HYDROLOGICAL SUMMARY FOR GREAT BRITAIN MAY 1990

Data for this review have been provided principally by the regional divisions of the National Rivers Authority in England and Wales, the River Purification Boards in Scotland and by the Meteorological Office. The recent areal rainfall figures are derived from a restricted network of raingauges and a significant proportion of the river flow data is of a provisional nature.

For a fuller appreciation of the water resources implications, this hydrological review should be considered alongside assessments of the current reservoir storage and water demand situations in each region.

SUMMARY

May provided a suitable climax to an exceptionally dry and notably warm spring. Provisional data suggest that the England and Wales rainfall total for the March to April period ranks as the driest since 1893. As a result, very steep declines in runoff and recharge rates have followed the widespread flooding in February. The transformation in hydrological conditions since the late-winter has been remarkable in most regions and a notable spring drought had become established by late-May. In most regions the abundant rainfall over the preceding winter greatly limits the severity of the drought for periods beyond three months. However, a fragile situation exists in those eastern areas where the spring shortfall overlays a long-term rainfall deficiency (extending in certain districts beyond two years).

Rates of evaporation have been high for an extended period and soil moisture deficits are greatly above average in all areas with the exception of western Scotland. The warm conditions have contributed to the steepness of flow recessions and runoff rates for May were well below average in all regions. In the east, and in some central areas, end-of-May flows were exceptionally low and in a few catchments discharge rates declined to below the corresponding flows in 1976. However, except in eastern catchments, especially in Yorkshire, Lincolnshire and Kent, accumulated runoff totals are substantially in excess of those registered during the Great Drought. Groundwater levels are generally below average, but not remarkably so, throughout most of the principal aquifers. However, where recharge has been very restricted over the last two winters, and the recovery during the recent winter had to be generated from a very low base, water tables are currently at historically low levels.

Whilst rainfall totals from the beginning of October 1989 have been close to, or above, the average in all regions, the temporal distribution has not been beneficial from a water resources viewpoint. The early onset of the seasonal decline in runoff rates, groundwater levels and - generally - reservoir stocks has focused attention on the length of time demands need to be satisfied before replenishment rates increase once again. An inordinate delay, such as occurred in 1988, for instance, would be a matter of concern.

RAINFALL

May was warm and exceptionally dry - similar to 1989 - in most areas. Provisional data suggest that the May rainfall total for England and Wales was marginally greater than last year but still ranks amongst the driest half dozen this century. Above average rainfall was recorded in a few isolated localities in north-east England and south-west Scotland but most areas registered well below 60% of the 1941-70 mean. Some districts in central England were remarkably dry; the 2.1 mm recorded at the Institute of Hydrology's meteorological station, which was commissioned in 1962, is the lowest total on record for *any* month.

Overall, the spring was also remarkably dry. Provisional data suggest that, for England and Wales, the three months to the end of May were amongst the driest half dozen sequences this century (for *any* three months). This follows directly on the wettest winter since 1914/15. The transformation is reflected in the accumulated rainfall figures and the associated return periods presented in Table 2.

An intense short-term drought may be recognised throughout most of southern Britain (in contrast western Scotland has been extremely wet throughout most of the winter and spring). Return periods associated with the spring rainfall exceed 50 years in all NRA regions with the exception of the North West, Northumbria and Anglia (see Table 2). The effect of the wet winter is evident in the return periods associated with rainfall totals from October 1989. Rainfall over the last twelve months is also well within the normal range; only in Northumbria would the total be expected, on average, less often than once in 10 years. Extending the timeframe to embrace the winter of 1988/89 reveals a number of important long term rainfall deficiencies in eastern regions. Locally, rainfall deficiencies are very severe - some eastern districts have registered below average rainfall in all but three or four of the last 27 months.

Comparisons: 1990 - 1976?

Any general comparisons between the meteorological conditions experienced in 1990 and those of 1976 are inappropriate. The data presented in Figure 2 and Table 2 testify to the different character of the two droughts, particularly with regard to spatial and temporal variations in severity, and to the greater magnitude of the earlier event. The spring of 1990 has certainly been drier in most areas than in 1976. The 12-month rainfall total (June-May) for 1975/76 was, however, extraordinary and was followed by an exceptionally dry summer. The June to August 1976 rainfall total for England and Wales is the second driest sequence for *any* three months this century and the driest summer in the 230 year general rainfall series for England and Wales by a considerable margin. What remains remarkable about the current hydrological condition is the extraordinarily episodic nature of rainfall in recent years; its distribution over the last twelve months in lowland England is more typical of a Mediterranean climate.

EVAPORATION AND SOIL MOISTURE DEFICITS

Temperatures and sunshine hours were well above average in May, especially in southern Britain. Consequently, the high rates of potential evaporation (PE) which have characterised much of the last couple of years continued. Soil moisture deficits (SMDs) increased briskly through May and, by month-end, exceeded the long term average by over 50 mm throughout most of lowland Britain and the North-East. Both PE and actual evaporation (AE) losses for 1990 have been close to the highest on record in many areas; typically 20-40% above average in lowland England. The unseasonal persistence of high SMD'S has truncated the period when evapotranspiration could proceed at the potential rate; some notable shortfalls (PE-AE) for the winter and spring periods have been registered since the beginning of October 1989. In eastern Britain especially, this has provided a counterbalancing influence to the very high PE values. Notwithstanding the mitigating effect of sustained large SMD's, the MORECS evaporation data confirm that - in hydrological terms - the current drought is somewhat more severe than the rainfall data alone might indicate.

RUNOFF

The steep recessions in river flows which, generally, began in late February continued throughout May. There are very few precedents for the scale of the decline in discharge rates through the spring of 1990. Runoff totals for May were well below average in all regions with the exception of western Scotland. Many notable monthly mean flows were reported. The Bewdley gauging station on the Severn recorded its second lowest May runoff in a 70-year record and runoff for the Trent was unprecedented in a 32-year record. New May minima were also established on, for example, the River Dee (Grampians), the Yorkshire Derwent and the Turkey Brook in the Lee catchment. Many other eastern catchments registered their lowest May runoff since 1976. Geological control over flow rates was clearly evident with brisk recessions characterising many northern and western catchments where natural storage is limited; daily flow rates were, for instance, exceptionally low in the South-West by the last week of May. Over large parts of central and southern England some residual benefit from the abundant late-winter recharge could be recognised in rivers reliant on baseflow, see, for instance, flows for the Mimram and the Itchen. Further east the hydrological situation deteriorates as the baseflow support becomes very moderate - a consequence of the limited recharge over the last two winters. Return periods associated with the May mean flows for selected rivers are given in Table 4.

Longer term runoff accumulations, which are more useful as a drought index than the data for a single month, present a less severe picture. Spring runoff totals, with the exception of a number of mostly eastern catchments, are well above historical minima and, generally, runoff for the period since the beginning of October is well within the normal range.

Exceptions include high baseflow rivers in Lincolnshire, Humberside and Yorkshire, where a severe drought may be identified, and a number of Scottish rivers. The eight-month runoff for the Clyde is the highest on record and that for the Tay - largely as a result of remarkably high runoff in the headwaters - ranks second in a 38-year record. To the north, the River Dee has experienced a sustained period of very low flows over most of the same period. Such contrasts serve to emphasise the extreme spatial variations in recent runoff patterns. One persistent feature however has been the continuing influence of rain-shadow effects. Depressed flow rates, often interrupted by several wet interludes, have typified many eastern catchments for periods of more than two years. The River Medway in Kent, for instance, has recorded below average flows (often substantially so) in 23 of the last 26 months. The 19-month runoff accumulations presented in Table 3 provide a useful measure of the long term shortfalls which are making a major contribution to the current hydrological drought. Substantial long-term deficiencies exist in eastern Scotland, North-East England, Lincolnshire and parts of Kent. Notable deficiencies may also be recognised in some central and southern catchments.

