation authority for the Lee and Stort Navigations and is therefore responsible for their management and maintenance, though the NRA contributes financially to this.

The River Stort rises below the northern boundary of the catchment and joins the River Lee at Feildes Weir on the southern boundary of the catchment. It is navigable in the lower reaches up as far as Bishop's Stortford, a distance of fourteen miles with fifteen locks. Unlike the Lee Navigation, the Stort Navigation is narrow and winding. It was opened to supply malt to the brewing industry in London and by 1811 over 40,000 tons of goods were transported each year. Commercial traffic has gradually declined since this time and finally ceased in 1973.

Future Situation: Since 1989 BW has marketed the "Lee and Stort Navigation" to maximise income generation from recreation. This includes the policy to double the number of moorings on the Stort Navigation from 150 to 300. The current proposal to develop a new marina at Harlow is consistent with this policy. Both the Sports Council and the NRA are concerned that this policy may be detrimental to other uses of the navigation and associated land.

The width of the waterways, particularly along the Lee Navigation, is restricted by boats mooring along the banks, causing congestion. This could be minimised by encouraging the provision of a greater number of off-line navigation moorings though with due consideration to any environmental impact that this may have.

With an increasing emphasis on sustainable transportation policies, Herts CC are likely to review the merits of using the navigation for freight transportation. In addition the towpaths, especially between Hertford, Ware and Hoddesdon, provide a safe environment for cyclists moving between urban areas. The implications for other towpath and navigation users of these policies will need careful consideration.



KEY

	Watercourse		Lee Navigation		Locks	<p>Scale (approx)</p>
	Sub Catchment Boundary		Stort Navigation		Boatyards	
	Urban area				Cruising Facilities	

2.12 AMENITY AND RECREATION

Current Situation: The Rivers Stort and Lee are "linear parks" providing important amenity and recreational opportunities within the catchment. Private boats on the Lee and Stort Navigations increased by 20% and 56% respectively over the period 1986 - 1992, a trend that is likely to continue. Angling is popular on both these rivers, particularly near settlement areas in the southern part of the catchment, such as Ware and Hoddesdon.

Public access to the River Lee has recently been improved by the completion of the Lee Valley Walk, a fifty mile trail from the River Thames that passes through Ware and Hertford and continues on to the source of the River Lee in Luton. In addition to the Stort Navigation towpath, public access to the River Stort has also been improved at Roydon Mill under the Countryside Commission's Countryside Stewardship Scheme.

The limited supply of enclosed water bodies in the area and the proximity of the population of Greater London, creates great pressure for access to enclosed water bodies for formal water sports in Hertfordshire and Essex. The catchment has several sailing and water skiing venues as well as many sites for informal recreation and facilities for the physically disabled.

To the south-east of Ware, the Lee Valley Regional Park Authority (LVRPA) has considerable influence over the provision of water recreation opportunities in the valley, and this is reflected in the number of water recreation sites situated here. LVRPA provides and manages individual sites for recreation and amenity, but also seeks to improve landscape and ecological aspects of the area. It has a strong role in identifying overall needs and assessing new sites to ensure recreational demands are met without detriment to other uses.

Access to the Rivers Ash and Rib is very much more limited although most villages have some footpaths or amenity areas adjacent to the rivers.

Future Situation: New developments in watersports and an increasing demand for "adventurous activity" have highlighted the need to create new opportunities for water recreation sites in the area. As there are unlikely to be many mineral sites coming forward for restoration within the catchment over the next few years, there will be a need to consider the development of water sports on any enclosed waters which become available and to make the best use of existing water bodies within their capacities.

Areas within the catchment highlighted for possible development of water-based recreation include Tumbling Bay pit on the edge of Ware, potentially for recreational uses such as angling, canoeing and windsurfing. This, however, could only be fully realised once gravel working has been completed and a new road access made available. Within the valley between Hoddesdon and Ware a number of other smaller opportunities may also become available, although the emphasis on after-use is likely to be for less intrusive sports such as sailing and angling.

Through the restoration of former gravel extraction pits, Essex County Council aim to make good the acknowledged deficiency in inland water space. The enhancement of the county's navigable waterways is also supported, as are measures to increase public access to them.



KEY

	Watercourse		Water Recreation Sites	
	Catchment Boundary	<ul style="list-style-type: none"> 1. Roydon Mill (Water Skiing & Boating) 2. Ryegate Farm Lane (Angling) 3. Ryemeads (Angling & Informal Recreation) 4. Marsh Lane Lake (Angling, Sailing, Inf. Rec.) 5. The Thrifts - Great Arnwell (Windsurfing) 6. Tumbling Bay Pit (Multi - Recreation) 7. Arnwell Quarry (Informal Recreation) 8. Rye Mead Works (Angling) 9. Hallingbury Park (Angling) 		<p>Scale (approx)</p> 
	Urban area		Known Active Canoeing Groups	
	Lee Valley Park		Existing Riverside Paths	

2.13 WATER ABSTRACTION

Current Situation: Water is abstracted from the catchment for several purposes and these are shown on the map opposite.

The number of licences and volumes abstracted from the catchments of the Rivers Lee (between Hertford and Feildes Weir), Rib, Ash and Stort are shown in the table below. It can be seen that over 90% of the total licensed abstractions is for public water supply, the rest for uses such as agriculture, spray irrigation and private water supply. Apart from the abstraction from the River Lee at New Gauge, most other abstraction in the catchment takes place in the Rib and Stort River sub-catchments. Actual abstraction is less than authorised and in 1993 was estimated at 54% of authorised. Licences of Right granted in the 1960s in the catchment, can exacerbate low river flows in the summer months and in times of drought. Revocation by the NRA requires compensation to be paid to the licence holder. As opportunities arise in the future, changes may be made to licences with consideration of specific impact and demand. This may involve the licence holder revoking the Licence in favour of a new licence authorising winter abstraction to fill a storage reservoir.

For example abstraction for use on agricultural land where there is land available for a storage reservoir.

Abstraction details for separate river catchments

Catchment	Number of Licences	Authorised Public Supply MI/d	Authorised Other Sources MI/d	Authorised Total MI/d	Estimated Actual 1993 MI/d	Average Resources MI/d	Dry Year Resource MI/d
Rib	51	25.4	7.0	32.5	20	86	32
Ash	19	4.5	5.7	10.3	2	47	18
Stort	68	40.3	4.3	44.6	25	156	59
Middle Lee	32	*171.3	5.5	176.8	125	**	**

Key:

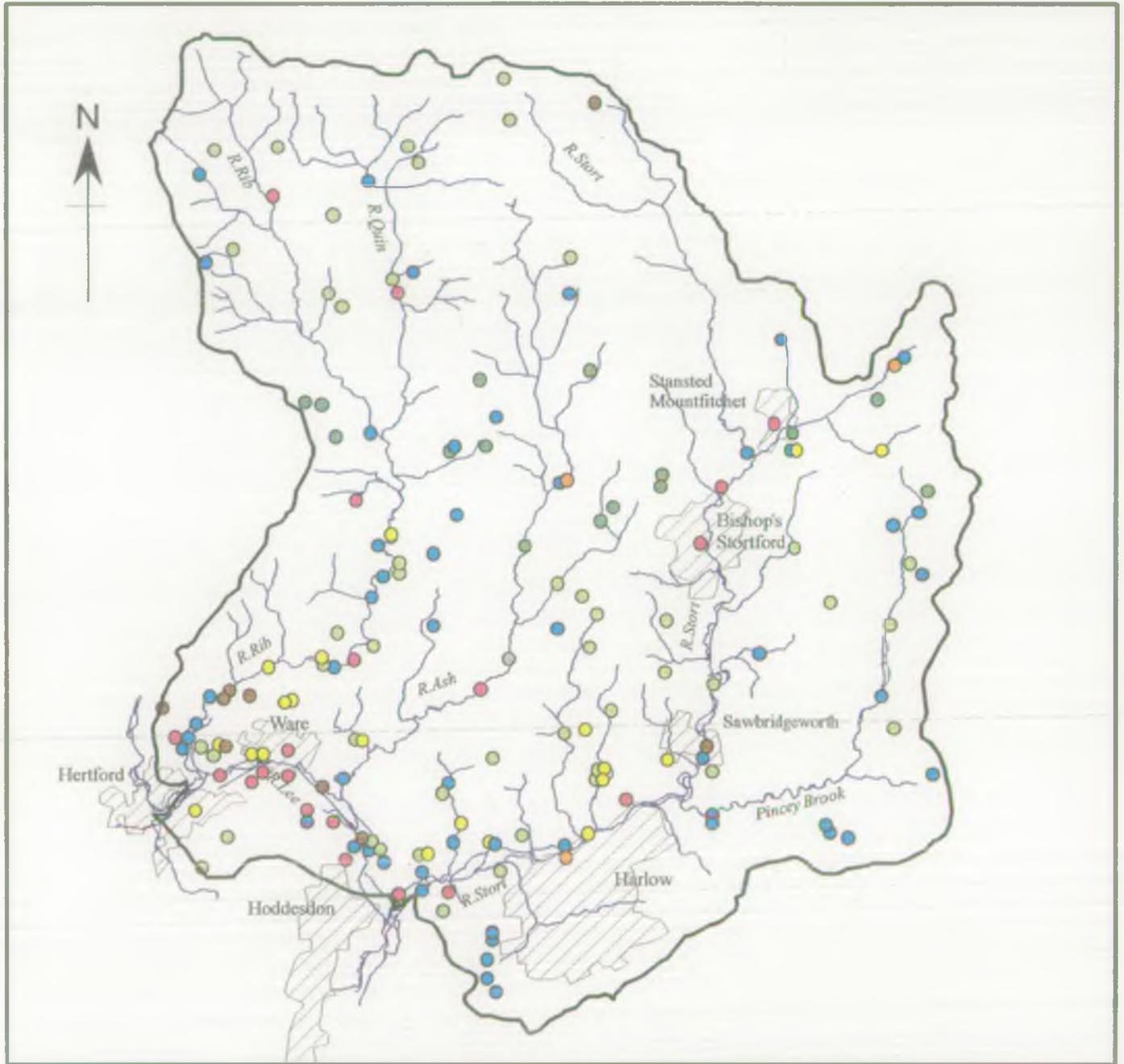
* 102ML/d accounted for by Thames Water's abstraction at New Gauge

** Data not available

Future Situation: The NRA is currently engaged in work to provide a simple water balance focusing on water use for each sub-catchment in the region. This will help identify areas where resources are fully committed and those where there is scope for further development.

It is unlikely that any further major abstractions could be licensed in the catchment. The NRA's Regional Policies on Licensing Abstraction (see Appendix III) provide for appropriate constraints to be imposed on all new licences, ensuring that environmental considerations are protected.

Water resources management is discussed further in Section 3.2.



KEY

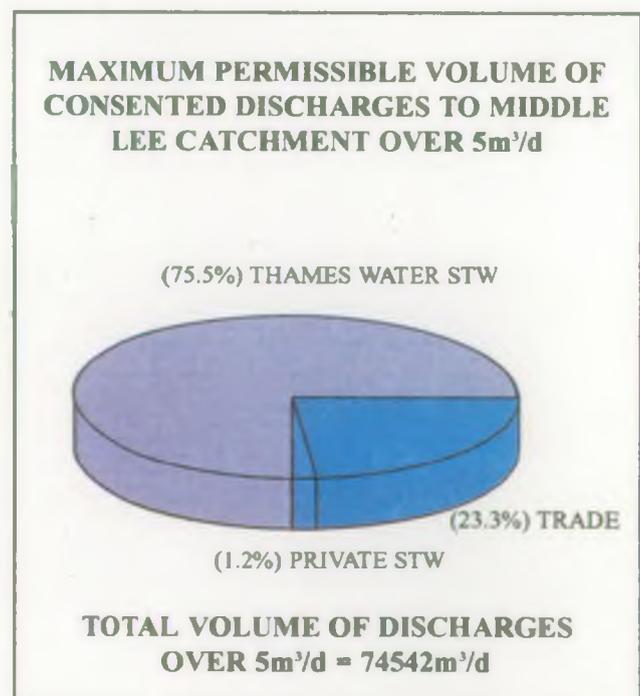
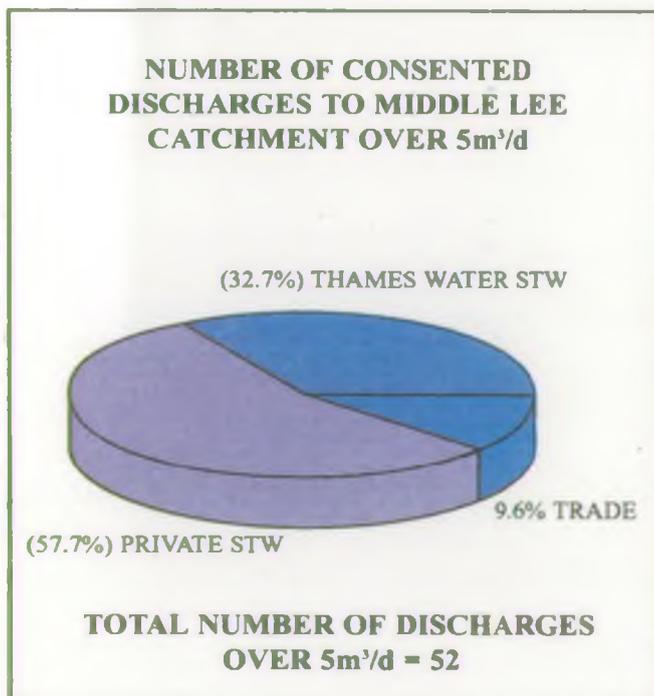
	Watercourse		Public Water Supply		Industrial and Mineral Washing		
	Catchment Boundary		Private Water Supply		Water Transfer		
	Urban area		Agriculture		Fish Farms	Scale (approx) 0 ————— 5 km	
			Spray Irrigation / Agriculture				

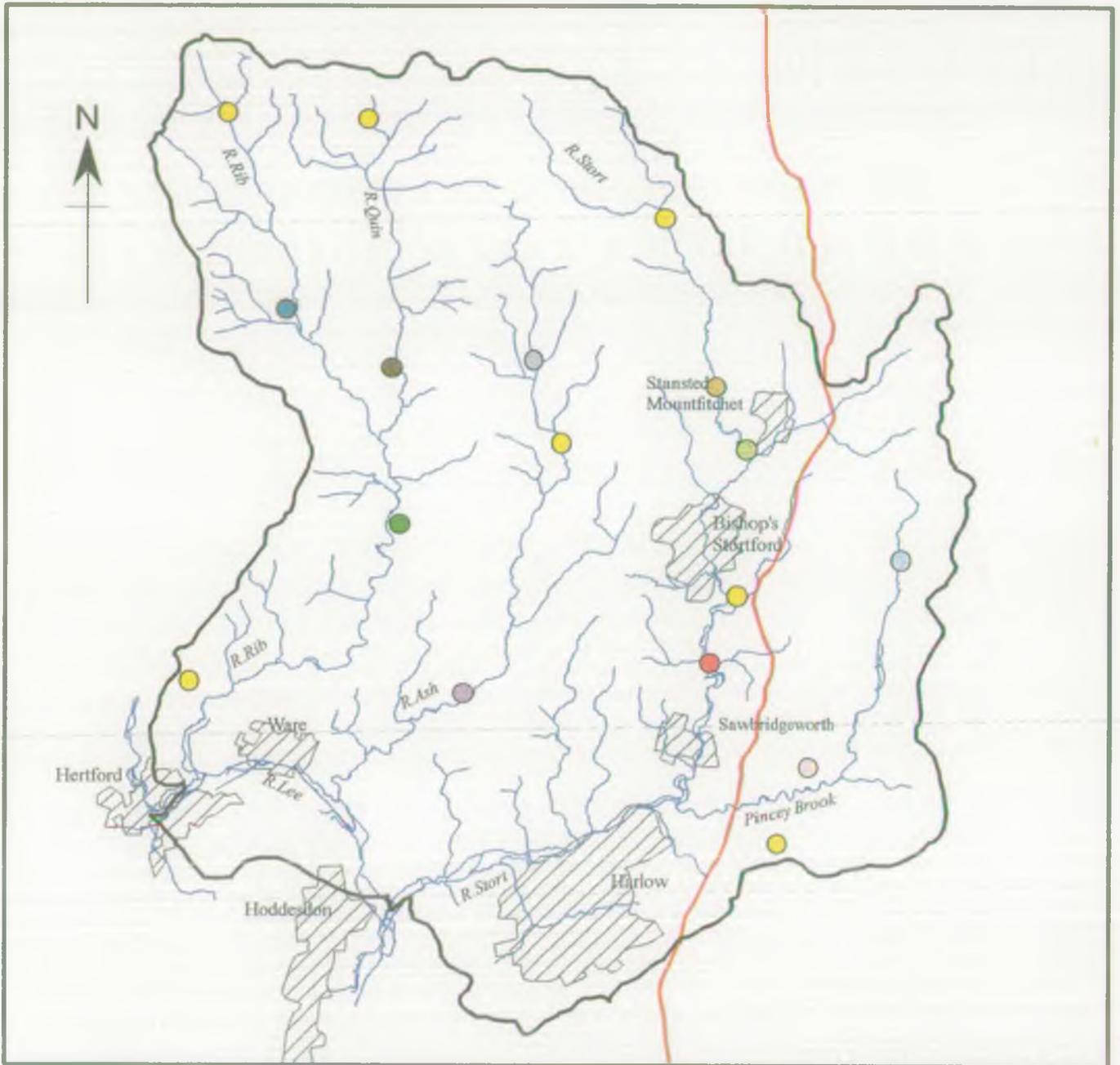
2.14 EFFLUENT DISPOSAL

Current Situation: All discharges direct to receiving waters in the catchment are controlled by means of either NRA consents or HMIP authorisations. Consents and authorisations are legal documents issued by the regulator which impose conditions on the quantity and quality of a discharge in order to protect the environment. The regulator has powers to monitor both the quantity and quality of these discharges and if the conditions are not being met, to take action to ensure compliance.

There are 167 consented discharges into the Middle Lee catchment, 52 of which have a maximum consented volume of $>5 \text{ m}^3/\text{d}$. The majority of these effluents are from private sewage treatment works (see figure below), a fact which reflects the rural character of the catchment with mains sewerage not always being available. The largest discharges by volume are those from Thames Water Utilities Limited (TWUL) sewage treatment works (see figure below); Bishop's Stortford being the largest of these works. The sewered areas of Harlow, Ware, Sawbridgeworth and Hertford drain to Rye Meads sewage treatment works. Although this works is located in the Middle Lee catchment, the effluent from the works is discharged into the River Lee catchment downstream of Feildes Weir.

Future Situation: The NRA and TWUL have identified the need to make changes to the consents and/or the plant at 10 of the 17 TWUL sewage treatment works discharging into this catchment in order to meet the needs of EC Directives and provide better protection for the aquatic environment. The location of these 10 works is given on the map opposite. The proposed changes have been included in the TWUL Asset Management Plan (AMP2) recently submitted to the Office of Water Services (OFWAT). The process of prioritizing Regional actions is progressing.





KEY

	Catchment Boundary	TWUL Sewage Treatment Works - A MP 2					
	Urban area		Manuden		Widford and Wareside		Stansted Mountfitchet
	Motorway		Buntingford		Hatfield Heath		Takeley
	Other TWUL STWs		Braughing		Little Hallingbury	Scale (approx) 0 ————— 5 km	
			Furneaux Pelham		Standon		

2.15 AGRICULTURE

Current Situation: Agricultural land is classified by the Ministry of Agriculture, Fisheries and Food (MAFF) using the Agricultural Land Classification System. Grades 1 and 2 are very good quality land, grade 3 is moderate to good, and grades 4 and 5 are considered poor quality. Over half of the catchment is grade 1 and 2 quality, the remaining agricultural land is grade 3.

The majority of agricultural land on the catchment is used for growing cereals particularly wheat and barley, and also combinable breakcrops such as oilseed rape, peas and beans. Horticultural crops are also grown in the catchment and usually within close proximity of urban centres.

There are a total of 455 holdings in the catchment of which over a third are less than 5 hectares. Of the remaining holdings approximately a third are between 5 hectares to 100 hectares and the remainder are over 100 hectares. The relatively large proportion of smallholdings in this catchment is probably due to the numerous horticultural units which are often less than 5 hectares in size.

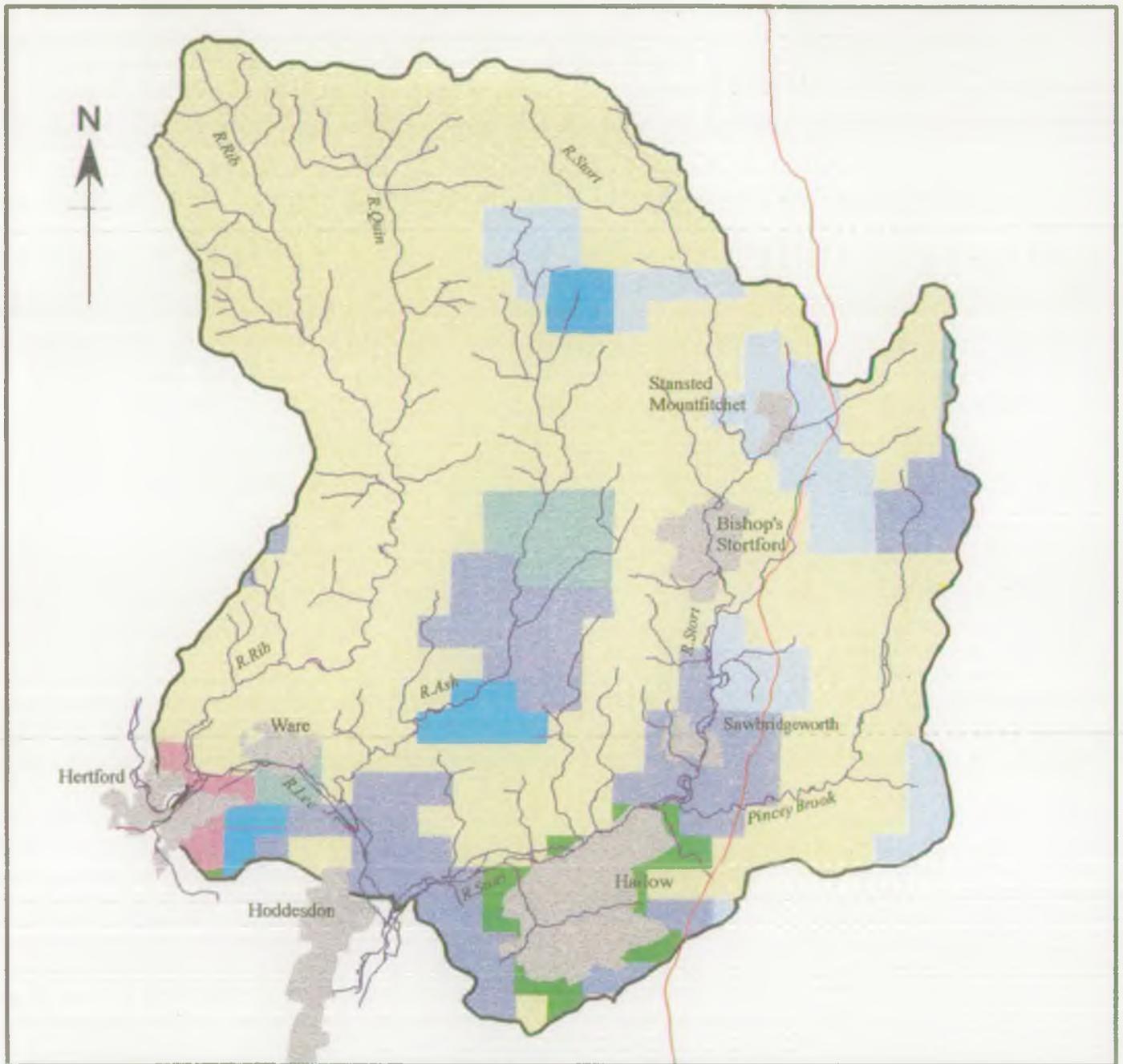
Grassland for livestock accounts for just over a tenth of the catchment. Cattle numbers, particularly dairy herds, have declined sharply in recent years as have numbers in more intensive livestock systems such as pigs and poultry. In contrast sheep farming has increased in size by more than a quarter.

