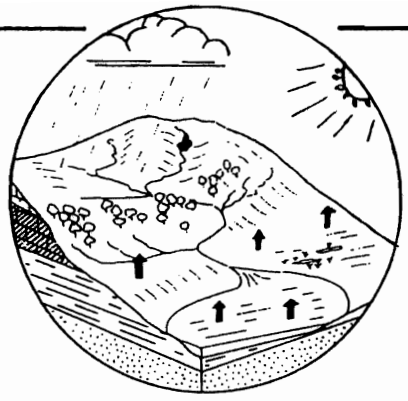
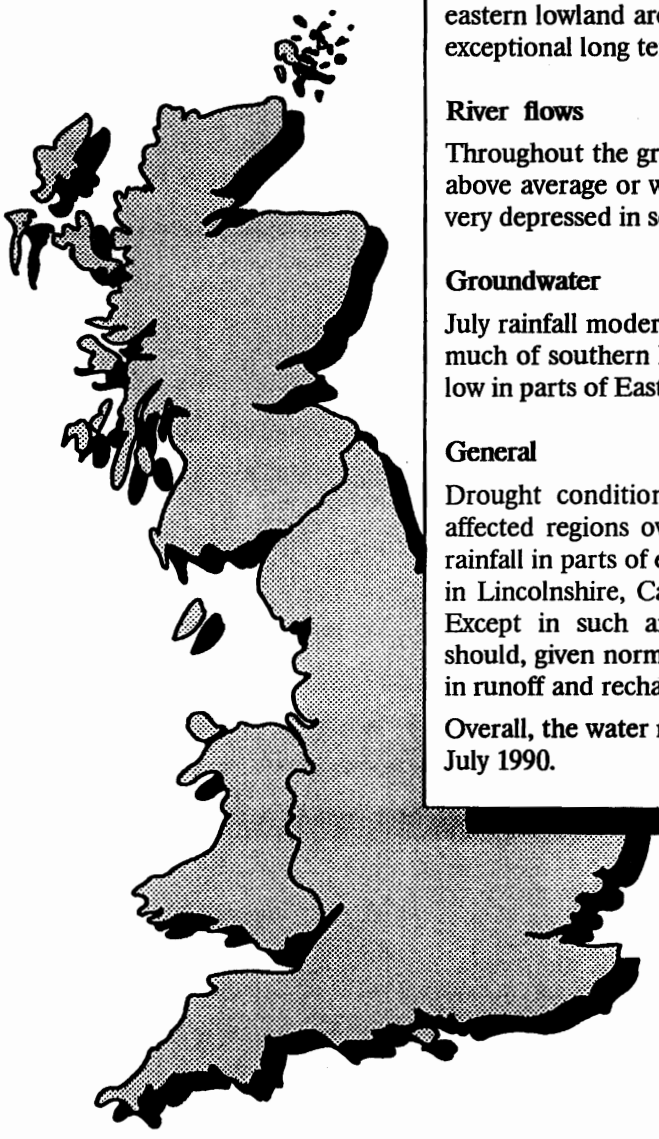
Hydrological Summary for Great Britain





JULY 1991

Rainfall

The July rainfall total for GB was close to the 1941-70 average but spatial variations were large. Accumulated rainfall totals are within the normal range in most regions but in some eastern lowland areas a dry summer has increased the already exceptional long term deficiencies.

River flows

Throughout the greater part of Britain, July runoff totals were above average or well within the normal range. Flows remain very depressed in some English lowland catchments.

Groundwater

July rainfall moderated the decline in groundwater levels over much of southern England but water-tables remain extremely low in parts of East Anglia and some adjacent areas.

General

Drought conditions have eased appreciably in most of the affected regions over the last two months. However, limited rainfall in parts of eastern England has intensified the drought in Lincolnshire, Cambridgeshire and some adjoining districts. Except in such areas the relatively moist soils (for July) should, given normal rainfall, herald a brisk seasonal recovery in runoff and recharge rates through the autumn.

Overall, the water resources outlook is much healthier than in July 1990.

Institute of Hydrology

British Geological Survey

HYDROLOGICAL SUMMARY FOR GREAT BRITAIN JULY 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

For Great Britain as a whole the July rainfall total was very close to the 1941-70 average. Regional and local variations in rainfall amounts were, however, large and a substantial proportion of the monthly rainfall was attributable to two or three very wet interludes, especially in southern Britain where notable rainfall totals were recorded early in the month and particularly on the 18th, 24th and 30th when thunderstorms produced localised flooding in, for instance, the West Midlands and in parts of Kent.

In broad terms, percentage rainfall totals for July decreased along a south-north transect but spatial variations were considerable, especially where rainfall was largely convectional in nature. A number of districts close to the south coast recorded more than twice the normal July rainfall whilst less than 50 per cent was registered in parts of eastern Scotland and, importantly, in a swathe cutting through eastern England from Northumbria to Suffolk. Parts of north Wales and north-west England were also dry.

