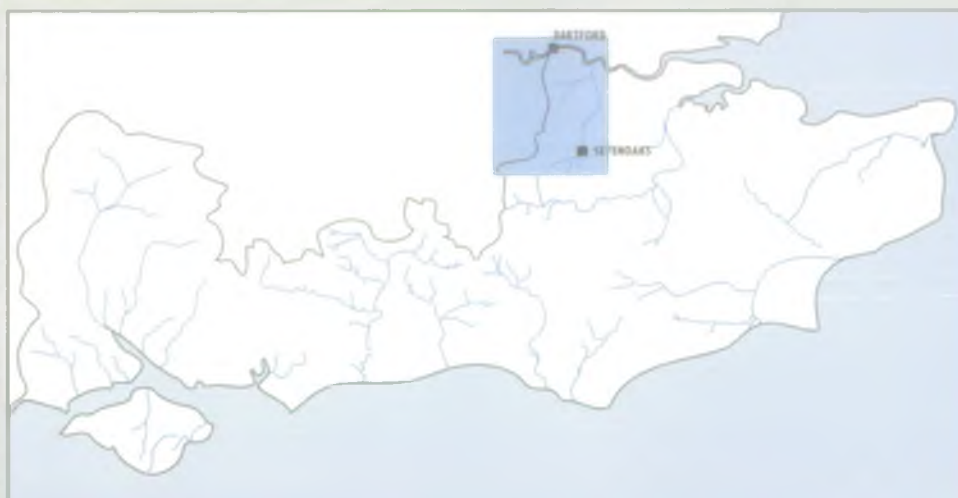


RIVER DARENT CATCHMENT MANAGEMENT PLAN CONSULTATION REPORT



NRA

*National Rivers Authority
Southern Region*

MISSION STATEMENT

The NRA's mission is :

"We will protect and improve the water environment by the effective management of water resources and by substantial reductions in pollution. We will aim to provide effective defence for people and property against flooding from rivers and the sea. In discharging our duties we will operate openly and balance the interests of all who benefit from and use rivers, groundwaters, estuaries, and coastal waters. We will be businesslike, efficient and caring towards our employees".

Our Aims are to :

- * Achieve a continuing overall improvement in the quality of rivers, estuaries and coastal waters, through the control of pollution.
- * Manage water resources to achieve the right balance between the needs of the environment and those of the abstractors.
- * Provide effective defence for people and property against flooding from rivers and the sea.
- * Provide adequate arrangements for flood forecasting and warning.
- * Maintain, improve and develop fisheries.
- * Develop the amenity and recreation potential of inland and coastal waters and associated lands.
- * Conserve and enhance wildlife, landscape and archaeological features associated with inland and coastal waters of England and Wales.
- * Improve and maintain inland waters and their facilities for use by the public where the NRA is the navigation authority.
- * Ensure that dischargers pay the costs of the consequences of their discharges, and, as far as possible, to recover the costs of environment improvements from those who benefit.
- * Improve public understanding of the water environment and the NRA's work.
- * Improve efficiency in the exercise of the NRA's functions and to provide challenge and opportunity for employees and show concern for their welfare.

NRA Copyright waiver

This document is intended to be used widely and may be quoted, copied or reproduced in any way, provided that extracts are not quoted out of context and due acknowledgement is given to the National Rivers Authority.

© Crown Copyright

Based on the 1990 Ordnance Survey 1:50,000 map with the permission of the Controller of Her Majesty's Stationery Office.

Published July 1994

River Darent Catchment Management Plan

River Darent Catchment Management Plan Consultation Report

CONTENTS

Page Nos

CONCEPT OF CATCHMENT PLANNING	2
SECTION A : GENERAL INFORMATION	3
A1.1 INTRODUCTION	3
A1.2 THE DARENT CATCHMENT	3
A2. HYDROLOGY AND RAINFALL	5
A3. FUTURE DEVELOPMENT	7
SECTION B : USES	11
B1. PUBLIC WATER SUPPLY	11
B2. WATER SUPPLY FOR INDUSTRY AND AGRICULTURE	13
B3. USE OF THE WATER RESOURCE	15
B4. WATER QUALITY	17
B5. EFFLUENT DISPOSAL	19
B6. INTERMITTENT AND DIFFUSE POLLUTION	21
B7. FLOOD DEFENCE AND LAND DRAINAGE	23
B8. CONSERVATION	27
B9. FISHERIES	31
B10. RECREATION AND AMENITY	33
SECTION C : TARGETS	35
C1 RIVER FLOW TARGETS	
C2 WATER QUALITY TARGETS	
C3 RIVER TOPOGRAPHY TARGETS	
C4 RIVER MANAGEMENT TARGETS	
SECTION D : CATCHMENT ISSUES	39
SECTION E : MANAGEMENT OPTIONS	41
APPENDICES	49
1 SUMMARY OF CATCHMENT DATA	
2 GLOSSARY OF TERMS AND UNITS	
3 FURTHER READING	

ENVIRONMENT AGENCY



099840

National Rivers Authority

What is the

add

tion

AKXX

River Darent Catchment Management Plan

CONCEPT OF CATCHMENT PLANNING

The Water Act 1989 established the National Rivers Authority (NRA) as the "Guardian of the Water Environment", a non-departmental government organisation with responsibility for regulating and managing water resources, water quality in coastal and inland waters, flood defence, salmon and freshwater fisheries, water recreation and, in some areas, navigation. An additional duty laid on the NRA was to further conservation of the natural environment, seeking opportunities for enhancement wherever possible.

NRA Regions are defined by river basin catchments - singly, as in the Thames Region, or in geographical groups of individual rivers. With the exception of sea defence and coastal water pollution control, all the NRA's functions are managed within this catchment framework, the need to resolve conflicts arising from differing functional objectives makes it essential to integrate the NRA's planning in the same way.

Catchment Management Plans relate firstly to the Authority's own operations, including that of a statutory regulator controlling the actions of others. However, the Plans also offer an opportunity for input from the public to the development of NRA policy, and for the Authority itself to draw attention to its aspirations for the improvement of the water environment.

The Plans concentrate on topics where the Authority has a direct interest and are focused mainly on the river corridor, although some functions such as water resource management and pollution control inevitably extend over the whole catchment area. Whilst they lack the status of statutory planning documents, it is hoped that Catchment Plans will make a positive input to the Town and Country planning process.

The NRA consults widely with interested organisations and the general public before definitive Catchment Management Plans are published. This Consultation Report is the first stage of the process, your comments would be welcomed by

The Catchment Planning Coordinator
Guildbourne House
Chatsworth Road
Worthing
West Sussex
BN11 1LD

SECTION A : GENERAL INFORMATION



TO THE
NORTH



RIVER THAMES



SECTION A : GENERAL INFORMATION

A1.1 INTRODUCTION

The high yield and good quality of its chalk groundwater and the proximity of areas of high demand have led to the Darent catchment being heavily developed for public water supply, to the extent that groundwater levels are reduced and river flows may fail at times of low rainfall. In 1959, 1973, 1976, 1989, 1990, 1991 and 1992 the middle reaches of the River Darent dried downstream of Farningham, and in Dartford the water was static, with no outflow to the estuary.

The NRA has identified the Darent as the most serious case of over abstraction amongst forty catchments in England and Wales requiring positive management for environmental improvement. Following extensive investigation, the Authority has agreed an Action Plan with the major abstractor for the management of water resources to reduce environmental problems and to enhance low river flows at times of drought. The Action Plan has been approved by the Department of the Environment and is being implemented - the purpose of this Consultation Report is to integrate this initiative with other management proposals for the Darent catchment.

A1.2 THE CATCHMENT

The River Darent rises near Westerham and flows eastwards before turning north at Sevenoaks, where it cuts through the Chalk of the North Downs to flow through a wide valley and join the Thames estuary at Dartford. The greater part of the catchment is on the Chalk where surplus rainfall soaks underground, resulting in few permanent surface streams. As a consequence the River Darent has few tributaries other than the Honeypot and Watercress Streams which join the river north of Sevenoaks, and the River Cray which joins the Darent just below its tidal limit. The River Shuttle is an urban tributary of the Cray.

The Darent valley has been a focus for human settlement and activity for many centuries. The catchment contains pre-Roman remains, Roman villas at Lullingstone, Farningham and Sutton-at-Hone, and mediaeval castles at Lullingstone and Eynsford. The Cray and lower Darent catchments are highly urbanised and include the London suburbs of Dartford, Bexley, Bromley, Sidcup and Orpington, whereas the middle and upper reaches of the Darent are rural in character with several villages close to the river.

In the past, some twenty five water mills along the course of the Darent produced flour, paper, fabric and gunpowder; many of these buildings survive, but are used as private houses or as industrial premises unconnected with milling. This intensive use of the river as a power source required the flow to be diverted down artificial channels leaving very little "natural" stream between mill ponds. There were once extensive water-meadows between Otford and Hawley, but much of this land has been developed for housing or gravel extraction. However, most of the gravel deposits in the lower Darent valley have now been exhausted leaving flooded pits which are used as nature reserves, fisheries, or sites for recreation. In the wider context, the Darent valley provides pleasant surroundings and historic interest for peaceful country walks, and many recreational users are attracted into the area from nearby London.

Whilst the problems of low flows have received most attention in recent years, there has also been a history of flooding in the catchment. The exceptional flood of September 1968 damaged roads, bridges and riverside property, but subsequent work on the Rivers Cray and Shuttle, and on the Darent at Westerham, Chipstead and Dartford, has reduced the risk of damage from future floods. However, low-lying water meadows are still permitted to flood regularly, preserving their value as wetland habitats. The Dartford tidal barrier is operated by the NRA as a defence against flooding from exceptionally high

River Darent Catchment Management Plan










tides, which threaten the low-lying land adjacent to the Thames estuary.

A range of statistics for the Darent catchment is given in Appendix 1 at the end of this report.

A2. HYDROLOGY AND RAINFALL



LEGEND

-  RIVER THAMES
-  RIVER DARENT
-  TOPOGRAPHICAL CATCHMENT
-  ESTIMATED GROUNDWATER CATCHMENT BOUNDARY
-  PERENNIAL WATERCOURSE
-  EPHEMERAL WATERCOURSE
-  TOWNS
-  MEAN ANNUAL RAINFALL (mm)
-  PRIMARY GAUGING STATION

GEOLOGY

-  LOWER LONDON TERTIARIES
-  CHALK
-  GAULT CLAY
-  LOWER GREENSAND

CATCHMENT HYDROLOGY & RAINFALL

A2. HYDROLOGY AND RAINFALL

A2.1 General

This section considers the main features of the natural water resources within the catchment. Sections B1, B2 and B3 consider the use of these resources for water supply.

A proportion of the rainfall which falls on the catchment is lost through direct evaporation and transpiration from plants and trees. The remainder is termed the effective rainfall and is the total available water resource to the catchment. This resource may manifest itself as surface run-off to streams and rivers or as recharge to the groundwater aquifer.

The allocation of effective rainfall between surface and groundwater is largely dependent on the nature of the surface geology. Low permeability clay and silt areas result in a high run-off component to a strongly developed surface drainage system. Chalk and some sand catchment areas allow a higher proportion of recharge to groundwater. Consequently, the surface drainage system is less well developed and a large part of the river flow is derived by outflow from the groundwater aquifer. This can occur from springs or through the bed of the river and is known as baseflow.

Surface flows in clay catchments respond rapidly to both high rainfall and drought periods. The water resource available at a river intake shows considerable seasonal variation and these catchments are referred to as 'flashy' in character. The water supply during low flow periods can be enhanced by the construction of reservoirs to store water abstracted during the periods of high flow.

Groundwater aquifers provide a natural storage system for the catchment. Groundwater systems react much more slowly to rainfall and generally provide a more reliable resource during drought periods. Recovery from drought periods may also take longer however. These catchments are considered to be baseflow controlled.

A2.2 Local Perspective

The catchment area is defined as the surface catchment of the Rivers Darent and the Cray down to their tidal limits. The groundwater catchment has a similar boundary, but has been altered by abstraction and is ill-defined, at its northern limit groundwater flow is towards the River Thames.

The Lower Greensand is the oldest geological formation in the catchment and outcrops in the south between Westerham and Sevenoaks. Above this lies the Gault Clay, which in turn is overlain by the Upper Greensand and the thick succession of Chalk of the North Downs. The River Darent rises to the west of Westerham and from here to Otford is fed by springs from the Lower Greensand and Chalk, and by run-off from the Gault Clay. Downstream of Sevenoaks the river is joined by the Honeypot Stream, which drains a very similar, but smaller, catchment to the east. From here the river turns northwards onto the Chalk, where Otford Gauging station measures the outflow from the upstream catchment.

Flow records indicate that the catchment downstream of Otford is less responsive to rainfall, with higher baseflow characteristics than in the upstream reaches. Here, the River Darent is in hydraulic contact with the Chalk and when abstraction lowers the groundwater level below the river bed, spring flow is prevented in all but the wettest years and river water may leak back into the aquifer. In the summers of 1989, 1990, 1991 and 1992 the flow at Hawley Gauging Station fell to zero.

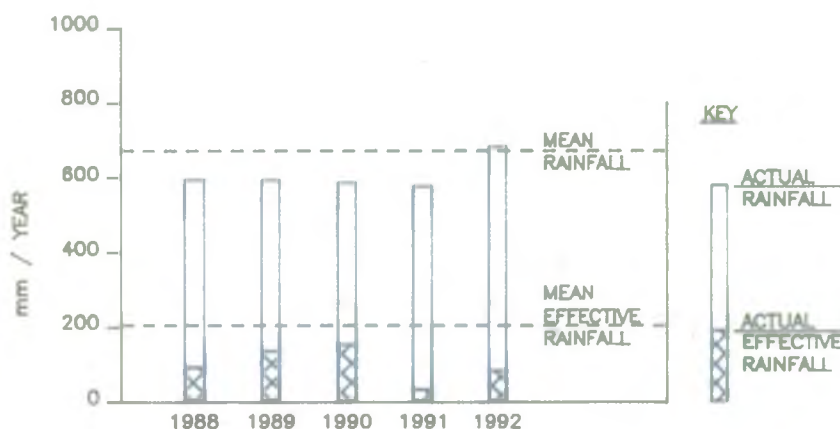
River Darent Catchment Management Plan

The River Cray lies mainly on the chalk, which supplies most of the base flow, but this sub-catchment is heavily urbanised and run-off from paved areas can give rise to high peak flows at times of heavy rainfall.

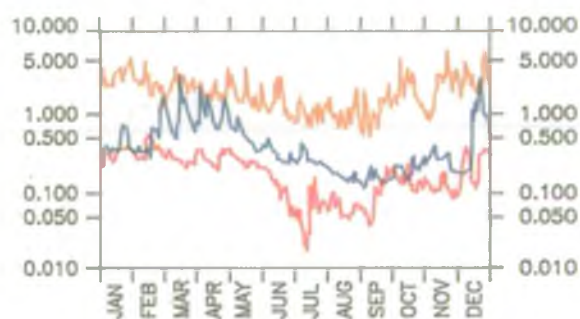
The Lower London Tertiary strata (mainly comprising the Thanet Sands) cover a significant part of the lower areas of both the Cray and Darent catchments, but are fairly thin and are not important as a water resource.

A2.3 Recent Meteorological Conditions

Mean annual rainfall across the catchment varies from 600mm at the Thames Estuary to over 800mm on the hills inland. However, between 1988 and 1992 the effective rainfall was only 50% - 75% of these figures and the effect on surface flows and groundwater levels is illustrated by the record for 1989 (see map). The groundwater hydrograph is particularly interesting as it relates to the chalk catchment at a distance from significant abstractions, making it a good indicator of natural levels over the drought period. By contrast, 1993 was wetter than average and river flow was maintained throughout the year.