The map opposite shows the dominant farm types rather than the agricultural landuse. Hence although horticultural units appear as several prominent blocks, they actually take up less than 1% of the total agricultural landuse of the catchment.

The introduction of the European Commission Common Agriculture Policy reform measures in 1992, requiring all but the smallest farms to set-aside 15% of land growing cereals, oilseed and protein crops, reduced the area in arable production. On land that is set-aside farmers are not allowed to apply artificial fertilisers or pesticides apart from the occasional application of non-residual herbicide and are encouraged to manage the land in an environmentally beneficial manner.

Future Situation: In 1995 further options will be available for farmers to withdraw land from food production. The Non-Rotational Set-aside Scheme has recently been introduced which increases the area of land set-aside to 18%, and also The Habitat Creation Scheme which allows land to be set-aside from production for 20 years. These proposals will lead to a reduction in cropping areas which will in turn reduce the overall amount of fertiliser and pesticide used by farmers in the area.

Nitrate Vulnerable Zones (NVZ) have recently been proposed and these are currently at consultation phase. Catchment areas surrounding public abstraction points are in the process of being designated NVZ where water supply exceeds 50 mg/l Nitrate (or for groundwater supplies, is likely to exceed this by 2010). Draft action programmes include measures to reduce nitrate pollution from agricultural sources. No NVZ have currently been proposed in the Middle Lee catchment though these are under periodic review.



KEY

	Watercourse	FARM TYPES (by Parish)				
	Catchment Boundary		Mixed		Mostly Cattle	
	Motorway		General Cropping		Predominantly Fruit	
	Urban area		General Horticulture		Specialist Dairy	
			Mostly Cereal Cropping			Scale (approx) 0 ————— 5 km

2.16 URBAN DEVELOPMENT

Current Situation: The major settlements are concentrated in the lower part of the catchment and along the River Stort. Towns such as Hertford and Ware were established by the 12th century and saw rapid growth with the railways of the 19th century. Harlow was designated a new town in 1946 and has expanded to become a regional centre for leisure, shopping and other service activities. All these towns are surrounded by Green Belt, placing a constraint on urban expansion and preventing the coalescence of settlements along the River Lee and Stort corridors.

Stansted Airport lies on the eastern boundary of the catchment. It was identified as London's third airport in the Airports White Paper 1985 and has been upgraded, with the construction of a new terminal, to handle 8 million persons per annum (mppa). Current passenger levels are at about 3 mppa. On-going residential development to the west of Bishop's Stortford and east of Harlow is directly related to the expansion of the Airport. Much of the airport related development, however, is located in areas to the east of the catchment.

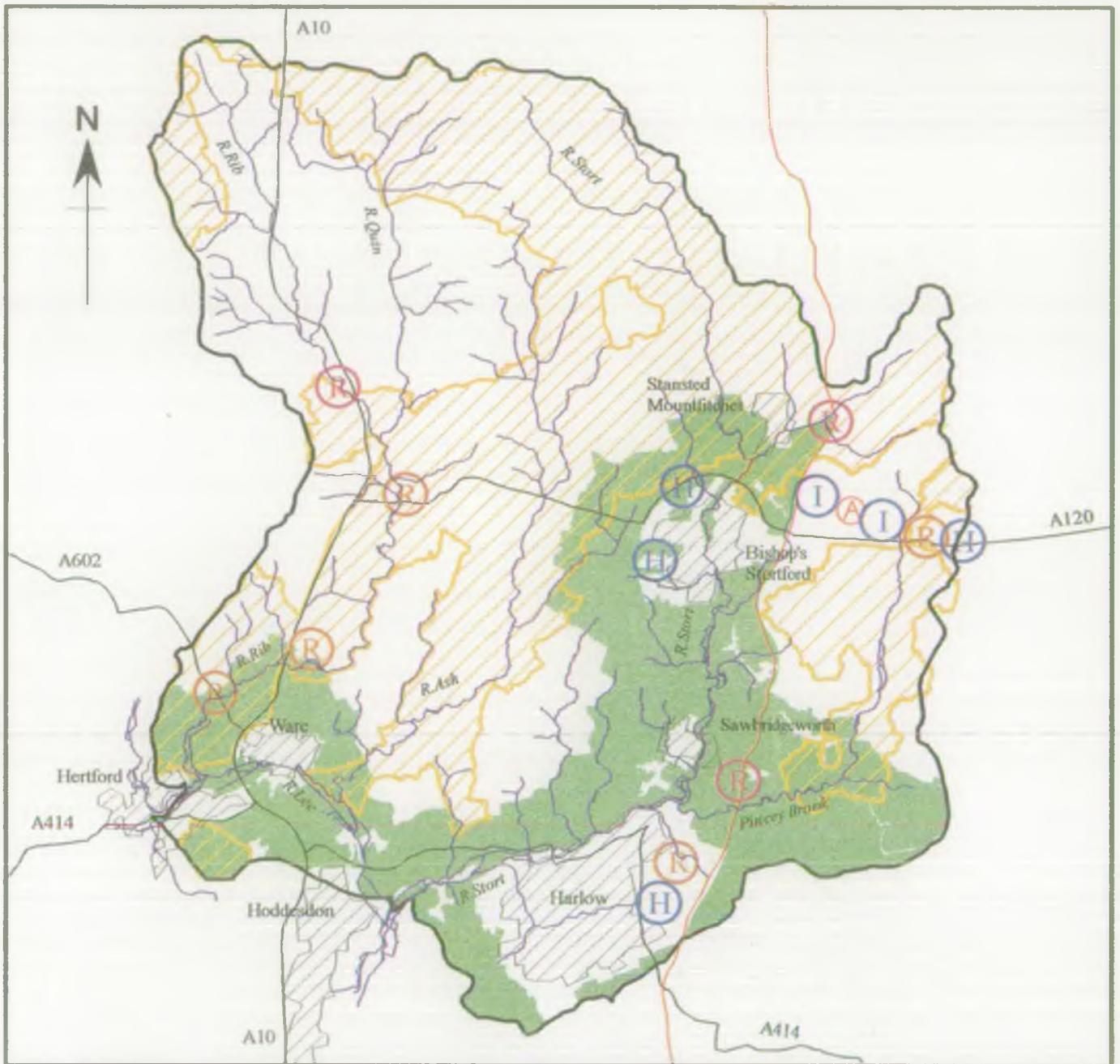
The M11 motorway runs up the eastern side of the catchment, whilst railway links include the Hertford/Ware/Hoddesdon and Stansted/Bishop's Stortford/Harlow lines to London.

Future Situation: Stansted Airport is likely to see continued growth with a predicted capacity of 15 mppa (subject to Parliamentary approval for development beyond 8 mppa) by the year 2010. In the longer-term the capacity may be increased to as much as 25 mppa. Whilst the emphasis is on locating any airport related industrial development within the airport site, there will inevitably be spin-off effects outside the immediate vicinity of the airport. Further residential development to the north-west of Bishop's Stortford and to the east of the airport on the A120 corridor is likely to be required within the next 10 years.

Several significant road developments will impinge on the catchment in the next 10 years. These include: proposed widening of the M11 (described in Planning Guidance from the Department of the Environment in 1994 as "a corridor of movement rather than growth". The A14 link between the east coast ports and the M1 links with the northern end of the M11 and provides access to the M25 and east London) which was the subject of recent public consultation; improvements to the A120 eastwards from Stansted; provision of a link between the M11 and A414 at Harlow (plans were prepared and consulted on in 1993); consideration of improvements to the A602 and A10; and, construction of the Wadesmill A10 by-pass. Government proposals for an "East-West Link" between Stansted and Luton have now been dropped from the Department of Transport's Roads Programme.

As well as the housing allocation of 1000 for Bishop's Stortford, there are some 2500 dwellings with planning permission in Harlow which await construction, with an additional 820 allocated in the period up to 2001. A further 800 dwellings have permission in Hertford.

The current consultation version of the Herts County Structure Plan stress the need for development to be sustainable. In the document the County Council identify a number of options for development beyond existing agreements. These include: remodelling of urban areas; new urban areas; and, measures to reduce demand. The impact of such strategies on the water environment (e.g. provision of water supply, disposal of sewage effluent, impact on conservation) will be part of the assessment to identify the most suitable approach. Essex CC are likely to follow a similar approach in their soon to be revised Structure Plan.



KEY

	Watercourse				
	Catchment Boundary		Landscape Conservation Areas (Herts CC) and Special Landscape Areas (Essex CC)		Green Belt
	Motorway				Road Proposals
	Urban area		Existing Highways		Road Widening
			Starnsted Airport		Major Housing / Industrial Development
					Scale (approx)
					0 5 km

2.17 MINERAL EXTRACTION AND SOLID WASTE DISPOSAL

Current Situation: Mineral extraction is largely confined to a belt of sand and gravel workings in the southern part of the catchment although there is one operational chalk pit located towards the northern boundary of the catchment. Most of the extensive deposits of sand and gravel on the floodplain of the River Lee have now been extracted, especially to the south. Many of these workings have been restored as water features, either for conservation or recreation. Production is now concentrated around Hertford and Ware and there is one site at Great Amwell with planning permission still to be worked. There has been some limited extraction of the sand and gravel deposits located along the valley floor of the River Stort. Extensive deposits of plateau gravel also surround the valleys of the Rivers Rib and Ash. Operational sites exist at the lower end of the River Rib, continuing a long history of small scale gravel extraction in the area.

Several current waste disposal sites are former gravel extraction sites which are being refilled with waste, such as landfill sites around Ware and Hertford. Facilities also exist at Bishop's Stortford, Sawbridgeworth, Roydon and Elsenham, and at the former quarry below Much Hadham. The landfill site at Ugley is known to require improvements in leachate management. No hazardous waste is produced or deposited within the catchment area.

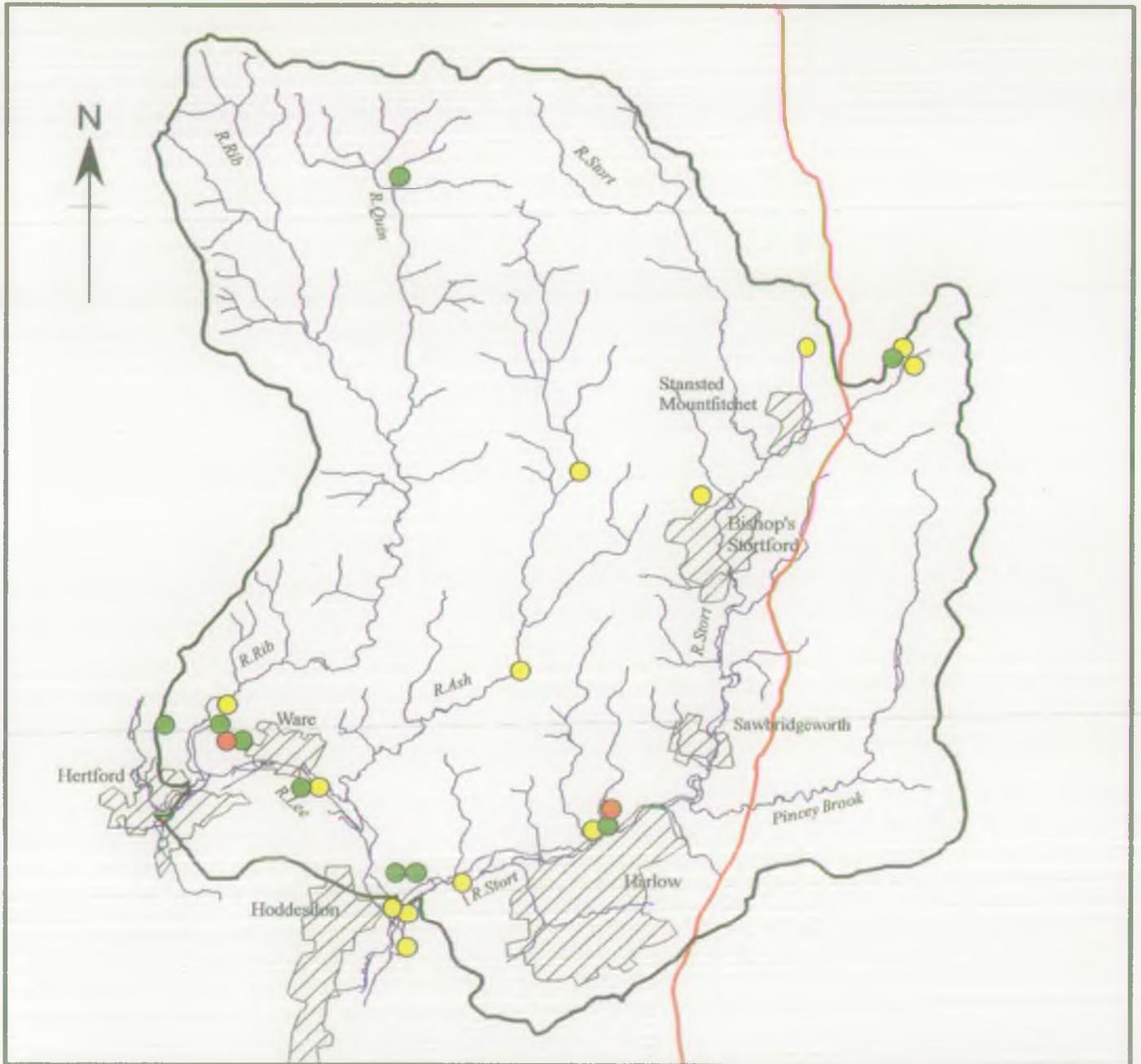
Some former disused landfill sites are situated in the catchment. These can cause pollution problems from leachate and are known to effect groundwater quality near to the site though there is little evidence of impact further afield.

Future Situation: Remaining known resources are often in close proximity to urban areas such as Hertford and Ware, near to the groundwater protection zone. Landscape protection policies are likely to be applied so as to protect the character of the settlements and the surrounding areas of countryside.

The Hertfordshire Deposit Minerals Plan does not identify "preferred sites for future workings" but does emphasise the need for appropriate restoration of former extraction sites. This includes restoration along the valley floor of the River Lee between Stanstead Abbots and Ware to develop a linked series of lakes for water based recreation and nature conservation, and similar plans for the River Stort valley.

No planning permission has been granted for future workings along the Rivers Rib and Ash and existing workings will be restored to agriculture and woodland. As the area to the west of here is Green Belt designated as a landscape conservation area, planning permission will not be granted for piecemeal incremental exploitation of the mineral reserves. The Essex Minerals Subject Plan (Sand and Gravel) is presently under review but does not identify any sites for further working in the catchment. This is to be combined with sections for chalk, clay and brickearth extraction to form an overall minerals plan.

Existing arrangements for solid waste disposal, based essentially on landfill, should be adequate for both public and private sector needs within the catchment. However, there is some uncertainty due to the need to accommodate waste from Greater London. During the next few months the NRA intends to commission environmental capacity studies of waste disposal across the Region, and of minerals in Hertfordshire.



KEY

	Watercourse		Mineral Extraction sites			
	Catchment Boundary		Existing Landfill sites			<p>Scale (approx)</p> 
	Urban area		Past Landfill sites			

2.18 FLOOD DEFENCE

Current Situation: The map opposite highlights areas that are known to have flooded in the past (ie: the extent of the known flood plain), those watercourses designated as main river, groups of properties at risk from flooding, flow gauges and areas where flood defence works are under consideration.

The NRA operates a flood forecasting and warning system which uses a combination of telemetered information, rainfall measured by weather radar and various other weather forecasting products as well as reports from flood defence staff in the field. Flood warnings are issued by the NRA to Hertfordshire and Essex Police.

The River Lee Flood Relief Channel has substantially alleviated the risk of flooding to properties in the Hertford to Hoddesdon area. The NRA has an ongoing programme of structural and operational maintenance on the Flood Relief Channel with current emphasis on the Stanstead and Hardmead Locks control structures.

The River Rib is subject to flooding in the rural areas but the Rib Flood Alleviation Scheme, implemented in the early 1980s, raised the level of protection given to Buntingford and Standon. On going flood defence maintenance of watercourses prevents any substantial deterioration in this situation and was a significant contributor to the low number of properties affected during the flooding in October 1993.

Properties along the River Quin valley are only threatened by the most severe flood events. Maintenance works here are concentrated on the conurbations of Hare Street and Braughing.

On the River Ash there is some history of flooding to Furneaux Pelham, including the brewery. Flood alleviation works have substantially alleviated the historic flooding problems at Little Hadham.

The significant flood history of the River Stort includes Clavering, Manuden, Bishop's Stortford, Spellbrook, Sawbridgeworth, Harlow and Roydon. Past flood defence works appear to have alleviated flooding in Bishop's Stortford and Spellbrook but the standard of protection given is under review.

Future Situation: Our reach specific Standards of Service will be developed and updated, incorporating current information on land use, maintenance activities and flood events. All Functions within the NRA will be involved in the fine tuning of a reach specific management programme and strategy to achieve specific flood defence standards within environmental constraints.

Repair works and improvements will continue to be made on the Lee Flood Relief Channel structures, especially at Stanstead and Hardmead.

As there are frequent significant flood events down the River Stort valley the standard of flood protection is being reviewed in a three stage programme. The investigation above Bishop's Stortford is now complete and the NRA will be seeking to implement the recommendations made, within resources available. The second stage of the review, covering Bishop's Stortford and Spellbrook, will start shortly.



KEY

	Watercourse	POTENTIAL FLOODING IMPACT ON GROUPS OF PROPERTIES			Flow Gauges	Scale (approx) 0 ————— 5 km
	Catchment Boundary		High		Areas Known to Have flooded	
	Urban area		Moderate		Reservoirs Listed Under 1975 Act	
			Low		Flood Defence Works Under Consideration	

SECTION 3 STATUS OF THE WATER ENVIRONMENT

The purpose of this section is to compare the current status or condition of the catchment (where it is now) with overall standards/targets (where they have been developed) in respect of water quality, water resources and physical features.

3.1 WATER QUALITY

Introduction

A principal aim of the NRA Water Quality Strategy (see Appendix 1) is to achieve a continuing improvement in the quality of rivers through the control of pollution. To achieve this aim, the NRA seeks to maintain waters that are already of high quality, to improve waters of poorer quality and to ensure all waters are of an appropriate quality for their agreed uses.

Water quality improvements cost money and in many cases it is the public who pay the bill for these improvements either directly or indirectly. It is important to compare the costs and benefits of any proposed improvements when deciding whether or not individual schemes should go ahead, and in assigning priorities.

Surface Waters

Chemical River Quality Monitoring

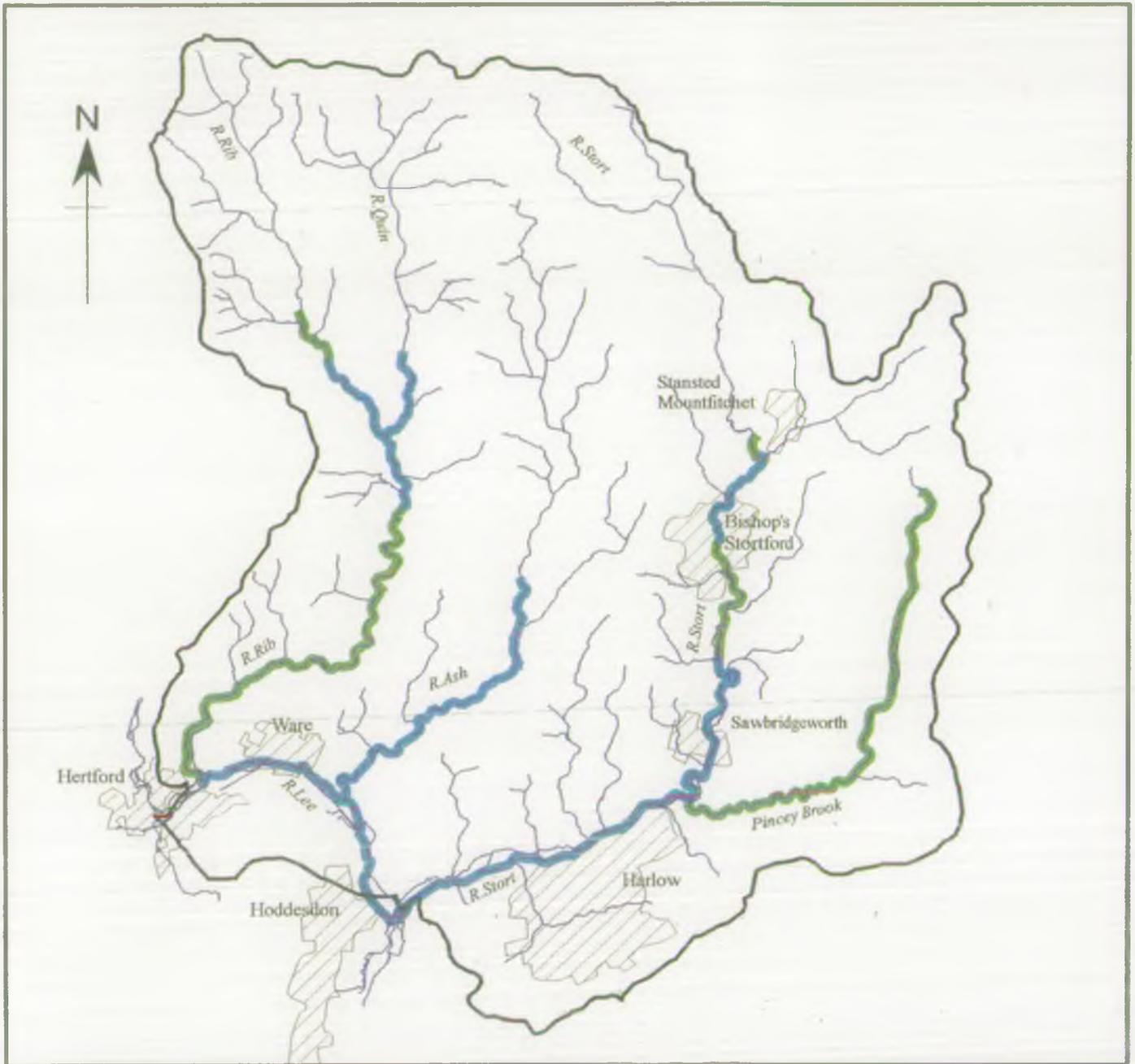
The NRA uses a range of chemical and biological techniques to assess water quality in our rivers. Until recently, the quality of individual lengths of rivers have been reported according to a classification scheme devised by the former National Water Council (NWC). In this scheme, rivers were assigned to one of six classes from Good to Bad based principally on a knowledge of the biochemical oxygen demand (BOD) and the concentrations of dissolved oxygen (DO) and ammonia. A number of problems with the application of the NWC scheme have been identified and it has recently been replaced by a new scheme called the General Quality Assessment (GQA). This consists of a number of separate water quality assessments, each providing a separate "window", through which water quality can be viewed. The first of these "windows" to be developed is the chemical component. Details of this chemical component are given in Appendix III. It is intended that further "windows" will be added, covering biology, nutrients and aesthetic quality, but this will depend on the successful development of suitable methods and classification systems.