The net effect of the summer rainfall thus far has been to reduce considerably the areal extent of the meteorological drought but, conversely, to increase its intensity in parts of East Anglia and the east Midlands. Table 2 confirms that rainfall totals are well within the normal range for all regions - but not all areas - both in 1991 and over the last 12 months. Appreciable longer-term drought conditions may still be identified over much of the English lowlands but rainfall deficiencies are severe only in the Anglian region (and some adjacent areas).

Intense drought conditions are now largely restricted to Cambridgeshire, Lincolnshire and neighbouring counties where rainfall since last autumn has been well below average; in some localities, rainfall has been above average in only one of the last 17 months. This exceptionally persistent drought, extending back in some areas to the spring of 1988, has produced very depressed runoff and recharge rates (see below).

Evaporation and Soil Moisture Deficits (SMDs)

Temperatures and sunshine hours were somewhat above average for much of Great Britain in July but the humid and generally calm conditions restricted evaporation losses somewhat. MORECS soil moisture deficits, whilst generally well below average, displayed exceptional local variability.

Potential evaporation (PE) losses for July were substantially below average throughout most of Britain apart from northern England and south-west Scotland. In the English lowlands, July PE totals were markedly lower (20-40 mm) than in the last two years. Actual evaporation losses tended to be close to or a little above the mean (reflecting lower than normal SMDs - see below).

Conditions in 1991 have not been conducive to a continuation of the exceptionally high evaporative

losses which characterised 1988-90. PE totals for the January-July 1991 period are well below average and close to the lowest on record over much of southern Britain; PE shortfalls of 100 mm relative to the record totals established last year are common. Actual evaporation losses for 1991 remain well within the normal range although over the twelve months to August AE losses are notably low - a reflection of limited evaporative demand in 1991 and the constraining influence of high SMDs over the latter half of 1990.

At the end of July soils were at, or close to, field capacity in much of northern Scotland, upland areas of Wales, parts of western England and, most unusually, in a few districts in Sussex and Kent (where zero end-of-July MORECS deficits are unprecedented). Throughout the greater part of Britain, SMDs are considerably below average, typically 30-50 millimetres, and greatly below calculated SMDs for the late summer in 1990. Above average SMDs are largely confined to a zone along the eastern seaboard from the Forth estuary to the Wash. Apart from the latter region, the generally moderate deficits (typically equivalent to less than six weeks average rainfall) provide grounds for optimism regarding a normal autumn recovery in runoff and recharge rates.

Runoff

The considerable July rainfall in many areas - following a wet June which greatly reduced SMDs - has generally served to moderate, or arrest, the rate of flow recession throughout much of southern Britain. Recessions have been steeper in northern England and parts of eastern Scotland but mean flows for July were within the normal range throughout by far the greater part of Britain. Flows in rivers draining from the Scottish Highlands were especially healthy in the first half of the month and the July runoff totals typically ranked among the highest half dozen on record. Flows were also well above average in south-west England and South Wales. One indication of the substantial recent amelioration in the drought was the above average mean flows recorded for rivers in the Wessex, Southern and Thames areas - naturalised flows on the Thames itself exceeding the monthly mean for the first time since February 1990.

In stark contrast to the general improvement in flows (relative to the monthly average) since May, the exceptionally long decline in runoff rates for a number of eastern rivers - principally those supported by baseflow - continued in July. Flows for the River Lud (Lincolnshire) were well below average for the 33rd successive month and although flows remain marginally above the minima recorded in 1976 and 1973, the long term accumulations (>18 months) are unprecedented in a 22-year record. Similarly depressed accumulated totals typify other East Anglian catchments (e.g. the Little Ouse) and tributaries of the lower Trent. After recovering well through the winter, flows in the Yorkshire Derwent are again very low; three of the four lowest July runoff totals in a 30-year record have now been recorded since 1988. The runoff accumulations presented on Table 3 serve to emphasise the remarkable regional runoff differences over both short and long durations.

Unusually for July, reservoir storages showed very little change on the previous month with a few modest increases reported both for naturally filling reservoirs in the west and pumped storage impoundments in the lowlands. Surface water stocks are generally healthy and represent a major improvement relative to the situation at the same time in 1990; even in the Anglian region surface water stocks are considerably greater than in July 1990.

Groundwater

As is typical of the late summer, groundwater levels exhibited relatively modest changes through July but the variations which did occur were often significant. In general, groundwater levels continued to fall throughout the outcrop areas of all the major aquifers, and there is as yet little sign of any sustained easing of the groundwater drought. However, over much of the southern Chalk outcrop, the relatively wet summer has produced just sufficient infiltration to slacken the normal July recession. Where July rainfall was particularly heavy some actual water-table rises have been reported - an

increase of several metres being registered in parts of the South Downs in Sussex. More generally, however, the recent wet spells have produced only inflections in the recessions and, as happened in 1973, the benefits of a wet summer in groundwater terms may well only begin to appear in the autumn.

