



LOWER RIVER COLNE
DRAFT
CATCHMENT MANAGEMENT PLAN

Prepared by Land Use Consultants

on behalf of

The National Rivers Authority
(Thames Region)

March 1991

Energy House, Lombard St.
Lichfield, Staffs. WS13 6DP

Tel: 0543 258868
Fax: 0543 415469

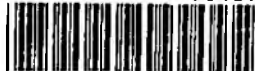
43 Chalton Street
London NW1 1JB

071 383 5784
071 383 4798

Gleniffer House
Glasgow G3 7XH

041 332 8098
041 333 0918

ENVIRONMENT AGENCY



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SECTION 1

INTRODUCTION

1.0 INTRODUCTION

1.1 OVERVIEW

The National Rivers Authority Thames Region (NRA TR) is currently producing three catchment management plans (CMP). These are for the catchments of the Lower Colne, Marsh Dykes and the Stort. The catchments differ greatly in character but the dominant pressure in each is urban development and related changes in land use. NRA policies must be able to anticipate the changes in demand and potential conflicts in the use of resources which such growth brings.

The basic aim of NRA policy making is to preserve water resources, in terms of adequacy and quality, and to provide flood defence and land drainage. However, the recently innovated system of catchment management planning recognises that such policies can only be maintained by taking the wider problems and opportunities of the catchment into account. The underlying principle of this is that the role of the NRA goes beyond the traditional provision and maintenance of works and infrastructure. It should actively seek opportunities for enhancement, widening its horizons to take in the closely related interests of conservation, amenity and so on. The limits of its interests must also widen. For example, it must deal with river corridors rather than river courses: it must be able to view specific problems in a multi-disciplinary, catchment wide context.

The CMPs present a preferred strategy based on multi-disciplinary interests. On the one hand, therefore, the plans seek to implement the strategic goals and objectives of the NRA and NRA TR. On the other hand, they seek to meet the needs of the catchment in terms of user demands and preservation of natural resources. The management strategy evolved for each catchment is also strongly oriented to enhancement.

1.2 SUMMARY OF APPROACH

The methodology and actual structure which have been developed for the CMP follow the NRA TR guidelines on catchment planning [Ref. 1], issued in 1990 by its Catchment Management Planning Group. The framework which these guidelines propose encompasses the phases of: evaluation; forward planning; implementation; monitoring.

The tailored approach which has been adopted for these the first of the Thames Region CMPs, adopts this sequence and comprises the five stages of:

- assessing the natural resources of the catchment
- identifying current and future uses of land and water
- setting out the NRA's objectives, targets and policies as they relate to the catchments and to the NRA's core functions
- defining the issues and developing strategies to address them
- presenting an integrated, overall strategy couched in terms of both policy and corresponding technical action plans.

The stages identified above provide the structure for this volume, the Catchment Management Plan. The foundation for the CMP has, as Figure 1 shows, been laid in a number of ways, each of which contributes to the fuller understanding of the catchment. First of all Baseline Reports were prepared for each catchment to provide a comprehensive database covering both

technical and planning/environmental aspects. This was structured to reflect the interests and needs not only of NRA and local authorities but also of other recognised bodies having either a managing role or an interest in the catchment. The comprehensive database created was also digitised for incorporation into the NRA's own GIS system.

The subsequent Technical Reports then advanced the analysis by distilling the baseline information in order to make a comprehensive identification and evaluation of issues. Catchment specific issues had first been identified in the 1989 NRA TR Evaluation Reports. These needed verifying and updating. New issues which had emerged since 1989 were also identified. Linkages between issues were fully explored. Further predictions were made of how the issues might change as the use of the resource base in the catchment changed. The interface between the resource base and NRA functions was assessed to identify conflicts of interest, constraints and opportunities.

The strands from the Technical Report are now pulled together in the CMP. Issues are first of all restated in a form amenable to treatment by policy formulation. They are then evaluated against NRA functions, existing policies and targets. The objective is to develop a strategy for managing each set of issues, then to meld these into an overall strategy for the catchment. From this a programme of actions may be developed.

The format of the CMP is designed to afford a ready grasp of the key elements of the catchment and of NRA functions. It is a decision maker's document. Careful balance has been maintained between text and illustrative maps. These maps are synoptic in nature and follow the requirements of the NRA Guidelines to summarise issues by drawing attention to problem areas and to areas identified for remedial action.

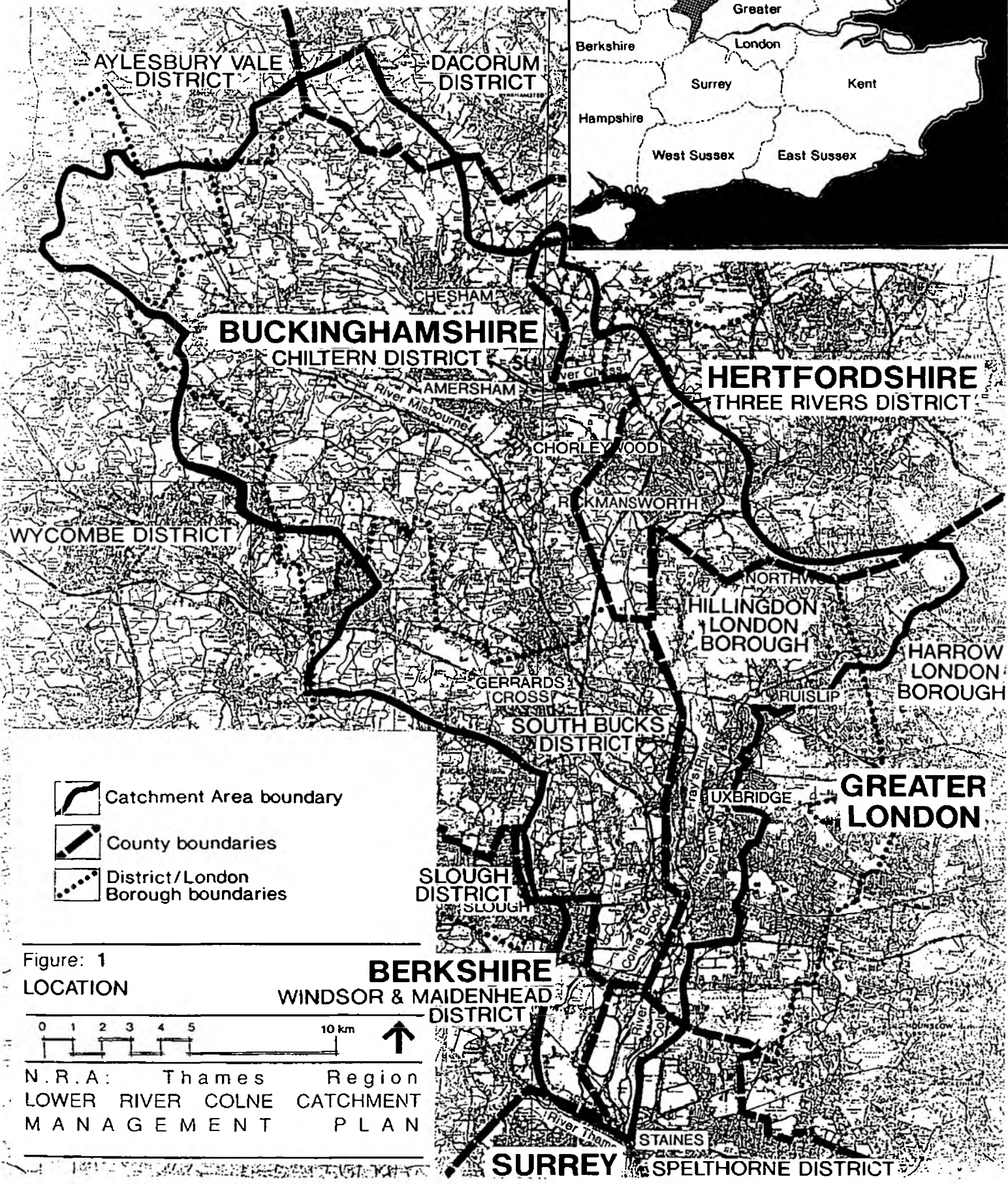
1.3

INTRODUCTION TO THE LOWER COLNE CATCHMENT

The Lower Colne Catchment defines the north-western edge of Greater London. It extends from the Thames at Staines in the south, to the Chiltern watershed near Wendover in the north. Thus it passes from the suburban edge of London to the heart of the Chilterns AONB. It includes (North to South) the London suburbs of Pinner, Ruislip, Uxbridge, West Drayton and Harmondsworth, and the separate towns of Northwood, Rickmansworth, Amesham and Chesham, as well as many historic villages along the valley floors, such as Iver, Denham, Colnbrook and the Chalfonts. In total, it has an estimated population of 600,000.

Around two-thirds of the catchment lies in Buckinghamshire, but with small areas within Hertfordshire, Berkshire and Surrey. The eastern edge of the catchment lies within the London Boroughs of Hillingdon and Harrow.

The catchment covers an area of some 430 km² with 203km of main river. Within the Colne Valley there is a complex series of broadly parallel and interconnecting southward flowing water-courses, including, the River Colne, the Frays and Grand Union Canal in the vicinity of Uxbridge and further south, the Wraysbury, Poyle Channel and Colne Brook. In the northern half of the catchment there are four main tributaries. Draining south-eastwards off the Chilterns into the Colne are the Rivers Chess, Misbourne and Alderbourne whilst draining south-westward into the Frays from Harrow and Hillingdon is the River Pim.



As will be seen in the following sections, this is a highly diverse and often attractive catchment suffering from a range of pressures of which gravel extraction, infrastructure and commercial development are the most acute. The challenge is to conserve those natural resources which remain and to maximise opportunities for revitalising and recreating those natural features which are threatened or have been lost.

Local Authority areas included within the Catchment

Buckingham County Council

- Chiltern District Council
- South Bucks District Council

Hertfordshire County Council

- Three Rivers District Council
- Dacorum Borough Council

London Boroughs

- London Borough of Harrow
- London Borough of Hillingdon

Berkshire County Council

- Royal Borough of Windsor and Maidenhead
- Slough Borough Council

Surrey County Council

- Spelthorne Borough Council

Principal Rivers of the Catchment

Watercourses of the Lower Colne Valley

River Colne
River Chess
Frays River
Grand Union Canal
Poyle Channel
Wraysbury River
Colne Brook

Tributaries

River Chess
Misbourne
Alderbourne
River Pinn

SECTION 2

CATCHMENT DESCRIPTION

2.0 CATCHMENT DESCRIPTION

2.1 INTRODUCTION

This section seeks to describe the natural attributes of the catchment from its geology and drainage to its present day characteristics in terms of ecology and landscape. The pressures and land-use changes which are affecting these natural attributes will then be considered in the following section.

The topography of the catchment, which reflects the underlying geology, is fairly gentle as it largely constitutes the dip slope of the Chilterns falling to the confluence of the Thames and Colne flood plains. Contours increase from around 20m OAD, at the southern end of the Lower Colne flood plain, to around 200m in the north west at the crest of the Chiltern escarpment. Cut into this relatively gentle slope are the distinctive valleys of the Colne tributaries and the valley of the Colne itself which becomes evident upstream of Uxbridge.

Today there is a distinct difference between the predominantly rural character of the chalk tributaries (Misbourne and Chess) and the urban-influenced Colne Valley which has been greatly altered over the last 50 years by extensive gravel extraction.

Figure: 2
TOPOGRAPHY



N.R.A: Thames Region
LOWER RIVER COLNE CATCHMENT
MANAGEMENT PLAN



NOTE: Contours are Shown in
Metres Above Mean Sea Level

GEOLOGY

Solid Geology

Geologically, the catchment divides into two main zones: the older cretaceous chalks of the Chilterns which dip gently south-east, and the younger Eocene solid formations of London Clay and the Reading Beds which overlie the chalk in the southern and eastern half of the catchment.

The Chalk

Cretaceous

The chalk is subdivided in order of increasing age, into the Upper, Middle and Lower Chalk. The Upper Chalk occurs at the surface in the northern part of the catchment while the Middle Chalk only occurs in the upper reaches of the Chess and Misbourne where exposed through river erosion; the Lower Chalk is not exposed in the catchment.

The Reading Beds

Eocene

The Reading Beds are generally considered to be of deltaic origin and are an extremely variable sequence of sands and clays 10-20m thick. These materials are dense and very stiff except where exposed to weathering processes.

London Clay

Eocene

The majority of the London Clay consists of a highly plastic clay although the upper and lower parts are extremely sandy. The London Clay weathers to a firm brown clay, becoming stiff and grey with depth.

Drift Geology

Over the solid geology are extensive superficial layers of younger river and glacial deposits in the order of 2-5m thick. These include:

- glacial or fluvioglacial deposits including 'clay with flints' and pebbly clay and sand found predominantly on higher ground and associated with the Ice Age and its aftermath;
- terrace gravels deposited above the present river flood plains by palaeo-rivers associated with past higher sea levels;
- flood plain gravels associated with the existing larger rivers, especially the Colne and flood plain of the Thames;
- alluvium, peat and brickearths generally lying adjacent and below existing water courses.

It is the extensive deposits of superficial river and terrace gravels which have given rise to the prominence of gravel extraction in the Colne Valley.

Figure: 3

SOLID GEOLOGY



N.R.A: Thames Region
LOWER RIVER COLNE CATCHMENT
MANAGEMENT PLAN






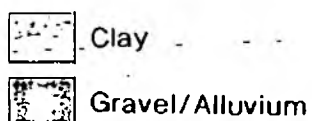
-  Chalk
-  London Clay
-  Reading Beds

Figure: 4
DRIFT GEOLOGY



N.R.A: Thames Region
LOWER RIVER COLNE CATCHMENT
MANAGEMENT PLAN



As a result of the geological variations across the catchment, the rivers are of three main types: the gravel channels of the Colne and its southern distributaries; the chalk streams of the Misbourne and Chess; and the clay-based River Pinn.

Throughout, although the rivers have a generally natural character with a mature ecology they have been substantially altered by man for milling (with many mill leats and empoundments) and navigation associated with the Grand Union Canal. In consequence few rivers within the Lower Colne Catchment retain their natural sinuosity.

Gravel Rivers

A survey of the **Colne Brook** as a representative of the **gravel rivers** shows that its upper and lower reaches are hydrologically controlled by weirs and mills and the majority of its length has been straightened and sometimes overwidened as part of past mill empoundments. In its middle length it has also been realigned to make way for the M25. Therefore, not only has its natural sinuosity been lost but low velocities encourage siltation. The survey indicates that no entirely natural reaches remain although 5 reaches have moderate sensitivity to change as they exhibit some remnant natural bed or bank characteristics or have partially recovered from previous channel management.

Chalk Rivers

A survey of the **Chess** as a representative of the **chalk rivers** shows that it likewise has been extensively altered historically to power mills. In consequence out of a total of 48 reaches only 4 have some natural sinuosity remaining, 3 are regaining natural morphological characteristics, and a further 5 have attained an equilibrium in their straightened state, with a stable segregated gravel bed. These 12 reaches are considered to be moderately sensitive to change.

Clay Rivers

The **Pinn** as the only **clay river** in the catchment is substantially a suburban river. The majority of its length has been straightened and resectioned this century as part of urban expansion. Therefore the geomorphological value of the Pinn and its tributaries is low except for the woodland section of the Woodriding Stream.

Figure: 5

GEOMORPHOLOGY



N.R.A: Thames Region
LOWER RIVER COLNE CATCHMENT
MANAGEMENT PLAN



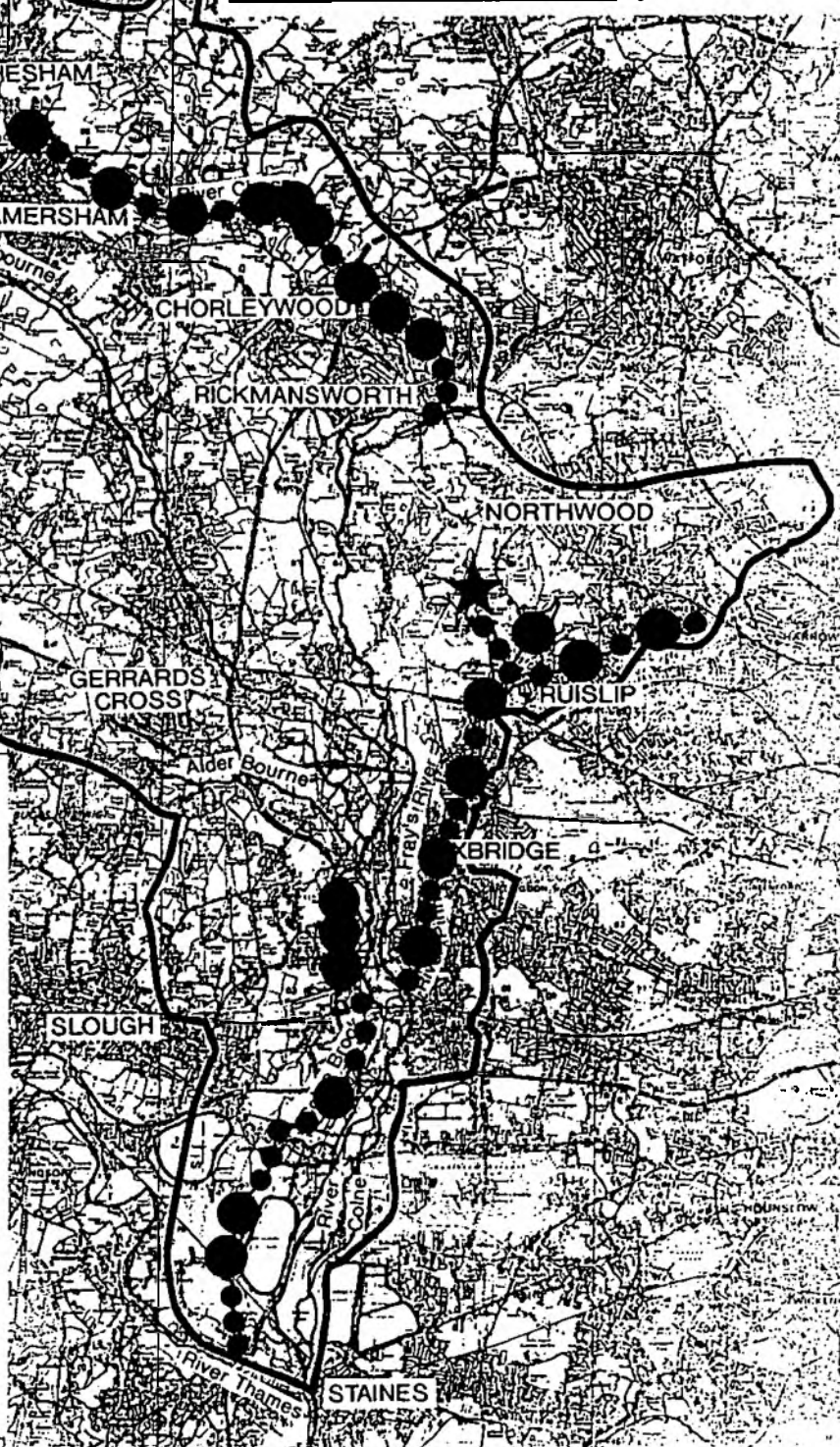
Surveyed Watercourse



Highly Sensitive Reach



Moderately Sensitive Reach

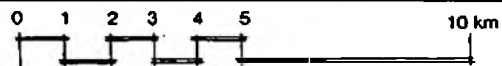


The climate of the catchment is generally typical of this part of South East England. The average rainfall ranges from 650mm in the southern part of the catchment to 750mm in the northern part while the mean for the whole Lower Colne Catchment is 675mm. The seasonal rainfall variation is characterised by long storms of low intensity during the winter and early spring, and short high intensity thunder storms in the summer. In recent years these summer thunder storms appear to have been increasing in frequency over the catchments serving Greater London and the surrounding area. This phenomenon is currently being considered as part of wider investigations by the Institute of Hydrology.

It is becoming increasingly accepted that global warming is occurring. The climatic changes anticipated may include drier summers and wetter winters with greater wind speeds (as experienced since October 1987).

Figure: 6

CLIMATE



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MANAGEMENT PLAN



Isohyet

Source: Meteorological Office, Bracknell

DRAINAGE: SURFACE WATER

On the chalk of the Chilterns, the predominantly rural land-use and porous nature of the bed-rock results in most rain water percolating directly into the underlying aquifer. This lack of surface water run-off results in few clearly defined water courses other than the ground-water fed rivers of the Chess and Misbourne. On the other hand, the extensive surface water run-off associated with areas underlain by the less permeable Reading Beds and London Clays (found in the central and southern parts of the catchment) has resulted in the well-defined southward flowing rivers of the River Colne corridor. This river system is highly complex with interconnections between the various channels and, as already noted, is controlled by a series of sluices and weirs operated by the NRA-TW, British Waterways, local authorities and private mill-owners. Where the rivers are artificially perched through empoundment above surrounding levels, a man-made low level drainage system operates to drain the local catchment. This discharges either to the tail of the main river control structures or directly to the Thames.

In urban areas the methods of coping with surface water run-off vary according to the underlying geology. Where chalk or gravel drift geology underlies the built-up areas, drainage is usually by soakaway combined with drainage into the arterial water course network e.g. Amersham, Chesham, the Chalfonts, Rickmansworth, Gerrards Cross and in the south, Slough East, Poyle, Iver and Colnbrook. Conversely where only impermeable materials underlie the built-up areas all drainage is to the arterial watercourse network as in Northwood and Ruislip. In Uxbridge and West Drayton it is assumed that the drift geology is not suitable for soakaways and therefore again all surface water drainage is to the arterial network.