The current GQA chemical quality of rivers in the Middle Lee catchment is given on the map opposite. This shows the rivers in this catchment to be predominantly of grade B (good quality), with some reaches of the Rivers Rib and Stort being of grade C (fair quality).

Water Quality Objectives

Since the late 1970s, river quality has been judged against statutory and non-statutory water quality objectives. These provide targets for both maintaining current quality and for planning for water quality improvements. The statutory water quality objectives are those specified in European Commission Directives. The non-statutory water quality objectives are the river quality objectives (RQOs), based on the NWC Classification.

Our rivers are divided into reaches. Water quality objectives are set for each reach to ensure that the water is of sufficient quality to meet agreed uses (e.g. water should be of a standard suitable to support a Salmonid fishery). Whether or not a reach passes its objectives is determined by assessing compliance with sets of chemical standards formulated for each objective. River water samples are collected periodically for this purpose at designated sampling sites within each reach.



KEY

	Watercourse	General Quality Assessment (1991 - 1993)			
	Catchment Boundary		Class B		Scale (approx) 0 ————— 5 km
	Urban area		Class C		

3.1 WATER QUALITY

Statutory Water Quality Objectives

The Water Resources Act 1991, allows the government to set Statutory Water Quality Objectives (SWQOs). These will replace the RQOs. Five uses have been proposed for rivers (River Ecosystem; Special Ecosystem; Abstraction for Potable Supply; Industrial or Agricultural Abstraction; and, Water Sport Activity) and to date regulations have been produced for the River Ecosystem (RE) use. Five classes have been established within this use, and are shown in the following table.

Class	Description
Class RE1	Water of very good quality suitable for all fish species.
Class RE2	Water of good quality suitable for all fish species.
Class RE3	Water of fair quality suitable for high class coarse fish populations.
Class RE4	Water of fair quality suitable for coarse fish populations.
Class RE5	Water of poor water quality which is likely to limit coarse fish populations.
Unclassified	Water of bad quality in which fish are unlikely to be present or insufficient data available by which to classify water quality.

Chemical standards have been derived for each of these classes and details of these standards are given in Appendix III.

Implementation of these regulations is still awaited from government. In the interim period, the current RQOs have been directly translated into provisional water quality objectives (PWQOs) and targets for water quality improvements have also been derived, again expressed as PWQOs.

Provisional Water Quality Objectives

The PWQOs for river reaches in the catchment are given on the map opposite. Fifteen of the 17 reaches in this catchment complied with their PWQOs for the 3 year period, 1991-1993. However, the reach of the River Stort from Hazel End to the Stansted Brook and the reach on the Stort Navigation from the Great Hallingbury Brook to the Spell Brook both failed to meet the required standards for dissolved oxygen during the 3 year period 1991-1993. These failures were likely to be due to low river flows, increasing the retention time of biodegradable material, increasing the temperature and thus the rate of biodegradation and providing less water for dilution. However, it is proposed to further investigate the nature of the problems.



KEY

	Watercourse	Provisional Water Quality Objectives : River Ecosystem Class		
	Catchment Boundary	RE2	RE3	Scale (approx) 0 ————— 5 km
	Urban Area			

3.1 WATER QUALITY

EC Directives

The EC Directive on the Quality of Fresh Waters Needing Protection or Improvement to Support Fish Life (78/659/EEC)

Nearly all the main river reaches in this catchment have been designated under this directive as being capable of supporting either cyprinid (i.e. coarse fish) or salmonid (i.e. Salmon and Trout) fish populations. Thirteen of the 17 water quality reaches are designated as cyprinid fisheries and 2 as salmonid fisheries. The remaining 2 reaches are not currently designated. The reaches and their designations are shown on the map opposite. All 15 of the designated reaches passed the water quality standards given in the directive for the 3 year period 1991-1993. The 2 remaining reaches in this catchment are being recommended by the NRA, Thames Region for designation by the Department of the Environment as cyprinid fisheries. This should help to ensure that the current water quality in these reaches is maintained.

The EC Directive on Pollution caused by certain Dangerous Substances discharged into the Aquatic Environment of the Community (76/464/EEC)

This directive is concerned with reducing pollution caused by substances known to be particularly hazardous to aquatic life. The substances which come under the control of the directive have been selected mainly on the basis of their toxicity, persistence and potential to accumulate in biological organisms. The substances include specific organic compounds such as pesticides and solvents, and specific metals.

The discharge consent from Bishop's Stortford sewage treatment works contains a limit on the concentration of cadmium in the discharge. The concentration of cadmium is also determined in the Great Hallingbury Brook above its confluence with the River Stort. Neither the consent condition nor the environmental quality standard for the receiving water were exceeded in any of the samples taken in the 3 year period 1991-1993.

Biological River Quality Monitoring

The health of rivers is reflected in the variety and abundance of animal and plant life that they support. The NRA routinely monitors the macroinvertebrate life in rivers and streams at a network of biological sampling points. Aquatic macroinvertebrates are small animals which are visible by eye. They are relatively immobile and so are continuously exposed to changes in water quality. A pollution incident may cause an identifiable change in the macroinvertebrates present at a site for many months. For this reason biological monitoring provides a useful measurement of water quality, since it takes into account the effects of intermittent of pollution which may remain undetected by standard chemical methods. Long term trends in biological river quality can also be shown.

The biological quality of a site is shown by the number of different macroinvertebrate taxa present and by their individual susceptibility to pollution. This is measured by using the Biological Monitoring Working Party (BMWP) score system. BMWP scores above 100 generally indicate good diversity whilst scores below 20 occur at the most polluted sites. The most natural rivers and streams in this area frequently achieve BMWP scores in excess of 150. The Average Score Per Taxa (ASPT) is a useful summary measure of the balance between pollution-tolerant and pollution-sensitive taxa in a sample. ASPTs below 3.00 arise when only highly tolerant families are present



KEY

	Watercourse		EC Surface Water Abstraction - New Gauge	Water Quality - EC Freshwater Fisheries Directive		<p>Scale (approx)</p>
	Catchment Boundary		EC Dangerous Substance Monitoring Point		Salmonid	
	Urban area	1. Bishop's Stortford STW 2. Great Hallingbury Brook			Cyprinid	

3.1 WATER QUALITY

(very poor water quality) whilst ASPTs above 5.00 indicate a more even spread of taxa - as expected if water quality is not a limiting factor. Marked differences in BMWP score which are corroborated by a change in ASPT are particularly strong evidence of water quality changes.

Current Biological Status

The average BMWP scores obtained at sampling sites during 1991-93 is represented on the map opposite. Appendix III includes further details of the results.

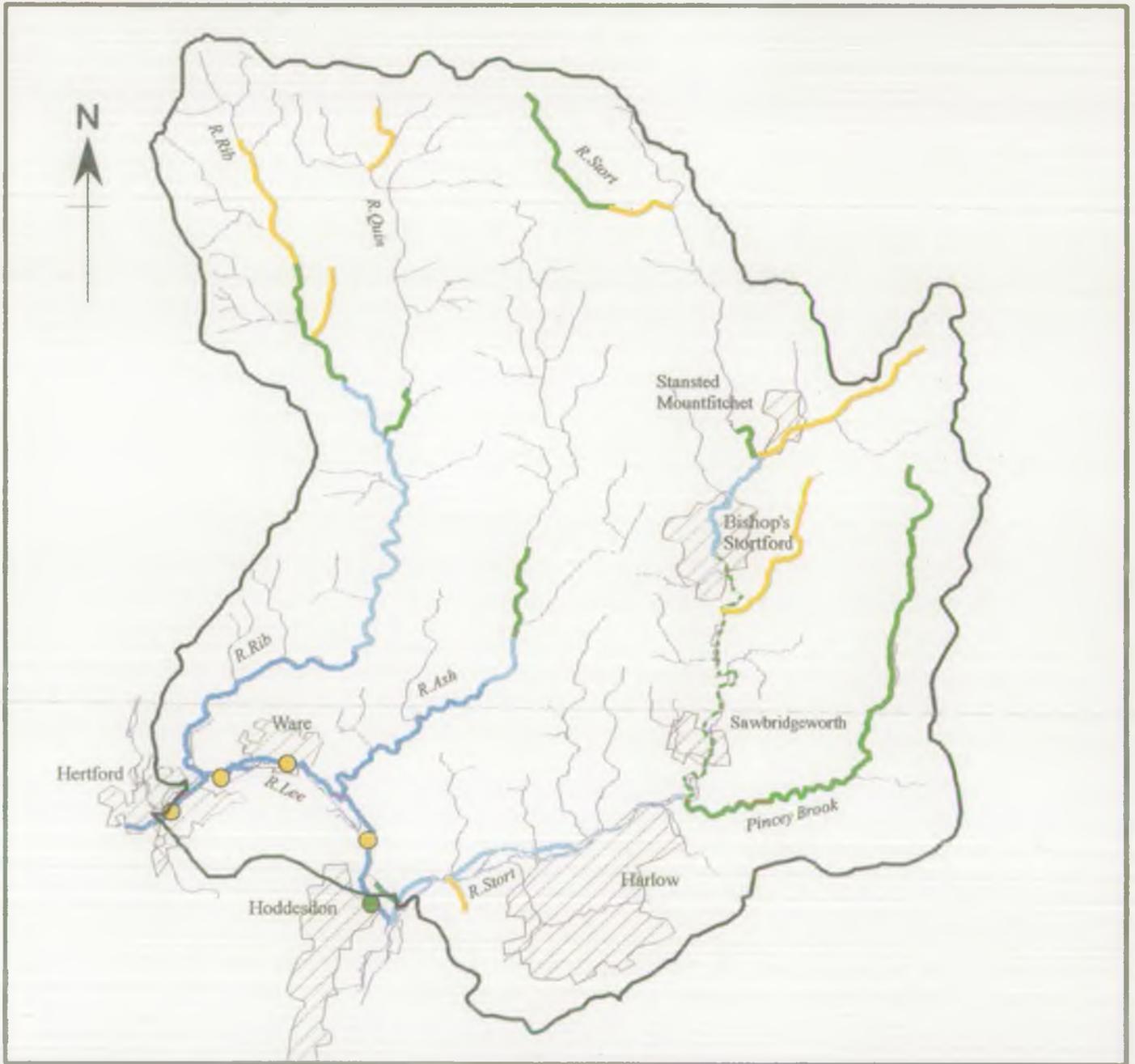
A relatively small proportion of watercourse length was found to be of poor biological river quality. This included the upper reaches of the principal watercourses (Rivers Rib, Quin and Stort) and several headwater streams. River flow in these naturally intermittent "bourne" (see Section 2.6) reaches ceased completely throughout 1990-1992. Water quality limitations were most evident in the Great Hallingbury, Roydon and Stansted Brooks.

The biological river quality of the Rivers Rib and Ash improves steadily downstream, their lower reaches supporting exceptionally diverse groups of macroinvertebrates. Many pollution-sensitive mayflies, caddisflies and stoneflies exist here. BMWP scores are also high in parts of the Rivers Lee (Amwell Magna) and Stort (above Roydon) and in all these waters, BMWP scores are amongst the top 5-10% nationally. Further sampling and identification to species level, however, is still necessary.

Elsewhere on the Rivers Stort and Lee, canalisation has led to the loss of habitats and has reduced potential BMWP scores. However, a good diversity of macroinvertebrates can be found where any marginal vegetation exists. Good examples are in Stanstead Mill Stream and parts of the Stort Navigation. Species of water bugs, water beetles and dragonflies characteristic of stillwaters are locally abundant.

Parts of the Stort and Lee Navigations have some rare deepwater flora. The water quality of these sites is best assessed using an alternative biological technique known as CHEAT (Chironomid Exuviae Assessment Technique) which considers the species composition of midge assemblages. There are over 600 species of midge in the UK, with a range of sensitivities to pollution.

BMWP scores in several sections of watercourse exhibit slight water quality limitations as a result of STW discharges. Below Buntingford STW (River Rib) and Braughing STW (River Quin) there is extensive growth of filamentous algae characteristic of nutrient enrichment and BMWP scores tend to fluctuate widely. Other STWs which may cause localised reductions in biological river quality, or effects upon plant growth, include Stansted Mountfitchet and Bishop's Stortford STW. An assessment of the effects of STW discharges upon the variety and abundance of plant growth within receiving waters, will be made during the period 1994-96. This work will contribute towards Region-wide testing of a new assessment protocol and the acquisition of baseline information necessary for formal designation of "Eutrophic Sensitive Areas" in connection with the European Commission Urban Wastewater Treatment Directive (UWWTD).



KEY

	Watercourse	BMWP CATEGORIES (Dashed Line Denotes Navigation)				Bacteriological Quality (Presumptive Geometric Mean for E.coli / 100ml)	
	Catchment Boundary		A (Very Good) 151 +		C (Fair) 51 - 100		less than 100
	Urban Areas		B (Good) 101 - 150		D (Poor) 21 - 50		100 to 2000
						Scale (approx) 0 ————— 5 km	

3.1 WATER QUALITY

Bacteriological Status

Bacteriological sampling is carried out at intervals to determine concentrations of human and animal faecal contamination. The micro-organism *E. Coli* present in sewage, is used to determine the concentrations of faecal contamination in waterbodies. Samples are taken four times per year at designated points, and a geometric mean of these is calculated. Current sampling points and their average score over the year are illustrated on the map opposite. Samples taken on the River Lee show all sites to have scores of below 2000 *E. coli*/100mls indicating very low levels of bacteria present.

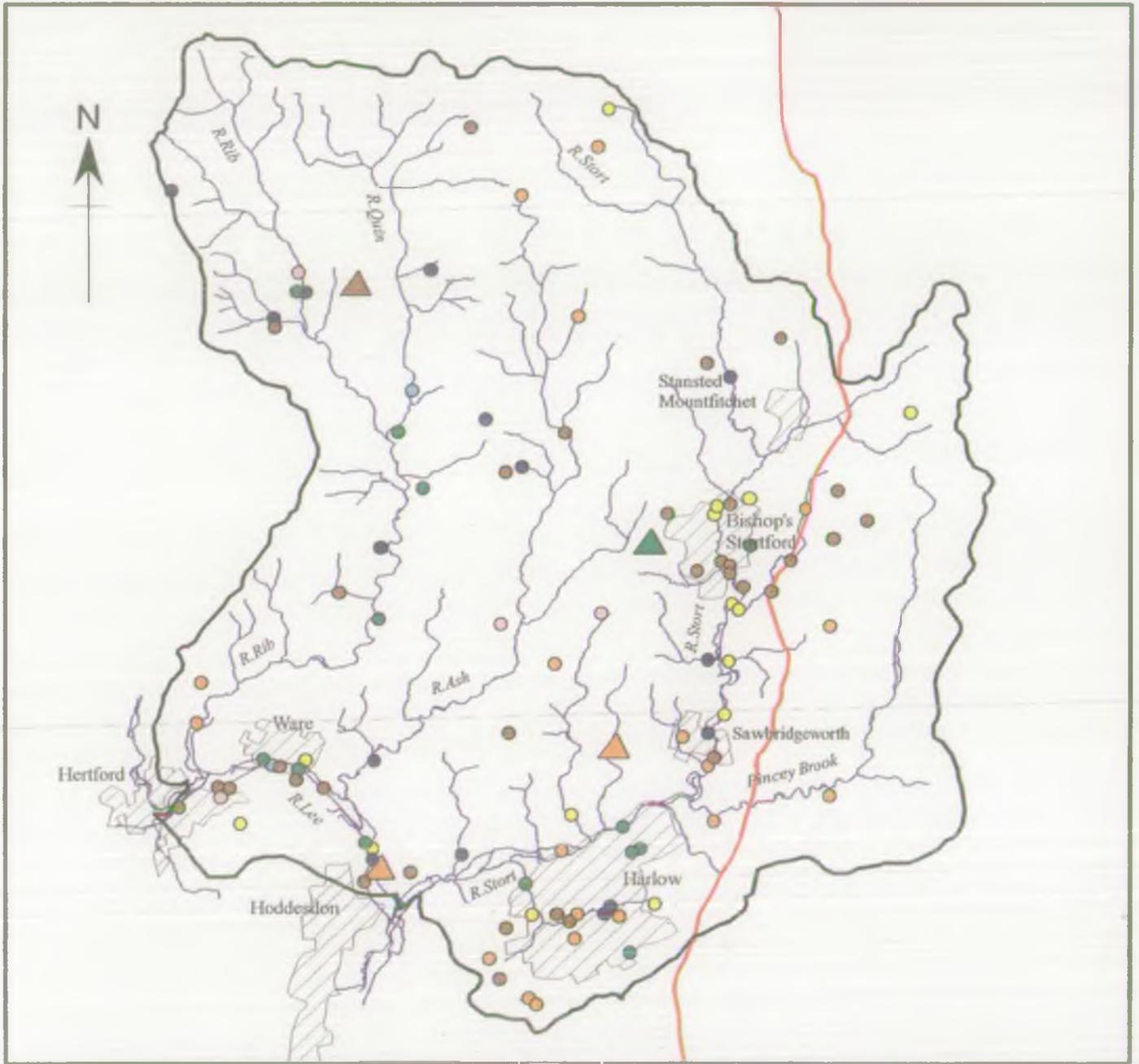
Nutrient Status

Nutrient status is a natural influence on plant growth. However, in excess, nitrogen and phosphorus may give rise to algal blooms. The majority of nutrients enter watercourses either as point sources in the form of effluents from sewage treatment works or as diffuse sources such as inputs from farming activities.

The occurrence of high levels of blue-green algae has been confirmed in some still-waters in recent years. However, catchments bordering the Middle Lee have a much higher incidence, and effort is needed to protect this catchment.

Pollution Incidents

The annual number of recorded incidents in the total catchment has been relatively stable in recent years. Sixty to eighty per cent of reported incidents occur within the River Stort sub-catchment reflecting its size and the presence of the urban and industrial conurbations at Harlow, Bishop's Stortford and Stansted Airport. In the 12 months to 31 May 1994, however, there was a 30 per cent reduction in the reported incidents in the River Stort sub-catchment compared to the previous period resulting from the NRA's pollution prevention activities within that area. An increase in pollution incidents in the River Lee sub-catchment may reflect greater awareness and reporting but requires close attention to see whether particular trends are indicated. NRA continues to place the highest priority on attending and dealing with pollution incidents.



KEY

	Watercourse	POLLUTION INCIDENTS (JUNE 1993 - MAY 1994)		Colour indicates type of pollution incident			Agricultural
	Catchment Boundary		Significant Incident		Oil		General
	Urban area		Minor Incident		Sewage		Not Known
	Motorway				Chemical	Scale (approx) 0 5 km	
					Natural		

3.1 WATER QUALITY

Groundwaters

The catchment is largely rural with urban areas such as Harlow, Hertford and Ware concentrated to the south of the catchment. Chalk outcrop is limited within these urban areas, so their potential effects on groundwater quality are reduced.

Rural areas are largely unsewered though the impact of septic tanks on groundwater quality is considered negligible in this catchment. Groundwater flow does not necessarily follow the direction of surface water flow and this is dramatically illustrated by occasional groundwater deterioration in public water supply abstraction boreholes situated along the northern New River water supply channel (between Hertford and Hoddesdon). A system of chalk fissures are known to transmit groundwater from the Mimms Hall Brook catchment near Water End and Hatfield via swallow holes. Protective measures, some distance from the Middle Lee catchment, are therefore needed to maintain groundwater quality at these public supply sites.

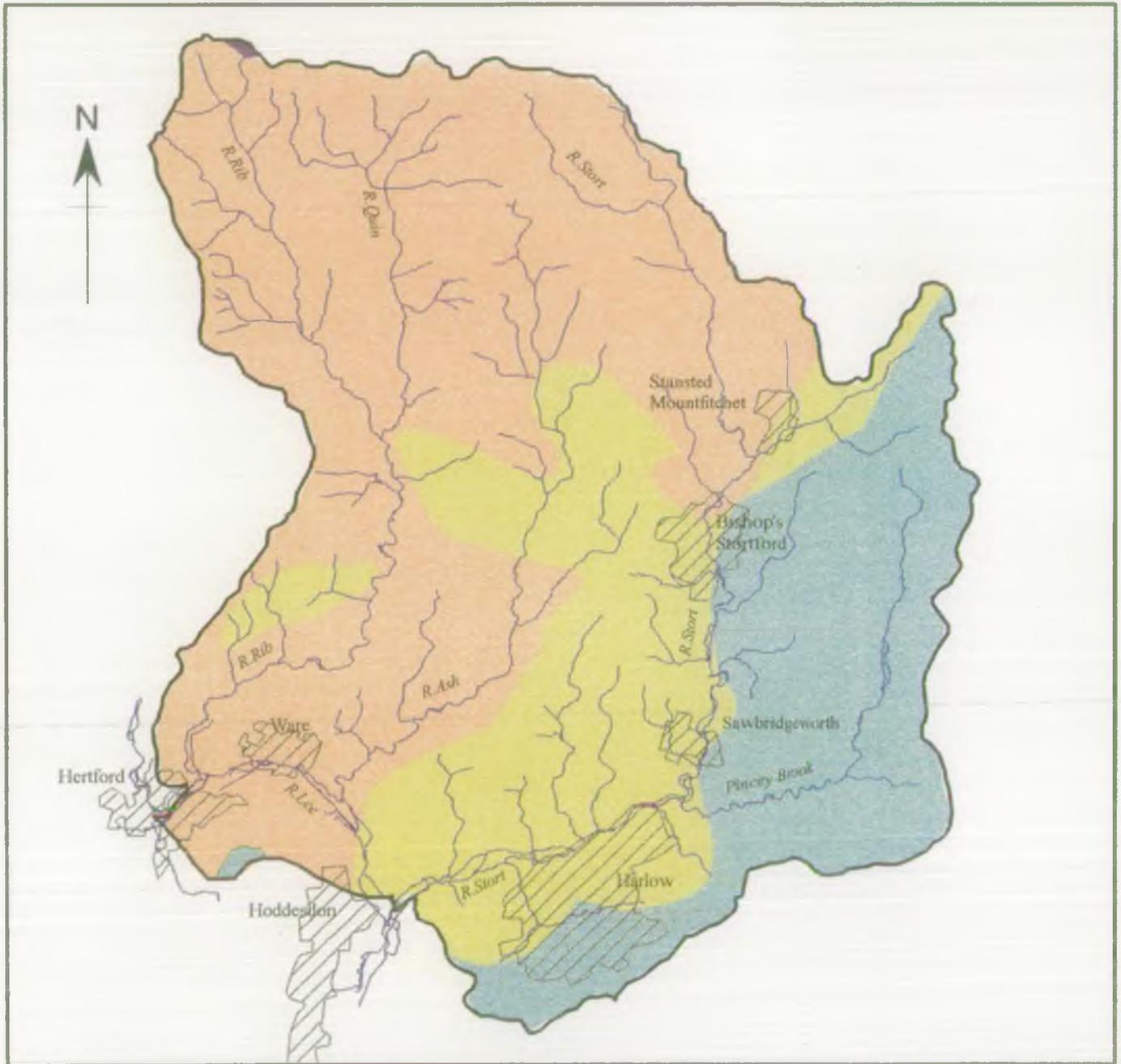
Mineral extraction and associated landfilling has occurred along the River Stort valley at Harlow and along the River Lee valley at Hertford and Ware. Waste disposal sites that have taken putrescible waste may generate leachate which would pose a risk to groundwater. There is little evidence at present to suggest anything other than localised effects around sites in this catchment though further monitoring and assessment at sites is required.