Very limited recharge in eastern areas over the last three years is the major influence on groundwater levels in July 1991; water-tables in some districts have yet to show any real recovery from the droughts of 1989 and 1990. In the Chalk levels remain very depressed - close to the minimum on record - east of a line from the Humber to Sussex. Local variations in the amount of 1990/91 recharge are however an important factor especially in southern England. At Washpit Farm in the Chalk of East Anglia, the groundwater level in July 1991 was the lowest recorded for that month. At the Chalk sites of Little Brocklesby in Humberside, the Holt and Little Bucket Farm in the South-East, groundwater levels are also very low although substantially above the 1976 minima. At the Fairfields and Redlands sites, levels are at their lowest since 1976. To the west, groundwater levels stand near to or a little below the seasonal average although nowhere appreciably above it. At Dalton Holme in the Yorkshire Chalk, where in 1990 levels reached an all-time low, the July levels are at their highest since 1988.

Groundwater levels in the Permo-Triassic sandstones of the South-West are close to normal for the summer but levels in the Midlands Trias remain at their lowest since 1976 (see the trace for Weeford Flats). Similarly in the outcrop of the Triassic Sandstones of North Wales (at the Llanfair DC site), the groundwater level is at its lowest for 15 years which suggests that the area of restricted recharge may extend from the upper Trent catchment across the upper Severn and into that of the River Dee.

Just as fairly modest winter rainfall deficiencies combined with persistent soil moisture deficits can result in especially depressed groundwater levels through central and eastern England, so the relatively modest nature of the current SMDs allows the possibility of a more rapid recovery in the last quarter of the year. A distinction can usefully be drawn between those districts (including the Chalk of much of southern England) where average autumn rainfall should generate a brisk recovery in groundwater levels, and those, more restricted, areas where a repetition of the long delayed recoveries in 1988, 1989 and 1990 may be anticipated. Such areas include Lincolnshire, Cambridgeshire and the lower Trent Valley. Rainfall over the next two months will be important in determining the start and very possibly the amount of the 1991/92 recharge.

IH/BGS
13/8/91

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

		Jul 1990	Aug	Sep	Oct	Nov	Dec	Jan 1991	Feb	Mar	Apr	May	June	July 1991
England and	mm	35	46	53	103	67	101	92	63	75	68	14	92	72
Wales	%	47	51	64	124	69	112	107	97	127	117	21	151	98
NRA REGIONS														
North West	mm	58	73	86	175	73	151	97	86	89	61	16	96	68
	%	56	58	70	148	60	126	87	106	124	79	20	116	66
Northumbria	mm	40	53	53	107	61	127	85	114	84	40	23	73	48
	%	52	52	66	143	65	169	106	173	162	73	36	120	62
Severn Trent	mm	27	37	46	93	52	87	78	41	59	66	11	74	73
	%	42	46	69	143	66	124	113	77	113	127	17	132	113
Yorkshire	mm	32	47	39	92	55	121	72	89	62	49	15	74	41
	%	46	52	54	133	62	164	94	139	117	88	24	128	59
Anglia	mm	21	31	32	51	53	47	44	39	29	44	13	77	40
	%	37	48	62	98	85	89	85	93	73	110	28	157	59
Thames	mm	17	35	34	58	34	68	80	39	45	62	14	96	81
	%	28	50	55	91	47	103	129	83	98	135	25	185	135
Southern	mm	13	33	38	105	63	65	98	40	59	56	17	125	96
	%	22	45	54	135	67	80	129	70	113	117	31	250	162
Wessex	mm	31	41	49	87	51	78	105	43	88	69	9	106	79
	%	50	50	62	106	53	87	125	73	152	128	13	196	127
South West	mm	61	59	69	128	106	124	151	82	127	99	10	127	90
	%	73	58	66	113	79	92	117	91	151	139	12	195	107
Welsh	mm	53	64	85	152	112	163	150	96	125	121	15	110	91
	%	56	54	68	118	78	112	110	100	144	141	16	134	96
Scotland	mm	75	119	149	213	102	191	146	83	128	121	43	121	99
	%	67	92	109	143	72	122	107	80	139	134	47	132	88
RIVER PURIFICATION BOARDS														
Highland	mm	93	156	234	225	147	241	173	70	141	129	67	124	91
	%	73	105	148	121	87	123	105	53	124	113	66	113	72
North-East	mm	43	75	86	136	95	97	56	77	80	59	48	128	55
	%	47	70	99	140	92	95	62	104	129	97	61	183	60
Tay	mm	38	73	68	186	63	149	164	89	117	107	22	136	93
	%	37	62	59	152	53	111	139	97	143	143	23	164	91
Forth	mm	49	83	68	194	56	143	120	84	104	90	19	108	97
	%	50	72	63	183	52	131	121	109	151	132	22	144	99
Tweed	mm	52	61	69	159	53	152	107	103	93	60	20	89	75
	%	58	54	74	181	51	169	115	149	160	98	21	131	84
Solway	mm	74	106	81	218	77	191	140	108	153	146	18	121	72
	%	67	82	54	151	53	126	100	116	168	166	17	134	65
Clyde	mm	96	151	172	301	94	226	181	88	162	181	35	129	112
	%	74	106	98	164	56	122	112	78	154	176	36	125	86

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 July 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.