GROUNDWATER

In most areas little significant infiltration has occurred since late February. The seasonal down-turn in groundwater levels began early in 1990 and has been much steeper than average. Nonetheless, water tables remain within the normal range, albeit significantly below average, throughout the greater parts of the principal aquifers in England and Wales (see, for example, the hydrographs for Rockley and Compton in Figure 4).

In the east, and parts of the south, however, water tables are exceptionally low. Extraordinarily steep recessions have characterised the Permo-Triassic aquifer in the South-West, where flow is predominantly through fissures. The near-record February peaks at Bussels (Figure 4) have been succeeded by a new period-of-record minimum in May; other wells in the South-West show a less precipitous decline. In the Chalk of eastern England the currently depressed water-table is a response to limited recharge over the winters of 1988/89 and 1989/90 combined with the sustained decline in levels through last year's drought. The Little Brocklesby and Dalton Holme traces are illustrative of the situation giving rise to most concern. In these areas index well levels remain typically somewhat above those registered during the droughts of 1965, 1973 and, particularly, 1976. However, even in a normal year recharge in these areas is modest and spatial variability is considerable. As a consequence certain of the wells featured in Figure 4 should not be considered fully representative. Thus in the Chalk of, for instance, parts of Humberside, Lincolnshire and Kent unprecedented levels have been reported.

Away from these districts, where the groundwater situation will remain fragile at least until the onset of the winter recharge, comparisons with 1976 are appropriate only in a few districts reliant on shallow supplies. Table 5 provides a comparison of groundwater levels in 1976 and 1990 for a selection of index boreholes.

TABLE 5 A COMPARISON OF MAY GROUNDWATER LEVELS: 1990 AND 1976

Borehole	**Aquifer**	**First Yr**	**Av. May level**	**May 1976**		**May 1990**		**No. of years of record with May levels <1990**
				Day	level	Day	level	
Dalton Holme	C & U.G.	1889	19.42	29	14.00	31	14.23	6
L. Brocklesby	"	1926	15.21	6	6.50	24	8.2	2
Washpit Farm	"	1950	45.42	1	42.90	2	43.49	5
Rockley	"	1933	136.13	30	129.16	31	134.15	13
Compton House	"	1894	42.20	27	29.71	30	37.48	17
L. Bucket Farm	"	1971	71.86	3	64.10	22	66.74	3
New Red Lion	L.L	1964	12.19	28	4.80	29	12.19	2
Bussels	PTS	1972	24.00	25	23.11	30	22.92	---

C & U.G. Chalk and Upper Greensand;
L.L Lincolnshire Limestone
PTS Permo - Triassic Sandstone

Institute of Hydrology / British Geological Survey 13 June 1990

TABLE 1 1989/90 RAINFALL AS A PERCENTAGE OF THE 1941-70 AVERAGE

		Apr 1989	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan 1990	Feb	Mar	Apr	May
England and Wales	mm	83	20	55	38	58	41	98	61	133	116	141	20	38	25
	%	143	30	90	52	65	49	118	63	147	135	217	34	66	37
NRA REGIONS															
North West	mm	87	37	82	33	116	29	146	84	103	178	187	39	52	45
	%	113	45	99	32	93	24	124	69	86	159	231	55	68	55
Northumbria	mm	58	22	51	19	77	20	71	35	61	110	132	30	28	59
	%	105	34	84	25	76	25	95	37	81	138	200	46	51	92
Severn Trent	mm	91	25	53	40	44	38	82	52	126	113	110	19	30	19
	%	175	39	95	62	54	57	126	66	181	164	207	37	58	29
Yorkshire	mm	78	19	69	43	41	20	77	45	93	106	112	23	24	32
	%	138	31	119	61	46	28	112	51	126	138	175	43	42	52
Anglia	mm	75	14	56	41	35	30	41	35	95	52	74	16	36	15
	%	188	30	114	72	55	58	79	56	180	100	177	40	36	31
Thames	mm	79	14	39	37	44	28	66	38	134	86	114	12	35	7
	%	172	25	75	62	63	45	103	52	203	139	242	26	76	12
Southern	mm	81	5	41	28	29	37	79	49	137	110	135	5	44	11
	%	169	9	82	54	40	52	101	52	169	145	238	10	91	20
Wessex	mm	77	21	32	37	43	49	101	59	174	124	157	17	35	11
	%	143	31	59	60	52	62	123	61	193	147	265	33	64	17
South West	mm	87	12	40	31	62	107	148	100	192	181	236	25	47	26
	%	123	14	62	37	61	103	131	75	142	140	262	29	65	30
Welsh	mm	98	25	67	48	91	62	179	100	189	211	214	36	46	33
	%	114	27	82	51	76	50	139	73	130	155	223	41	53	36
Scotland	mm	63	54	76	49	184	96	187	61	95	218	268	183	97	66
	%	70	59	83	44	143	70	126	43	61	159	258	199	108	73
RIVER PURIFICATION BOARDS															
Highland	mm	60	68	90	66	222	118	252	83	107	290	364	382	148	67
	%	53	66	82	52	150	75	135	49	55	177	274	335	130	65
North-East	mm	54	59	57	25	84	57	87	30	61	100	145	96	51	48
	%	89	77	81	27	78	66	90	29	60	110	195	155	84	62
Tay	mm	45	42	58	31	140	84	135	53	87	230	249	160	62	52
	%	60	44	70	30	119	73	111	45	65	195	270	195	83	55
Forth	mm	44	36	64	27	142	69	112	38	78	210	221	121	50	46
	%	65	43	85	28	122	64	106	35	72	212	287	175	74	55
Tweed	mm	48	43	51	23	114	47	67	30	72	158	180	59	47	52
	%	79	57	75	27	100	51	76	29	80	170	260	102	77	68
Solway	mm	87	35	71	43	177	78	146	58	117	270	282	100	50	95
	%	99	38	79	39	136	52	101	40	77	193	303	110	57	103
Clyde	mm	82	46	90	64	249	120	240	74	107	320	343	221	144	70
	%	80	47	87	49	175	69	131	44	58	199	304	210	140	72

Note: March, April and May figures for E and W for 1990 are based upon MORECS figures supplied by the Meteorological Office

Scottish RPB data for May 1990 are estimated from the isohyetal map of May rainfall in the MORECS bulletin.