DAILY FLOW HYDROGRAPH $(m^3 s^{-1})$
Max. and min. daily mean flows from 1989 to 1990 with an example yearly hydrograph (1989)



DARENT AT LULLINGSTONE

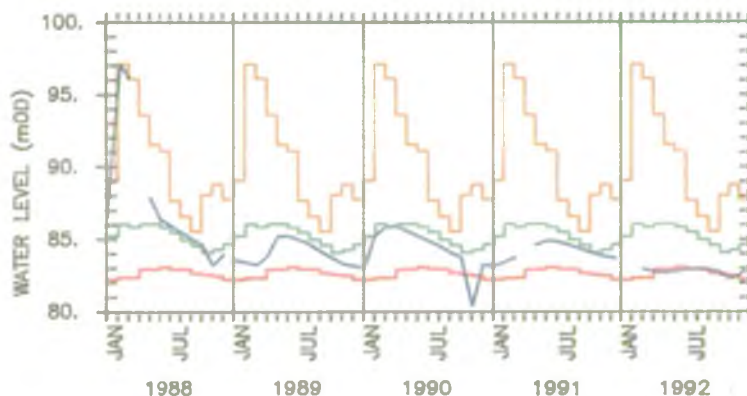
Site name : WEST KINGSDOWN (KNATTS VALLEY)

National grid reference : TQ 5648 6124

Well number : TQ56/19

Aquifer : CHALK AND UPPER GREENSAND

Measuring level : 130.00



Actual groundwater levels 1988-1992. This can be compared to long term Max, Min and Mean values calculated from years 1961 to 1992

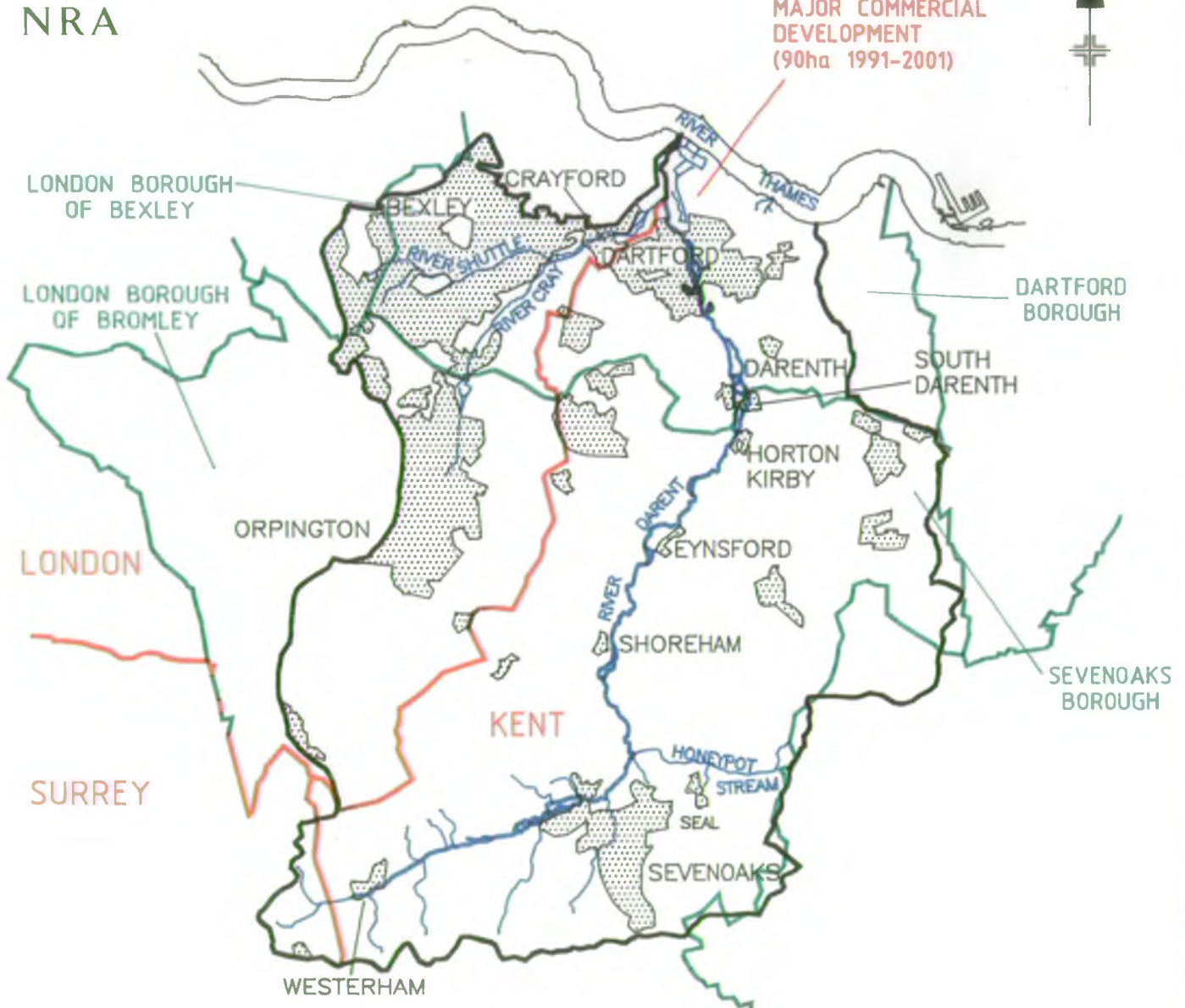
HYDROMETRIC DATA



NRA



AREA OF PROPOSED
MAJOR COMMERCIAL
DEVELOPMENT
(90ha 1991-2001)



LEGEND



RIVER THAMES



RIVER DARENT TOPOGRAPHICAL
CATCHMENT



RIVER DARENT



TOWNS



DISTRICT/BOROUGH BOUNDARY



COUNTY BOUNDARY



INTERACTIONS WITH PLANNING AUTHORITIES

A3. FUTURE DEVELOPMENT

A3.1 General

The Town and Country Planning Act 1990 requires planning authorities to have regard to relevant development plans and the Planning and Compensation Act 1991 specifically states that decisions should be in accordance with the plan, unless material considerations indicate otherwise. The 1991 Act requires the preparation in non-metropolitan areas of the following plans:

- i) **County Structure Plan.** This provides the broad strategic planning framework and should ensure that the provision for development is realistic and consistent with national and regional policy. The Structure Plan policies are not required to be site specific.
- ii) **District or Local Plan.** This plan sets out detailed policies and specific proposals for the development and use of land. The local plans should be in general conformity with the Structure Plan and make proposals for specific allocations of land as well as setting out the policies for the control of developments.
- iii) **Minerals Local Plan.** Although County Structure Plans address broad strategies, the Minerals Local Plan should cover more detail and take account of impacts such as pollution, siltation, or interference with aquifers, and should consider the after-use of exhausted sites. The plan should also indicate the areas where mineral resources are to be safeguarded for future working.
- iv) **Waste Local Plan.** The 1974 Control of Pollution Act places a duty on Waste Regulation Authorities to licence disposal sites and ensure that they do not endanger public health, cause water pollution or serious detriment to local amenity. The 1990 Environmental Protection Act introduced strict controls on the closure and after care of waste disposal sites, requiring an operator to seek a certificate of completion from the Waste Regulation Authority before being released from legal responsibility. Waste disposal policies can either be integrated into the Minerals Local Plan or presented as a separate Waste Local Plan, but should examine land use implications and identify suitable locations for further facilities.

All development plans should make proper provision for the needs of the National Rivers Authority and of Utilities responsible for water supply, sewerage, electricity, gas and telecommunications. The Town and Country Planning (Development Plan) Regulations 1991 require local authorities to consult a number of bodies, including the NRA, before putting plans on deposit.

A3.2 Local Perspective

A3.2.1 Housing and Employment

The Darent catchment lies mainly within the Boroughs of Bromley and Bexley in Greater London and the Districts of Sevenoaks and Dartford in Kent. Small parts of the London Borough of Greenwich, Tonbridge & Malling District in Kent, and Tandridge District in Surrey are also included.

In Kent the relevant strategic plan is the Kent Structure Plan (1990) which is currently (1993) under review, looking forward to 2011: within Greater London it is the Strategic Guidance published by the Secretary of State for the Environment, based on advice from the London Planning Advisory Committee.

River Darent Catchment Management Plan

Additional overall planning guidance for the whole of the South East is prepared by the South East Regional Planning Conference (SERPLAN). Regional Guidance is embodied in PPG9 (February 1989), but this is currently under review.

In March 1993 the government made a statement on the East Thames Corridor, which extends from London Docklands to Sheerness in Kent and includes the northern part of the Darent Catchment.

At the District level there is Local Plan coverage for the whole of the Darent Catchment, although the status of individual plans varies. Draft Unitary Development Plans (UDPs) are in force in both Bexley and Bromley; in Sevenoaks, Local Plan coverage is provided by three separate plans, only one of which has been adopted; a draft district plan is in force in Dartford.

Preliminary results from the 1991 Census reveal that the population of Kent increased from 1,463,300 to 1,493,891 (2.09%) between 1981 and 1991. Within the districts of Dartford and Sevenoaks the changes over the last decade were estimated as follows:

	1981	1991	Change %
Dartford	81,200	78,645	- 3.86
Sevenoaks	107,200	106,705	- 0.46

For Bexley and Bromley 1991 Census data has yet to be published but OPCS 1989-based population projections indicate the following changes:

	1989	1992	2001
Bexley	220,005	217,482	214,624
Bromley	299,394	303,938	314,356

The following provision for housing in Kent is made in the Draft Structure Plan:

District	Dwellings				Total
	1991-96	1996-2001	2001-06	2006-11	
Dartford	2000	2500	1800	1700	8000
Sevenoaks	1100	900	700	400	3100
Total	3100	3400	2500	2100	11100

NB. These figures relate to Districts rather than to the Darent Catchment
The Structure Plan Review allocates the following employment floor space provision (m²).

Area	Use*	1991-2001	2001-2011	Total
Sevenoaks	A2-B1	45,000	35,000	80,000
	B2-B8	5,000	5,000	10,000
Swanley	A2-B1	20,000	10,000	30,000
	B2-B8	5,000	5,000	10,000

River Darent Catchment Management Plan

Dartford	A2-B1	165,000	165,000	330,000
	B2-B8	105,000	105,000	210,000

* A2-B1 - offices, research and development, and light industry

B2-B8 - general and special industry, warehousing and distribution

In Bexley, strategic guidance prepared by the DoE identifies the need for 7,500 new dwellings between 1991 and 2001. The Draft UDP makes provision for 7,225 dwellings, although some of this housing will have been completed in the period 1987- 1992. The Draft UDP also proposes a total of 51ha of employment land within the Borough, concentrated in the Belvedere area which lies outside the Darent catchment.

In Bromley there is a strategic requirement for 8,000 new dwellings over the period 1987-2001. Building in the period 1987 - 1992 has already met much of this need. The Draft UDP contains no significant new allocations of employment land.

A3.2.2 Planning Overview

Dartford is well located to attract new development, being accessible to the M25 and M2/A2 trunk roads. Several sites are currently being promoted and extensive areas of disused land north of the A2 present opportunities for development. Expansion of Dartford south of the A2 is constrained by the Green Belt. Housing provision in this area has been set above trend requirements to provide for migration into the Borough to reverse the past pattern of population decline.

In Western Kent the expansion of towns such as Sevenoaks and Swanley is constrained by the Green Belt policy. Much of this area is also designated as an Area of Outstanding Natural Beauty. The majority of the Borough of Bexley within the Darent catchment is built-up, much of the remainder being Green Belt which acts as a constraint on development. In Bromley most of the land falling within the Darent catchment is Green Belt countryside, so future development is likely to be limited to the existing built up areas of Chislehurst, St.Pauls Cray and Orpington.

A3.2.3 Waste Disposal

The Structure Plan Review highlights the need for adequate, safe and properly controlled waste disposal, but with less than five years' permitted tipping capacity available there is an urgent need for new facilities. The position is particularly acute in West Kent where less than two years' permitted tipping capacity remains. This may have implications for water resources within the Darent Catchment.

Landfill will continue to be the principal means of waste disposal in the short term, but revised draft planning policies now emphasise the importance of environmental constraints, particularly the protection of aquifers. As a statutory consultee the NRA considers applications for waste disposal in the light of its Groundwater Protection Policy, which encourages the location of landfill sites in areas where groundwater is least vulnerable to pollution.

A3.2.4 Minerals

The Structure Plan Review states that with the exception of flint gravels, the mineral resources currently exploited in Kent are relatively extensive. The County Council is of the view that planning provision should be made for their continued supply, subject to strict environmental controls. The importance of

River Darent Catchment Management Plan

the County's chalk and clay resources to the local and national economy is fully recognised and the Minerals Local Plan identifies specific areas of search for mineral working. It is acknowledged that the South East Region relies on imports of aggregates from other areas, including marine deposits.

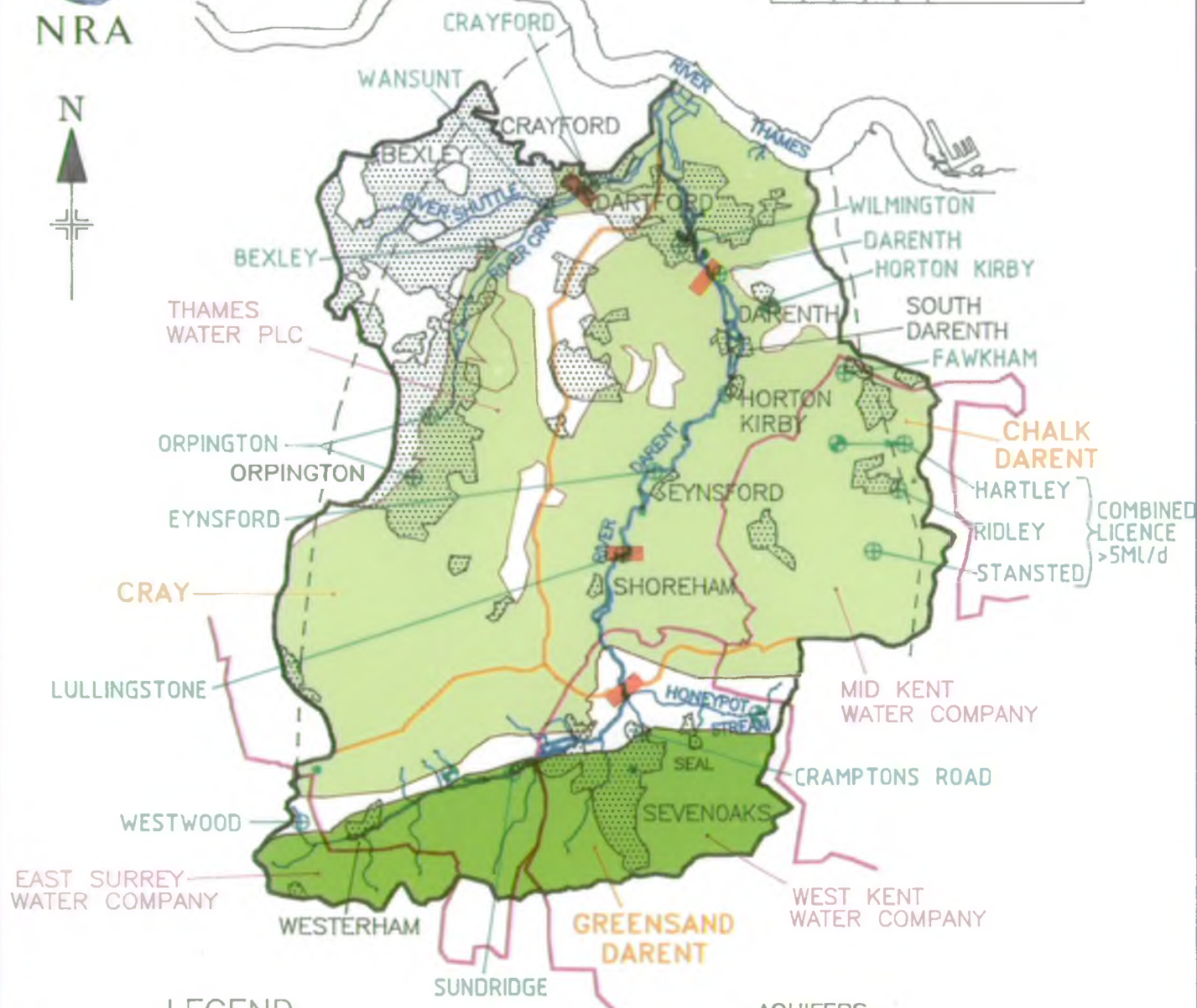
A3.2.5 Natural Resources

The Structure Plan Review contains a new chapter concerning natural resources, which include water supply and energy. With regard to water supply, sewage and waste water treatment, the Plan acknowledges the need for consultation with the NRA and Water Companies to ensure the provision of infrastructure for major new developments, the identification of shortfalls in capacity, and that the water supply and waste water implications of development are taken into account.

SECTION B : USES



0 1 2 3 4 5 10 km



LEGEND

- RIVER THAMES
- RIVER DARENT
- TOPOGRAPHICAL CATCHMENT
- ESTIMATED GROUNDWATER CATCHMENT BOUNDARY
- PERENNIAL WATERCOURSE
- EPHEMERAL WATERCOURSE
- TOWNS
- RESOURCE AREA BOUNDARY
- WATER COMPANY BOUNDARY

AQUIFERS

- CHALK
- LOWER GREENSAND

LICENSED SOURCES

- GROUNDWATER > 5ML/d
- 1-5ML/d
- < 1ML/d

(ALL POTABLE GROUNDWATER LICENCES WITHIN THE CATCHMENT WERE ISSUED AS LICENCES OF RIGHT)

PRIMARY GAUGING STATION

PUBLIC WATER SUPPLY

SECTION B : USES

B1. PUBLIC WATER SUPPLY

B1.1 General

Abstractions for water supply are controlled by licences from the NRA which stipulate maximum allowable annual and daily volumes, the mean daily abstraction being the daily average of the annual total. New abstraction is licensed on the basis that existing sources and the natural environment are not adversely affected. However, abstractions in use before 1963 were entitled to Licences of Right under the Water Resources Act (1963), even if the quantities taken could not be sustained by the water resource.