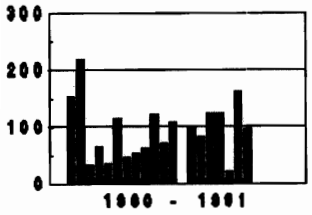
TABLE 2 RAINFALL RETURN PERIOD ESTIMATES

		JAN - JULY 90 Est Return Period, years		AUG 90 - JULY 91 Est Return Period, years		MAY 89 - JULY 91 Est Return Period, years		AUG 88 - JULY 91 Est Return Period, years	
England and	mm	476		846		1813		2456	
Wales	% LTA	101	2-5	93	2-5	90	5-10	90	5-15
NRA REGIONS									
North West	mm	513		1071		2395		3405	
	% LTA	84	5-10	88	5-10	89	5-10	93	5
Northumbria	mm	467		868		1702		2301	
	% LTA	103	2-5	99	2-5	87	10-20	87	15-20
Severn Trent	mm	402		717		1558		2063	
	% LTA	98	2-5	93	2-5	90	5-10	87	15-20
Yorkshire	mm	402		757		1591		2175	
	% LTA	92	2-5	91	2-5	86	10-20	87	10-20
Anglia	mm	286		500		1109		1488	
	% LTA	88	2-5	82	5-10	81	30-50	81	85-105
Thames	mm	417		646		1375		1824	
	% LTA	113	2-5	92	2-5	87	5-15	86	10-20
Southern	mm	491		795		1601		2084	
	% LTA	124	5-10	100	<2	91	5	87	10-20
Wessex	mm	499		805		1747		2336	
	% LTA	114	2-5	93	2-5	91	5	90	5-10
South West	mm	686		1172		2557		3433	
	% LTA	113	2-5	98	2-5	98	2-5	96	2-5
Welsh	mm	708		1284		2790		3811	
	% LTA	105	2-5	96	2-5	95	2-5	95	2-5
Scotland	mm	741		1515		3461		4896	
	% LTA	103	2-5	106	2-5	110	10-15	114	60-90
RIVER PURIFICATION BOARDS									
Highland	mm	795		1798		4297		6166	
	% LTA	92	2-5	104	2-5	114	20-40	119	>200
North-East	mm	503		992		2033		2777	
	% LTA	95	2-5	97	2-5	89	10-15	90	10-15
Tay	mm	728		1267		2868		4080	
	% LTA	113	2-5	101	2-5	103	2-5	108	5-10
Forth	mm	622		1166		2590		3613	
	% LTA	109	2-5	104	2-5	104	2-5	108	5-10
Tweed	mm	547		1041		2126		2849	
	% LTA	106	2-5	104	2-5	95	2-5	95	2-5
Solway	mm	758		1431		3131		4447	
	% LTA	108	2-5	100	<2	100	<2	104	2-5
Clyde	mm	888		1832		4197		5195	
	% LTA	109	2-5	110	5	115	25-45	118	130-170

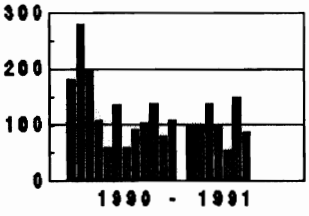
Return period assessments are based on tables provided by the Meteorological Office*. These assume a start in a given month; return periods for a start in any month may be expected to be an order of magnitude less.
The tables reflect rainfall totals over the period 1911-70 only and the estimate assumes 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 1990/91 AS A PERCENTAGE OF THE 1941-70 AVERAGE



England and Wales



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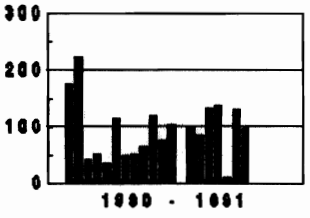
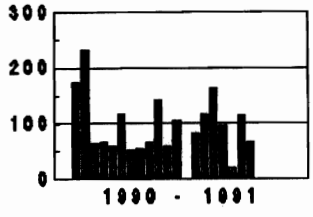
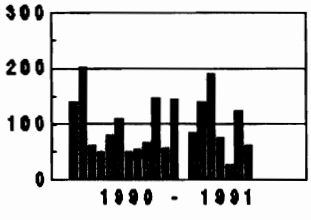


