

**DEMANDS & RESOURCES OF WATER UNDERTAKERS  
IN ENGLAND & WALES**

Preliminary Report Under  
Section 143(2)(a) Water Act 1989

March 1991



**NRA**

*National Rivers Authority*

**Preface**

This is the first report published by the National Rivers Authority (NRA) under Section 143(2)(a) of the Water Act 1989. This section of the Act places a duty on the NRA to publish information from which assessments can be made of the actual and prospective demand for water, and of actual and prospective water resources in England and Wales. The report represents an important benchmark in the overall understanding of the national water resources situation and is primarily concerned with the demands and resources of water undertakers the needs of which together account for the major proportion of water abstraction. The development of a water resources strategy is underway and future reports will detail this strategy in the light of demands for water supply industry and agriculture.

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Environment Agency  
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Class No .....  
Accession No *B.D.Q.V*.....

MARCH 1991



**PRELIMINARY REPORT UNDER  
SECTION 143(2)(a) WATER ACT 1989**

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**PRELIMINARY REPORT UNDER  
SECTION 143(2)(a) OF THE WATER ACT 1989**

**EXECUTIVE SUMMARY**

The National Rivers Authority (NRA) has statutory duties and powers in relation to the management of water resources arising from the Water Act 1989 and the Water Resources Act 1963. They include water resources planning, abstraction licensing and enforcement and surface and groundwater protection. The NRA also has a significant operational involvement in augmenting river flows to support abstractions and to protect the environment, through its water transfer and river regulation schemes. Amongst these duties the NRA is required to collate and publish information from which assessments can be made of actual and prospective demand for water and of actual and prospective water resources, in England and Wales.

In part fulfilment of this duty, this report presents information for each water undertaker in England and Wales which includes estimates of present and future demands, together with existing levels of reliable yield available to the undertakers.

In addition, a list of possible water resource development proposals is included which gives an indication of the potential magnitude of the available reliable yields and the water undertaker(s) who might benefit from the development options.

The information presented in this report should be interpreted with particular caution. The NRA was formed in September 1989 and is therefore only at the beginning of a process leading to a sustainable strategy for the management and development of water resources for England and Wales. While every effort has been made to check the data included in this report, the NRA has not yet had the opportunity to satisfy itself that present and future demand estimates are

appropriate nor whether reliable yields of existing sources are adequately represented. Similarly, inclusion of the list of possible resource development options does not necessarily imply that these are schemes preferred by water undertakers or by the NRA. Water resources planning will be an ongoing activity by both the water undertakers and the NRA, and it is expected that new schemes will emerge and existing proposals varied.

Bearing in mind the above limitations, the information presented indicates that, considering water supply undertakings as a whole, most have sufficient resources to meet existing average and peak demands for the severity of drought for which they were designed. However the balance between resources and demands on a water supply undertaking basis masks deficiencies which may occur within an undertaking due to the lack of capacity to distribute surplus water to areas of need or because the planning margin is too narrow to provide for operational difficulties. In addition comparison of average demands and reliable yields is only a crude indicator. Comparison of peak demands and available yields at critical periods of a drought are also necessary to provide a full understanding especially in the case of groundwater sources. This additional work will be done in due course and published in subsequent reports.

Development of plans for meeting future public water supplies is a joint exercise by the NRA and the undertakers. Both parties are liaising in this process and the water undertakers have been consulted over the information presented in this report.

## 1. INTRODUCTION

Under Section 143(2)(a) of the Water Act 1989 it is the duty of the National Rivers Authority (NRA) to:-

**'collate and publish information from which assessments can be made of the actual and prospective demand for water, and of actual and prospective water resources, in England and Wales'.**

This Preliminary Report takes an initial view of the present and future position and concentrates upon resources and demands for water supply undertakings. Future reports will refine the information given in this report and in addition, will include information on resources and demands for other water abstractors such as industry and agriculture which, in some parts of the NRA, will be competing for the same resources.

The information presented in this report is mainly derived from a combination of data obtained directly from water supply undertakers and from data held by the NRA.

Since the formation of the NRA in September 1989 there has not been sufficient time for the NRA to satisfy itself on the validity of the data which are presented in this report. Information has been taken largely at face value and will be subject to review and updating in future publications.

The report is set out as described in the following sections.

Section 2 reviews the balance of present water resources and demands on an NRA regional basis.

Section 3 gives present and forecast data on demands for each water supply undertaking for the years 1990 and 2011.

Section 4 tabulates the present total reliable yield available to each water supply undertaking and Section 5 lists selected water resource development options which are available within each NRA region.

Section 6 draws together the information contained in Sections 3, 4 and 5 to facilitate a broad comparison of existing and future demands with existing reliable yields on a water undertaking basis and also a comparison of demands and resources on an NRA regional basis.

Section 7 provides a commentary of the overall situation within England and Wales.

Location maps showing the NRA boundaries, the Water Service Companies and Water Companies are presented in Appendix 1.

## **2. COMPARISON OF REGIONAL RESOURCES AND DEMANDS**

### **2.1 The variation in rainfall across the NRA**

Effective rainfall is a measure of the total water resources which are available from surface water and from groundwater after allowing for losses through evapotranspiration. The average effective rainfall is the average water resource which is theoretically available assuming sufficient storage could be constructed to prevent runoff being discharged to the sea and ignoring re-use of abstracted water. Clearly these are not realistic assumptions in practice, but effective rainfall is a useful cross regional comparator and an index of the theoretical upper limit of potential resource development.

Figure 1 compares the annual average rainfall, the annual average effective rainfall and the effective rainfall under drought conditions, for each NRA region. The diagrams demonstrate the higher resource potential of the wetter northwest and west of England and Wales compared to the southeast and east of England. There are however many other factors which need to be considered for resource development, such as the severity of droughts of different durations and the competing demands on the environment.

### **2.2 Comparison of effective rainfall and licensed abstractions**

The NRA is presently compiling an up to date set of licensed abstraction figures, but for the purposes of this report, abstraction data has been obtained from Water Facts 1990 which contains the most recent published data. (Reference 1).

Figure 2 compares the licensed abstraction for each region with the effective rainfall under drought conditions. This is the kind of severe event for which public water supply schemes are commonly designed. The high utilisation of resources is most marked in the Anglian and Thames regions where the annual licensed abstraction is similar to or even exceeds the effective rainfall during severe droughts. This clearly demonstrates the importance of water storage, either in reservoirs or as groundwater, to maintain supplies during periods of drought. The re-use of abstracted water is also important in this context, especially in the longer river systems such as the Thames and Severn where the potential for re-use is at its greatest. It should be noted however that the full licensed abstraction is not made at all times, and a worst case situation has therefore been presented in this report.

## VARIATION IN RAINFALL

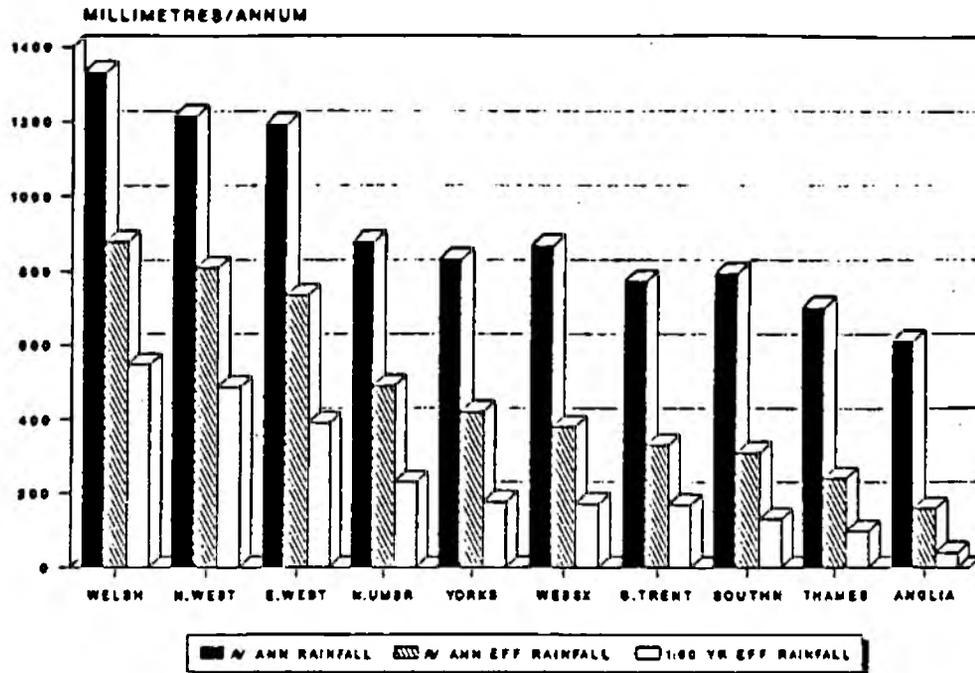


FIGURE 1

## LICENSED ABSTRACTION COMPARED WITH EFFECTIVE DROUGHT RAINFALL

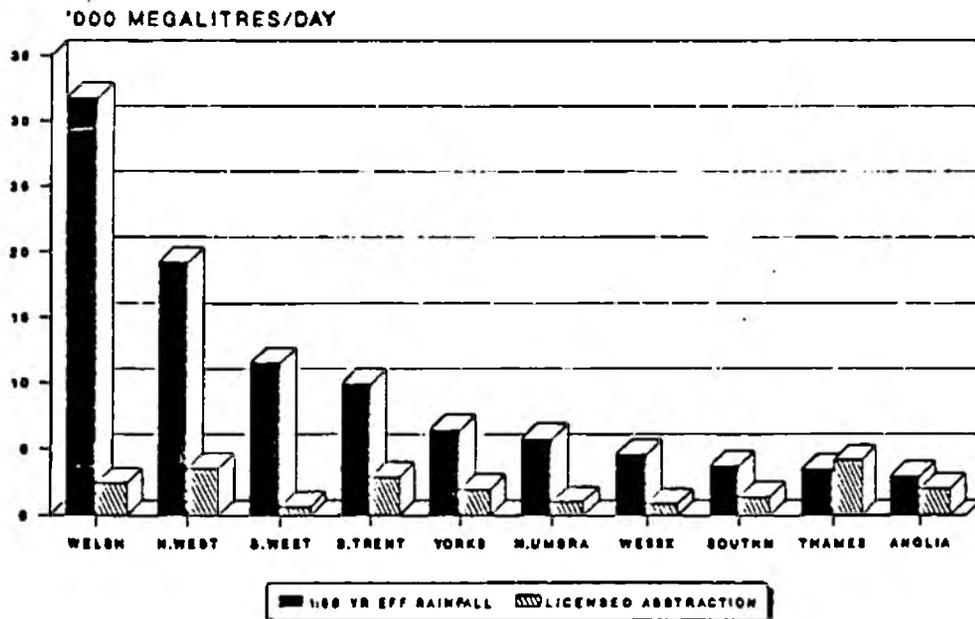


FIGURE 2

### LEGEND

AV ANN RAINFALL  
 AV ANN EFF RAINFALL  
 1:50 YR EFF RAINFALL  
 LICENSED ABSTRACTION

is the average annual rainfall  
 is average annual effective rainfall  
 is the once in fifty dry year effective rainfall  
 is the total licensed abstraction for 1987 excluding abstractions by CEGB and abstractions for fish farming and watercress

### 3. DEMANDS BY WATER UNDERTAKING

A preliminary set of average demand estimates for water supply undertakings is given in Table 1. Where appropriate, or available, information is also shown for peak demands required to be met by the undertaker.

For the purposes of this report data are presented for the years 1990 and 2011.

The NRA is in the process of auditing demand assessments particularly in relation to demand forecasts and therefore the values shown in the tables should be viewed as a broad indication of possible trends.

Ideally the NRA will wish to be sure that the demand data are produced on a common basis and which gives a range of projections for different assumptions such as the use of domestic metering, leakage control activity and per capita consumption assumptions, but this is not possible at present.