TABLE 2 RAINFALL RETURN PERIOD ESTIMATES

		MAR 90 - MAY 90	ERP*	OCT 89 - MAY 90	ERP	NOV 88 - MAY 90	ERP	JUN 89 - MAY 89	ERP	JUN 75 - MAY 76	ERP
England and Wales	mm	83		632		1267		840		**636**	
	% LTA	45	100	104	2-5	88	5-10	92	2-5	**70**	**80-120**
NRA REGIONS											
North West	mm	137		817		1822		1151		**1052**	
	% LTA	59	10-20	104	2-5	97	2-5	95	2-5	**86**	**5-10**
Northumbria	mm	117		541		1093		708		**705**	
	% LTA	68	5-10	97	2-5	75	20-50	78	40-60	**78**	**10-20**
Severn Trent	mm	68		551		1089		735		**500**	
	% LTA	40	80-120	100	2	90	5	95	2-5	**65**	**100-200**
Yorkshire	mm	78		519		1064		690		**649**	
	% LTA	46	50-100	96	2-5	81	20-50	83	5-10	**78**	**10-20**
Anglia	mm	67		369		791		530		**382**	
	% LTA	53	20-50	104	<2	86	5-10	86	5-10	**63**	**200-500**
Thames	mm	53		491		943		645		**403**	
	% LTA	36	80-120	107	2-5	86	5-10	92	2-5	**57**	**500**
Southern	mm	59		565		1021		709		**408**	
	% LTA	38	50-100	104	2-5	81	10-20	89	2-5	**66**	**50-100**
Wessex	mm	63		681		1209		829		**523**	
	% LTA	35	80-120	115	5	88	5-10	95	2-5	**60**	**200-500**
South West	mm	98		944		1749		1199		**805**	
	% LTA	41	50-100	112	2-5	91	2-5	100		**67**	**100**
Welsh	mm	114		992		1962		1294		**902**	
	% LTA	43	50-100	109	2-5	93	2-5	97	2-5	**68**	**80-120**
Scotland	mm	846		1191		2631		1633			
	% LTA	127	10	124	20-50	117	20-50	114	10		
RIVER PURIFICATION BOARDS											
Highland	mm	610		1708		3325		2202			
	% LTA	184	>>200	145	>>200	114	10-200	128	100-200		
North-East	mm	434		604		1304		827			
	% LTA	119	5-10	90	2-5	77	100-200	81	10-20		
Tay	mm	784		1058		2160		1369			
	% LTA	170	>>200	126	10-20	103	2-5	109	2-5		
Forth	mm	671		901		1885		1205			
	% LTA	169	>>200	125	20	103	2-5	108	2-5		
Tweed	mm	446		615		893		1340			
	% LTA	159	50-100	109	2-5	89	5	86	10		
Solway	mm	679		1000		1404		2204			
	% LTA	165	200-500	117	5-10	99	2-5	97	2-5		
Clyde	mm	1093		1514		2083		3194			
	% LTA	227	>>200	149	>200	125	40-60	119	20-50		

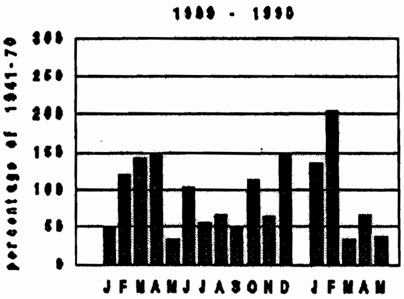
* Estimated Return Period. Return period assessments are based on tables provided by the Meteorological Office[1]. These assume a start in a specified month; return periods for a start in any month may be expected to be an order of magnitude less. "Wet" return periods underlined.

The tables reflect rainfall totals over the period 1911-70 only and the estimate assumes a sensibly stable climate.

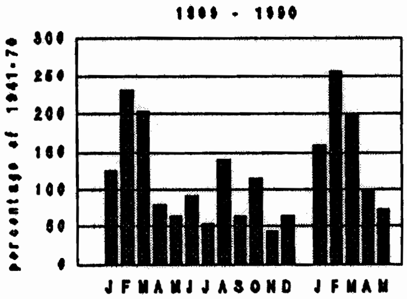
The May 1990 RPB values are estimated from the isopleth map within the May summary published in the Met. Office's MORECS bulletin.

[1] Tabony, R C, 1977, The Variability of long duration rainfall over Great Britain, Scientific Paper No. 37, Meteorological Office (HMSO).

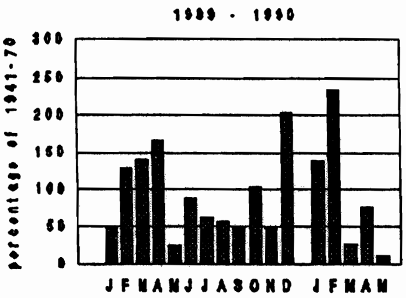
FIGURE 1. MONTHLY RAINFALL FOR 1989 – 1990 AS A PERCENTAGE OF THE 1941 – 1970 AVERAGE FOR ENGLAND AND WALES, SCOTLAND, AND THE NRA REGIONS