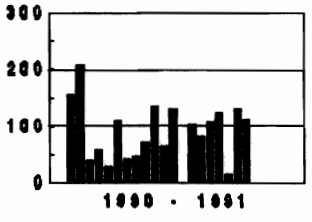
Welsh Region



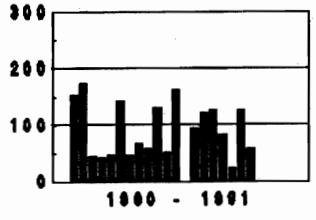
North West Region



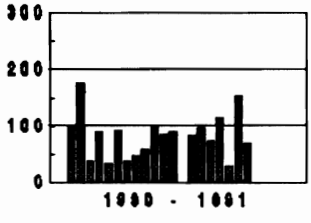
Northumbria Region



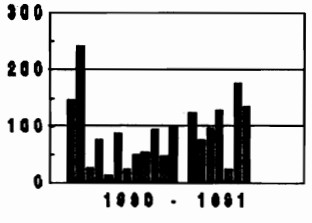
Severn-Trent Region



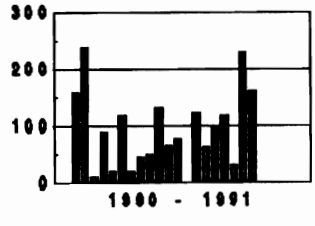
Yorkshire Region



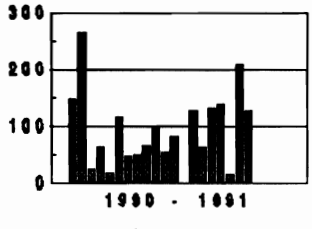
Anglian Region



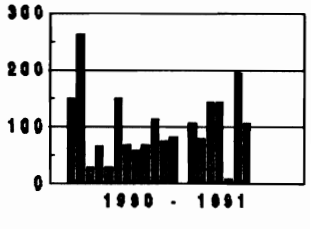
Thames Region



Southern Region

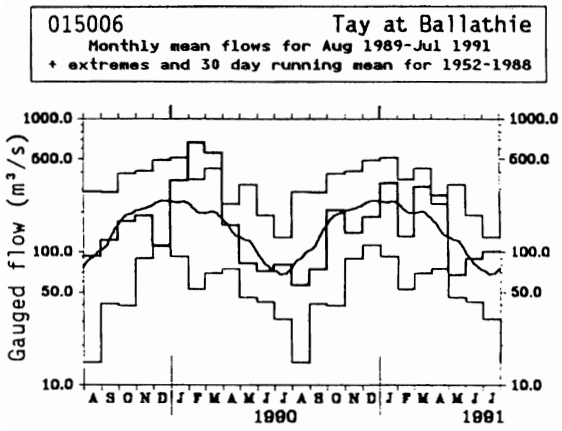


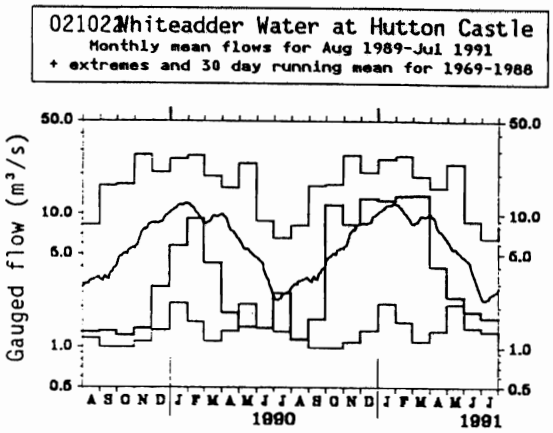
Wessex Region