**Footnote:**

**Demands and resources are quoted in units of MI/d which are millions of litres per day. (1MI/d is equivalent to 0.22 million gallons per day).**

Table 1. Demands (ML/d)

NRA Region	Water Undertaker	Average demand		Peak demand	
		1990	2011	1990	2011
Anglia	Anglian Water S.L.	1226	1575	1560	2000
	Essex W.Co.	421	497	526	631
	Cambridge WCo.	80	112	101	161
	Tendring hundred WWC.	33	46	46	67
	Suffolk Water Co.	79	113	100	147
Northumbria	Sunderland/S.Shielda Plc	150	160	158	168
	Newcastle&Gateshead Plc	254	252	276	279
	Hartlepool W.Co.	45	41	55	47
	Northumbrian Water	665	765	672	773
North West	North West Region	2550	2446*	2805	2685*
Severn Trent	Severn Trent Water Ltd	1970	2100	2270	2460
	South Staffs Water Works Co.	356	387	444	480
	E.Worce Water Works Co.	72	86	86	104
Southern	Southern Water	729	841	893	1062
	Portsmouth WCo.	215	272	275	350
	Mid Sussex	69	92	82	116
	Eastbourne WCo.	60	84	74	107
	West Kent WCo.	34	43	40	50
	Mid Kent WCo.	160	186	196	235
	Folkestone WCo.	57	59	62	69
South West	South West Water	493	598.4	555.5	-

\*demand estimates to be revised in 1991

NRA Region	Water Undertaker	Average demand		Peak demand	
		1990	2011	1990	2011
Thames	Thames Water Utilities Ltd	2744	3170	-	-
	Three Valleys Water Services Plc.	740	865	895	1247
	North Surrey WCo.	145	164	194	266
	East Surrey WCo.	120	141	164	244
	Mid Southern WCo.	219	310	285	403
	Sutton District WCo.	64	73	104	118
Welsh	Dwr Cymru	1145	1313	1260	1444
	Wrexham Water	43	67	52	77
	Chester Water	28	37	N/A	N/A
Wessex	Bournemouth & District WCo.	69	95	98	143
	Bristol Water	316	447	359	550
	Cholderton & District	0.6	1	0.8	1.25
	Wessex Water	425	529	515	688
	West Hants WCo.	50	63	83	110
Yorkshire	Yorkshire Water	1410	1526	1551	1679
	York Water Works Co.	47	61	54	70

England &  
Wales Total

17284

19617

#### 4. RELIABLE YIELDS AVAILABLE TO WATER UNDERTAKERS

Table 2 presents data on the reliable yield available to each water undertaker. Average reliable yield is given for all undertakers and peak yield is shown where the data is available and/or where it is relevant. Peak yield applies particularly to abstractions from groundwater which can be limited by the physical characteristics of the aquifer and boreholes.

Average reliable yields from existing resource developments generally relate to the continuous supply that could be obtained during a 'design' drought, regardless of whether there is sufficient capacity such as treatment and distribution, to effectively utilise the yield potential. However, yields from boreholes will generally relate to the yield available from the borehole, given the physical capacity of the aquifer and borehole to yield the water.

Further work is required to adequately define reliable yields, and in particular, taking into account the realistic operational capability to sustain output during drought periods.

**Table 2 Reliable Yields (Ml/d)**

NRA Region	Water Undertaker	Average reliable yield	Peak reliable yield
Anglian	Anglian Water Services Ltd	1500	1796
	Essex Water Co.	446	549
	Cambridge Water Co.	94	119
	Tendring Hundred W.W.Co.	42	50
	Suffolk Water Co.	86	107
Northumbria	Sunderland & Shields W.Flo	185	-
	Newcastle & Gateshead Plc	304	-
	Hartlepool W.Co.	59	-
	Northumbria Water	1546	-
North West	North West Region	2867*	N/A
Severn Trent	Severn Trent Water	2125	2345
	South Staffs Water Works	356	441
	E.Worce Water works Co.	73	76
Southern	Southern Water	759	934
	Mid Sussex Water Co.	98	125
	Portsmouth Water Co.	266	290
	Eastbourne Water Co.	70	80
	West Kent Water Co.	38	47
	Mid Kent Water Co.	167	192
	Folkestone Water Co.	57	62
South West	South West Water Ltd	797	798

\* Figures to be revised in 1991 to take into account changes in licences and operational constraints etc

NRA Region	Water Undertaker	Average reliable yield	Peak reliable yield
Thames	Thames Water Utilities Ltd	2658	N/A
	Three Valleys Water Services Plc	779	958
	North Surrey Water Co.	233	361
	East Surrey Water Co.	128	162
	Mid Southern Water Co.	260	330
	Sutton District Water Co.	67	91
Wales	Dwr Cymru	1405	N/A
	Wrexham Water	56	N/A
	Chester Water	34	N/A
Wessex	Bournemouth & District Water Co.	110	122
	Bristol Water	360	459
	Cholderton & District	0.77	1.25
	Wessex Water	510	631
	West Hants Water Co.	61	104
Yorkshire	Yorkshire Water	1500	1730
	York Water Works	96	96

England &  
Wales Total

20193

## 5. POSSIBLE WATER RESOURCE DEVELOPMENTS

Table 3 is a schedule of possible schemes which have been considered as options for meeting additional demands.

The schedule is not exhaustive and other options will be added when further investigations have been carried out, such as the review of strategic options currently being carried out by consultants for the NRA.

The schemes listed have not necessarily met with NRA approval and it is possible that some options will be rejected or modified because of environmental or cost considerations.

The reliable yields should be taken as preliminary and may be revised in the light of further investigations.

No inference on scheme priority should be made from the order in which the schemes are listed.

Table 3- Possible resource development options

NRA region	Possible development	Scheme type	Possible supply to:-	Estimated yield(ML/d)	Comments
Anglian	Lincolnshire Limestones	GD	Anglian Water	Up to 20	1
	Spilsby Sandstone	GD	Anglian Water	10	1
	Trent - Witham - Ancholme Scheme	River to river transfer	Anglian Water + Industry, Agriculture and river needs	Up to 500	
	W. Norfolk and Cambridgeshire Chalk Sandringham Sands	GA + GD GD	Anglian Water, Cambridge W.Co. Anglian Water	Up to 70 Up to 15	1
	Increased abstraction to Grafham	P	Anglian Water + Lee Valley W. Co.	Up to 60	Requires ELA
	E.Norfolk and Suffolk Crag and Chalk	GA+GD	Anglian Water Suffolk Water	100	1
	Enhancement to Ely Ouse - Essex system including provision of additional storage	Various	Essex W.Co. Tendring W.Co Anglian Water	250	Subject to various constraints
	Chelmsford and Witham effluents	Diversion of effluents to enhance pumped storage inputs	Essex W.Co.	Up to 40	Subject to quality considerations
Northumbria	Groundwater development in Fell Sandstones	GD	Newcastle and Gateshead W.Co.	2	
	Groundwater development in Magnesian limestone	GD	Hartlepool W.Co.	8-10	
North West	Cheshire boreholes	GD	North West Water	Not available	
	West Cumbria source	GD/SA			
	Haweswater raising	D/R/RA			
	Borrow Beck	R/RA			
	Morecambe Bay	P			
	Additional R. Dee take	RA			

Where D= Direct supply reservoir      GD= Direct groundwater abstraction      R= River augmentation  
P= Pumped storage etc      GA= Groundwater augmentation      RA= Direct river abstraction  
SD= Direct surface water abstraction      SA= Surface water augmentation

1. Only water undertakers have been listed against groundwater sources. In almost all cases industrial and agricultural demands compete for the same resource.

Possible resource development options (continued)

NRA region	Possible development	Scheme type	Possible supply to:-	Estimated yield (ML/d)	Comments
Severn Trent	Direct abstraction from river gravels Upper Severn	GD	Severn Trent Water Limited Montgomery area	c.10	To partially replace yield from existing sources
	Carsington Reservoir, river augmentation scheme	R/RA	Severn Trent Water Limited, East Midlands area	225	
	Local groundwater developments in Shropshire, Staffordshire, Coventry and Nottinghamshire	GD	Severn Trent Water Limited	Total yield up to approx. 50	
	Direct abstraction from R.Severn supported by further development of NRA Shropshire Groundwater Scheme	R/RA	Severn Trent Water LTD Increase in licensed quantities at existing R.Severn intakes	c.60	
	Direct abstraction from R.Severn supported by further development of NRA Shropshire Groundwater Scheme	R/RA	South Staffs Waterworks Co., Hampton Loade intake - possible increase in licensed quantity	15	
	Direct abstraction from R.Severn supported by further development of NRA Shropshire Groundwater Scheme	R/RA	E.Worcs Waterworks Co. New intake at Ombersley nr Worcester	24	
	Direct abstraction from River Trent	RA	South Staffs Waterworks Co.	15	
	Local groundwater developments	GD	South Staffs Waterworks Co.	< 30	
	Local groundwater developments	GD	East Worcs Waterworks Co.	< 10	
South West	Axe Scheme	P + SD	South West Water Services	27.5	undergoing serious investigation
	Wimbleball pumped storage development	D,P&R	South West Water Services	N/A	
	Further development associated with Roadford Scheme: Rivers Taw, Torridge and Dart	RA	South West Water services	N/A	Undergoing investigation

Where D= Direct supply reservoir      GD= Direct groundwater abstraction      R= River augmentation  
P= Pumped storage etc                      GA= Groundwater augmentation      RA= Direct river abstraction  
SD= Direct surface water abstraction      SA= Surface water augmentation

Possible resource development options (continued)

NRA Region	Possible development	Scheme type	Possible supply to:-	Estimated yield (ML/d)	Comments
Southern	Test groundwater	GA	Southern Water Hampshire Div.	20-30appx.	-requires NRA investigation
	Yalding intake	P	Southern Water Kent Div., Mid Kent W.Co.	19-27	
	Crowhurst bridge	GA	Eastbourne W.Co.	4	
	Boreholes various	GD	Mid Kent W.Co.	12 approx.	-Sites distributed across N&E Kent
	Hardham	GD	Southern Water Sussex Div.		-Conjunctive use scheme
	Broad Oak reservoir	DP	Mid Kent W.Co, Southern water Folkestone Water	94	-Licence application expected
	Darwell reservoir enlargement	DP	Eastbourne water, Southern Water Mid Sussex W.Co.	40 approx.	-Licence expected
	Arle groundwater	GA	Southern Water Hampshire Div. Portsmouth W.Co.	25	-NRA scheme 75% complete
	Chillerton Reservoir	D	Southern Water, Isle of Wight Div	8	
	Test reservoir	P		<5	-Mainly for security of supply
	Slindon/Easthampnet	GD	Southern Water, Hampshire Div.	Up to 16	
	Gaters Mill	SD	Portsmouth Water Co. Portsmouth Water Co.	22.	

Where D= Direct supply reservoir  
P= Pumped storage etc  
SD= Direct surface water abstraction

GD= Direct groundwater abstraction  
GA= Groundwater augmentation  
SA= Surface water augmentation

R= River augmentation  
RA= Direct river abstraction

Possible resource development options (continued)

NRA region	Possible development	Scheme type	Possible supply to:-	Estimated yield (ML/D)	Comments
Thames	Artificial recharge schemes (London)	GA/GD	TWUL - London	180	
	Rising groundwater levels (London)	GD	TWUL - London	10-30	
	Potential major new reservoir	R/D	TWUL - Oxford/ Swindon/ London	200-300	
	Groundwater development (Gatshampton, Oxon)	GD	TWUL - Oxford/ Swindon	55	
	Redevelopment of existing reservoirs		TWUL	150	
	Various local g/w developments		TWUL	140-150	
	Review of Iver (Thames) licences conditions		Three Valleys WSPic.	additional 63	
	Development of pumped storage for peak demands		Three Valleys WSPic.	91	
	Various local groundwater developments	GD	Three Valleys WSPic, NSWC, MSWC, ESWC, SDPic		
	Increase volume and reliability of TWU Bulk Transfer		Three Valleys WSPLc.		
	Possible bulk supply arrangements		Three Valleys WSPic, MSWC, NSWC, SDPic	MSWC - 14	
	Review of Bray (Thames) licence conditions		Mid Southern W.Co.		
	Review Bough Beech licence conditions		E.Surrey W.Co.		
Additional abstractions at Leatherhead		E.Surrey W.Co.			

