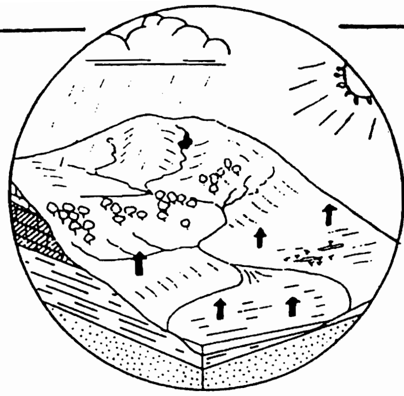
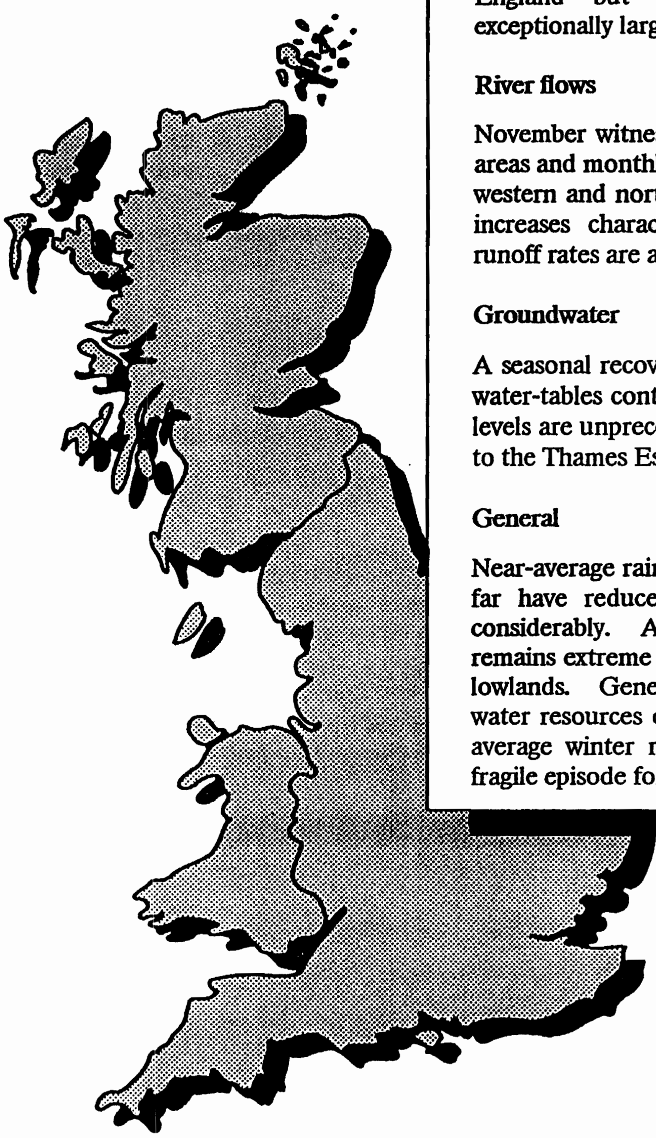
Hydrological Summary for Great Britain





NOVEMBER 1991

Rainfall

Around 110% of average for GB but somewhat below the 1941-70 mean over large parts of England and Wales. Some amelioration in drought conditions in much of lowland England but long term rainfall deficiencies remain exceptionally large, in East Anglia especially.

River flows

November witnessed an increase in mean flows in almost all areas and monthly runoff totals were above average in most of western and northern Britain. By contrast, very modest flow increases characterised many lowland chalk rivers where runoff rates are among the lowest on record.

Groundwater

A seasonal recovery was evident in some western aquifers but water-tables continued to decline in the east and groundwater levels are unprecedented in many boreholes from Lincolnshire to the Thames Estuary.

General

Near-average rainfall (and normal temperatures) for 1991 thus far have reduced the area subject to drought conditions considerably. Although spatially restricted, the drought remains extreme in groundwater terms in parts of the English lowlands. Generally, reservoir stocks are healthy and the water resources outlook is better than in late 1990 but above average winter rainfall will be essential to avoid a further fragile episode for groundwater resources in 1992.

Institute of Hydrology

British Geological Survey

HYDROLOGICAL SUMMARY FOR GREAT BRITAIN - NOVEMBER 1991

Data for this report 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. Reservoir contents information for England and Wales has been supplied by either the Water Services Companies or the NRA. The most recent areal rainfall figures are derived from a restricted network of raingauges (particularly in Scotland) and a proportion of the river flow data is of a provisional nature.

A map (Figure 4) is provided to assist in the location of the principal monitoring sites.

Rainfall

November was generally a cool, damp month. Very unsettled conditions characterised much of the first three weeks but a developing anticyclone began to dominate weather patterns towards month-end. A slow-moving depression brought substantial rainfall to all areas on the 18th/19th - triggering the removal of hosepipe bans in some districts - but precipitation thereafter was largely restricted to occasional drizzle and fog-drip in many eastern areas.

Rainfall totals for November - on average the wettest month of the year throughout much of Britain - were within the normal range in most regions and, for Britain as a whole, it was the wettest month for over a year. Parts of Scotland were notably wet, some western areas recording more than twice the November average. By contrast, much of southern Britain had slightly below average rainfall. Importantly from the drought viewpoint, a substantial proportion of the English lowlands once again failed to reach average rainfall totals.

Despite the below average monthly totals, the November rainfall was generally sufficient to ameliorate, albeit modestly, meteorological droughts in much of eastern Britain. Table 2 confirms that only in Yorkshire (on a regional basis) can a notable rainfall deficiency be identified over the period since the late spring. For the year thus far, rainfall totals are within the usual range in all regions but still around 20 per cent below average in parts of eastern England and the Midlands. Such deficiencies are not uncommon over a twelve-month period but shortfalls of a similar magnitude extending beyond three years are indicative of remarkably sustained drought conditions (see Table 2). An illustration of the extreme nature of the drought in parts of eastern England is provided by the catchment rainfall figures for the River Partney Lymn (Lincolnshire). Without inordinate rainfall over the remainder of December, the annual total will be less than in 1989 and 1990 - themselves the driest two years in a 30-year record. The accumulated rainfall total from December 1988 is considerably lower than ANY 36-month totals ending before 1990. Long term raingauges confirm the singular nature of the current drought in a zone from Humberside and the East Midlands to Hertfordshire.

Whilst November rainfall has laid the foundation for a recovery in runoff and recharge rates, the dry interlude over the last 20 days or so has served to highlight the need for substantial rainfall over the next three months, in particular to generate a sustainable rise in groundwater levels.

Evaporation and Soil Moisture Deficits (SMDs)

Temperatures and sunshine hours were generally a little below average in November and, apart from northern Britain, evaporative losses fell somewhat short of the November mean. In most regions potential evaporation totals for 1991 are below the long term average, notably so in a few districts; actual evaporation totals (for grass) are also below average, substantially so in parts of East Anglia.