Figure: 7
SURFACE WATER DRAINAGE
FROM DEVELOPMENT



N.R.A.: Thames Region
LOWER RIVER COLNE CATCHMENT
MANAGEMENT PLAN

Surface Water Discharge
Not Directly to Rivers:

80% Approx. Percentage Area to Soakaways

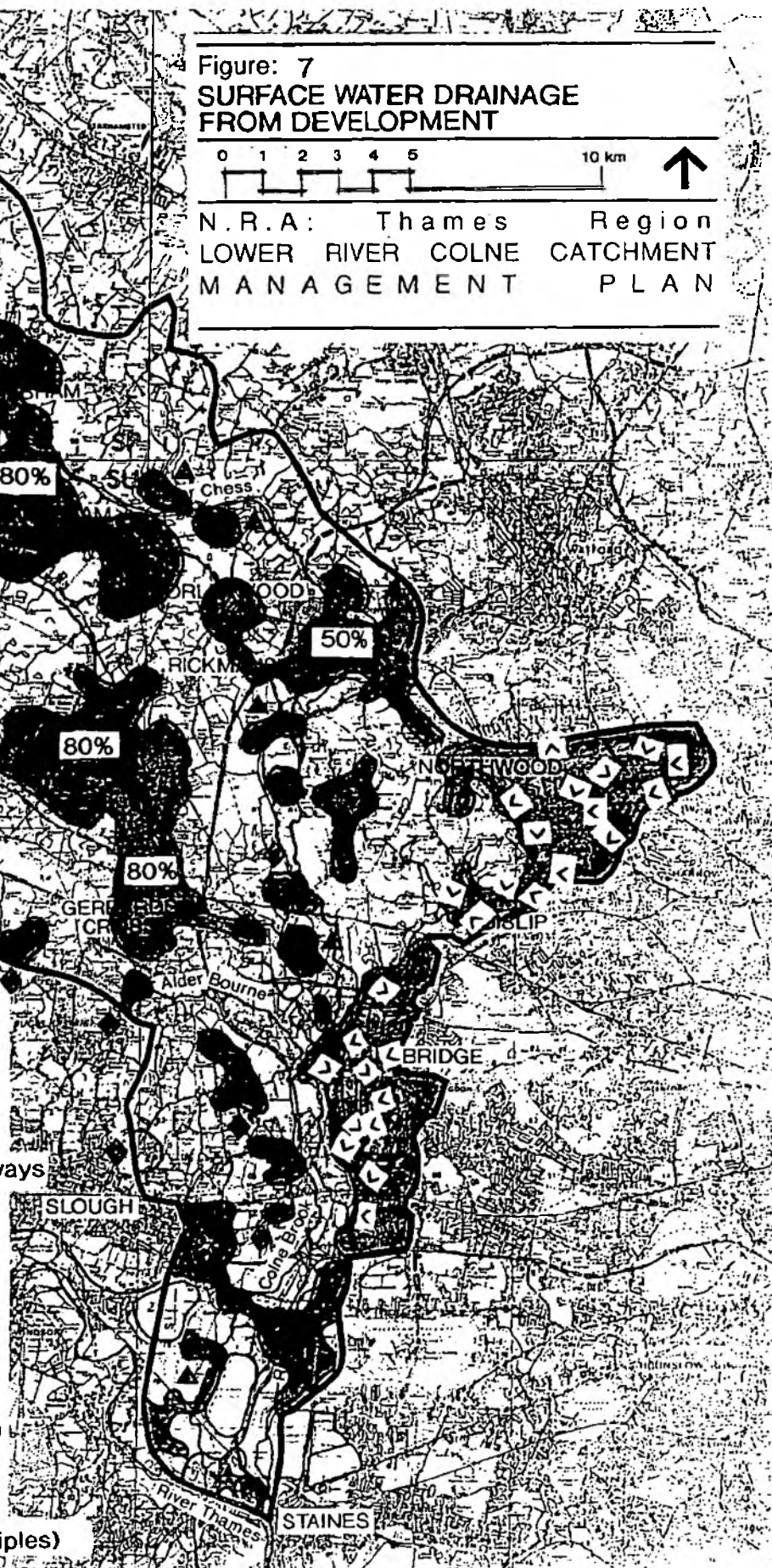
All to Soakaways

All to Ditches

To Soakaways and Ditches

Roof Drainage Only to Soakaway
(arrows show known drainage route)

Surface Water to Watercourses
(arrow shows known drainage principles)



The groundwater bearing geology (aquifers) of the catchment consists of the deep permeable chalk solid geology in the northern part of the catchment and the shallow permeable gravel drift geology underlain by impermeable clay solid geology in the southern part of the catchment.

Groundwater levels in the chalk are sensitive to both annual and seasonal variations in recharge by rainfall, and to the rate of abstraction for public water supply. In the catchment of the River Misbourne the total abstraction is approximately 50% of the average annual recharge. This abstraction, in combination with drier summers, has resulted in the perennial head of the Misbourne moving downstream by 4-5km over recent years and in long reaches of the river seasonally drying out, as well as reduced flows in those reaches which remain wet.

Groundwater levels in the shallow gravel aquifer are sensitive to individual rainfall events, resulting in water logging, infiltration of foul sewers and inefficient operation of soakaways during wet weather. These problems of waterlogging are exacerbated in natural flood plain areas (especially where the main watercourses are artificially impounded) by seepage of river flood waters due to the hydraulic gradient between the channel and the surrounding ground. During periods of high flows in the rivers, this can result in adjacent soakaways acting as wicks, with water rising to the surface via the soakaways and causing localised flooding.

At present the use of soakaways in the shallow gravel drift material of the southern part of the catchment increases the groundwater level. However, this is considered to be of less adverse impact on drainage than the alternative of direct drainage to watercourses (which could well already be in flood) with the effect of increasing flood flows and flood risk to property.

Figure: 8

GROUND WATER DRAINAGE



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LOWER RIVER COLNE CATCHMENT
MANAGEMENT PLAN



DRAINAGE: FOUL WATER

Foul water from urban areas within the catchment is drained and pumped to 17 separate sewage treatment works (STW's), 3 of which are outside the catchment. For example, the majority of the foul water from the Misbourne Valley is transferred to Maple Cross STW where the effluent is discharged to the River Colne rather than returned to the Misbourne. This net export of water, therefore, further exacerbates the problem of low flows in the Misbourne already noted as being associated with abstraction from the aquifer.





Private sewage treatment plants, cesspits and septic tanks are used for small outlying dwellings and hamlets which are not connected to the main drainage system.

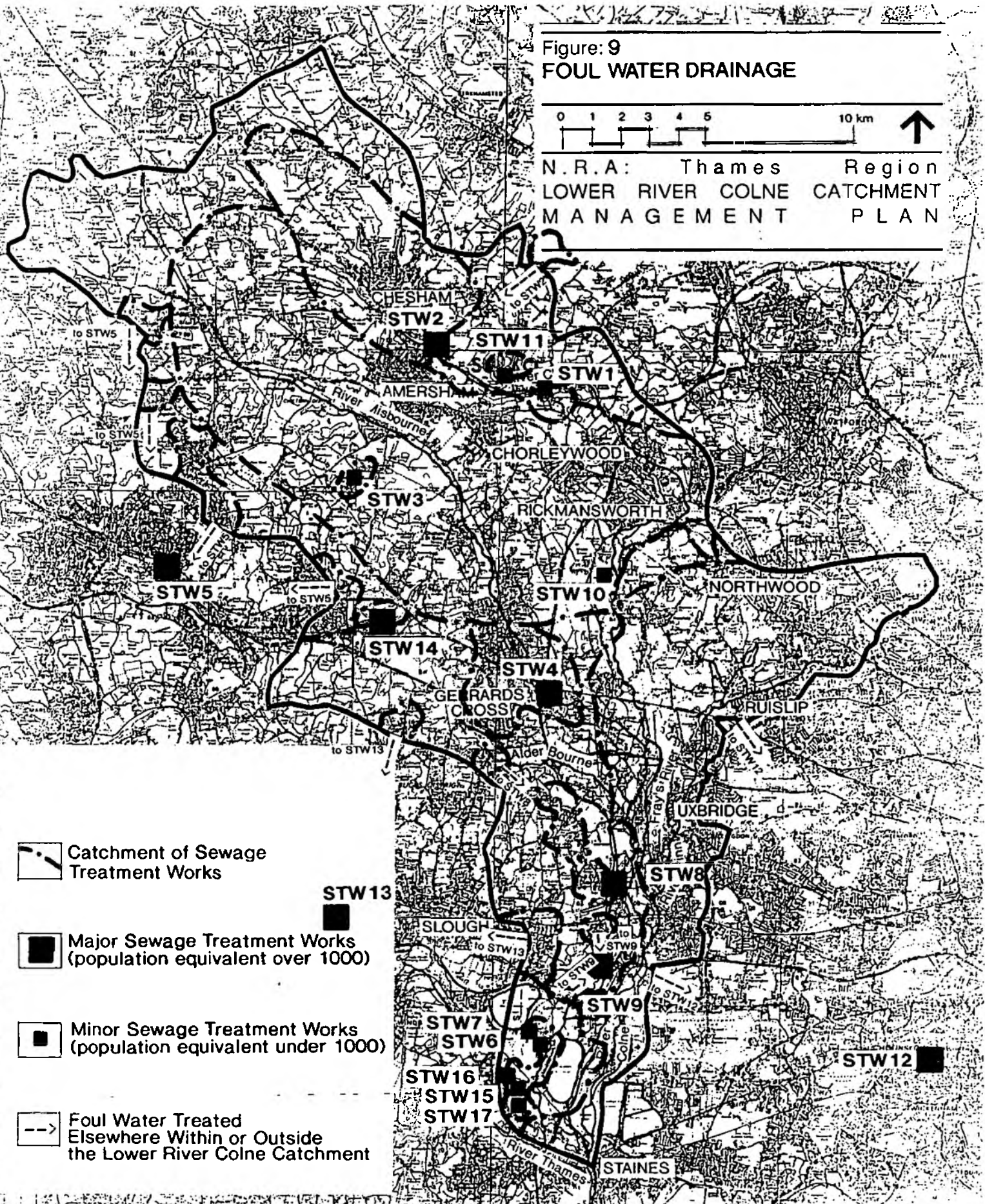
SCHEDULE OF SEWAGE TREATMENT WORKS

STW NO.	NAME OS GRID	REF.	POP EQUIV.	RECEIVING WATER-COURSE	CONSENT STD SS/BOD/AMM	CONSENT VOLUME CUM/DAY
1	Chenies	TW 018 987	203	Chess	45/30	DWF 59.5
2	Chesham	SU 981 996	26784	Chess	25(20)/20/13	DWF 14000
3	Coleshill	SU 951 955	218	Groundwater	30/20	Max 36.4
4	Gerrards X	TQ 019 877	6537	Misbourne	25/15/4	DWF 3040
5	High Wycombe	SU 885 920	82641	Wye	15/9/7	Max 94636
6	Horton	TQ 023 757	75	Groundwater	30/20-	N/A
7	Horton (Private)	TQ 022 758	75	Mildridge Green Drain	30/20/-	N/A
8	Iver North	TQ 044 807	7321	Colne Brook	45/30/25	DWF 3200
9	Iver South	TW 039 778	3082	Colne Brook	45/30	DWF 1154
10	Maple Cross	TQ 041 920	482260	GUC/Colne	25/15/4	DWF 130000
11	Latimer	SU9999 9860	620	Old R Chess	45/30/15	DWF 122
12	Mogden	TQ1578 7535	1714010	Thames	55/50/7	DWF 420000
13	Slough	SU 943 792	226402	Roundmoor Ditch	30/20/-	Max 116480
14	Wilton Park	SU9599 8999	1200	Pond/ Groundwater	30/20-	Max 400
15	Wraysbury	TQ 004 741	75	Drain on the Green	30/20/-	N/A
16	Wraysbury N	TQ 003 742	75	Groundwater	30/20/-	N/A
17	Wraysbury S	TW 005 737	75	Groundwater	30/20/-	N/A

Figure: 9
FOUL WATER DRAINAGE

0 1 2 3 4 5 10 km ↑
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-  Catchment of Sewage Treatment Works
-  Major Sewage Treatment Works (population equivalent over 1000)
-  Minor Sewage Treatment Works (population equivalent under 1000)
-  Foul Water Treated Elsewhere Within or Outside the Lower River Colne Catchment



RIVER QUALITY**Effluent Discharges**

Within the Catchment there are relatively few consented trade effluent discharge points, other than those on the Grand Union Canal which include cooling waters and fish farm effluents. The main sources of effluent discharge to the rivers, therefore, are the sewage treatment works (STW's) located within the river valleys. The Colne system is influenced by STW's located both within and outside the catchment at Berkhamsted, Chesham, Gerrards Cross, Iver Heath, Blackbirds (Watford) and Maple Lodge; the Chess receives major discharges from Chesham STW and minor discharges from Chenies STW; while the Misbourne receives major discharges from Gerrards Cross STW and minor discharges from other works in the valley.

River Quality Objectives (RQO's)

The National Water Council has defined water quality classes, ranging from 1A & 1B (high quality waters) to 2A & 2B (fair quality waters), to 3 (poor) and 4 (bad). Each class has prescribed levels for different water quality determinants (such as cadmium), and for each stretch of river the NRA sets a River Quality Objective (RQO).

Within the Lower Colne catchment out of nearly 200km of channel with designated RQO's, some 24% are Class 1A (the upper Misbourne and Chess, and the Frays between the Pinn and the Colne), while the majority (42%) is 1B; and the remainder is 2A or 2B.

Length of current RQO	1A	44.0	(24%)
	1B	79.2	(42%)
	2A	28.3	(15%)
	2B	34.8	(19%)

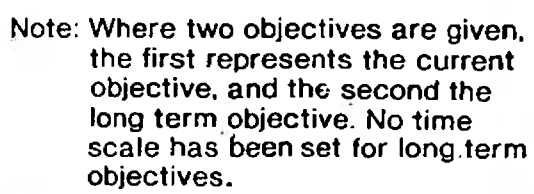
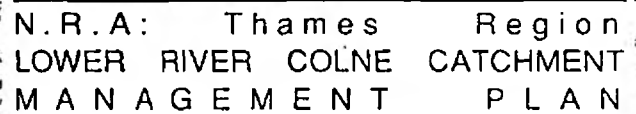
186.3 km

(For Class 2A and 2B river sections, an improvement to 1B is usually the long term objective).

These RQO's are currently being reviewed, with the aim of having new RQO's operational by 1992.

Biological water quality, which reflects the sensitivity of the river to pollution, is measured by the diversity of aquatic macro-invertebrates. Within the lower river reaches of the Colne and its distributaries it varies from A (excellent) to C (fair); no data are available for the Misbourne or Chess.

RIVER QUALITY OBJECTIVES



Overall, the Lower Colne Catchment supports in its lakes, rivers and canals, one of the richest and most varied coarse fisheries in the Thames Region¹. The Lower Colne rivers also form part of a salmonid migration route connecting the important spawning grounds of the Chess and Misbourne (which support EEC-designated salmonid fisheries) to the sea.

Surveys indicate that:

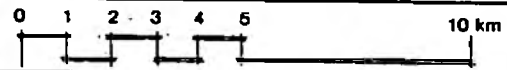
- The Colne Brook, Wraysbury and Frays (surveyed in 1986) have a very good mixed coarse fishery with chub, dace and roach, being the dominant species. The target biomass of 20g/m² was met at all designated sites except for the Wraysbury River.
- The Chess (surveyed in 1987) was used as a salmon nursery site between 1979 and 1988 but this was subsequently stopped because of decreasing water quality. One third of the designated sites met the target biomass of 15g/m².
- The Misbourne (surveyed in 1989) has been regularly restocked in its lower reaches with brown and sea trout by the NRA. Both designated sites failed to meet the biomass target of 15g/m².
- The Grand Union Canal (surveyed in 1987) has stable self-supporting communities of mixed coarse fish, reported to be typical of canals. Biomass results were 7 to 9g/m².

1. Footnote:

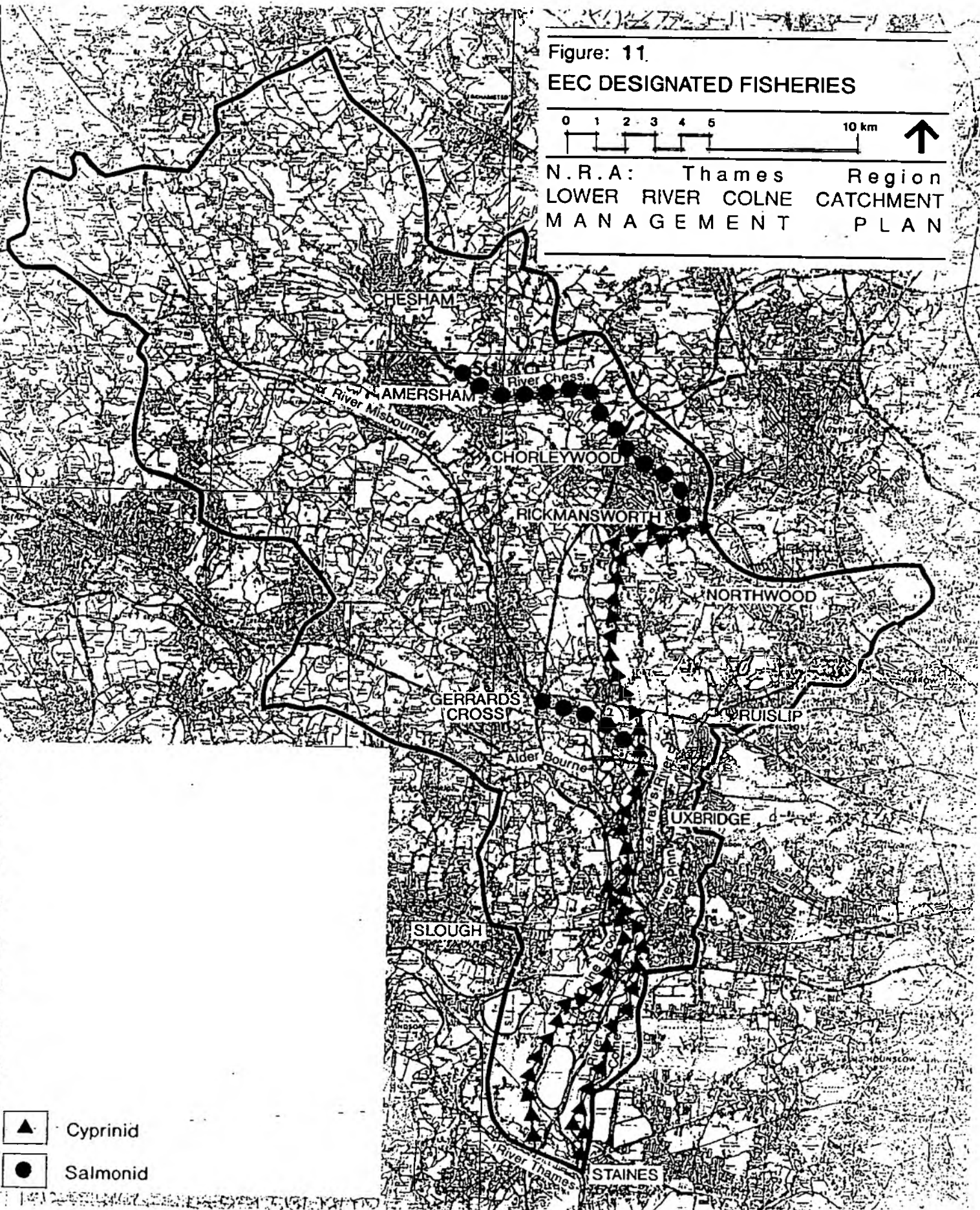
The salmonid family includes salmon (which migrate), rainbow trout, brown trout (some of which migrate as sea trout), and grayling. All other fish are referred to as coarse. Among the coarse fish an important group is the cyprinid (carp) family; these include roach, rudd, bream, tench, barbel and others. Other coarse fish are eel (which migrate), perch and pike.

Figure: 11.

EEC DESIGNATED FISHERIES



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- ▲ Cyprinid
- Salmonid

The ecological interest of the catchment's river valleys is rich and primarily relates to:

- terrestrial habitats (predominantly but not exclusively wet flood meadows);
- the wet gravel pits of the valley floor;
- the ecology of the river channels themselves.

Although not all habitats are of the highest quality, few lowland river complexes can be said to show such a concentration and diversity of interest.

Terrestrial habitats

The terrestrial habitats of the Colne Valley floor are of two main types: secondary habitats resulting from past disturbance (mainly but not exclusively related to gravel extraction) such as interesting ruderal communities, wet woodland (alder and willow carr) and scrub; and much older habitats associated with historical land management practices including marsh, fen and most importantly alluvial grazing meadows. Today Frays Meadows and Staines Moor at the northern and southern ends of the Colne Valley respectively are both SSSI's and are of the greatest importance as nationally scarce habitats. These are complemented by smaller areas of original flood plain pasture lying directly adjacent to the Colne Valley rivers such as Jobs Dairy Meadows near Horton, meadows in the vicinity of Trout Lane and Little Britain, and Croxley Heath SSSI east of Rickmansworth.

On the Chess there are important alluvial meadows in the area of Sarraf Bottom including Frogmore Meadows SSSI. However, the M40 generally lacks the characteristic water meadows of a chalk stream as, even historically, its middle reaches had a naturally sealed clay bed which lay perched above a much lower water table.

Wet Gravel Pits

The two main complexes of mature wet gravel pits in the Colne Valley of value to wildfowl are between Rickmansworth and the M40, centred on Stockers Lake and Broadwater SSSI's in the north, and just north of Wraysbury in the south. These are of national if not international importance for wildfowl. Broadwater (70 ha) has recently been judged by the Wildfowl and Wetland Trust as the premier gravel pit for wildfowl in Britain while the Wraysbury gravel pit is nationally important for wintering Tufted Duck and is a major site for Smew, Golden-eye, Pochard, Goosander and Great Crested Grebe.

The River Channels

The braided river channels of the Colne Valley have a rich marginal flora, comparable to the very best in Britain. This is concentrated in areas with shallow or low lying banks and is especially rich where associated with the three largest areas of marshland/unimproved pasture (Croxley, Fray's & Staines Moor SSSI's). In contrast, the Colne system has a rather poor aquatic flora. Whilst retained heads above mills have advantaged 'edge' species requiring a permanently high water table, the resultant creation of a relatively uniform aquatic habitat has not benefited plant diversity.




The lower reaches of the Chess have wetlands including reed swamp and old cress beds while the greatest interest of the Milbourne chalk stream relates to spring-fed flushes and cress beds, as at Little Missenden, and to sections where the river has been dammed to form formal lakes as at Shardaloes, near Amersham.

In the case of the Pinn the river has limited ecological interest because of its urban setting although the corridor is of local importance for wildlife.

Figure: 12
ECOLOGY



N.R.A: Thames Region
LOWER RIVER COLNE CATCHMENT
MANAGEMENT PLAN

-  Site of Special Scientific Interest
-  Site of Ecological Interest
-  Linear Site of Ecological Interest



2.11 LANDSCAPE

Within the catchment there is a clear distinction between the landscape of the narrow, well-defined, chalk valleys of the Misbourne and Chess and the less clearly defined north-south valley of the Colne and its associated rivers.