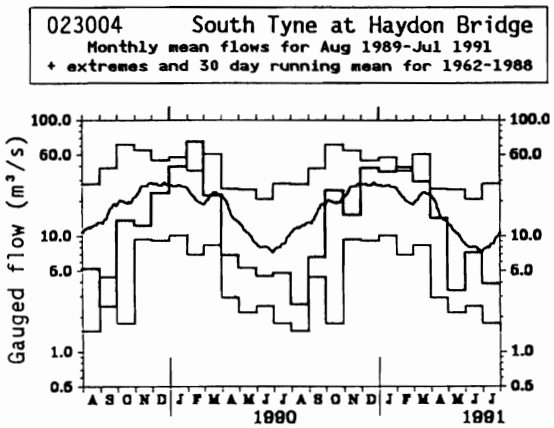


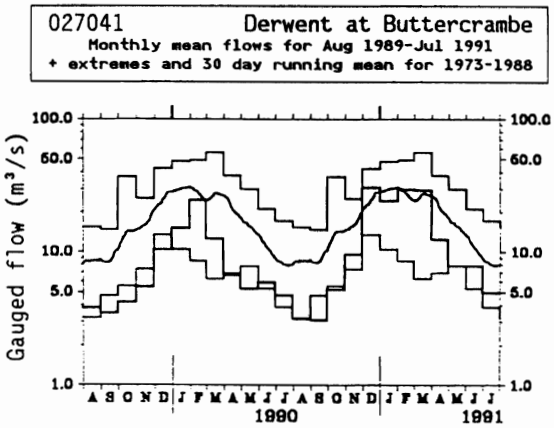
South West Region

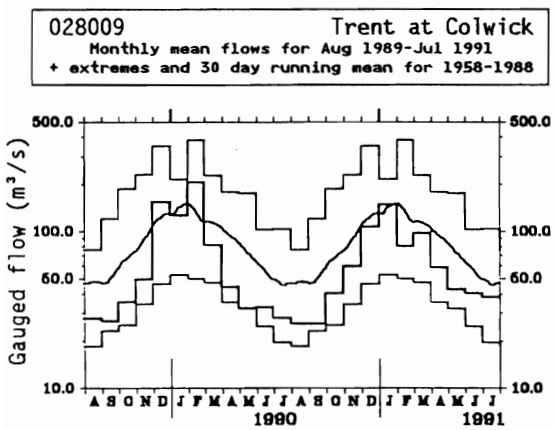
FIGURE 2 MONTHLY RIVER FLOW HYDROGRAPHS

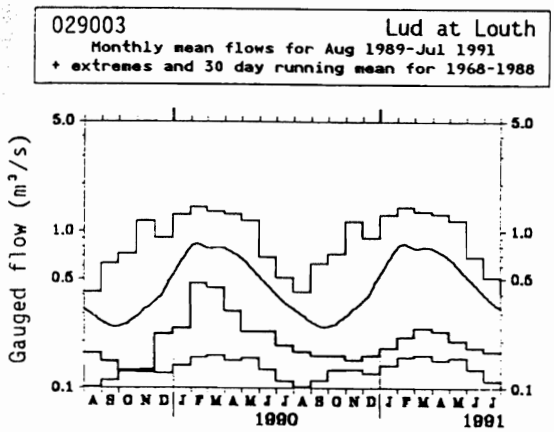


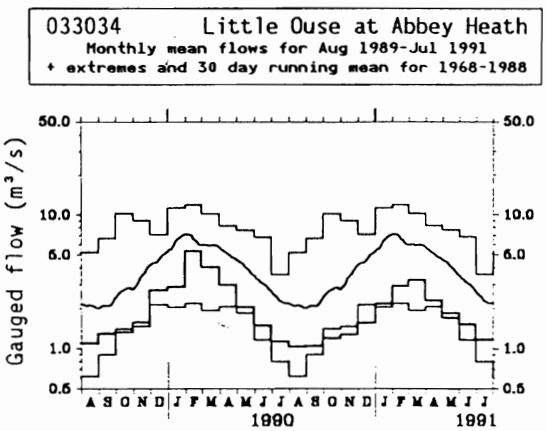


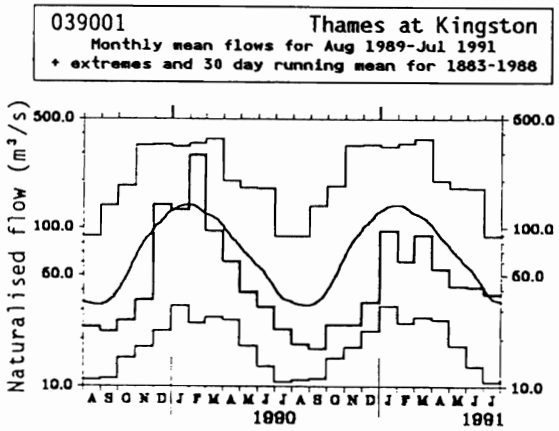




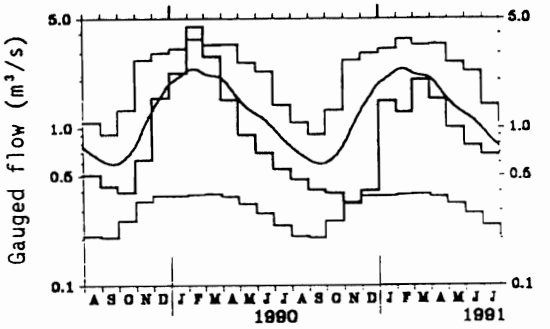




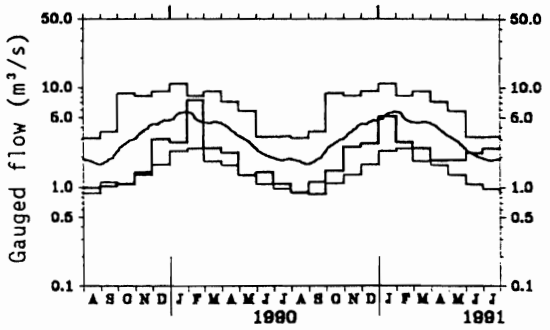




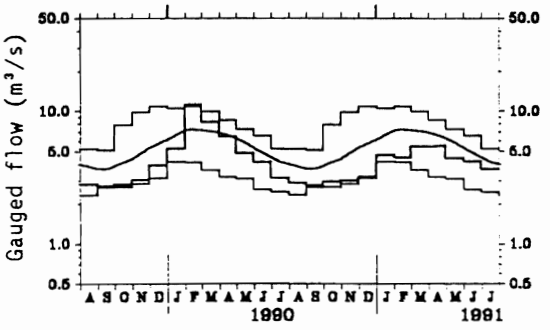
039020 Coln at Bibury
Monthly mean flows for Aug 1989-Jul 1991
+ extremes and 30 day running mean for 1963-1988