The area over which soil moisture deficits have been effectively eliminated increased steadily in November and by the end of the third week significant deficits (greater than 50 mm) were restricted to parts of the eastern lowlands from the Tyne to the Thames estuaries - generally embracing the area where the drought has achieved its greatest severity. In much of this zone, month-end deficits were 15-40 mm above average but generally well below the corresponding figures for 1990; exceptions include parts of the South-East, North Midlands and the Cheshire Plain. Notwithstanding modest increases in SMDs from around the 20th November, soil moisture conditions are such as to allow a realistic expectation - given average rainfall - of appreciable percolation in almost all areas by early 1992.

Runoff

Substantial rainfall over the week beginning around the 29th October reinforced the seasonal recovery in runoff rates throughout much of northern and western Britain and the heavy rainfall on the 18th/19th generated a sharp increase in flows extending across most of the lowlands; localised (and minor) flooding was reported from parts of London. However, steep recessions generally became established from around the 20th.

Away from the English lowlands, November runoff totals were generally approaching the average or above, markedly so in northern Britain - the average flow on the Dee (at Park), for instance, was the second highest in a twenty-year record. Below average runoff totals were largely confined to eastern England where, particularly in a zone stretching from Yorkshire to the Thames Estuary, flows remain very depressed in rivers supported principally from groundwater. The November runoff total for the Mimram (Hertfordshire), for example, was the lowest in a 40-year record with the exception of 1973. Other eastern Chalk streams also remained close to or below historical minima. In central and northern parts of East Anglia (extending into adjacent areas) runoff rates were depressed for the fourth successive year. On the Lud (Lincolnshire) three of the five lowest totals in a 24-year record have occurred since 1988 and November was the thirty-seventh successive month to register below average flows.

The accumulated runoff totals presented on Table 3 confirm the remarkable persistence of the drought in eastern and central England. Over the longer timeframes, a clear accentuation in the normal NW/SE runoff gradient is also evident. Considering three-year periods ending in November, the River Tay runoff for 1989-91 is surpassed only by the overlapping sequence ending in 1990 (the culmination of a notably wet period in Scotland stretching back to the late-1970s). In contrast the three-year runoff totals for the Lud, Little Ouse, Kent Stour and the Itchen, amongst others, are the lowest on record.

Healthy improvements in reservoir stocks were recorded in almost all areas during November. Impoundments in the Lake District and the Pennines registered rapid increases over the first three weeks - a particularly welcome improvement in Yorkshire where levels were low in late-October. The need to retain some flood alleviation storage moderated the increases in parts of Wales and very modest runoff failed to reverse the decline in stocks in lowland reservoirs in the Trent basin. On a regional basis, however, stocks are considerably greater than in early December 1990.

Groundwater

The November rainfall produced brisk recoveries in the Permo-Triassic sandstones of North Wales, the Cotswolds and in much of the Chalk in south-western England. In these areas the early-winter groundwater levels are mostly within the normal range. Elsewhere, recessions have eased but increases in level, where they can be identified, are marginal. Generally, the picture is still one of gently declining water-tables and groundwater levels in eastern, central and parts of southern England remain exceptionally depressed.

The effect of the droughts of 1989 and 1990 ensured that the summer recession of 1991 started at levels generally much below normal in most lowland areas. The failure of any, other than very localised, recoveries to be underway by late November has left groundwater levels in the Chalk standing at historically low levels over much of the eastern outcrop from southern Yorkshire to north Kent. In the Triassic sandstones of the Midlands, levels are reportedly still very depressed in the Nottingham area, and the well at Weeford Flats remains dry.

Near to the eastern seaboard, and more extensively in East Anglia, water-tables have remained well below average levels for much of the last three years. One measure of the remarkable persistence and severity of the drought is provided by the series of annual minima for the Dalton Holme borehole (in the Yorkshire Wolds) which was commissioned in 1889. As foreshadowed in the October report, the continuing decline in levels through the autumn has resulted in the November level being below any recorded prior to 1988; the four lowest annual minimum have all been registered since 1987. Less dramatic, but still remarkable hydrograph traces characterise the Washpit Farm and Redlands Farm boreholes. At both sites, the annual minima (in records of 40 and 27 years) established in 1990 were clearly eclipsed in November 1991.

As is common in November, the seasonal groundwater recovery is markedly more evident in the west than the east. The exceptional base from which the increase in the lowlands needs to be generated emphasises the need both for above average precipitation through the winter followed by further rainfall well into the spring to avoid a fourth year of fragile groundwater resources and shrunken river networks.

IH/BGS
12 December 1991

TABLE 1 1990/91 RAINFALL AS A PERCENTAGE OF THE 1941-70 AVERAGE

		Nov 1990	Dec	Jan 1991	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov 1991
England and	mm	67	101	92	65	75	69	14	92	69	30	62	75	90
Wales	%	69	112	107	100	127	119	21	151	95	33	75	90	92
NRA REGIONS														
North West	mm	73	151	98	94	110	67	18	96	65	65	68	111	167
	%	60	126	88	116	153	87	22	116	63	52	55	94	138
Northumbria	mm	61	127	83	113	85	41	22	73	55	37	42	75	115
	%	65	169	104	171	163	75	34	120	71	37	53	100	122
Severn-Trent	mm	52	87	77	43	59	67	11	74	77	21	55	54	66
	%	66	124	112	81	113	129	17	132	118	26	82	83	83
Yorkshire	mm	55	121	71	88	63	49	14	74	37	21	40	63	88
	%	62	164	92	138	119	88	23	128	53	23	56	91	99
Anglian	mm	53	47	44	39	29	45	13	77	38	18	62	26	53
	%	85	89	85	93	73	113	28	157	67	28	119	50	85
Thames	mm	34	68	80	38	45	63	13	96	79	19	52	36	65
	%	47	103	129	81	98	137	23	185	132	27	84	56	89
Southern	mm	63	65	98	39	59	56	17	125	87	15	50	51	80
	%	67	80	129	68	113	117	31	250	147	21	70	65	85
Wessex	mm	51	78	108	40	81	72	10	106	73	20	70	84	76
	%	53	87	129	68	140	133	15	196	118	24	89	102	79
South West	mm	106	124	153	82	127	100	9	127	91	32	84	123	108
	%	79	92	119	91	151	141	11	195	108	32	81	109	80
Welsh	mm	112	163	151	94	127	124	15	110	98	53	85	153	137
	%	78	112	111	98	146	144	16	134	103	45	68	119	96
Scotland	mm	102	191	151	83	127	123	41	121	92	67	129	162	215
	%	72	122	110	80	138	137	45	132	82	52	94	109	152
RIVER PURIFICATION BOARDS														
Highland	mm	147	241	180	71	141	131	63	124	108	84	181	191	294
	%	87	123	110	53	124	115	61	113	85	57	115	103	174
North-East	mm	95	97	60	77	81	62	46	128	57	33	57	116	135
	%	92	95	66	104	131	102	60	183	62	31	66	120	131
Tay	mm	63	149	154	90	117	110	23	136	91	41	108	146	139
	%	53	111	131	98	143	147	24	164	89	35	94	120	117
Forth	mm	56	143	133	86	103	90	18	108	96	39	99	109	111
	%	52	131	134	112	149	132	21	144	98	34	92	103	103
Tweed	mm	53	152	110	102	93	62	21	89	65	35	66	99	124
	%	51	169	118	148	160	102	28	131	73	31	71	113	119
Solway	mm	77	191	144	108	150	148	17	121	77	69	79	175	213
	%	53	126	103	116	165	168	18	134	70	53	52	122	147
Clyde	mm	94	226	187	90	156	184	33	129	110	86	157	190	287
	%	56	122	116	80	149	179	34	125	85	61	90	104	172

Note: The most recent monthly rainfall figures for England and Wales correspond to the MORECS areal assessments derived by the Meteorological Office; for the Scottish RPBs the November 1991 totals were estimated from the isohyetal map provided with the MORECS bulletin. The regional areal rainfall figures are regularly updated (normally one or two months in arrears) using figures derived from a far denser raingauge network.