The valleys of the Chess and Misbourne are characterised by an agricultural landscape, typically consisting of pasture across the valley floor (although in a number of instances this has given way to arable production), arable on the lower slopes, with the upper slopes crowned with copses and woodlands. This mature agricultural scene is complemented by well defined historic towns and villages of high visual quality which straddle the valley floors and by the rivers themselves which, in certain key sections, retain the shallow-edged, meandering course, marked with scattered willow pollards, so typical of traditional chalk rivers.

By contrast, the Colne valley floor is largely a product of modern land-use pressures characteristic of so much of London's urban fringe, with fragmented agricultural holdings, active mineral workings, downgraded and poorly reclaimed pasture, scrub, horse grazing, intrusive urban development, inter-war suburban sprawl, non-conforming users and, at the southern end of the valley, the massive embankments of water supply reservoirs. Retained within these mixed landuses, however, are remnants of a past agrarian landscape and distinctive landscaped estates as evident in the ancient meadows of Staines Moor and Frays Farm and in the parklands and estate plantings around Denham Court, Delaford Manor, Hunstmoor Park and Sutton Park. These marks of maturity are further enhanced by the older villages of the valley floor such as Denham, Iver and Colnbrook.

Most importantly, a cohesion is provided to these disparate landscape features by the water environment consisting of the rivers themselves, which retain a largely natural character, and the mature tree-fringed gravel pits to be found in a chain between Rickmansworth and the M40, in the area of Little Britain to the east of Uxbridge, and around Wraysbury at the southern end of the valley.

SECTION 3

CURRENT AND FUTURE USES OF THE CATCHMENT

3.0 CURRENT AND FUTURE USES OF THE CATCHMENT

3.1 INTRODUCTION

This section looks at the changing land-use pressures facing the catchment and considers what effects these are having on the water environment. The latter half of this section, starting with Hydrology and Flooding, goes on to examine in more detail how the natural attributes of the catchment will be affected by these changing land use pressures. Consideration is also given to opportunities offered for the conservation and enhancement of the catchment's environment.

As already outlined, the catchment is an area of contrasts, passing from the outer suburbs of London, through the urban fringe shatter-zone of the Colne Valley itself, to the more tranquil rural scene of the Chilterns, with its distinct residential settlements.

Strategic Planning Policies

The whole catchment outside existing built up areas is designated Metropolitan Green Belt. This is strongly upheld by the constituent local authorities of the area and is reaffirmed by the regional strategies of the DOE¹ and South East Regional Planning Conference (SERPLAN)² which seek to restrain any further development on the west side of London. These restraint policies are enhanced by inclusion of the Chilterns dip slope in the Chilterns AONB and recognition of the Colne Valley floor, between Rickmansworth and Staines, as a Regional Park - the Colne Valley Park - where the emphasis is on landscape conservation and rehabilitation, and informal recreation.

The need for development restraint in the Colne Valley has also been highlighted by the Lower Colne Flood Alleviation Scheme, at present being implemented by the NRA. This scheme has been necessitated by the large number of properties within the Colne Valley which are at risk from flooding. However, the success of this scheme depends on further development within the flood plain being prevented.

Despite the emphasis on development restraint, change associated with gravel extraction and landfill continues unabated in the Colne Valley, as does pressure for commercial development. This pressure is fuelled by the excellent transport links enjoyed by the catchment (the M40 and M4 cross the catchment and the M25 runs the length of the Colne Valley), by the proximity of London's Heathrow, and by the uncertain future surrounding many of the older mineral planning permissions.

The dilemma facing the local authorities of the Colne Valley is that, in the present economic climate, they lack the funds to implement the main objectives of the Colne Valley Park. Furthermore, if all original mineral extraction conditions were fulfilled (requiring filling of certain wet pits) the objectives for the Valley would be further undermined. Therefore, in seeking a constructive way forward, the local authorities necessarily enter into extensive negotiations with mineral operators and developers with the aim of framing new strategies of mutual benefit to the public and private sectors. It is these forms of negotiation which at present provide the back-bone to potential major improvements in the Colne Valley.

Footnote:

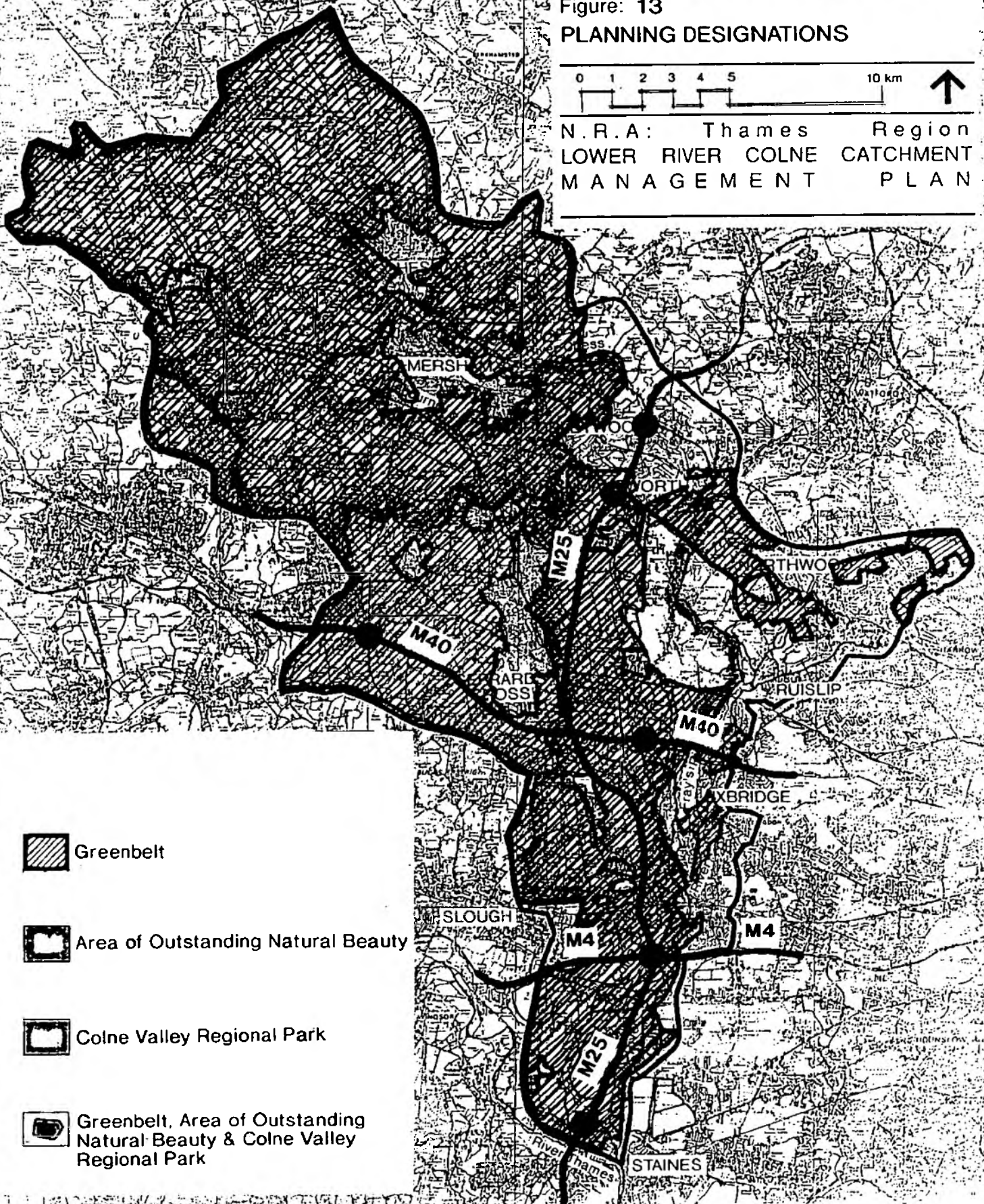
1. Planning Guidance Note No. 9. Regional Guidance for the South East, DOE (1989)
2. Shaping the South East. SERPLAN (1990)

Figure: 13

PLANNING DESIGNATIONS



N.R.A.: Thames Region
LOWER RIVER COLNE CATCHMENT
MANAGEMENT PLAN



Archaeology

The catchment has a long history of human settlement. This was initially influenced by the varying geology of the catchment. The fertile soils of the Colne Valley gravels favoured early settlement, whilst the clays of the centre and east, and the chalk of the north, proved less hospitable. As a result, archaeological finds are concentrated in the Colne Valley.

A total of 566 archaeological sites or find spots have been recorded across the catchment of which five are scheduled Ancient Monuments. These range from palaeolithic to post medieval times although, in terms of numbers, the prehistoric period (neolithic, bronze and iron age) predominates. The area between Stanwell and Staines is particularly rich in neolithic as well as late bronze and iron age sites, whilst Staines has an important Roman history having developed as a bridgehead of the Thames.

Heritage

The main settlements of the catchment date from the Saxon period and many were closely related to the river system as crossing points, mill sites and spring-line settlements. In the Chilterns, settlements were probably somewhat later, relating to the Medieval Period.

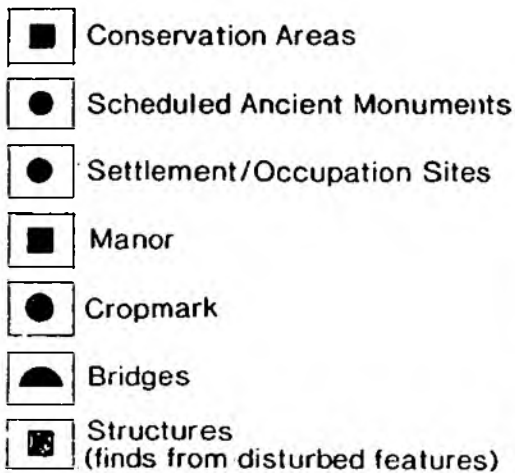
In more recent times, settlements developed in response to the early water mills (mainly pre-1820) and to the introduction of transport links, first the Grand Union Canal in 1796, and then the coming of the railway era starting with the Great Western Railway in 1838, the LWS London-Windsor Line in 1846 and the Metropolitan Line in 1904. Small settlements grew up around the Canal at Cowley, Harefield and Uxbridge Moor but it was the advent of the railways which gave the major impetus to urban development.

Today there are no less than 33 designated Conservation Areas within the river valleys. These cover many waterside settlements and developments, not least all the main settlements of the Misbourne Valley (Old Amersham on the Misbourne is listed by the Council for British Archaeology as a town of outstanding national significance). Not surprisingly many of the waterside buildings and structures are listed.

Implications for the Water Environment

The main concern of the constituent local authorities is to conserve the character of these listed buildings and Conservation Areas. There is concern that new works should not disrupt the setting or fabric of important structures. Most likely to be affected by the NRA's activities are mills, riverside housing and related structures, and traditional canal vernacular. Equally vulnerable are buried riverside structures of archaeological importance which may have been preserved by waterlogging.

ARCHAEOLOGY/HERITAGE



RESIDENTIAL DEVELOPMENT

The Current Situation

The coming of the Metropolitan Line in 1904 was to herald the real spate of urban expansion and ribbon development characteristic of the 1920's and 1930's, prior to the imposition of planning controls under the 1949 Act. The residential areas of Rickmansworth, Uxbridge, Cowley, West Drayton, Horton, Wraysbury, Poyle and Staines mainly date from this period, as do those of Chesham, Amersham and the Chalfonts. For the first time residential development made substantial inroads into the Colne floodplain.

Since the 1930's residential development has been fairly restricted. Nevertheless major expansion has occurred at West Drayton, Poyle, Colnbrook and Stanwell Moor, amongst others, as well as small scale but cumulatively significant infill throughout the catchment.

Future Residential Development

Because of strong policies of restraint new housing within the catchment is likely to be very restricted for the foreseeable future. Review of the local plans suggests that the main areas of new housing are likely to be limited to infill around Wraysbury, Horton, Hythe End, Iver, Denham, Chorley Wood, Rickmansworth, Amersham and Chesham and redevelopment of the Old Ford plant in Slough.

Implications for the Water Environment

Because of the restricted nature of future housing development, impacts on the water environment are likely to be relatively insignificant, so long as new housing is sited outside the floodplain and so long as it does not include excessive areas of hardstanding likely to lead to major problems of surface water run-off.

These developments will also need to take account of local groundwater conditions, bearing in mind the propensity of the Colne Valley gravels to waterlogging.

The Current Situation

While residential development arose primarily as a result of the railways, industrial and commercial developments have been more closely related first to water power and more recently in response to Heathrow and the excellent motorway communications offered by the M4, M40 and the M25. These industrial/commercial areas are primarily concentrated in and around the Colne Valley.

Brewing and milling, relating to water power, still operate in the Colne Valley but the major expansion has been in general and light engineering industries and medical, chemical and petroleum research laboratories, followed most recently by the electronic and computer industries and distribution industries associated with Heathrow. Particularly significant industrial developments within the Colne floodplain include Poyle Trading Estate and industrial estates along the western edge of Uxbridge, Harmondsworth and Colnbrook, while major office developments are concentrated in Uxbridge and Staines.

Future Industrial/Commercial Expansion

As in the case of residential development, Green Belt policies focus attention on redevelopment and restructuring opposed to green field developments. Nevertheless, because of the very high development values in the Colne Valley, (further encouraged by the possibility of a fifth terminal at Heathrow), developers continue to explore every avenue to gain planning permission on Green Belt land, including tying development proposals to major improvement schemes desired by the local authority and of benefit to the wider community. At present the only firm Green Belt proposal of this nature, supported by the local authority, is Prospect Park, lying immediately to the north-west of Heathrow and including proposals for the new British Airways Headquarters. Nevertheless, other developments of this type will inevitably come forward in the future.

Implications for the Water Environment

Large commercial/industrial developments can have a significant impact on the water environment, not least through:

- increased surface water run-off, which can exacerbate flood flows and lead to pollution of water courses;
- adverse changes to channel geomorphology to accommodate the development;
- increased demand on water resources, leading to further drawdown of the chalk aquifer, and
- reduction in flood defence levels of service if the development is constructed in the floodplain.

On the other hand, if these problems can be overcome through careful planning, such developments can offer significant opportunities for the introduction of major mitigation and enhancement measures, often forming part of wider environmental objectives.

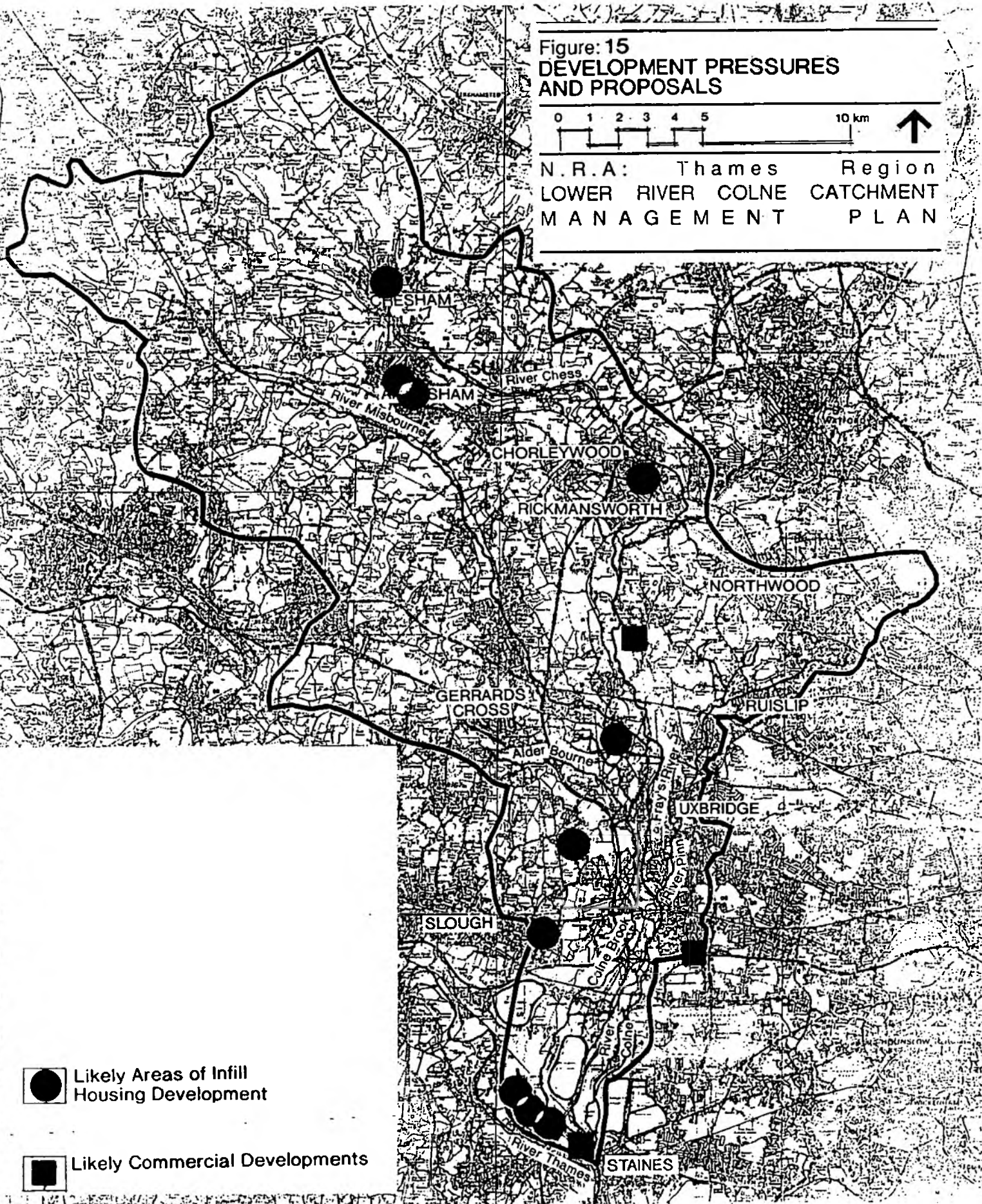
Figure: 15
DEVELOPMENT PRESSURES
AND PROPOSALS



N.R.A: Thames Region
LOWER RIVER COLNE CATCHMENT
MANAGEMENT PLAN

● Likely Areas of Infill
Housing Development

■ Likely Commercial Developments



COMMUNICATIONS

The Current Situations

As already noted, successive improvements in communication links have been a major spur to development in the Colne Valley with the M4, M40 and M25 now being the dominant transport links within the catchment.

Future Communication Developments

The catchment's location ensures that it will continue to be subject to great pressure for major infrastructure development in the regional and national interest. Plans for an M25 Motorway Service Station in the Colne Valley have been dropped, but proposals are afoot to substantially improve the motorway network. Specifically, the Department of Transport has announced:

- widening of the M25 to dual 4 from the M4 intersection northward to well outside the catchment;
- widening of the M4 to dual 4 westward from the M25 intersection.

(In both cases widening will be largely within existing highway land).

In addition, Heathrow Airport Ltd. (HAL), propose to construct a fifth terminal at Heathrow (T5) on the site of the Perry Oaks Sewage Works between the existing airport and the M25. Not only will this require a new terminal building but will also require substantial ancillary car parking and offices, and major road improvements including:

- a new motorway link and associated distributor roads (known as Case 1B2) feeding into the M25 between the M4/M25 Intersection and the Poyle Intersection;
- localised improvement of roads crossing the M25 in this area;
- new grade separated collector distributor roads between the M4/M25 Intersection and Junction 4 of the M4, plus widening of the M4 from dual 3 to dual 4 between Junctions 3 and 4.

Implications for the Water Environment

These proposals have a number of significant implications for the water environment which have or are being investigated by the NRA-TR in a number of separate studies. The road proposals outlined above will not take any significant land from the floodplain, as works are largely being carried out within the existing road corridor, but they will lead to increased road run-off which could affect river water quality and will increase river flood flows. The M25/T5 proposals will also require the relocation of lengths of the Wraysbury River and Bigley Ditch.

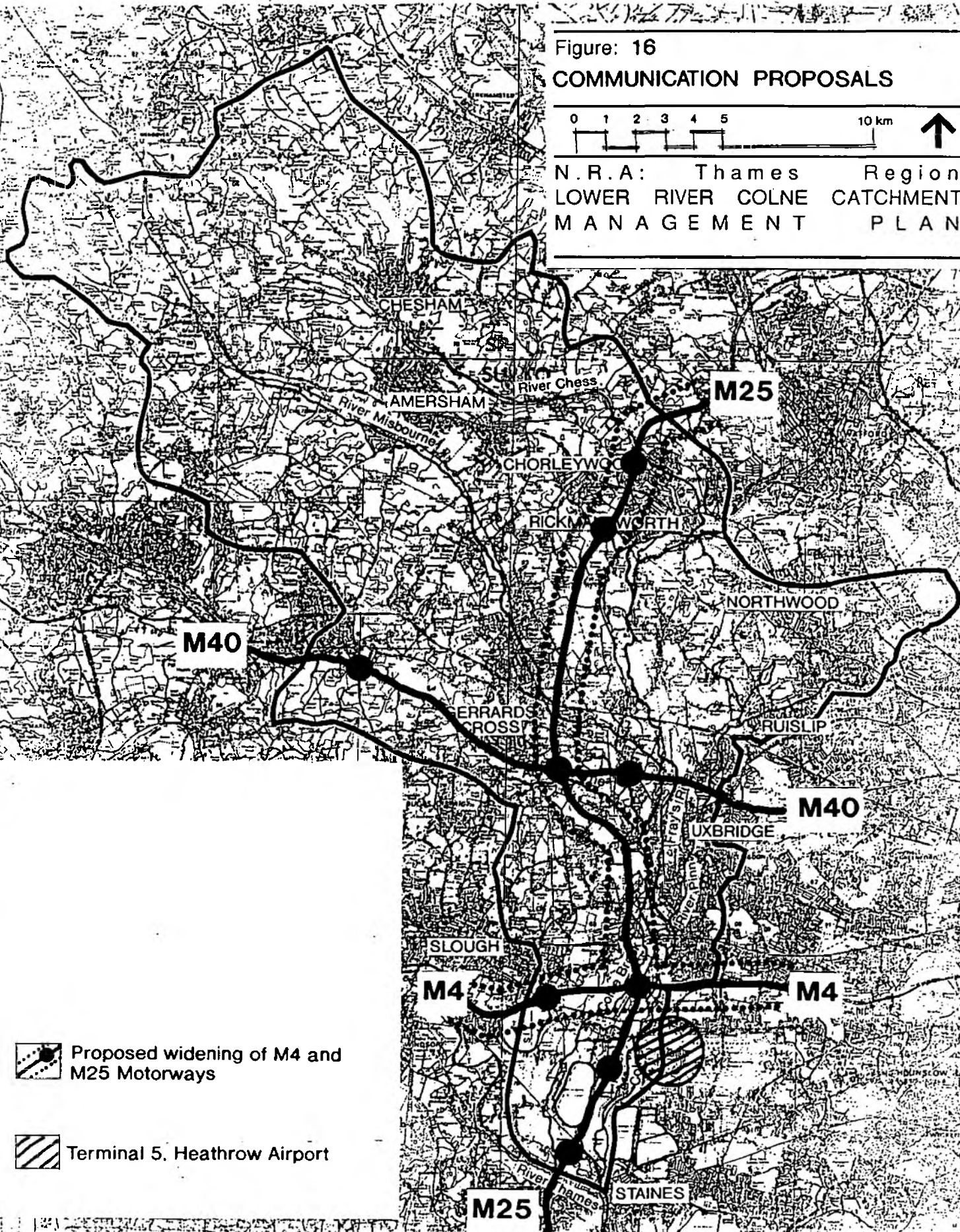
At the same time, Terminal 5 and its ancillary works, such as car parking, will require the relocation of the Longford and Duke of Northumberland's Rivers which skirt the perimeter of Heathrow. They will also take a small area of land from the existing floodplain which, in terms of the Lower Colne Flood Alleviation Scheme, can be compensated by the widening of Moor Bridge. It is understood that water quality in the catchment will not be affected by the new terminal as all airport surface water run-off will be carried to the Bedfont Lakes complex in the Crane catchment, where it could cause considerable impact.