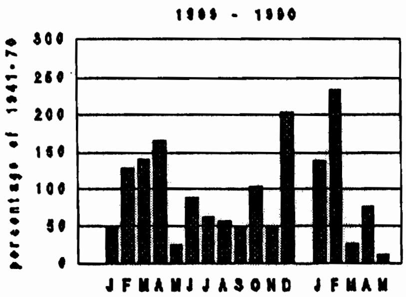
England and Wales



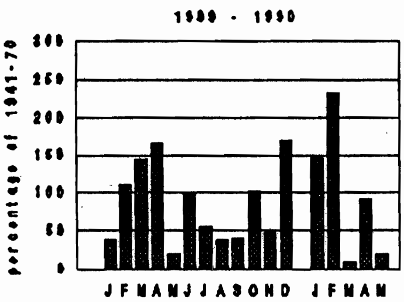
Scotland



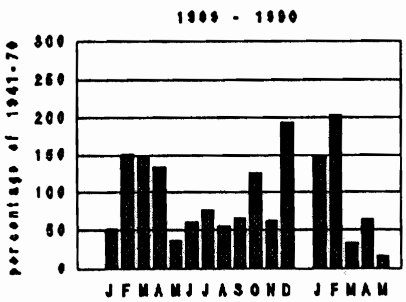
Anglian NRA Region



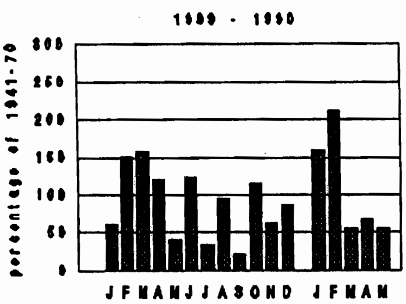
Thames NRA Region



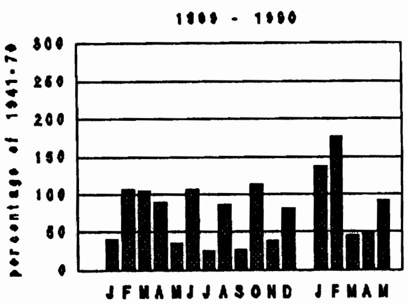
Southern NRA Region



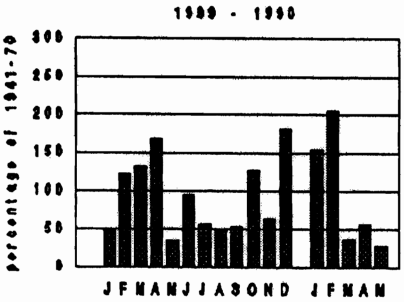
Wessex NRA Region



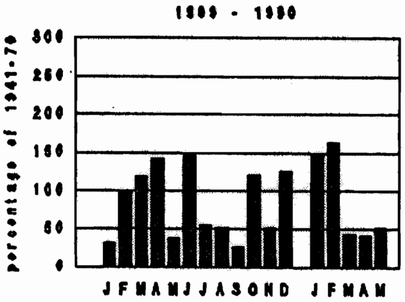
North West NRA Region



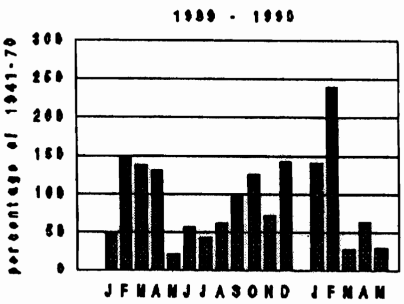
Northumbrian NRA Region



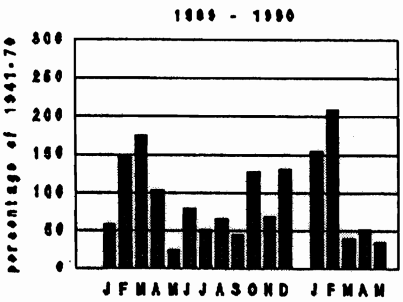
Severn-Trent NRA Region



Yorkshire NRA Region



South West NRA Region



Welsh NRA Region

FIGURE 2 RAINFALL FOR ENGLAND AND WALES FOR 1976-76 AND 1989-90 AS A PERCENTAGE OF THE MONTHLY MEANS

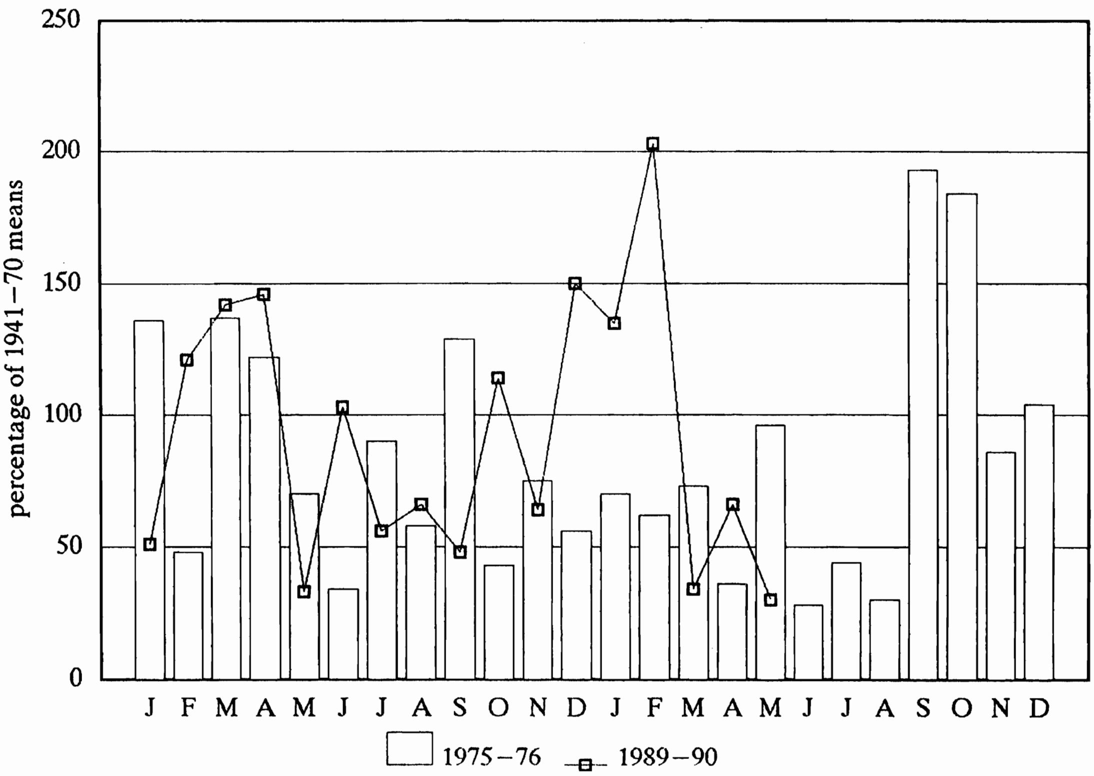
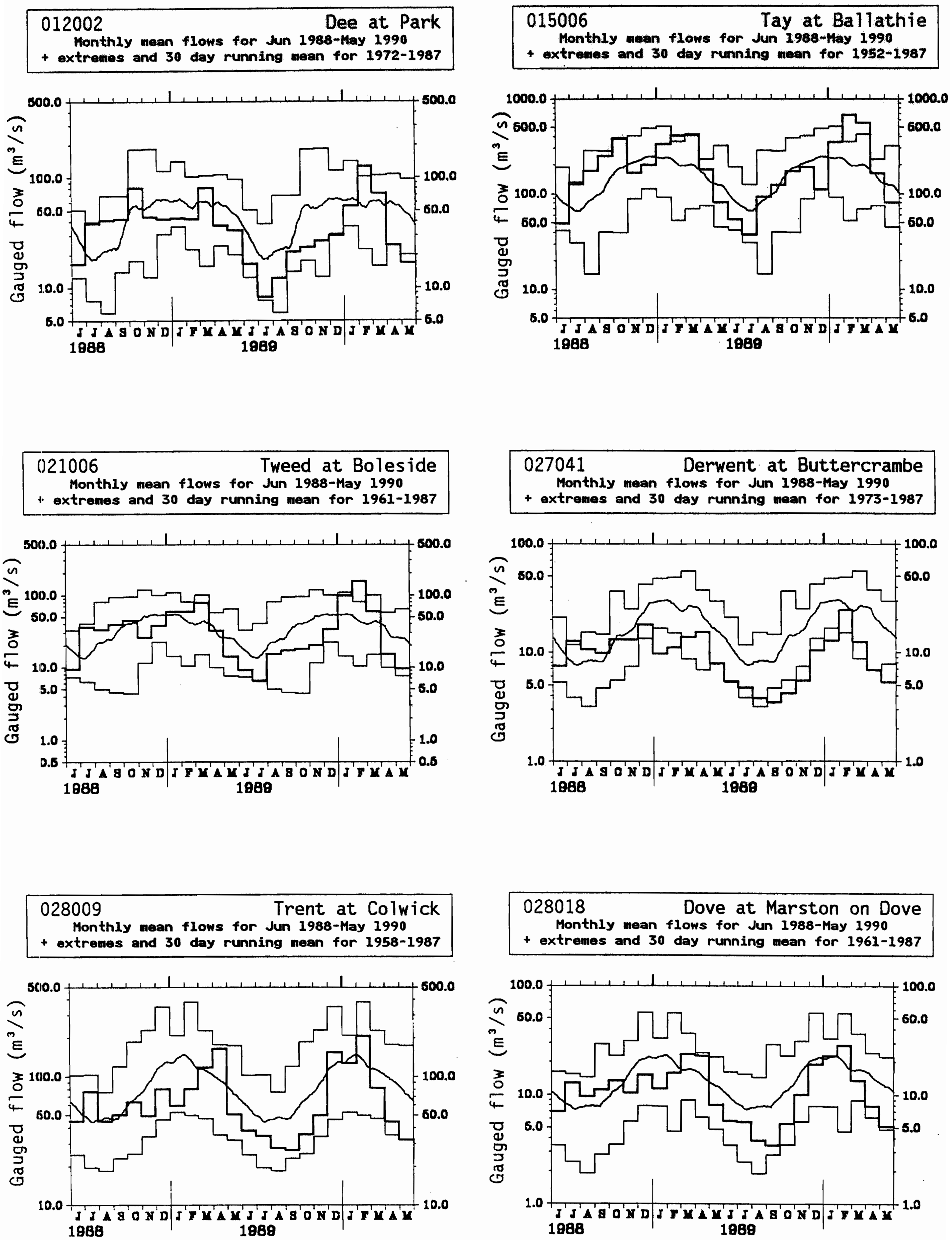
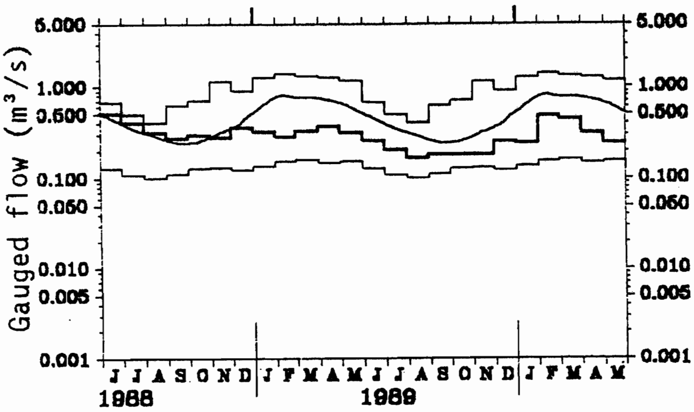