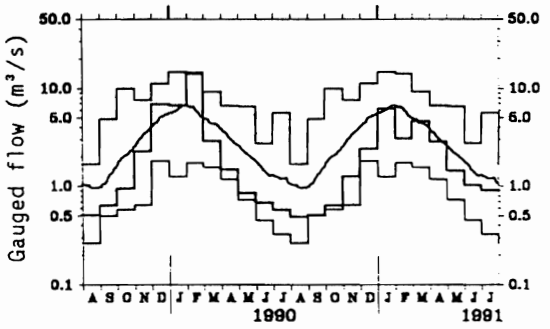
040011 Great Stour at Horton
Monthly mean flows for Aug 1989-Jul 1991
+ extremes and 30 day running mean for 1964-1988



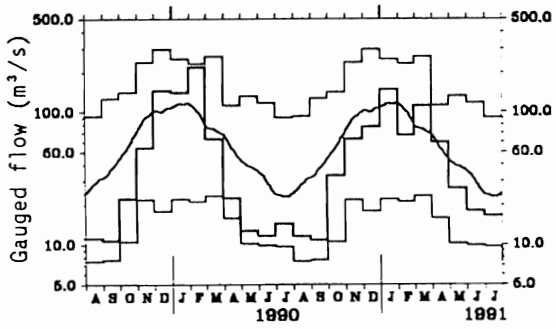
042010 Itchen at Highbridge+Allbrook
Monthly mean flows for Aug 1989-Jul 1991
+ extremes and 30 day running mean for 1958-1988



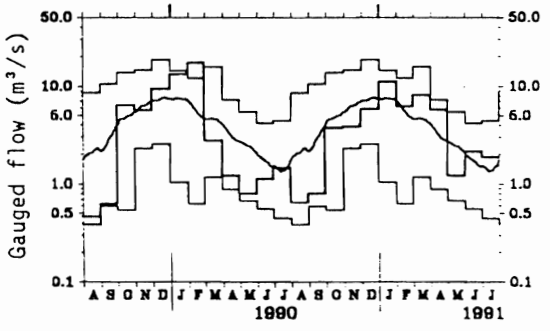
052005 Tone at Bishops Hull
Monthly mean flows for Aug 1989-Jul 1991
+ extremes and 30 day running mean for 1961-1988



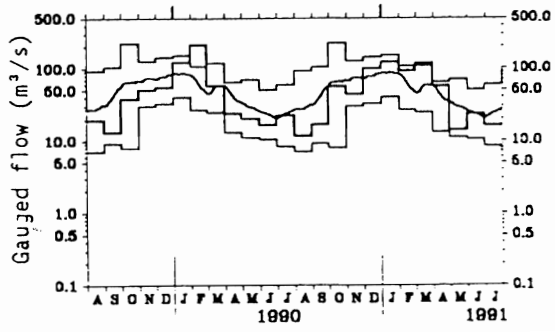
054001 Severn at Bewdley
Monthly mean flows for Aug 1989-Jul 1991
+ extremes and 30 day running mean for 1921-1988