Where D= Direct supply reservoir  
P= Pumped storage etc  
SD= Direct surface water abstraction

GD= Direct groundwater abstraction  
GA= Groundwater augmentation  
SA= Surface water augmentation

R= River augmentation  
RA= Direct river abstraction

Possible resource development options (continued)

NRA region	Possible development	Scheme type	Possible supply to:-	Estimated yield(ML/d)	Comments
Welsh/ Severn Trent	Enhancement of local supplies in Herefordshire and Radnorshire	GD/RS/RU	Local communities in Herefordshire and Radnor	5 - 20	
Welsh	Local supplies in Dyfed. Supplies for Pembrokeshire	GD/D/R	Dyfed. S.W.Dyfed	5 - 10 2 - 30	
	Supplies for Clwyd.	GA/RS	Clwyd.	5 - 10	
	Local sources in Meirionnydd	GD/RU	Corris Penrhyndeudraeth Dinas Mawddwy	5 - 20	
	Local sources in Gwynedd	GD/RU	Local communities in Gwynedd.	5 - 10	
Wessex	Cholderton Groundwater	GD	Cholderton	< 1	Yield for Wessex
	Bankside storage	P	Bournemouth	53	
	Bankside storage	P	West Hants	6	
	Wimbleball	P	Wessex/ South West	16	
	Blashford Lakes	P	Wessex	20	
	River Avon at Bath	P	Bristol Water	55	
	Gloucester/ Sharpness canal Supported by further development of NRA Shropshire Groundwater Scheme	SD	Bristol Water	55 phase I 55 phase II	
Yorkshire	Vale of York Groundwater Scheme	GA	Yorkshire Water	76 (phases 1&2) 200 (ultimately)	Developed by NRA to support increased abstraction from R.Ouse
	Local boreholes in North Yorks	GD	Yorkshire Water	20	

Where D= Direct supply reservoir  
P= Pumped storage etc  
SD= Direct surface water abstraction

GD= Direct groundwater abstraction  
GA= Groundwater augmentation  
SA= Surface water augmentation

R= River augmentation  
RA= Direct river abstraction  
RS= Supported river abstraction

## **6. COMPARISON OF WATER UNDERTAKERS' DEMANDS AND RESOURCES**

### **6.1 Existing resources compared with existing and future demands.**

Figures 3.1 to 3.37 show the existing resources available to each water undertaker and also the present and future estimates of demand. For presentation purposes it has been assumed that there is a linear relationship between demands in years 1990 and 2011. (Reservations relating to the resources and demands values are given in Sections 3 and 4 respectively.)

Where resources exceed demand it does not necessarily imply that satisfactory levels of service for raw water availability are being met throughout the whole of the undertaker's area and it is the capacity available for distributing the available resource that will determine the reliability for the whole of the undertaker's operation. The Office of Water Services has published information relating to the levels of service for each water undertaker and Figures 3.1 to 3.37 and footnotes show the percentage of the population supplied by the undertaker during 1989/90 which received an inadequate supply reliability due to raw water availability. (Reference 2)

### **6.2 Comparisons between present and future water demands and present resources plus future resource options**

Figures 4.1 to 4.10 combine the information contained in Tables 1, 2 and 3 to present a comparison between water undertakers' demands and resources on a regional basis.

In making interpretations from the figures it should not be inferred that the schemes listed will necessarily be developed in the order given or indeed that all options will be developed.

### 6.3 **Climate Change**

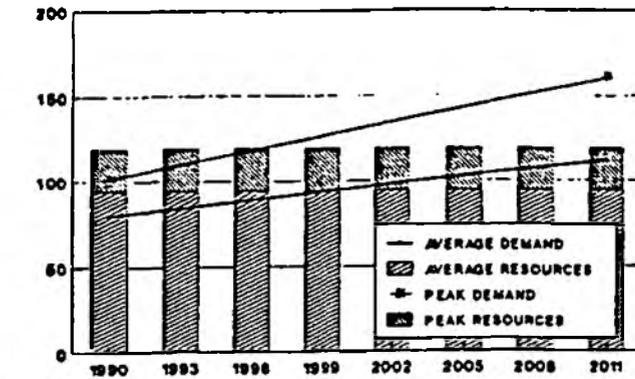
The impact of climate change on the water resources of England and Wales is presently under review by a number of organisations. Whilst it would be premature to prepare detailed plans for the effects at this stage, it is worth noting the main conclusions which have recently been published in the first report by the UK Climate Change Impacts Review Group. The Group have concluded that the wetter winters which they expect to occur, would benefit water resources in general, but the warmer summers with longer growing seasons and increased evaporation would lead to greater pressures on water resources, especially in the south and east of the U.K. Increased variability in rainfall, even in a slightly wetter climate, could lead to more droughts in any region of the U.K. The extent to which resources will need to be developed in response to such future droughts cannot properly be determined at this stage of current research. (Reference 3).