B1.2 Local Perspective

The Darent catchment comprises three resource areas, the total mean daily licensed abstraction from each of which is listed in Table B1.1. together with the total actually abstracted in a typical year (1989). Details of the volume abstracted under individual licences cannot be reported as they are confidential under the terms of the Water Resources Act 1991.

B1.2.1 Surface Water Sources

There are no surface water abstractions in the catchment for public supply.

B1.2.2 Groundwater Sources

Chalk sources account for almost 80% of the licensed groundwater abstraction for public supply, with the remainder coming from the Lower Greensand aquifer in the upper part of the catchment. Thames Water Utilities are responsible for almost 70% of the total licensed abstraction in this category.

The groundwater resources of the Darent and Cray catchments, particularly the Chalk, have been heavily developed to satisfy demand from south-east London. Much of this development was after 1945, but as all the existing sources were installed prior to the Water Resources Act 1963 they were entitled to Licences of Right. It was recognised at an early stage that the catchment could not support the total licensed abstraction, and the abstractors have, in recent years, voluntarily held abstraction at between 70% and 75% of the licensed maximum. However, in spite of this restraint, groundwater levels and spring flows have been reduced significantly. Records from Lullingstone and Hawley Gauging Stations (River Darent) show that when flows are below average water is lost through the bed in the middle reaches of the river, and that at no time is there a significant inflow to the river from groundwater in this area.

Parts of the Darent catchment are heavily urbanised and the unconfined chalk aquifer is vulnerable to pollution. Wilmington Pumping Station, for example, was closed periodically between 1989 and 1990 following spills of chlorinated hydrocarbons from an industrial area. Whilst remaining within the Maximum Admissible Concentration (MAC) of 11.3mg/l(N) allowed by the EC Drinking Water Directive, nitrate concentrations in parts of the chalk aquifer exceed the Guideline limit of 5.6mg/l(N). The NRA Groundwater Protection Policy is applied to control potentially polluting activities around supply sources and important aquifers. Details are given in Section B6.

River Darent Catchment Management Plan

B1.3 Supply Requirements

Water Resources

- Maximum availability of resources within the terms specified by the licence.
- Protection of existing public and private water supply abstractions.

Water Quality

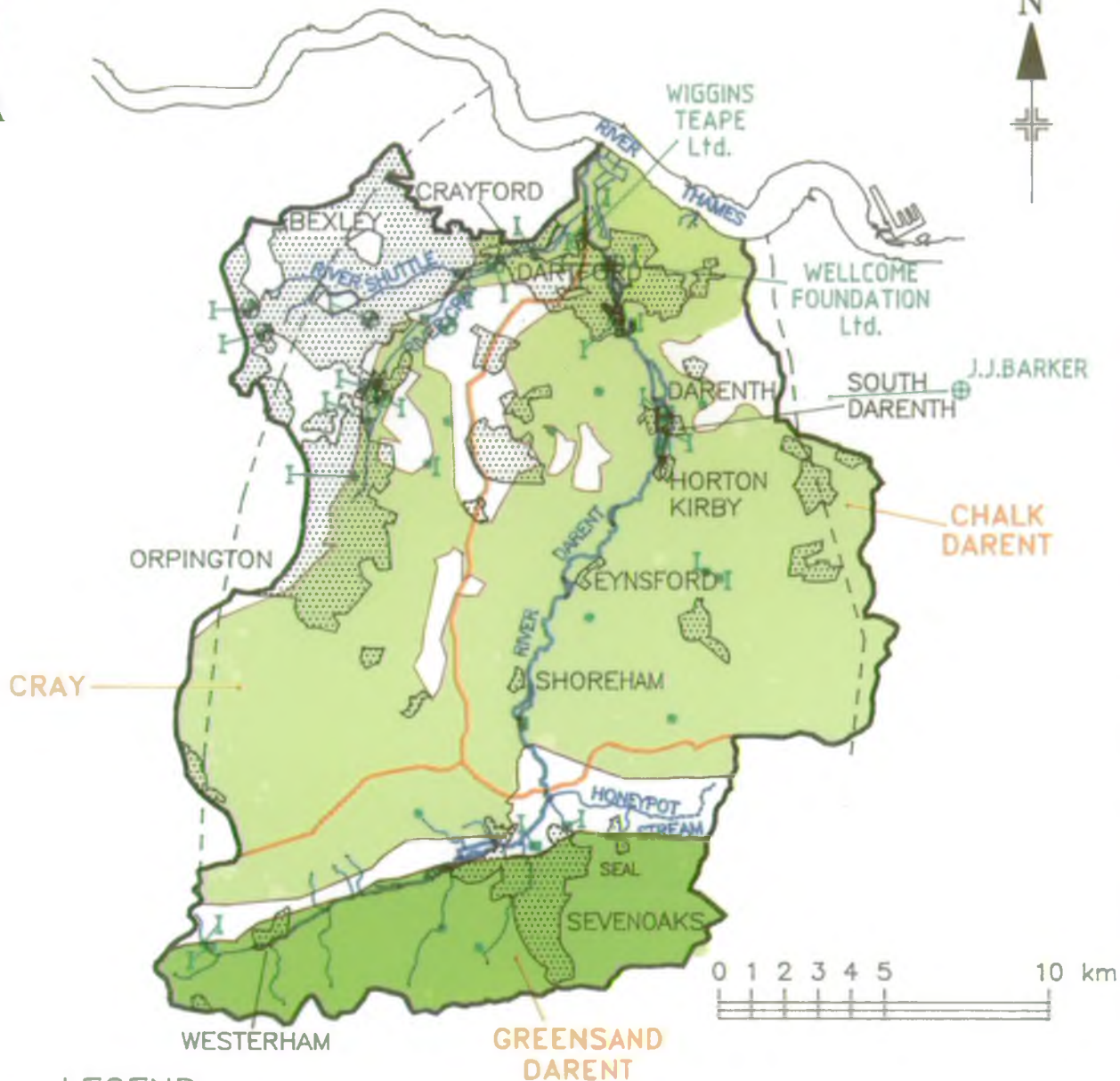
- Groundwater sources. Not Specified, Chalk sources generally within the limiting values for A1 Category treatment. (EC Council Directive 75/440/EEC).

Table B1.1 Mean Licensed and Actual Abstractions for Public Water Supply



Resource Area	Licensed Abstraction (Mld)	Actual Abstraction (Mld)	Av Annual Recharge (Mld)	1 in 5 year Recharge
Darent Greensand	48	35	43	35
Darent Chalk	104	71	101	71
River Cray	79	66		
Total Catchment	231	172		

Note. Under the Water Resources Act 1991 details of individual abstractions are confidential, but are included in the totals.







B2. WATER SUPPLY FOR INDUSTRY AND AGRICULTURE



LEGEND

-  RIVER THAMES
-  RIVER DARENT
-  TOPOGRAPHICAL CATCHMENT
-  ESTIMATED GROUNDWATER CATCHMENT BOUNDARY
-  PERENNIAL WATERCOURSE
-  EPHEMERAL WATERCOURSE
-  TOWNS
-  RESOURCE AREA BOUNDARY
- AQUIFERS**
-  CHALK
-  LOWER GREENSAND

LICENSED SOURCES

SURFACE WATER		GROUNDWATER	
	> 5MI/d		> 5MI/d
	1-5MI/d		1-5MI/d
	< 1MI/d		< 1MI/d
I DENOTES INDUSTRIAL ABSTRACTIONS			

INDUSTRIAL & AGRICULTURAL ABSTRACTION

River Darent Catchment Management Plan

B2. WATER FOR INDUSTRY AND AGRICULTURE

B2.1 General

This use deals with surface and groundwater supplies abstracted for industrial and agricultural purposes. Industrial abstractions include all licensed supplies for industrial process uses, cooling water and gravel washing. Agricultural abstractions include all supplies for spray irrigation and general agricultural use.

B2.2 Local Perspective

The total licensed abstraction from each of the three resource areas is given in Table B2.1 in terms of the mean daily abstraction from both surface and groundwater sources. The total actual abstraction in a typical year (1989) is also listed as a percentage of the licensed volume. Under the terms of the Water Resources Act 1991 abstraction details for individual sources are confidential, so only the totals for each resource area are included.

Industrial uses are concentrated within the Cray sub-catchment and the downstream reaches of the Darent around Dartford, accounting for over half of the fifty seven licences in this category and over 90% of the licensed volume. Since the passage of the 1963 Water Act it has been the practice of the NRA and its predecessors not to grant new industrial abstraction licences in the catchment. This, combined with the closure of some industries and the transfer of others from private sources to public water supply, has reduced industrial abstraction by some 20% over a thirty year period.

Agricultural abstraction is not significant in the catchment, there being only fourteen licensed abstractions for spray irrigation and eight for general agricultural use. Further licences for consumptive uses of groundwater would not normally be granted, but applications for new surface water abstractions may be considered, providing the use is non-consumptive or the abstraction is confined to the winter months with storage for summer use.

Table B2.1 Water Abstractions for Industry and Agriculture

Resource Area	Licensed Abstraction (Ml/d)			Actual Abstraction (% Licensed)		
	Surface	Groundwater	Total	Surface	Groundwater	Total
D Greensand	< 1	1	1	*	*	*
D Chalk	7	18	25	4%	72%	53%
Cray	2	14	16	17%	10%	11%
Total	9	33	42	7%	44%	36%

Note. Under the Water Resources Act 1991 details of individual abstractions are confidential, but are included in the total.

B2.3 Supply Requirements

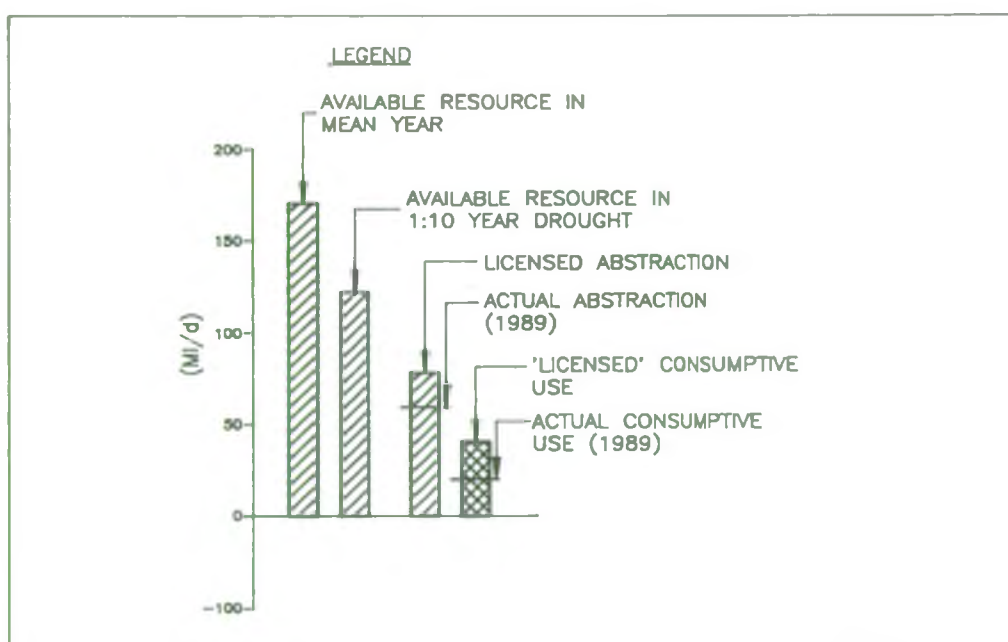
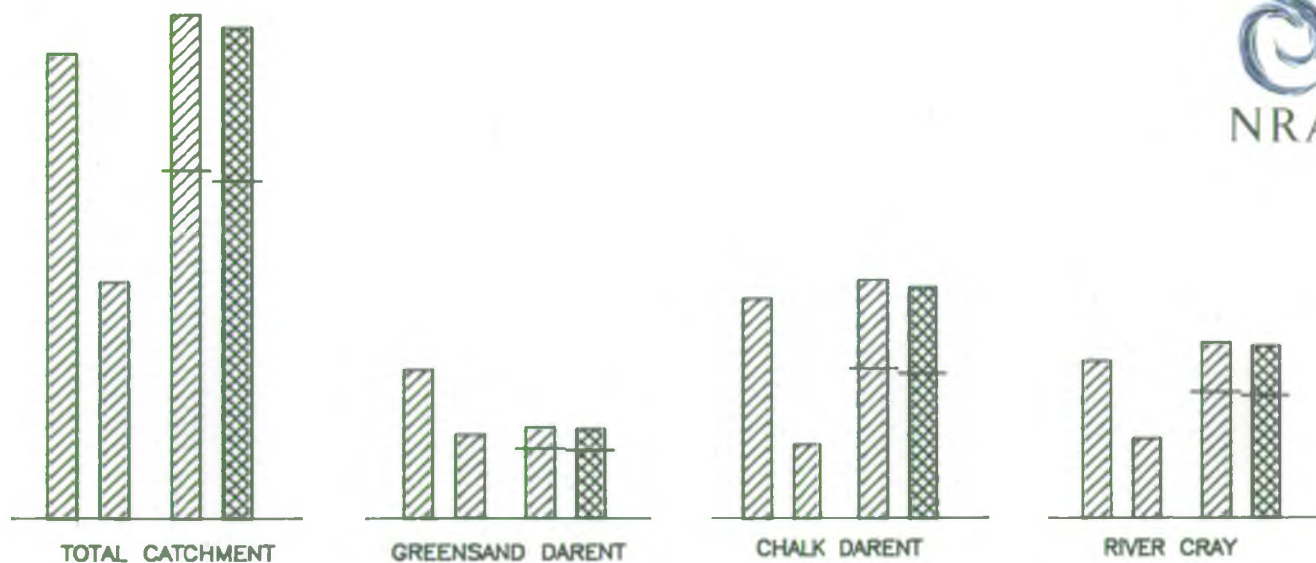
Water Resources

- Availability of resources within the terms specified in the licence.
- Presumption against new licences for consumptive use of chalk groundwater.

Water Quality

- Water quality guidelines for agricultural irrigation have been published by the MAFF Agricultural Development and Advisory Service (ADAS).
- ADAS Central Veterinary Laboratory has published guidelines for the quality of water to be used by livestock.
- The Food and Agricultural Organisation of the United Nations (FAO) classifies water with salinity between 0.7-3.0 ds/m, or chloride concentrations between 140-350 mg/l as having slight to moderate restrictions for irrigation use. NRA guidelines categorise the sensitivity of irrigated crops in terms of chloride toxicity and recommend maximum chloride concentrations in irrigation water of 100mg/l to 500mg/l, depending on the tolerance of the crop.

B3. USE OF THE WATER RESOURCE



Resource Area	'Licensed' Consumptive Use (% of Resource)	
	Mean Year	1:10 Year Drought
Greensand Darent	60	107
Chalk Darent	105	312
Cray	109	216
Overall Catchment Balance	106	208

USE OF THE WATER RESOURCE

River Darent Catchment Management Plan

B3. USE OF THE WATER RESOURCE

B3.1. General

This section compares the overall use of water within the catchment with the available resource, which is defined as the annual effective rainfall to the resource area. Available resource totals have been assessed for both mean-annual and 1 in 5 yr drought conditions. These are compared with the total annual licensed abstraction and the estimated actual abstraction for a typical year (1989).

The mean consumptive use - the difference between the water abstracted from the catchment and that returned - has been assessed using actual abstraction and discharge data for a typical year (1989).

B3.2 Local Perspective

Abstraction for all uses is confined to the two major aquifers, the Chalk and Lower Greensand, with no significant use of river water. There is a relatively wide North to South variation in annual rainfall, the upper catchment above Otford receiving an average of 757 mm while the middle catchment, corresponding to the Chalk outcrop, averages 662 mm. It is estimated that between 25% and 35% of this represents effective rainfall, most of which passes through the soil to replenish the groundwater. In an average year this recharge is equivalent to 101 Ml/d for the Chalk outcrop and 43 Ml/d for the Lower Greensand.

Under natural conditions most of the recharge would re-emerge as springs or seepages supporting flow in the river or its tributaries, but the greater part has for many years been taken up as direct abstraction for public supply from wells and boreholes. Abstraction now totals 86 Ml/d for the Chalk and 35 Ml/d for the Lower Greensand, representing 83% and 87% respectively of the recharge in an average year. However, in a 1 in 5 year drought these proportions rise to 100% and 120% of the effective rainfall.