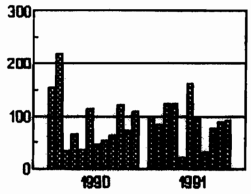
TABLE 2 RAINFALL RETURN PERIOD ESTIMATES

		May-Nov 91		Jan-Nov 91		Mar 90 - Nov 91		Nov 88 - Nov 91	
			Est Return Period, years		Est Return Period, years		Est Return Period, years		Est Return Period, years
England and Wales	mm	433		734		1297		2483	
	% LTA	78	5-15	89	2-5	82	30-40	88	15-20
NRA REGIONS									
North West	mm	590		959		1825		3475	
	% LTA	78	5-15	87	5	86	5-15	92	5-10
Northumbrian	mm	419		741		1359		2340	
	% LTA	76	10-15	92	2-5	88	5-10	86	20-30
Severn Trent	mm	358		604		1076		2089	
	% LTA	75	10-15	86	5-10	79	30-45	87	15-20
Yorkshire	mm	337		608		1155		2152	
	% LTA	66	40-50	80	10-15	80	30-40	83	40-60
Anglia	mm	287		444		789		1514	
	% LTA	75	10-15	80	10-15	74	120-170	80	110-150
Thames	mm	360		586		933		1828	
	% LTA	82	5	92	2-5	76	40-60	84	20-35
Southern	mm	425		677		1119		2094	
	% LTA	89	2-5	95	2-5	81	15-25	85	15-25
Wessex	mm	439		740		1200		2347	
	% LTA	84	2-5	95	2-5	80	20-30	87	20-30
South West	mm	574		1036		1778		3446	
	% LTA	84	2-5	98	2-5	87	5-10	93	2-5
Welsh	mm	651		1147		1193		3872	
	% LTA	83	5-10	96	2-5	87	5-10	93	5
Scotland	mm	827		1311		2685		4975	
	% LTA	97	2-5	103	2-5	109	5-10	112	30-50
RIVER PURIFICATION BOARDS									
Highland	mm	1045		1568		3300		6279	
	% LTA	104	2-5	103	2-5	111	5-10	117	140-180
North-East	mm	572		852		1656		2782	
	% LTA	90	2-5	93	2-5	93	2-5	88	15-25
Tay	mm	684		1155		2150		4051	
	% LTA	91	2-5	103	2-5	99	<2	104	2-5
Forth	mm	580		992		1944		3602	
	% LTA	83	5-10	98	2-5	100	<2	104	2-5
Tweed	mm	499		866		1622		2867	
	% LTA	79	5-15	95	2-5	93	2-5	93	5
Solway	mm	751		1301		2373		4436	
	% LTA	87	2-5	102	2-5	96	2-5	100	<2
Clyde	mm	992		1609		3169		5932	
	% LTA	99	<2	109	2-5	110	5-10	115	45-65

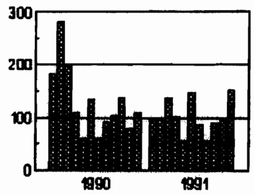
Return period assessments are based on tables provided by the Meteorological Office*. These assume a start in a specified month; return periods for a start in any month may be expected to be an order of magnitude less. "Wet" return periods underlined.
The tables reflect rainfall totals over the period 1911-70 only and the estimate assumes a sensibly stable climate.

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

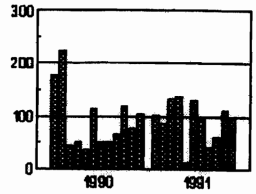
FIGURE 1. MONTHLY RAINFALL FOR 1990-1991 AS A PERCENTAGE OF THE 1941-1970 AVERAGE