**FIGURES 3.1 - 3.37**

**RESOURCES 1990 AND DEMANDS 1990 - 2011**

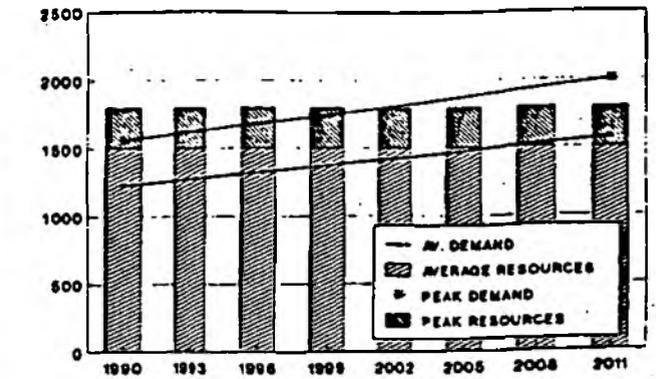
**SHOWN BY WATER UNDERTAKER**

**FIG 3.1 CAMBRIDGE WATER COMPANY**  
(NRA ANGLIAN REGION)



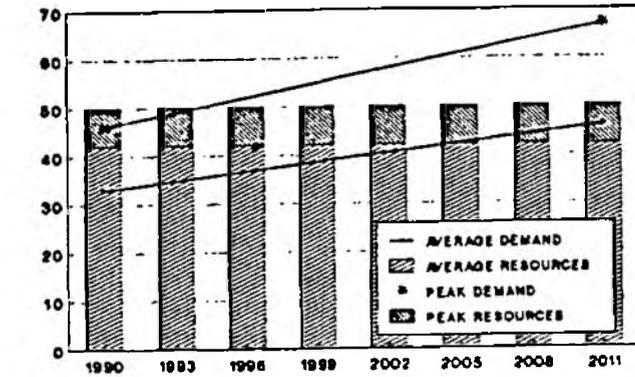
UNITS-ML/D  
% OF POPULATION WITH DEFICIENT RAW WATER  
AVAILABILITY - 0

**FIG 3.2 ANGLIAN WATER SERVICES**  
(NRA ANGLIAN REGION)



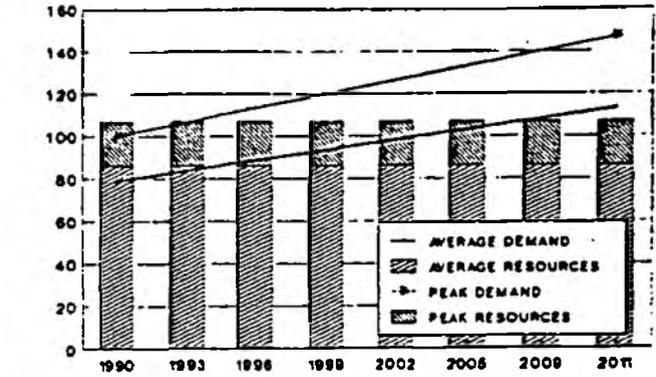
UNITS ML/D  
% OF POPULATION WITH DEFICIENT RAW WATER  
AVAILABILITY - 0

**FIG 3.3 TENDRING HUNDRED WATER WORKS**  
(NRA ANGLIAN REGION)



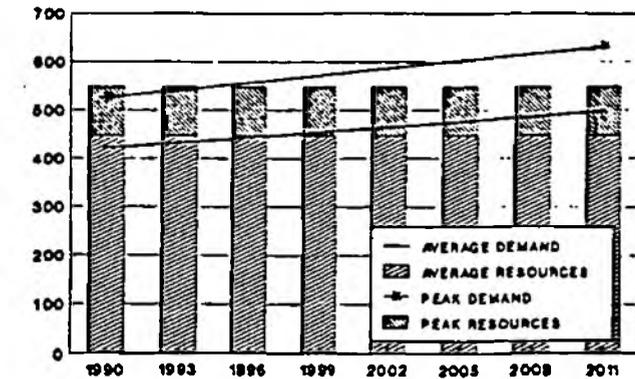
UNITS-ML/D  
% OF POPULATION WITH DEFICIENT RAW WATER  
AVAILABILITY - 0

**FIG 3.4 SUFFOLK WATER COMPANY**  
(NRA ANGLIAN REGION)



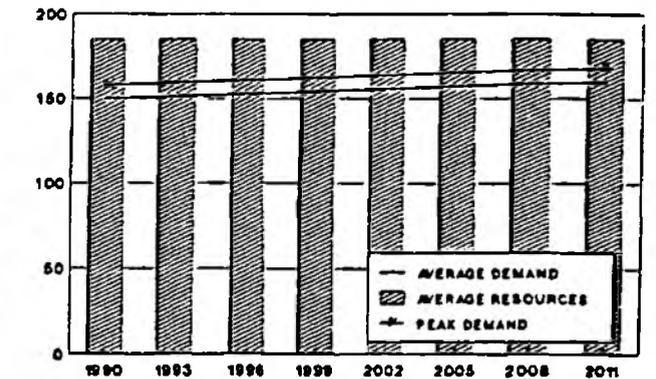
UNITS-ML/D  
% OF POPULATION WITH DEFICIENT RAW WATER  
AVAILABILITY - 19

**FIG 3.5 ESSEX WATER COMPANY.**  
(NRA ANGLIAN REGION)



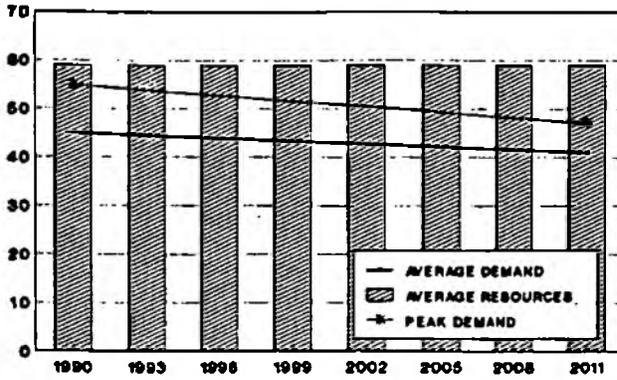
UNITS-ML/D  
% OF POPULATION WITH DEFICIENT RAW WATER  
AVAILABILITY - 0

**FIG 3.6 SUNDERLAND & S.SHIELDS WATER PLC**  
(NRA NORTHUMBRIA REGION)



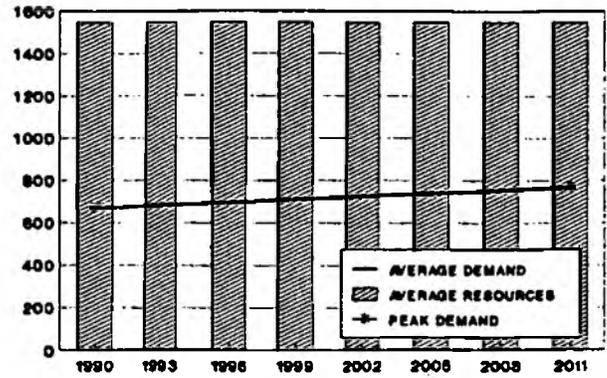
UNITS-ML/D  
% OF POPULATION WITH DEFICIENT RAW WATER  
AVAILABILITY - 0.0

**FIG 3.7 HARTLEPOOLS WATER COMPANY**  
(NRA NORTHUMBRIA REGION)



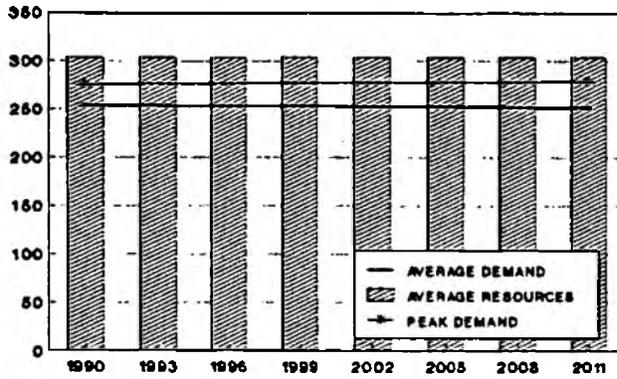
UNITS-ML/D  
% OF POPULATION WITH DEFICIENT RAW WATER  
AVAILABILITY - 0.0

**FIG 3.8 NORTHUMBRIAN WATER**  
(NRA NORTHUMBRIA REGION)



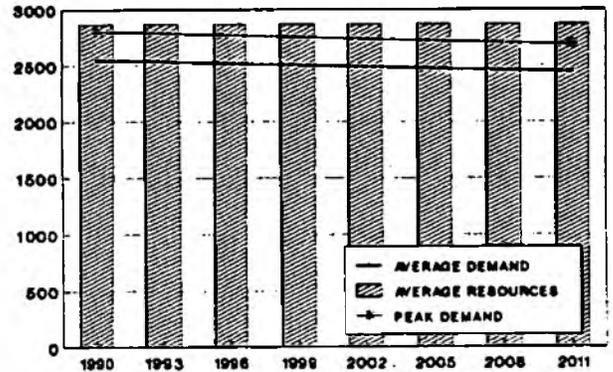
UNITS-ML/D  
% OF POPULATION WITH DEFICIENT RAW WATER  
AVAILABILITY - 0.0

**FIG 3.9 NEWCASTLE AND GATESHEAD PLC**  
(NRA NORTHUMBRIA REGION)



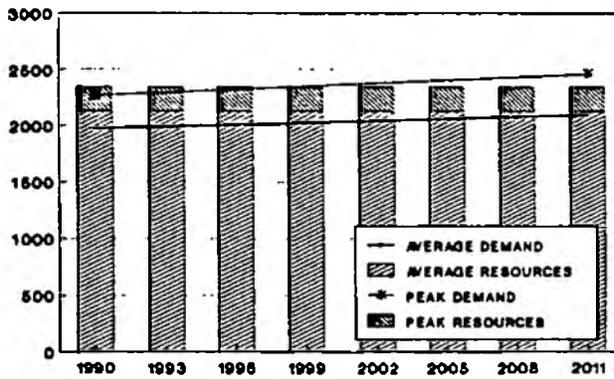
UNITS-ML/D  
% OF POPULATION WITH DEFICIENT RAW WATER  
AVAILABILITY - 3.2

**FIG 3.10 NORTH WEST WATER**  
(DEMAND FIGURES TO BE REVISED IN 1991)



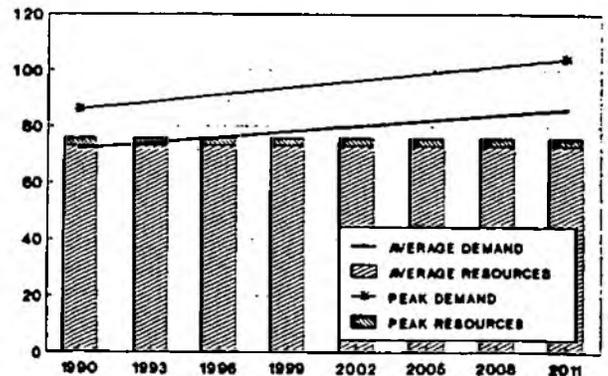
UNITS-ML/D  
% OF POPULATION WITH DEFICIENT RAW WATER  
AVAILABILITY - 0

**FIG 3.11 SEVERN TRENT WATER LIMITED**  
(NRA SEVERN TRENT REGION)



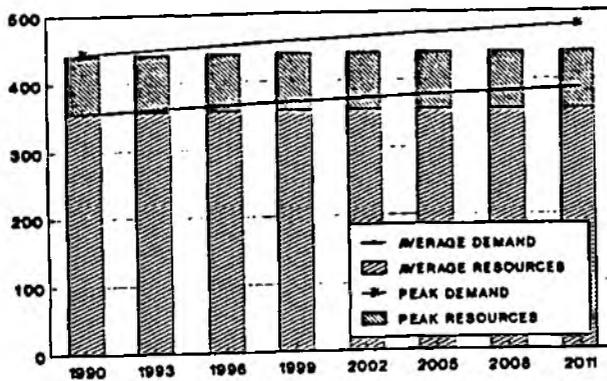
UNITS-ML/D  
% OF POPULATION WITH DEFICIENT RAW WATER  
AVAILABILITY - 4.0

**FIG 3.12 EAST WORCS WATER WORKS**  
(NRA SEVERN TRENT REGION)



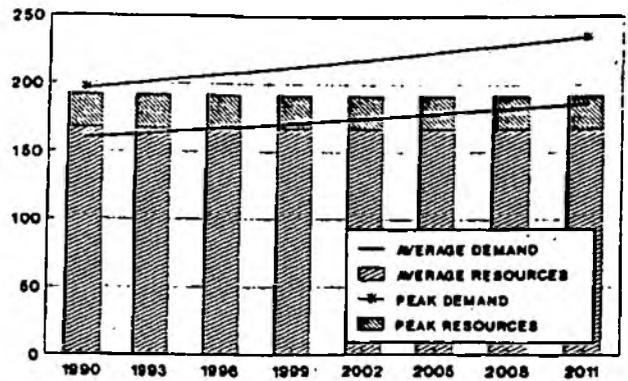
UNITS-ML/D  
% OF POPULATION WITH DEFICIENT RAW WATER  
AVAILABILITY - 0

**FIG 3.13 SOUTH STAFFS WATER WORKS**  
(NRA SEVERN TRENT REGION)



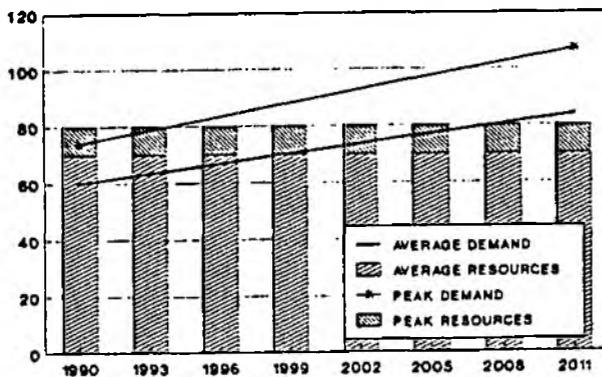
UNITS-ML/D  
% OF POPULATION WITH DEFICIENT RAW WATER  