Groundwater within the catchment is generally of very good quality and several public water supply abstraction points are sited in the catchment, mostly along the river valleys.

Our document "The Policy and Practice for the Protection of Groundwater" (PPPG) sets out the NRA's approach to the concept of vulnerability of groundwater to pollution. This includes the definition of protection zones around key boreholes and the classification of aquifers depending on their vulnerability (see map opposite). It also specifies contaminative activities requiring high standards of control. Certain controls are available to the NRA and local authorities who can play a major role in influencing the location of development which may pose a risk to groundwater. The vulnerability of groundwater towards pollutants is dependent on the presence and nature of the overlying soils (see Section 2.5) and Drift deposits, the geology (see Section 2.4) and the depth to the water table. In accordance with the NRA's PPPG, 1:100,000 scale maps showing groundwater vulnerability are being produced which take account of these factors (but excluding depth to water table). These maps and their accompanying user-manuals are scheduled for completion, covering the UK, by the middle of 1996.

A 1:1,000,000 scale vulnerability map has been enlarged and reproduced for this catchment (see opposite). Only general categories of vulnerability in the area, therefore, are shown. The map in its present form can only give a general indication and may bear little resemblance to the map ultimately produced. Nevertheless, the principles outlined above constitute the basis of information upon which resource protection measures are applied by the NRA.

A comprehensive NRA monitoring network is currently being established to enhance groundwater quality evaluation and will be complemented with site specific initiatives to tackle specific groundwater problems.



KEY

	Watercourse	Groundwater Vulnerability Classification			
	Catchment Boundary		Major Aquifer (High Vulnerability Soil)		Minor Aquifer
	Urban area		Major Aquifer (Intermed. Vulnerability Soil)		Non - Aquifer
					Scale (approx)
					0 ————— 5 km

3.2 WATER RESOURCES

NRA Policy

Proper use of water resources includes meeting not only the legitimate demands of abstractors but also the important demands of aquatic life within the river system itself. In carrying out our water resources activities we have to meet our general duties for environmental conservation and have particular regard to the statutory obligations of the water undertakers (primarily Three Valleys Water in this catchment) to provide water supplies to domestic and industrial customers. The NRA Water Resources Strategy (*Water, Nature's Precious Resource*) was published in March 1994 as an environmentally sustainable Water Resources Development Strategy for England and Wales. In June of this year "Future Water Resources in the Thames Region" was also published. This provides a regional focus on the issues raised by the national review, reflecting current views of water resources in the Region and providing a strategy for the sustainable management of the region's resources to meet future demands. Demand management measures such as leakage control, metering and water efficiency were described as well as the problems in forecasting future demand. The report also shows the whole catchment subject to a possible local deficit by 2021 in times of peak demand if the high demand scenario is realistic.

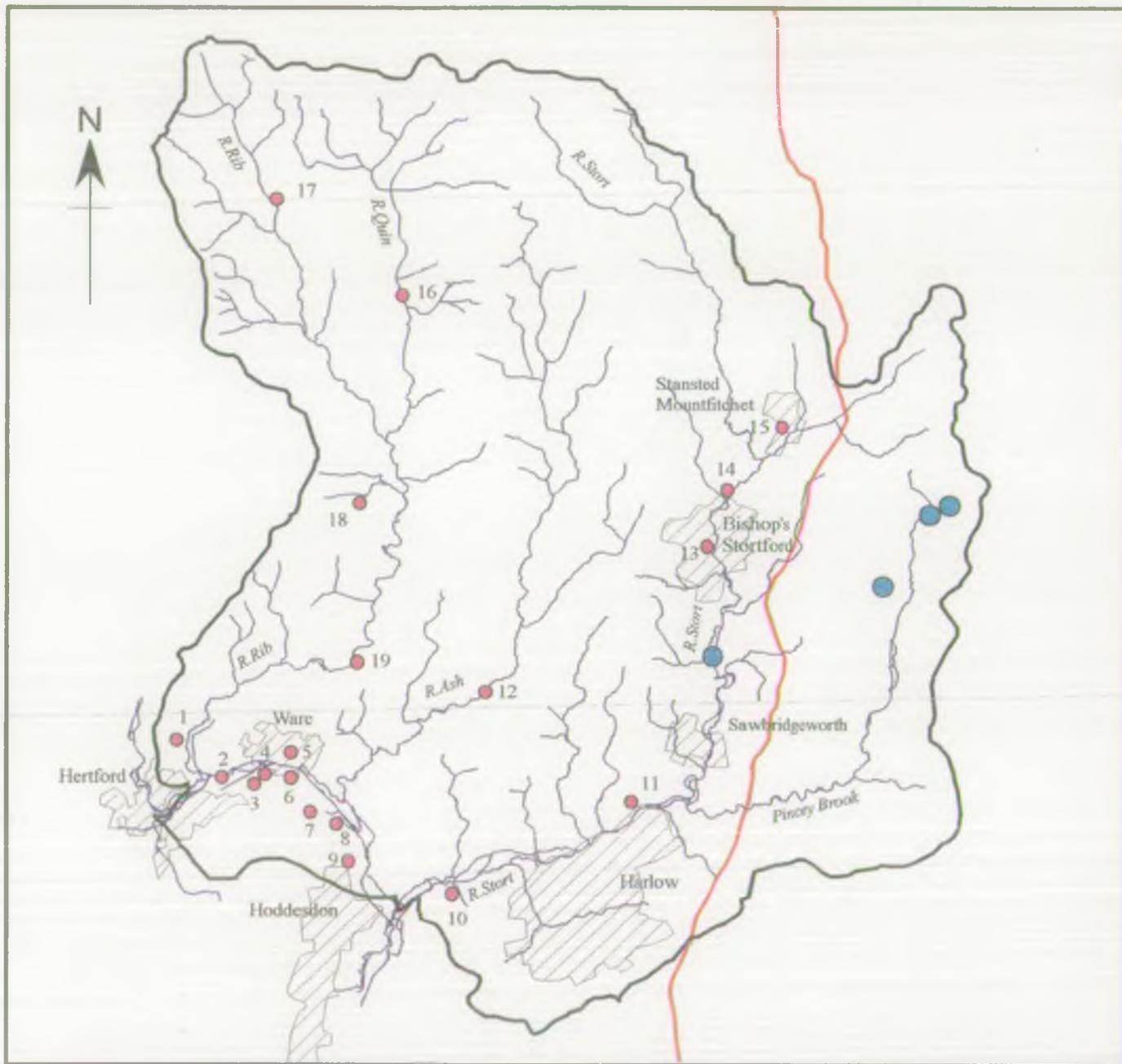
Demand is high in the Thames Region as it supports a fifth of the nation's population. The Water Resources Strategy also looked at the long term possibility of water transfer to the Region from other parts of England and Wales, and the environmental implications of doing so.

Abstraction Licensing Policy

Our Licensing Policy (see Appendix III) sets down a framework of principles against which individual applications for a licence can be considered. These principles reflect the relevant legislation, the Water Resources Act 1991, and make a distinction between consumptive abstractions (i.e. water is not returned to the source of supply immediately) and non-consumptive abstractions (e.g. gravel washing where water is returned close to the point of abstraction). For consumptive uses (eg spray irrigation, public water supply) future licences which are considered acceptable will often have constraints applied to them.

For new licences:

- Unconstrained abstractions from rivers from April to October will not be allowed
- Abstractions from rivers will be prohibited during periods of low flow
- Abstractions from confined aquifers will be time-limited to review dates at 5 or 10 year intervals and will be prohibited during periods of low groundwater levels
- Abstractions from unconfined aquifers will also be prohibited during periods of low flows.



KEY

	Watercourse	LICENCED WATER ABSTRACTIONS:			Reservoirs (listed under 1975 Act).
	Catchment Boundary			1. Wadesmill Road, Bengoe 2. New Gauge, Hertford 3. Chadwell 42 Ring, Ware 4. Broadmead Near Chadwell 5. Musley Lane, Ware 6. Amwell End, London Rd. Ware 7. Amwell Hill Near Ware 8. Amwell Marsh 9. Rye Common Well, St. Margarets	10. Roydon 11. Redbrick Lane, Sawbridgeworth 12. Hadham Mill Near Widford 13. The Cauneway, Bishop's Stortford 14. North Stortford Pumping Station 15. Stansted Mountfitchet Pumping Stn. 16. Worsted Lane Pumping Station 17. Chipping Pumping Station 18. Standon Pumping Station 19. Thuntridge Pumping Station
	Urban area	Scale (approx) 0 ————— 5 km			
	Motorway				
	Public Water Supply				

3.2 WATER RESOURCES

Specific Targets

Formal targets or standards for water resource management have not been set for the catchment although the Water Resources Act 1991 does make provisions for the setting of statutory "minimum acceptable flows". However, "Q95" flows (i.e. those flows that are exceeded for 95% of the time) are used informally by us to help set discharge consents and assess abstraction licence requests. These "Q95" flows are used to constrain new abstractions since when flows drop below this value or similar flow/level criteria then abstractions must cease. The "Q95" flow is much less than the average or map mean flow of a river. Values for key sites are shown on the following table.

	RIVERRIB WADESMILL	RIVERASH MARDOCK	RIVER STORT	RIVERLEE FEILDESWEIR
Q95 flow	11.7	5.4	12.3	50.4
Mean flow	45	26	111	381
groundwater	23	54	18	34
surface water	63	33	71	47
effluent	14	13	11	19

Notes: All flows in Ml/d

Figures for Feildes Weir relate to the total flow there, including contributions from the Rivers Lee, Mimram and Beane upstream of the catchment

Low River Flows

The NRA is committed to a national programme of alleviating situations of low flow in rivers, where it can be demonstrated that existing abstractions are a major contributory factor. As a means of establishing whether particular rivers are experiencing man-made problems (as opposed to effects of natural drought) the NRA has developed a scoring system which draws on the evidence of changes in hydrology, fisheries, amenity value and water quality, as well as abstraction records. In this way we can target our efforts at the most severe cases first and can also identify those rivers which are behaving naturally.

In the Middle Lee catchment the NRA is proposing to carry out an assessment of the River Stort which has been the subject of some comment in recent years and increasing public concern. It is important to stress that, at this stage, it is not possible to say either that there is a genuine problem or that the NRA would propose to implement an alleviation scheme.

In cases where a legitimate case has been established (like the River Ver in Hertfordshire) it has taken many years and has cost millions of pounds to develop and implement a solution.



3.3 PHYSICAL FEATURES

Flood Defence

Flood Warning: We set ourselves the target of issuing warnings of potential flooding to the Police at least 4 hours in advance in rural areas and 2 hours in urban areas. A need for additional telemetered river level monitors has been identified on the River Stort between Bishop's Stortford and Roydon, on the upstream end of the Pincey Brook and on the River Rib upstream of Standon.

Flood Alleviation: "Standards of Service for Urban and Rural Flood Defence" is a system prepared by us to assess appropriate standards of service and to plan for providing a consistent approach towards service provision. A key feature of the system is that it relates flood defence standards of service to current land use in the floodplain. As land use varies so therefore do customer interests and the requirements for flood defence and land drainage. Different land uses have been brought together into five land use bands which range from A (heavily urbanised) to E (unintensive agriculture). Each land use band has a "target range" of service levels. Within the catchment the main river system has been divided into a number of reaches which are described in Appendix III and shown on the map opposite.

This system depends on an appropriate length of historic data to be fully effective and since the system has only recently been introduced the relevant amount of data has not been collected. The actual standard of service therefore, cannot yet be assessed.

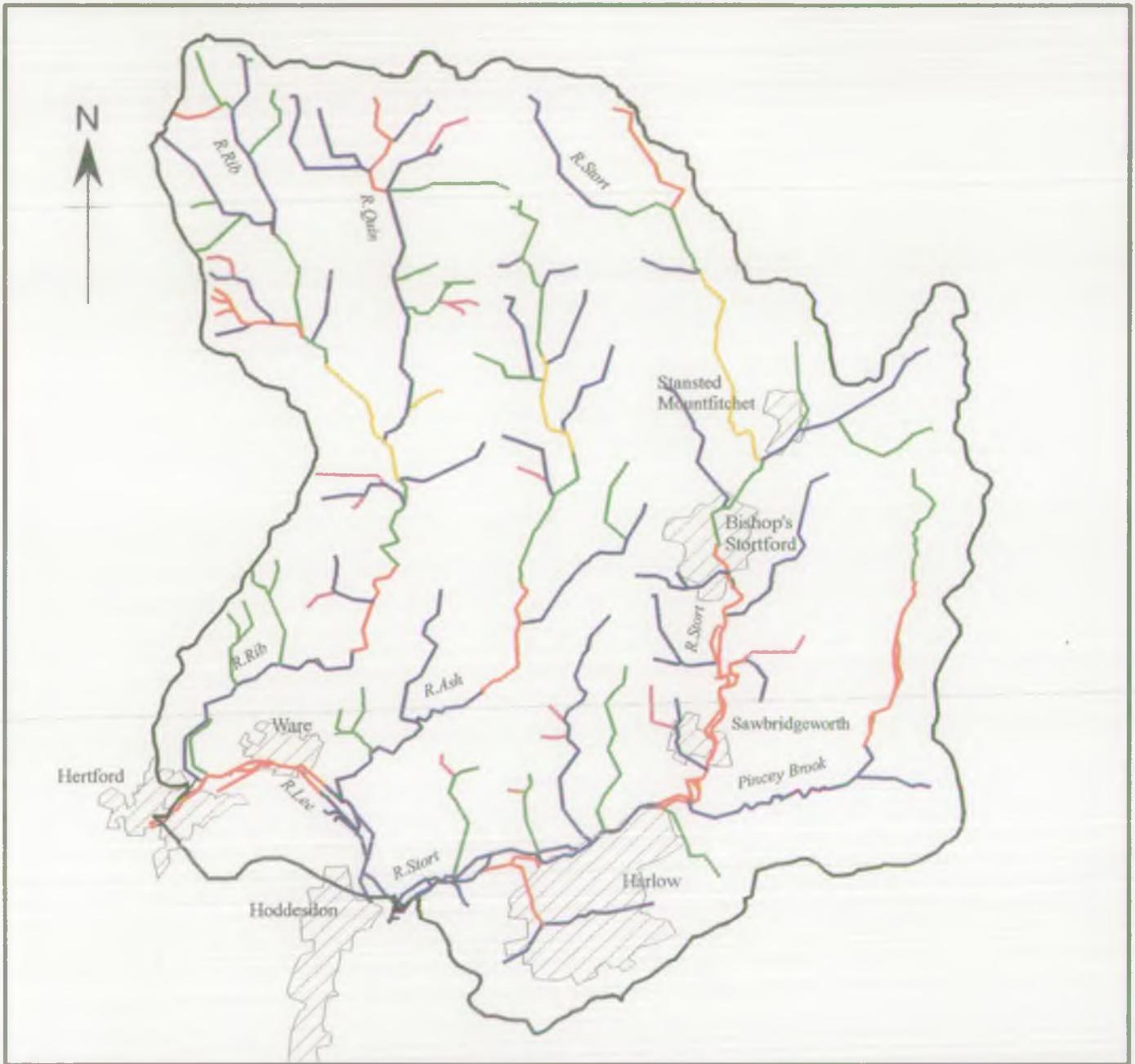
A number of site specific problems were highlighted in Section 2.18. These will be tackled through a range of capital schemes and maintenance projects where the benefits of such work (e.g. reduced flood damages) can be shown to exceed costs.

Floodplain and River Control: It is preferable to prevent flooding problems arising rather than to solve them later. The relevant authority for controlling development in the floodplain is not, however, the NRA, but the local planning authority. We have recently adopted a Non-Tidal Floodplain Policy and are working with local planning authorities to ensure its implementation. The purpose of this policy is to protect the catchment's flood storage areas and routes, as defined by the 1 in 100 year flood event, from new development. Hydraulic studies we have completed and propose undertaking will help us identify the areas covered by this policy.

This approach is detailed further in Department of the Environment Circular 30/92 which encourages local planning authorities and the NRA to liaise closely on flooding and surface water run-off matters. The aim is to ensure that the flood defence risks of development are an integral part of the decision making process undertaken by local planning authorities on relevant planning applications. In this respect, the NRA has a responsibility to prepare Section 105 surveys to define the nature and extent of flood risks. The preparation of such surveys is the subject of a recent Memorandum of Understanding between representatives of the local planning authorities and the NRA.

Riverine and Water Dependent Conservation Features

The status of the physical structure of the river bed, banks, margins and floodplain and other water dependent habitats can in part be assessed through an evaluation of their capability to support a range of habitats typical of rivers with similar characteristics (e.g. flow, geology, historic management). Survey data can be used to monitor changes in the status. No overall set of standards/targets currently exist for this area of concern. We are undertaking research to formulate



KEY

	Watercourse	Land Use Bands and Target Standards of Service for Flood Plain Areas			Unclassified	
	Catchment Boundary		A = (1 in 50 Years on Average)			
	Urban area		B = (1 in 20 Years on Average)			
			C = (1 in 10 Years on Average)			Scale (approx) 0 ————— 5 km
			E = (3 Times a Year on Average)			

3.3 PHYSICAL FEATURES

Conservation features continued:

a general environmental classification system for river corridors which can be used regularly to identify changes in the health of the river and its adjacent areas.

The lack of comprehensive baseline data on the status of the water environment in respect of river morphology and landscape, and to a lesser extent fisheries and ecology precludes a complete assessment of status at this stage. However, interpretation of fisheries survey data, biological monitoring results (which reflect in part habitat quality; see Section 3.1 also), ecological and morphological surveys and landscape assessments do provide an indication of some of the areas of value as well as particular concerns.

Landscape

The NRA have not undertaken any detailed landscape assessment of river corridors in this catchment. However, an outline appraisal of the River Stort and its tributaries was undertaken in 1990. This survey characterised the landscape and provided quality assessments. The key features of the survey are as follows:

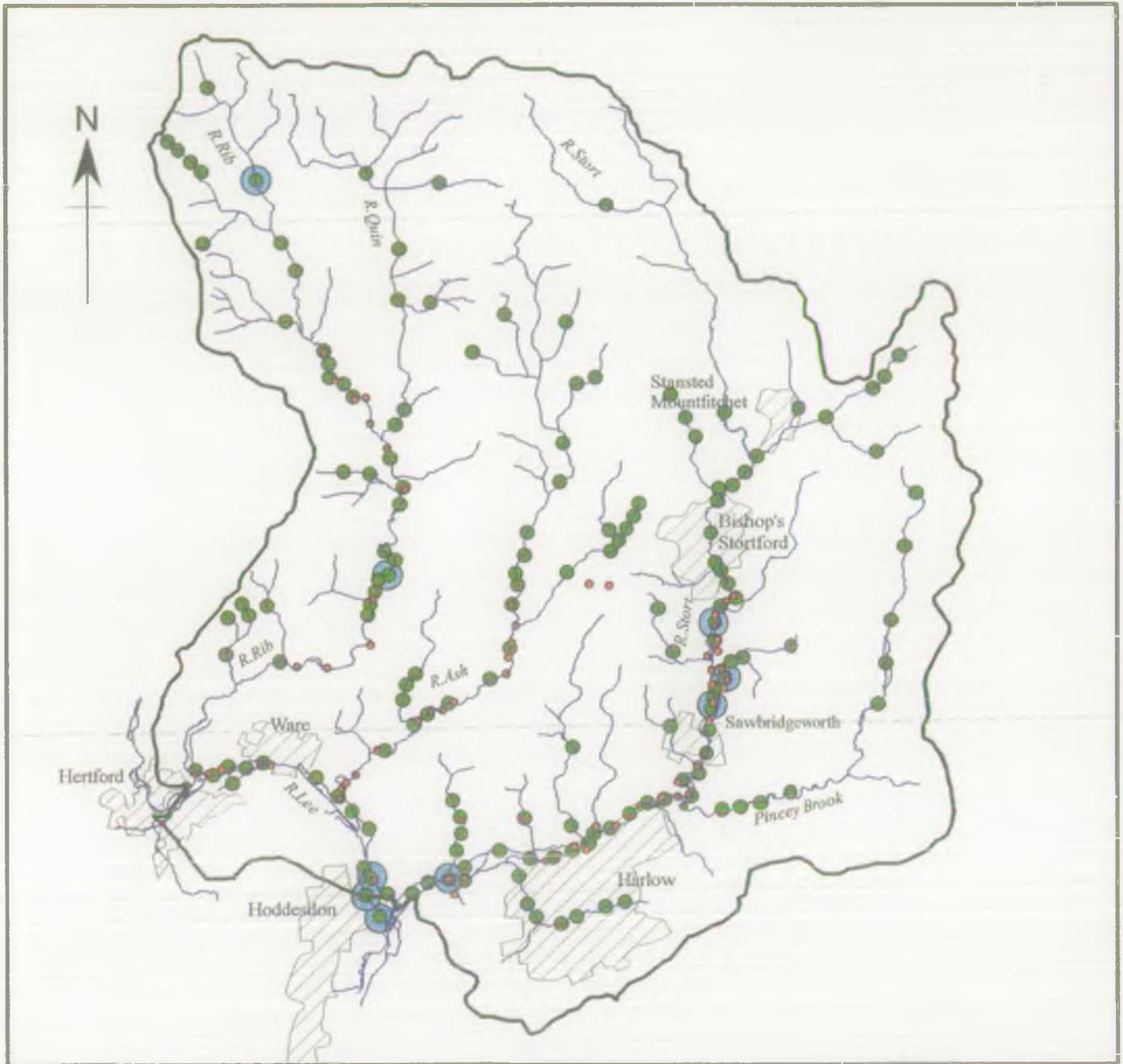
Landscape Character: Five broad zones covering the river valleys were identified: open arable landscape (most of the tributaries); wooded tributary valleys (e.g. parts of Pincey Brook, Parndon Brook, Hunsdon Brook, Fiddler's Brook); upper main River Stort (confluence of Stansted Brook to Bishop's Stortford); middle River Stort (Bishop's Stortford to Harlow); and, lower River Stort (Harlow to Feildes Weir).

Landscape Value: Each landscape character zone covers a considerable area and there tend to be significant variations in the landscape quality of particular reaches. Four classes were used in the survey: Class 1 - Prime River Landscape with Natural Features; Class 2 - Generally Good River Landscape; Class 3 - Average River Landscape with Few Intrusions; and, Class 4 - Poor Quality River Landscape. These classes apply in a national context and no Class 1 reaches were identified in the River Stort catchment. Significant parts of the River Stort and its tributaries did, however, fall into the Class 2 category indicating the presence of many natural features worthy of protection. Class 4 landscapes were found in Clavering, Bishop's Stortford south of the town centre, on parts of the Great Hallingbury Brook and on the lower section of the Sawbridgeworth Brook. These reaches offer opportunities for enhancement.