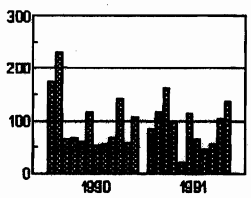
England and Wales



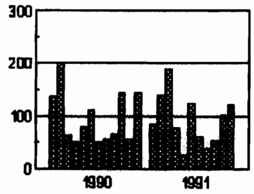
Scotland



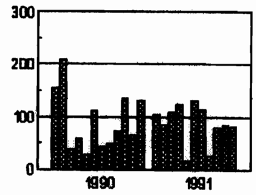
Welsh Region



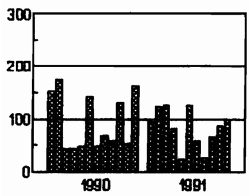
North West Region



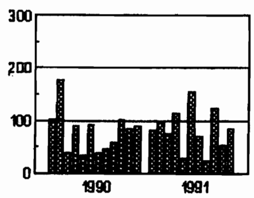
Northumbria Region



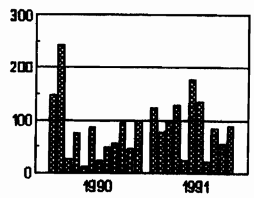
Severn-Trent Region



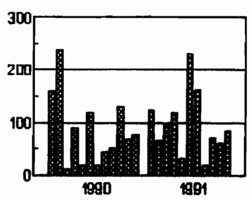
Yorkshire Region



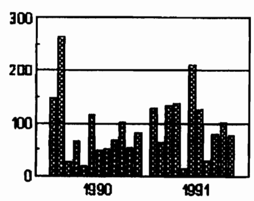
Anglian Region



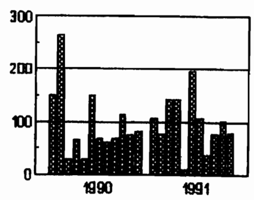
Thames Region



Southern Region

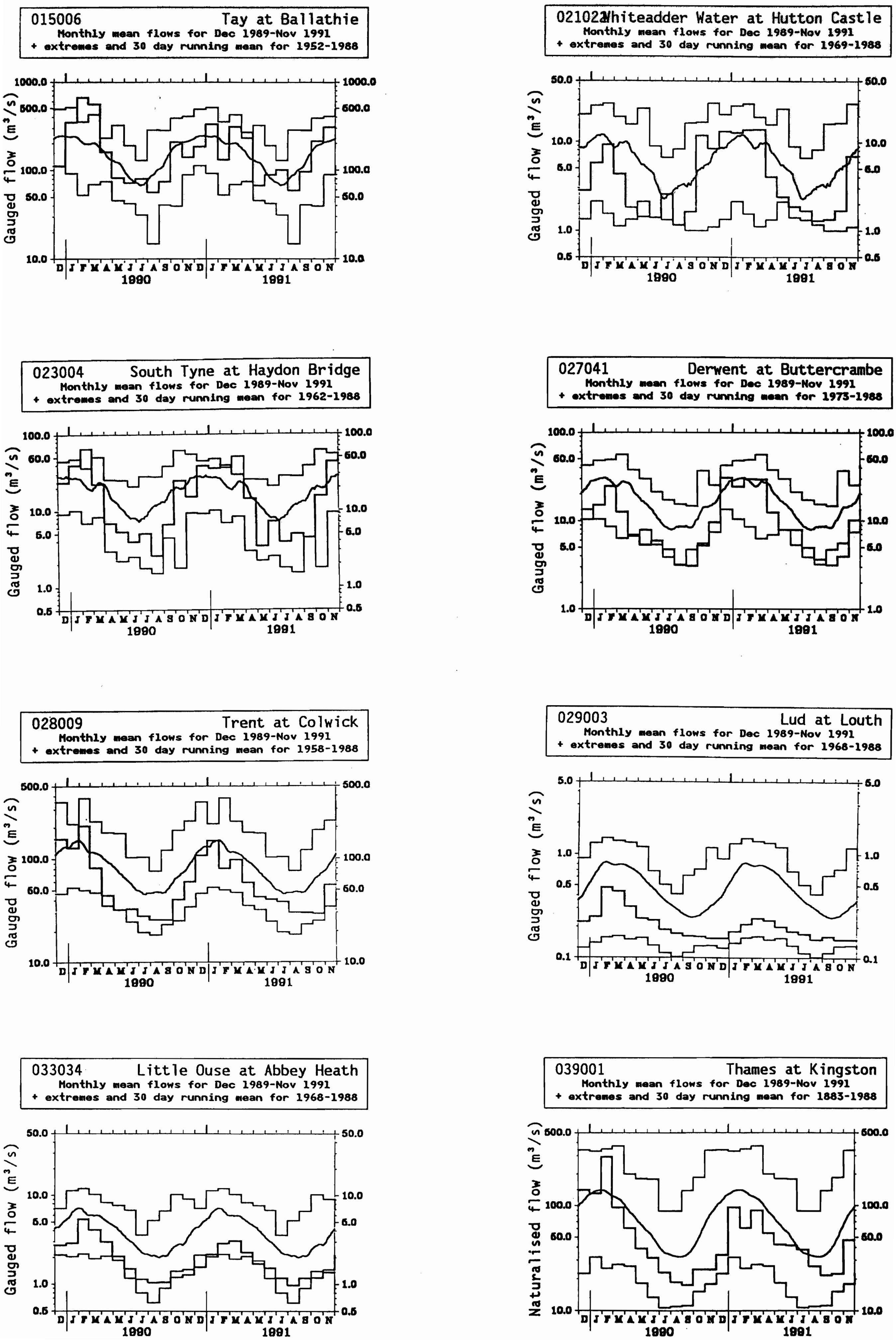


Wessex Region

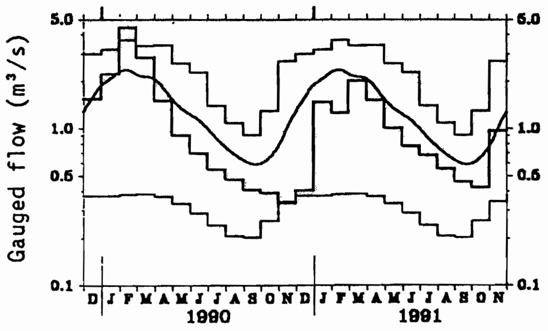


South West Region

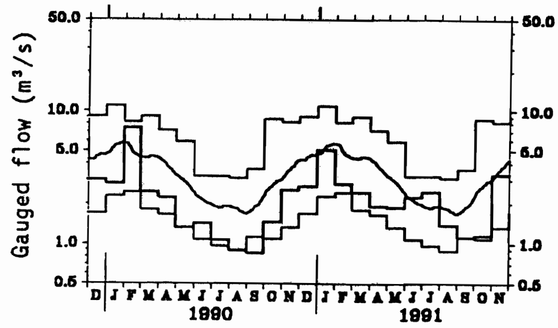
FIGURE 2 MONTHLY RIVER FLOW HYDROGRAPHS



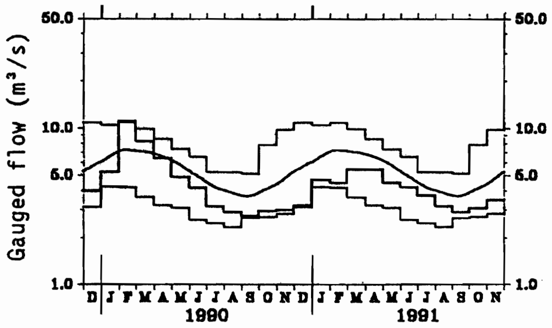
039020 Coln at Bibury
Monthly mean flows for Dec 1989-Nov 1991
+ extremes and 30 day running mean for 1963-1988



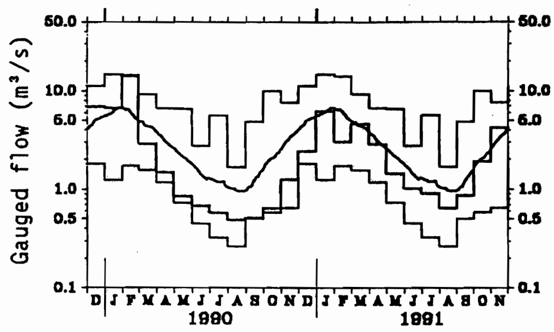
040011 Great Stour at Horton
Monthly mean flows for Dec 1989-Nov 1991
+ extremes and 30 day running mean for 1964-1988



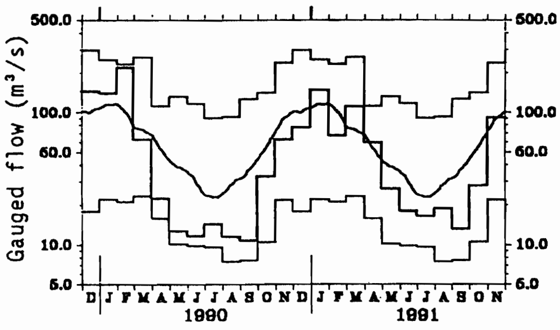
042010 Itchen at Highbridge+Allbrook
Monthly mean flows for Dec 1989-Nov 1991
+ extremes and 30 day running mean for 1958-1988



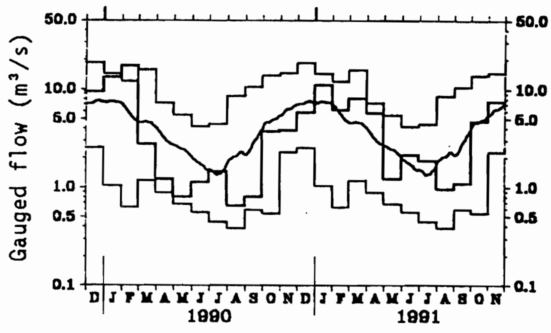
052005 Tone at Bishops Hull
Monthly mean flows for Dec 1989-Nov 1991
+ extremes and 30 day running mean for 1961-1988