AVAILABILITY = 0

**FIG 3.14 MID KENT WATER COMPANY**  
(NRA SOUTHERN REGION)



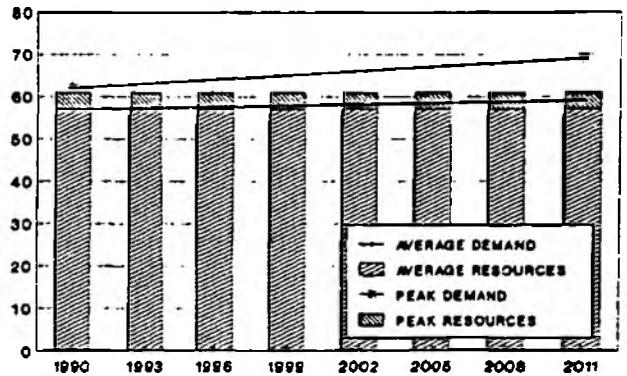
UNITS-ML/D  
% OF POPULATION WITH DEFICIENT RAW WATER  
AVAILABILITY = 0

**FIG 3.15 EASTBOURNE WATER COMPANY**  
(NRA SOUTHERN REGION)



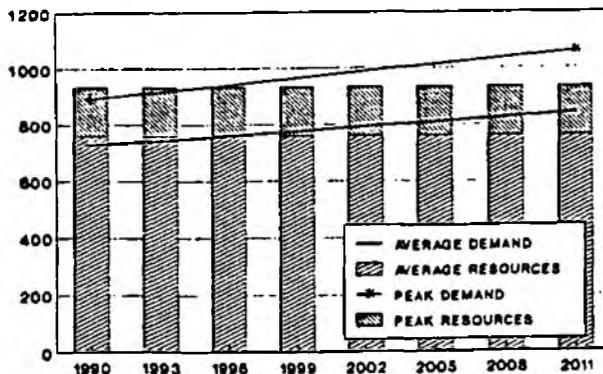
UNITS-ML/D  
% OF POPULATION WITH DEFICIENT RAW WATER  
AVAILABILITY = 0

**FIG 3.16 FOLKESTONE WATER COMPANY**  
(NRA SOUTHERN REGION)



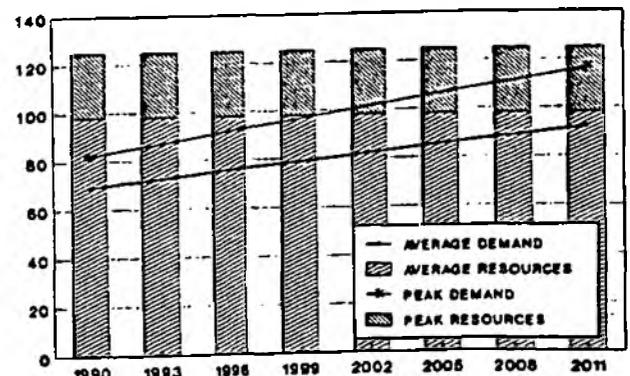
UNITS-ML/D  
% OF POPULATION WITH DEFICIENT RAW WATER  
AVAILABILITY = 100

**FIG 3.17 SOUTHERN WATER**  
(NRA SOUTHERN REGION)



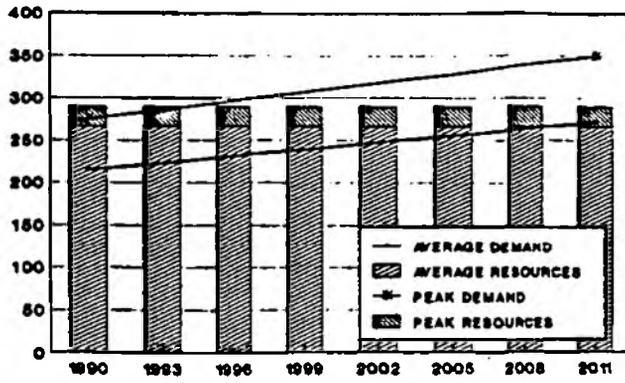
UNITS-ML/D  
% OF POPULATION WITH DEFICIENT RAW WATER  
AVAILABILITY = 31.2

**FIG 3.18 MID SUSSEX WATER COMPANY**  
(NRA SOUTHERN REGION)



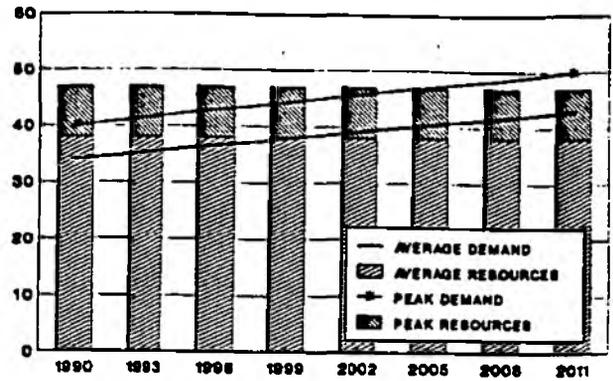
UNITS-ML/D  
% OF POPULATION WITH DEFICIENT RAW WATER  
AVAILABILITY = 0.6

**FIG 3.19 PORTSMOUTH WATER COMPANY**  
(NRA SOUTHERN REGION)



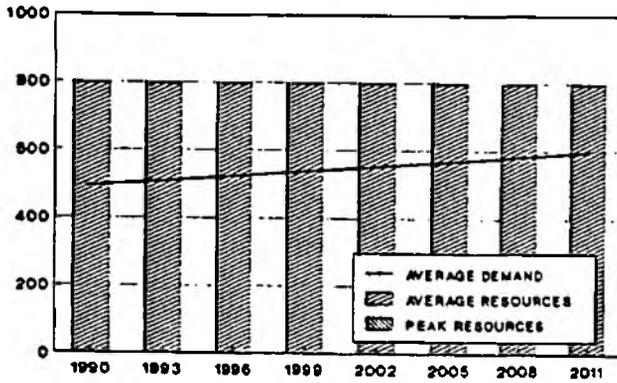
UNITS-ML/D  
% OF POPULATION WITH DEFICIENT RAW WATER  
AVAILABILITY - 0

**FIG 3.20 WEST KENT WATER COMPANY**  
(NRA SOUTHERN REGION)



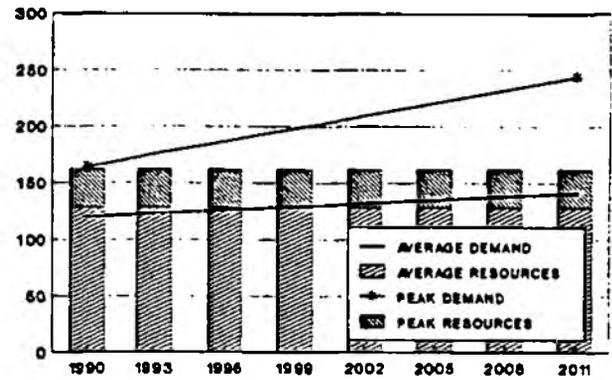
UNITS-ML/D  
% OF POPULATION WITH DEFICIENT RAW WATER  
AVAILABILITY - 0

**FIG 3.21 SOUTH WEST WATER**  
(NRA SOUTH WEST REGION)



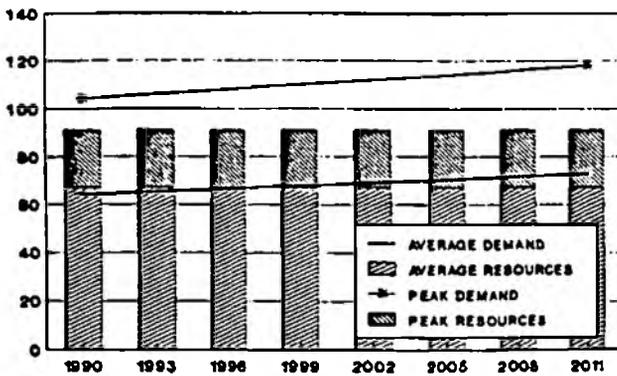
UNITS-ML/D  
% OF POPULATION WITH DEFICIENT RAW WATER  
AVAILABILITY - 3.2

**FIG 3.22 EAST SURREY WATER COMPANY**  
(NRA THAMES REGION)



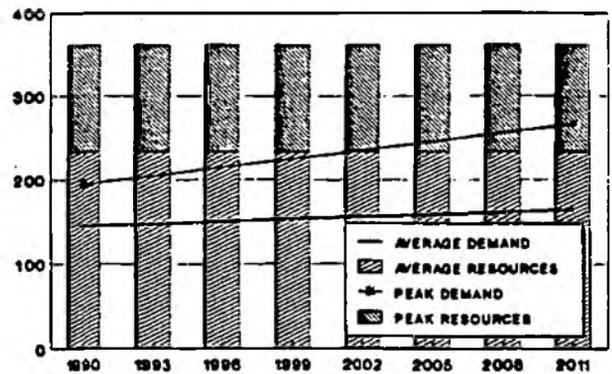
UNITS-ML/D  
% OF POPULATION WITH DEFICIENT RAW WATER  
AVAILABILITY - 0

**FIG 3.23 SUTTON DISTRICT WATER COMPANY**  
(NRA THAMES REGION)



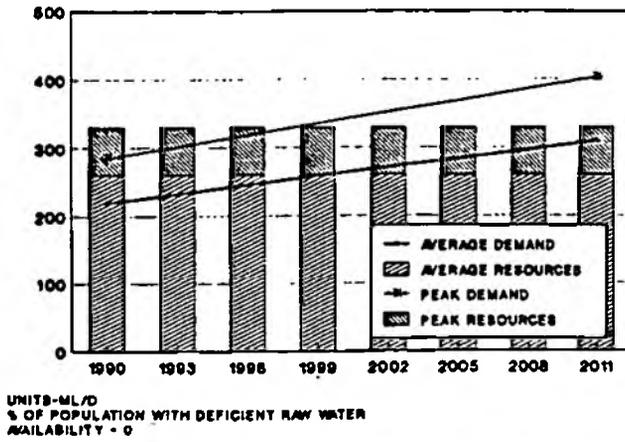
UNITS-ML/D  
% OF POPULATION WITH DEFICIENT RAW WATER  
AVAILABILITY - 16.9

**FIG 3.24 NORTH SURREY WATER COMPANY**  
(NRA THAMES REGION)

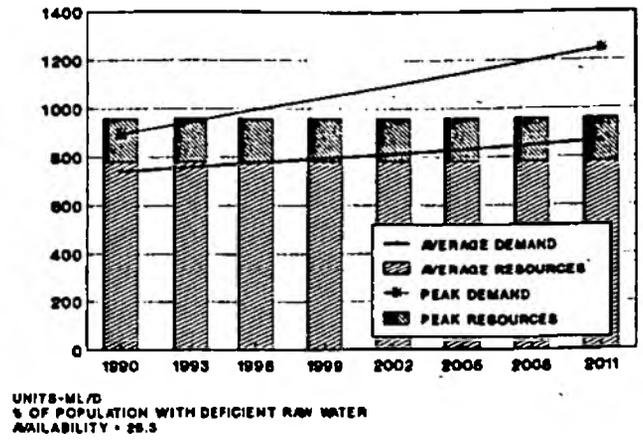


UNITS-ML/D  
% OF POPULATION WITH DEFICIENT RAW WATER  
AVAILABILITY - 10.8

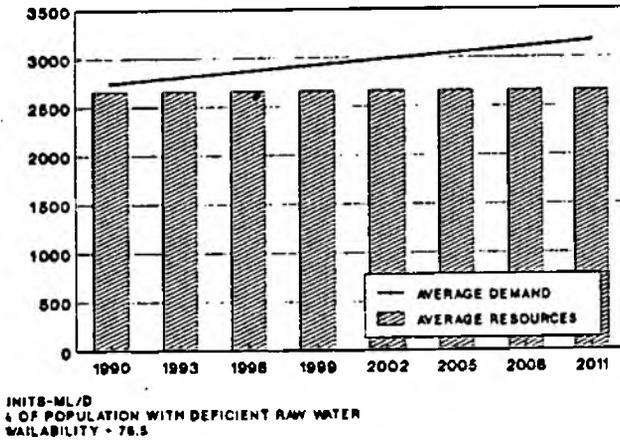
**FIG 3.25 MID SOUTHERN WATER COMPANY**  
(NRA THAMES REGION)



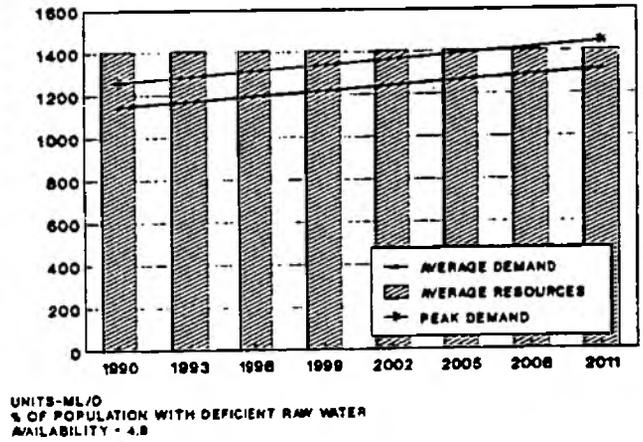
**FIG3.26 THREE VALLEYS WATER SERVICES PLC**  
(NRA THAMES AND ANGLIAN REGIONS)



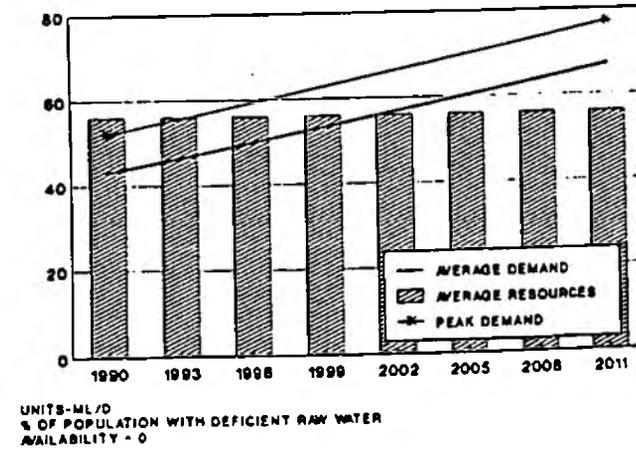
**FIG 3.27 THAMES WATER UTILITIES**  
(NRA THAMES REGION)



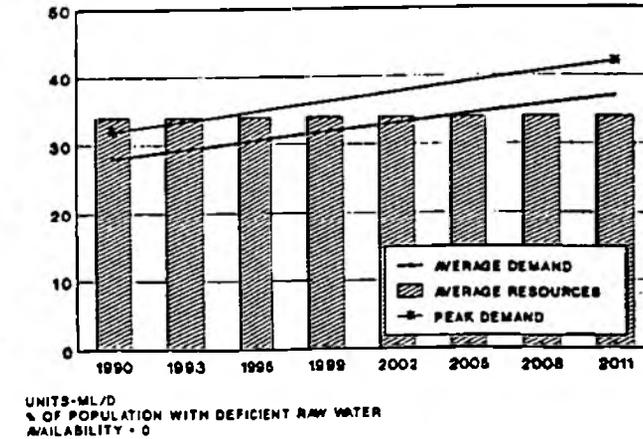
**FIG 3.28 DWR CYMRU**  
(NRA WELSH REGION)



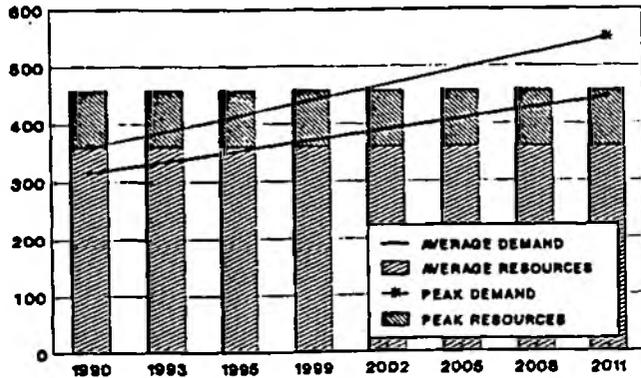
**FIG 3.29 WREXHAM WATER**  
(NRA WELSH REGION)