A detailed Landscape Assessment of the river corridors of the Middle Lee catchment is to be carried out by the NRA during 1995/96.

Ecology

Habitat surveys of the River Stort and its tributaries were undertaken in 1990 and 1991. Similar surveys on the River Lee within the catchment and the River Ash have recently been completed. The River Rib is due to be surveyed in 1995. However some habitat data is available for the catchment and these are shown on pages 69 and 71. These surveys concentrate on describing the vegetation of the river banks, channel and adjacent habitats in accordance with a standard NRA methodology (River Corridor Surveys, Conservation Technical Handbook 1, 1992). A number of categories are used including critical and important habitats. These are described overleaf:



KEY

	Watercourse			RIPARIAN HABITATS		Scale (approx)
	Catchment Boundary				Important Riparian Habitat	
	Urban area		Potential Otter Habitat sites		Critical Riparian Habitat	

3.3 PHYSICAL FEATURES

Critical Habitats: These habitats are dependent on the river and are thought to be extremely vulnerable to damage by a lowering of water levels. Habitat types in this category are: unimproved neutral floodplain grasslands, marshy grassland, swamp, fen, carr and bogs.

Important Habitats: These habitats are not necessarily associated with the river channel and are less affected by changes to the river or its water level. Damage to these areas is liable to occur as an incidental effect of river engineering work. Features in this category include any habitat which is of conservation interest and is not dependant on a high water table, for example: ancient or semi-natural woodlands, heathland and species-rich grassland.

The map on the previous page highlights the location of in-stream habitats whilst the map opposite highlights riparian habitats in the above categories.

The River Stort habitat survey, however, also included an assessment of the wider water related environmental resources of the catchment, notably the wetland habitats in the lower River Stort valley.

Complementing these river corridor surveys of vegetation are surveys undertaken for the Hertfordshire Otter Habitat Project sponsored by British Telecom, Herts and Middlesex Wildlife Trust and the NRA in 1992 and 1993. Phase I of this project reviewed the status of potential Otter habitat in the country whilst Phase II looked at broader issues affecting the re-establishment of Otters in the county. The map opposite highlights the distribution of sites with the potential to be improved or managed as Otter habitat sites.

Biological

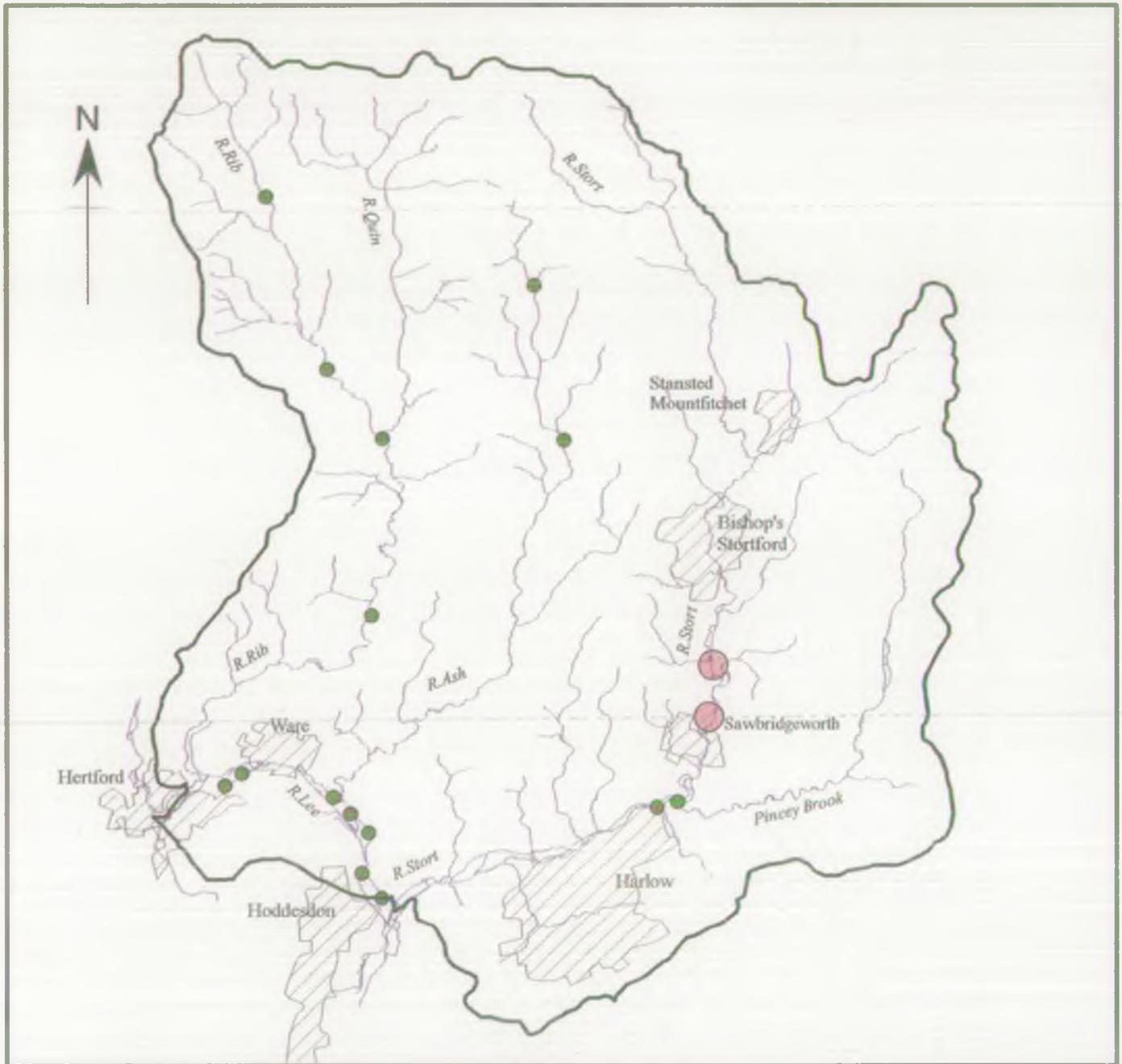
Low flows in the headwater streams (which may be primarily a natural phenomenon) are responsible for locally restricted fauna and flora. There is some evidence to suggest that sections of more modified channel are most vulnerable to drying completely (e.g. River Stort below Clavering), whilst well preserved channels retain discontinuous pools which protect and enhance their ecological value (e.g. River Stort above Clavering in vicinity of Meesden Bridge).

Habitat limitations in canalised or overdeepened watercourses (e.g. Stort Navigation) can cause suppressed BMWP scores (see Appendix III and Section 3.1).

Modified river channels tend to contain a more uniform bed topography, bank character and water depth. The loss of riffle-pool sequences can greatly reduce habitat diversity. Zones of low flow behind channel obstructions can provide important refuge for macroinvertebrates and fish.

Fisheries

A fisheries survey of the River Stort catchment was completed in 1991 and of the River Lee between Hertford and Feildes Weir in 1993. Surveys of the Rivers Ash and Rib are due to be completed before the end of 1994. The results of these surveys are described in Section 2.9. Copies of Fisheries Survey reports are available from the NRA Area office.



KEY

	Watercourse	INSTREAM HABITATS		<p>Scale (approx)</p> 
	Catchment Boundary		Critical Instream Habitat	
	Urban area		Important Instream Habitat	

3.3 PHYSICAL FEATURES

Geomorphology

A detailed geomorphological survey of the River Stort catchment was completed in 1991. A high proportion (60%) of the "main river" watercourses in the catchment were found to have been substantially altered from their natural form. Reasons for this included past flood defence, agricultural, navigation and built development activity. However, 8% or 15 km of watercourses, were found to be significantly unaffected by such activity and can be termed natural. These sections, shown on the map opposite, are an important resource because they illustrate how improvements in other parts of the catchment could be made.

Land Use Planning

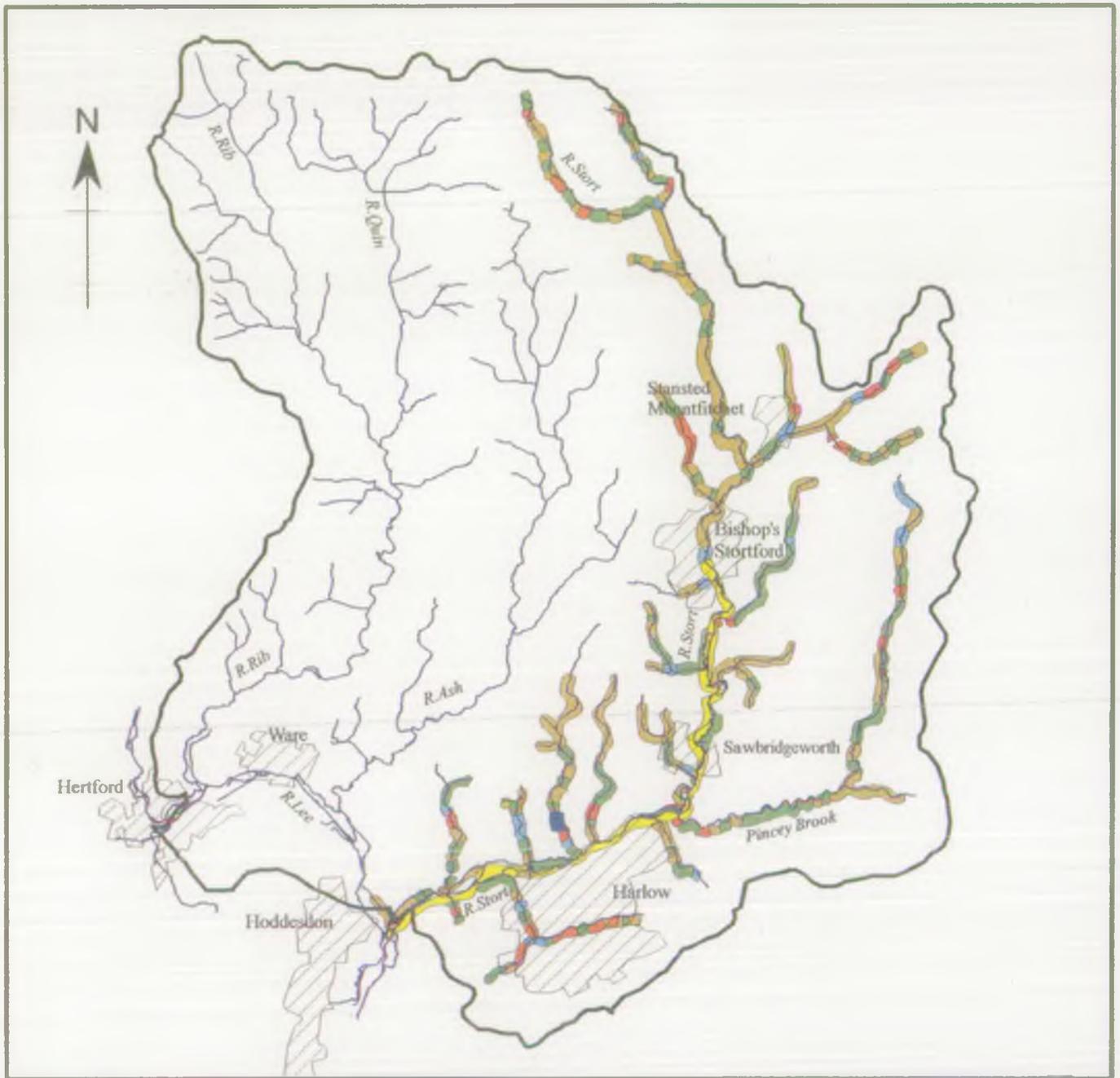
Government policy on Town and Country land use planning highlights the importance of good communications between the NRA and local planning authorities. This is because development application decisions made by local planning authorities may lead to detrimental impacts on the quality of the natural water environment. Increased demands for water supply and effluent disposal, construction of property in the floodplains of rivers, and the indirect impacts on flora and fauna dependent on specific conditions are just some of the considerations that have to be weighed during the process of making decisions on development.

The NRA role in this process is as a statutory consultee. We take this role very seriously and seek to influence policy making at national (e.g. Planning Policy Guidelines such as PPG12 on the content of development plans and PPG23 on pollution and planning controls) regional (e.g. Regional Planning Guidance for the South-east of England which raises the need for local planning authorities to take full account of the water environment when preparing development plans) and local (e.g. Structure and Local Plan preparation) levels so that decisions made by local planning authorities take into account all the relevant issues.

Our Planning Liaison and Development Control teams provide advice on individual applications both to developers and the statutory planning authorities.

We have been working with all the relevant local planning authorities (see Section 2.2) to integrate water environment issues into their statutory land use development plans. Our "Guidance notes for local planning authorities on the methods of protecting the water environment through development plans" (NRA, June 1993) covers the following issues:

- waste water management
- surface water protection
- groundwater protection
- availability of water resources
- protection of the floodplain
- surface water run-off
- tidal and fluvial flood defences
- river corridors and coastal margins
- navigation
- mineral workings and waste disposal.



KEY

	Watercourse	GEOMORPHOLOGY				
	Catchment Boundary		High Sensitivity		Culverted	
	Urban area		Moderate Sensitivity		Navigation	Scale (approx) 0 ————— 5 km
			Low Sensitivity		Lake	

3.3 PHYSICAL FEATURES

The overall extent to which these policy interests have been taken up by local planning authorities is as follows:

- East Herts 36%
- North Herts 46%
- Broxbourne 64%
- Uttlesford 68%
- Epping Forest 75%
- Harlow 75%.

These figures, however, can be slightly misleading as they do not take into account the timing of plan production. For instance the East Herts Local Plan reflects the concerns of the NRA as expressed in 1991 rather than the full range of issues we now promote. Clearly the NRA will be working with the relevant authorities to improve their coverage of water issues as opportunities arise. However, a reasonable level of policies has been achieved.

Particular attention has been paid to the polluting effects of mineral extraction and waste disposal activities in discussions with Herts County Council who produce the Minerals and Waste Local Plans. Flooding, is one topic that is covered by all local authority plan policies, the aim being to protect established and future development. Circular 30/92 from the Department of the Environment stresses the need for the NRA to work with planning authorities on this issue.

It is hoped that local authorities will work with ourselves so that the information and actions arising in Catchment Management Plans will be integrated into their own local plans. The Final Plan for the Middle Lee will contain a 'Land Use Statement' which will draw to the fore key land use planning issues needed to be covered in development plans. Clearly the north-east part of the catchment around Stansted Airport (see Section 2.16) is one of the pressure points we will need to address. A regional perspective on the planning issues is contained in our document "Thames 21 - A Planning Perspective and a Sustainable strategy for the Thames Region" which we are due to publish shortly for consultation.

Some authorities such as Herts County Council have already begun to address this issue, with specific policies relating to Catchment Plans incorporated in the latest Consultation version of the Structure Plan (May 1994). The closer integration of water and land use planning and management is an essential element of Agenda 21, the blueprint for sustainable development that was launched at the World summit held in Rio de Janeiro in June 1992. Many local authorities are now preparing Local Agenda 21 documents and Environmental Audits (e.g. Herts Environmental Forum reports). The NRA is assisting in these and other initiatives aimed at delivering sustainable development.

3.4 REVIEW OF SECTION

In this and the previous sections we have presented information relating to the Middle Lee Catchment. Much of this information summarises detailed reviews, investigations or studies by NRA and/or other organisations. Support documents may therefore be available for those seeking further information. We have gone through this process of data collection and presentation in order to assess the catchment, analyse the factors impacting upon it, and identify conflicting uses and activities within the catchment that require careful management. The following are some of the pressures and conflicts.

Communications

There are two County Councils and seven District and Borough councils covering the catchment. Whilst BW manage and maintain the navigations on the catchment, the NRA contribute towards the funding of maintenance. Many riparian owners situated on the catchment have responsibilities for both the river banks and structures. The NRA has the overall job of protecting and enhancing the water environment. However without the co-operation of other bodies the NRA will not achieve this. Close liaison with those other bodies is an essential aspect of the NRA role to ensure that the interests of all parties are considered. The NRA must maintain and improve liaison with:

- Councils over development plans and policies to incorporate interests of NRA.
- BW to maintain navigations in an environmentally sensitive way.
- Riparian owners to promote works around the rivers to enhance the river corridors and water related features.

Change

The catchment is within commuting distance of London, and good rail, road and air links mean that there is constant housing, industrial and commercial development pressures. Stansted Airport is set to increase in size substantially and the associated developments need close consideration. Impacts from development include:

- Increases in made ground leading to greater surface run-off and flood risk.
- Increased threat from pollution.
- Loss of river corridors and associated areas of interest.
- Water supply, sewage disposal and waste disposal demands which increase with associated population growth.
- Increased demand for recreational areas.

3.4 REVIEW OF SECTION

Circumstances

The flat topography and quality of the subsoil has resulted in the catchment being extensively farmed for crop production. This has several side-effects:

- Increased use of pesticides. The persistence and the accumulation of these in the food chain has led to the loss of native species.
- Increased use of fertilizer. The resultant nitrate run-off can cause eutrophication in adjacent rivers and still-waters.
- Areas prone to waterlogging are often artificially drained by farmers. This can cause increased run-off leading to a greater possibility of flooding. It can also cause a lowering of water levels around water dependent sites of high conservation value.
- Increases in field size have led to a decrease in habitats as hedgerows and associated ditches are removed.

Approximately half of the catchment is on London Clay and half on Upper Chalk. These strata and their associated soils have very different characteristics; for example the use of soakaways with septic tanks is ineffective on clay due to its impermeability.

Conflicts

Many uses have been highlighted and it will now be evident that many of these conflict. Some areas of conflict include:

- Increased recreational boat use of the navigations causing water levels to fall thus causing damage to conservation interests in backwaters which require high pound levels.
- The impact of effluent disposal on water quality which is amplified by low flows.
- Use of urban land by industry increases the threat of pollution through discharge to river or contamination of groundwater.
- Weirs, mills and locks may inhibit the passage of migratory fish up stream.
- Navigation use may be inhibited by the use of water for other purposes.

These are some of the points which evolve from the information in this and the previous section. In addition we carried out informal external liaison where we asked for comments and views from various interested parties. A report on this informal liaison can be found in Appendix II.

3.4 REVIEW OF SECTION

NRA Activity

The NRA undertake a range of works within the catchment. A substantial portion of this is regular ongoing activity related to the monitoring of the health of the water environment. However, specific projects to deal with key issues are also undertaken. The following list summarises specific projects undertaken in 1993/94 and those expected to be completed in 1994/95.

Water Quality and Resources

- 94/95
- Pollution prevention activity at Harlow
 - Survey of agricultural and non-agricultural pesticide use in the Mimmshall Brook catchment (to protect abstractions in the Middle Lee catchment)

Flood Defence

- 93/94
- Remedial work to bridge at Ware Lock, Lee Navigation
 - NRA purchased Spellbrook flood lagoon
- 94/95
- Report on flood defence needs at Langley, Clavering and Manuden (Implementation in 95/96 and beyond subject to approval)
 - Report on flood defence needs at Bishop's Stortford (Implementation in 96/97 and beyond subject to approval)
 - Improvement works at Standon on the River Rib
 - Improvement works on Millers Green Brook culvert
 - Improvement works at Glen Faba and Feildes Weir access bridges

Fisheries, Recreation and Conservation

- 94/95
- Fisheries surveys of Rib and Ash
 - Habitat surveys of Middle River Lee and Ash
 - Landscape assessment of Middle River Lee

Catchment Planning

- 94/95
- Completion of Middle Lee CMP
 - Completion of Upper Lee CMP
 - Lower Lee CMP Consultation Report prepared
 - Influence built development at Harlow and Bishop's Stortford

SECTION 4 ISSUES, STRATEGIES AND ACTIONS

In the following section we describe issues that have arisen through investigation of the catchment and through internal and informal external liaison. We suggest ways of dealing with these issues and look for your comment on the best way forward. We also identify where external support and action is required.

4.1 INTRODUCTION

In identifying the catchment issues we sought to consolidate the many key points and areas of concern, into a small number of integrated categories. In some cases these categories have a geographical perspective (e.g. Stort Corridor) and in others they have a single theme (eg Low Flows).

The issue of **Low Flows** has been raised internally and externally for the whole of the catchment, so this is dealt with in one sub-section. **Pollution Control and Prevention** is another topic raised affecting several different areas of the catchment and is also given its own sub-section. **Conservation Projects** encompasses the protection and enhancement of valuable conservation sites and the work required to remove any non-native species which pose a threat. The **Management and Communications** section looks at how communications between individuals and groups could be improved, to achieve a greater degree of success on the ground. Sections that have a geographical perspective are the **Stort Corridor** and the **Lee Corridor**, and are separated for their particular local interest.

For each of the categories there is an overview, briefly describing problems or points that have been raised and need to be dealt with. The separate issues are then described, followed by the suggested way forward. In many cases the co-operation and help of other interested parties will be required if the issue is to be successfully tackled.

The draft catchment vision for the Middle Lee presented on page 3 draws together the major themes described in these issue groupings. We believe this statement can act as a focus for all those involved in securing a sustainable future for the water environment. The actions associated with the following issues will work towards this vision but are not expected to achieve it in the short or medium term. Only action in the longer-term on a broad front will enable the vision to be achieved.

4.2 THE STORT CORRIDOR

Overview

The corridors of the River Stort are a valuable natural resource comprising sensitive ecological habitats, a landscape of considerable diversity and value, and areas which are popular for informal recreation. The Stort Navigation is of particular historical interest and its character makes it unique in the Thames Region. In May 1991 a draft Catchment Management Plan for the River Stort (Flood Defence and the Environment) was produced by the NRA. This document is to be superseded by the Middle Lee Catchment Management Plan but is an important reference which describes in detail the background to many issues.

The catchment has suffered from inappropriate management in the past. Assessment and sensitive management is required now to prevent further environmental degradation, and to protect and, where possible, enhance the present valuable sites on the catchment. The following are considered to be issues needing attention in the Stort corridor.

ISSUE: Flooding of Properties

Many areas and properties on the Stort corridor are liable to flood during times of heavy rain, and it is a specific aim of the NRA to provide effective defence for people and property against flooding from rivers. In the upper reaches of the River Stort, floods have affected the villages of Langley Clavering and Manuden. Urban areas still at risk in the main river valley include small areas of Spellbrook, Sawbridgeworth, Harlow and Roydon. A progressive review of all flooding in the River Stort Catchment is being carried out in order to assess the extent and prioritise action.

Way Forward

- Complete the phased (upper, middle and lower reaches) review of flooding on the Stort catchment.
- Works at Manuden, Langley and Clavering are under consideration following completion of the first phase of the flood alleviation review.
- Environmental impact should be assessed before and after any work.

ISSUE: Impact of past flood defence works

Several past flood defence and land drainage works have had a detrimental effect on the water environment within the River Stort catchment. Examples include: Clavering Flood Alleviation Scheme carried out in the mid 1970s; Bishop's Stortford Flood Alleviation Scheme in the late 1960s and 1970s; and Spellbrook Flood Lagoon to protect Sawbridgeworth town. The last two of these were carried out as part of Phase I of a major land drainage scheme for the whole of the River Stort downstream of Bishop's Stortford. While these schemes have been effective at alleviating major flooding of properties, it is thought that the schemes went ahead without sufficient assessment of the environmental impacts of such works.

Due to the potential environmental impact of Phase II of the earlier River Stort scheme, it was never carried out. A reassessment of the whole of the Stort is now taking place which integrates

4.2 THE STORT CORRIDOR

conservation into the process of scheme assessment. Increased internal and external liaison prior to commencement of capital schemes is now an integral part of NRA procedures to ensure protection of the natural environment.