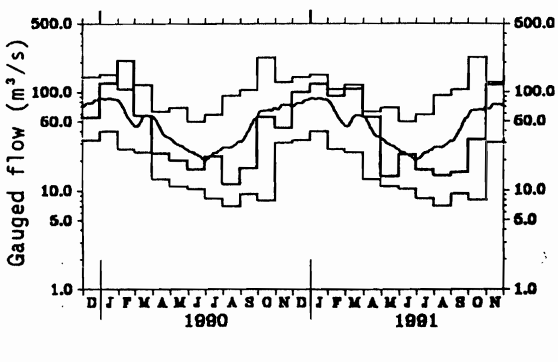
054001 Severn at Bewdley
Monthly mean flows for Dec 1989-Nov 1991
+ extremes and 30 day running mean for 1921-1988



057004 Cynon at Abercynon
Monthly mean flows for Dec 1989-Nov 1991
+ extremes and 30 day running mean for 1957-1988



076007 Eden at Sheepmount
Monthly mean flows for Dec 1989-Nov 1991
+ extremes and 30 day running mean for 1967-1988



084013 Clyde at Daldowie
Monthly mean flows for Dec 1989-Nov 1991
+ extremes and 30 day running mean for 1963-1988

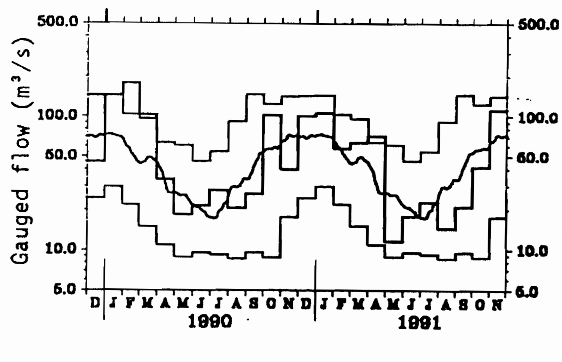


TABLE 3 RUNOFF AS MM. AND AS A PERCENTAGE OF THE PERIOD OF RECORD AVERAGE WITH SELECTED PERIODS RANKED IN THE RECORD

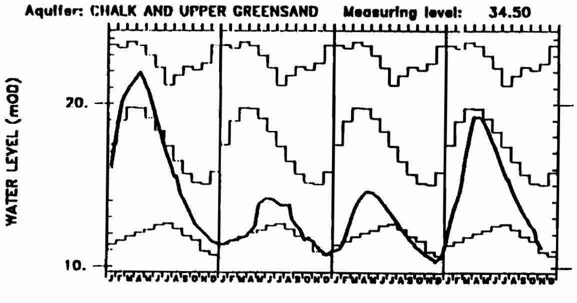
	Jul 1991	Aug 1991	Sept 1991	Oct 1991	Nov 1991		6/91 to 11/91		1/91 to 11/91		5/90 to 11/91		5/89 to 11/91	
	mm %LT	mm %LT	mm %LT	mm % LT	mm %LT	rank /yrs	mm %LT	rank /yrs	mm %LT	rank /yrs	mm %LT	rank /yrs	mm %LT	rank /yrs
Dee at	42	17	17	70	122	19	323	12	735	12	1072	6	1698	3
Park	149	53	41	87	165	/20	109	/19	106	/19	92	/18	86	/17
Tay at	58	34	54	124	173	34	494	29	1127	32	1644	21	3098	30
Ballathie	146	66	77	111	145	/40	112	/39	115	/39	100	/38	112	/37
Whiteadder Water at	9	7	7	9	35	12	77	4	316	8	534	9	712	5
Hutton Castle	70	45	44	32	94	/23	61	/22	91	/22	97	/21	75	/20
South Tyne at	14	17	15	55	148	28	274	11	692	17	1050	12	1728	7
Haydon Bridge	48	43	29	79	165	/30	89	/28	106	/28	95	/26	92	/24
Wharfe at	18	15	15	36	117	32	225	10	578	14	877	5	1464	3
Flint Mill Weir	67	37	33	56	149	/37	80	/36	93	/36	84	/35	83	/34
Derwent at	8	6	5	7	17	9	56	4	224	6	337	5	508	2
Buttercrambe	56	42	37	34	60	/31	52	/30	78	/30	73	/29	64	/28
Trent at	14	11	10	10	19	11	78	5	227	2	352	2	655	2
Colwick	88	66	60	43	63	/34	65	/33	73	/33	70	/32	76	/31
Lud at	8	7	8	8	7	3	46	1	96	2	166	1	309	1
Louth	49	51	71	66	48	/24	56	/23	40	/23	46	/22	50	/21
Witham at	5	4	5	5	7	15	32	11	110	8	150	6	306	5
Claypole Mill	71	57	81	59	59	/33	64	/33	66	/32	60	/32	70	/31
Little Ouse at	4	4	4	4	5	2	28	2	72	2	113	1	224	1
Abbey Heath	48	52	54	40	41	/24	50	/24	47	/23	47	/23	54	/22
Colne at	4	3	3	3	5	11	24	9	61	4	89	4	198	1
Lexden	96	74	71	36	41	/33	63	/32	51	/32	49	/31	62	/30
Thames at	10	7	6	6	12	38	52	29	142	16	198	9	442	14
Kingston (natr.)	106	80	67	45	56	/109	70	/109	66	/109	59	/108	76	/107
Blackwater at	15	11	11	12	19	18	85	18	202	11	299	9	598	12
Swallowfield	131	96	84	62	79	/40	90	/39	88	/39	79	/38	93	/37
Coln at	17	14	11	11	23	17	95	9	272	5	375	4	788	6
Bibury	81	83	78	69	96	/29	81	/28	78	/28	69	/27	83	/26
Great Stour at	19	11	9	9	25	16	88	10	195	6	289	4	487	1
Horton	135	82	65	44	94	/28	85	/26	75	/25	68	/24	67	/22
Itchen at	27	23	21	23	25	8	150	5	327	5	526	1	943	1
Highbridge+Allbrook	89	82	80	76	73	/34	82	/33	78	/33	77	/32	82	/31
Stour at	14	9	8	13	29	10	89	10	288	5	364	3	806	5
Throop Mill	128	88	69	61	95	/19	90	/19	88	/19	71	/18	88	/17
Piddle at	21	15	16	23	30	18	127	18	320	8	431	4	833	6
Baggs Mill	118	97	106	113	105	/29	106	/28	89	/27	78	/26	86	/24
Exe at	32	15	14	56	128	29	270	17	681	16	988	11	1735	7
Thorverton	155	53	36	75	134	/36	96	/36	98	/35	86	/35	88	/34
Tone at	12	8	11	25	54	22	124	17	357	9	455	3	957	6
Bishops Hull	78	65	72	94	130	/31	96	/31	88	/30	72	/30	86	/29
Severn at	10	12	8	17	54	42	112	18	360	27	503	9	938	14
Bewdley	71	70	37	51	101	/71	71	/71	93	/70	79	/70	86	/69
Wye at	107	178	102	167	315	29	965	19	1784	16	2978	12	4973	8
Cefn Brwyn	98	125	62	80	126	/39	101	/35	101	/34	95	/30	96	/25
Cynon at	47	24	27	120	182	25	452	15	1246	24	1701	12	3144	16
Abercynon	138	48	40	99	120	/34	96	/32	118	/32	96	/30	103	/28
Dee at	63	54	43	146	260	13	633	4	1308	5	2254	2	3930	4
New Inn	94	59	32	72	107	/23	79	/22	84	/22	84	/21	87	/20
Eden at	19	16	17	38	132	19	249	10	691	16	1022	12	1728	10
Sheepmount	70	52	39	51	162	/22	92	/21	115	/21	104	/19	104	/17
Clyde at	32	20	28	58	151	24	313	13	737	19	1232	17	2134	21
Daldowie	117	49	49	70	160	/29	96	/28	111	/28	109	/27	113	/26

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 1991. For the long periods (at the right of this table), the end date for the long term is 1991.