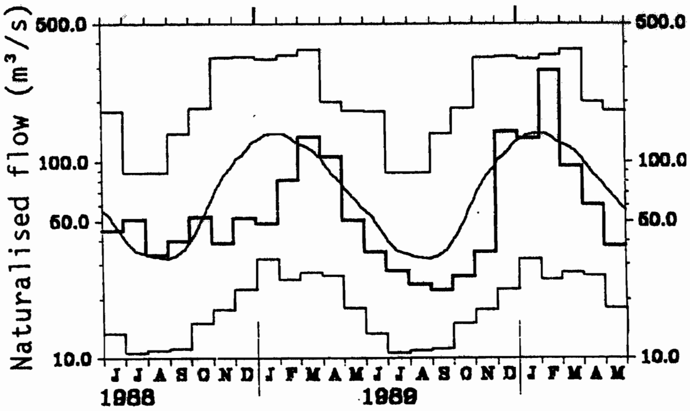
FIGURE 3 MONTHLY RIVER FLOW HYDROGRAPHS



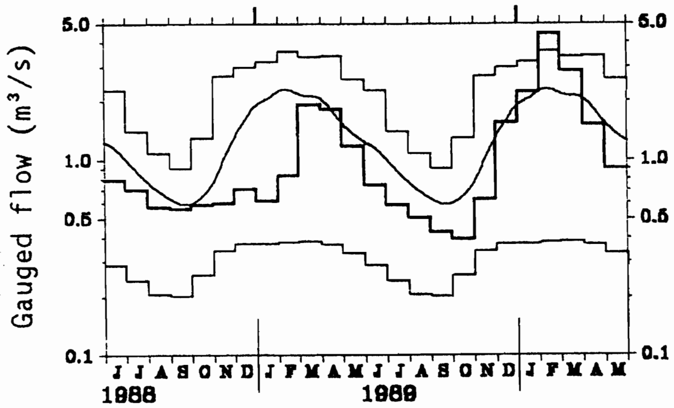
029003 Lud at Louth
Monthly mean flows for Jun 1988-May 1990
+ extremes and 30 day running mean for 1968-1987



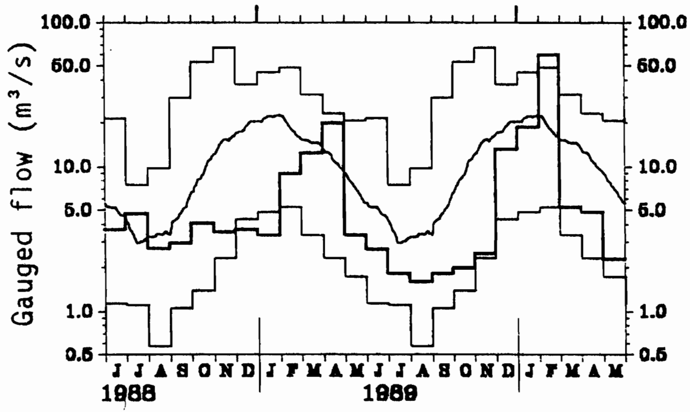
039001 Thames at Kingston
Monthly mean flows for Jun 1988-May 1990
+ extremes and 30 day running mean for 1883-1987



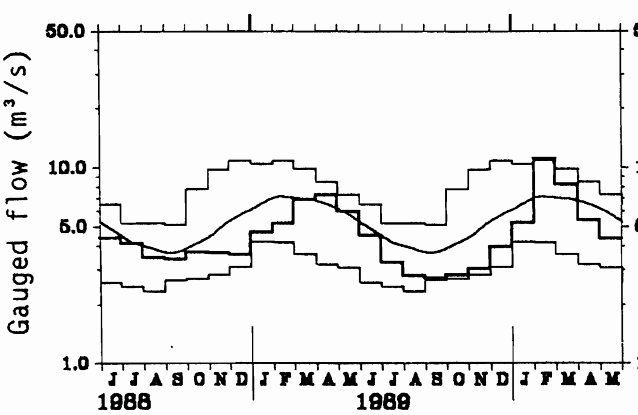
039020 Coln at Bibury
Monthly mean flows for Jun 1988-May 1990
+ extremes and 30 day running mean for 1963-1987



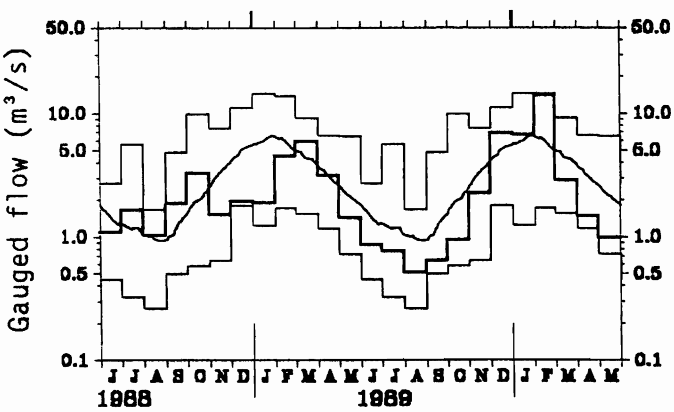
040003 Medway at Teston
Monthly mean flows for Jun 1988-May 1990
+ extremes and 30 day running mean for 1956-1987



042010 Itchen at Highbridge+Allbrook
Monthly mean flows for Jun 1988-May 1990
+ extremes and 30 day running mean for 1958-1987

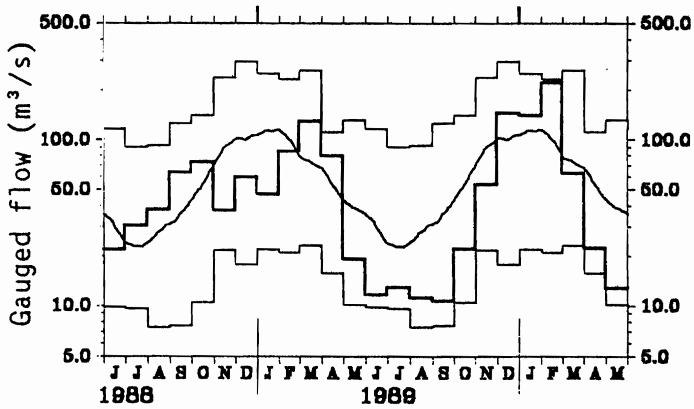


052005 Tone at Bishops Hull
Monthly mean flows for Jun 1988-May 1990
+ extremes and 30 day running mean for 1961-1987



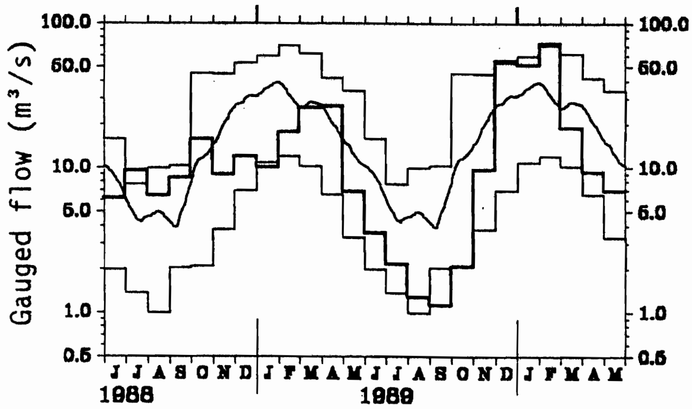
054001 Severn at Bewdley

Monthly mean flows for Jun 1988-May 1990
+ extremes and 30 day running mean for 1921-1987