Way Forward

- Assess what can be done at sites that have suffered environmental damage to rectify the damage without compromising flood defences.
- Carry out enhancement works as funds become available (i.e. prioritise action).
- More rigorous assessment of future works with increased liaison internally and externally.

ISSUE: Improvement of flood warning monitoring network

There are frequent significant flood events down the River Stort valley and more isolated flooding on the Rivers Rib; Ash and Lee and, whilst capital work goes on to alleviate flooding, flood warning remains an important function of the NRA. In some locations, a flood alleviation scheme may not be justified and so a flood warning system will continue to be required. Flood forecasting by the NRA relies on telemetered information, rainfall recorded by weather radar and various other weather forecasting products as well as reports from flood defence staff in the field. A need for additional telemetered river level monitors has been identified in certain areas.

Way Forward

- Installation of telemetry : Upstream end of Pincey Brook.
: Between Bishop's Stortford and Roydon.
- Monitor resultant improvements in service.
- Assess to see if further improvements can be made.
- Development of flood forecasting models.

ISSUE: Maintenance of water levels

The issue of low flows has a high profile throughout the catchment and so it is dealt with in a separate section. However, it is worth reiterating in this section the significance of low flows on the River Stort.

The backloops and wetlands on the River Stort catchment are important ecological sites and their valuable habitats rely on water at a particular quality and quantity. Significant reductions in flow can cause the wetlands to dry out thus destroying their ecological value. The navigation also supports one of the few areas of deepwater flora. Maintenance of water levels is therefore important to protect valuable conservation areas. Recreational users of the Stort Navigation also depend on the maintenance of levels in order that movement between pounds remains possible.

4.2 THE STORT CORRIDOR

The conservation value of much of the valley however, depends on the regular flooding that occurs. This water need must be balanced with the need for protection of neighbouring urban areas. This reiterates the need for environmental impact assessment of flood defence schemes and illustrates how complex this can be. Section 4.7 deals in more detail with this issue.

Way Forward

- Internal NRA departments of Water Resources and Flood Defence to liaise in order that telemetry installed for flood warning purposes can also be used to measure low water levels.
- Investigate possible reasons for low flows (natural and otherwise) and develop strategies to ensure the sustainable future of the navigation and associated features.

ISSUE: Operational management of the navigation

The navigation is operated and maintained by British Waterways (BW). The NRA currently pays approximately £130,000 per annum to BW towards maintenance costs of the Lee and Stort Navigations. This agreement is due to be reconsidered in the coming year.

Maintenance works undertaken on the navigation have caused concern in the past due to their lack of environmental sensitivity. For example, the use of sheet steel piling for bank stabilization where more natural methods of bank protection could be used as an alternative. Works such as insensitive dredging could also lead to environmental degradation as it may threaten the deepwater flora of the navigation. The NRA needs to actively encourage management, including bankside vegetation management, that increases the number and range of habitats (e.g. planting of reeds rather than the use of piling which inhibits plant growth), whilst recognising the role the navigation plays in passing floodwaters and the legitimate needs of recreational users.

Way Forward

- Look at maintenance procedures and determine where improvements in policy and practice could be made to safeguard the water environment.
- Specify clear environmental, navigation and flood defence objectives for maintenance work on the navigation.

ISSUE: Relationship between recreational uses and conservation interests of the backloops of the Stort

The navigation is currently operated by BW as a cruising waterway. The Sports Council also recognises the increased demand for recreation in the area. Increasing recreational use (eg cruising and angling) is seen by BW as a means of maximising revenue to contribute to the maintenance and operating costs of the navigation. However, increased boating activities has major impacts on the important conservation areas of the Stort Navigation and its backwater.

4.2 THE STORT CORRIDOR

Increased boat movements up and down the locks may result in insufficient water to maintain pound levels at locks especially in periods of low natural flows. This results in the lowering of water levels in the backloops and could cause the wetlands to dry out. When situated in the backloops, boats may damage the important habitats and inhibit their use by aquatic species: More boats bring an increased demand for mooring facilities. Inappropriate use of structures, or structures in need of repair, can both result in water levels in the backloops reducing.

Way Forward

- Work with BW to limit moorings in sensitive areas.
- Work with BW to strictly control boat movements during periods of low flow.
- Investigate low flow situations and evaluate the environmental capacity of the navigation.
- Agree a management strategy for the operation of the Stort navigation in conjunction with BW, and other relevant agencies.

ISSUE: Management of SSSI at Spellbrook

The flood lagoon at Spellbrook is designated a Site of Special Scientific Interest (SSSI) and is owned by the NRA. The site needs to be managed effectively to protect and enhance its value and to prevent further degradation. The NRA could use success in managing this important ecological site to influence the management practices of other landowners within the whole of the valley. This experience can also be combined with that of others such as the County Wildlife Trusts. An interim management plan has been produced with the approval of English Nature. In it, specific areas requiring management were identified including:

Scrub invasion: The habitat is not naturally occurring and so grazing is required to stop scrub invading and crowding out important species. The site has SSSI status for its wetland flora. Scrub invasion causes the marshlands to dry out so this needs to be checked.

Willow Pollarding: This prolongs the life of the trees and reduces the build up of dead wood (a problem that could have flood defence implications). Spreading a pollarding programme over several years also means that trees will be at different stages of the programme, enhancing the diversity of the area.

Control of water level: Water needs to be at a certain level to ensure marshland is maintained without flooding or drying out.

Way Forward

- Produce the full management plan for the SSSI and implement
- Assess the effectiveness and report back on its successes and failures
- Promote the management plan as an example of best practice for the integrated management of wetland areas.

4.3 THE LEE CORRIDOR

Overview

The Lee corridor within the Middle Lee catchment runs from Hertford, through Ware to Rye Meads on the north west side of Hoddesdon. Urban development within the corridor poses a constant threat to the many sites of ecological importance and recreational usage, that serve a large local population, and must, therefore be strictly controlled.

Habitat degradation within the corridor, due to mans activity now requires, a plan of action to counteract past insensitive works and to protect delicate areas from future impacts.

A strategic management regime to balance the conflicting issues, activities and uses up the corridor is necessary. Outlined below are areas of particular concern:

ISSUE: Management of Kings Meads

Situated between Hertford and Ware, Kings Mead consists of a combination of grasslands, ditches and river channels along the valley floor. Kings Mead is owned by the NRA, Glaxo and Thames Water plc. This multiple ownership has led to unco-ordinated local management in the past as the site has not been considered in its entirety. Additionally a reduction in water levels (on the meads) in recent years will affect important aquatic fauna and flora present.

Herts and Middlesex Wildlife Trust and the Herts Countryside Management Service have recently published a draft management plan for the entire Kings Mead area. The NRA and Thames Water have given money this year in order for works contained in the management plan to go ahead. This co-ordinated and integrated approach (e.g. the management plan considers recreation, access and landscape issues as well as conservation issues) is important to ensure successful future management of the Meads.

Investigation into the reduction in water levels is required. River levels could possibly be restored within the Manifold Ditch, which flows through the meads by a series of weirs upstream of the Lee Navigation confluence. However, it is very important that water level assessment is carried out beforehand so that work can be done to produce the optimum level. The site was identified as a potential Otter habitat in the Herts Otter Project (see Section 3.3). Otters are dealt with under conservation issues in section 4.4.

Way Forward

- Continued work with riparian owners to develop and implement a co-ordinated approach to future management of the Meads.
- Investigate reduced water levels and maintenance of optimum levels.

ISSUE: The decline of Amwell Magna

The Amwell Magna is an old river loop of the River Lee between Ware and Stanstead Abbots and is historically a noted trout fishery. However, due to previous land drainage works for flood defence purposes, the value of the site has declined.

4.3 THE LEE CORRIDOR

The NRA is now working on a habitat enhancement programme for the site which has cost £90,000 so far; £30,000 has been spent on weir alterations. With £60,000 earmarked for further expenditure significant improvements will be made for fisheries and conservation interests, without compromising flood defence needs. It is essential that a co-ordinated approach from all, is adopted before works are carried out.

Way Forward

- Complete enhancement works.
- Monitor improvements and report back.

ISSUE: Conflicting demands on Old Gravel Pits

Around the Amwell Magna there are several old gravel pits within this and adjacent catchments. The Sports Council Zone 4 Water Strategy (July 1994) highlights the high demand for waterside recreation in the area. However, several of the pits are now important conservation areas whose value would be threatened by over use for watersports and recreation. Another possible use for the gravel pits could be for flood water storage to relieve downstream flooding. Each of these uses and activities could cause conflict and degradation of the water bodies.

Separate sites could be used for different activities and important conservation sites could be protected from other conflicting uses. A survey of all the gravel pits in the River Lee valley is required to decide which are best for the various competing demands.

Way Forward

- Interested parties to confer over compilation of information relating to potential of individual pits.
- A strategic overview of the pits is required.

ISSUE: Frequency of Lock use

Higher frequency of locking between pounds within the Lee Navigation, due to an increase in summer boat traffic, has contributed to low flows/levels along particular stretches of the navigation. As such this issue is dealt with under the Low Flows issue (see Section 4.7). It is at this stage however, worth emphasising that proper management and control of use of the navigation is particularly important in periods of low flow so that conditions are not exacerbated.

Way Forward

- Work with BW on tighter control of proper use of locks during periods of low flows.

4.3 THE LEE CORRIDOR

ISSUE: Structures in need of repair

Several structures such as locks and weirs, on the River Lee system are in a poor condition. This can again result in water loss and a reduction in water levels upstream. This again is dealt with under the Low Flows issue (see Section 4.7).

Conversely, if structures inhibit flows they could become a flood defence threat.

Way Forward

- The NRA is compiling a list of structures it owns and will visit and inspect at intervals depending on importance.
- The NRA will liaise with riparian owners to help keep non-NRA owned structures properly maintained.

ISSUE: Capacity of the River Lee Flood Relief Channel

The capacity and standard of flood protection offered by the Lee Flood Relief Channel to properties in Hertford, Ware and downstream to Feildes Weir has not been assessed using contemporary approaches. With the change in land use that has occurred over the last 20 years it could be that the original scheme design has been compromised.

Way Forward

- Investigate effectiveness of flood channel and implementation of cost-effective remedial measures if required.

4.4 CONSERVATION PROJECTS

Overview

The Middle Lee catchment has one of the best range of habitats in the south of England supporting several nationally rare species. The backloops and wetland areas of the Stort corridor are of particular ecological interest providing habitats for many aquatic species. Protection of valuable aquatic ecosystems is an important issue to be dealt with in this plan, and strategic plans produced by other relevant organisations.

Man's impact on the water environment has led to the demise and depletion of species and habitats in the catchment. Effort is needed to counteract these effects. Conservation of key species, protection of valuable habitats and enhancement of poor habitats is vital if we are to maintain biodiversity in the catchment. Several key areas have been highlighted where work is needed to enhance and protect the water environment in the catchment.

ISSUE: Otters have disappeared from the catchment

The otter is a key species in the aquatic environment since it is near to the top of the food chain. As such it is a useful indicator species since it depends on the health of the riverine ecosystem for its survival. Environmental factors such as pollution, that effect flora and fauna further down the food chain and therefore threaten biodiversity, would therefore impact on the otter community.

Otters were last seen in Hertfordshire on the River Mimram in 1974. Their depletion is thought to be due to several contributory factors:

- **Pollution.** Poly-Chlorinated Biphenyls (PCBs) and pesticides such as DDT used in the past have been found to be environmental hazards due to their persistent toxicity. They accumulate in fat tissues as they go up the food chain (bioaccumulation). Since 1973 the use of PCB's has been limited through international agreement and the use of persistent pesticides is now banned in this country. As a result, their levels in the environment are slowly diminishing.
- **Hunting.** Man has in the past hunted otters and this has caused a significant reduction in numbers. However, hunting otters is also now banned in this country.
- **Habitat pressures.** Production pressures on agricultural land in the past has led to increase in field sizes and reductions in habitats. Urban development has also added to this problem.

The last of these factors is thought to be limiting otter recolonization of the catchment now. Otters have been re-introduced into Hertfordshire in recent years but the NRA believes that if suitable habitats are enhanced and protected, then otters will migrate naturally back into the catchment.

A recent Otter Habitat Survey identified habitats suitable for otters as well as sites that through enhancement could be suitable. Recognition, protection and enhancement of these sites is important in order to encourage this native species back onto the catchment. Work has been carried out at the lower end of Pincey Brook with riparian owners to enhance potential otter habitat sites.

4.4 CONSERVATION PROJECTS

Way Forward

- Work with riparian owners to protect suitable sites.
- Work with riparian owners and interested groups to enhance potential sites.

ISSUE: No native Crayfish on the catchment

The native white clawed crayfish is a protected species under Schedule 5 of the Wildlife and Countryside Act 1981 and the IUCN Red data list. It has not been found on the catchment since 1981, due to an outbreak of crayfish plague that hit the native species. Non-native signal crayfish are now present in several watercourses within catchment. These can act as carriers of the plague and so their presence may inhibit the successful re-introduction of native crayfish. Non-native crayfish have been introduced into the catchment by man. These sources need to be identified so that the river system can be protected from further invasion. The NRA recognises the need to reintroduce and maintain this key species into the catchment and to closely monitor its survival.

Way Forward

- Identify sources of non-natives and isolate these from the rest of the river.
- Actively seek to prevent fish farms using non-native fish species.
- Undertake a study on the feasibility of re-introducing native crayfish populations. Consider a re-introduction programme in a suitable part of the catchment, involving introducing native crayfish and monitoring population numbers, health and dispersion.

ISSUE: Use of Common Agricultural Policy Reforms to benefit the environment

Production pressures on agricultural land in the past have led to increases in field size and reduction of natural habitats. This expansion has impinged on the land in and around the river corridor and has reduced the diversity and conservation value on the catchment.

Arable crop land is however subject to the set-aside scheme, where farmers receive payment for land they do not use. Changes to the scheme due next year will mean that land can be set-aside for much longer periods, giving the chance for stable habitats to develop. The concentration of set-aside land around the river corridor could improve the biodiversity and ecological value of the area.

Way Forward

- Work with farmers and riparian owners to promote set-aside along river corridors.
- Advise on the successful management of such sites.
- Concentrate work on a pilot catchment possibly adjacent to the River Rib and assess effectiveness.

4.4 CONSERVATION PROJECTS

ISSUE: Invasive Plant Species

Man has in the past introduced non-native plants to this and adjoining catchments in and around the water environment. Plants such as Giant Hogweed, Japanese Knotweed and Himalayan Balsam are present particularly in the upper reaches of the catchment and are spreading rapidly. Downstream catchments (such as the Lower River Lee) are effected to such an extent that these invasive plants have totally crowded out the native plants. It may still be possible to control the problem in this catchment with the co-operation of relevant parties. Natural areas including those of high ecological importance in the catchment are under constant and increasing threat if the spread of these invasive species is not checked.

Giant Hogweed also represents a health and safety risk. If skin comes into contact with the sap of the plant during spring and summer it causes hypersensitivity to sunlight which can result in burning of the skin.

An NRA Research and Development Project has been carried out to find the best way of successfully eradicating these invasive plants. River corridor surveys by the NRA have identified their presence in areas adjacent to main river. Assessment of the rest of the catchment is required with co-operation of Local Authorities, Wildlife Trusts, riparian owners and interested groups. Co-ordination is needed to assess the spread and to come up with a plan for eradication.

Way Forward

- Set up a group to deal with this of both NRA personnel and outside interested bodies.
- Identify the spread of the species throughout the catchment and map their distribution.
- Carry out experimental eradication on a pilot tributary.
- Assess the outcome with a view to expanding the project to the rest of the catchment.

4.5 POLLUTION CONTROL AND PREVENTION

Overview

In the main, rivers in this catchment are of good quality and pass their Water Quality Objectives (see Section 3.1). Groundwater too is generally of very high quality and many major public water abstractions are situated along the river valleys. Pollution prevention is therefore important to protect the quality particularly as the water environment of the catchment has high amenity and ecological values.

Several actual and potential pollution sources have been highlighted and are dealt with here separately.

ISSUE: Septic tanks discharges

Foul and surface water sewerage systems (mains drainage) do not extend to much of the rural areas of the catchment. Individual properties dispose of sewage by various means, most commonly septic tanks. These rely on a porous sub-soil for successful disposal of effluent. However due to the clay nature of much of the rural catchment, disposal of sewage by septic tanks can be difficult or impossible without seepage or "overflows" to surface water. Individually septic tanks may have a negligible effect on water quality but groups of properties can cause localised nuisance.

Way Forward

- The NRA may refuse an application to soakaway sewage effluent from septic tanks where soil conditions are unsuitable for shallow soakaways. (Guidelines on this are available from the NRA).
- Where pollution of a watercourse is brought to the attention of the NRA an investigation and assessment will be made in conjunction with the local Environmental Health Department.

ISSUE: Pollution from towns and industry

Bishop's Stortford: There is not considered to be any downgrading of water quality due to discharges from industrial areas of Bishop's Stortford. However experience has shown that without continued pressure from the NRA through its pollution prevention policies, local background pollution invariably returns.

Harlow: Though not a major problem, pollution from industrial estates in Harlow has been known to cause some problems in the past. A pollution prevention campaign aimed at industry has just been completed in the Harlow area. In this, actual and potential sources of pollution were identified. Appropriate action can then be taken to protect the water environment from further pollution from these sources.

4.5 POLLUTION CONTROL AND PREVENTION

Way Forward

- The NRA will make recommendations and give advice through the planning system.
- The NRA will carry out pollution prevention visits to local industry with guidance advice and recommendations.
- The NRA will continue monitoring surface water discharges from industrial areas.

ISSUE: Wrong Connections

Areas on mains drainage within the Middle Lee catchment are connected to separate drainage systems. This means foul water goes via its own drainage system to the sewage works and surface water enters drains that discharge into the river. Wrong connections occur when foul water is discharged into the surface water drain and vice versa.

Wrong connections are a minor issue in the Middle Lee catchment. However the NRA recognises the need to publicise the importance of correct connections. Faulty and DIY plumbing is a major cause of wrong connections. Advice on foul or surface water connections should be sought from the local authority Technical Services offices.

Way Forward

- Involve the water companies and local authorities in the Thames Region in carrying out a publicity campaign. The aim of this would be to educate and advise on correct drainage connection.
- Continue to investigate and rectify present wrong connections in liaison with TWUL, as they become apparent.

ISSUE: Pollution from Stansted Airport

The airport lies just to the north-east of Bishop's Stortford and surface water discharges are made to local watercourses that drain to the River Stort. Whilst there is generally a good record regarding pollution from the airport and associated industry, in February 1991 a leakage of aviation fuel led to a major pollution incident when some 250 cubic metres (50,000 gallons) of fuel affected the River Stort and its tributaries.

It is clear that while pollution control measures have been incorporated into the airport drainage control systems there must be a continued vigilance to minimise the potential environmental effect of the airport.

Way Forward

- Instigate pollution prevention initiatives by visits to industrial premises and operational areas at the airport.

4.5 POLLUTION CONTROL AND PREVENTION

Way Forward (continued)

- Provide pollution input control through planning applications for development of new industrial or operational areas at the airport.
- Continue to monitor water quality of discharges from the airport to local watercourses.
- Continued liaison with airport management.

ISSUE: Eutrophication

As can be seen from the agriculture map in Section 2.15, land is predominantly used for arable farming. When fertilizers are used, run-off from the land often contains nitrate. In addition, sewage effluents provide significant amounts of phosphate. Once these nutrients enter watercourses they can contribute to significant increases in algae (algal blooms) and excessive plant growth, a process known as eutrophication.

There is some evidence of eutrophication downstream of Buntingford and Bishop's Stortford STWs. There are plans to remove phosphate from a number of sewage treatment works effluents currently discharging to rivers in the south east area of the Thames catchment. These measures are required in order to meet the requirement in the Urban Waste Water Treatment Directive. The effectiveness of such measures will be assessed before any wider application is considered.

Way Forward

- To quantify the extent of eutrophication resulting from the discharges from Buntingford and Bishop's Stortford STWs.
- To evaluate likely options for tackling the problem - to include shading of the river and phosphate removal.
- To produce a plan for action to include likely costs and benefits, and a list of regional and catchment priorities.

ISSUE: Provisional Water Quality Objective Failures

The River Stort from Hazel End to the Stansted Brook and the Stort Navigation from the Great Hallingbury Brook to the Spell Brook both failed to meet their PWQO of RE class 2. In both cases, this was due to a failure to meet the dissolved oxygen standard of 70% saturation. These failures are likely to be due to the low river flows in 1991.

Way Forward

- NRA will further investigate the nature of the problem and report on its findings by June 1995.

4.6 MANAGEMENT AND COMMUNICATIONS

Overview

Within the NRA different functions have different but linked responsibilities for aspects of the water environment. Externally, different bodies also have different responsibilities and interests relating to the water environment. The NRA sees the need to improve management and communications both internally and externally for a more co-ordinated approach to the water environment. Several cases have already been highlighted under other categories within this document. These briefly are as follows:

Communications with: BW
riparian owners
the farming community
water companies and local authorities on sewerage system problems.

ISSUE: Improvement of communications

Other situations where communications could be improved have been highlighted both internally and externally and have not yet been raised in this consultation document. These are as follows:

- Improve notification of flood defence schemes that may have implications for other internal functions as well as external organisations and riparian owners. This should include notifying owners of the timetable for routine flood defence works.
- Internal liaison between the Flood Warning and Water Resources functions of the NRA for combined use of flow gauges throughout the Middle Lee catchment.
- Continue working with planning authorities to integrate relevant NRA water environment issues into their statutory land use development plans.
- Assess the present system of planning application consultation to ensure that we receive all relevant planning applications for comment.

ISSUE: Enhance communication of information and ideas

To maintain activity on, and commitment to, the key issues we have raised, we have identified the need to establish means of reporting on and co-ordinating action. Options include:

- Publish quarterly news sheets and hold an annual monitoring conference.
- Utilise existing communication forums (e.g. Lee and Stort Planning and Amenities Forum, Lee Valley Regional Park newsletters) to communicate to a broader section of the community.
- Establish a small working party to drive forward key integrated action plans.
- Establish a small group of interested representatives of the local community to advise on ways of improving communications.

4.7 LOW FLOWS

Overview

The NRA has a duty to conserve and secure the proper use of water resources whilst protecting the natural environment. This means that we must seek to strike a sustainable balance between the needs of the environment and society's legitimate needs for reliable water supplies to homes, industry and agriculture. Where this balance is wrong, low river flows may result with consequent impacts on the uses and activities described in Section 2 of this document.

Conservation: The backloops and wetlands of the River Stort, Amwell Magna on the River Lee and water related SSSIs such as Spellbrook reservoir are important habitat sites for many species. They all depend on the maintenance of water levels to preserve their conservation value.

Fisheries: Fish stocks in the catchment are of good quality. Low flows can result in damage or loss of valuable fish habitats. Low flows can inhibit fish migration and, threaten their food supply.

Effluent Disposal: Discharges of effluent under normal flows may not cause a problem because the effluent is of good quality. However, in times of reduced flow, the effluent may be the only source of water for the river. With little or no dilution even good quality effluent may prove to be a problem.