**FIG 3.30 CHESTER WATER COMPANY**  
(NRA WELSH REGION)

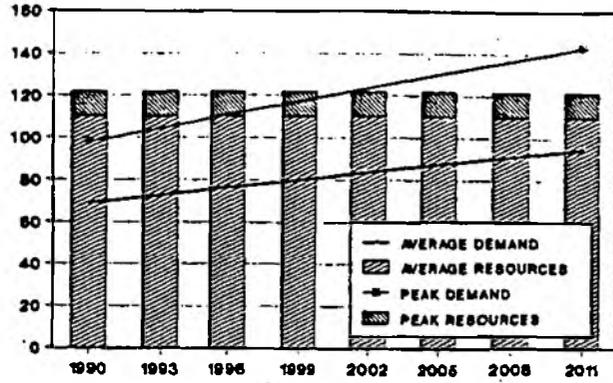


**FIG 3.31 BRISTOL WATER**  
(NRA WESSEX REGION)



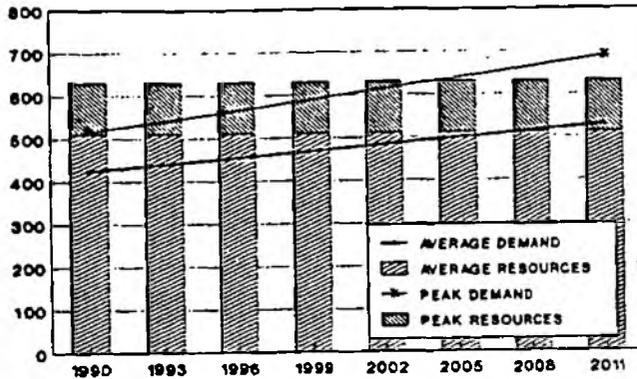
UNITS-ML/D  
% OF POPULATION WITH DEFICIENT RAW WATER  
AVAILABILITY - 0

**FIG 3.32 BOURNEMOUTH & DISTRICT WATER CO**  
(NRA WESSEX REGION)



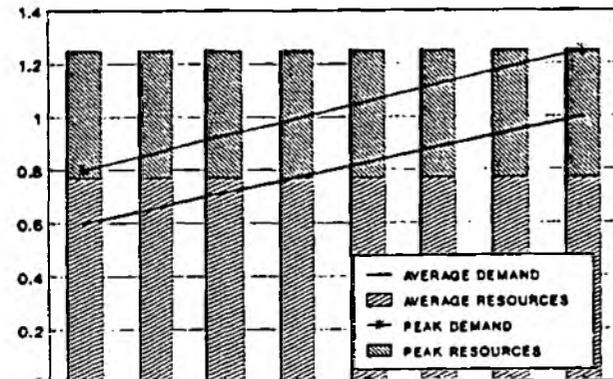
UNITS-ML/D  
% OF POPULATION WITH DEFICIENT RAW WATER  
AVAILABILITY - 0

**FIG 3.33 WESSEX WATER**  
(NRA WESSEX REGION)



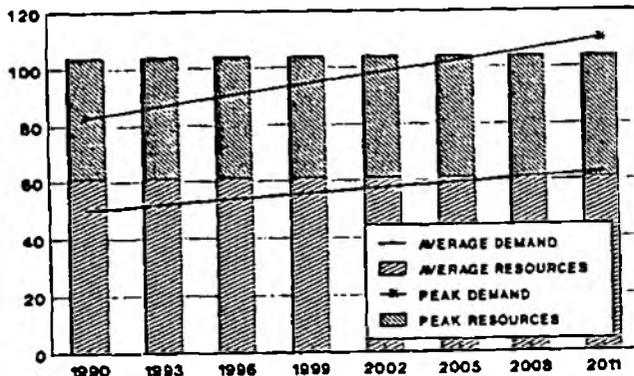
UNITS-ML/D  
% OF POPULATION WITH DEFICIENT RAW WATER  
AVAILABILITY - 18

**FIG 3.34 CHOLDERTON & DISTRICT WATER CO**  
(NRA WESSEX REGION)



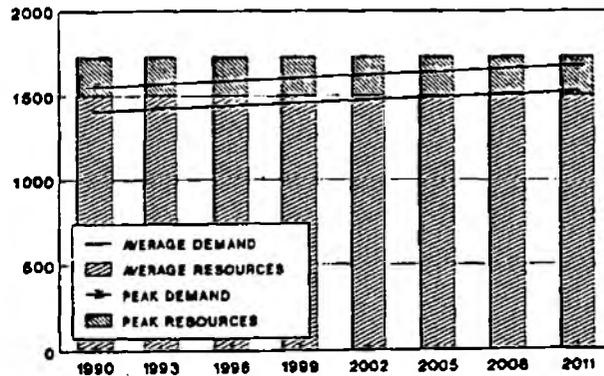
UNITS-ML/D

**FIG 3.35 WEST HANTS**  
(NRA WESSEX REGION)



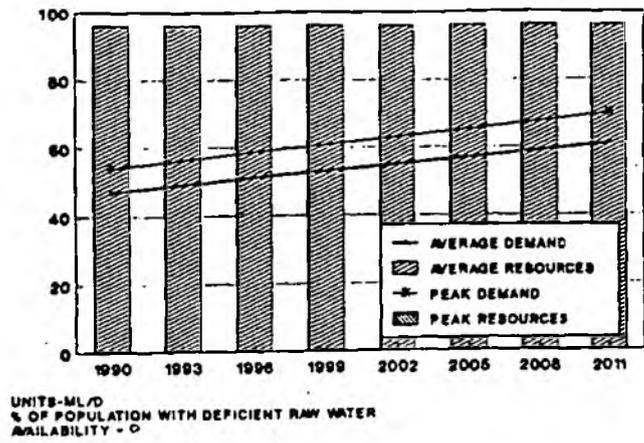
UNITS-ML/D  
% OF POPULATION WITH DEFICIENT RAW WATER  
AVAILABILITY - 0

**FIG 3.36 YORKSHIRE WATER**  
(NRA YORKSHIRE REGION)



UNITS-ML/D  
% OF POPULATION WITH DEFICIENT RAW WATER  
AVAILABILITY - 16

FIG 3.37 YORK WATERWORKS CO  
(NRA YORKSHIRE REGION)



**FIGURES 4.1 - 4.10**

**ACTUAL AND PROSPECTIVE DEMANDS IN RELATION TO ACTUAL**

**RESOURCES AND POSSIBLE DEVELOPMENTS**

**SHOWN BY NRA REGION**

FIG 4.1 ANGLIAN REGION

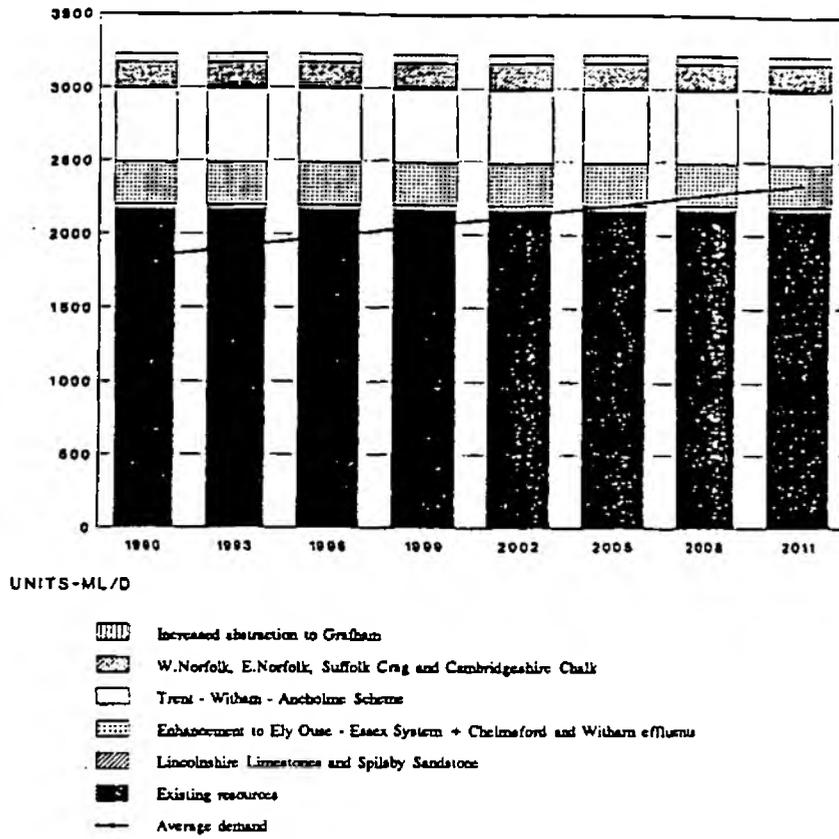


FIG 4.2 NORTHUMBRIA REGION

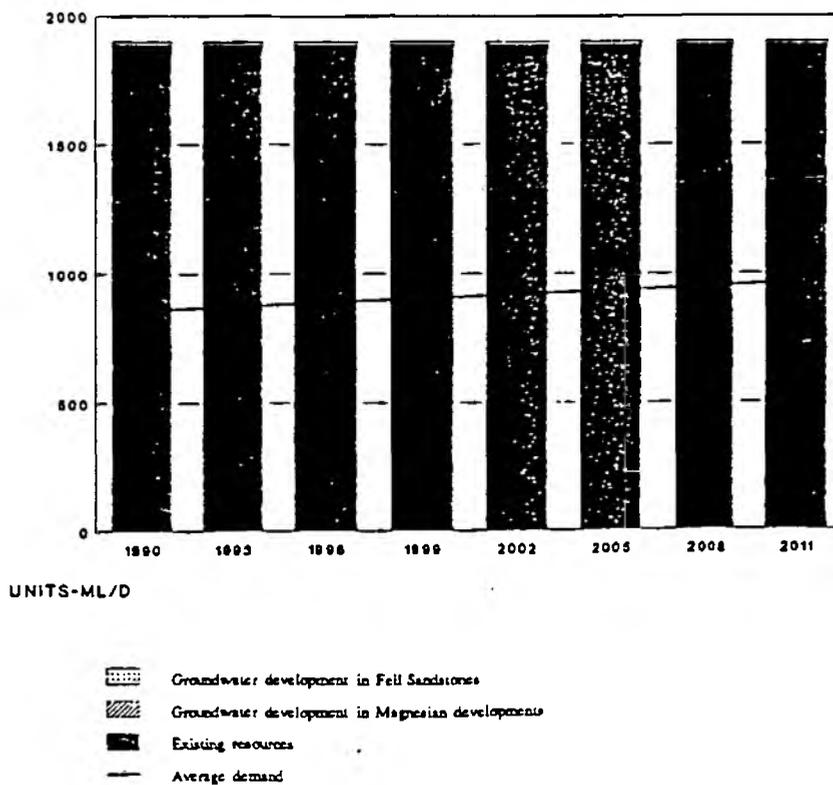


FIG 4.3 NORTH WEST REGION  
(NO RESOURCE DEVELOPMENT PLANNED)