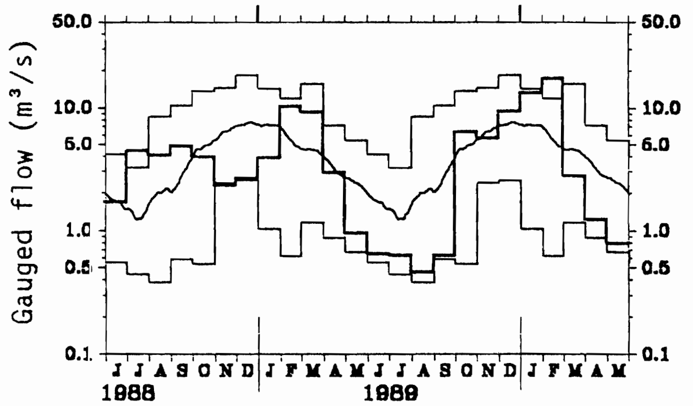
054029 Teme at Knightsford Bridge

Monthly mean flows for Jun 1988-May 1990
+ extremes and 30 day running mean for 1970-1987



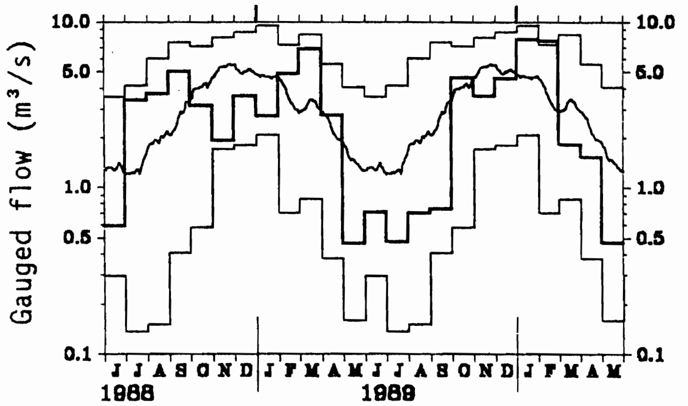
057004 Cynon at Abercynon

Monthly mean flows for Jun 1988-May 1990
+ extremes and 30 day running mean for 1957-1987



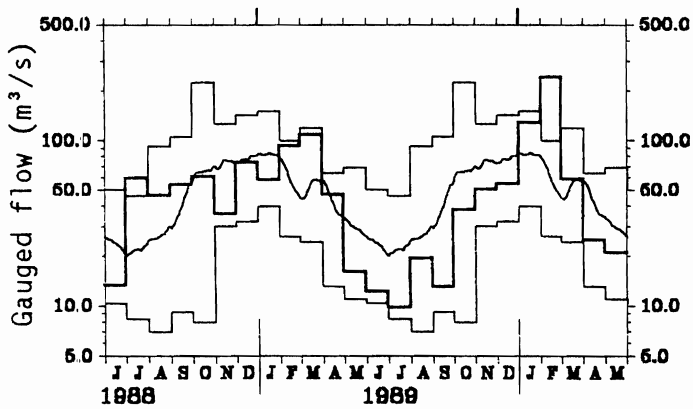
067018 Dee at New Inn

Monthly mean flows for Jun 1988-May 1990
+ extremes and 30 day running mean for 1969-1987



076007 Eden at Sheepmount

Monthly mean flows for Jun 1988-May 1990
+ extremes and 30 day running mean for 1967-1987



084005 Clyde at Blairston

Monthly mean flows for Jun 1988-May 1990
+ extremes and 30 day running mean for 1958-1987