Amenity and Recreation: The public have a right to enjoy the water environment and can do so on the catchment through watersport activities as well as riverside walks. The public also has the right to use the Lee and Stort Navigations for boating. Maintenance of flows in the rivers is important in order to maintain its high amenity value. There are several possible reasons for low flows in the catchment and these are dealt with as separate issues below.

Reason: Abstractions

There are 138 abstraction licences in the Middle Lee area authorising the abstraction of a total of 87.4 Ml/d, as described in Section 2. However, as can be seen from the abstractions map in that section, very few are situated in the upper reaches of the rivers and as such there will tend not to be significant effects on stream flows. Data from the monitoring of abstractions suggests that the impacts are low, but the NRA will continue to adopt strict criteria when granting new licences to ensure that unsatisfactory situations which have occurred in the past in other areas will not be brought about here.

Reason: Land use change

As shown in the map in Section 2.15, agriculture is a significant landuse in the catchment. The introduction of field drains in the past led to an increase in flow from the land. This means water is removed from the catchment at a faster rate leaving less to permeate through to the aquifer below. Close proximity of agricultural drainage can also impact on important wetlands, increasing the risk of them drying out. Many areas are not as intensively farmed now as in previous years. Where possible the NRA would seek to remove agricultural drainage.

4.7 LOW FLOWS

Reason: Underlying Chalk

As can be seen from the geology map in Section 2 a large proportion of the catchment lies on chalk. The upper reaches of these watercourses are mostly purely groundwater fed and therefore act as typical chalk "bourne" rivers by drying up during droughts and dry summers, as the groundwater levels drop. Further downstream there are reaches which also manifest apparent low flows. These could be due to loss of water through the river bed which may be a natural feature or could be the result of interference by man e.g. over dredging. In some reaches the river bed has been artificially widened so the flow is channelled through a cross-section 2-3 times as wide as normal making it sluggish. Further investigation is required as is monitoring of present and future levels to detect any slow changes.

Riverbed clearance as part of flood defence procedures in the past may have amplified the problem. The natural channel bed in some stretches may have been removed resulting in a porous chalk bed that does not hold water. In areas where this has happened it may be feasible to restore the riverbed.

Reason: Navigation

The navigations on the catchment are controlled by BW and promoted as cruising waterways in order to maximise income generation from recreation. Increasing use of the waterway by boats, however, means increased lock use. The 15 pounds on the Stort Navigation from Bishop's Stortford to its confluence with the River Lee allow water to spill over side weirs and into the side loops (the original part of the River Stort). These side loops and conservation areas near them are valuable habitats.

Increased traffic through the locks means the pound levels may drop to a point where no water is going over the side spill weirs and into the back channels. With the co-operation of BW, the NRA intends to set minimum required flows for these side spill weirs.

The NRA is at present collating a list of structures for which it has responsibility so that an organised inspection programme can be made.

NRA and BW also need to work with other riparian owners to ensure their structures are in working order and they understand the importance of keeping them so.

Maintenance is by BW though the NRA contributes to costs (see Section 4.2). Leakage of water through the lining of the channels could cause water levels in the pounds to drop. Work is needed to determine whether the linings of the channels leak and what can be done about them.

4.7 LOW FLOWS

Way Forward

- Promote the removal of land drainage around areas of important wetland and where they are now inappropriate.
- NRA and BW need to work together to manage the conflicting needs and uses of the navigation. Close liaison of these two bodies is very important.
- Install temporary loggers on parts of Stort Navigation to monitor river flows and investigate any leakage from navigations.
- Inspect NRA structures on a regular basis.
- When considering applications for new abstraction licences or variations to existing licences the NRA will make decisions in line with agreed policy.
- Where locally unacceptable abstraction situations exist the NRA will seek to bring activities into line with current best practice (as described in policy see Appendix III) as the opportunities present themselves.

APPENDICES

*Appendix 1:
Organisational Responsibilities and
NRA Aims Objectives and Strategies*

*Appendix 2:
Report on Informal Liaison*

*Appendix 3:
Supporting Information*

*Appendix 4:
Glossary*

APPENDIX I - ORGANISATION RESPONSIBILITIES AND NRA AIMS AND STRATEGIES

INTRODUCTION

The supply of water for domestic consumption and industrial use is not the responsibility of the NRA but of **water and sewerage undertakers**. The prices charged by these private companies are regulated by the **Office of Water Services**. The quality of water supplied for consumption is monitored by the **Drinking Water Inspectorate** and **District or Borough Councils**.

The disposal of sewage effluent is the responsibility of **water and sewerage undertakers**. Their discharges are subject to control by the NRA. Potentially significant industrial discharges to the water environment are controlled by **Her Majesty's Inspectorate of Pollution**.

The NRA has the primary responsibility for flood defence and land drainage matters but on "ordinary watercourses" the responsible land drainage and flood defence agency is the **District or Borough Councils** who may also manage on behalf of **water and sewerage undertakers** surface water drains leading to rivers and watercourses.

British Waterways are responsible for navigation on the Lee and Stort Navigations.

The responsibilities of the above organisations are described further below. The activities of the NRA are then described in detail.

Water and Sewerage Undertakers

These private companies are responsible for providing water supplies and the management of sewage treatment works. Thames Water Utilities, Anglian Water Services and Three Valleys Water Company all provide services to the catchment area.

Her Majesty's Inspectorate of Pollution (HMIP)

HMIP is the regulatory authority for Integrated Pollution Control. This is a system introduced to control pollution from industrial processes which could cause significant pollution to air, land or water. Discharges from sewage treatment works and other discharges to water are regulated by the NRA.

Drinking Water Inspectorate (DWI)

The DWI is responsible for checking that companies supplying drinking water carry out proper monitoring and meet the regulations for the quality of water supplies set in part by the European Community Drinking Water Directive.

Office of Water Services (OFWAT)

A government agency responsible for making sure that the water and sewerage undertakers provide customers with a good quality and efficient service at a fair price.

APPENDIX I - ORGANISATION RESPONSIBILITIES AND NRA AIMS AND STRATEGIES

District or Borough Councils

These authorities monitor the quality of all water supplies, including private supplies, within their area. They can require improvements to be made to private water supplies.

Watercourses which have not been statutorily designated as "main river" on maps held by the NRA and Ministry of Agriculture, Fisheries and Food (MAFF) are known as "ordinary watercourses". The provision of flood defence and land drainage services on these watercourses is the responsibility of the relevant council (see p.15).

British Waterways (BW)

Created by the Transport Act 1962 BW is the largest navigation authority in the country. The Lee and Stort Navigations are run by BW (Southern Region).

NATIONAL RIVERS AUTHORITY (NRA)

AIMS

- *To achieve a continuing overall improvement in the quality of rivers, estuaries, and coastal waters, through the control of pollution.*
- *To manage water resources to achieve the right balance between the needs of the environment and those of the abstractors.*
- *To provide effective defence for people and property against flooding from rivers and the sea.*
- *To provide adequate arrangements for flood forecasting and warning.*
- *To maintain, improve and develop fisheries.*
- *To develop the amenity and recreational potential of inland and coastal waters and associated lands.*
- *To conserve and enhance wildlife, landscape, and archaeological features associated with inland and coastal waters of England and Wales.*
- *To improve and maintain inland waters and their facilities for use by the public where the NRA is the navigation authority.*
- *To ensure that discharges pay the costs of the consequences of their discharges, and, as far as possible, recover the costs of water environment improvements from those who benefit.*
- *To improve public understanding of the water environment and the NRA's work.*

APPENDIX I - ORGANISATION RESPONSIBILITIES AND NRA AIMS AND STRATEGIES

- *To improve efficiency in the exercise of the NRA's functions and to provide challenge and opportunity for employees and show concern for their welfare.*

STRATEGIC OBJECTIVES

Corporate Strategy

The NRA's vision is of a healthy and diverse water environment, managed in an environmentally sustainable way, balancing the needs of all users.

Sustainable development is at the heart of international and UK policy on the environment. The most widely accepted definition of sustainable development of the 1987 Brundtland Report: "...development that meets the needs of the present without compromising the ability of future generations to meet their own needs". This has been further developed through Agenda 21, the action plan for the next century, endorsed at the 1992 UN conference on environment and development held in Rio de Janeiro (the 'Earth Summit').

Sustainable development must embrace environmental, social and economic concerns for it to be a workable concept; our challenge is to apply it to the water environment. The NRA Corporate Strategy relates the principles of sustainability, precaution and economic efficiency to our Mission to protect and improve rivers and coastal waters.

To achieve our Mission we apply three principles:

- making real improvements to the water environment through effective local operations,
- integrating our services to balance the needs of water users with those of the environment,
- providing value for money through economic efficiency and effective use of our resources.

We guide by three core values which we use as a template by which we can judge our actions:

- achievement of results,
- teamwork,
- trust.

Our functional strategic objectives (these are described later) express how we achieve our Mission and Aims. They follow a logical cycle of planning, action and subsequent review.

Plan: To plan for environmental sustainable improvement through an integrated approach to river catchment management.

Act: To protect and regulate the water environment and its various uses by achieving agreed standards and objectives
To identify and ensure implementation of balanced, lasting and cost-effective solutions to environmental problems
To provide customers with advice, information and incentive to influence behaviour and mitigate or prevent environmental damage.

APPENDIX I - ORGANISATION RESPONSIBILITIES AND NRA AIMS AND STRATEGIES

To use collaboration, partnership and consultation with others to further NRA objectives and make best use of available resource.

Review: To assess and report on the state of the water environment and our success in ensuring its sustainable use.

Water Resources

It is the NRA's responsibility to assess, manage, plan and conserve water resources. The Water Resources Act 1991 describes the duty of the NRA to be to ensure measures are taken towards conservation, redistribution, augmentation and proper use of water resources. The Act requires the NRA to make arrangements with water and sewerage undertakers and statutory water companies for securing proper management and operation of water resources and associated works. To effect these requirements the NRA controls abstractions by a licensing system and has the power, if necessary, to issue drought orders and designate water protection zones and nitrate sensitive areas.

Under the Water Resources Act 1991 all abstractions require a licence except for those of less than 20 cubic metres a day for domestic or agricultural use from surface water and those of less than 20 cubic metres per day for domestic use. There are also other exceptions for small abstractions from boreholes and springs. Charges for abstraction licences are based upon quantity, source, season and loss.

To secure proper management of water resources the NRA operates a hydrometric network of rainfall and river flow gauging stations. These not only provide data for water resource assessment but also for flood prediction, impact of effluent discharges, fisheries management, conservation and recreational uses.

Our Strategic Objectives are:

- To plan for the sustainable development of water resources, developing criteria to assess reasonable needs of abstractors and of the environment.
- To collect, validate, store and provide hydrometric data and water environmental data in order to assess water resources.
- To apply a nationally consistent approach to abstraction licensing, including licence determination, charging, policing and enforcement.
- To implement a consistent approach to the resolution of inherited problems caused by authorised over-abstraction.
- To work with other functions and external bodies to protect the quality of our water resources.

Water Quality

The aim of the NRA is to maintain and improve the quality of rivers, estuaries, coastal waters and groundwater through the control of water pollution. These aims are fulfilled via:

- water quality management
- effluent quality regulation
- pollution incident investigation and
- pollution prevention.

APPENDIX I - ORGANISATION RESPONSIBILITIES AND NRA AIMS AND STRATEGIES

Water quality management is based principally on monitoring of the environment to establish chemical, biological and microbiological quality. These data are used by the NRA to detect trends, plan improvements and execute its statutory duties regarding the setting of discharge parameters and compliance with EC directives.

The NRA controls inputs into the environment via the issue of consents. Discharges from industrial, agricultural, domestic and sewage related sources are regulated by specification of effluent quality limits and conditions which the discharger must achieve. Such discharges are routinely monitored and failure to satisfy consent conditions may lead to legal action being taken.

The NRA makes an immediate response to all reports of pollution. During a pollution incident investigation actions are taken to identify the source, stop the discharge, minimise adverse effects and ensure remedial work where appropriate is completed. Legal action is considered in cases of serious and/or repeated incidents.

Pollution prevention via development control and advice on best practice to industry, farmers, water supply and sewage companies is carried out in support of water quality management to prevent deterioration of the water environment.

Our Strategic Objectives are:

- . To maintain waters that are already of high quality.
- . To improve waters of poorer quality.
- . To ensure all waters are of an appropriate quality for their agreed uses.
- . To prosecute polluters and recover the costs of restoration from them.
- . To devise charging regimes that allocate the costs of maintaining and improving water quality fairly and provide incentive to reduce pollution.

Conservation

Conservation activities of the NRA aim to:

- conserve and enhance the wildlife, landscapes and archaeological features associated with inland and coastal waters
- promote the conservation of aquatic flora and fauna.

APPENDIX I - ORGANISATION RESPONSIBILITIES AND NRA AIMS AND STRATEGIES

The statutory duties under the 1991 Water Resources Act further state that the NRA shall further the conservation and enhancement of natural beauty in respect of proposals relating to NRA functions, protect sites of conservation interest and take into account the effects that any proposals would have. This is achieved through regulating the work of others through the land use planning consultation process and the issuing of consents under the Land Drainage Act 1991 and Water Resources Act 1991 for works adjacent to rivers. The NRA also carries out a programme of conservation works using its own workforce, in addition to assessing the conservation implications of other functional activities.

Our Strategic Objectives are:

- Assess and monitor the conservation status 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.

Recreation

The NRA has statutory duties to:

- ensure that water and land under the NRA's control is made available for recreational purposes
- promote the use of inland and coastal waters, and land associated with them, for the purpose of recreation.

Recreation and amenity includes provision for opportunities and facilities for sports associated with water and the surrounding land, passive activities around water including public access and rights of way and the general aesthetic quality of the water environment.

These duties are identified in the 1991 Water Resources Act in addition to a Code of Practice which gives guidance on the kinds of provision required and the need to consider collaborative management with other bodies.

In addition to these recreation and amenity considerations the NRA, where it is the authority, has responsibilities towards the maintenance and improvement of waterways for navigation.

Our Strategic Objectives are:

- Maintain, develop and improve recreational use of NRA sites.
- To take account of recreation in proposals relating to any NRA function.
- Promote the use of water and associated land for recreational purposes.

Fisheries

The general fisheries duties of the NRA are set out in the Water Resources Act 1991. Under this Act the NRA is responsible for the regulation of fisheries through the application of orders, byelaws and licensing systems.

APPENDIX I - ORGANISATION RESPONSIBILITIES AND NRA AIMS AND STRATEGIES

An essential feature of the Water Resources Act 1991 is the statutory duty placed on the NRA to "maintain, improve and develop fisheries". The term "fisheries" encompasses both sport fisheries and commercial fisheries, however the Act extends further to effectively cover all inland waters, other than fish farms, which are regulated by the Ministry of Agriculture, Fisheries and Food, which have the capacity to support fish. Sport fisheries include waters such as rivers, streams, canals, lakes, ponds and reservoirs.

To discharge its statutory duties the NRA undertakes a wide range of fish surveillance and monitoring activities. Fish populations are biological indicators of changes in river flow, quality and habitat. The regulation of fish introductions and fish capture are important activities.

The costs of the fisheries service are met, in part, by funds raised from rod licences.

Strategic Objectives:

- . Protect and conserve salmon, trout, freshwater, eel and, where appropriate, coastal fisheries.
- . Regulate fisheries through the enforcement of a consistent series of licences, orders, byelaws and consents.
- . Monitor the fisheries status of rivers and inland estuaries 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.

Flood Defence

The NRA has powers to:

- protect people and property against flooding from rivers and the sea
- provide a means for the drainage of land
- provide adequate arrangements for flood forecasting and warning.

Certain watercourses are designated as "main river". On main rivers the NRA have permissive powers to: construct new defences; maintain defences; and, control the actions of others so that the risk to existing and future uses (e.g. development) can be minimised. The NRA are the primary group involved in flood defence matters but on ordinary rivers District or Borough Councils are the first point of contact. For flooding from sewers the responsible group is either the District or Borough Council or Thames Water Utilities.

The standard of flood protection can be measured in terms of the frequency at which (e.g. 1 in 50 years), on average, it will prove ineffective. The standards considered appropriate vary according to the land use to be protected and the economics of providing the service.

These activities are undertaken under the 1991 Water Resources Act and are directed by the Regional Flood Defence Committee. In addition to works on statutory main river, the NRA also has powers to control weirs and culverts on ordinary watercourses that would otherwise affect the flow.

APPENDIX I - ORGANISATION RESPONSIBILITIES AND NRA STRATEGIES

Our Strategic Objectives are:

- To develop and implement our flood defence strategy through a systematic approach for assessing capital and maintenance requirements and develop medium and long-term plans for those defences owned and maintained by the NRA.
- To encourage development of information technology and extension of facilities which will further improve the procedures for warning of, and responding to, emergencies.
- To support R&D which will assist in identifying future flood defence needs.
- To review best practices for all operational methods, and the identification and justification of work, thus increasing efficiency and enhancing value for money.
- To heighten general awareness of the need to control development in flood plains and contribute to the development of catchment management plans.
- To identify opportunities for the enhancement of environmental, recreational and amenity facilities when undertaking flood defence works.

Navigation

Our future strategy is to take a lead in working with other navigation authorities (e.g. British Waterways) to bring about a more consistent approach to the administration of navigation in inland waters than currently exists in England and Wales, and to facilitate and regulate the use of those inland navigations for which the NRA is navigation authority or has powers, and to manage the inter-relationship of navigation with other core functions of the NRA.

Our Strategic Objectives are:

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

Land Use Planning

The NRA is a statutory consultee of the land use planning system and seeks to ensure that local authorities take into account the needs of the water environment when preparing development plans and determining planning applications. A close working relationship is required with both County, District and Borough Councils on mineral workings, waste disposal issues, infrastructure works, works within river corridors or floodplain, and any activities likely to pollute surface or groundwaters or increase the demand for water resources.

Guidance notes for local planning authorities on the methods of protecting the water environment through development plans have been produced (September 1993), and these are being promoted in conjunction with the initiative to prepare Catchment Management Plans.

Summary

Further details on the work of the NRA can be found in a series of NRA strategy documents covering: corporate strategy water quality; water resources; flood defence; fisheries; conservation; navigation; recreation; and, research and development. These documents are available from the NRA Corporate Planning section at our head office at Rivers House, Waterside Drive, Aztec West, Almondsbury, Bristol BS12 44D.

APPENDIX II - REPORT ON INFORMAL LIAISON

Between April and June, 1994 we wrote to all County, District and Parish Councils in the catchment and over 70 other organisations with an interest in the water environment of the catchment. The other organisations contacted included: Government Departments and statutory bodies; conservation, amenity and other interest groups; industries and other businesses located in the catchment; landowners; and, angling organisations. In addition to consultation by letter, meetings were held with all the County and District Councils some of the Government Departments and statutory bodies and interested groups.

The purpose of this period of informal external liaison was to secure relevant information and appreciation of the issues related to the water environment concerning those associated with the area from as wide a range of local people, interest groups and statutory bodies as possible. This period of informal liaison was not intended to be a substitute for the planned period of formal consultation. It enabled the NRA, however, to review a wide range of activities relevant to the natural water environment before identifying the key issues we and others need to tackle.

The overall response rate from all the organisations contacted was 31%. However, as shown on the table below the level of response varied between the different groupings of consultees.

Consultee Group	Number Contacted	Number Responding	% Response
A. County and District Councils	9	9	100
B. Parish Councils	63	14	22
C. Government Depts and Statutory bodies	20	8	40
D. Organisations and Interest Groups	42	12	29
E. Industry	6	1	17
F. Landowners and Angling Interests	5	1	20
Total	145	45	31

The issues of concern to the consultees ranged widely. However, certain issues attracted particular attention. The issues raised in the responses from the different groups of consultees were divided into three main categories:

- Water Quality including groundwater and surface water quality
- Water Resources including water resources management, low flows and over abstraction
- Physical Environment including flooding, nature conservation, recreation, access and landscape.

APPENDIX II - REPORT ON INFORMAL LIAISON

Issues of concern to County and District Councils mainly concerned water resources and quality. There was widespread concern expressed over low flows localised flooding, pollution from agriculture and poorly maintained private sewerage systems and the possible impacts on nature conservation and recreation of both flood defence works and low flows. Concern was also indicated regarding the cost of monitoring pollution in the water environment and of conservation waste. The impact of additional residential development on run off, the water supply and water environment was also identified as an area of concern. A number of County and District Councils noted their interest in the pro-active approach to catchment management planning adopted by the NRA.

Parish Councils raised many of the same concerns as the Counties and Districts, but these were more frequently related to specific locations. In particular, low flows in the upper reaches of the rivers Stort and Rib were identified as problems as well as possible public health problems associated with higher concentrations of effluent from sewage treatment works during summer months. High levels of abstraction upstream of low flow were identified as causing major problems rather than low levels of water supply generally. Pollution concerns were raised in general terms as was localised flooding, in Pincey Brook and the Upper Stort in particular, and the poor maintenance of ditches. River Enhancement Schemes were mentioned in a number of cases with particular emphasis on nature conservation, the value of rivers to landscapes and the importance of maintaining and enhancing recreational and access opportunities.

Government departments and statutory bodies raised issues relating to water resources and the physical environment low water flows, particularly in the River Stort, caused concern and the resultant impact on nature conservation value was highlighted as a problem.

Conservation generally and the need to balance water based recreation and access to rivers and streams was considered important. The Lee Valley Regional Park and Kings Mead in particular was identified as an area of concern. The development of large areas of new housing was seen to increase the problem of localised flooding.

The interest groups contacted were frequently concerned with physical environment issues including recreation and access (particularly in the Lee Valley Regional Park), archaeology, after use of mineral workings, navigation, landscape, houseboat mooring provision and navigation and the balance between access and nature conservation. However, concerns regarding water quality and resources, particularly in relation to pollution associated with low flows and the effect on habitats, were also mentioned, as well as the risk of localised flooding following river enhancement works. The potential for pollution from development was an area of concern, particularly in the Colne Valley Regional Park.

Landowners, industry and anglers produced low response rates. However, concern was expressed over low flows and the effect on habitats and fisheries, particularly in the River Stort. High levels of nitrates resulting in weed growth were also identified. Some concern was also shown over water quality and resources provision for new development.

APPENDIX II - REPORT ON INFORMAL LIAISON

Taking responses as a whole, a number of issues were common. Low flows and the perceived associated health threatening pollution brought about through higher concentrations of sewage effluent and run-off from agricultural land. Low flows were mainly associated with upstream abstraction and a number of consultees requested the granting of fewer licenses. Concerns regarding the physical environment included localised flooding, threats to habitats, access and recreation provision and the impact of new development. Consultees identified the importance of monitoring water quality and resources and were concerned about the costs of nature conservation schemes. The consultees were particularly concerned about water resource management in the catchment; the most frequent comments focused on low flows in the Rivers Stort and Rib.