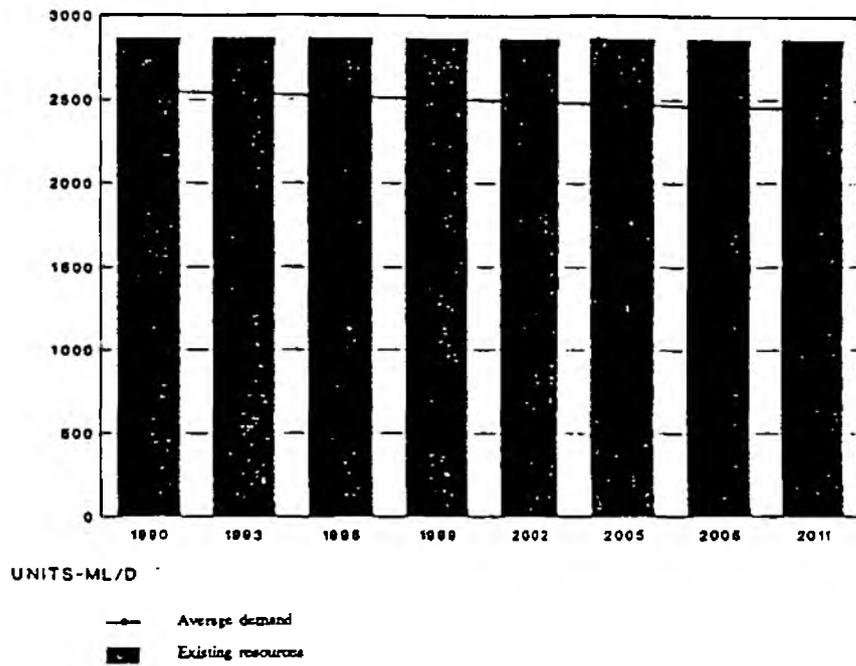


FIG 4.4 SEVERN TRENT REGION

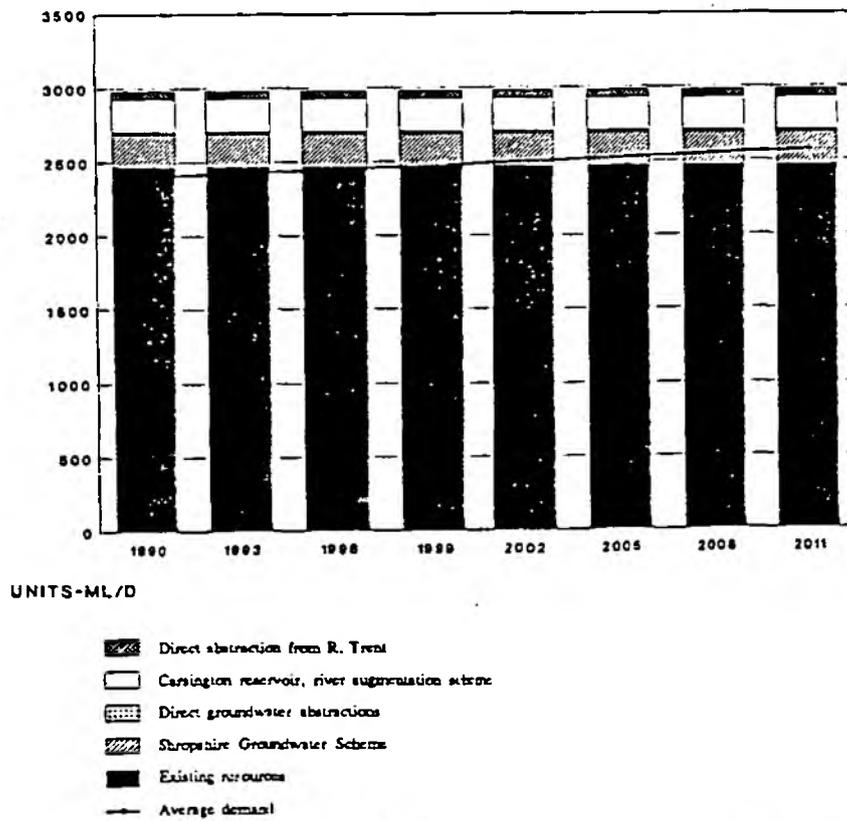


FIG 4.5 SOUTHERN REGION

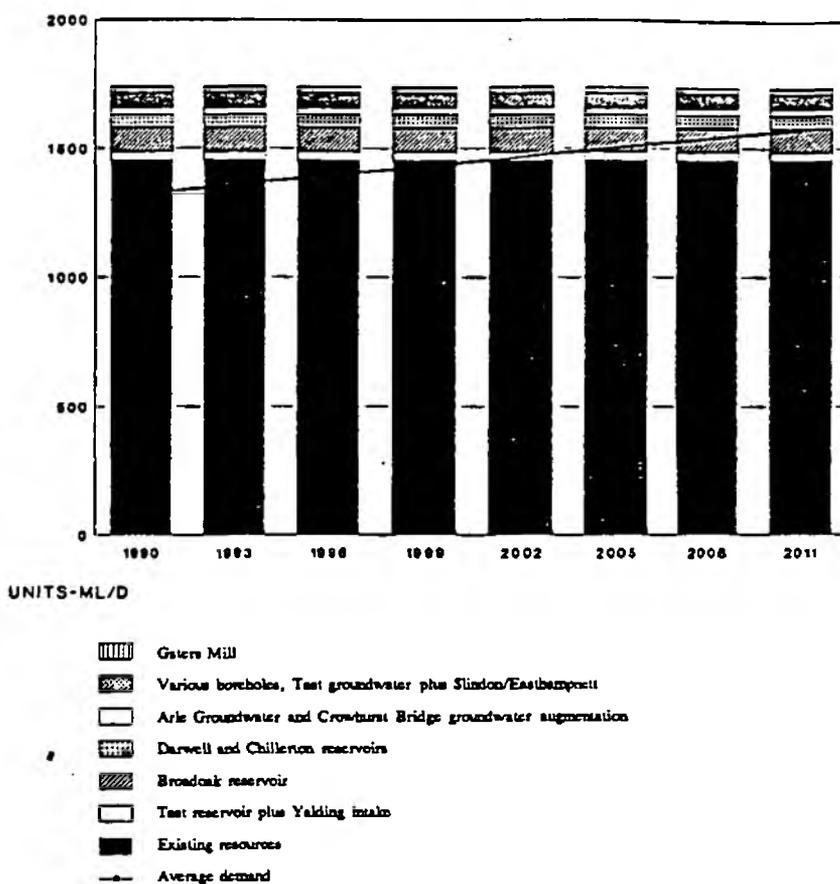


FIG 4.6 SOUTH WEST REGION

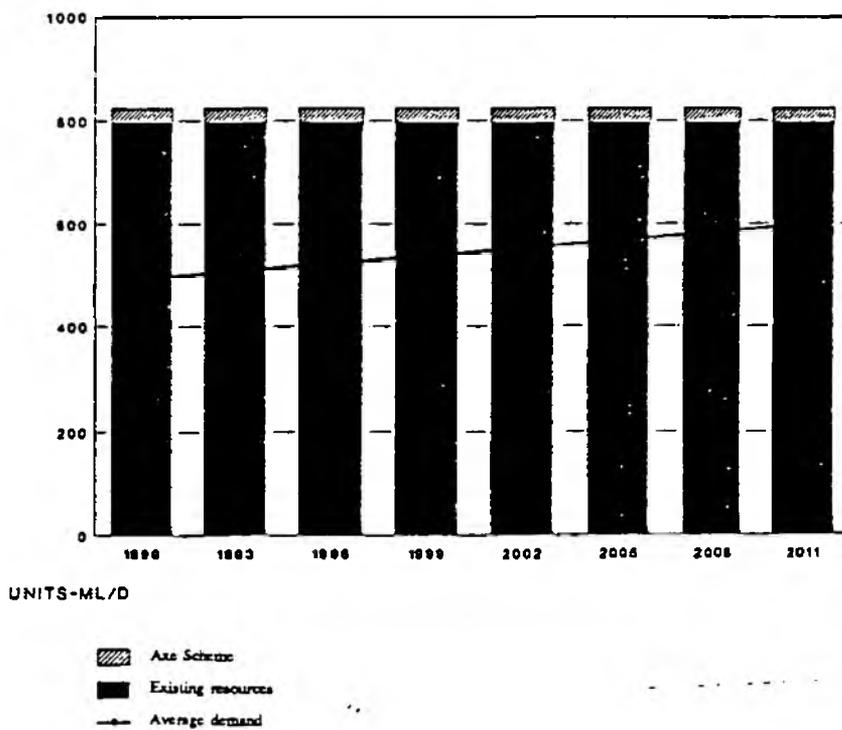


FIG 4.7 THAMES REGION

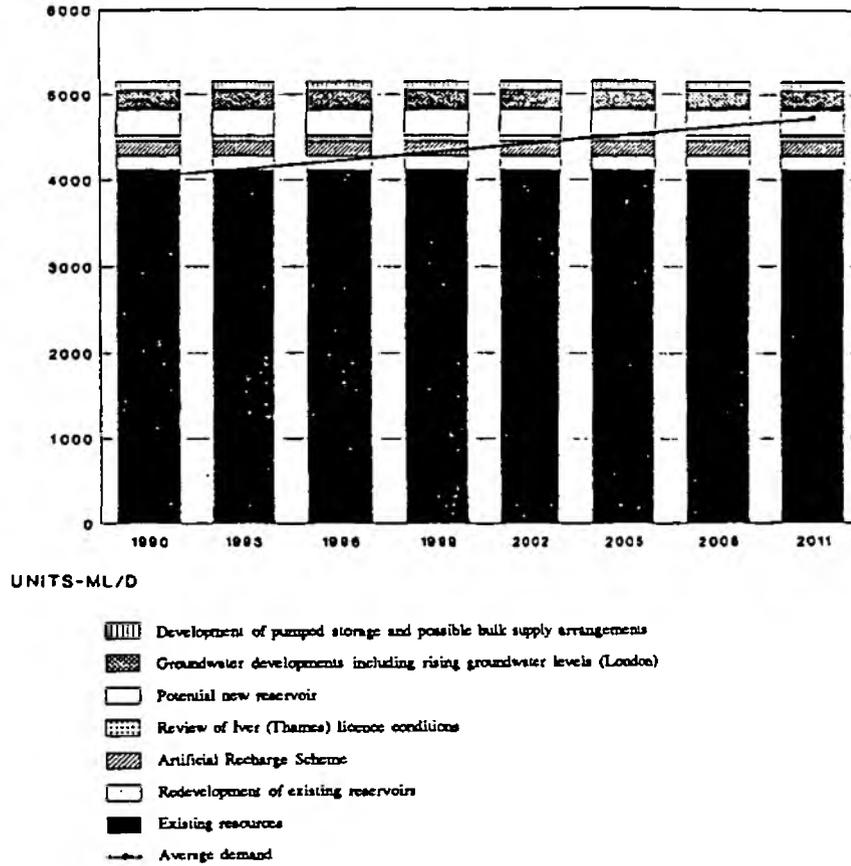


FIG 4.8 WELSH REGION

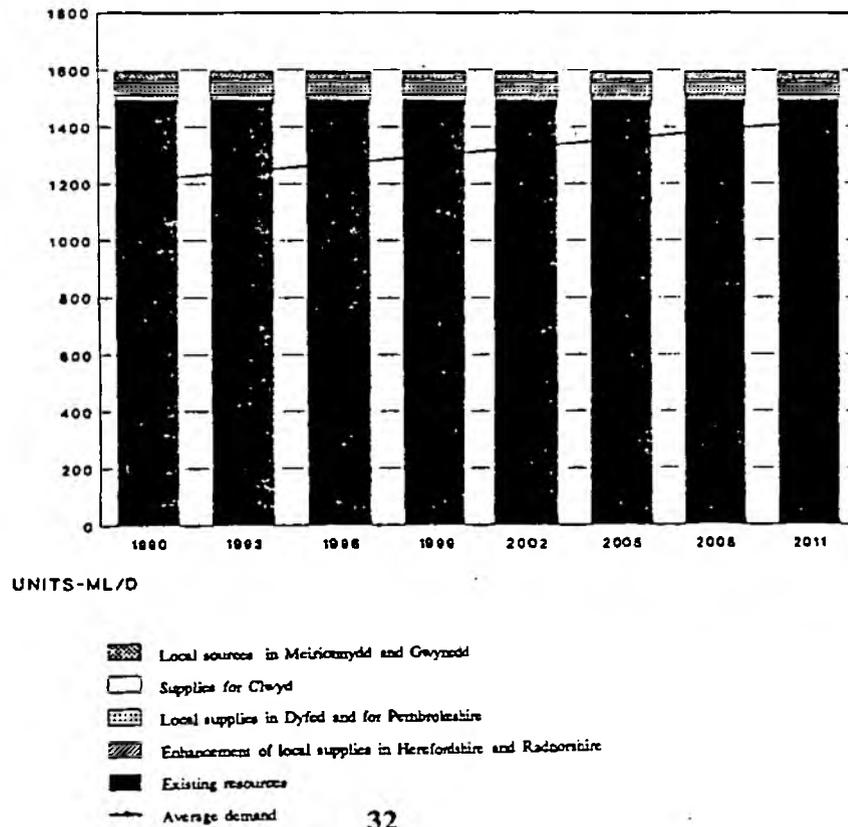


FIG 4.9 WESSEX REGION

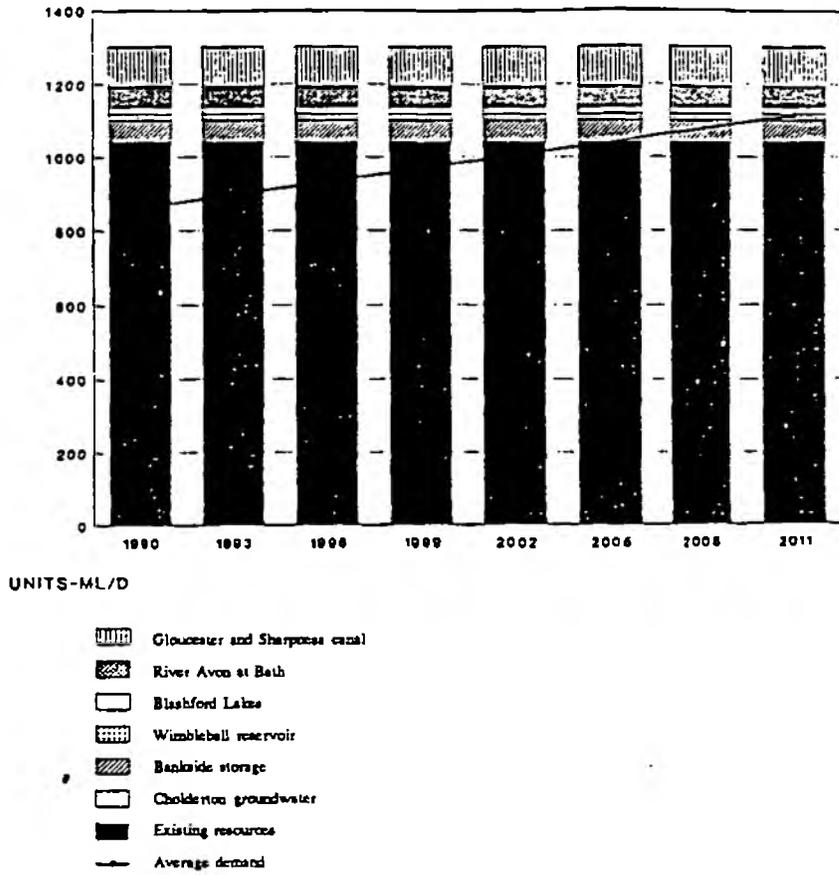
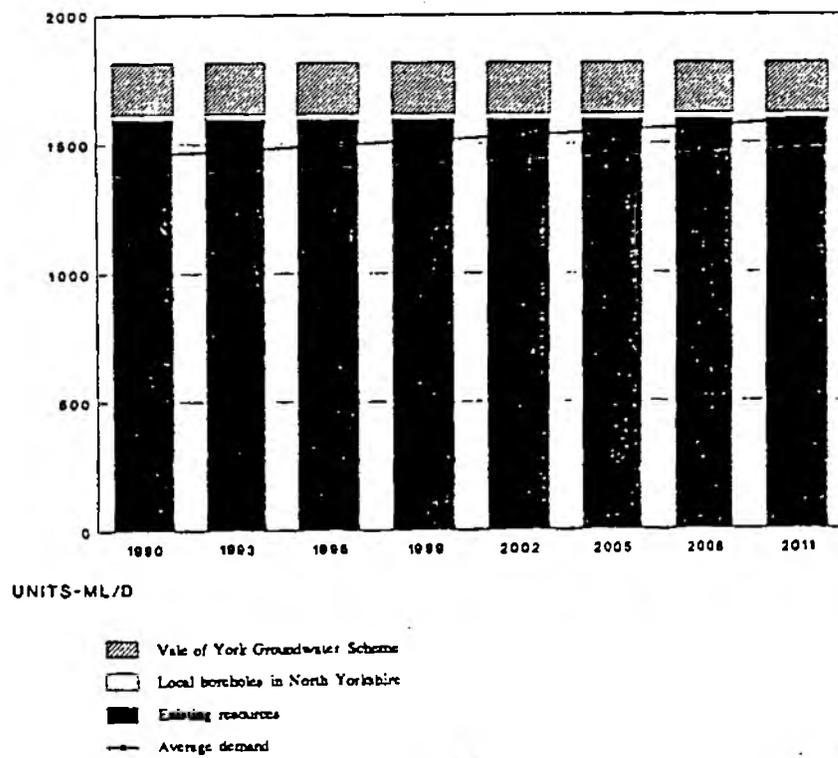