Table B3.1 Use of Groundwater in the Darent Resource Areas

Resource Area	Actual Abstraction Mld	Recharge Ml/d 1 in 5 year		% Used 1 in 5 year	
		Av. Yr	Drought	Av. Yr	Drought
Greensand	35	43	35	87%	100%
Chalk	86	101	71	83%	120%
Total	121	144	106	84%	114%

Most of the abstracted water is exported from the catchment to meet demand in SE London, and nearly all the water used locally is discharged as effluent to the Thames estuary via trunk sewers to Longreach treatment works, and is lost from the resource.

The resources of the Cray catchment are also heavily developed, although surface flows are less severely affected than those of the Darent and the River Cray continued to flow at Crayford throughout 1989 and 1990.

B3.3 The Darent Action Plan

The NRA has accorded the River Darent the highest priority on a National list of forty catchments requiring special measures to alleviate the environmental consequences of artificially low flows. To this end a "Darent Action Plan" has been agreed between NRA Southern Region and Thames Water Utilities (and approved by the Department of the Environment) whereby action will be taken by both parties to improve river flow whilst safeguarding drinking water supplies.

Ecological surveys and an analysis of river hydrology under drought conditions have indicated a provisional Environmentally Acceptable Flow Regime to meet the minimum requirements of all uses of the River Darent.

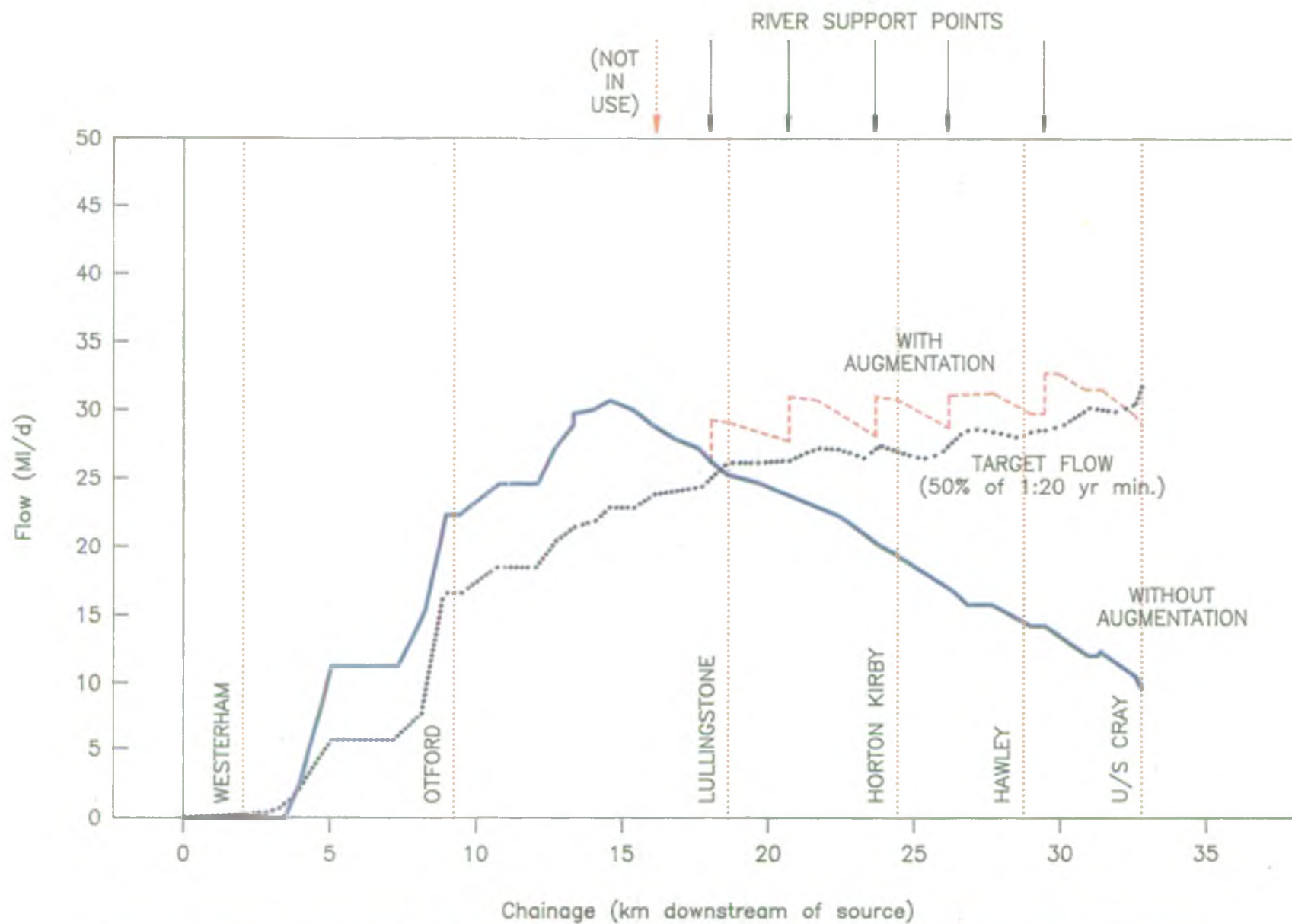
This has been refined to produce monthly Target Flow Profiles which have been adopted as the basis for the flow-alleviation programme. Figure B3.1 shows the target flow profile of the River Darent.

The Action Plan has three principal aims:-

- 1) To secure flows in the River Darent in accordance with defined targets.
- 2) To conserve the ecology of the River Darent.
- 3) To maintain the security of public water supplies.

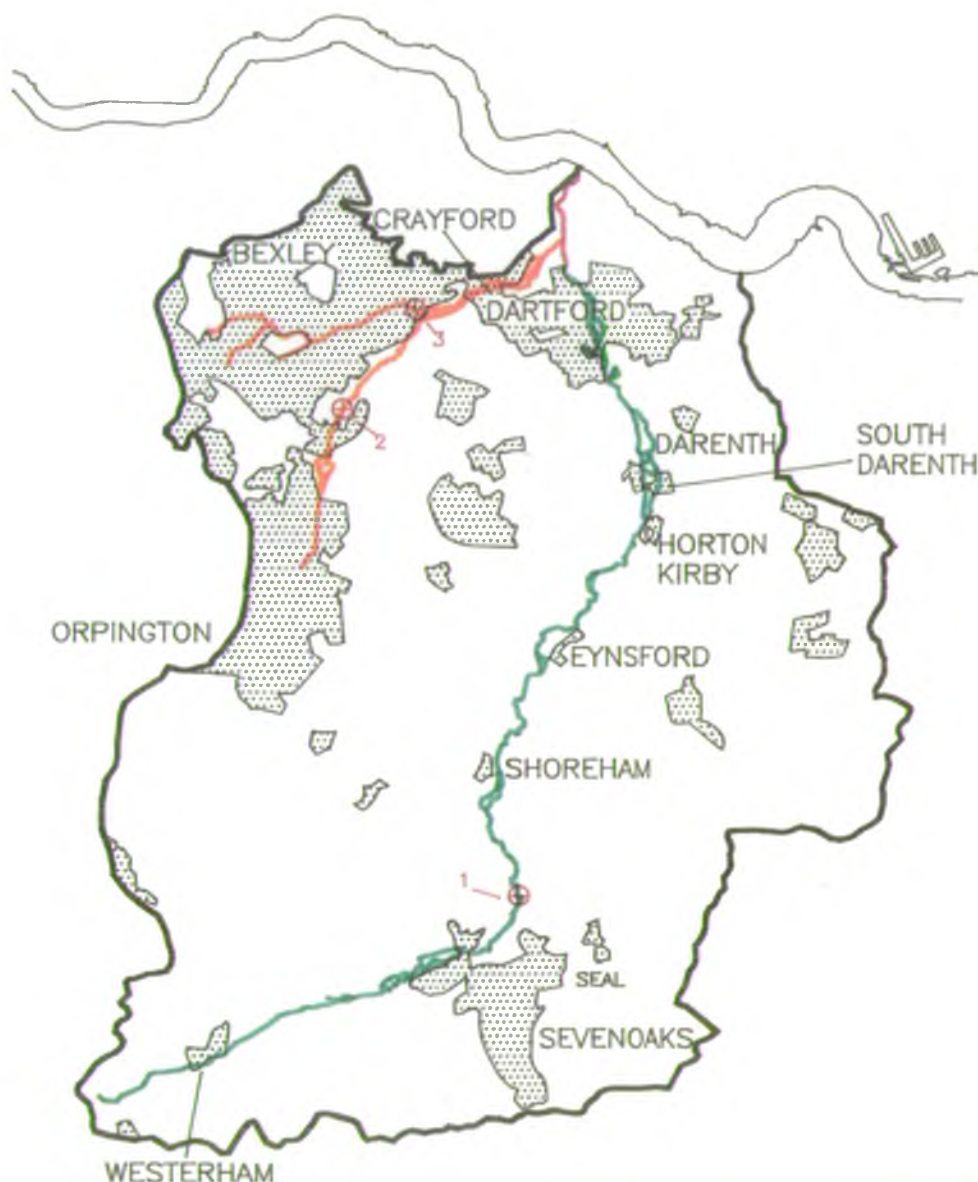
Agreed Water Resource Management Objectives

- To ensure that existing and future resource developments do not degrade the flow regime of the river.
- Where possible, to reduce licensed abstraction to restore flows for the benefit of fisheries, amenity and nature conservation in the catchment.
- To encourage the operation of seasonal resource management schemes to improve river flows during the summer.
- To augment low river flows to achieve the target environmental flow regime.
- To encourage abstractors and water users to adopt water saving measures, including demand management and leakage control to target levels.
- To consider the adoption of a scheme of licence charges which reflects the environmental impact of abstraction.
- To maintain and develop the hydrometric monitoring network.
- To consider the effects of possible climate change in long term water resource planning.



TARGET FLOW PROFILE FOR THE RIVER DARENT

FIGURE B3.1



LEGEND



RIVER THAMES



RIVER DARENT TOPOGRAPHICAL
CATCHMENT



TOWNS



RIVER — CLASSIFICATION



1A GOOD



1B GOOD



2 FAIR



3 POOR

ESTUARINE — CLASSIFICATION



A GOOD



B FAIR



SAMPLING POINT

WATER QUALITY CLASSIFICATION

River Darent Catchment Management Plan

B4. WATER QUALITY

B4.1 General

Whereas continental European practice is to apply uniform emission standards to all effluents, river water quality in the United Kingdom is managed by matching effluent consent conditions to the needs of the environment and the circumstances of individual discharges. Environmental Quality Objectives (EQOs) are determined for receiving waters and quantified as Environmental Quality Standards (EQSs); permitted pollution load and consent conditions can then be calculated for each discharge.

EQSs and consent standards for toxic or non-degradable substances are very strict and in practice there is little difference between the two control philosophies, but in the case of degradable wastes the British approach results in protection of the environment whilst allowing rational decisions to be taken about the allocation of investment between competing projects.

By defining the water quality requirements of different water uses (e.g. agriculture, water supply, angling etc.) it is possible to set use-based EQOs and to classify individual river reaches according to the functions they serve. However, this approach lacks the means for making absolute comparisons of water quality - from year to year or between different water courses. The NRA has developed a more comprehensive water quality classification system which received Government approval in 1994.

B4.2 Local Perspective

The map shows routine sampling sites and water quality targets within the Darent catchment. Compliance is assessed using the results of a comprehensive surface water sampling programme from sites shown on the map and detailed in Table B4.1 below.

Table B4.1 - Routine Surface Water Sampling Points

Map Ref No	River/Stream	Sampling Point	Grid Ref
1	River Cray	Footscray	TQ 47767129
2	Darent	Otford Gauging Station	TQ 52495939
3	Shuttle	Black Prince	TQ 49857240











B5. EFFLUENT DISPOSAL

LONG REACH
SEWAGE TREATMENT
WORKS (THAMES REGION)

THIS IS A MAJOR DISCHARGE IN
TERMS OF DAILY POLLUTANT
LOADING AND IS SHOWN AT
1/20th SCALE COMPARED TO THE
OTHER DISCHARGES

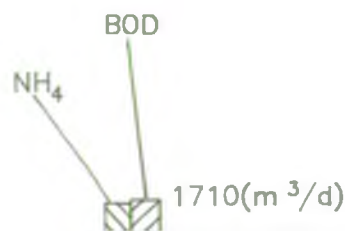


LEGEND

-  RIVER THAMES
 -  RIVER DARENT TOPOGRAPHICAL CATCHMENT
 -  RIVER DARENT
 -  TOWNS
 -  DARENT VALLEY TRUNK SEWER
 -  FISH FARMS
 -  COOLING WATER DISCHARGE
 -  PUBLIC SEWAGE TREATMENT WORKS
 -  PRIVATE SEWAGE TREATMENT WORKS
 -  PROCESS EFFLUENT DISCHARGES
- THERE ARE NO MAJOR PUBLIC SEWAGE
TREATMENT WORKS IN CATCHMENT

DAILY POLLUTANT LOADING FROM THE
MOST SIGNIFICANT DISCHARGES

	(kg/d)
NH ₄	BOD
15	75
12	60
9	45
6	30
3	15
0	0



EFFLUENT DISPOSAL

B5. EFFLUENT DISPOSAL

B5.1 General

This use relates to the disposal of domestic, industrial and agricultural effluents to the river system. The conditions to be met by a particular discharge are set out in a specific consent and are calculated in relation to the quality objective assigned to the receiving water. It follows that any subsequent deterioration in upstream water quality or diminution of river flow beyond the values used to calculate the consent could put downstream uses at risk, even if the effluent was within consent limits.

Effluents discharged to the river system can make a significant contribution to river flow and may be important as a re-usable water resource. The location of discharges is therefore important for both quantity and water quality reasons.

B5.2 Local Perspective

Water quality in the Darent Catchment is good as most domestic sewage and some trade wastes are piped via a trunk sewer to Longreach STW, which discharges direct to the Thames estuary. Within the catchment there are some twenty minor sewage treatment plants, each of which discharges less than 20 m³/d (the majority less than 1 m³/d). The map shows the larger consented discharges.

There are five licensed process effluent discharges within the catchment. Those from the Wellcome Foundation and Wiggins-Teape are significant in terms of flow and pollutant loading, but their impact is small as they discharge close to the tidal limit. Cooling water discharges and one fish farm effluent have little effect on river water quality.

B5.3 Environmental Requirements

Water Quality

- No deterioration in upstream water quality beyond that used in setting the consent.
- Continued monitoring of surface waters and effluent discharges to ensure compliance with consents.

River Flow

- No diminution of the flow regime below that used in setting the consents. (Consents are normally set using Annual Q95 river flows).

River Topography

- Outfalls should be sited so as to achieve good effluent mixing with the river.




B6. INTERMITTENT AND DIFFUSE POLLUTION



LEGEND

-  RIVER THAMES
-  RIVER DARENT TOPOGRAPHICAL CATCHMENT
-  RIVER DARENT
-  TOWNS
-  LICENSED STORMWATER DISCHARGE
-  REACHES WHERE THE IMPACT OF INTERMITTENT POLLUTION IS MOST OFTEN OBSERVED
-  GROUNDWATER MONITORING BOREHOLES AND 1987-1990 AVERAGE NITRATE CONCENTRATION (mg/l as N)

OPEN DISPOSAL SITES AND CATEGORIES OF MATERIAL LICENSED FOR DISPOSAL

-  MAINLY INERT
-  DIFFICULT/PUTRESCIBLE AND NON SPECIAL LIQUIDS
-  ASBESTOS AND TOXIC SPECIAL WASTES

AQUIFERS

-  CHALK
-  LOWER GREENSAND

0 1 2 3 4 5 10 km

INTERMITTENT AND DIFFUSE POLLUTION

B6. INTERMITTENT AND DIFFUSE POLLUTION

B6.1 General

This section highlights the risks to the catchment from accidental pollution and intermittent discharges from sources such as surface water drains and storm sewage overflows. In addition there are diffuse sources of contamination such as run-off from agricultural land or seepage from land-fill waste disposal sites. Installations such as chemical and oil stores may cause severe impacts as the result of accidents.

The frequency and impact of these problems are unpredictable as they result from human error or natural events such as heavy rainfall. Vigilance is essential to police pollution incidents, and comprehensive monitoring is needed to detect long-term changes in the quality of rivers and groundwater.

The danger of groundwater pollution is a major cause for concern, since once contamination has occurred it is very difficult to remove. The NRA Groundwater Protection Policy (GPP) was implemented in December 1992, continuing the control over polluting activities formerly exercised in this Region under a local Aquifer Protection Policy.