APPENDIX III - SUPPORTING INFORMATION

RIVER ECOSYSTEM CLASSIFICATION: WATER QUALITY CRITERIA

Class	Dissolved Oxygen	BOD (ATU) mg/1	Total Ammonia mg N/1	Un-ionised Ammonia mg N/1	ph	Hardness mg/1 Ca CO ³	Dissolved Copper pg/1	Total Zinc pg/1
	% saturation 10 percentile	90 percentile	90 percentile	95 percentile	lower limit as 5 percentile; upper limit as 95 percentile		95 percentile	95 percentile
RE1	80	2.5	0.25	0.021	6.0 - 9.0	≤ 10 > 10 and ≤ 50 > 50 and ≤ 100 > 100	5 22 40 112	30 200 300 500
RE2	70	4.0	0.6	0.021	6.0 - 9.0	≤ 10 > 10 and ≤ 50 > 50 and ≤ 100 > 100	5 22 40 112	30 200 300 500
RE3	60	6.0	1.3	0.021	6.0 - 9.0	≤ 10 > 10 and ≤ 50 > 50 and ≤ 100 > 100	5 22 40 112	300 700 1000 2000
RE4	50	8.0	2.5	-	6.0 - 9.0	≤ 10 > 10 and ≤ 50 > 50 and ≤ 100 > 100	5 22 40 112	300 700 1000 2000
RE5	20	15.0	9.0	-	-	-	-	-

GENERAL QUALITY ASSESSMENT: CHEMICAL GRADING FOR RIVERS AND CANALS

Water Quality	Grade	Dissolved Oxygen	Biochemical Oxygen Demand (ATU ¹)	Ammonia
		(% saturation) 10 percentile	(mg/1) 90 percentile	mgH/1) 90 percentile
Good	A	80	2.5	0.25
	B	70	4	0.6
Fair	C	60	6	1.3
	D	50	8	2.5
Poor	E	20	15	9.0
Bad	F ²	-	-	-

¹ as suppressed by adding allyl thio-urea

² ie quality which does not meet the requirements of grade E in respect of one or more determinands

APPENDIX III - SUPPORTING INFORMATION

TABLE OF BIOLOGICAL MONITORING RESULTS

WATERCOURSE/SITE	Mean BMWP Score (Diversity measure)				Mean ASPT score (Water quality measure)			
	74-79	80-84	85-89	90-94	74-79	80-84	85-89	90-94
River Ash	-	-	-	dry	-	-	-	dry
Violet Lane Ford (TL 437 286)	-	-	-	dry	-	-	-	dry
Hadham Ford (TL 436 219)	36	-	-	64	4.2	-	-	3.8
Much Hadham (TL 432 196)	-	-	-	89	-	-	-	4.3
Maltings Lane (TL 430 187)	96	119	102	125	4.9	5.1	4.7	5.0
Bridge North of Widford (TL 424 169)	132	120	148	170	5.7	5.4	5.4	5.3
Easneye (TL 377 133)								
Cannons Brook								
Below Todd Brook (TL 437 092)	-	-	35	-	-	-	3.5	-
Collins Meadow (TL 437 094)	-	-	24	-	-	-	3.4	-
Fourth Avenue Harlow (TL 434 098)	-	-	42	-	-	-	3.5	-
Great Hallingbury Brook								
Parsonage Farm (TL 517 229)	-	33	18	-	-	3.7	3.0	-
Birchanger TL 515 219)	-	-	31	-	-	-	3.3	-
Above Starthill Brook (TL 516 213)	-	-	-	34	-	-	-	3.8
Above Bishops Stortford STW (TL 506 201)	-	27	-	42	-	3.4	-	3.7
Above River Stort (TL 498 191)	-	40	36	46	-	3.7	3.6	3.7
Haley Hill Ditch								
Above B1038 (TL 378 304)	-	-	-	34	-	-	-	3.8
Hatfield Forest Brook								
Above A120 (TL 537 213)	-	-	-	34	-	-	-	3.8
Hatfield Forest Country Park (TL 538 203)	-	-	-	30	-	-	-	3.8
River Lee								
Below Navigation Ware (TL 365 143)	-	-	-	114	-	-	-	4.6
Amwell Magna (TL 380 127)	98	107	136	158	5.0	5.1	5.5	5.3
Above River Stort (TL 381 093)	22	-	-	162	3.8	-	-	5.2
Lee Navigation (Sub.F)								
Above Stanstead Lock (TL 374 129)	52	108	-	-	4.2	4.8	-	-
	40	81	-	-	4.1	4.3	-	-
Parndon Brook								
Above Todd Brook (TL 436 090)	-	-	27	-	-	-	3.4	-
Pincey Brook								
Above Stanstead Airport STW (TL 553 227)	-	9	-	-	-	2.3	-	-
Below Stanstead Airport STW (TL 554 226)	-	25	-	-	-	3.6	-	-
Below A120 (Above Takeley STW) (TL 549 211)	-	-	37	47	-	-	3.6	3.6
Below Takeley STW (TL 549 209)	-	12	-	43	-	2.4	-	3.5
Bridgefoot Farm (TL 545 187)	-	30	-	71	-	3.3	-	4.4
Stone Bridge A1060 (TL 535 150)	-	55	88	97	-	3.8	4.7	4.4
Sheering (TL 513 132)	27	26	63	-	3.0	3.3	4.2	-
Below Ealing Bridge (TL 489 125)	-	76	91	98	-	3.4	4.4	4.4
Pishiobury Brook								
Above Stort (TL 474 130)	95	-	-	76	-	-	-	4.8
River Quin								
Above Barkway STW (TL 388 351)	-	-	-	dry	-	-	-	dry
Below Barkway STW (TL 388 348)	-	-	-	29	-	-	-	3.6
Biggin Bridge (TL 388 334)	-	-	-	29	-	-	-	3.6
Above Braughing STW (TL 394 269)	-	-	-	dry	-	-	-	dry
Below Quinbury Farm (TL 396 260)	-	-	67	65	-	-	4.4	4.3
Braughing Bridge (TL 390 247)	-	100	47	86	-	5.2	4.1	4.4

APPENDIX III - SUPPORTING INFORMATION

TABLE OF BIOLOGICAL MONITORING RESULTS (Continued)

WATERCOURSE/SITE	Mean BMWP score (Diversity measure)				Mean ASPT score (Water quality measure)			
	74-79	80-84	85-89	90-94	74-79	80-84	85-89	90-94
River Rib								
Above Chapel G STW (TL 345 352)	-	-	-	dry	-	-	-	dry
Below Chapel G STW (TL 344 344)	-	-	-	23	-	-	-	3.8
Above Buntingford (TL 363 300)	-	33	-	41	-	4.7	-	3.7
Westmill (TL 369 175)	-	51	52	80	-	4.2	4.0	4.3
Below Coles Park (TL 381 258)	116	93	-	-	4.8	4.9	-	-
Above R. Quin (TL 388 247)	-	73	99	139	-	4.7	5.2	5.2
Above Standon (TL 392 237)	-	85	-	123	-	4.7	-	4.7
Barwick Ford (TL 387 201)	106	113	116	148	5.5	5.4	5.5	5.2
Wadesmill (TL 359 174)	108	110	121	168	5.4	5.6	5.3	5.4
Bengeo Hall Hertford (TL 331 139)	-	-	148	161	-	-	5.7	5.4
Roydon Brook								
Harlow Road (TL 413 101)	-	-	-	42	-	-	-	4.2
Roydon Lodge (TL 412 103)	-	-	-	37	-	-	-	4.2
Stanstead Mill Stream								
Amwell Magna (TL 380 128)	-	-	-	136	-	-	-	4.9
Stanstead Brook								
Above Gypsy Lane (TL 505 240)	40	42	-	46	4.2	3.8	-	3.5
River Stort / Stort Navigation								
Above Furtherford End (TL 444 330)	-	92	-	-	-	4.8	-	-
Measdon Bridge (TL 445 329)	-	62	-	67	-	4.6	-	4.4
Above Ford End Ford, Clavering (TL 467 318)	-	-	-	40	-	-	-	3.7
Above Clavering STW (TL 476 318)	-	-	-	dry	-	-	-	dry
Below Clavering STW (TL 477 316)	-	-	-	65	-	-	-	3.8
At Manuden Below STW (TL 495 261)	46	-	-	dry	3.6	-	-	dry
Hazel End (TL 501 246)	-	-	-	86	-	-	-	4.2
Cannons Mill Lane (TL 494 225)	73	88	90	97	4.6	4.6	4.5	4.4
Stort Nav at Thorley Marsh (TL 492 192)	22	56	-	-	3.0	3.8	-	-
Stort Nav at Twyford Mill Lock (TL 493 192)	36	51	61	88	3.5	4.1	4.3	4.3
Stort Nav at Spellbrook Lock (TL 490 178)	27	88	-	90	3.0	4.5	-	4.5
Stort Nav at S'Worth Lock (TL 486 153)	34	99	-	78	3.4	4.7	-	4.3
Stort Nav Below Sheering (TL 487 143)	-	109	77	-	-	4.7	4.3	-
Stort Nav Above Harlow Lock (TL 474 129)	42	83	81	119	4.2	4.5	4.5	4.6
Stort Nav Above Hunsdon Lock TL 422 113)	84	93	-	-	4.8	4.8	-	-
Above Roydon (TL 417 113)	-	100	96	144	-	5.1	5.2	5.1
Stort Nav above Feildes Weir (TL 391 093)	53	90	-	167	4.7	4.9	-	5.4
Stortford Hall Brook								
Above SWO, Stortford Hall Road (TL 498 215)	-	-	-	39	-	-	-	3.6
Todd Brook								
Harlow Museum, Third Ave. (TL 443 913)	-	-	-	25	-	-	-	3.1
Toll House Stream								
Above Rye Meads STW (TL 389 101)	-	-	-	74	-	-	-	4.1
Below Rye Meads STW (TL 393 095)	-	-	-	55	-	-	-	4.2
Tye Green Brook								
Above Tye Green Road (TL 546 244)	-	-	-	42	-	-	-	3.8

APPENDIX III - SUPPORTING INFORMATION

TABLE OF BACTERIOLOGICAL QUALITY

SITE	NGR	1st Quarter		2nd Quarter		3rd Quarter		4th Quarter	
		T.C.	E.coli	T.C.	E.coli	T.C.	E.coli	T.C.	E.coli
Mill Bridge, Hertford	TL 3252 1264	32000	700	2000	1600	1600	330	2400	540
New Gauge	TL 3400 1380	44000	400	1000	40	1800	210	1000	300
Ware Road Bridge	TL 3600 1420	3000	680	3800	380	9000	1000	4000	800
High St, StansteadAbbotts	TL 3827 1182	2500	260	1000	50	1900	290	500	130
Rye House	TL 3850 0980	1800	140	100	20	220	7	100	50
Dobbs Weir	TL 3850 0820	26000	1400	12000	1300	5000	600	320000	35000

Notes:

1. All results are for 1991 (Jan - Dec)
2. T.C. = Presumptive Total coliforms/100ml
3. *E.coli* - Presumptive *Esherichia coli*/100ml

APPENDIX III - SUPPORTING INFORMATION

POLLUTION INCIDENT CATEGORIES

MAJOR

A major incident involving one or more of the following:

- a) potential or actual persistent effect on water quality or aquatic life;
- b) closure of potable water, industrial or agricultural abstraction necessary;
- c) extensive fish kill;
- d) excessive breaches of consent conditions;
- e) extensive remedial measures necessary;
- f) major effect on amenity value.

SIGNIFICANT

- a) notification to abstractors necessary;
- b) significant fish kill;
- c) measurable effect on invertebrate life;
- d) water unfit for stock;
- e) bed of watercourse contaminated;
- f) amenity value to the public, owners or users reduced by odour or appearance;
- g) breach of consent conditions

MINOR

Minor suspected or probable pollution which, on investigation, proves unlikely to be capable of substantiation or to have no notable effect.

POLLUTION AND PROSECUTIONS

<u>Location</u>	<u>Incident Date</u>	<u>Pollutant</u>	<u>Polluter</u>	<u>Fine (£)</u>
River Ash, Widford	22/5/91	silt	J Browne Constr. Co. Ltd	750
Tye Green Brook, Tye Green	21/2/91	kerosene	BP Oil Int Ltd	50,000
Trib River Stort, Clavering	22/2/93	pig slurry	Clifford R Abraham	caution
Pincey Brook Hatfeld	27/4/93	sewage sludge	Veladail Hotels Ltd	caution

APPENDIX III - SUPPORTING INFORMATION

NRA POLICY STATEMENTS ON LICENSING ABSTRACTIONS

Introduction The abstraction of water is controlled by the Water Resources Act 1991 . This summary presents the key policy statements contained in the General Statement on Licensing Abstraction in the Thames Region. These policies are currently being applied to all new applications for licences or variations. They are not being applied retrospectively to existing licences as such action would render the NRA liable for compensation.

Consumptive Abstractions from Inland Waters (Rivers, Streams, Lakes, Ponds, etc..)

Policy G1. No licences will be granted allowing the unconstrained abstraction of water in the summer months (April to October) for a consumptive use from an inland water except in cases which can be continuously monitored and with a condition prohibiting abstraction at times when river flows are below a prescribed flow.

Policy G2. Winter abstractions from an inland water will normally be allowed but will also contain a prescribed flow condition.

Consumptive Abstractions from Underground Strata (Aquifers)

Consumptive Abstractions from Confined Aquifers **Policy G3.** Licences may be granted if the aquifer is full to the base of the overlying clay, and groundwater levels do not show an unacceptable trend of long-term decline. As water levels in this type of aquifer fluctuate rapidly in response to pumping all licences will be time limited to review dates at 5 or 10 year intervals and some may be subject to control by a prescribed groundwater level.

Consumptive Abstractions from Unconfined Aquifers **Policy G4.** Within 250m of a perennial, groundwater-fed stretch of river, or within its main flood plain, whichever is the greater, consumptive ground water abstractions will be treated as abstractions from a river (See G.2 above).

Policy G5. Beyond the limits in Policy G4, consumptive groundwater abstractions may be allowed, providing the level of resource utilisation permits, but they will generally be subject to control by prescribed river flow or, less commonly, by prescribed groundwater level.

In some cases some reservoir storage will be required to make such abstractions fully reliable.

Non Consumptive Abstractions

Policy G6. Where a very high proportion (95% or more) of the water taken is returned to the source of supply upstream of or immediately downstream of the point of abstraction a licence will normally be granted provided that any by-passed stretch of channel is adequately protected against low flows.

Very Small Abstractions ('De Minimus')

Policy G7. Very small abstractions for general agriculture and private water undertaking uses, will normally be allowed without constraint of a prescribed flow, a prescribed level or a time limit. The cut off limits for an individual abstraction for these concessions will normally be 5000 cu.m (1.1 million gallons) per year and 20 cu.m (4,400) gallons per day.

APPENDIX III - SUPPORTING INFORMATION

NRA POLICY STATEMENTS ON LICENSING ABSTRACTIONS (Continued)

Abstractions for Spray Irrigation

Policy G8. Spray irrigation abstractions from rivers will not be permitted in summer (April to October) but will normally be permitted in Winter with a prescribed flow constraint to protect low winter flows. Reservoir storage for the full annual volume will be required.

Policy G9. Spray irrigation abstractions from groundwater may be permitted in some circumstances, generally in accordance with normal policies on consumptive groundwater abstractions. The imposition of a prescribed flow or a prescribed level may require some reservoir storage but this is optional on the applicant.

Policy G10. For non-agricultural uses (e.g. golf courses) groundwater licences for direct spray irrigation will include a further restriction on use when restrictions on public water supply are in force.

Abstractions from the Tideway of the River Thames

Policy G11. Abstractions from the tideway of the River Thames will normally be permitted providing there is no conflict with water quality and fisheries.

Appeal. All the statements above are subject to the right of the applicant to appeal to the Secretary of State for the Environment against a refusal by the NRA to grant a licence or against any of the terms of a licence.

APPENDIX III - SUPPORTING INFORMATION

STANDARDS OF SERVICE FOR FLOOD DEFENCE AND LAND DRAINAGE

RIVER	REACH	REACH FLOODPLAIN		LAND USE BAND
		LENGTH(KM)	AREA (ha)	
Rib	Roadway	14.02	250	D
Rib	Braughing Warren Bourne	4.62	75	B
Rib	Roadway to Westmill	5.18	87	D
Rib	Chipping Bridge	5.97	95	A
Rib	MRL	5.73	0	E
Chelsings Trib	MRL	4.18	0	E
Wadesmill Bourne	MRL	4.03	0	E
Barwick Trib	MRL	3.38	16	E
Puckeridge Trib South	MRL	5.89	0	E
Braughing Warren Bourne	MRL	3.13	0	E
Quin	Meesden Trib	9.06	113	D
Quin	MRL	3.97	12	E
Braughing Bourne	MRL	1.27	0	E
Little Hornmeed Brook	MRL	4.93	0	E
Great Hornmeed Brook	MRL	1.21	2	C
Meesden Trib	MRL	3.92	9	E
Bandons Trib	MRL	4.29	6	E
Reed End Trib	MRL	7.87	26	E
Nuthamsstead Trib	MRL	1.67	0	E
Haley Hill Trib	MRL	2.74	0	E
Aspenden Brook	MRL	6.11	0	E
Thistley Vale Brook	MRL	4.12	0	E
Sandon Trib	MRL	5.51	5	E
Bolderos Trib	MRL	2	0	E
Whitehall Trib	MRL	1.56	0	E
Reed Trib	MRL	2.75	0	E
Kelshall Trib	MRL	2.36	0	E
Philpotts Trib	MRL	1.56	0	E
Ash	Pegs Lane	8.69	99	E
Ash	MRL	19.94	165	D
All Ash Tribs	MRL	35.77	44	E
Stort	Parndon Lock	6.04	242	B
Stort	Stansted Brook	3.86	62	D
Stort	Track	6.81	61	C
Stort	Cock Lane	5.99	33	D
Stort	MRL	5.67	4	E
Stort	The Causeway	15.36	407	A
Stort Navigation	MRL	4.79	0	E
Hunsdon Brook	MRL	9.37	137	E
Canons Brook & Tribs	MRL	3.3	0	E
Eastwick Brook	MRL	10.72	13	E
Fiddlers Brook	MRL	6.47	44	E
Pole Hall Brook	MRL	1.88	11	E
Harlowbury Brook	Stone Bridge	9.52	77	E
Pincey Brook	Roadway	6.01	54	D
Pincey Brook	MRL	4.38	0	E
Pincey Brook	MRL	2.46	17	E
Colville Hall Brook	MRL	3	0	E
Sawbridgeworth Brook	MRL	1.52	12	C
Little Hallingbury Brook	MRL	3.92	11	D
Spellbrook	MRL	29.95	11	E
Grt Hallingbury Brk & all other Stort trib	MRL	2.38	0	E
Ware Park Mill Stream				

Notes:

1. MRL - main river limit
2. Reach location is upstream end
3. See next table for land use band descriptions.

APPENDIX III - SUPPORTING INFORMATION

STANDARDS OF SERVICE FOR FLOOD DEFENCE AND LAND DRAINAGE

Land Use Band	Description of Typical Land Use	Target Standards of Service
A	A reach containing the urban elements of residential and non-residential property distributed over a significant proportion of its length, or densely populated areas over some of its length. Any agricultural influence is likely to be over-ridden by urban interests. Amenity uses such as parks and sports fields may be prominent in view of the floodplain's proximity to areas of population density.	These heavily built-up areas should be protected to a standard such that the risk of flooding in any one year is no greater than 1 in 50. In some areas higher standards may be applied.
B	Reaches containing residential and/or non-residential property either distributed over the full length of the reach or concentrated in parts but characterised by lower densities than Band A.	Buildings should be protected to a standard such that the risk of flooding in any one year is between 1 in 20 and 1 in 50. However, agricultural or amenity land found in these areas should remain susceptible to regular flooding.
C	Limited numbers of isolated rural communities or urban fringe at risk from flooding, including both residential and commercial interests. Intensive agricultural use could also be included.	The chance of flooding in property in any one year would be between 1 in 10 and 1 in 50 years. Agricultural or amenity land, however, could be susceptible to more regular flooding.
D	Isolated, but limited number of residential and commercial properties at risk from flooding. Agricultural use will probably be the main customer interest with arable farming being a feature. In undeveloped pockets of largely urban use, amenity interests may be prominent.	Agriculture and amenity land in this band should be protected to a standard such that the chance of flooding or prolonged bankfull events in any one year, at a time when crops are normally susceptible to damage (i.e. March to October inclusive), is between 1 in 2 and 1 in 5.
E	There are likely to be many properties and major roads at risk from flooding in these reaches. Agricultural use will be the main customer interest with either extensive grassland or, where the flood plain extent is small, arable cropping being the most common land uses. Amenity interests are likely to be limited to public footpaths along or across the river.	Agricultural land in this category could be susceptible to yearly waterlogging and/or flooding, possibly occurring on several occasions throughout the year. Protection should be maintained to a standard which reduces the risk of either type of event to between one and three times per year at a time when crops are normally susceptible to damage.

APPENDIX IV - GLOSSARY

Acronyms

AMP	-	Asset Management Plan
AOD	-	Above Ordnance Datum
AONB	-	Area of Outstanding Natural Beauty as designed by the Countryside Commission
AQUIFER	-	A layer of underground porous rock which contains water and allows water to flow through it
ASPT	-	Average Species Per Taxa
BC	-	Borough Council
BMWP	-	Biological Monitoring Working Party
BOD	-	Biochemical Oxygen Demand - a measure of the amount of oxygen required to breakdown all organic material in a water body.
BW	-	British Waterways
CC	-	County Council
CMP	-	Catchment Management Plan
CONSENT	-	The 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.
CYPRINID	-	Coarse fish of the Carp family ie roach, dace, bream.
DC	-	District Council
DIRECTIVE	-	A type of legislation issued by the European Community which is binding on the member states.
DoE	-	Department of the Environment
DO	-	Dissolved Oxygen
DWI	-	Drinking Water Inspectorate
E. coli	-	<i>Esherichia Coli</i>
EC	-	European Commission
ECC	-	Essex County Council
ECSR	-	Eastern Council for Sports and Recreation
ENVIRONMENTAL CAPACITY	-	The point at which development passes from being sustainable to unsustainable.
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.
GQA	-	General Quality Assessment
GROUNDWATER	-	Underground water contained in the pores and fissures of aquifers (water bearing strata)
HMIP	-	Her Majesty's Inspectorate of Pollution
MAFF	-	Ministry of Agriculture, Fisheries and Food
MPPA	-	Million Persons Per Annum
MRL	-	Main River Limit
NCZ	-	Nature Conservation Zone
NGR	-	National Grid Reference
NRA	-	National Rivers Authority
NRA TR	-	National Rivers Authority Thames Region
NVZ	-	Nitrate Vulnerable Zone
NWC	-	National Water Council

APPENDIX IV - GLOSSARY

Acronyms (continued)

OFWAT	-	Office of Water Services
PWQO	-	Provisional Water Quality Objectives
Q95	-	Flows exceeded for 90% of the time
RE	-	River Ecosystem
RIPARIAN OWNER		
	-	A person/organisation with property rights on a river bank
RQO	-	River Quality Objective
SALMONIDS		
	-	Fish classified as belonging to the Salmon family ie salmon, trout, char etc
SSSI	-	Site of Special Scientific Interest
STW	-	Sewage Treatment Works
SWQO	-	Statutory Water Quality Objective
TVWS	-	Three Valleys Water Services
TWUL	-	Thames Water Utilities Limited

Units

Length: 10mm = 1 cm (equivalent to 0.394 inches)

100cm = 1m (equivalent to 39.37 inches)

1000m = 1km (equivalent to 0.621-miles)

Area: 10 000 m² = 1 ha (equivalent to 2.47 acres)

Flow: 1 000 l/s = 1 m³/s (equivalent to 35.31 cusecs)

1 000 m³/d = 11.6 l/s (equivalent to 0.41 cusecs)

1 Ml/d = 11.6 l/s (equivalent to 0.224 mgd)