FIGURE 3 GROUNDWATER HYDROGRAPHS

Site name: DALTON HOLME

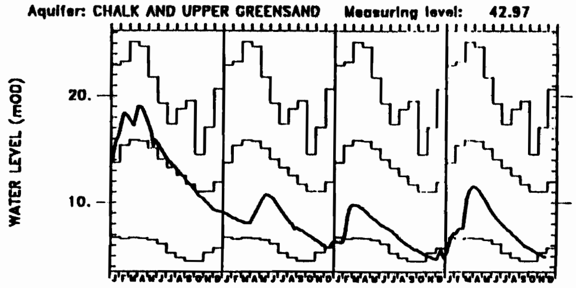
National grid reference: SE 9651 4530 Well number: SE94/5
Aquifer: CHALK AND UPPER GREENSAND Measuring level: 34.50



1988 1989 1990 1991
Max, Min and Mean values calculated from years 1889 TO 1989

Site name: LITTLE BROCKLESBY

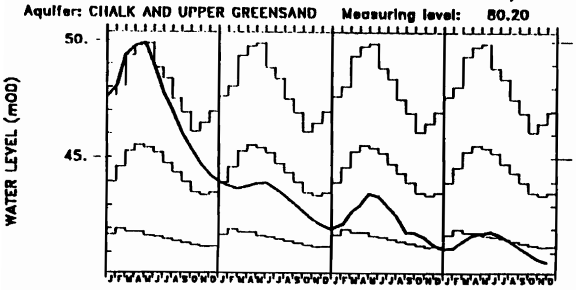
National grid reference: TA 1371 0888 Well number: TA10/40
Aquifer: CHALK AND UPPER GREENSAND Measuring level: 42.97



1988 1989 1990 1991
Max, Min and Mean values calculated from years 1926 TO 1989

Site name: WASHPIT FARM

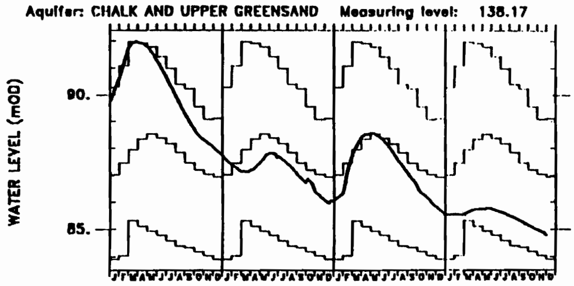
National grid reference: TF 8138 1960 Well number: TF81/2
Aquifer: CHALK AND UPPER GREENSAND Measuring level: 80.20



1988 1989 1990 1991
Max, Min and Mean values calculated from years 1950 TO 1989

Site name: THE HOLT

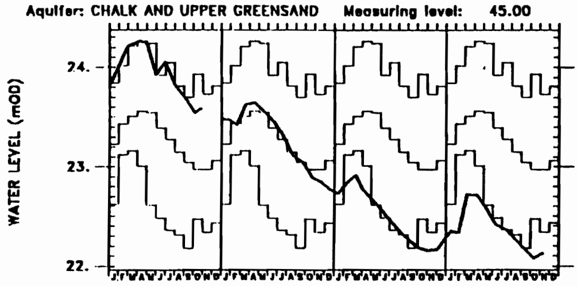
National grid reference: TL 1692 1965 Well number: TL11/9
Aquifer: CHALK AND UPPER GREENSAND Measuring level: 138.17



1988 1989 1990 1991
Max, Min and Mean values calculated from years 1964 TO 1989

Site name: FAIRFIELDS

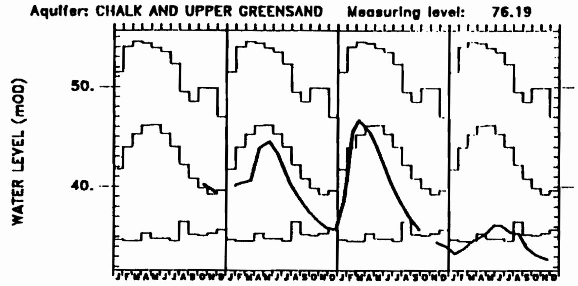
National grid reference: TM 2461 6109 Well number: TM26/46
Aquifer: CHALK AND UPPER GREENSAND Measuring level: 45.00



1988 1989 1990 1991
Max, Min and Mean values calculated from years 1974 TO 1989

Site name: REDLANDS HALL,ICKLETON

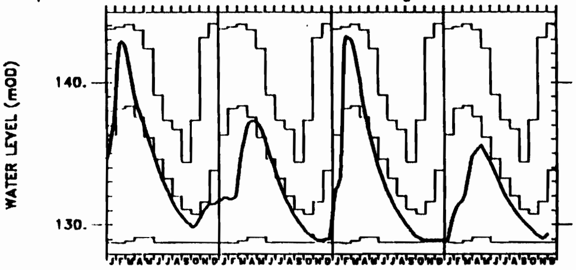
National grid reference: TL 4522 4182 Well number: TL44/12
Aquifer: CHALK AND UPPER GREENSAND Measuring level: 76.19



1988 1989 1990 1991
Max, Min and Mean values calculated from years 1964 TO 1989

Site name: ROCKLEY

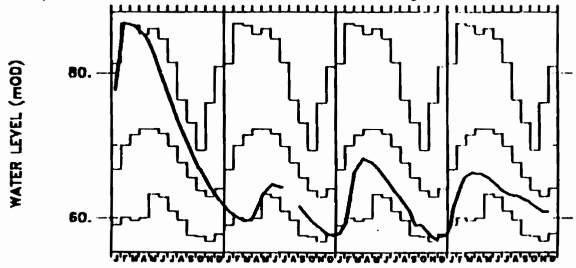
National grid reference: SU 1655 7174 Well number: SU17/57
Aquifer: CHALK AND UPPER GREENSAND Measuring level: 146.57



1988 1989 1990 1991
Max, Min and Mean values calculated from years 1933 TO 1989

Site name: LITTLE BUCKET FARM,WALTHAM

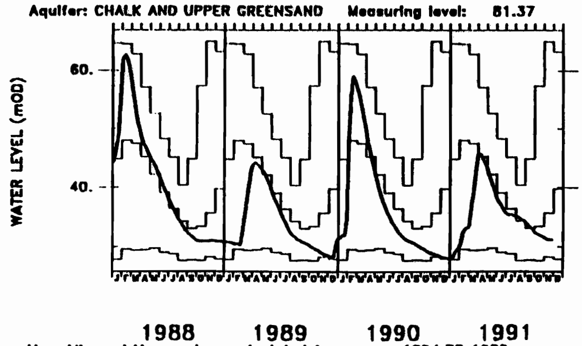
National grid reference: TR 1225 4690 Well number: TR14/9
Aquifer: CHALK AND UPPER GREENSAND Measuring level: 87.33