GPP Zones are defined in terms of the travel time for water contributing to the abstracted resource, and are applied to sources used for potable supply or for commercial food or drink production. A graduated scale of restrictions on potentially polluting activities will be applied to designated GPP Zones.

Zone 1. Inner Source Protection

The zone around a water source encompassing the 50 day saturated flow travel time area (minimum 50m), other than where the aquifer is confined below a layer of very low permeability.

Zone 2. Outer Source protection

The zone surrounding Zone 1, encompassing the 400 day saturated flow travel time area, or the recharge catchment area calculated using 25% of the long term abstraction rate, whichever is the larger. This zone is not generally defined for confined aquifers.

Zone 3. Source Catchment Zone

The area from which groundwater will eventually reach the source. This may be very large and in the case of confined aquifers may be some distance from the actual abstraction.

B6.2 Local Perspective

Pesticide concentrations in surface and groundwater are monitored by the NRA. Triazine herbicides and the 'Drin group of insecticides cause most concern, but concentrations of these two indicator groups are generally well below the Maximum Admissible Concentration (MAC) of 500 nanograms per litre (parts per million million).

EC Directive 71/354/EEC on drinking water quality lays down a MAC for nitrate of 11.3 mg/l (measured as N). The map shows contours of average groundwater nitrate concentrations for the period between 1987 and 1990.

River Darent Catchment Management Plan

The MAC is not exceeded, but values are marginally greater than the guideline of 5.6 mg/l (N).

Local water quality problems resulted in the 1970s from spills of creosote from a timber yard adjacent to the River Cray. Whilst the soil and sediments were contaminated, the deeper chalk aquifer was not affected and there is now thought to be little risk of pollution from this source. The situation is being kept under review.

The catchment is crossed by a number of trunk roads and the disposal of highway drainage is a significant issue. The environmental impact of new roads is assessed as part of their design and practical measures are introduced to minimise the risk of pollution from this source, but the subject is under review and formal guidelines will be issued by the NRA.

As part of a broad monitoring regime the National River Authority takes samples, normally at the downstream tidal limit of many watercourses. These samples are analysed for a complex range of compounds including pesticides. Some positive results have been identified on the River Cray at Vitbe Mill and the River Darent at Mill Pond Road for the triazine group and lindane (hexachlorocyclohexane). The triazines are a group of persistent herbicides normally used for controlling weeds on hard surfaces such as road edges and railway lines. The concentrations identified are however, substantially lower than the actual environmental quality standard for lindane (.1 microgrammes per litre) or the suggested environmental quality standard for simazine and atrazine of 2 microgrammes per litre.

B6.3 Environmental Requirements

Water Quality

- Compliance with effluent consent conditions and EC Directives.
- Continued routine monitoring of surface and groundwaters.
- Prompt reporting of all pollution incidents to the NRA.
- Emergency procedures to deal with pollution incidents.
- Implementation of the NRA Groundwater Protection Policy.

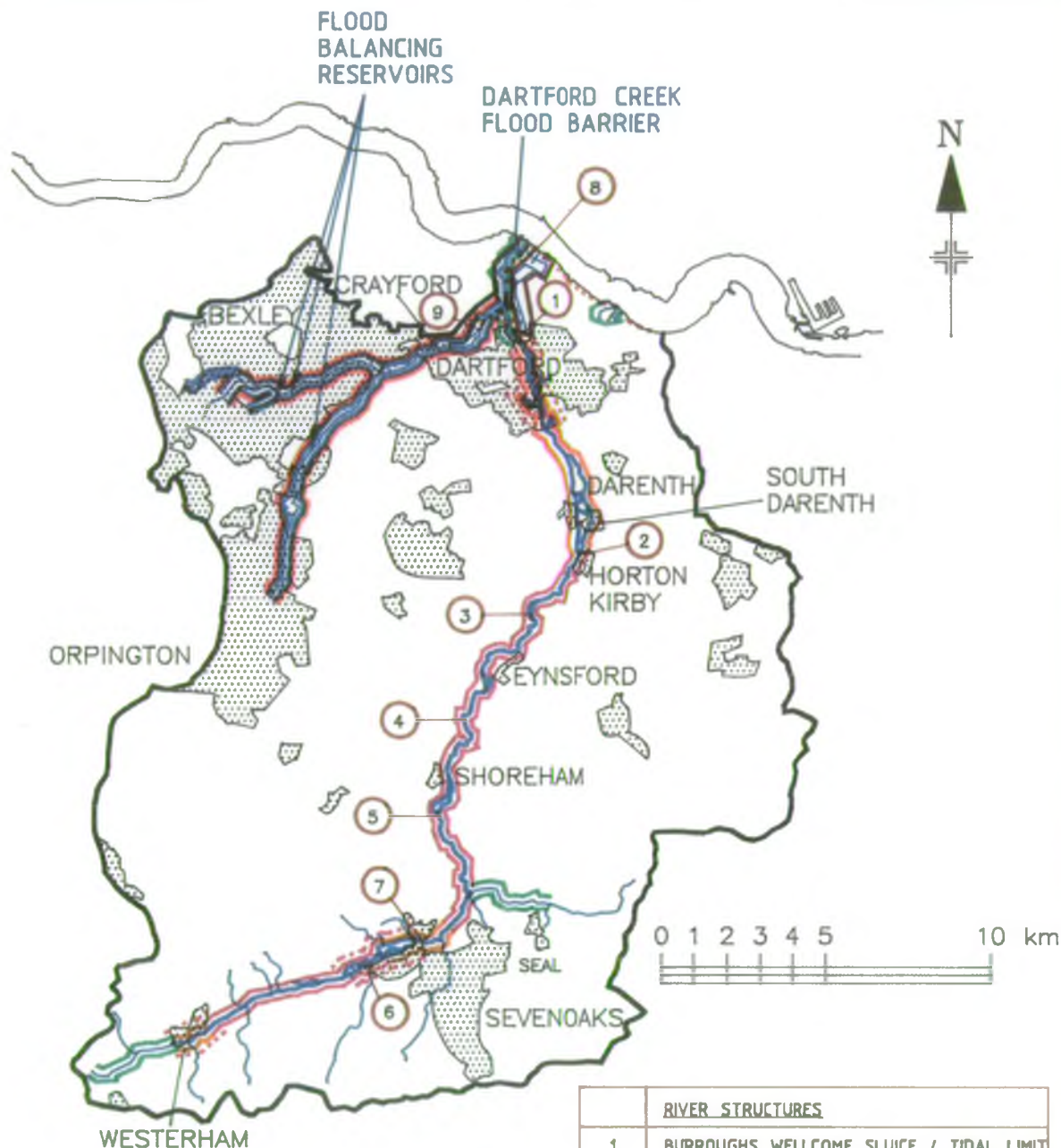
River Flow

- Basic flow regime to reduce the impact of intermittent and diffuse pollution is met by the requirements for Conservation (Section B8)

River Topography

- Provision of an uncultivated bankside buffer strip to attenuate diffuse pollution from overland run-off.

B7. FLOOD DEFENCE AND LAND DRAINAGE



LEGEND

- RIVER THAMES
- RIVER DARENT TOPOGRAPHICAL CATCHMENT
- RIVER DARENT
- TOWNS
- RIVER STRUCTURE
- EMBANKMENT
- RIVER WIDENED TO INCREASE CAPACITY
- IMPROVED CHANNEL HYDRAULICS

RIVER STRUCTURES	
1	BURROUGHS WELLCOME SLUICE / TIDAL LIMIT
2	WEIR
3	MILL AT FARNINGHAM
4	MILL
5	MILL
6	SUNDRIDGE WEIR
7	CHIPSTEAD LAKE CONTROLS
8	DARTFORD CREEK BARRIER
9	CRAY VITBE MILL SLUICE

LAND USE ALONG MAIN RIVER SECTIONS — FLOOD PROTECTION CATEGORY

- A
- B
- C
- D
- E

SEE TABLE B7.1 FOR LAND USE CATEGORIES

FLOOD DEFENCE AND LAND DRAINAGE

B7. FLOOD DEFENCE AND LAND DRAINAGE

B7.1 General

The Authority has a duty to provide effective defence for people and property against flooding from rivers and the sea - an associated activity is the drainage of low-lying areas to meet the needs of agriculture. Flooding is a natural result of extreme climatic conditions which cannot be forecast, but whose frequency is described in statistical terms. On this basis a 1 in 50 year flood will be more severe than a 1 in 5 year event, but whilst the return period is the average frequency expected over thousands of years, there is no guarantee that similar events will not be clustered more frequently in the short term. Whilst floods cannot be prevented, they can be controlled. Defences are designed to protect property against events of a given size (the design flood) but will be overwhelmed by more extreme events. The level of protection is related to the potential danger to human life, land use and the value of the benefit/cost ratio of the work needed. The different land uses and the proposed targets for their protection are shown in Table B7.1.

Under the Water Resources and Land Drainage Acts of 1991 the NRA has a general duty to oversee, and powers to control significantly obstructive works on any watercourse. In addition, certain reaches are designated Statutory Main River, where the NRA has powers to carry out works to ensure that a given level of flood protection is maintained. Any proposal for development that could interfere with the bed or banks, or obstruct the flow in Main River, requires the formal consent of the NRA.

The NRA is a statutory consultee for the Local Authority planning process and is invited to comment on all planning proposals which might affect its interests. Urban development is a particular cause for concern as it can increase the amount and rate of run-off into rivers, and thus the risk of flooding. Development in the flood plain is an even greater problem, adding to the number of properties at risk and possibly reducing river- flow attenuation by the flood plain, which is part of the natural channel of the river. This can lead to higher flood levels upstream and increased river flows downstream of the development, so that existing property is also placed at higher risk. In view of this it is essential to consider very carefully the potential effects of development in a catchment, particularly if the flood plain is affected.

The drainage of low-lying land is often controlled by Internal Drainage Boards (IDB), independent statutory bodies with powers extending over defined areas, responsible to their rate payers.

The nature of flood defence works may bring the function into conflict with other river uses - notably fisheries and conservation. The NRA consults widely to ensure that flood defence targets can be achieved with minimum impact on other interests.

River Darent Catchment Management Plan

Table B7.1 Typical Land Use Bands for planning Flood Defence works

Band	Typical Land Use	Typical Flood Return Period
A	Dense Urban Areas	At least 1 in 50 years
B	Suburban Areas	1 in 20 to 1 in 50 years
C	Limited Development or intensive agriculture	1:10 to 1 in 50 years
D	Few, isolated properties or arable farming	1:2 to 1 in 5 years
E	Very few properties or grassland farming	Annual Flooding
F	Other areas	No standard set

B7.2 Local Perspective

There has been a history of flooding on the Rivers Darent and Cray, 1968 in particular saw extensive flooding of agricultural land and damage to properties between Westerham and Farningham. Since then extensive flood defence work has been carried out along the Rivers Cray and Shuttle to increase stream capacity to accept storm run-off from urban areas. Westerham, Chipstead and Dartford (R Darent) have benefited from flood defence work, but some problems remain at Brasted and Shoreham, and at Foots Cray on the R Cray. Low-lying meadows are still permitted to flood regularly, benefiting the conservation of wetland habitats.

Flood management is complicated by the existence of twenty-two privately owned water mills in fifty kilometres of river, most of which are now used for other purposes, but have sluices which must operate correctly to prevent flooding at times of high flow. This is achieved by liaison between NRA flood defence staff and the mill owners.

B7.3 Environmental Requirements

River Topography

- Ensure that no unacceptable increased flood risk results from development.
- Resist building or land-raising in the flood plain, which lowers the flood capacity of the river.
- Inspect and maintain control structures and embankments to ensure their continued effectiveness.
- Design river channels to need the minimum of maintenance.
- Maintain long-term channel capacity by dredging where necessary.

River Management

- Manage aquatic weeds to maintain the appropriate flood defence standard.
- Manage bankside trees to prevent obstruction of the river channel.
- Maintain channel water levels and the water table of adjacent land at a level appropriate to land

River Darent Catchment Management Plan



use.

- Liaise with the owners of private sluices to ensure proper control of river levels.
- Carry out flood defence works with sensitivity to the needs of other river uses and in accordance with the NRA's environmental responsibilities.

B8. CONSERVATION



LEGEND

- | | | | |
|---|---|--|--------------------------------------|
|  | RIVER THAMES |  | AREA OF OUTSTANDING NATURAL BEAUTY |
|  | RIVER DARENT TOPOGRAPHICAL CATCHMENT |  | COUNTY TRUST RESERVE |
|  | RIVER DARENT |  | SCHEDULED ANCIENT MONUMENT |
|  | TOWNS |  | SITE OF NATURE CONSERVATION INTEREST |
|  | SITE OF SPECIAL SCIENTIFIC INTEREST WITHIN RIVER CORRIDOR | | |

0 1 2 3 4 5 10 km



CONSERVATION

B8. CONSERVATION

B8.1 General

The Water Act 1991 and Land Drainage Act 1991 require the NRA to enhance natural beauty, and to further (and where desirable to promote) the conservation of flora, fauna, geological and landscape features of special interest. The conservation function also encompasses impacts on the man-made environment including buildings, and objects of archaeological or historic interest. These considerations apply both to the primary functions of the NRA and to the actions of others operating under the consent of the Authority.

The character of the river corridor is highly dependent upon adjacent land use and the nature of the river management regime - what we have today is the result of human intervention over thousands of years, from the clearance of the forests to the construction of motorways. However, in modern times the pace of change has accelerated beyond the rate which can be accommodated by natural processes, creating the dangers of lost ecological diversity, soil erosion and increased run-off from the land.

Many other bodies have roles and responsibilities which are relevant to the activities of the NRA in this field:-

English Nature is the official agency responsible for nature conservation, with the functions of establishing, maintaining and managing National Nature Reserves (NNRs); notifying Sites of Special Scientific Interest (SSSIs); advising the Government on conservation matters; providing general information and advice; grant-aiding conservation work and supporting research.

The Countryside Commission is responsible for conserving and enhancing the natural beauty and amenity of the countryside. It is empowered to designate (subject to Ministerial consent) National Parks and Areas of Outstanding Natural Beauty (AONBs) and operates grant schemes for the preservation and re-creation of landscape and wildlife habitats, including waterside areas. The Commission also advises the Ministry of Agriculture Fisheries and Food (MAFF) on its Environmentally Sensitive Areas (ESA) programme, which has similar aims.

English Heritage is responsible for protecting and conserving the architectural and archaeological heritage, managing Ancient Monuments and providing advice and information. Buildings of special architectural or historic interest are listed by the Department of the Environment. Similarly, local planning authorities may designate Conservation Areas of particular architectural interest.

The voluntary sector includes County Wildlife Trusts and their parent organisation the Royal Society for Nature Conservation, and the Royal Society for the Protection of Birds. These bodies play an important part in protecting wildlife and manage many established nature reserves.

The National Trust, an independent charity, owns and protects a variety of properties and areas of land of natural beauty open to the public.

In addition to formally designated sites identified on the map there are many other areas of high conservation value, in particular the Local Nature Reserves (LNRs) of Local Authorities and sites monitored by the County Wildlife Trusts. National Trust properties are not shown.

B8.2 Local Perspective

Whilst the area has great landscape value, intensive land use within this small catchment has left few natural river features and the main sites of interest are essentially man made. The channels, structures and water ram associated with the Shoreham water meadows are capable of restoration; old gravel workings on the Rivers Cray and Darent have been notified as SSSIs, whilst the Darent gravel pits and Crayford/Dartford Marshes support rich populations of birds and have been recognised by the Kent Trust for Nature Conservation as Sites of Nature Conservation Interest (SNCIs).

The reaches of the River Darent which cut through the North Downs AONB show classic chalk stream features and support diverse invertebrate communities. The rest of the river is less rich: downstream of Farningham severe low flows and impoverished habitat have dramatically reduced the abundance and diversity of aquatic life; above Riverhead a similar situation has resulted from the vigorous management of bankside and aquatic vegetation.

From Dartford to the confluence with the Thames the tidal Darent flows through old grazing marshes. Although these are now reduced in size and interest by industrial development and agricultural "improvement", some dykes still support good invertebrate communities and the reseeded pastures attract feeding and roosting birds. A few wet pastures remain upstream of Farningham and more extensive, though largely improved, pastures are found between Otford and Sevenoaks. Former gravel and clay pits, now flooded, provide an important habitat for waterfowl, and their margins often include remnants of unimproved grassland, fen and carr. Woodland, absent from the main river corridor, is frequent on the valley sides and shades some of the smaller tributaries on the Greensand slopes between Sevenoaks and Westerham.

A recent initiative to conserve the landscape and ecological interest of the area has been the launch (in 1993) of the River Darent Conservation Project. This extension by the NRA of the NW Kent Countryside Project (which is sponsored by the County and four District Councils) will address the problems of the Darent catchment. The NRA funds an additional Countryside Officer and specific field work.