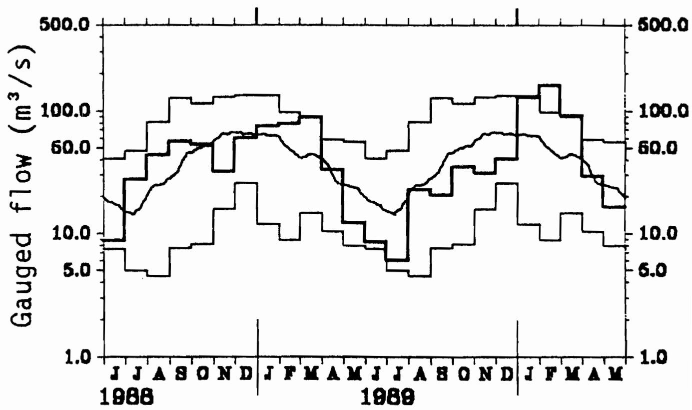


TABLE 3 RUNOFF AS MM. AND AS A PERCENTAGE OF THE PERIOD OF RECORD AVERAGE WITH SELECTED PERIODS RANKED IN THE RECORD

River/ Station name	Jan 1990	Feb	Mar	Apr	May 1990		3/90 to 5/90		10/89 to 5/90		6/89 to 5/90		11/88 to 5/90	
	mm %LT	mm %LT	mm %LT	mm %LT	mm %LT	rank /yrs	mm %LT	rank /yrs	mm %LT	rank /yrs	mm %LT	rank /yrs	mm %LT	rank /yrs
Dee at	79	165	103	34	24	1	161	3	520	2	602	2	1058	2
Park	87	239	113	43	37	/18	70	/18	79	/17	76	/17	78	/17
Tay at	201	353	324	91	47	7	462	38	1286	37	1461	34	2461	37
Ballathie	143	322	268	110	67	/38	165	/38	141	/38	134	/37	128	/37
Tweed at	175	245	105	26	17	3	148	14	694	27	778	14	1306	12
Boleside	177	341	133	51	39	/29	85	/29	115	/29	104	/28	103	/28
Wharfe at	126	142	59	20	17	10	96	3	516	9	569	5	1026	5
Flint Mill Weir	130	193	78	36	44	/35	57	/35	89	/35	79	/34	83	/34
Derwent at	22	37	21	11	9	1	41	1	133	1	162	1	308	1
Buttercrambe	45	90	46	33	35	/17	41	/17	48	/17	48	/16	51	/16
Trent at	45	66	29	15	11	1	56	2	253	11	297	6	506	5
Colwick	89	154	71	45	43	/32	57	/32	87	/32	83	/31	81	/31
Dove at	68	78	41	23	15	2	79	2	329	5	384	4	700	3
Marston on Dove	100	143	75	53	42	/29	60	/29	82	/29	77	/27	80	/27
Lud at	12	21	21	15	12	3	48	3	109	3	148	3	255	2
Louth	39	59	56	45	43	/22	49	/22	52	/22	56	/21	55	/21
Witham at	20	34	23	10	6	2	39	8	123	13	146	13	232	6
Claypole Mill	78	129	88	47	37	/32	61	/31	80	/31	79	/31	69	/30
Colne at	11	35	9	7	4	4	21	6	90	7	106	5	200	6
Lexden	47	194	48	52	45	/31	51	/31	75	/31	76	/30	79	/30
Mimram at	10	15	14	12	10	9	36	16	83	16	113	13	184	9
Panshanger Park	86	128	105	94	81	/38	94	/38	94	/37	90	/37	89	/36
Thames at	35	70	25	16	10	22	51	29	211	57	239	51	373	32
Kingston (natr.)	94	213	80	71	57	/108	72	/108	102	/107	97	/107	85	/106
Coln at	56	100	71	36	23	5	130	10	350	15	406	12	594	6
Bibury	110	189	132	83	69	/27	100	/27	110	/27	102	/26	85	/26
Mole at	64	153	21	22	14	6	57	2	385	10	438	9	702	1
Kinnersley Manor	89	315	40	63	52	/17	50	/16	98	/15	98	/15	85	/13
Medway at	39	115	11	10	5	2	26	2	217	14	234	9	348	1
Teston	80	315	35	44	34	/32	38	/29	87	/28	82	/26	69	/24
Ouse at	60	132	24	20	10	4	54	3	300	12	336	11	502	3
Gold Bridge	94	278	52	58	40	/31	52	/31	87	/29	85	/28	71	/27
Itchen at	39	74	61	39	32	4	132	8	317	10	414	8	685	5
Highbridge+Allbrook	80	152	117	82	75	/32	93	/32	91	/32	89	/31	87	/31
Stour at	66	156	47	22	15	4	85	5	405	12	437	11	644	4
Throop Mill	111	281	90	63	63	/18	77	/18	117	/17	110	/17	89	/16
Tone at	88	170	38	19	13	2	71	3	461	23	497	17	759	7
Bishops Hull	111	235	65	48	46	/30	57	/30	111	/29	104	/29	88	/28
Brue at	78	125	26	12	8	2	46	1	369	14	392	8	655	3
Lovington	112	214	50	39	34	/26	45	/26	99	/26	88	/25	83	/25
Severn at	86	123	39	13	8	2	60	11	494	44	433	32	708	18
Bewdley	121	215	84	41	33	/70	59	/69	106	/69	96	/69	89	/68
Teme at	93	118	34	16	12	8	63	4	394	19	408	13	599	2
Knightsford Bridge	144	226	67	45	56	/20	60	/20	117	/20	109	/20	87	/19
Cynon at	331	393	70	30	22	3	122	4	1382	31	1441	22	2222	15
Abercynon	177	300	58	39	36	/32	48	/32	132	/32	114	/30	102	/30
Dee at	388	344	90	73	23	6	187	4	1543	15	1672	8	2786	5
New Inn	165	213	49	70	33	/21	53	/21	106	/21	92	/20	91	/20
Lune at	266	298	77	43	28	9	148	5	1018	22	1088	13	1883	13
Caton	185	322	77	58	56	/28	67	/28	116	/26	96	/26	99	/24
Eden at	149	253	68	28	24	7	121	7	689	17	751	12	1243	10
Sheepmount	149	381	99	60	73	/20	82	/20	121	/19	109	/18	106	/17
Clyde at	200	227	143	45	26	12	214	27	807	31	896	26	1476	24
Blairston	195	313	196	99	72	/32	137	/32	131	/31	116	/31	114	/31

Notes (i) Values based on gauged flow data unless flagged (natr.), when naturalised data have been used.
(ii) Values are ranked so that lowest runoff as rank 1;
(iii) %LT means percentage of long term average from the start of the record to 1989. For the long periods (at the right of this table), the end date for the long term is 1990.

TABLE 4 RIVER FLOW RETURN PERIODS

Station No.	River	Station Name	First Year of Rec.	Mean May Flow	1990 May Flow	Return Period (in years)	Base Period Index
12002	Dee	Park	1972	44.93	16.80	40-60	0.54
23004	South Tyne	Haydon Bridge	1962	10.17	5.30	3-5	0.35
27002	Wharfe	Flint Mill	1955	11.10	4.91	5	0.39
27041	Derwent	Buttercrambe	1973	15.50	5.28	25-50	0.68
29003	Lud	Louth	1968	0.58	0.24	10	0.90
30001	Witham	Claypole Mill	1959	1.80	0.65e	15-20	0.67
30003	Bain	Fulsby Lock	1962	1.15	0.24	25-50	0.58
31021	Welland	Ashley	1970	0.86	0.19	25	0.41
37001	Roding	Redbridge	1950	1.20	0.28	25	0.40
37005	Colne	Lexden (Essex)	1959	0.80	0.38	10	0.53
38021	Turkey Brook	Albany Park	1971	0.18	0.009	25	0.21
40003	Medway	Teston	1956	6.90	2.2e	25	0.41
41005	Ouse	Gold Bridge	1960	1.70	0.69	10-15	0.49
52005	Tone	Bishops Hull	1961	2.16	0.99	25-30	0.58
54001	Severn	Bewdley	1921	39.50	12.70	25-50	0.53
57004	Cynon	Abercynon	1957	2.40	0.87	10	0.42

Note (i): The stations featured are drawn from those areas where the hydrological drought is currently most severe.

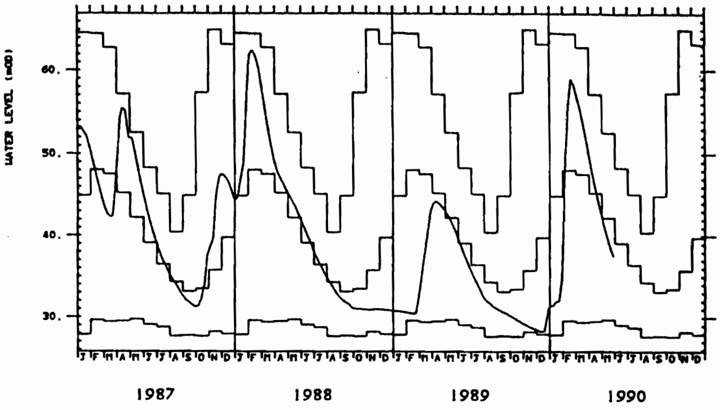
Note (ii): Because of changes in the pattern of water utilisation in certain catchments and the effects of measures to counteract low flows, some return periods need to be treated with particular caution.