1988 1989 1990 1991
Max, Min and Mean values calculated from years 1971 TO 1989

Site name: COMPTON HOUSE

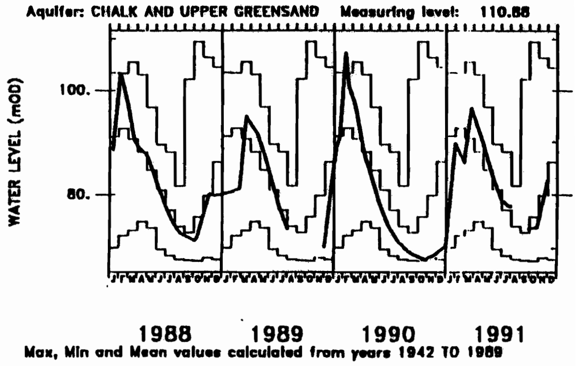
National grid reference: SU 7755 1490 Well number: SU71/23
Aquifer: CHALK AND UPPER GREENSAND Measuring level: 81.37



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

Site name: WEST WOODYATES MANOR

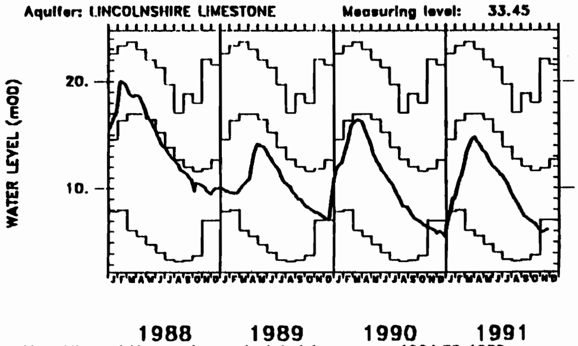
National grid reference: SU 0160 1960 Well number: SU01/58
Aquifer: CHALK AND UPPER GREENSAND Measuring level: 110.88



Max, Min and Mean values calculated from years 1942 TO 1989

Site name: NEW RED LION

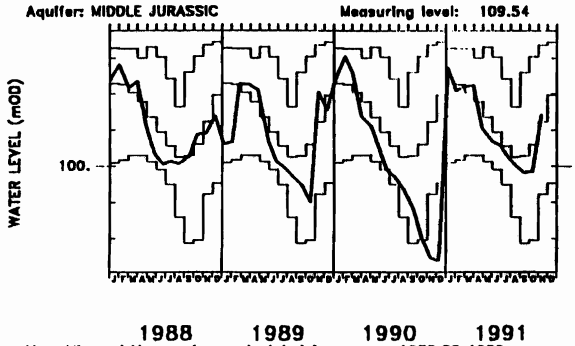
National grid reference: TF 0885 3034 Well number: TF03/37
Aquifer: LINCOLNSHIRE LIMESTONE Measuring level: 33.45



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

Site name: AMPNEY CRUCIS

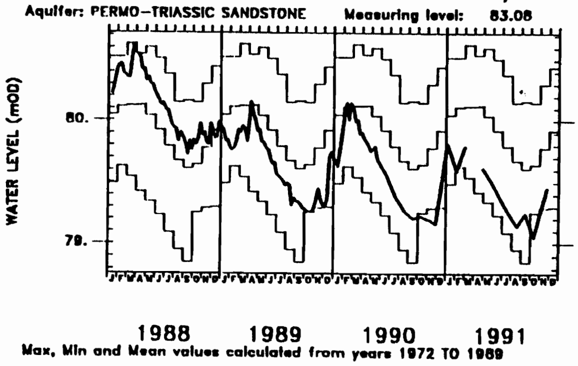
National grid reference: SP 0595 0190 Well number: SP00/62
Aquifer: MIDDLE JURASSIC Measuring level: 109.54



Max, Min and Mean values calculated from years 1958 TO 1989

Site name: LLANFAIR DC

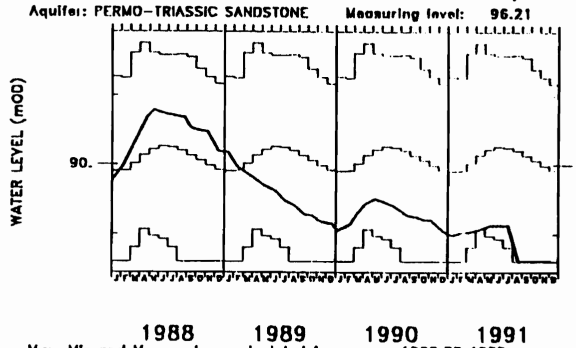
National grid reference: SJ 1374 5556 Well number: SJ15/15
Aquifer: PERMO-TRIASSIC SANDSTONE Measuring level: 83.08



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

Site name: WEEFORD FLATS,WEEFORD

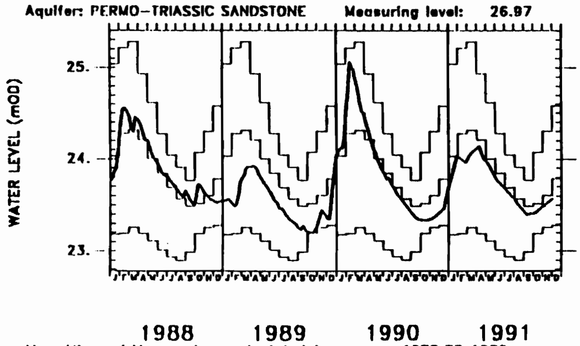
National grid reference: SK 1440 0464 Well number: SK10/9
Aquifer: PERMO-TRIASSIC SANDSTONE Measuring level: 96.21



Max, Min and Mean values calculated from years 1966 TO 1989

Site name: BUSSELS NO.7A

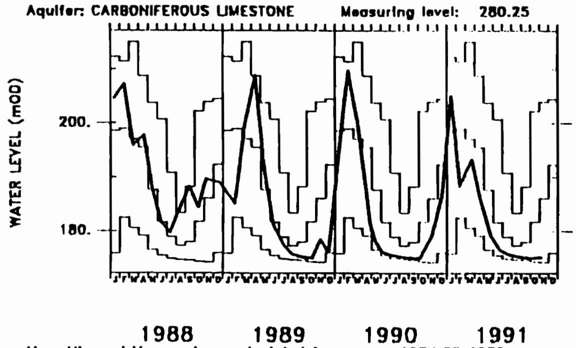
National grid reference: SX 9528 9872 Well number: SX99/37B
Aquifer: PERMO-TRIASSIC SANDSTONE Measuring level: 26.97



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

Site name: ALSTONFIELD

National grid reference: SK 1292 5547 Well number: SK15/16
Aquifer: CARBONIFEROUS LIMESTONE Measuring level: 280.25