Figure: 16


COMMUNICATION PROPOSALS



N.R.A.: Thames Region
LOWER RIVER COLNE CATCHMENT
MANAGEMENT PLAN



 Proposed widening of M4 and M25 Motorways

 Terminal 5, Heathrow Airport

The Current Situation

Exploitation of the gravel resources of the Colne Valley since the 1930's has had a fundamental impact on the character and hydrology of the Colne Valley. The extensive mature wet gravel pits of the valley floor, found in three main blocks between Rickmansworth and the M40, in the area of Little Britain to the east of Uxbridge, and around Wraysbury, have become highly valuable wildlife and landscape features. The more recent areas of gravel extraction have tended to be in the south of the Valley between Yiewsley and Wraysbury. The majority of these have been used for landfill and restored to agriculture (often low grade) with doming above surrounding land.

Future Minerals Development

Although a large percentage of the valley gravels have now been exploited, economic pressures necessitate the release of further land for mineral extraction and use of void space for landfill.

The County Minerals plans define 'preferred areas' where future mineral extraction will be favoured. They may also indicate 'prospect areas' where extraction may sometimes be permitted, and 'restricted areas', where extraction will not be permitted. Within the Colne Valley the majority of 'preferred sites' are in Buckinghamshire, including a major site in the Denham area, whilst the most important restricted areas are along the eastern edge of Slough, north of Hythe End and Staines Moor itself.

By comparison, the location of future landfill sites is not so clear. Some minerals plans, notably that of Buckinghamshire, indicate the favoured after-use for the various 'preferred extraction areas' and by inference the requirements for landfill but more commonly decisions on landfill are taken on a site by site basis as new applications come forward.

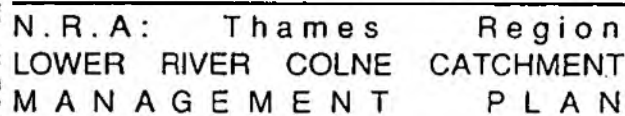
At present, however, the most pressing problem associated with landfill are the outstanding planning conditions requiring the filling of at least 14 of the old mature wet gravel pits of the Colne Valley, including some of exceptionally high wildlife interest, most notably Broadwater and the Wraysbury Pits.

Implications for the Water Environment

The prime problems of mineral workings relate to their subsequent use for landfill. In particular:

- past doming of landfill sites above original ground level has taken substantial areas out of the floodplain so increasing the risk of flooding. Any further loss of floodplain through doming would reduce the effectiveness of the Lower Colne Flood Alleviation Scheme.
- filling of established wet gravel pits would reduce their flood attenuation capacity, as well as leading to the loss of some nationally important habitats;
- backfilling of gravel workings with impermeable materials forms a barrier to groundwater movement, resulting in increased groundwater levels on the upstream side with a mirror decrease in levels on the downstream side. The effects of this are respectively to increase waterlogging and deplete low flows in water courses;
- backfilling with putrescible or hazardous wastes over permeable materials can lead to pollution of groundwater. This is a particular concern in older pits filled before the more stringent controls introduced under the control of Pollution Act 1974.

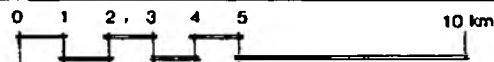
MINERALS/WASTE DISPOSAL



Recent filling where known

Figure: 17b

MINERALS/WASTE DISPOSAL



N.R.A: Thames Region
LOWER RIVER COLNE CATCHMENT
MANAGEMENT PLAN

Gravel pits with outstanding permission for filling

KINGSMEAD (MANOR)

WRAYSBURY No.1

WRAYSBURY No.2

ARC WRAYSBURY LAKE

LONGFIELD FARM

ARC HYTHE END LAKES

RAILWAY PIT

HITHERMOOR
(SOUTHERN SECTION)

HYTHE END LAKES A.

LAKESIDE ROAD (TANHOUSE PIT)

HORTON ROAD/ROSARY FARM

EGGLESEY FARM

WOODLANDS PARK

UXBRIDGE

BRUISLIP

BROADWATER LAKE

NORTHWOOD

RICKMANSWORTH

CHORLEYWOOD

AMERSHAM

CHESHAM

GERRARDS CROSS

Alder Bourne

SLOUGH

STAINES


Figure: 17c


MINERALS/WASTE DISPOSAL





N.R.A.: Thames Region
LOWER RIVER COLNE CATCHMENT
MANAGEMENT PLAN

MINERAL PLAN DESIGNATIONS

 Preferred areas, restoration water, inerts or unspecified

 Preferred areas, putrescible waste restoration

 Prospect areas

 Areas of restriction or objection



The Current Situation

The tributary valleys of the Misbourne and Chess are still predominantly in agricultural use (grazing and arable). Conversely few viable agricultural units remain in the Colne Valley. Here the combined effects of urbanisation and fragmentation associated with gravel extraction have resulted in a highly complex pattern of land ownership and occupancy, with gravel companies having significant involvement in agriculture. Inherently non-viable holdings achieve an income through horse grazing, or farm-related enterprises, or are rented without security of tenure by large farm businesses centred some distance away. The few remaining areas of viable agriculture in the Colne Valley are found on the valley sides around Harefield and Iver Heath and relate to ex-GLC Green Belt holdings which have been passed on to the relevant local authorities. High quality arable/horticultural land of Grades 1 and 2 also remains south of Colnbrook, but the majority of this is now subject to gravel extraction proposals.

Thus within this catchment it is interesting to note that current agricultural activity largely reflects land use pressures rather than agricultural land quality. The high quality free draining soils (Grades 1 and 2) overlying the gravels of the Colne Valley have all but been lost to gravel extraction whereas the lower grade soils of the Chilterns and valley sides (Grades 3a and 3b) remain in agricultural production.

Future Agricultural Developments

At present there is a national downturn in the agricultural economy, equivalent to the agricultural slump of the 1930's. This is affecting all agricultural sectors with the possible exception of dairying. Agricultural units suffering most are those at the margins, i.e. the majority of the holdings in the Colne Valley. The likely effects of this will be to encourage:

- marginal farm holdings to move entirely out of agriculture, into non-agricultural activities such as car storage;
- mineral companies to seek recreational rather than agricultural end uses for new mineral sites, with a preference for economically viable uses such as golf courses;
- larger agricultural units, such as those in the Chilterns, to explore options for agricultural diversification. Again economically viable recreational activities, such as golf or shooting, may prove attractive;
- further long term land speculation.

The combination of these shifts could lead to further dramatic changes in the landscape, with increasing suburbanisation of the Chiltern and Colne landscapes as farms and gravel companies diversify into recreational uses, combined in the Colne Valley with increased horse grazing, a potential spread of non-conforming uses and 'shakery', and with many small plots being left entirely unmanaged.





Implications for the Water Environment

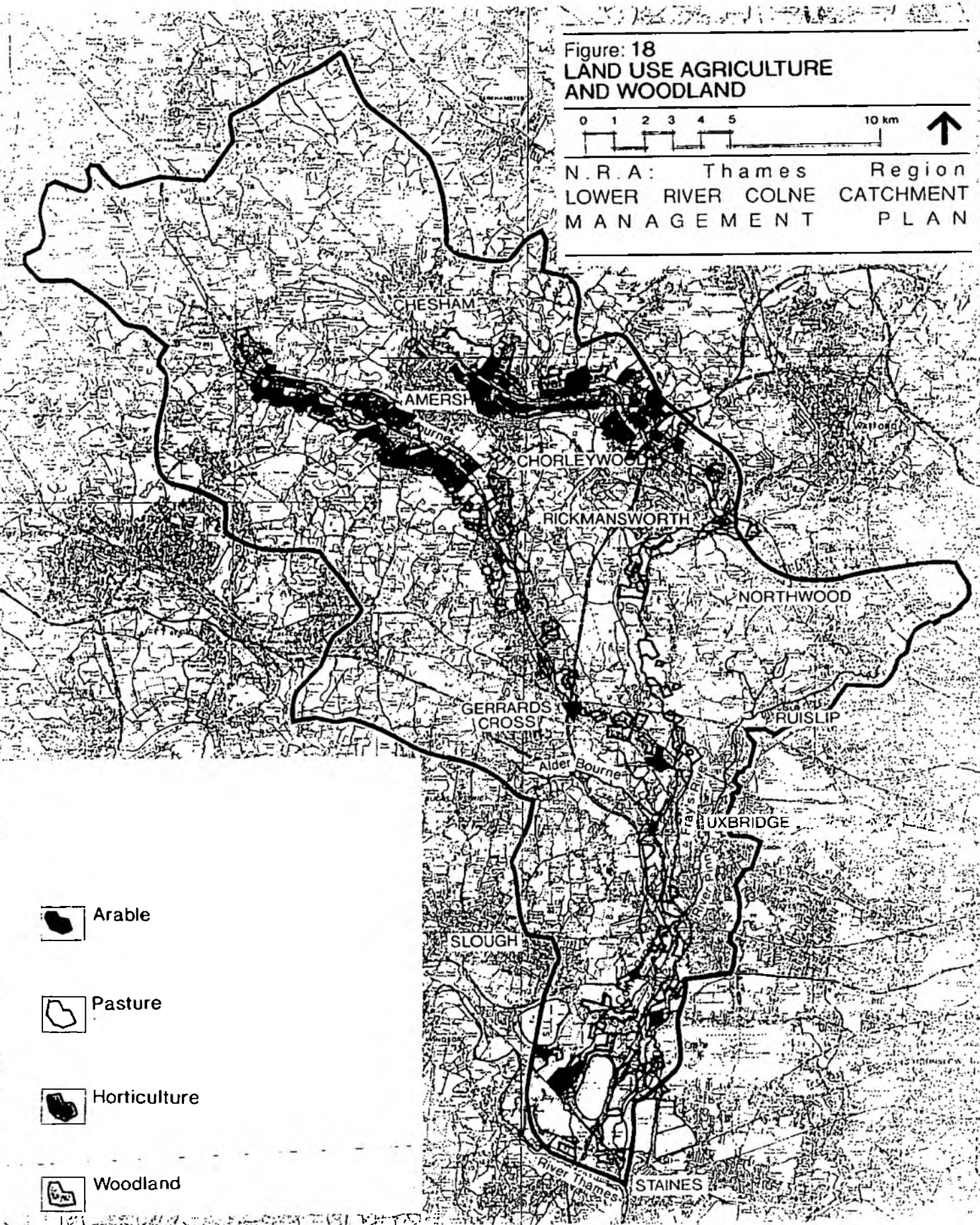
In the recent past, agricultural activities affected the water environment, not least through pollution of water courses and aquifers, and by the straightening of watercourses to accommodate arable production, (as seen on parts of the Misbourne). The primary effect of current agricultural changes, however, may be to place further emphasis on the landscape and conservation importance of the rivers as one of the few remaining features of continuity.

Figure: 18
LAND USE AGRICULTURE
AND WOODLAND



N. R. A: Thames Region
LOWER RIVER COLNE CATCHMENT
MANAGEMENT PLAN

-  Arable
-  Pasture
-  Horticulture
-  Woodland



The Current Situation

The catchment is a valuable recreational resource. The Colne Valley Park, with its large number of wet gravel pits, is of regional importance for water-based activities, especially dinghy and board sailing, water skiing, and canoeing. These are primarily club run and occur in two main areas: between Rickmansworth and Uxbridge in the north and around Wraysbury and Horton in the south.

By comparison, formal land-based sports provision is local in character, although there are a number of golf courses which serve a wider audience. However, it is primarily for informal recreation that the Colne Valley Park has been developed but this potential has yet to be fully realised.

Future Recreation Developments

To redress the balance, the Colne Valley Park has proposed a programme of improvements for informal recreation for the period to 1998. This will improve informal provision in the north and middle of the Colne Valley but still makes no major provision at the southern end. The proposals include a Wildfowl Centre based on Broadwater, Country Parks in the areas of Denham Quarries/Denham Court and Little Britain, and a variety of footpaths, bridleways and picnic sites, many of which relate to the rivers. Of more strategic importance, however, are proposals to draw the Colne Valley and its tributaries into the growing network of regionally and nationally important long distance rights-of-way. Proposals are afoot to:

- find a footpath link between the Thames long distance footpath and the Grand Union Canal towpath, so linking the Thames to the footpaths of the Midlands;
- develop a Misbourne Valley footpath linking Wendover to Denham;
- develop a bridleway running the length of the Colne Valley which will link to the Ridgeway via a developing network of regional routes.

Although there are no strategic plans for the improvement of land-based formal sports facilities, current land use trends (see Minerals and Agriculture) will probably lead to an increase in golf courses and other financially lucrative sporting uses. A major golf course development is at present underway in the grounds of Denham Court.

Implications for the Water Environment


At present the key determinants of recreation provision in the catchment are mineral extraction, landfill/development proposals and, increasingly, agricultural diversification. Nevertheless new river works can also offer major opportunities for the creation of strategic riverside links; although increased public access needs to be carefully planned if it is not to adversely affect the wildlife interest of the rivers and wetlands.


Figure: 19

FORMAL RECREATION



N.R.A: Thames Region
LOWER RIVER COLNE CATCHMENT
MANAGEMENT PLAN

 Existing Formal Water Based

 Proposed Country Parks

KINGSMOOR LAKE

WRAYSLEY No 1

HYTHE LAGOON
& COLNE MERE

TROY LAKE

BROADWATER LAKE

FARLOES LAKE

SLOUGH

BURY LAKE

GERRARDS
CROSS

CHORLEYWOOD

AMERSHAM

CHESHAM

BATCHWORTH LAKE

NORTHWOOD

HOVERINGHAM LAKE

RUISLIP

DENHAM QUARRY

UXBRIDGE

WOODLANDS PARK

STAINES

HERON LAKE

River Chess

River Misbourne

Alder Bourne

River Colne

River Thames

The Current Situation

The Grand Union Canal runs down the Colne Valley as far south as Yiewsley. Recreational boat traffic is the principal user and, although traffic density is not high in the Lower Colne area, pressure for moorings is much heavier as London is approached.

Future Navigation Developments

The Inland Waterways Association has put forward proposals whereby the Grand Union Canal would be linked to the non-tidal Thames via the rivers of the Colne Valley. This would involve seven locks and extensive canalisation of parts of the Colne Brook, Poyle Channel and Wraysbury River, and would cost in excess of £30 million (1987 prices). Regardless of these proposals, BWB would like to create more visitor moorings on the existing canal to encourage boat tourists, preferably sited off the line of the canal, including a proposed 100 berth marina on the Slough Arm of the Grand Union Canal, near Iver.


Implications for the Water Environment


There is little doubt that the proposed Colne Valley Navigation Link would have a fundamental adverse impact on the rivers affected, destroying any remaining natural geomorphology, severely affecting ecological interest, and potentially contributing to low flows. On the other hand, carefully controlled development of recreational facilities on the existing canal could enhance the character of the Valley.

Figure: 20
NAVIGATION




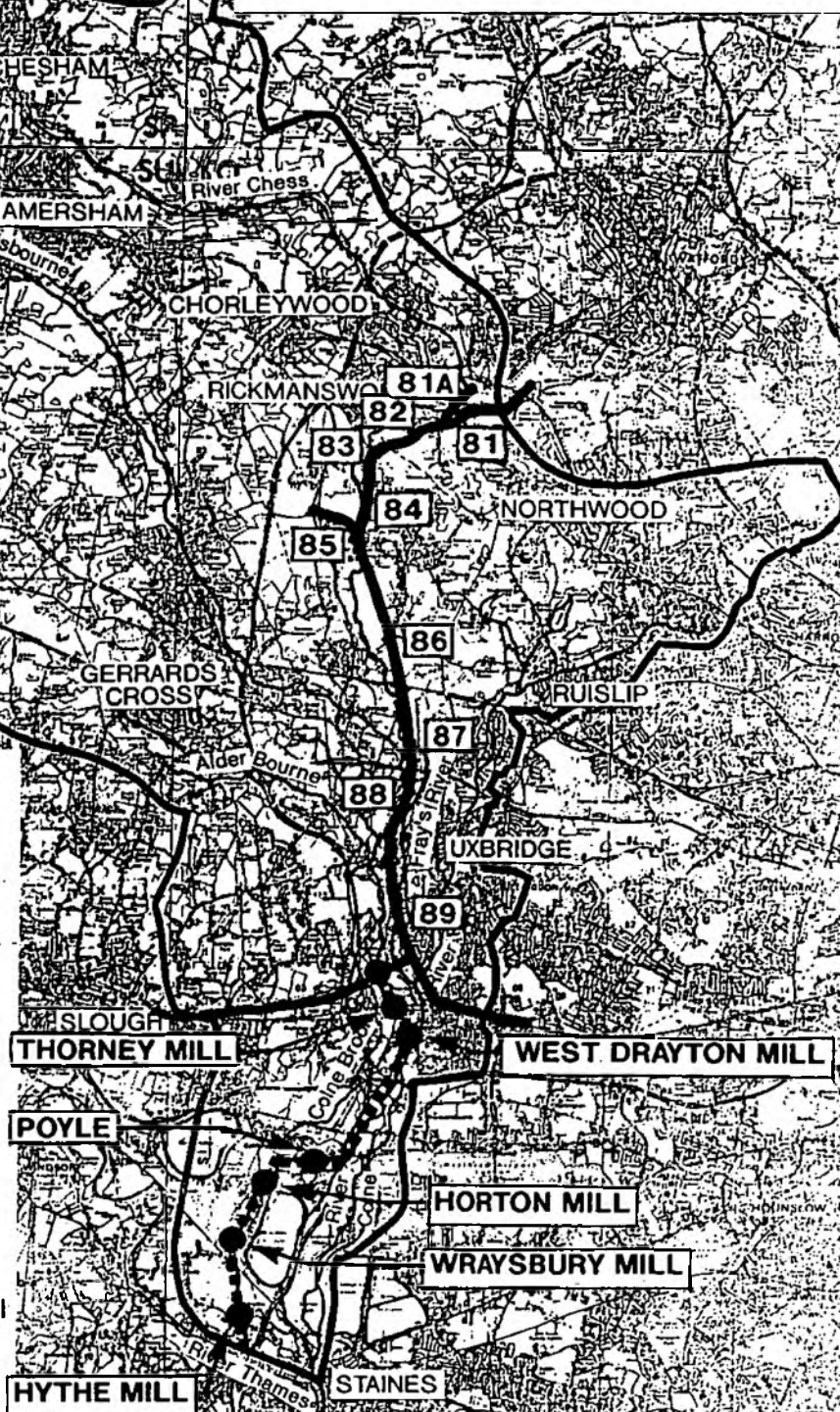
N.R.A: Thames Region
LOWER RIVER COLNE CATCHMENT
MANAGEMENT PLAN

 Grand Union Canal

 Existing Locks

 Colne Valley Navigation Link

 New Lock Structures (IWA Proposal 1986) as part of C.V.N.L.



The Lower Colne Flood Alleviation Scheme

The last major river flood in the Lower Colne Valley occurred in March 1947 and was deemed to be a 1:50-1:60 year event. Since then there have been several lesser events, with the most recent occurring in October 1987 and May 1988. These led to flooding of properties, particularly in the Colnbrook, Wraysbury and Uxbridge areas. A feature of Lower Colne river floods is their relatively long duration, possibly lasting a week or more.

There has been a dramatic increase in flood risk in the Colne Valley since 1947, with loss of floodplain to development and raised landfill sites, and with increased run-off associated with major development outside the floodplain. In 1987 the potential flood damage associated with a 1:100 year flood event was valued at £18 million, involving over 2,000 homes and many industrial premises. A major scheme - the Lower Colne Flood Alleviation Scheme - is now being implemented to overcome this problem. This has undergone wide public consultation and seeks to minimise environmental damage whilst maximising enhancement opportunities. Retention of flood plain storage is a fundamental tenet of the proposals, which also include removal of bottlenecks, transfer of flood flows between existing channels and new bypass channels. More damaging flood alleviation options, such as flood bunds and walls, and channel widening or deepening, have only been used where other strategies are ineffective.