B8.3 Environmental Requirements

Water Quality

- Waters should comply with amenity protection standards and the aesthetic criteria listed in Section B10 : RECREATION AND AMENITY. DoE Circular 7/89 and site-specific Statutory Water Quality standards also apply.

River Flow

- A variable flow regime where the monthly averages reflect the natural flow pattern of the river is required to conserve natural features.
- Spate flows to inundate wetlands and to achieve natural cleansing of the river channel.

River Darent Catchment Management Plan

River Topography

- Maintain existing margins of trees or wetland vegetation and encourage such vegetation in areas where it is currently lacking.
- Maintain and enhance natural river features such as emergent vegetation, meanders and pool:riffle sequences.
- Channels to be of appropriate cross-section for the flow regime.
- Manage access to the river for livestock, to control excessive trampling.
- Control public access to avoid ecological damage.
- Avoid damage to archaeological sites.

River Management

- Operate sluices and weirs to maintain water levels in adjacent wetlands.
- Maintain and clear ditches in a way which encourages rather than destroys ecological diversity.
- Encourage autumn weed cutting to maintain channel capacity for winter spates whilst minimising loss of vegetation by scouring.
- Carry out river corridor surveys to determine the conservation value and requirements of river reaches.
- Co-operate with Local Authorities and riparian landowners to ensure banks and surrounding areas are free from litter and waste material.
- Encourage the application of land-use grant schemes to enhance wetlands and provide an uncultivated buffer strip adjacent to the river.
- Recognise the importance of Sites and Monuments records maintained by Local Authorities.

River Darent Catchment Management Plan

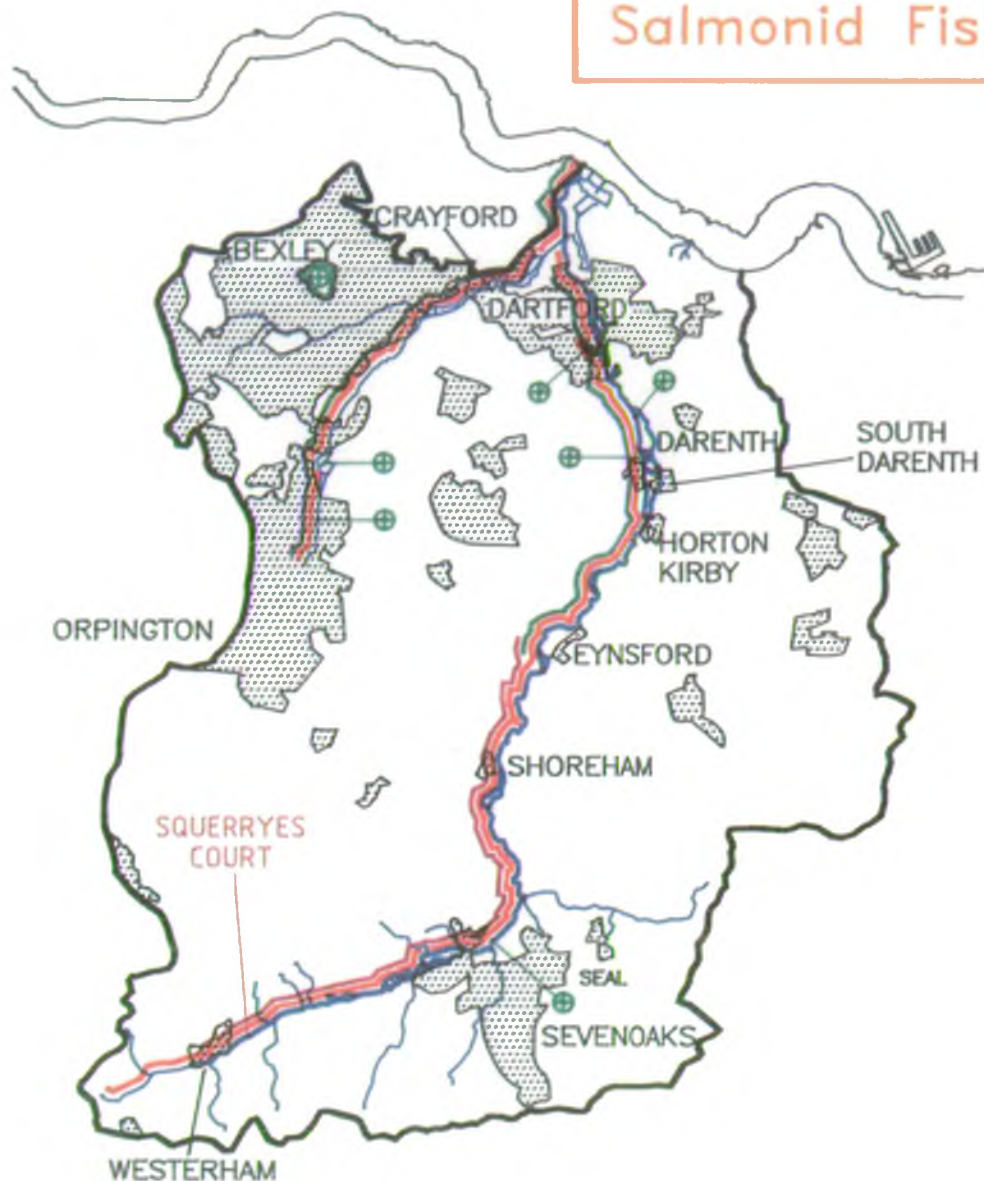
Table B8.1 Schedule of Designated Sites (references are to the map)

Map Ref No.	Name	Designation	Reasons for Designation
1	Sevenoaks Gravel Pit and Wildfowl Reserve (Darent)	SSSI	Breeding bird population Aquatic Plants Wintering Birds Developing Fen and Carr
2	Ruxley Gravel Pits (Cray)	SSSI	Undisturbed Open Water Variety of Insects Breeding wetland birds Developing Fen and Carr
3	Sutton at Hone Lakes (Darent)	SSSI	Wetland & remnant grassland communities Bird populations
4	Crayford & Dartford (Estuary Area)	SNCI	Marshland habitats
5	Lullingstone Castle (Darent)	SNCI	Wetland habitat

- * SSSI Site of Special Scientific Interest (Statutory designation)
 SNCI Site of Nature Conservation Interest (Informal designation)

B9. FISHERIES

No Designated Salmonid Fisheries



LEGEND



RIVER THAMES



RIVER DARENT TOPOGRAPHICAL CATCHMENT



RIVER DARENT



TOWNS



CYPRINID FISHERIES DESIGNATED UNDER EC FISHERIES DIRECTIVE (78/659/EEC)



COARSE FISHERY



STOCKED TROUT FISHERY



STILLWATER FISHERY



FISHERIES

B9. FISHERIES

B9.1 General

This use is concerned with the maintenance and conservation of appropriate fish populations. EC Fisheries Directive (78/659/EEC) sets water quality criteria to protect fish life in designated freshwater reaches, with separate standards for Salmonid (game fish) and Cyprinid (coarse fish) fisheries. Fish are sensitive to general conditions in the river since they have demanding requirements and are near the top of the aquatic food chain. Their distribution in a catchment is influenced by parameters such as bed gradient and river flow, but water quality is of overriding importance, making them good indicators of the overall health of the river.

B9.2 Local Perspective

B9.2.1 Game Fisheries

In the seventeenth century the River Darent was prized by Isaac Walton as one of Britain's premier trout streams. At present none of the river is specifically designated as a Salmonid Fishery under the EC Freshwater Fisheries Directive (78/649/EEC), although trout continue to be stocked from Otford to Lullingstone. The capacity of the river to support brown trout has been diminished by its low-flow problem, and there is no evidence that a self-sustaining population of this species has existed since the late 1970s.

B9.2.2 Coarse Fisheries

The entire lengths of the Darent and Cray have been designated as cyprinid fisheries under the EC Fisheries Directive (78/649/EEC). Water quality problems are rare and high class coarse fisheries are maintained for most of the time, but during periods of low flow it has been necessary to rescue fish from the drying middle and lower reaches of the Darent and to restock when flow conditions improve.

B9.3 Environmental Requirements

Water Quality

- Compliance with EC Fisheries Directive (78/659/EEC).

River Flow

- A more natural flow regime to be restored to sustain fish populations and to allow fish movements within the catchment.

River Topography

- Provide and maintain fish passes at identified obstructions to ensure the free passage of fish. All barriers should be passable at low river flows.
- Diverse and natural river features to ensure a variety of spawning and feeding areas.
- Maintenance of a diverse bankside habitat and appropriate aquatic plants to provide adequate shade and cover.

River Darent Catchment Management Plan

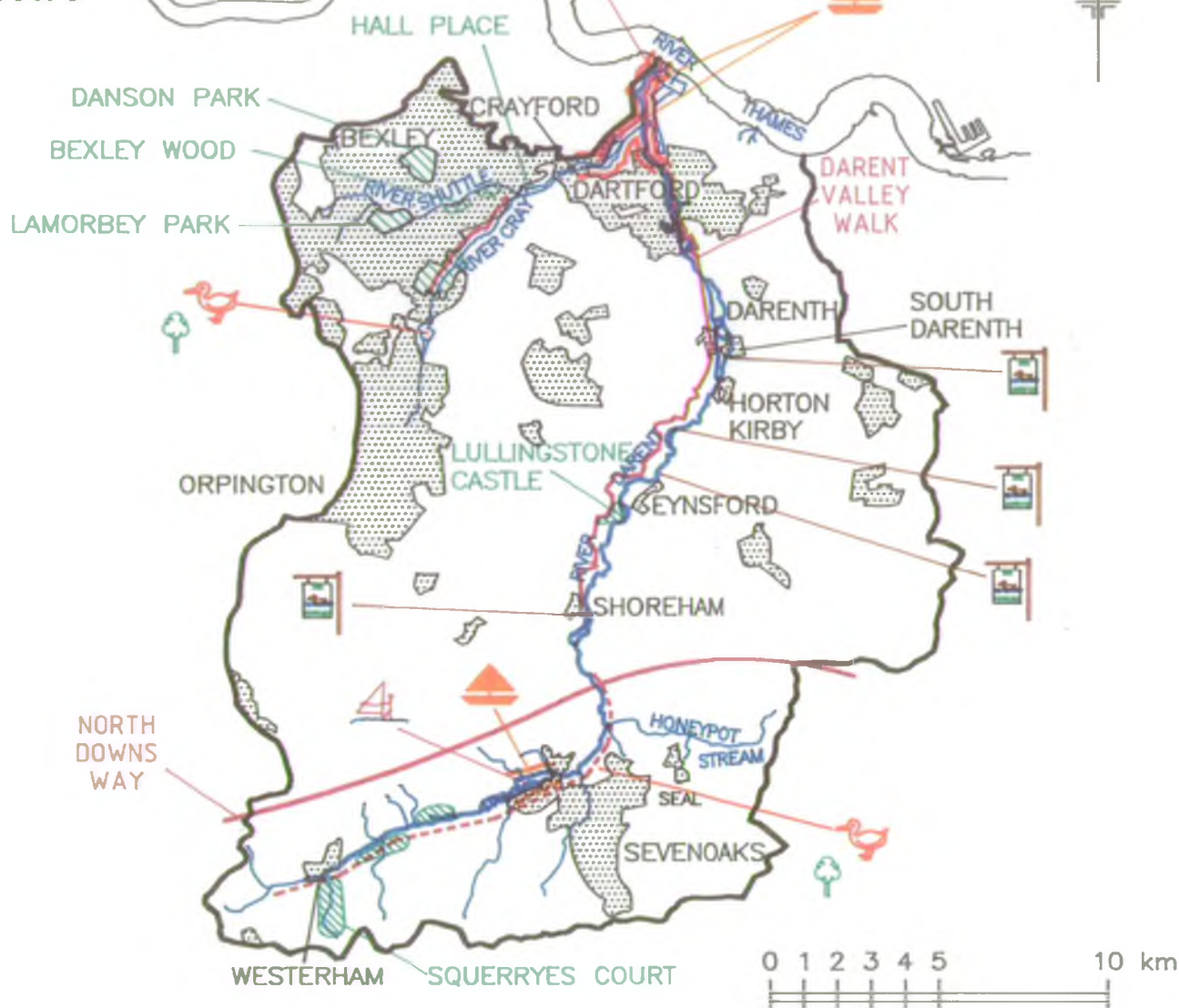
River Management

- ° Control of weirs and stop boards, and the provision of additional small weirs to maintain water levels appropriate for angling.
- ° Stocking with appropriate numbers and species of fish.
- ° Ensure fish farms prevent mass escapes of fish, which can disrupt the natural ecological balance of the river.
- ° Fisheries management operations to be consistent with conservation objectives.

B10. RECREATION AND AMENITY



POSSIBLE LOCATION OF
IMMERSION SPORTS



LEGEND

	RIVER THAMES		BIRDWATCHING
	RIVER DARENT TOPOGRAPHICAL CATCHMENT		NATURE RESERVE
	RIVER DARENT		RIVERSIDE PUB
	TOWNS		PUBLIC RIGHT OF NAVIGATION
	CONTINUOUS FOOTPATH IN REACH		CANOEING
	INTERMITTENT FOOTPATH IN REACH		WINDSURFING
	PARKLAND		
	SAILING / BOATING		

RECREATION AND AMENITY

B10. RECREATION AND AMENITY

B10.1 General

This use relates to the activities which attract people to the river corridor. The principal areas of concern are general aesthetic acceptability, access to the water-course and, in the case of immersion sports, the potential health risk. Navigation is included here: this is a public right on most tidal waters, but elsewhere such rights exist only if established through immemorial usage, by dedication by the riparian owners, or by statute.

The Recreation and Amenity duties of the NRA are set out in Section 16 of the Water Resources Act 1991, which empowers the Authority to conserve and enhance the natural beauty and amenity of inland and coastal waters and associated land. The NRA may use such waters and land for recreation, and is required to have regard to the preservation of public access - both in pursuit of its own activities and where it regulates the actions of others. The Authority is also empowered to promote the development of recreation and amenity where it is considered desirable.

Angling is a popular sport and is practised wherever conditions are suitable. An environment of high landscape and ecological value is preferred, but anglers will be attracted to featureless urban ponds if they contain specimen fish. However, for most anglers the aim is not only to catch fish but also to enjoy an outdoor activity in a harmonious environment.

B10.2 Local Perspective

Proximity to south-east London makes the Darent Valley a popular area for country walks and informal recreation, and this use is likely to increase with development in the Dartford/E.Thames corridor area. Between Shoreham and Dartford the Darent Valley Walkway brings walkers close to the river, but access to the upstream reaches is limited and intermittent. There is parkland with public access between Westerham and Sundridge, and Lullingstone Castle in the middle reaches of the Darent provides a popular amenity. Public parks give access to the Rivers Cray and Shuttle.

The Darent Countryside Project officer operates within the catchment as part of the North West Kent Countryside Project, with the aim of improving access to the countryside and increasing public understanding of rural affairs.

At present there is little organised immersion sport other than on the flooded clay pits at Sevenoaks. However, wherever there is public access (particularly in the lower catchment and adjacent to riverside public houses) the river attracts children to paddle and swim when the weather is warm. The Sevenoaks Wildfowl Reserve on the River Darent caters for bird watchers, who are also attracted to Ruxley gravel pits on the Cray.

A sailing club operates on Marley Lake, a clay pit to the north of Sevenoaks, and there are a few moorings for larger craft in the tidal Dartford and Crayford Creeks. Navigation in tidal waters is administered by the Port of London Authority.

The catchment is very popular with anglers, with much of the demand being met by fisheries on disused gravel pits. Brooklands Lake at Dartford regularly records up to four hundred anglers per day and fisheries at Ruxley (R.Cray), South Darent, Horton Kirby, Lullingstone and Sevenoaks are equally popular. As these lakes are either spring-fed or have direct connections with the river they are adversely

River Darent Catchment Management Plan

affected by drought and over-abstraction, which results in lowered water levels, raised water temperatures and increased predation as the volume diminishes. With the expected growth of Dartford demand for fishing is likely to increase. However, with a finite resource which is already heavily used it is unlikely that angling demand will be fully satisfied.

In the prolonged drought of 1989 to 1992 recreational uses were badly affected by reduced water levels and dried river reaches.

B10.3 Environmental Requirements

Water Quality

- Waters to be aesthetically acceptable for participants. Guidelines on public health implications are awaited.
- Waters to be free from surface films, litter, discolouration and unpleasant odours.

River Flow

- Basic flow regime for the needs of recreation and amenity is met by requirements detailed in Section B8 : CONSERVATION.

River Topography

- Maintenance of existing footpaths and access points.
- Sympathetic management of historical riverside artifacts (eg. Mills, weirs and bridges).