Max, Min and Mean values calculated from years 1974 TO 1989

TABLE 4 START-MONTH RESERVOIR STORAGES UP TO DECEMBER 1991

Area	Reservoir (R)/ Group (G)		Capacity● (Ml)	Jul 1991 (%)▲	Aug 1991 (%)▲	Sep 1991 (%)▲	Oct 1991 (%)▲	Nov 1991 (%)▲	Dec 1991 (%)▲	Dec 1990 (%)▲
North West	Northern Command Zone[1]	(G)	133375	68	55	43	33	41	72	66
	Vyrnwy	(R)	55146	86	83	85	71	82	85	77
Northumbria	Teesdale[2]	(G)	87936	61	52	39	31	41	68	77
	Kielder	(R)	199175*				85*	85*	96*	75*
Severn-Trent	Clywedog	(R)	44922	99	94	91	74	75	82	84
	Derwent Valley[3]	(G)	39525	74	66	53	35	32	46	61
Yorkshire	Washburn[4]	(G)	22035	72	59	46	36	28	48	42
	Bradford supply[5]	(G)	41407	76	65	50	38	37	70	69
Anglian	Grafham	(R)	58707	96	95	88	81	76	81	59
	Rutland	(R)	130061	80	81	70	68	63	63	60
Thames	London[6]	(G)	206232	91	90	80	66	57	71	52
	Farmoor[7]	(G)	13843	100	100	89	82	89	97	52
Southern	Bewl	(R)	28170	73	75	73	62	54	58	34
	Ardingly	(R)	4627	100	100	81	84	81	85	54
Wessex	Clatworthy	(R)	5364*	71*	59*	47*	40*	59	89	47
	Bristol WW[8]	(G)	36620	79	71	57	46	39	50	27
South West	Colliford	(R)	28540	89	90	86	81	79	83	68
	Roadford	(R)	34500	94	95	89	84	81	86	61[9]
	Wimbleball[10]	(R)	21320	75	73	63	52	57	69	39
	Stithians	(R)	5205	77	66	53	40	34	34	29
Welsh	Celyn + Brenig	(G)	131155	94	89	79	68	71	84	76
	Brianne	(R)	62140	93	93	92	84	89	100	100
	Big Five[11]	(G)	69762	94	92	92	69	73	87	49
	Elan Valley[12]	(G)	99106	91	87	85	77	90	94	90

● Live or usable capacity (unless indicated otherwise)

* Gross storage/percentage of gross storage

1. Includes Haweswater, Thirlmere, Stocks and Barnacre.
2. Cow Green, Selset, Grassholme, Balderhead, Blackton and Hury.
3. Howden, Derwent and Ladybower.
4. Swinsty, Fewston, Thruscross and Eccup.
5. The Nidd/Barden group (Scar House, Angram, Upper Barden, Lower Barden and Chelker) plus Grimwith.
6. Lower Thames (includes Queen Mother, Wraysbury, Queen Mary, King George VI and Queen Elizabeth II) and Lee Valley (includes King George and William Girling) groups - pumped storages.
7. Farmoor 1 and 2 - pumped storages.
8. Blagdon, Chew Valley and others.
9. The new Roadford reservoir was still filling after impounding.
10. Shared between South West (river regulation for abstraction) and Wessex (direct supply.
11. Usk, Talybont, Llandegfedd (pumped storage), Taf Fechan, Taf Fawr.
12. Claerwen, Caban Coch, Pen y Garreg and Craig Goch.

Note: Variations in storage depend on the balance between inputs (from catchment rainfall and any pumping) and outputs (to supply, compensation flow, HEP, amenity). There will be additional losses due to evaporation, especially in the summer months. Operational strategies for making the most efficient use of water stocks will further affect reservoir storages. Table 4 provides a link between the hydrological conditions described elsewhere in the report and the water resources situation.

TABLE 5 A COMPARISON OF NOVEMBER GROUNDWATER LEVELS : 1991, 1976 AND 1973

Site	Aquifer	Records commence	Average November Level	November 1973		November 1976		November and December 1991		No of years November levels <1991	Lowest pre-1991 level (any month)
				Day	Level	Day	Level	Day	Level		
Dalton Holme	C & UGS	1889	15.12	24/11	15.60	27/11	15.07	11/11	11.18	2	10.34
Little Brocklesby	C & UGS	1926	11.03	14/11	9.07	26/11	7.09	26/11	4.90	1	4.56
Washpit Farm	C & UGS	1950	43.31	1/11	41.25	1/11	41.50	02/12	40.61	0	41.24
The Holt	C & UGS	1964	87.03	25/11	84.04	24/11	84.16	24/11	84.88	2	83.90
Fairfields	C & UGS	1974	22.97	-	-	30/11	23.08	12/11	22.12	0	22.15
Redlands Farm	C & UGS	1964	39.23	1/11	35.89	1/11	35.30	25/11	32.71	0	34.04
Rockley	C & UGS	1933	131.62	25/11	129.83	26/11	129.12	24/11	129.12	9	dry (below 128.78)
Little Bucket Farm	C & UGS	1971	62.91	28/11	58.74	1/11	56.77	28/11	60.83	6	56.77
Compton House	C & UGS	1894	35.76	29/11	28.22	4/11	29.90	26/11	31.11	>10	27.64
West Dean	C & UGS	1940	1.76	23/11	1.27	26/11	2.13	29/11	1.64	>10	1.01
Lime Kiln Way	C & UGS	1969	124.87	30/11	124.53	15/11	124.42	05/12	124.24	0	124.09
Ashton Farm	C & UGS	1974	65.93	-	-	25/11	68.85	29/11	68.20	>10	63.10
West Woodyates	C & UGS	1942	79.84	25/11	70.65	22/11	93.00	29/11	81.80	>10	67.62
New Red Lion	LLst	1964	11.86	25/11	9.45	26/11	10.6	25/11	6.11	1	3.29
Ampney Crucis	Mid Jur	1958	101.22	18/11	99.70	28/11	101.76	11/11	101.39	>10	97.38
Dunmurry (NI)	PTS	1985	28.28	-	-	-	-	26/11	28.10	3	27.47
Llanfair DC	PTS	1972	79.78	1/11	72.29	1/11	79.47	25/11	79.45	3	78.85
Morris Dancers	PTS	1969	32.60	28/11	32.18	23/11	31.81	12/11	32.11	3	30.87
Weeford Flats	PTS	1966	89.90	30/11	89.94	25/11	88.61	06/12	dry	1	(dry)
Bussels 7A	PTS	1972	23.60	28/11	23.36	30/11	24.30	04/12	23.56	>10	22.90
Rusheyford NE	MgLst	1967	75.80	1/11	64.83	30/11	68.18	12/11	75.04	>10	64.77
Peggy Ellerton	MgLst	1968	34.12	29/11	32.72	22/11	32.34	11/11	32.86	5	31.10
Alstonfield	CLst	1974	186.07	-	-	25/11	182.08	06/11	175.08	2	174.22

Groundwater levels are in metres above Ordnance Datum

C & UGS	Chalk and Upper Greensand
LLst	Lincolnshire Limestone
PTS	Permo-Triassic sandstones
Mid Jur	Middle Jurassic limestones
MgLst	Magnesian Limestone
CLst	Carboniferous Limestone

FIGURE 4 LOCATION MAP OF GAUGING STATIONS AND GROUNDWATER INDEX WELLS