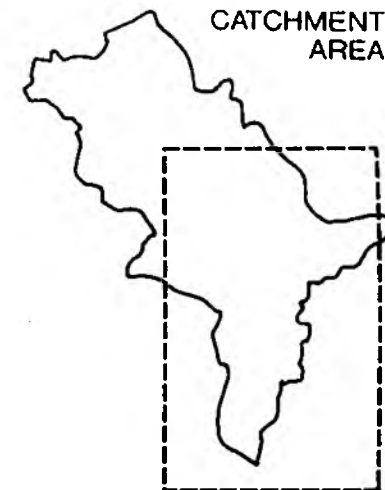
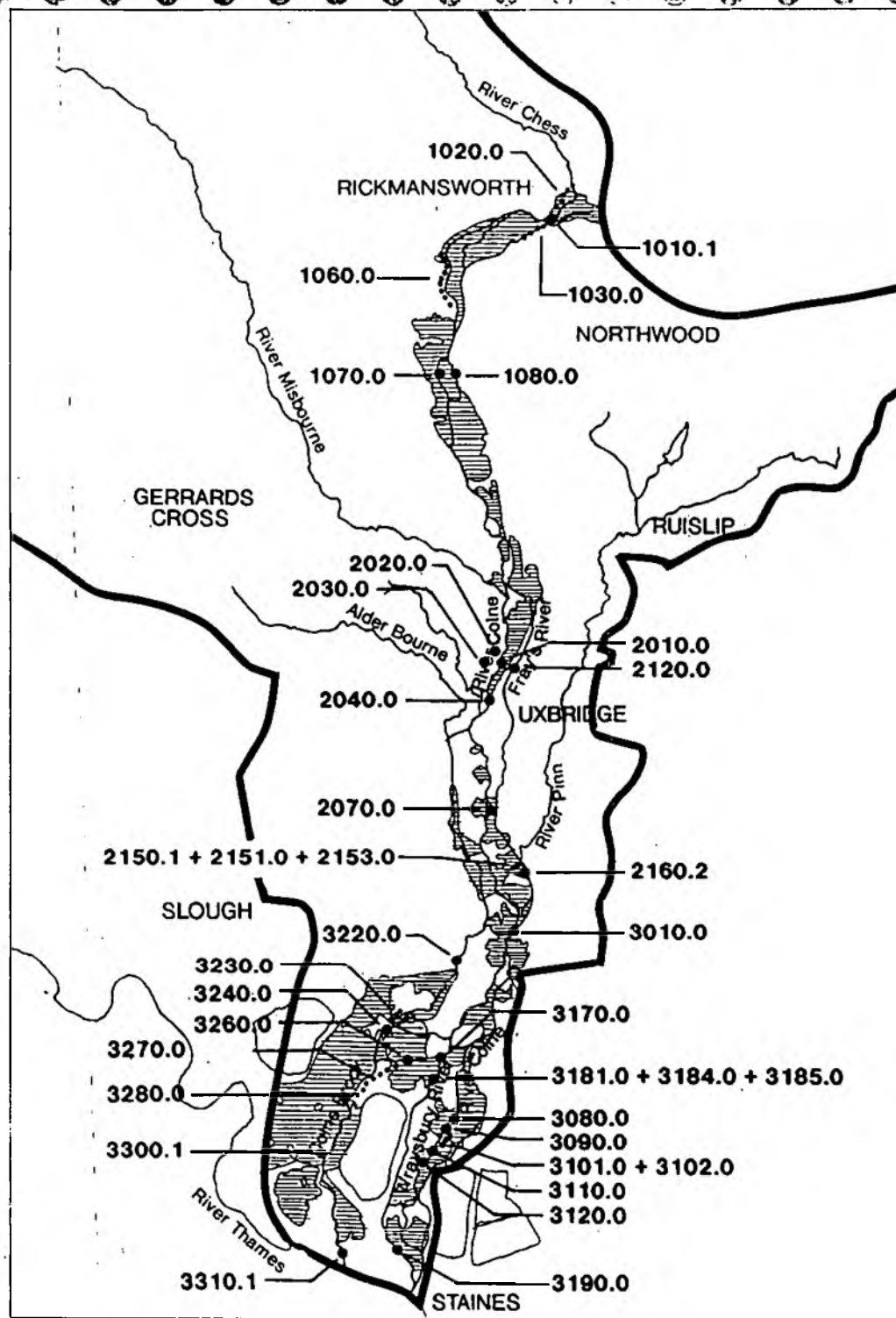
In total the scheme consists of some 60 works between Rickmansworth and Staines costing £11m. (1990 prices). Site work commenced in 1988 with completion due in 1995, although progress has been significantly affected by major development proposals including widening of the M25, Heathrow Terminal 5 and redevelopment of central Staines.

This scheme has sought to be comprehensive in dealing with river flooding in the Colne Valley but inevitably some gaps and problems have been identified as detailed design has progressed. These have included identification of: properties still subject to localised flooding (including Hithermore Road flooded from Stanwell Moor Ditch), river structures subject to blockage for which there are no refurbishment proposals, and works within the original scheme which require further refinement before implementation (most notably flood conveyance through Staines which is affected by the redevelopment proposals in central Staines).

Public Perception: According to a recent public survey of the Colne Valley Flood Alleviation Scheme, undertaken by the Flood Hazard Research Centre, residents are now generally more confident about being protected from flooding in the valley, although it was felt that the efficiency of the works had yet to be tested. The most important factor to emerge, however, was that respondents felt they had insufficient information about flooding and the alleviation proposals, despite an extensive programme of public consultation associated with the scheme.

Other Flooding Problems

Even with the Colne scheme in progress, other flooding problems still remain in the catchment. These are: river flooding from the Pinn, flooding from the Thames, and other flooding associated with surface and ground water drainage.



 Catchment boundary

 2110.0 Works completed & in preparation 1990

 1:100 Year Flood Envelope at current stage of working

Figure: 21
LOWER COLNE FLOOD ALLEVIATION
SCHEME: WORKS UNDERTAKEN TO DATE



N.R.A.: Thames Region
LOWER RIVER COLNE CATCHMENT
MANAGEMENT PLAN

The River Pinn: The River Pinn exhibits very peaky flood flows due to its highly urbanised catchment. Following extensive flooding in August 1977, flood alleviation measures were introduced, including construction of a flood storage area at George V Avenue in the upper catchment. However, prior to completion of the work, serious flooding in 1987 and 1988 (affecting 300 properties) led to a re-appraisal of the problems and a deferral of the implementation programme.

The Thames: Much of the southern end of the Colne Valley also lies within the flood plain of the Thames and is therefore susceptible to Thames flooding. This problem is currently being addressed through a separate study (the Datchet, Wraysbury, Staines and Chertsey Flood Alleviation Scheme) which is at an early stage of preparation but is likely to involve the construction of a flood relief channel across the southern extremity of the Lower Colne Catchment between Datchet and Staines.

Non-main river flooding: In the Colne Valley, although major flooding relates to the rivers, other localised flooding is caused by the inadequate operation of the low level drainage system and by the rapid fluctuations in ground water levels associated with the gravels of the valley floor. This in turn can lead to infiltration of the foul sewers. These problems have not been addressed during the Lower Colne Scheme and in consequence the NRA-TR has to rely on inadequate information when advising local authorities on the implications of gravel extraction and landfill proposals, local drainage issues, and potential interactions with the sewerage system. This is of concern, in that for residents of the Valley, the most common and frequent problems of flooding relate to these factors, rather than to river flooding which, although much more acute, only occurs relatively infrequently.

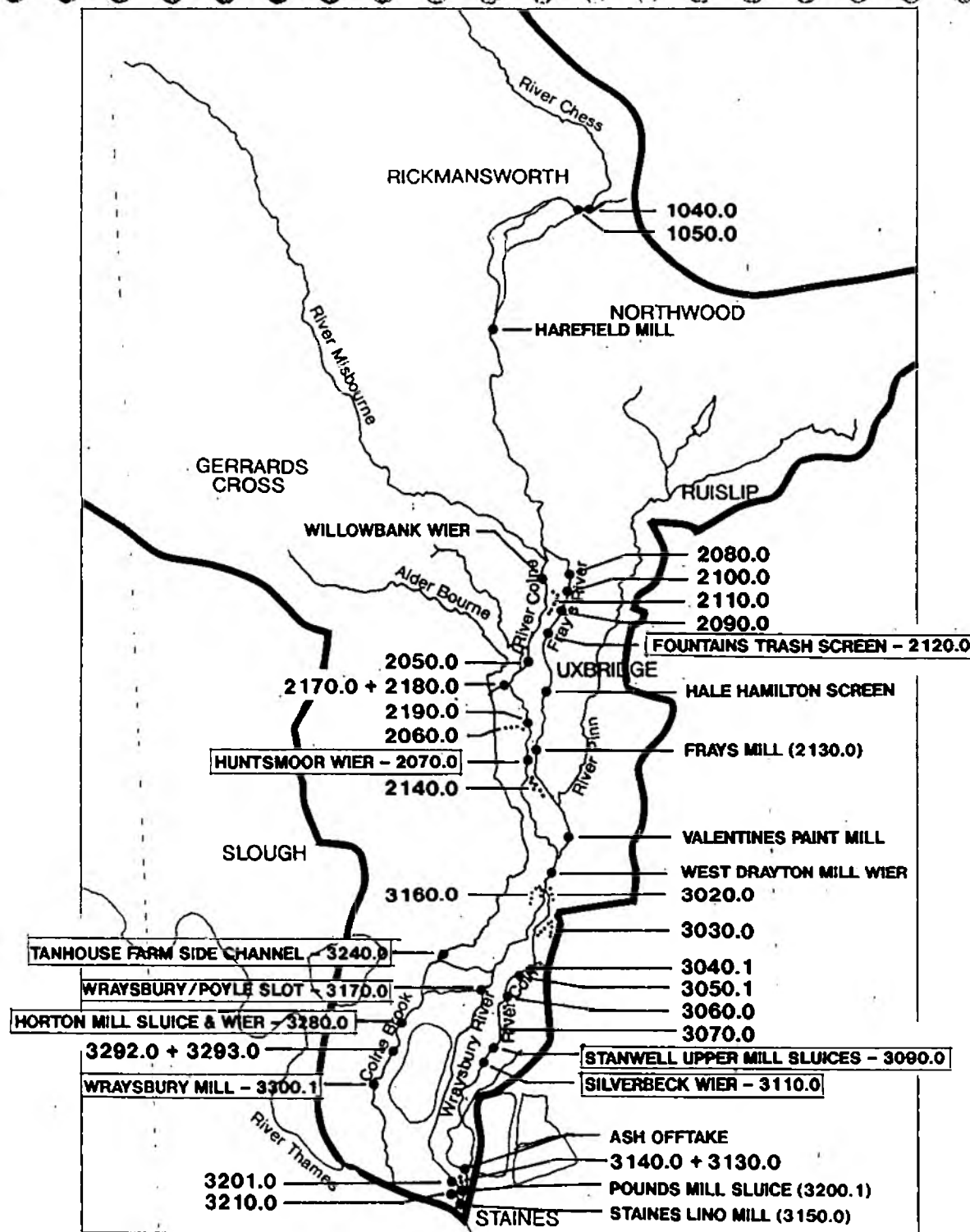
Future Land Use Changes and the Implications for Hydrology/Flooding

From the information available it appears unlikely that future agricultural trends will have any significant effect on hydrology and flooding but other land use changes could have important implications, most notably, development, landfill and communications.

Built Development and Landfill: If the effectiveness of the Lower Colne Scheme is to be maintained, all new green field developments outside the flood plain will need to incorporate appropriate flood attenuation measures, while the floodplain itself will need to be protected from any further erosion by development or land doming. Until recently, control of flood plain development was hindered by a lack of accurate information on flooding. But the hydraulic model for the flood alleviation scheme now gives precise details on the extent of the flood plain and provides a powerful tool for ensuring implementation of an effective flood plain policy, assuming adoption by the constituent local authorities.

Communications: The proposed improvements to the M4, M25 and Heathrow will not take significantly from the floodplain but will lead to a substantial increase in run-off. Following detailed modelling it has been proposed that run-off from the Terminal 5 distributor roads should be accommodated by a transfer of flows from the Wraysbury River to the River Colne combined with improved conveyance on the Colne between Bath Road and Hithermore Farm. In the case of the M4 it is planned that the increased run-off should be discharged largely to the low level drainage system, whilst that from the M25 should be discharged direct to the Colne Brook, although the implications of this latter proposal have yet to be modelled.

Recreation: Although current recreation use does not affect flooding, the possible Colne Valley Navigation Link would have fundamental implications for the Lower Colne Flood Alleviation Scheme.



Catchment boundary

No. only

= Works outstanding on the Colne Improvement Scheme

Name & No.

= Works outstanding on the Colne Improvement Scheme identified as prone to blockage

Name only

= Structures prone to blockage not included so far in the Colne Improvement Scheme

Name & No.

= Structures once prone to blockage but now refurbished as part of the Colne Improvement Scheme

Figure: 22

LOWER COLNE FLOOD ALLEVIATION SCHEME: WORKS OUTSTANDING



N.R.A: Thames Region
LOWER RIVER COLNE CATCHMENT
MANAGEMENT PLAN

The Current Situation

The rivers of the catchment are highly modified. Historically, the majority of the water courses were harnessed for power. More recently, reaches have been realigned to make way for development, major water storage reservoirs and road improvements and, in the case of the Misbourne, to accommodate agricultural improvements.

Future Land Use Changes and the Implications for Geomorphology

Further changes to river geomorphology associated with agriculture are unlikely in the present economic climate, but changes associated with development could compound existing problems if the necessary works are not appropriately designed. On the other hand, there is the opportunity to use these changes to right past wrongs. Most notable in the short-term are the opportunities offered by the Lower Colne Flood Alleviation Scheme and by new infrastructure proposals. Improvements could then be extended to other reaches, perhaps partially or completely implemented through changing river management practices.

Development and Flood Alleviation: A geomorphological input has already been made to the design of 12 of the Lower Colne Flood Alleviation Works, in all cases leading to a stable geomorphological design and in 4 cases allowing introduction of pool/rifle sequences and a meandering low flow channel. Further opportunities to improve river geomorphology will continue to arise on this and other flood alleviation schemes (eg. the Pinn). Opportunities are also offered through advice given on planning applications and land drainage consents.

Communications: As already outlined, the potential development of Terminal 5 will require relocation of sections of the Wraysbury River, Bigley Ditch, Duke of Northumberland's River and Longford River. In addition, the capacity of the Colne will need to be increased south of Bath Road. In all cases great opportunity exists to improve channel geomorphology. The sections of the Wraysbury and Bigley Ditch to be realigned have already been realigned once to make way for the original M25 construction. They are straight trapezoidal channels of little visual or ecological value and currently present a damaging discontinuity for wildlife, fisheries and in terms of landscape. The Duke of Northumberland's and Longford Rivers are likewise older canal structures built around the current periphery of Heathrow. In realigning these rivers therefore, there is the opportunity to create a series of new roughly parallel water courses with a stable geomorphology and natural sinuosity.

Recreation/Navigation: Although most recreational pressures are unlikely to affect river geomorphology, introduction of the Colne Valley Navigation Link, with extended lengths of canalisation and new locks, would have a fundamental adverse impact on river geomorphology.

The Current Situation

At present there is no abstraction from the rivers of the catchment or from the gravels of the Colne Valley, other than one North Surrey Water Company emergency abstraction point. However, there is extensive abstraction from the chalk aquifer. This primarily relates to licensed boreholes, located in the valleys of the Misbourne, Chess and Colne between Rickmansworth and the M40. These are operated by the Three Valleys Water Company who extract 74 million m³ per annum from the chalk aquifer and supply up to 1 million people with potable water. This abstraction represents approximately 50% of the annual recharge of the aquifer but is still not enough to meet the needs of the catchment, which is a net importer of water from Grafham in the Anglian Region.

The effect of this increasing groundwater abstraction from the chalk aquifer has been to lower groundwater levels leading to derogation of base flows in the Misbourne. This has resulted in the river's perennial head moving about 5km downstream, long sections of the river drying up for the majority of the year and flows being reduced in the remaining wet sections upstream of Denham. A similar, although less acute problem, has been noted on the Chess during the last few drought summers.

The low flows associated with the Misbourne are detrimental to the fisheries, ecological and amenity value of the river and have caused increasing public concern. In consequence, in 1987 a major feasibility study was undertaken by Sir William Halcrow & Partners into options for Alleviating the Low Flows (ALF). Arising from this study, the two options now being considered to improve flows in the Misbourne are either to reduce abstraction and pump from other resources, or to provide flow augmentation from a borehole at the confluence of the Misbourne with the Colne, connected to the head of the river by pipeline.

So far there have not been any major problems of low flow in the River Colne, partly because the varied geology of the catchment helps even out extremes of flow, and partly because the gravels which lie above the chalk in the Colne Valley have a perched water table which effectively buffers the Colne from any changes in the underlying chalk.

Future Land Use Changes and the Implications for Water Resources

The future of the catchment's water resources will be a balance between the amount of new development allowed and the amount of water imported to meet increased demand.

Development: If the problems of the Misbourne are not to be repeated it is clearly important for future development decisions to take account of water resource implications. This will become all the more critical if global warming leads to an increased frequency in drought summers.

Recreation/Navigation: Although of much lesser concern, greater use of the Grand Union Canal for navigation could ultimately lead to low flow conditions in the Colne¹, especially if the Thames Navigation Link were ever taken forward.

Footnote:

- 1- British Waterways (BW) abstracts water from the Colne/Frays Rivers to supply the 22 mile level canal from Slough to Paddington. This abstraction is by Act of Parliament and no prescriptive rights are established. Since the 1940's this source has been a substitute for use of water stored in the BW-owned Brent Reservoir which has had to be kept low for fear of breaching its banks. To date this abstraction from the Colne has not caused low flow conditions in the Colne.

WATER QUALITY**Current Situation**

Water quality is a key indicator of the health of any catchment. Poor water quality will directly impact on all aspects of the water environment, not least water resources, fisheries, ecology and amenity value. In the case of the Lower Colne Catchment, water quality issues are impossible to separate from actions taken in the upper catchment, not least the performance of Blackbirds Sewage Treatment Works in Watford.

Future Land Use Changes and the Implications for Water Quality

Nearly all land uses carry a significant threat of water pollution not least development, landfilling and agricultural practices.

Development and Communications: In the Colne Catchment low flows and sewage effluent may pose a particular threat to river water quality.

The low flows in the Misbourne, caused by over abstraction from the chalk aquifer, are known to be affecting water quality in the river; at times the discharges from the sewage treatment works in the valley can account for well over 50% of stream flows. Insufficient data is available on the operation of individual sewage treatment works but there is a discernible drop in water quality downstream of Chesham Treatment Works which has prevented the use of the Chess as a Salmon nursery site since 1988. Fisheries surveys have also indicated that, in the Colne (downstream of Denham) and the Colne Brook, levels of total ammonia are sometimes above those stipulated in the EEC directive for freshwater fisheries.

Urban storm water run-off is also a potential source of pollution. In the Colne this problem is most likely to relate to roads. At present road run-off (which includes the results of accidental spills) passes via petrol interceptors direct to the rivers. So far the dilution effect of the rivers is thought to have avoided any major pollution incidents but the long term effect on the rivers is unknown. This uncertainty will be exacerbated by the proposed widening and increased run-off associated with the M4, M25 and the Terminal 5 roads.

Gravel Extraction/Landfill: Problems of landfill leachate are a particular concern, not least because the costs of taking remedial action are usually excessively high and well beyond the finances available to most local authorities. In the near future new government legislation may make landfill operators responsible in perpetuity for their sites. The primary problems, therefore, are most likely to relate to past sites, and particularly those filled prior to the 1974 Control of Pollution Act, when standards were very much less stringent. These are concentrated at the southern end of the Colne Valley and it is thought (although no data is available) that they have adversely affected groundwater quality. At present the consequences may not be too serious, in that no water companies extract from the gravel (except at one emergency location) and no particular river pollution is apparent. However, leachate leaking from landfill above the chalk aquifer i.e. sites north of the M40 could have dire consequences. To date there has been relatively little landfill in this area other than a major 80ha GLC site at Park Lodge Farm, Harefield (1950-1979), another on the east bank of Broadwater of a similar age, and current proposals to backfill Broadwater itself.

Agriculture: with regard to agriculture, the primary concern within the Colne Catchment is protection of the chalk aquifer from infiltration by polluted run-off.

Current Situation

The catchment has a highly valuable fisheries resource with EEC designated Cyprinid and Salmonid fisheries. As fisheries are highly sensitive to water quality it follows that they are an accurate indicator of the health of the water environment as a whole. Poor water quality affects the size and health of fish populations generally and that of salmonids in particular.

Future Land Use Changes and the Implications for Fisheries

Land use changes affecting river water quality will, therefore, be equally applicable to fisheries interests.

Development and Infrastructure: As for water quality, fisheries are directly affected by low flows, contaminated surface water run-off and sewage effluent. Thus the fisheries of the Misbourne and Chess have been particularly badly effected. Fisheries are also susceptible to other side effects of development, not least poor river geomorphology, lack of ecological diversity and sedimentation associated with increased surface water run-off. The Wrybury, Frays, Chess and Misbourne would all benefit from localised removal of sediments carried into the rivers by surface water run-off.

The mal-operation and impassability of river structures are other causes of reduced fisheries interest, as is inappropriate river maintenance. Mal-operation of old structures, including gates, can release excessive flows, or silt deposits, or both. Excessive flows can damage habitats by removal of vegetation whilst released silts can cover gravel beds and destroy spawning grounds (as happened at Sarrat Mill Weir on the Chess, 1988). Impassable structures inhibit fish migration. In the case of the Colne, fish passability has been greatly improved by the Lower Colne Flood Alleviation Scheme which has incorporated fish passes in all river structures which have been refurbished. But as the Colne river system has several parallel routes for migrating fish, it follows that the flood alleviation scheme cannot hope to cover all potentially impassable structures. In consequence there is now a need to identify a key migratory route where efforts to increase passability will be concentrated. This task is now made very much easier by the recent survey of all river control structures on the Colne system, completed as part of the baseline studies for this Plan.

Agriculture: Any changes in agriculture which could lead to increased nitrate and other pollution levels in the rivers would be highly detrimental to fisheries. However, current agricultural trends suggest that farmers will be using less rather than more fertilisers.

Recreation: Generally the interests of fisheries and recreation need not conflict if carefully planned, although on rivers canoeists can conflict with angling, while on gravel pits dinghy and board sailing can present problems.

Current Situation

The river corridor habitats of the catchment are important locally and regionally as they represent a scarce resource in close proximity to urban populations. Of key significance are the remnant water-table dependent habitats, such as Staines Moor and Frays Meadow which are non-recreatable, the mature wet gravel pits at the northern and southern ends of the Colne Valley with their very high ornithological interest, and the extensive marginal flora of the rivers themselves.