FIGURE 4 GROUNDWATER HYDROGRAPHS

Site name: COMPTON HOUSE

National grid reference: SU 7755 1490 — Well number: SU71/23

Aquifer: CHALK AND UPPER GREENSAND — Measuring level: 81.37

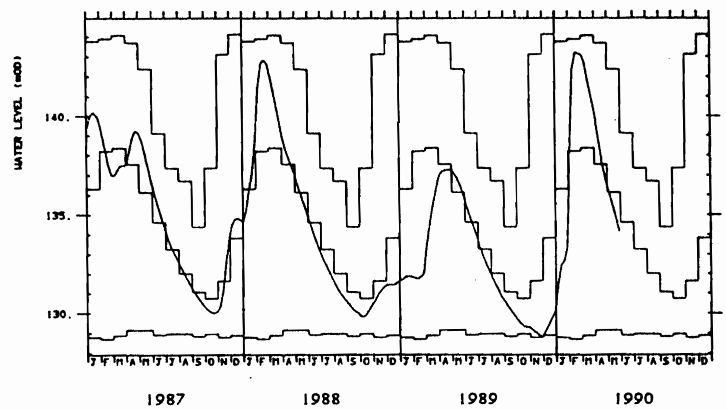


Max, Min and Mean values calculated from years 1894 TO 1989

Site name: ROCKLEY

National grid reference: SU 1655 7174 — Well number: SU17/57

Aquifer: CHALK AND UPPER GREENSAND — Measuring level: 146.39

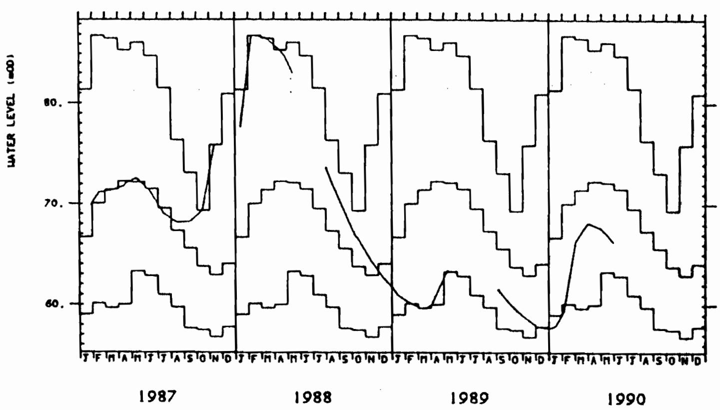


Max, Min and Mean values calculated from years 1933 TO 1989

Site name: LITTLE BUCKET FARM,WALTHAM

National grid reference: TR 1225 4690 — Well number: TR14/9

Aquifer: CHALK AND UPPER GREENSAND — Measuring level: 87.33



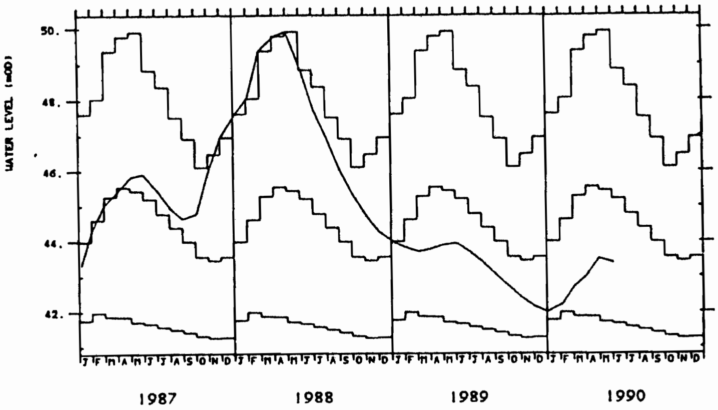
Max, Min and Mean values calculated from years 1971 TO 1989

A break in the data line indicates a recording interval of greater than 8 weeks

Site name: WASHPIT FARM

National grid reference: TF 8138 1960 — Well number: TF81/2

Aquifer: CHALK AND UPPER GREENSAND — Measuring level: 80.20

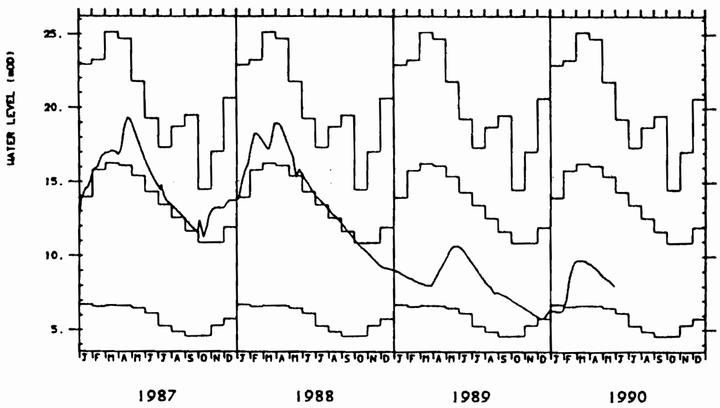


Max, Min and Mean values calculated from years 1950 TO 1989

Site name: LITTLE BROCKLESBY

National grid reference: TA 1371 0888 — Well number: TA10/40

Aquifer: CHALK AND UPPER GREENSAND — Measuring level: 44.33

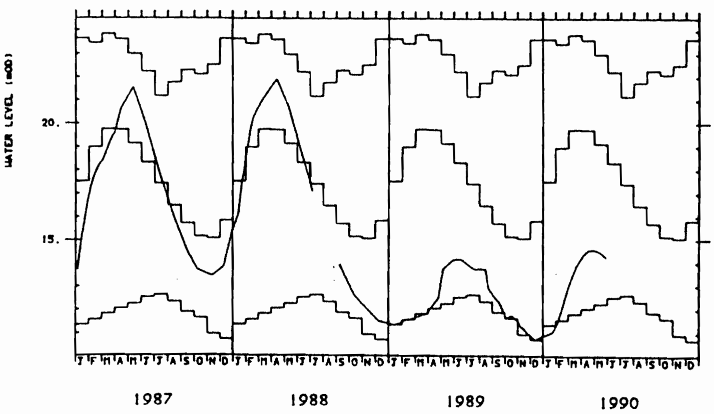


Max, Min and Mean values calculated from years 1926 TO 1989

Site name: DALTON HOLME

National grid reference: SE 9651 4530 — Well number: SE94/5

Aquifer: CHALK AND UPPER GREENSAND — Measuring level: 33.50



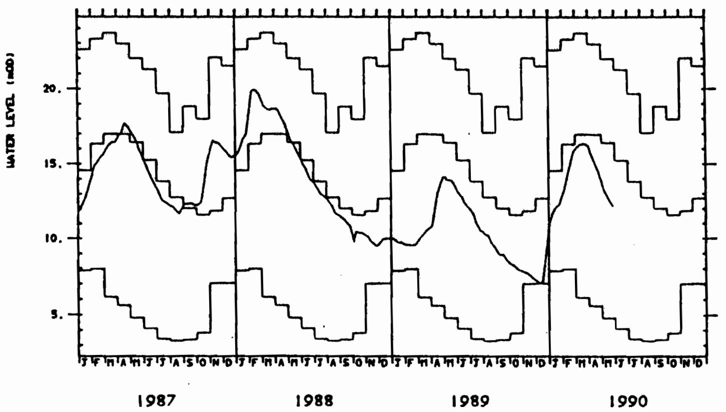
Max, Min and Mean values calculated from years 1889 TO 1989

A break in the data line indicates a recording interval of greater than 8 weeks

Site name: NEW RED LION

National grid reference: TF 0885 3034 Well number: TF03/37

Aquifer: LINCOLNSHIRE LIMESTONE Measuring level: 33.82

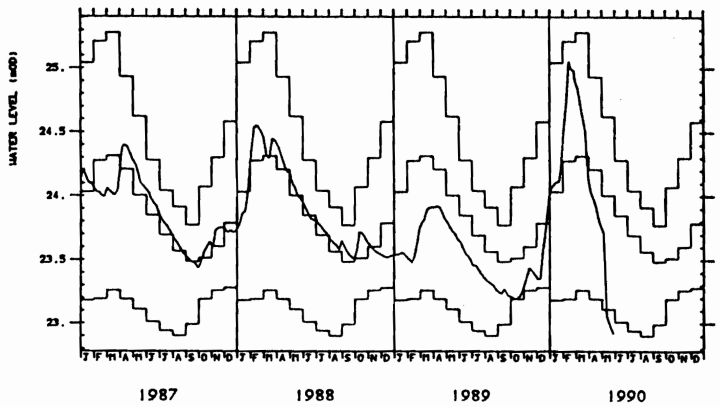


Max, Min and Mean values calculated from years 1964 TO 1989

Site name: BUSSELS NO.7A

National grid reference: SX 9528 9872 Well number: SX99/37B

Aquifer: PERMO-TRIASSIC SANDSTONE Measuring level: 26.07



Max, Min and Mean values calculated from years 1972 TO 1989

FIGURE 5 LOCATION MAP OF GROUNDWATER INDEX WELLS