River Management

- Clear signposting of footpaths and recreational features.
- Provision of countryside interpretation information.
- Promotion of recreation to be consistent with conservation objectives.

SECTION C : TARGETS

C1. RIVER FLOW TARGETS

This section considers the requirements for river flows to sustain the various river uses. Flow targets are set related to specific river uses and are stated below:

- The flow regime should reflect the natural seasonal variations to conserve the character of the river. Specific flow targets should be set to protect vulnerable interests such as the maintenance of water quality, wildlife conservation or migratory fisheries. These may be expressed as operating rules to control abstractions, or as specified flows (eg Minimum Residual Flows) at sensitive locations where flow is a significant influence on the river corridor.
- Where migratory fish occur (eg salmon, sea-trout, mullet, smelt, flounder, eels, lamprey) the natural flow regime should not be altered in a way which significantly inhibits their passage.
- There should be no diminution of the flow regime below that assumed in setting effluent discharge consents.
- Minimum Residual Flows should be set for reaches of the river as the basis for Prescribed Flows for incorporation into abstraction licences.

C2. WATER QUALITY TARGETS

The water quality requirements for identified uses are combined to provide overall targets for the entire catchment. Clearly the quality requirements that apply to a particular reach of river are equal to the strictest requirements of any of the uses of the reach identified in this Plan.

In addition to standards for specific uses, the following more general requirements are considered to be targets for the catchment :

- To meet the NRA objective class for individual reaches as detailed in Section B4.
- To meet the general requirement to conserve the wildlife and amenity value of the river corridor, as detailed in Sections B8 and B10.
- To implement the NRA Policy and Practice for the Protection of Groundwater.
- To monitor water quality by implementing a programme of routine sampling throughout the catchment.
- To seek designation for appropriate river reaches under EC Directives.

C3. RIVER TOPOGRAPHY TARGETS

This section considers the general requirements for the topography of the river and its corridor as well as the provision and maintenance of permanent facilities and access. The nature of features included under the term River Topography means that the targets involved can vary widely in scale. The intention here is not to identify detail but to indicate major requirements in relation to the uses concerned.

There are a number of specific uses with their own River Topography requirements. These are detailed in Table C1 overleaf. In addition, the following more general requirements are considered to be targets for the catchment:

- To achieve the Flood Defence Target Levels of Protection shown in Section B7.
- To maintain flood defence structures to ensure their continued effectiveness.
- To control new development, especially development in the flood plain, to prevent a significant increase in flood risk.
- To encourage the management of a strip of uncultivated vegetation alongside the river to enhance the landscape, to act as a buffer against siltation and diffuse pollution, and to provide habitats, shade and cover for wildlife.
- To preserve the diversity of natural river features so as to conserve the river corridor and enhance the quality of the landscape.
- To control access to the river by livestock to prevent excessive trampling of the banks.
- To ensure that exhausted quarries and waste disposal sites are restored to an acceptable environmental standard.
- To control new development so that the conservation value of the river corridor is not reduced.
- To maintain the integrity of river banks and channels adjacent to mineral extraction sites.
- To provide a public footpath alongside the Royal Military Canal for the whole of its length.

C4. RIVER MANAGEMENT TARGETS

This section considers the regular management activities needed to maintain and enhance the river and its bankside features. The intention is not to provide a maintenance schedule but rather to indicate the major requirements of the uses concerned.

A number of specific uses with their own requirements for River Management are detailed in Table C2 and, in addition, the following more general requirements are considered to be targets for the catchment:-








- To achieve co-operation between Local Authorities and riparian landowners to ensure that river banks and surrounding areas are free from litter.
- To determine the conservation value and management requirements of river reaches.
- To control aquatic weeds in a way which provides adequate flood protection and ensures that conservation objectives are not compromised.
- To manage trees to prevent them obstructing river channels.
- To maintain ditches in a way which encourages rather than diminishes ecological diversity.
- To maintain appropriate instream and marginal plant communities.
- To operate sluices in a way which minimises fisheries problems.

SECTION D : CATCHMENT ISSUES

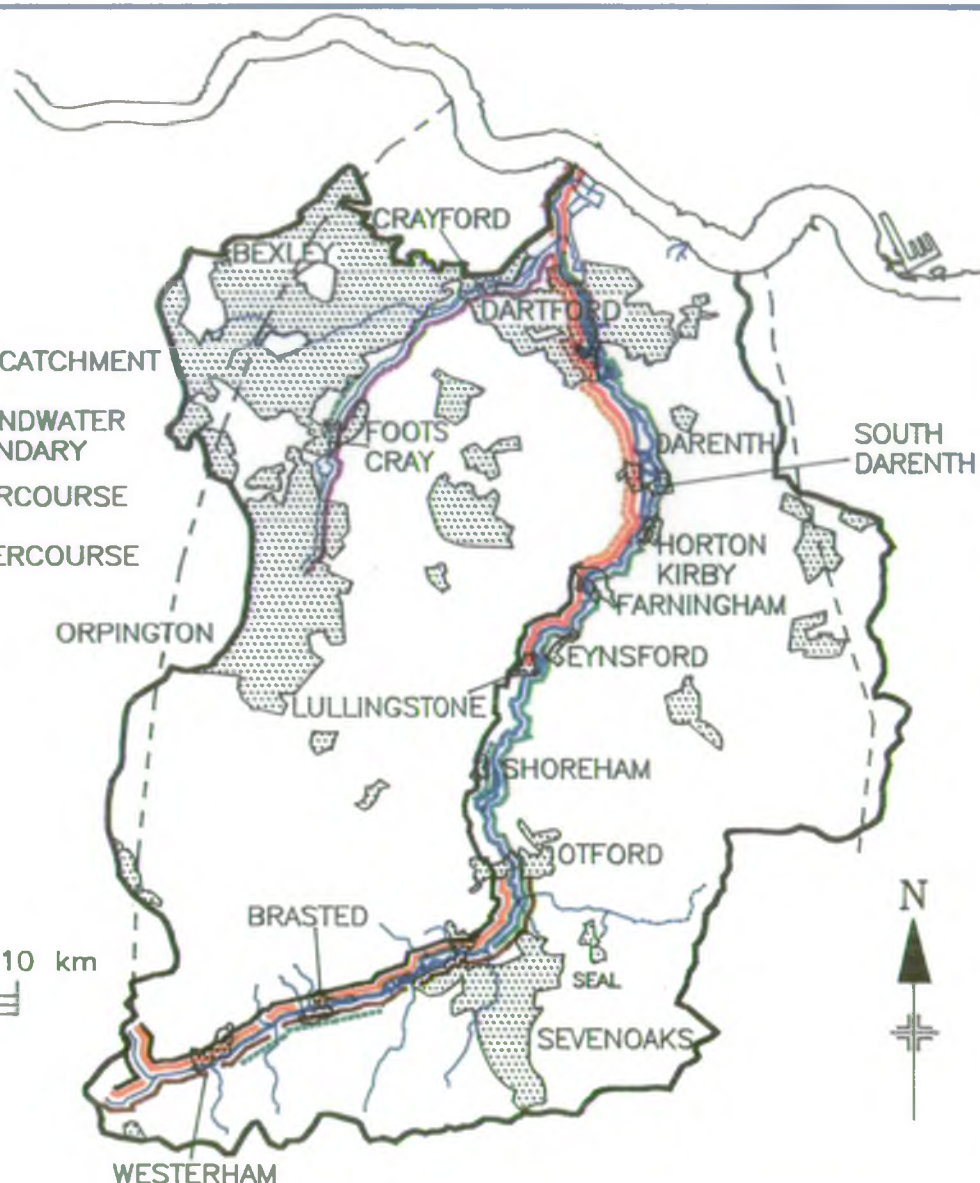


NRA

LEGEND

-  RIVER THAMES
-  RIVER DARENT
-  TOPOGRAPHICAL CATCHMENT
-  ESTIMATED GROUNDWATER CATCHMENT BOUNDARY
-  PERENNIAL WATERCOURSE
-  EPHEMERAL WATERCOURSE
-  TOWNS

0 1 2 3 4 5 10 km



1 FLOWS BELOW LULLINGSTONE SIGNIFICANTLY REDUCED BY ABSTRACTIONS FROM CHALK FOR EXPORT FROM CATCHMENT



2 FLOW REDUCTIONS IN REACHES ABOVE OTFORD DUE TO ABSTRACTION FROM LOWER GREENSAND



6 TRUNK FOUL SEWER FROM SEVENOAKS TO DARTFORD OVERFLOWS DURING HEAVY RAINFALL



7 FLOWS IN RIVER CRAY REDUCED BY ABSTRACTION FROM CHALK. RECENT REDUCTION IN DEMAND AND RECOVERING GROUNDWATER LEVELS HAS LED TO OCCASIONAL LOCALISED FLOODING.



10 RIVER ABOVE FARNINGHAM DESIGNATED AS CYPRINID FISHERY. WATER QUALITY GOOD ENOUGH TO SUPPORT TROUT AND SOME REACHES COULD BE RE-DESIGNATED AS SALMONID WATER WHEN TARGET FLOW REGIME ACHIEVED



11 UPSTREAM OF OTFORD THE NATURAL BANKSIDE VEGETATION IS SPARSE



12 DOWNSTREAM OF FARNINGHAM AQUATIC VEGETATION IS POOR



17 ADEQUACY OF FLOOD PROTECTION QUESTIONABLE ALONG WESTERHAM TO BRASTED REACH, SHOREHAM AND FOOT'S CRAY

CATCHMENT ISSUES

SECTION D : CATCHMENT ISSUES

As a result of the porous geology of the mid-catchment flow in the Darent decreases significantly in most years as the river crosses the Chalk outcrop, the loss rate in summer being estimated to be at least 1 Ml/d per km run of channel. As a result, long reaches of the river between Lullingstone and Hawley either dry or become stagnant, losing the characteristics of a Chalk stream. The Target Flow Profile adopted by the NRA as the basis of the Darent Resources Action Plan corresponds to 50% of the 1 in 20 year minimum naturalised baseflow (estimated by mathematical modelling). At the confluence with the River Cray the Target Flow amounts to an increase of some 35 Ml/d over the current average summer baseflow of less than 1 Ml/d.

ISSUES IDENTIFIED

1. Flows in the Darent below Lullingstone are significantly reduced by abstractions from the Chalk for export from the catchment. Long reaches of the river dried for several months in the years 1989-92.
2. Flow reductions in the reaches above Otford are attributable to abstraction from the Lower Greensand.
3. The NRA is committed to improve low flows in the Darent to restore the river as a chalk stream habitat. The Target Flow Profile corresponds with a low flow regime equivalent to half the 1 in 20 year natural low flow. To achieve this will require reduced abstraction from key sources and artificial river augmentation.
4. Solutions to the low flow problem must recognise that water undertakings have a duty to maintain the continuity and security of public supply, and must satisfy the benefit/cost criteria set for public expenditure.
5. Most of the liquid waste generated within the catchment is discharged direct to the Thames estuary, reducing the potential for recovery of water for reuse within the catchment.
6. The trunk foul sewer from Sevenoaks to Dartford overflows during periods of heavy rainfall and may pollute watercourses.
7. Flows in the River Cray are reduced by abstraction from the Chalk, but reduced demand in recent years appears to have resulted in recovering groundwater levels, leading to occasional localised flooding.
8. The chalk aquifer is vulnerable to pollution from spillages in urban and industrial areas.
9. Chalk groundwater nitrate concentrations are within the MAC of the EC Drinking Water Directive, but exceed guideline limits.
10. The river above Farningham is designated as a Cyprinid fishery under the EC Freshwater Fisheries Directive, but water quality is good enough to support trout and some reaches could be re-designated as Salmonid water when the target flow regime is achieved.

River Darent Catchment Management Plan

11. Upstream of Otford the natural bankside vegetation is sparse and in some reaches the banks have been trampled excessively by livestock. This is particularly noticeable in the area of the junction with the Honeypot Stream.
12. Downstream of Farningham aquatic vegetation is poor, although the river has many natural features. Much of the river lacks a buffer strip of natural vegetation which conserves wetland features, attenuates siltation and run-off from surrounding land and forms an important feature of the landscape.
13. Flood defence maintenance work, the management of riparian vegetation and excessive trampling of the river banks by cattle damage the nature conservation interest of some reaches.
14. Over-intensive management of vegetation on river banks can detract from their conservation and amenity value.
15. Sensitive management of the river channel (eg by regulating its width) can reduce the environmental impact of low flows. Low weirs have been built in some reaches and used to be more common, but were removed for land drainage reasons. Consideration should be given to their wider use.
16. The timely operation of privately owned sluices is essential to control flooding when flows are high.
17. Following extensive flood defence works in the catchment, most reaches of the river meet their flood protection targets, provided sluices are operated properly. Only the Westerham to Brasted reach, Shoreham and Foots Cray are questionable in this respect.
18. There is a need for close control of development in flood risk areas such as river and coastal flood plains.
19. Low flows and lack of suitable habitat in the River Darent prevent the establishment of a sustainable population of brown trout.
20. There is potential conflict between the objectives of fishery management and conservation.

SECTION E : MANAGEMENT OPTIONS

A variety of management options to address catchment issues is listed in this section of the Plan, although some may not be achievable in practice. An indication is given as to where responsibilities are expected to lie, together with some of the 'pros' and 'cons' for each option. They do not represent NRA policy, but are put forward as a basis for public discussion which will influence future NRA thinking.

Comments and suggestions for new ideas are invited.

River Darent Catchment Management Plan

Table of Management Options

Issue Ref. No. 1, 2, 3, 4	Artificially induced low flows in the River Darent. River dries in places at times of drought		
Management Options	Responsible Bodies	Pros	Cons
Implement the River Darent action Plan at an estimated cost of up to £12m.			
Adapt potable water distribution systems to allow the replacement of Darent water with water from other sources.	TWU	Flexibility of supply; Reduced demand on Darent	Cost
Close Brasted and Sundridge supply boreholes to reduce demands on catchment resources.	TWU	Reduced demand on Darent	Cost
Vary selected abstraction licences to reduce the abstraction of chalk water in the Lullingstone-Eynsford area.	NRA	Reduced demand on Darent	Cost
When necessary, augment river flows from bankside wells as a contribution to achieving the agreed Target Flow Profile.	NRA	Improved river flow regime	Cost
Investigate the need for further flow augmentation using surplus groundwater from the Blue Circle Industries chalk quarries at Northfleet (currently discharged to the Thames estuary).	NRA	Improved river flow regime	Cost

Abbreviations

TWU -	Thames Water Utilities
DoE -	Department of Environment
MAFF -	Ministry of Agriculture, Fisheries and Food
DRIPS -	Darent River Preservation Society

River Darent Catchment Management Plan

Issue Ref. No. 1, 2, 3, 4 Continued	Artificially induced low flows in the River Darent. River dries in places at times of drought		
Management Options	Responsible Bodies	Pros	Cons
<p>Introduce a legally binding Water Resource Management Scheme :-</p> <p>a) for the conjunctive use by TWU of River Thames surface water and Darent catchment groundwater to supply south-east London.</p> <p>b) for river augmentation by NRA to maintain the agreed Target Flow Profile.</p> <p>c) to monitor the adequacy of the agreed Target Flow Profile.</p> <p>d) to introduce demand-management measures for water supply in the area served by the Darent catchment, with agreed performance targets, and to adjust demand forecasts to reflect the results of this work.</p>	<p>TWU</p> <p>NRA</p> <p>NRA</p> <p>TWU</p>	<p>Flexibility of supply; Reduced demand on Darent</p> <p>Improved river flow regime</p> <p>Optimisation of investment</p> <p>Reduced demand; Delayed investment</p>	<p>Cost</p> <p>Cost</p> <p></p> <p>Cost</p>
Issue Ref No. 5,6	Treated effluent is discharged to the Thames Estuary, depleting the resources of the catchment. Occasional overflows from the trunk foul sewer are a threat to water quality in the Darent.		
Management Option	Responsible Bodies	Pros	Cons
Investigate treatment of urban wastes within the catchment, using the trunk sewer only for storm flows.	TWU, NRA	Enhanced river flows; Conservation of water resource	Cost, Risk of lower river water quality
Investigate the frequency and severity of the overflow problem and propose engineering solutions (eg balancing tanks, separators).	TWU, NRA	Improved pollution control	Cost