Future Land Use Changes and Implications for Ecology

Over this century the water-table dependent habitats of the valley floor, including reed swamp, fen, marsh and damp grassland, have been gradually eroded through a combination of changing agricultural practices and gravel extraction. Today, gravel extraction proposals still pose a threat, not least to the long term survival of Staines Moor. But more insidious and potentially just as damaging are changes to the water environment relating to the side effects of gravel extraction and development, not least pollution of groundwater, reduction in frequency of inundation (usually associated with flood alleviation works), and falling water-tables associated on the chalk, with over abstraction for public water supply (as in the case of the M18), and on the gravels by mineral extraction on adjacent land. Falling water-tables are a particular concern on Staines Moor, as recognised in the current Management Plan being prepared for this important SSSI.

At present the most obvious threat to the nationally important wet gravel pits of the Colne Valley is filling in compliance with past restoration conditions (affecting Broadwater and the Wraysbury Pits amongst others). Also damaging to wildlife interest would be pollution associated with groundwater infiltration or urban run-off, and increased frequency of inundation, often accompanied by siltation, associated with flood alleviation schemes. Potential conflicts with water sports also need to be monitored.

The marginal habitats of the rivers are at risk from low flows associated with over abstraction (as in the case of the M18), river pollution, and river works such as river widening deepening or straightening usually associated with flood alleviation works but equally applicable to river realignments resulting from development or new communication links, such as the original construction of the M25.

Future Enhancements

The Lower Colne Flood Alleviation Scheme has sought to avoid any damage to the non-recreatable habitats and to wet gravel pits important for wildlife. It has also sought to minimise damage to marginal vegetation whilst maximising opportunities for habitat enhancement, including improved river geomorphology. This scheme, however, is only addressing a series of scattered sites. If the valuable river corridors of the catchment are to be conserved and enhanced in perpetuity there is a requirement for a more comprehensive river corridor plan, which brings together the opportunities for habitat conservation and reconstruction offered by changing patterns in agriculture, major land reclamation schemes associated with gravel extraction, and development proposals which are seeking wider environmental enhancement.

Current Situation

The landscapes of the catchment divide into those which should be conserved and those which would benefit from substantial enhancement. Broadly, the landscapes requiring conservation are:

- the agrarian landscapes of the Misbourne and Chess;
- original flood plain meadows, especially Staines Moor and Frays Meadows;
- the mature wet gravel pits between Rickmansworth and the M40, in the area of Little Britain west of Uxbridge, and around Wraysbury;
- mature parkland landscapes associated with the rivers.

Conversely, the area most in need of enhancement is that part of the Colne Valley lying between the M40 and Wraysbury, which has become fragmented, degraded and open in character, in response to the pressures of gravel extraction, development, building of infrastructure and urban fringe speculation. Also in need of substantial improvement is the largely urbanised corridor of the River Pinn.

Future Land Use Changes and Implications for Landscape

In the near future, possibly the greatest single threat to the continuity of the Colne Valley will be the development of a fifth Terminal at Heathrow. If taken forward this development, plus all its infrastructure, could close the already narrow gap which separates the outer edge of London from the eastward extension of Slough at this point. On the other hand, if sensitively handled, the proposals offer the opportunity to revitalise and strengthen this narrow stretch of river corridor which has all but been destroyed by the construction of the M25.

In the longer term, the rivers are likely to become all the more important as key landscape features, reflecting continuity and maturity, in a landscape otherwise characterised by continual change resulting from declining agriculture and further gravel extraction.

Future Enhancements

The works associated with the Lower Colne Flood Alleviation Scheme have sought to reflect the needs of conservation and enhancement, with proposals to blend new structures into their surroundings and enhancements identified in areas of damaged landscape. However, as argued under Ecology, this scheme only affects a series of scattered sites. Furthermore, post-project appraisal of those works which have already been completed under the scheme suggests that, while environmental damage has been kept to a minimum, mitigation and enhancement measures have not always been maximised.

Again, as argued under Ecology, current land use pressures indicate that the time is now ripe to develop a comprehensive conservation and enhancement plan for the river corridors of the catchment. If such a plan is not developed, further ad hoc development and land use change may destroy for ever the open and relatively natural riverine character of these corridors. Yet if harnessed

SECTION 4

NRA OBJECTIVES AND POLICIES

4.0 NRA OBJECTIVES & POLICIES

4.1 INTRODUCTION

In the Mission Statement which sets the scene for its Corporate Plan [Ref.2] the NRA defines its role as protecting and improving the water environment. This is to be achieved through effective management of water resources, by substantial reductions in pollution and by provision of effective flood defence.

Strategic corporate planning in support of this role is based directly on strategies specific to each of the core functions and support services which comprise the NRA's operational structure. These specific strategies are, in turn, used in the preparation of both the annual regional plans and the long term catchment management plans. The implied ultimate objective of the latter is to link all function and support service activities into an overall integrated programme of work.

The Corporate Plan

The NRA has seven core functions which form the foundation of its planning. These are water resources, pollution control, flood defence, fisheries, recreation, conservation and navigation. For each of these there is a defined aim and a set of objectives to achieve it. These embody the need for sustainable, forward looking policy oriented to the maintenance, conservation or improvement of resource assets. Fulfilling them implies close cooperation with other bodies concerned in the management of the catchment and, as an important part of that cooperation, a full understanding of the aims and objectives of such bodies.

The aim for each core function is given below with key objectives outlined in Sections 4.2 - 4.8:

Function	Aim	to:
Water Resources	- assess, manage, plan and conserve water resources and maintain and improve water quality for all	
Pollution Control	- continue improving the quality of all waters through pollution control	
Flood Defence	- implement 'polluter pays' policies	
Fisheries	- provision of effective flood defence	
Recreation	- adequacy of flood forecasting and response	
Navigation	- maintain, improve and develop fisheries	
Conservation	- develop the amenity and recreational potential of waters and lands under NRA control	
	- improve and maintain inland NRA managed waterways and their facilities for public use	
	- conserve and enhance wildlife, landscapes and archaeological features associated with waters under NRA control	

The Business Plan

The NRA Thames Region Business Plan is intended to serve two purposes. The first is to propose the means or outputs by which it believes the national NRA should judge the Region's performance. The second is to outline how it intends

to manage the Region. The mission it defines for itself is to maintain and enhance the total river environment in its area. The Business Plan sets strategic objectives to achieve this whilst at the same time observing the overall objectives of the NRA. The aims (which NRA TR calls initiatives) for each core function (or NRA TR key business area) are given below. Sections 4.2 - 4.8 outline the corresponding sets of objectives.

Function Aim to:

Water Resources	- manage these as legislated but balance consumption/environmental protection against the needs of individual abstractors
Water Quality & Pollution Alleviation	- ensure that the quality of surface water and groundwater is maintained/ improved for all uses
Flood Defence	- protect adequately against flooding
Fisheries & Conservation	- promote vigour/diversity in fish populations and encourage development of river corridor ecosystems and appropriate development of the man made environment
Recreation	- make best possible use of the river system and water bodies for recreation

4.2 **WATER RESOURCES**

The NRA sees that it must establish a consistent water resources policy throughout the regions and it believes it to be essential that the policies for water resources and water quality are as closely linked as possible. Controlling abstraction is clearly the key to the proper management of the resource and so corporate objectives relate primarily to ensuring adequacy of supply and countering over abstraction/low flows. However they also highlight the importance of aquifer protection and the principle of enforcement. Of particular importance to Thames Region are the linked issues of low flows and adequacy of supply. Improving the ability to monitor changes in flow is seen as vital to the management of this issue. The Region's water resources include both surface and groundwater and control of effluent quality and pollution are of equal importance.

The key corporate objectives are:

- formulating a sustainable policy and plans for developing and augmenting resources to meet demands
- formulating and implementing an aquifer protection policy
- developing a policy to overcome low flows problems caused by over-abstraction in various catchments
- developing licensing, determination, enforcement and charging policies, charging databases and billing systems.

The intensive use of the Thames catchment means that there is both heavy use and significant 're-use' of water. Supply is tending to move out of balance with demand and increased licensed abstractions have led to the existing low flow conditions in a number of rivers. Water resources are therefore threatened in terms of both quantity and quality. The 'Alleviation of Low Flows' scheme (commencing 1990) is not expected to be sufficient to counter the situation.

There are two parts to NRA TR's water resource planning: strategic water resources planning and the managing of licensed abstractions. Little change is expected to the latter but resource planning is given a new significance. The main objective here is to use the 1989 review of water resource strategic options and demand forecasts to identify work priorities and objectives to 1992/93.

4.3

POLLUTION CONTROL & WATER QUALITY

Comprehensive management of water quality is impeded by the historic absence of standards. There are European Community Directives on some aspects but until the situation has become fully rationalised, the NRA has to cope with a mixed legacy of consents to discharge and consequent quality problems. The setting, maintaining and improving of water quality standards and the improving of response to unconsented and/or emergency pollution are therefore essential requirements of the corporate plan.

In Thames Region the extensiveness of both consented and unconsented discharges has made protection of groundwater resources of paramount importance, together with the need to monitor for pollution and adjust charging policy to deal with it.

Key corporate objectives are:

- setting water quality objectives (WQOs) for controlled waters; producing appropriate water quality standards (WQOs); defining water protection zones (WPZs)
- undertaking monitoring and surveillance of all controlled waters
- ensuring a close relation between water quality and water resources management
- implementing measures to prevent potential pollution of controlled waters at source
- developing consent, compliance and enforcement policies
- increasing the use of automated instrumentation for sampling
- undertaking increased pollution prevention activities and initiating site specific clean-up campaigns, eg litter removal

In translating this into regional level objectives, NRA TR sees the first priority being to establish (by March 1991) the current quality position of the Region's rivers. A second objective is to demonstrate through the River Survey Programme (1990/91 to 1995/96) that water quality is being maintained and improved.

Surface Water

Improvements to surface water quality are essential if the newly vested NRA is to be regarded as a success. A specific objective of NRA TR in these terms is that, whilst maintaining existing water quality in the 95% of its rivers already in River Quality Objective (RQO) Classes 1 or 2, all non-urban watercourses must be upgraded to achieve an RQO of Class 2 by 1996.

New statutory Water Quality Objectives (WQOs) are likely to become mandatory by 1992. The strategies which NRA TR is developing to meet these include reviewing existing standards and developing a new approach using biological parameters so that ecological requirements are taken into consideration when establishing water quality.

Ground Water

The quality of groundwater is of increasing concern. Contamination from agricultural use of nitrates and pesticides and from waste disposal are the two sources of pollution currently receiving the most attention. Mandatory protection zones has been suggested as one form of containment.

Effluent Quality and Pollution Control

All discharges need not only to comply with their consents but also to be compatible with WQOs by April 1993. Particular attention will be paid to sewage discharges. Overall, pollution must be minimised and there needs to be improved response to incidents.

4.4

FLOOD DEFENCE & LAND DRAINAGE

Corporate objectives focus on flood defence and relate to the managing of tidal and sea flood defence and emergency systems. Within Thames, consideration of flood defence explicitly includes the wider issue of land drainage. It is NRA TR's perspective that the whole catchment needs control and not simply the watercourses. There are three ways in which NRA TR is geared to managing these aspects. They are: using its 'levels of service systematic approach' which provides a methodology for allocating priorities to work programmes and resource allocations; improving the standards of protection through planned maintenance and capital investment; development control based on catchment planning.

Key corporate objectives are:

- developing national planning and management systems for flood defence works
- formulating policies for tidal and sea defence works in response to rising sea levels
- extending national flood warning systems and improving responses to emergencies.

Standards of protection are to be improved in the Thames Region. It was NRA TR's objective to have target levels for flood defence/land drainage set for every reach in the catchment by 1989. The criteria used in developing these took account of the needs and influence of adjacent land use. Following the setting of the targets, maintenance and capital works planning would proceed: maintenance programmes are scheduled for completion by April 1990 and the overall programme should be 70% complete by 1993. The plan provides for an additional 4500 properties to have been protected from undue risk of flooding by 1993. Construction should start on the Maidenhead, Windsor and Eton scheme by 1994.

NRA TR intends to produce land drainage and flood defence catchment plans for all major urban catchments by March 1993. Also, appropriate impact assessment procedures are to be put in place for major development proposals.

4.5

FISHERIES

Variety and abundance of fish species present in UK rivers has been affected not only by pollution incidents and generally poor water quality but also by the use of in-river structures which are insensitive in design and are either in

some measure impassable to migratory fish. Corporate strategy recognises that there is a need to enhance or rehabilitate at least one stock or river in every region of the NRA and objectives focus on the assessment and improvement of stock. An important element of this is seen as being the maintaining of water quality standards. Improving emergency pollution response will alleviate fish kill problems as will increasing protection against illegal fishing. For Thames Region, the priority objective is to survey fish stocks in all watercourses, improve fishery work and enforcement.

The key corporate objectives are:

- assessing the status of fish stocks
- formulating policies to maintain, improve, develop, restore and rehabilitate fisheries
- review licensing, regulatory and charging policies, especially seeking additional income
- developing response policies on actions following fish kills and disease outbreaks
- developing methods to prevent illegal fishing and to protect fisheries.

NRA TR is taking active steps to increase the number and types of fish in its rivers. It places particular emphasis on surveys since these provide an indicator of river health as well as providing information on fish life. The current survey programme is to be completed by 1991, following which a new survey will be initiated, focussing on stretches of river which were given water quality upgrading priorities in 1990.

NRA TR recognises the importance of re-stocking, particularly after pollution incidents, and is developing its own fish stocks. Enforcement is designed both to control illegal practices and to regulate fish movements.

4.6

RECREATION

Nationally, the agreed objective for Recreation is to promote it in terms of provision, access, Code of Practice and management. In Thames region this is translated into a need for a recreation strategy and for the management of existing sites and the provision of new sites.

The key corporate objectives are:

- formulating a recreation policy incorporating the statutory duty to promote recreation
- implementing the Code of Practice on access, conservation and recreation
- producing management plans for NRA controlled sites
- reviewing charging and regulatory practice and procedures.

In Thames Region, recreation and navigation are seen as closely linked and, indeed, the two are treated jointly in the NRA TR Business Plan.. There is a wish to increase river facilities but at the same time to minimise sectional interest conflicts. Encouraging greater use of water and associated land facilities will be effected by adding to public amenity facilities including footpaths, camp sites, sailing, canoeing, ornithology, hire of boats and bicycles. The Thames Long Distance Path is to be completed by 1995. The provision of a visitor centre similar to that at the Thames Barrage but situated in the non tidal reaches is also a possibility.

NAVIGATION

The question of navigation function is complex in that it is closely associated with recreation, general riparian interests and a number of other functions. However, the maintaining of water levels is important to all these interests. The corporate objectives for navigation mainly concern the need for a navigation policy and for the review of licensing, charging and regulation procedures. In Thames Region, river use is almost entirely by pleasure craft and is both seasonal and intensive. NRA TR will increase attention to the maintenance of the navigation fairway, reviewing navigation objectives generally and introducing revised performance indicators.

Key objectives for navigation are:

- formulating a navigation policy
- reviewing licensing, charging and regulatory policies.

NRA TR's primary task is to improve and increase recreational navigation facilities. Plans so far are limited to improving the provision of supporting facilities such as lock lay-bys, water and sanitary facilities.

CONSERVATION

Waterways and wetlands are well recognised as important habitats for flora and fauna. Both the NRA and NRA TR see a pressing need for a conservation policy to be formulated to ensure conservation of such areas together with their associated lands, landscapes and archaeology. NRA TR attributes particular importance to conservation policy which will treat river corridors as an entity and increase public perception of this view. In implementation, emphasis is being given to both maintenance and capital schemes.

Key corporate objectives are:

- formulating a conservation policy
- implementing the Code of Practice on access, conservation and recreation
- reviewing and developing river corridor survey methodology for increased application to river management.

In Thames Region, the objective is to increase environmental awareness generally and to ensure that conservation issues are taken into account in decision making. In practical terms, NRA TR is accelerating its river corridor survey programme and has (1990) prepared guidelines on conservation and fisheries for use by its Land Drainage, Catchment Control and Statutory Planning departments.

SECTION 5

ISSUES AND STRATEGY

5.0 ISSUES AND STRATEGY

5.1 INTRODUCTION

This section identifies the key issues within the catchment of relevance to the NRA-TR. It then goes on to identify the strategies which should be adopted by NRA-TR in response to these key issues.

The key issues identified are of four types:

- i) **First Order/Short Term:** Issues which are very significant in the catchment at present or are likely to be so in the next five years.
- ii) **First Order/Long Term:** Issues which are already or could become very significant in the catchment and are likely to continue to be so for many years given existing land use trends.
- iii) **Second Order/Short Term:** Issues which are significant in the catchment or are likely to be so in the next five years.
- iv) **Second Order/Long Term:** Issues which are already or could become significant in the catchment and are likely to continue to be so for many years given existing land use trends.

5.2 KEY ISSUES

The catchment has undergone many land use changes over this and preceding centuries and in recent years has been the subject of many detailed studies. The identified key issues, therefore, are concerned primarily with the refinement of existing controls rather than with the introduction of entirely new arrangements. They are also largely related, either directly or indirectly, to the development pressures facing the catchment.

A. First Order/Short Term

1. **River flooding from the Colne System:** The Lower Colne Flood Alleviation Scheme has gone a long way towards resolving the problems of river flooding in the Colne Valley but some areas still require resolution before the scheme can become fully effective. Specifically:
 - there are two areas of work identified in the original flood alleviation scheme which require significant re-appraisal. These are alleviation of flooding in the area upstream of West Drayton Mill (Trout Lane Flood Carrier and associated works) and, more importantly, identification of a preferred method for conveying flood flows through and around Staines (this decision is closely related to proposals for the redevelopment of Staines town centre).
 - a few areas of development, excluded from the original study, have recently suffered from flooding and need to be brought into the overall Colne Scheme. These areas include properties in Hithermoor Road, Stanwell Moor, flooded from Stanwell Moor Ditch and Rockingham Road Recreation Ground, Uxbridge, flooded from the Frays River.

- blockage runs indicate that a number of older structures on the Colne system could impede flood flows. The majority of these are already due for refurbishment as part of the Lower Colne Scheme but six additional structures need to be included, namely Harefield Mill, West Drayton Mill, Hale Hamilton Screen, Willowbank Weir, Valentines Paint Mill and the Ash Offtake.
2. **River flooding from the Pinn:** The river Pinn was excluded from the Lower Colne Flood Alleviation Scheme and at present, uncontrolled out of bank flows from the River cause flooding in central Pinner, and in several areas upstream and downstream, even though various improvements were made following a flood in 1977. In a 1 in 50 year event an estimated 350 properties, both residential and commercial, would be affected. However, feasibility studies to resolve this problem have been deferred for the time being.
 3. **Increased run-off associated with road proposals:** In the Colne Valley, increased run-off associated with the proposed widening of the M4, M25 and Terminal 5 distributor roads will increase flood flows in the receiving water courses (which will be, respectively, the low level drainage system, the Colne Brook and the Colne). Unless carefully controlled, these increased flood flows could compromise the integrity of the existing Lower Colne flood protection proposals and could lead to a substantial increase in river pollution.
 4. **Low flows in the chalk tributaries:** The low flows in the Misbourne, resulting from over abstraction of the chalk aquifer, are of great public concern, and are affecting the amenity, fisheries and wildlife value of this attractive high quality chalk river which forms an important feature of the Chilterns AONB and is a key amenity of the historic settlements of the valley floor (all Conservation Areas). In turn these low flows are known to be affecting river water quality; at times now the discharges from sewage treatment works in the valley can account for well over 50% of the river flows. Less acute problems of low flow have also been noted in the Chess over the drought summers of 1989 and 1990.
 5. **Proposal for Heathrow Terminal 5:** If taken forward, the development of Terminal 5 at Heathrow will have a fundamental impact on the river environment at the southern end of the lower Colne Valley. Its access roads will require the relocation of lengths of the Wraysbury River and Bigley Ditch, while the Terminal itself will require the relocation of the Duke of Northumberland's and Longford Rivers. As already noted above (3), there will be substantially increased surface water run-off from the roads, whilst run-off from the Terminal itself is to be transferred into the Crane catchment where it could have a significant impact on the Bedfont Lakes complex and Feltham Hill Brook. Potentially of wider concern though, are the implications for the continuity of the Colne river corridor itself, which is only 0.5km wide at this point and serves the strategic function of separating the outer edge of London from the eastward extensions of Slough, which now link unbroken to Poyle. If insensitively handled the Terminal development, with its associated roads, could effectively close this gap so breaking the continuity of the river corridor and Colne Valley Park. On the other hand, if sensitively handled, the proposals offer the opportunity to revitalise and strengthen this narrow stretch of river corridor which has all but been destroyed by construction of the M25.

B. First Order/Long Term

1. **Mineral extraction and landfill:** Mineral extraction and landfill have had a fundamental impact on the character of the Colne Valley providing some of its finest features (mature wet gravel pits) and causing some of the worst effects of landscape degradation (poorly restored landfill sites). Of critical importance are threats to the water environment posed by:
 - the potential of future gravel extraction around Denham, south of Colnbrook and even on Staines Moor itself, which would lead to the loss of the few remaining large blocks of traditional landscape on the valley floor;
 - the filling of mature wet gravel pits in response to past filling conditions, which would reduce their flood attenuation capacity as well as leading to the loss of nationally important habitats including (Broadwater and the Wraysbury Pits);
 - any further doming of landfill sites within the floodplain which would threaten the integrity of the Lower Colne Flood Alleviation Scheme.
 - past backfilling of gravel pits with putrescible and hazardous wastes which has almost certainly led to a drop in groundwater quality. Of particular concern are landfill sites located over the chalk aquifer (of which there are relatively few at present) and older sites filled prior to the more stringent regulations introduced under the Control of Pollution Act 1974 (these are primarily concentrated in the southern end of the catchment). Such landfill sites are of particular concern in that the costs of taking remedial action are usually excessively high and well beyond the finances available to most local authorities.
2. **Lack of knowledge about the low level drainage system and groundwater conditions:** The NRA-TR has no detailed information on the operation of the low level drainage system or groundwater conditions and quality in the Lower Colne Valley. This is of particular concern not least because:
 - inadequate operation of the low level drainage system and rapid fluctuations in groundwater levels, associated with the gravels of the valley floor, lead to frequent incidents of waterlogging and localised ground water flooding, which in turn can lead to infiltration of the foul sewers;
 - in areas where rivers are perched above surrounding ground levels, the hydraulic continuity set up between the rivers and the surrounding gravels can cause waters to rise up through the gravels, leading to localised flooding in times of high river flows;
 - filling of past gravel pits with impermeable materials is known to form a barrier to groundwater movement;
 - a drop in ground water levels and quality, sometimes associated with gravel extraction and landfill, can cause irreparable damage to non-recreatable water dependent habitats, such as Staines Moor, which is known to be suffering from falling watertable levels.