FIG 4.10 YORKSHIRE REGION



## 7. COMMENTARY

The information presented in this report is of a preliminary nature and an emphasis has been placed throughout on the limitations of the data and the conclusions which can be drawn. The assessment of existing and potential resources and demands requires consideration of many factors, including:-

- impact of water resource development upon the environment and other users such as agriculture and industry
- evaluation of the reliability of resources and resource systems, including definition of reliability criteria and the operational performance of resource/supply systems during droughts
- assumptions on per-capita consumption, population, non-domestic demands and leakage levels
- examination of the way in which water is abstracted and returned to the water environment and the potential for re-use of water resources.

A considerable amount of further work will be required to draw together consistent information on demands and resources for England and Wales as a whole.

Much of this work forms part of an ongoing NRA activity in evaluating particular resource development options and a separate study is underway to quantify broad strategic resource development options for England and Wales, which when considered with local options, will lead to the development of a national strategy for water resources development.

Despite the limitation of the information presented in this report there is an indication

that most water supply undertakers, taken as a whole, appear to have sufficient existing resources to meet existing demands. It is probably not cost effective for water resources developments to meet unrestricted demands during all droughts and the experiences during the dry years of 1989 and 1990 have demonstrated that demands on resources need to be reduced when severe dry periods occur.

Presentation of information on a water undertaker basis does not necessarily mean that all customers receive the same level of service for raw water availability. There are some undertakers' areas which contain supply areas, where demands are greater than the available resources even though, taken as a whole, the undertaking has a surplus of resources. This may be because treatment or distribution capacity needs to be improved or it may be necessary to increase resources because it is not economically feasible to transfer spare water to areas of deficit.

Information on potential resource developments is a first attempt to portray the types and scale of resource developments under consideration in England and Wales. They are not exhaustive, nor prioritised and will be updated and augmented in future reports.

The impact of climate change on water resources is clearly a major concern for the future, both in terms of its effect on resource availability and in terms of the effect on demand. The present level of research is however only sufficient to make generalised statements on the broad effects which seem likely. This is clearly an important area of research which the NRA is both funding directly and collaborating with others, with the aim of making more quantified assessments.

## REFERENCES

1. Water Facts 1990, Water Authorities Association, October 1988.
2. The Water Industry of England and Wales. Levels of Service Information 1989/90, Office of Water Services, October 1990.
3. The Potential Effects of Climate Change in the United Kingdom, United Kingdom Climate Change Impact Review Group, First Report, HMSO, January 1991.

**APPENDIX 1**

**LOCATION MAPS OF:**

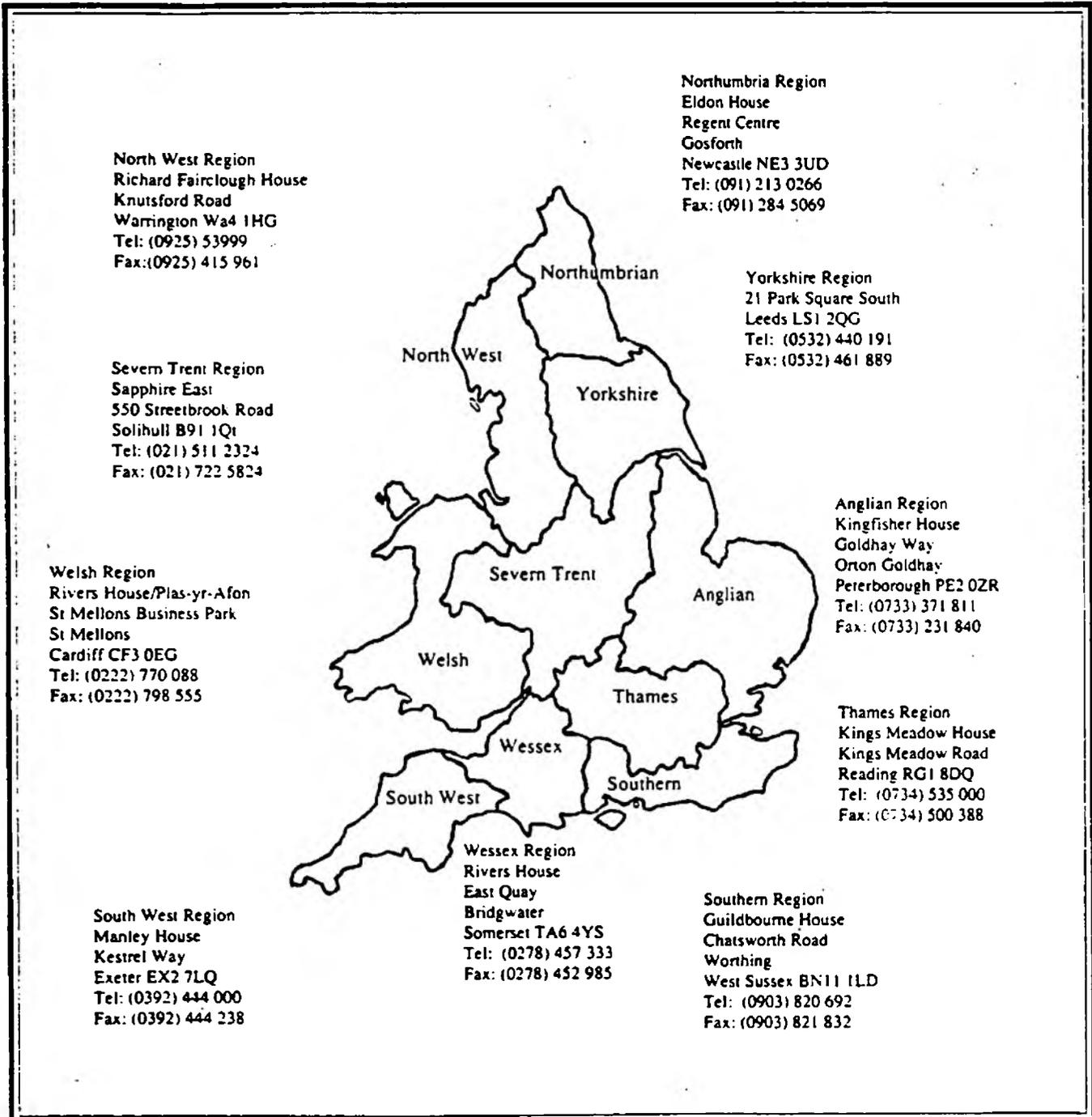
**NATIONAL RIVERS AUTHORITY**

**WATER SERVICE COMPANIES**

**WATER COMPANIES**

# National Rivers Authority

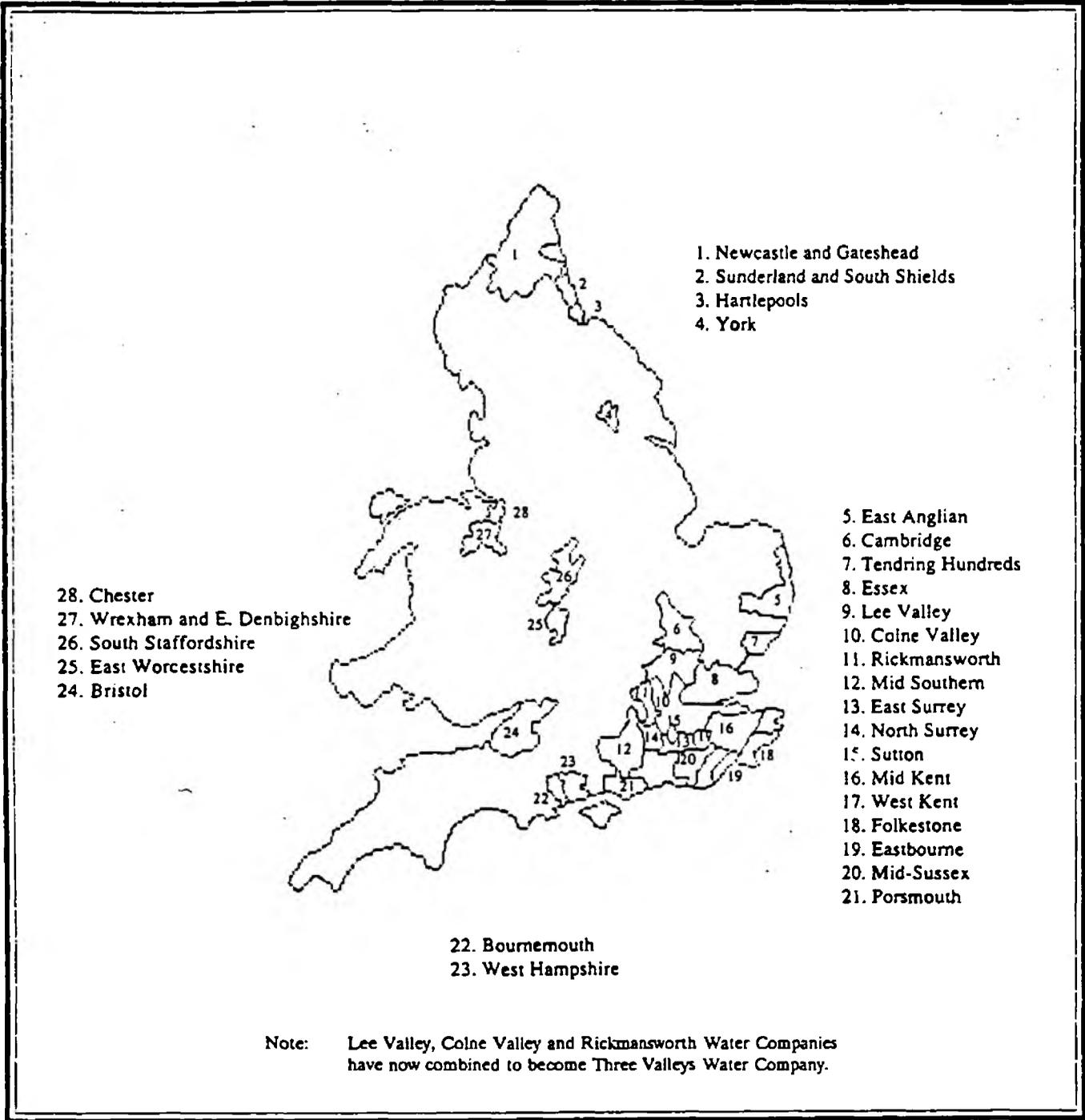
Head Office, Eastbury House, 30-34 Albert Embankment, London SE1 7TL  
Tel: (071) 820 0101 Fax: (071) 820 1603



# Water Service Companies



# Water Companies



*National Rivers Authority*

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