River Darent Catchment Management Plan

Issue Ref. No 7	Following a temporary reduction in abstraction, groundwater levels appear to have risen in the Cray sub-catchment and may contribute to localised flooding problems.		
Management Options	Responsible Bodies	Pros	Cons
Monitor the abstraction regime and its effects on local groundwater levels.	TWU, NRA	Better management of water resources	
Issue Ref No. 8	The chalk aquifer in urban areas is vulnerable to pollution		
Management Options	Responsible Bodies	Pros	Cons
Apply the NRA Groundwater Protection Policy.	NRA	Improved security of the resource	
Ensure that every care is taken with the transport, storage and handling of oils, solvents and toxic substances.	Industry, Local Authorities, NRA	Improved security of the resource	
Ensure that operators are aware of the risks.	Industry, Local Authorities, NRA	Improved security of the resource	
Relocate affected boreholes away from industrial areas.	TWU	Improved security of the resource	Cost
Ensure that road drainage systems incorporate measures to minimise pollution.	Dept of Transport, County Councils, NRA	Improved security of the resource	Cost
Continue to monitor the situation at Broomwood Lake.	NRA	Anticipatory pollution control	

River Darent Catchment Management Plan

Issue Ref. No 9	Whilst remaining below the MAC, the nitrate concentration in parts of the chalk aquifer exceeds the guideline limit of the EC Drinking Water Directive.		
<p style="text-align: center;">Management Options</p> <p>Reduce applications of nitrogenous fertilisers, especially when crops are dormant.</p> <p>Investigate alternative strategies for the treatment of potable water.</p> <p>Consider the need to designate Nitrate Sensitive Areas.</p>	<p style="text-align: center;">Responsible Bodies</p> <p>Farmers, Domestic Gardeners</p> <p>TWU</p> <p>NRA, DoE, MAFF</p>	<p style="text-align: center;">Pros</p> <p>Security of water resource; Cost savings</p> <p>Enables continued use of existing sources</p> <p>Protection of the resource</p>	<p style="text-align: center;">Cons</p> <p>Reduced yields</p> <p>Pumping costs</p> <p>Restraints on agriculture</p>
Issue Ref No. 10	Good water quality provides an opportunity to designate some reaches as Salmonid River under the EC Freshwater Fisheries Directive.		
<p style="text-align: center;">Management Options</p> <p>Review designations under the Directive once a brown trout population has been re-established.</p>	<p style="text-align: center;">Responsible Bodies</p> <p>NRA</p>	<p style="text-align: center;">Pros</p> <p>Improved Management targets</p>	<p style="text-align: center;">Cons</p>

River Darent Catchment Management Plan

Issue Ref Nos. 11, 12, 13, 14	Adverse impact on amenity and river ecology from maintenance work, intensive management of riparian vegetation and excessive trampling of river banks by cattle.		
Management Options	Responsible Bodies	Pros	Cons
Adopt sensitive maintenance techniques which have minimum environmental impact whilst achieving flood defence targets.	NRA	Reduced environmental impact	
Control access to the river bank by cattle in sensitive areas.	Farmers	Reduced environmental impact	Cost
Where good river management practice exists, ensure that it continues.	NRA, TWU, Riparian Owners, Angling Clubs, DRIPS	Reduced environmental impact	Cost
Encourage landowners to manage land adjacent to watercourses as an uncultivated buffer strip which has landscape value, provides a green corridor for the movement of wildlife through the catchment and helps to attenuate the effects of run-off from the land.	NRA, Landowners, Countryside Commission, English Nature, MAFF	Improved environment	Cost of maintenance, Land taken out of production
Encourage the application of land-use grant schemes to protect and enhance wetland habitats.	NRA, Landowners, Countryside Commission, English Nature, MAFF	Improved environment	
Issue Ref No. 15	Provision of weirs to retain water levels at times of low flow		
Management Options	Responsible Bodies	Pros	Cons
Investigate the provision of small weirs to improve the amenity and conservation value of the river without increasing flood risks.	NRA	Improved environment	Cost, possible flood risk

River Darent Catchment Management Plan

Issue Ref. No. 16	Timely operation of privately owned sluices is needed to control flooding		
Management Options Maintain good liaison between riparian owners and NRA.	Responsible Bodies NRA, Owners, Local Authorities	Pros Efficient management of flood events	Cons
Issue Ref. No. 17	Flood defence standards not met in some river reaches		
Management Options Investigate improvement schemes which meet benefit/cost criteria.	Responsible Bodies NRA	Pros Rational investment programme	Cons
Issue Ref. No. 18	Development control in the flood plain		
Management Options Promote good liaison between the NRA and Local Authority planners to ensure that unsuitable development does not occur.	Responsible Bodies NRA, Local Authorities	Pros Avoidance of flood risk	Cons
Issue Ref No. 19	Action is needed to restore a sustainable population of brown trout in the River Darent		
Management Options Restore minimum river flows to conform with the Target Flow Profile. Manage in-river gravel beds to provide suitable spawning sites for brown trout. Ensure that river water quality is maintained. Consider stocking with suitable brown trout to form the basis of a naturalised population.	Responsible Bodies NRA, TWU NRA, Anglers NRA NRA, Angling Clubs, Owners	Pros Overall improvement of aquatic environment Improved fisheries; Environmental benefit Anticipatory pollution control; Protection of fishery Reinforce sparse pollution of wild fish	Cons Cost Cost Dilution of wild gene pool

River Darent Catchment Management Plan

Issue Ref No. 20	There is a potential conflict between the objectives of fishery management and conservation		
Management Options	Responsible Bodies	Pros	Cons
Ensure that conservation objectives are taken into account in the management of fisheries and fish stocks.	Angling Clubs, NRA	Improved environmental management	Restrictions on fisheries activities

River Darent Catchment Management Plan

APPENDIX 1 : STATISTICS FOR THE DARENT CATCHMENT

1. GENERAL INFORMATION

Surface Catchment Area 40096 Ha (400.96 km²)

Groundwater Catchment Area 37332 Ha (373.32 km²) * estimated

Topography

Maximum Level 251 mAOD
Minimum Level 0 mAOD

Geology (% of catchment)

Lower London Tertiaries 19%
Chalk 59%
Gault Clay 6%
Lower Greensand 16%

Estimated Catchment Population

Year	Population	Change per decade
1981	301,100	
1991	329,400	+ 8.5 %
2001	354,400	+ 7.0 %

Districts and Estimated Population (1991)

District	Persons per Ha	Ha in catchment	% area of catchment	Population in catchment
Dartford	10.9	5,300	13.3%	57,800
Sevenoaks	3.0	22,800	56.8%	68,400
Ton. & Mall.	4.2	900	2.3%	3,800
KCC Total	29,000		72.4%	130,000
Bexley	35.6	3,200	7.9%	113,900
Bromley	19.1	6,400	16.0%	122,200
Greenwich	43.6	1,000	2.5%	43,600
GLC Total	10,600		26.4%	279,700
Tandridge (SCC)	3.1	500	1.2%	1,600

Note: The population figures are approximate and portray overall trends rather than precise values.

River Darent Catchment Management Plan

2. WATER RESOURCES

	Resource Areas			
	Darent Greensand	Darent Chalk	River Cray	Total
Catchment Area (Ha)				
Surface	9822	17354	13242	40096
Groundwater				37332
Public Water Supply (Ml/d)				
Surface Water	0	0	0	0
Ground Water	48	104	79	231
Industrial / Agricultural	1	25	6	42
TOTAL DEMAND	49	129	95	273

Rainfall (mm)		
Mean Annual Total	Mean Year 655	1:10 yr Drought 515
Effective Rainfall	191	50

Abstraction

Licensed Abstraction (Ml/d)	273
Actual Abstraction (1989) (Ml/d)	194
Percentage from groundwater	96%
Percentage in High/Med Loss category	99%

River Flow (cumecs):

Mean Flow	(Q50)	0.46
95 percentile Flow	(Q95)	0.02

Water Supply Companies serving the catchment

	Area (km ²)	% Catchment
East Surrey Plc	11	3%
Mid Kent	60	15%
SE Water (W Kent)	50	13%
SWS (Medway)	18	4%
Thames	262	65%

River Darent Catchment Management Plan

3. WATER QUALITY

River Designated under EC Freshwater Fish Directive (Km)

Salmonid designation	-
Cyprinid designation	51.64

Length of River in each Quality Class (Km)

Class	Description	Target	Achieved 1990
1A	Good	0	13.4
1B	Good	38.2	45.7
2	Fair	20.9	0
3	Poor	0	0
4	Bad	0	0
TOTAL		59.1	59.1

4. FLOOD DEFENCE

Length of Coastline (Km)

Schedule 4	0
Main Tidal Waters	9.2
Sea Defences (NRA)	0
Sea Defences (LA)	0
Tidal Banks (NRA)	13.2

Length of Main River (Km) 78.7 (includes tidal lengths)

Internal Drainage Districts

West Gravesend Commissioned Area 6 Km² approx

5. CONSERVATION

Number of Designated Sites in the Catchment

Type	Total	Water Dependent
Ramsar Sites	0	0
NNRs	0	0
SSSIs	19	18

APPENDIX 2. GLOSSARY OF TERMS AND UNITS

1:10 YEAR DROUGHT/FLOOD

A drought/flood event with a statistical probability of occurring once in a ten year period (other periods may be specified in a similar way).

ABSTRACTION LICENCE

Licence to abstract water from a surface or underground source. The maximum annual, daily and hourly abstraction rates are set by the licence.

ABSTRACTION - ACTUAL

Individual abstraction records are reported to the NRA each year but under the Water resources Act 1991 these data are confidential. Actual abstraction figures reported in the Plan are area annual totals expressed in Ml/d.

AONB

Area of Outstanding Natural Beauty, notified by the Countryside Commission.

BOD

Biochemical Oxygen Demand. A measure of the polluting potential.

COARSE FISH

See FRESHWATER FISH, CYPRINIDS, SALMONIDS

CONSUMPTIVE USE

Water which is abstracted but not returned to the catchment, either because it evaporates (as in spray irrigation) or is exported for use in another catchment.

COUNTY STRUCTURE PLANS

Statutory documents produced by County Councils outlining their strategy for development over a 10-15 year timescale.

CYPRINIDS

Fish of the carp family. (See also FRESHWATER FISH, SALMONIDS)

DISTRICT LOCAL PLANS

Statutory documents produced by District or Borough Councils to implement the development strategy set out in County Structure Plans. Specific land use allocations are identified.

DROUGHT ORDER

Order issued by the Secretary of State for the Environment allowing the terms of abstraction licences to be varied and/or the levels of service to water company customers to be reduced at times when the resource is under stress.

EFFECTIVE RAINFALL

Total rainfall minus direct evaporation and the water used by plants for transpiration. This is equivalent to the total resource of a catchment. (See also TOTAL RAINFALL)

River Darent Catchment Management Plan

EIFAC

The European Inland Fisheries Advisory Commission. An agency of the United Nations Food & Agriculture Organisation (FAO).

EMERGENT VEGETATION

Plants with roots in the river bed but which emerge from the water. Examples include reeds, iris and bullrush.

EPHEMERAL FLOW

River flow which dries at some times of the year (eg winterbournes).

FLOW MEASUREMENT UNITS

m ³ /s	Cubic metres per second
l/s	Litres per second
Ml/d	Megalitres per day. A megalitre is equivalent to a ten metre cube (approximates to a 4-bedroom detached house).
mgd	Millions of gallons per day

FLOW CONVERSION TABLE

<u>m³/s</u>	<u>Ml/d</u>	<u>mgd</u>
0.012	1	0.224
0.06	5	1.12
0.12	10	2.24
0.24	20	4.48
0.6	50	11.2
1.2	100	22.4

FRESHWATER FISH (COARSE FISH)

For the purposes of the Salmon and Freshwater Fisheries Act 1975, fish other than Salmon, Brown Trout, Sea-Trout, Rainbow Trout and Char.

HECTARE

Unit of area 100m X 100m, equal to 2.471 acres.

HIGH SEAS RIGHTS

Common law rights of navigation and fisheries on tidal waters where no specific authority exists.

IDB

Internal Drainage Board. A local land drainage authority with powers to raise finance and do works.

IMPOUNDMENT RESERVOIR

Surface water storage area formed by construction of a dam and supplied only by natural inflow from the upstream catchment.

ISOHYETALS

Contours of equal mean annual rainfall.

River Darent Catchment Management Plan

LOCAL NATURE RESERVE

A nature reserve designated by a Local Authority, frequently owned or managed by a voluntary conservation organisation.

mAOD

A measure of altitude. Metres above ordnance datum.

MARSH FEEDING

Supply of water from the river to marsh areas during the summer for wet fencing or abstraction (usually for spray irrigation).

MEAN LICENSED ABSTRACTION

In this Plan the mean licensed abstraction is the total annual abstraction permitted within the terms of a licence, expressed as an average daily volume in terms of megalitres per day (Ml/d).

MHWS

Mean High Water Spring Tides. A datum level used in mapping.

MINIMUM RESIDUAL FLOW (MRF)

The flow set at a river gauging station to protect downstream uses and below which controlled abstractions are required to cease. (see also **PRESCRIBED FLOW**)

NATIONAL NATURE RESERVE

A nature reserve of national importance, designated and managed by English Nature.

NATURAL FLOW REGIME

The river flow pattern experienced prior to the influence of man, with no abstraction from or discharges to the catchment.

PERENNIAL FLOW

River flow present through the entire year. (See also **EPHEMERAL FLOW**)

POTABLE WATER SUPPLY

Water supplied for domestic use, including human consumption.

PRESCRIBED FLOW (PF)

A river flow incorporated as a condition in an abstraction licence, such that abstraction must cease once the flow falls below this value. Prescribed flows are set at or above the MRF (qv) which applies to the river where the abstraction takes place.

In many instances the PF applying to new licences is increased incrementally in step with the total licensed abstraction to protect the interest of existing abstractors: ie. newer abstractions have to cease at higher river flows. (see also **MINIMUM RESIDUAL FLOW**)

PRIMARY GAUGING STATION

A permanent river flow gauging installation included in the National Surface Water Archive.

River Darent Catchment Management Plan

PUMPED STORAGE RESERVOIR

Surface water storage area where the natural inflow is supplemented by water pumped from a separate source, typically a nearby river.

POOL:RIFFLE

A stretch of river with alternate sections of shallow fast-flowing water and deeper slow-moving pools.

Q95

River flow that is exceeded for 95 percent of the flow record (a low flow, the Q5 flow would be a high flow).

RAMSAR SITE

A wetland site of international significance for conservation, notified under international treaty.

SALMONIDS

Fish classified by the Salmon and Freshwater Fisheries Act 1975 as belonging to the salmon family - Salmon, Brown Trout, Sea-Trout, Rainbow and Char. (Summer-spawning salmonid species such as Grayling are classified by the Act as Freshwater Fish).

SPATE FLOWS

Episodic fresh water flood flows.

SSSI

Site of Special Scientific Interest. A site designated by English Nature as being in need of protection to conserve its outstanding ecological or geological features. Land use and management operations within SSSIs are subject to control.

SNCI

Site of Nature Conservation Interest. A site of local importance for wildlife or geology, identified by the County Wildlife Trust or the County Council.

STW

Sewage Treatment Works.

TOTAL RAINFALL

Rainfall as measured by a rain gauge.

TOTAL RESOURCE

See EFFECTIVE RAINFALL

WET FENCING

Water-filled ditches used as field boundaries or to control the movement of livestock.

River Darent Catchment Management Plan

APPENDIX 3 - FURTHER READING

EC Directives

Quality of Surface Water for Abstraction as Drinking Water:	(75/440/EEC)
Pollution Caused by the Discharge of Dangerous Substances:	(76/464/EEC)
Quality of Fresh Waters for the Support of Fish Life:	(78/659/EEC)
Protection of Groundwater Against Pollution:	(80/68/EEC)
Urban Waste Water Treatment:	(91/271/EEC)
Protection Against Pollution by Nitrates from Agriculture:	(91/676/EEC)

Acts of Parliament

Salmon and Freshwater Fisheries Act 1975
Wildlife and Countryside Act 1981
Water Act 1989
Environment Protection Act 1990
Land Drainage Act 1991
Water Resources Act 1991

NRA Publications

NRA Corporate Plan (Annually)
Water Resources Development Strategy: A Discussion Document. 1992
Sustaining our Resources. Southern Region Water Resources Development
Strategy: NRA Southern Region 1992
River Itchen Catchment Management Plan, Phase I: NRA Southern Region 1992

Other Publications

Conservation and Land Drainage Guidelines: Water Space Amenity Commission 1980
Nature Conservation and River Engineering: Nature Conservancy Council 1983
Rivers and Wildlife Handbook: RSPB 1984
Changing River Landscapes: Countryside Commission CCP238 1987
Code of Practice on Conservation, Access and Recreation: MAFF, DoE & Welsh Office. HMSO 1989
Nature Conservation and the Management of Drainage Channels: Nature Conservancy Council & Association of
Drainage Authorities 1989
Conservation Guidelines for Drainage Authorities: MAFF, DoE & Welsh Office. 1991
Solving the Nitrate Problem: MAFF 1993