3. **Sewage effluent discharges:** Although largely based on fisheries survey information, it would appear that sewage effluent discharges are leading to a noticeable drop in river water quality in certain reaches. Of particular concern are the effluent discharges from Chesham Sewage Treatment Works (STW) which have prevented the use of the Chess as a Salmon nursery site since 1988 and discharges from Blackbirds STW and Maple Lodge STW both of which affect the main Colne river system.
4. **The importance of the river corridors of the catchment:** Past land use history, with loss of floodplain to development and land doming, indicates that the river corridors of the catchment have often not been perceived by the planning community as special areas to which special policies should apply. Thus, whilst the river corridors of the Misbourne and Chess remain largely intact, that of the Pinn has been almost entirely lost to development and that of the Colne has suffered major disruption. Now any further erosion of the Colne flood plain through development or land doming will irrevocably undermine the Lower Colne Flood Alleviation Scheme. At the very least this requires strong enforcement of a flood plain protection policy.
5. **Development pressure:** Despite the planning restraint policies covering the catchment, land use pressures are such that the Colne Valley will continue to suffer from industrial/commercial development, gravel extraction/landfill, and major infrastructure improvements, as evidenced by the current Terminal 5 and motorway widening proposals, for example. If insensitively handled such developments pose a further threat to the integrity of the river corridors, especially where they take land from the floodplain, lead to significant increases in run-off or threaten the rivers and their immediate habitats. Because of their contravention of Green Belt policies, however, such developments are almost invariably accompanied by a package of strategic environmental improvements most usually aimed at meeting local authority/community objectives. In these circumstances, so long as the development is not in direct and irreconcilable conflict with NRA objectives, they can offer a key to the improvement of areas of past degradation and in particular, can make a major contribution to the resolution of landfill problems, which are well beyond the finances of local authorities.
6. **Landscape changes:** The rivers of the catchment are a key feature of the conservation and amenity value of the catchment; they are the focus of remnant ancient habitats and new colonising communities and they provide a linking element in an otherwise frequently discordant and, in the case of the Colne, urbanised landscape. The value of the rivers as features of continuity is likely to become all the more important in the future as the current downturn in the agricultural economy leads to a gradual but significant change in the landscape of the catchment.

C. Second Order/Short Term

1. **Flood warnings:** At present the national NRA flood warning targets of a minimum of 2 hours warning on the Pinn and 4 hours elsewhere cannot always be guaranteed because of gaps in appropriate data gathering and limitations of forecasting technology.
2. **Public awareness of flood risk:** Despite the high degree of public consultation associated with the Lower Colne Flood Alleviation Scheme, residents in the valley still feel uninformed about potential flood risk and proposed alleviation methods.
3. **Fish migration:** There is a need to identify a preferred fish migratory route up the Colne system to allow development of a co-ordinated programme of fish pass construction.

D. Second Order/Long Term

1. **Recreation opportunities:** The Colne Valley Broadsheet sets out a series of proposals for the Colne Valley Park, but falls short of recognising the particular recreational opportunities of the Colne river corridor. These opportunities should now be explored.
2. **Thames Navigation Link:** Any further advancement in the proposals of the Inland Waterways Association to develop a Thames Navigation Link should be treated with the utmost care as the impacts arising appear to far outweigh any benefits.

RECOMMENDED STRATEGY

Background to the Strategy

It is clear from the key issues that the Colne Valley is likely to be subject to continuing change for the foreseeable future. This change will relate to commercial and infrastructure development, gravel extraction, landfill proposals, and agricultural change.

The implementation of the Lower Colne Flood Alleviation Scheme has addressed one of the fundamental problems of the catchment, namely that of severe flooding in the Colne Valley. In consequence, this Catchment Plan can look forward to a wider remit, concerned with tackling the problems associated with land use change and development pressure, combined with seeking to improve the quality of the river environment as a whole.

As already argued in preceding sections there are many aspects of the catchment's water environment which require conservation; there are equally many aspects which require enhancement.

Those aspects requiring conservation and those requiring enhancement can be roughly sub-divided as follows:

Features Requiring Conservation (Fig. 23)

- the agrarian landscapes of the Misbourne and Chess;
- original floodplain water-dependent habitats, most notably Staines Moor and Frays Meadows SSSI's on the Colne and Frogmore Bottom SSSI on the Chess;
- the mature wet gravel pits of the Colne Valley, concentrated between Rickmansworth and the M40, to the west of Uxbridge around Little Britain, and in the south of the Colne Valley around Wraysbury;
- mature parkland landscapes associated with the rivers including Shardaloes and Chalfont Park on the Misbourne, Denham Court at the confluence of the Misbourne and Colne, and Huntsmoor Park and Delaford Manor on the Colne Brook;
- lengths of river which display one or more of the following characteristics: a relatively stable geomorphology, good pool/rifle sequences, good marginal vegetation, mature tree-fringed banks, and historic river/canal vernacular, including original eel traps;
- known archaeological features of interest and, listed buildings and built conservation areas relating to the rivers;
- existing well-used riverside rights-of-way.

Features Requiring Enhancement (Fig. 24)

- areas of downgraded rural landscape resulting from the poor restoration of gravel pits and often associated with suspected leachate problems arising from landfill, found in pockets between Uxbridge and Horton, with a particular concentration between West Drayton and Slough;

N.R.A: Thames Region
LOWER RIVER COLNE CATCHMENT
MANAGEMENT PLAN

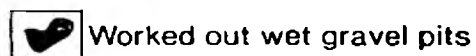




Figure: 24


**THE RIVER CORRIDORS:
AREAS REQUIRING ENHANCEMENT**





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LOWER RIVER COLNE CATCHMENT
MANAGEMENT PLAN

 Gravel pits with outstanding filling conditions

 Past landfill areas requiring major enhancement

 Downgraded agricultural areas requiring enhancement

 Urban/urban edge areas requiring enhancement

 Low flows requiring alleviation



- small panels of downgraded agricultural land largely given over to horse grazing;
- areas of poor urban riverscape including nearly all of the Pinn; the Misbourne where it passes through the southern part of Chalfont St. Peter and in the area of Higher Denham, the Frays and Colne through parts of Uxbridge and Cowley, and the Colne and Wraysbury Rivers through Staines;
- lengths of river which are badly silted or have very poor geomorphology, particularly sections of the Wraysbury, Colne Brook and Bigley Ditch realigned to make way from the original construction of the M25;
- the full length of the Misbourne downstream to Chalfont Park, in need of alleviation of low flows.

The Proposed Strategy

The proposed strategy for the catchment, therefore, is one which seeks to conserve remaining features and areas of interest from further change, matched by enhancement of degraded areas (Fig. 25).

Specifically, the areas to be covered by this strategy would be the river corridors of the catchment, in other words the rivers themselves plus all adjacent land having an existing or potential value relating to the presence of the rivers. In the case of the Colne this is largely defined by the 1 in 100 year flood plain, and in the case of the Misbourne and Chess by the valley floors, which are generally fairly narrow. In the case of the Pinn, however, which has been squeezed by urban development, the current width of the river corridor is sometimes little more than the width of the river itself. Here, therefore, it is suggested that the river corridor should be defined as the area of land required for the river to achieve a natural meandering course with associated riparian habitats. This would be on the basis that future riverside redevelopment should be obliged to take account of restoration of the river corridor as a conservation principle.

The **purpose** of developing a conservation and enhancement strategy for the river corridors of the catchment is two fold, first to provide a programme of action and second to provide a framework against which individual proposals and river works can be judged as to their acceptability or otherwise; in other words to encourage comprehensive planning rather than ad hoc decision making. It should also have the benefit of:


- encouraging closer consideration of the interaction between changing land uses and the water environment;
- ensuring that all land use changes in the river corridor make a direct and positive contribution to the overall plan;
- ensuring that localised enhancement works identified as part of individual proposals, contribute to a wider plan.

The overall strategy would be given greater stature if local authorities could be encouraged to identify the river corridors of the catchment as protected land to which specific conservation and enhancement policies applied, in their statutory plans. Although not essential, such a step would give statutory recognition to the river corridors as a separate entity and would enhance the NRA's position when negotiating with individual developers.

Figure: 25
THE RIVER CORRIDORS: A CONSERVATION
& ENHANCEMENT STRATEGY



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MANAGEMENT PLAN

-  Sites of Special Scientific Interest
-  Areas of Landscape/Ecological Value
-  Mature wet gravel pits
-  Past landfill areas requiring major enhancement
-  Downgraded agricultural areas requiring enhancement
-  Urban/urban edge areas requiring enhancement
-  Low flows requiring alleviation



Responsibility and Implementation

Obviously it is well beyond the NRA's remit to take on overall responsibility for these river corridors. Rather, the requirement is for the NRA to form a partnership with the constituent local authorities and conservation interests of the catchment (including the Colne Valley Groundwork Trust), to identify a preferred conservation and enhancement plan for the river corridors and to agree the most appropriate methods of implementation.

Main Areas Requiring Conservation: As demonstrated in Appendix 1 (Table 1), mechanisms are already largely in place to ensure the conservation and management of prime areas of the Colne Valley. The most critical concern in these areas, therefore, is to identify the best method for ensuring that mature wet gravel pits are not filled in accordance with outdated planning conditions. The local authorities will take the lead on this but the NRA can provide a valuable contribution in predicting the effects of filling, particularly on groundwater quality and flows. Ultimately, the prevention of filling is likely to require negotiation on a quid pro quo basis with the loss of void space being balanced by the offer of alternative void space, further gravel extraction rights or even development of an equivalent value.

In areas identified for conservation there will also be a need to identify small-scale enhancement projects required to improve the status quo. These will be very wide ranging in type but could well include:

- localised tree planting programmes, for example to replace lost riverside pollards;
- localised habitat creation and enhancement;
- improvement in river geomorphology and river habitats through the re-direction of river maintenance;
- improvements in watertable levels through changes to the land drainage network in areas supporting water-table dependent habitats;
- improvements to existing river structures, especially those in concrete, to help blend them with their surroundings;
- restoration of historic river structures;
- improvements in public access.

This is an area where the NRA could take a positive lead.

Main Areas Requiring Enhancement: By comparison, the major enhancement areas identified in the strategy are likely to require fundamental restructuring. These areas primarily consist of poorly restored mineral workings with their attendant problems of leachate and water quality, or urban developments which have turned their back on the rivers. The resolution of these problems is likely to prove very expensive and well beyond the resources of the local authorities or the NRA.

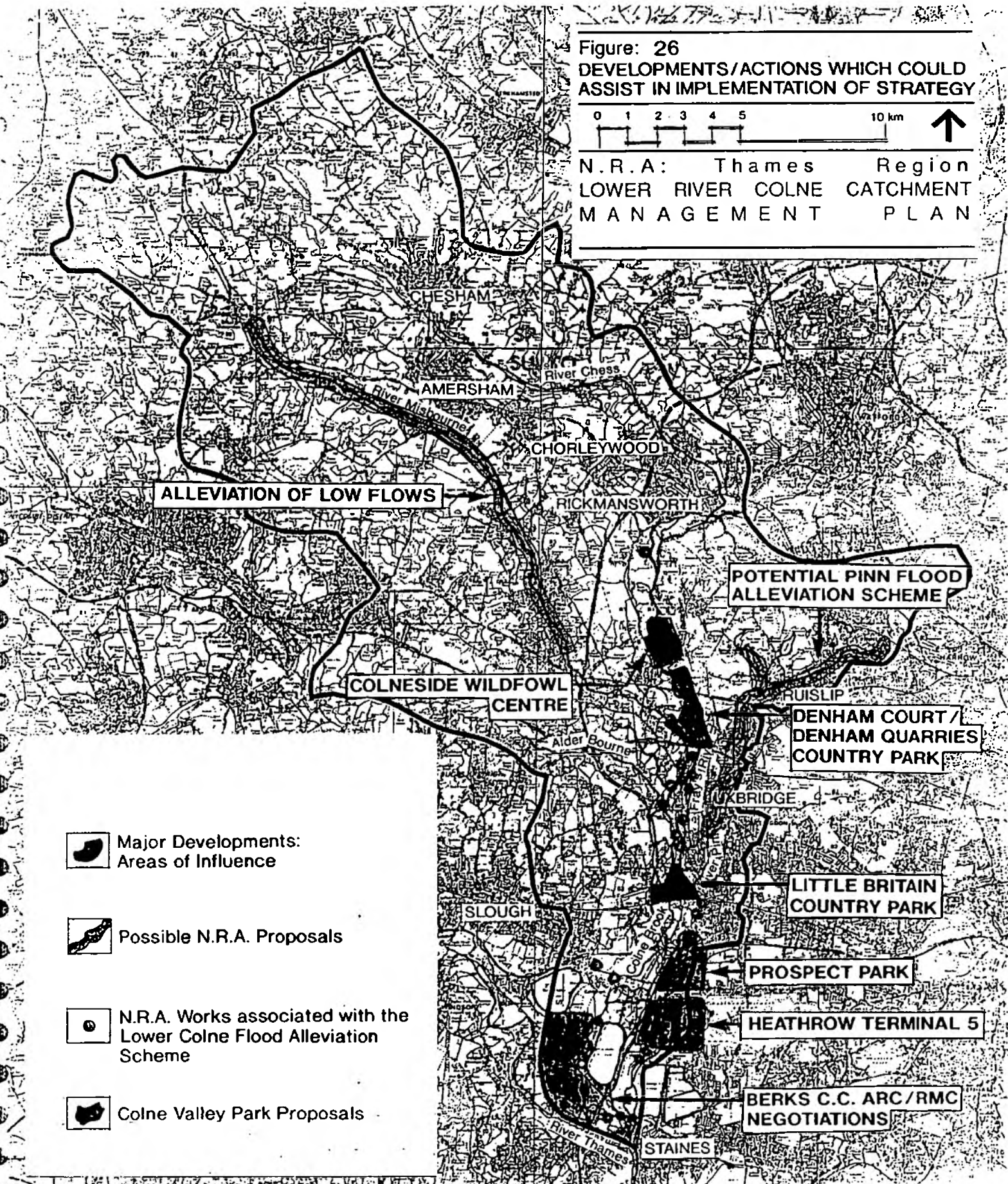
In these circumstances, therefore, while priorities should be identified, the NRA and local authorities should work in concert seeking the appropriate advancement of identified river corridor improvements through a pro-active involvement in development and infrastructure proposals as they come forward.

Figure: 26

DEVELOPMENTS/ACTIONS WHICH COULD ASSIST IN IMPLEMENTATION OF STRATEGY



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LOWER RIVER COLNE CATCHMENT
MANAGEMENT PLAN



(Current development and infrastructure proposals which are or could contribute to river corridor improvements are shown in Fig. 26). In the case of old landfill sites the aim should be to tie major restoration schemes to Green Belt development and infrastructure proposals. In the case of urban encroachment, the minimal requirement will be to secure an attractive riverscape, combined with opening up the river corridor wherever redevelopment allows.

As can be seen from Appendix 1 (Table 2), the adoption of a pro-active approach to development is already beginning to bear fruit. Major restoration schemes are now being put forward, as part of development/infrastructure proposals, for some of the most degraded parts of the Colne Valley.

Other Actions

In addition to the need for conservation and enhancement of the river corridors as a whole, there are also a number of other specific actions required by the NRA-TR to improve the character of the water environment and reduce the flooding risks associated with it. These actions directly contribute to the overall strategy and include:

- resolution of outstanding river flooding problems in the valleys and identification of the flooding problems associated with surface (non main river) and ground water flows;
- a further improvement in current water quality, not only through control of ground water leachate associated with landfill sites, but also through control of surface water run-off, and improvements in the quality of sewage effluent.;
- identification of a preferred fish migratory route up the Colne Valley which would then be made fish passable.

Action Plans

For the strategy of river corridor conservation and enhancement to become a reality, three interrelated Action Plans will be required which bring together the key actions contributing to the overall strategy. These Action Plans are likely to involve a number of different NRA functions and are:

Action Plan 1: A Conservation and Enhancement Plan for the River Corridors of the Catchment, ie. the Colne, the Pinn, the Midsbourne, and the Chess. This should detail areas requiring conservation, areas requiring enhancement and the necessary actions to be taken to achieve these two prime objectives. Specifically this plan should embrace Landscape, Nature Conservation, Fisheries, River Geomorphology, Groundwater Issues and Control of Urban Water Run-off. It should also identify methods of implementation, including:

- local enhancements funded by the NRA or by the local authority;
- enhancements attached to wider NRA proposals, eg. a flood alleviation scheme;
- major works which will need to be tied to strategic development proposals.

Action Plan 2: Gravel Pit Restoration: This would contribute directly to the first Action Plan but would look in more detail at the implications of gravel pit restoration. Amongst other things it should seek to identify:

- old landfill sites known to be affecting groundwater quality;
- zones where, according to water quality issues, filling will not be acceptable. This should consider both active and future mineral sites and also old mature wet gravel pits with outstanding filling conditions;
- areas where doming of landfill sites will not be acceptable if flood defence target levels of service are to be maintained;
- the advice to be given to planning and waste disposal authorities on the siting, containment, monitoring and control of new landfill proposals;
- the advice to be given to planning and waste disposal authorities to ensure that gravel extraction and landfill sites do not adversely affect groundwater flows.

This study should build on the existing baseline study on gravel pit filling undertaken as part of this Catchment Plan.

Action Plan 3: A Re-appraisal of the Terminal 5 Proposals including Associated Roads: At present the Terminal 5 proposals are the largest single development proposals to affect the catchment. A number of studies have already been undertaken to assess the implications of this development for the water environment. However, once the proposals are further advanced there will be a need for a full Environmental Statement which objectively reviews the implications for the river corridor. This is likely to involve all NRA functions and should contribute to the conservation and enhancement plan for the river corridors.

The remainder of this section outlines the actions which should be taken by each NRA function.

ACTIONS BY FUNCTION

In the remainder of this section, consideration is given as to how the individual NRA functions can contribute to the overall catchment strategy outlined previously. Function-specific objectives are described, followed by a lists of tasks required to complete the identified objective or objectives. These tasks are grouped according to priority, however, these priorities will need to be reviewed against the resources available.

1. FORWARD PLANNING

Objective: The achievement of the NRA's aims will depend, to a large extent, on the co-operation and support of the statutory planning authorities of the catchment. There is a need therefore for continued close working relationships with the relevant local authority departments, with the specific objectives of:

- facilitating NRA-TR's input into statutory and non-statutory planning documents, as the prime decisions about land use change will be made during the process of statutory plan development and review (including Unitary Development Plans, District Development Plans, County Minerals Plans and non-statutory Waste Disposal Plans and the Colne Valley Broadsheet);
- encouraging local authorities to designate the river corridors of the catchment as protected land to which a specific policy or policies would relate;
- seeking early warning of major development proposals and land use changes which could affect NRA interests and ensuring, through liaison, that these interests are fully taken into account in any final planning approvals.

Specific tasks required to achieve this objective are:

High Priority Tasks

- Preparation of a briefing note for local authorities setting out the purpose of the Catchment Plan.
- Continued preparation of model policies (fine-tuned to suit individual local authorities) for incorporation in statutory plans as and when they come forward for public consultation.
- Definition of a boundary for the River Corridors of the Colne and its tributaries, in consultation with the local authorities.
- Preparation of a model policy(s) for the River Corridors backed by a statement of objectives for these areas, in consultation with the local authorities.
- Ensuring that a pro-active role is pursued on all major developments. This should lead to an assessment of the implications for the water environment, with conclusions clearly set out in an Environmental Statement. The first Environmental Statement to be prepared is likely to relate to Terminal 5, as outlined previously.

Other Tasks

- Preparation of a briefing note for local authorities and potential developers, setting out preferred procedures to be adopted when consulting the NRA-TR on specific development proposals and also clearly setting out the areas of interest to the NRA.

2. FLOOD DEFENCE/LAND DRAINAGE

In the case of flood defence/land drainage, five separate objectives have been identified. These relate to river flooding; non-main river and groundwater issues; information dissemination; operation and maintenance issues; and flood warning.

Objective 1 (River Flooding): The primary investment objective is to complete the Lower Colne Flood Alleviation Scheme at the earliest opportunity, combined with resolving other, generally more minor, river flooding issues remaining in the Catchment. In all cases, revisions to existing proposals and identification of new works should not compromise the levels of service achieved by the Colne scheme. All works should seek to minimise environmental disruption (both short and long term) and maximise opportunities for environmental enhancement, consistent with any wider conservation and enhancement objectives for the river corridor under consideration.

Specific tasks required to achieve this objective are: ,

High Priority Tasks

River Pinn

- Resumption of the feasibility study into options for flood alleviation on the River Pinn, combined with environmental assessment, leading to identification of a preferred environmentally sensitive flood alleviation scheme acceptable to the relevant local authorities. Following public consultation, this should be taken to detailed design with the target of starting construction in year 1992/93.

Lower Colne Flood Alleviation Scheme

- Resolution of those parts of the Lower Colne Scheme which have yet to be fully defined. Primarily:
 - The Trout Lane area
 - Central Staines
- Inclusion of all structures subject to blockage in the Lower Colne Scheme i.e. the addition of Harefield Mill, West Drayton Mill, Hale Hamilton Screen, Willowbank Weir, Valentines Paint Mill and the Ash Offtake in the current refurbishment proposals.
- Review of all built up areas in the Colne Valley, not specifically covered by the Flood Alleviation Scheme, to ensure that all property susceptible to flooding is drawn into the scheme. This should lead to the identification of flood alleviation works required to resolve outstanding problems, including continued flooding of Hithermore

Road from Stanwell Moor Ditch (where an outline proposal has already been prepared) and Rockingham Recreation Ground flooded from the Frays.

- Continued liaison with Heathrow Airports Ltd to ensure that appropriate environmentally acceptable flood alleviation options are adopted to accommodate excess road run-off which will be discharged to the Colne (the implications of this have already been modelled).
- Continued liaison with the DTp to ensure that appropriate environmentally acceptable flood alleviation options are adopted as part of the M4 widening (at present it is proposed that the majority of the additional run-off will be discharged to the low level drainage system).
- Hydraulic modelling of the impacts of increased run-off from the M25 widening on the Colne Brook and other receiving water courses, leading to identification of any required flood alleviation works to accommodate increased flood flows.

Other Tasks

- Consideration of the maintenance implications relating to the Horton Drain, the Mildridge Green Drain and the Drain on the Green, if it is resolved that these watercourses should be the prime recipients of increased surface water run-off associated with the M4 widening. A preferred option would be the 'maining' of these water courses.
- Consideration of the implications of a possible Colne Valley Navigation Link on the Lower Colne Flood Alleviation Scheme, should this proposal be put forward again by the Inland Waterways Association.
- Introduction of a formal system of post-completion appraisal as a check on the implementation of projects and as a means of improving future assessments. This should include consideration of river geomorphology and enhancements.
- Review of the implications of potential climatic changes associated with global warming, on existing and proposed flood alleviation schemes in the Catchment.

Objective 2: (Non-main River and Ground Water Issues): The second objective is to gain a clearer picture of how the low level drainage system operates and to understand the groundwater characteristic of the Colne Valley. This information is required to:

- help identify the cause of local flooding problems;
- allow the NRA-TR to give clear advice to local authorities when consulted on local drainage issues;
- allow identification of the implications of future gravel extraction and landfill proposals on local drainage and groundwater characteristics;

- allow a more precise understanding of how local drainage and ground water levels operate within and adjacent to important water-table dependent habitats.

Specific tasks required to achieve this objective are:

High Priority Tasks

- A scoping exercise to identify the present operation of the low level drainage system.
- A scoping exercise, including review of the 1981 groundwater model, to assess the general characteristics of groundwater flows, levels and potentially quality within the gravels of the Colne Valley. (Contributing to Action Plan 1).
- An assessment of whether channel improvements should replace outstanding flood defence works on the Lower Colne scheme bearing in mind the hydraulic gradient which exists between the perched rivers of the valley and the surrounding flood plain gravels. Any such review must take account of the environmental implications of such a change of emphasis.

Objective 3: (Improvement in Information Dissemination on Flooding): The third objective is to keep local authorities and the public informed about flood alleviation measures being adopted. In particular, the co-operation of local authorities must be enlisted to prevent any further loss of floodplain to development or land doming.

Specific tasks required to achieve this objective are:

High Priority Tasks

- Preparation of a definitive post-scheme floodplain map for the Colne Scheme, based on a 1 in 100 year flood event, which can be used by local authorities when forming floodplain protection policies and when reviewing individual planning applications.
- In association with the relevant local authorities, preparation of a co-ordinated plan to ensure the most effective restoration of existing and future gravel pits in order to maintain flood defence target levels and accommodate groundwater flows. (Contributing to Action Plan 2).

Other Tasks

- Publication of a regular news letter (6-monthly or yearly) informing the public about flooding problems in the catchment and flood alleviation works being undertaken (such a newsletter should not be seen as an alternative to public consultation on individual schemes as they come forward).

Objective 4: (Operations and Maintenance): The fourth objective is to establish maintenance regimes appropriate to the levels of service criteria for flood defence and the environment, together with prioritising emergency operations and blockage clearance at vulnerable sites.

The specific tasks required to achieve this objective are:

High Priority Tasks

- The setting up of experimental trials to assess the inter-relationship between river maintenance, river geomorphology and levels of service. The aim would be to select 3 or 4 sample reaches and to experiment with maintenance regimes required to achieve geomorphological enhancement, whilst retaining the required levels of service. Such trials would need to be implemented in conjunction with Geomorphology, Conservation and Fisheries.
- Preparation of an 'Operations and Maintenance Manual' for all major river structures. This would be in two parts, the first would describe how all the structures worked in sequence and the second would be an operation guide for each of the structures in turn. The production of this manual will be greatly assisted by the survey of control structures undertaken as a baseline survey for this catchment plan.

Other Tasks

- Refinement of the levels of services defined for the catchment, based on further flood monitoring and river flow gauging.

Objective 5: (Flood Warning): In accordance with the NRA National Flood Warning System, the fifth objective is to provide three levels of flood warning (YELLOW, AMBER, RED associated with increasing risk). It is intended that a RED warning should be issued 2 hours before flooding occurs in London (eg. River Pinn) and 4 hours elsewhere (eg. the Colne).

At present this level of warning cannot always be guaranteed as the required data for predicting flood events is not always comprehensive. Therefore, the specific tasks required to achieve this objective are:

High Priority Tasks

- Completion of the system of PSTN water level recorders. This requires completion of their installation, provision of maintenance procedures and contracts, and development of software to allow automatic interrogation and data handling.

Other Tasks include:

- Extension of the analytical radar coverage, presently on trial in London, to cover the Pinn.
- Telemetering more rain gauges and establishing stage/discharge relationships at selected sites.
- Identifying trigger levels for warnings and further developing the predictive river flow/modelling techniques.

3. WATER RESOURCES

Objective: The primary objective is to address the alleviation of low flows associated with over abstraction, through such actions as are necessary on licensing, abstraction, monitoring and enforcement, and through charging for water abstraction, as is consistent with or indicated by national policy.

The tasks required to achieve this strategy will depend on the work programme and priorities already established for Water Resources. However, the most pressing priority within the Colne Catchment is to:

High Priority Tasks

- Implement a scheme to relieve low flows on the Misbourne, following further review and environmental assessment of options.

Other Tasks

- To prevent the problems of the Misbourne re-occurring or other rivers becoming affected by low flows, by ensuring that future applications for abstraction licences are thoroughly assessed in terms of their potential impact on river flows and associated water-dependent habitats.

4. WATER QUALITY

Objective: The primary objective is to ensure that the present quality of both surface and groundwater is maintained and, where appropriate, improved so as to be fit for all present and potential uses.

The tasks required to achieve this objective will depend on the work programme and priorities already established for Water Quality. However, work on this Catchment Plan indicates that there would be great benefit in inclusion of the following tasks (if not already programmed).

High Priority Tasks

- A review of effluent discharges, especially in relation to Chesham Sewage Works, (this would be of particular benefit to Salmonid fisheries).
- Preparation, in association with the Mineral Planning Authorities, of a strategic plan indicating where and what type of gravel pit filling will be acceptable to the NRA in terms of water quality issues. This should pay particular attention to protection of the chalk and gravel aquifers of the Catchment and should be accompanied by guidance on the types of condition which should be imposed by the Waste Regulation Authority to achieve the required level of environmental protection in cases of landfilling. (Contributing to Action Plan 2).
- Exploration of pro-active methods available to control pollution impacts associated with surface water run-off, for example, the use of riverside buffer strips, cross land flows and reed bed pollution traps. (Contributing to Action Plan 1).

5. FISHERIES

Objective: The primary objective is to encourage a thriving fish population consistent with a healthy river system and to ensure that the rivers live up to their recognition as EEC-designated fisheries, both Salmonid and Cyprinid.

The fisheries of the catchment will be greatly improved by resolution of low flows in the Misbourne (Water Resources), and by improvement in river water quality associated with the upgrading of sewage effluent discharges and improvements in the control of surface water run-off (Water Quality). They will also be greatly enhanced by the proper operation of individual river structures (Maintenance) and by improvements to river geomorphology (discussed under Landscape and Conservation). Other tasks which would assist in the meeting of the above objective include:

High Priority Tasks

- Start of a new fish survey programme, more closely attuned to river quality priorities, potentially using additional indicators of fish performance (other than just biomass). The results of these surveys are essential not just to fisheries but also provide a key indicator to water quality.
- Identification of a key fish migratory route, linking the Thames with the spawning grounds of the Misbourne and Chess. Once identified, the key objective will be to make all river structures along this route passable either through incorporation in flood defence proposals or as part of a separate project. (Implementation of the route will therefore fall to Flood Defence/Projects). (Contributing to Action Plan 1).
- Identification of a maintenance programme for the de-silting of reaches on the Wraysbury, Frays, Chess and Misbourne, affected by silts washed into the watercourse by local run-off (to be implemented by NRA operations). (Contributing to Action Plan 1).

Other Tasks

- Continuation of current restocking programmes including grayling, brown trout and barbel in the Lower Colne Rivers; and brown trout in the Chess and Misbourne.
- Identification of river habitat improvements, including increased marginal cover on reaches of the Chess, which could be implemented as part of wider river corridor enhancement. (Contributing to Action Plan 1).

6. RECREATION/NAVIGATION

Objective: The primary objective is to improve opportunities for informal recreation within the river corridors, consistent with conservation objectives.

The tasks required to achieve this objective are:

High Priority Tasks

- Identification of potential alternative riverside routes for inclusion in an overall programme of river corridor enhancements, in consultation with local authorities and the Colne Valley Groundwork Trust. Only those routes judged to have minimal impact on wildlife interest should be included in the final programme. (Contributing to Action Plan 1).

- Identification of the preferred amenity afteruse for existing and proposed mineral extraction sites within the Colne Valley river corridor, in close consultation with local authorities and conservation interests. This should form part of a wider NRA-TR review of the future of mineral workings. (Contributing to Action Plan 2).

Other Tasks

- Incorporation of recreation enhancement in river works and planning proposals as they come forward.

7. LANDSCAPE AND CONSERVATION

Objective: The primary objective is to identify a conservation and enhancement plan for the river corridors of the catchment, in other words to provide the lead on Action Plan 1. Before this work can be finalised, however, some basic survey work has still to be completed.

Specific tasks required to complete this objective are:

High Priority Tasks

- Carrying out of a river corridor wildlife survey of the River Chess and River Pinn.
- Carrying out of a landscape assessment of the River Chess and River Pinn with the specific objective of identifying conservation and enhancement opportunities.
- Extension of the geomorphological survey to cover all the main rivers in the Lower Colne system with the specific objective of identifying conservation and enhancement opportunities.
- Preparation of a Conservation and Enhancement Plan for each of the river corridors of the catchment. This should draw on existing base line surveys, further survey work noted above, and the skeleton provided by Figure 25 and Tables 1 and 2 of Appendix 1. The proposals should be drawn up in consultation with the local authorities and should cover Landscape, Nature Conservation, River Geomorphology, with separate input on Fisheries, Groundwater Issues and Control of Urban Run-off.
- In association with the local authorities, Forward Planning, Flood Defence and Water Resources (alleviation of low flows) to assign tasks identified in the Conservation and Enhancement Plan according to the most appropriate method of implementation, e.g. as a special project, through river maintenance, as part of a flood alleviation programme, or as part of a major development.

Other Tasks

- Preparation of a Design Guide demonstrating how new river structures and flood walls can best be blended with their surroundings within the Colne context. This should include consideration of brick types, bridge designs, paving, hand rails and

vernacular in the case of works affecting the Grand Union Canal.
(Contributing to Action Plan 1).

- Ensure that all base line survey data covering wildlife, landscape and geomorphology are transferred to GIS to provide a readily available source of information.
- Ensure that the above base line data is used to guide regular river maintenance activities, with the objective of limiting environmental damage and maximising opportunities for improving river geomorphology and marginal and aquatic habitats.

APPENDICES

TABLE 1

Main Conservation Areas: Mechanisms in Place for their Continued Management

Location	Management Mechanisms in Place	Potential NRA Contribution	Priority for Resolution/Action
Colne Valley: Wet Gravel Pits North of M40			
1. Rickmansworth Aquadrome: Bury & Batchworth Lakes	Owned and managed as water recreation areas by Three Rivers District Council.	To ensure that there is no change in water quality or frequency of inundation in the wet gravel pits.	
2. Stockers Lake	SSSI and Local Nature Reserve managed by Herts and Middlesex Wildlife Trust who now have plans to improve public access		
3. Lynsters, Pynesfield & Troy Lake	Managed by private clubs for recreational use including shooting and sailing.		
4. The Broadwater Complex of Lakes	SSSI, still being worked, with Colne Valley Park proposals to develop it as a major Wildfowl Centre, perhaps managed by an organisation such as the Wildfowl and Wetland Trust. However, the main waterbody is subject to an outstanding filling condition (1949) although a recent application for a site licence to fill a small area was turned down on the grounds of threat to groundwater quality. Assuming that filling could eventually be allowed Redlands (the primary landowners) are pulling together a major development package involving Green Belt office development as an option in lieu of filling.	To pursue ground water quality issues in relation to filling of Broadwater	1
5. Stockers Lake	Fishing Lake forming part of the overall development proposals currently being investigated by Redlands for Broadwater.		

Location	Management Mechanisms In Place	Potential NRA Contribution Potential	Priority for Resolution/ Action
6. Harefield Moor	Privately run canal marina.		
7. The Denham Quarries Area including Hoveringham Lake & Frays Meadows SSSI	All owned by London Borough of Hillingdon with plans to develop the area for informal recreation/ as a Country Park, linking to the proposed Denham Court Country Park on the other side of the Grand Union Canal. Implementation constrained at present by lack of funds, therefore, consideration being given to allowing gravel extraction adjacent to Frays Meadow SSSI, to assist with raising of funds.	i) To assist with review of river access links. ii) To assist with assessment of any groundwater changes which might be experienced in Frays Meadows resulting from adjacent gravel extraction.	1
8. Denham Court	Majority of parkland being converted to a private Golf Club with residual riverside area being developed as a Country Park by Bucks C.C. in association with the Colne Valley Groundworks Trust.	To assist with review of river access links.	
Colne Valley: Little Britain Area			
9. Delaford Manor	In private ownership, land between Colne Brook and M25 now degraded.	To assist in improvements to parkland character, perhaps as part of any future works to the Colne Brook required to accommodate additional run-off from the M25.	2
10. Huntsmoor Park	In private ownership, although there are Colne Valley Park proposals (Bucks) to undertake parkland restoration.	To assist in provision of Colneside bridleway, proposed by Colne Valley Park.	

Location	Management Mechanisms in Place	Potential NRA Contribution Potential	Priority for Resolution/Action
11. Complex of wet pits lying to either side of Slough Arm of the Grand Union Canal	These mature lakes are actively managed for angling and are planned to form the Little Britain Country Park, one of the Strategic proposals for the Colne Valley Park.	<ul style="list-style-type: none"> i) To assist with review of river access links. ii) To review enhancement contributions which could be made by the proposed flood alleviation works in this area, eg. Little Britain Defences and Trout Lane Flood Carrier, forming part of the Lower Colne Flood Alleviation Scheme. 	
Colne Valley: South of the M4			
12. Old Slade Lake	Managed as a nature reserve by the RSPB.	To prevent bank erosion which could eventually breach the embankment between the lake and the Colne Brook.	2
13. Orlette Lake	Still being worked. Proposed by the Colne Valley Park to be developed as a Nature Reserve although no management agency has been identified.	To assist in ensuring the long term management of the site.	
14. Bedfont Court Estate	Potentially forming part of Heathrow Terminal 5 proposals.	(See Table 2)	1
15. Staines Moor	SSSI, managed as common land. At present subject of a management plan being prepared by Spelthorne Borough Council. Suffering from falling water table levels.	To assist in improving groundwater levels in line with the requirements of the management plan.	1

Location	Management Mechanisms in Place	Potential NRA Contribution Potential	Priority for Resolution/ Action
16. Complex of Wet Pits south of Horton, Inc. Kingsmead and Wraysbury No.1 and No.2	Nearly all these lakes have outstanding conditions to fill. However, Berkshire County Council is actively involved in negotiation with ARC and RMC (the two land owners) to secure a package which allows some landfill but ensures the conservation and management in perpetuity of the most valuable wet pits and ensures the creation of a Country Park at Hythe End.	NRA-TW is working in partnership with the County on these negotiations in order to secure required flood alleviation measures, (Horton Diversion Channel forming part of the Lower Colne Flood Alleviation Scheme and a Thames flood relief channel forming part of the Thames flood relief programme) and to secure river corridor enhancements, including control of leachate from a past tip site.	1
Tributary Valleys			
17. Misbourne Valley	Parish and Town Councils have expressed an interest in carrying out localised enhancements to the river and its surroundings if a scheme were introduced to alleviate low flows. However, the valley floor could be subject to agricultural change in the future.	In association with the District and Parish Councils, to identify and carry out a programme of enhancements as part of any scheme to alleviate low flows. Ideally this should be combined with the setting up of a liaison group with those farmers whose land is crossed by the Misbourne.	1
18. Chess Valley	Situation not known.	?	

TABLE 2

Main Enhancement Areas: Mechanisms Available to Achieve Enhancement Works

Location	Mechanisms for Achieving Enhancement	Potential NRA Contribution	Priority for Resolution/Action
Colne Valley: North of M40			
1. Maple Lodge and adjacent industrial estate	Urban edge	Partial screening of sewage works is now being achieved through a current landscape contract associated with Lower Colne Flood Alleviation Scheme.	
Uxbridge Area			
2. Urban edge of Uxbridge	Urban fringe: Despite the unsatisfactory character of some of the urban development in this area, the Colne Brook provides a clear dividing line between the urban edge and a traditional agricultural landscape. This distinction is likely to be eroded, however, by loss of this agricultural land to gravel extraction (Round Coppice Farm is a designated 'Preferred Extraction Area' in the Berkshire Minerals Plan).	i) To liaise with the Mineral Planning Authority to ensure a satisfactory afteruse for the current agricultural land. ii) To review any redevelopment proposals which affect land adjacent to the rivers, with the aim of encouraging river-side improvements. iii) To review options for carrying out wider enhancements as part of outstanding works on the Lower Colne Flood Alleviation Scheme, eg. Grand Union Canal Overflow, Bell Punch Works, Palmers Moor Bund and any protection required to Cowley Industrial Estate.	2
West Drayton/ Harmondsworth			
3. Land between railway line and Thorney Mill Road	Mixture of degraded agriculture and landfill: No known mechanisms available to improve the area other than a past Hillingdon/private initiative to secure improvement to the land lying immediately to the west of the Colne, known as the Philglow Study.	i) To assist in securing a long term future for this area. ii) To undertake planting along the Colne Brook.	

Location	Mechanisms for Achieving Enhancement	Potential NRA Contribution	Priority for Resolution/Action
4. Larbourne Farm	<p>Past gravel extraction site cut in two by the M25: The eastern half has been restored as a recreation lake by Bucks C.C. while the western half has been restored to good quality productive agriculture with boundary planting undertaken by the Colne Valley Groundwork Trust. However, the Colne Brook which was diverted as part of the M25 construction, has an unattractive trapezoidal form across both blocks of land.</p>	<p>To ensure a mechanism for reforming the Colne Brook in this area. Options include:</p> <ul style="list-style-type: none"> - any works required to improve the conveyance of the Colne Brook associated with additional run-off from the M25; - works associated with the Lower Colne Scheme, eg. 'Motorway Interchange Embankments'. 	2
5. Land between Thorney Mill Road and the A4	<p>Mixture of old landfill sites, active landfill sites and gravel extraction: The future of this area is largely dependent on the fate of Prospect Park. The enhancements associated with this major development proposal are likely to include:</p> <ul style="list-style-type: none"> - relocation of non-conforming users on 'the Common'; - landscape works to the gypsy site; - major restructuring of current and past mineral workings (including noxious landfill sites), lying between the M4 and the A4 to create an area of public open space; - retention of a small wet gravel pit, of Metropolitan Importance for Nature Conservation, at present subject to a filling condition. 	<ul style="list-style-type: none"> i) To work with the London Borough of Hillingdon to ensure that the Prospect Park proposals meet the needs of the NRA-TR. ii) To work with Heathrow Airport Ltd./the DTp to ensure that relocation of the Bigley Ditch allows for the recreation of a natural sinuous course. 	2
6. Tanhouse Farm Between M4 & A4	<p>Past gravel extraction and noxious landfill site restored to low grade agriculture: No known mechanisms to improve this area at present, although in the past Bucks C.C. investigated the possibility of creating a farm theme park on this site.</p>	<p>To work with Bucks C.C. to secure high quality reclamation.</p>	2

Location	Mechanisms for Achieving Enhancement	Potential NRA Contribution	Priority for Resolution/Action
7. Land between A4 and Colnbrook	Downgraded paddocks along Northern edge of Colnbrook: Identified as part of a landscape enhancement programme by Bucks C.C. in 1985 but little work so far carried out.	?	
Land in the Vicinity of Heathrow			
8. Land between Heathrow & Poyle	<p>Major landfill sites largely restored to agriculture except for Bedfont Court Estate which is an area of small holdings: This area, lying between the present edge of Heathrow and Poyle and between the A4 and Airport Way, forms part of the package of proposals being put forward for Terminal 5 including:</p> <ul style="list-style-type: none"> - creation of a permanent well managed agricultural land holding to either side of the M25; - relocation of the Colne Brook, Bigley Ditch, Duke of Northumberland's River and Longford River to accommodate the development proposals. 	<p>NRA-TW has already been closely involved with Heathrow Airports Ltd. over these proposals for the last 2 years. This liaison must continue to ensure that:</p> <ul style="list-style-type: none"> - relocated rivers achieve a natural sinuous form; - the scheme addresses all landfill leachate problems associated with land covered by the scheme; - a strong and defensible river corridor is created centred on the Colne and relocated Duke of Northumberland's and Longford Rivers; - any required river works do not damage sensitive areas. 	
9. Poyle Farm immediately west of Poyle Industrial Estate	Active landfill sites: The need for further work will depend on the final quality of restoration achieved, but there will almost certainly be a requirement for further enhancement.		

Location	Mechanisms for Achieving Enhancement	Potential NRA Contribution	Priority for Resolution/Action
Areas South of Heathrow			
10. Stanwell Moor	Mixture of well restored agricultural land, active landfill (domed) and wet pit with outstanding filling condition: The need for further work will depend on the final quality of restoration achieved.	<ul style="list-style-type: none"> i) To ensure that these works do not affect watertable quality or levels on Staines Moor immediately to the south. ii) To ensure that local river-side enhancements are included with the works required to improve conveyance in the Colne, necessitated by the road proposals of Terminal 5. 	
11. Staines Town Centre	Poor riverscape where Colne and Wraysbury pass through Staines Trading Estate: Potential major restructuring of area if the Hanover Centre is granted planning permission.	To liaise with Spelthorne Borough Council to ensure that any redevelopment of Staines Town Centre acknowledges the requirements of NRA-TR.	
River Pinn			
12. The river corridor of the Pinn	Urbanised river corridor No known major proposals for this area.	<ul style="list-style-type: none"> i) to implement river corridor enhancements incrementally as riverside redevelopment occurs. ii) to develop a comprehensive enhancement programme as part of any future Pinn flood alleviation scheme. 	