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



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



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

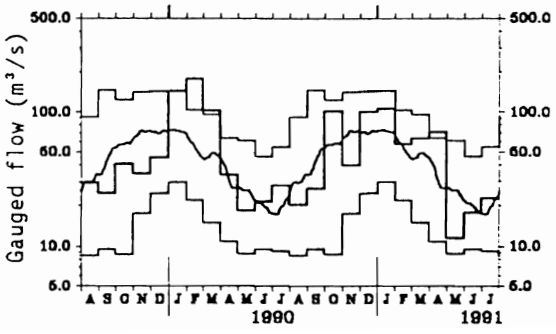


TABLE 3 RUNOFF AS MM. AND AS A PERCENTAGE OF THE PERIOD OF RECORD AVERAGE WITH SELECTED PERIODS RANKED IN THE RECORD

River/ Station name	Mar 1991	Apr	May	Jun	Jul 1991		1/91 to 7/91		3/90 to 7/91		5/89 to 7/91		8/88 to 7/91	
	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 Park	149 162	80 104	41 65	56 153	42 149	15 /19	510 110	11 /19	984 90	5 /18	1473 85	2 /17	2117 88	2 /16
Tay at Ballathie	180 142	152 183	39 56	50 111	58 146	36 /39	741 119	32 /39	1670 112	33 /38	2712 113	32 /37	4123 122	35 /36
Whiteadder Water at Hutton Castle	74 149	21 57	13 48	10 57	9 70	7 /22	258 103	13 /22	508 94	8 /21	654 77	6 /20	903 76	5 /19
South Tyne at Haydon Bridge	105 125	49 91	12 34	25 93	14 48	8 /28	456 114	21 /28	918 92	10 /26	1493 92	8 /24	2086 90	4 /22
Wharfe at Flint Mill Weir	86 114	53 98	13 34	24 97	18 67	13 /36	395 101	21 /36	765 81	4 /35	1259 82	2 /34	1907 88	8 /33
Derwent at Buttercrambe	49 120	20 64	13 54	13 77	8 56	4 /30	190 89	13 /30	335 73	5 /29	473 66	2 /28	662 66	1 /27
Trent at Colwick	35 87	20 62	15 60	14 74	14 88	13 /33	177 78	3 /33	345 71	2 /32	604 78	2 /31	852 79	2 /30
Lud at Louth	12 33	11 34	10 37	8 39	8 49	3 /23	67 35	2 /23	172 45	1 /22	279 49	1 /21	413 53	1 /21
Witham at Claypole Mill	21 80	11 52	9 57	7 72	5 71	11 /33	90 69	7 /32	165 62	6 /31	286 71	6 /31	376 68	5 /30
Little Ouse at Abbey Heath	12 54	8 43	7 47	6 55	4 48	3 /24	56 47	2 /23	123 51	1 /22	208 55	1 /22	340 66	1 /21
Colne at Lexden	8 43	5 37	5 57	5 93	4 96	22 /32	46 51	5 /32	90 48	2 /31	183 63	2 /30	289 71	3 /29
Thames at Kingston (natr.)	24 77	14 62	11 63	11 87	10 106	66 /109	111 68	22 /109	209 62	7 /108	411 77	21 /107	564 76	15 /106
Blackwater at Swallowfield	29 98	18 78	15 78	16 108	15 131	36 /39	149 91	14 /39	292 81	9 /38	545 94	13 /37	743 93	11 /36
Coln at Bibury	50 92	37 85	25 75	19 71	17 81	11 /28	213 76	5 /28	424 74	5 /27	729 83	5 /26	930 78	3 /25
Great Stour at Horton	19 56	14 52	15 70	16 104	19 135	25 /27	142 76	5 /25	271 66	2 /23	434 67	1 /22	588 65	1 /20
Itchen at Highbridge+Allbrook	40 77	39 83	33 78	30 86	27 89	8 /33	235 78	5 /33	540 81	2 /32	851 82	2 /31	1113 80	1 /30
Stour at Throop Mil	58 112	35 102	20 85	14 90	14 128	16 /19	227 89	4 /19	373 71	3 /18	746 88	6 /17	976 82	2 /16
Piddle at Baggs Mill	53 93	47 111	28 88	23 99	21 118	23 /28	237 84	6 /27	446 78	4 /26	750 85	5 /24	958 78	2 /22
Exe at Thorverton	106 125	52 92	22 58	24 101	32 155	32 /36	467 101	18 /35	847 80	3 /34	1521 87	8 /34	2189 88	7 /33
Tone at Bishops Hull	60 104	36 93	19 69	13 74	12 78	14 /31	259 84	8 /30	414 66	2 /30	859 85	5 /29	1184 83	5 /28
Severn at Bewdley	68 147	35 111	16 68	11 63	10 71	24 /71	269 102	38 /70	464 79	8 /69	847 88	16 /69	1217 90	16 /68
Wye at Cefn Brwyn	171 97	192 153	34 35	96 114	107 98	22 /38	1021 101	19 /36	2413 91	8 /32	4202 94	9 /27	6038 97	9 /24
Cynon at Abercynon	204 172	141 189	31 52	53 131	47 138	28 /33	894 135	31 /33	1448 91	10 /31	2792 105	17 /29	3869 102	15 /27
Eden at Sheepmount	126 184	63 138	16 49	26 103	19 70	7 /21	487 128	20 /21	912 103	11 /19	1524 105	10 /17	2183 107	10 /15
Clyde at Daldowie	89 119	96 232	16 46	24 91	32 117	21 /28	480 123	26 /28	1164 120	23 /27	1877 116	23 /26	2685 117	22 /25

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 1990. For the long periods (at the right of this table), the end date for the long term is 1990.

TABLE 4 START-MONTH RESERVOIR STORAGES UP TO AUGUST 1991

Area	Reservoir (R)/ Group (G)		Capacity● (Ml)	1991 Mar	Apr	May	Jun	Jul	Aug	[1990 Aug]
				(%)▲						
North West	Northern Command Zone[1]	(G)	133375	98	99	90	72	68	55	58
	Vyrnwy	(R)	55146	100	99	96	88	86	83	54
Northumbrian	Teesdale[2]	(G)	87936	97	93	82	64	61	52	74
Severn Trent	Clywedog	(R)	44922	96	95	97	98	99	94	78
	Derwent Valley[3]	(G)	39525	99	97	91	78	74	66	51
Yorkshire	Washburn[4]	(G)	22035	96	99	91	80	72	59	57
	Bradford supply[5]	(G)	41407	100	98	92	76	76	65	53
Anglian	Grafham	(R)	58707	76	85	91	96	96	95	80
	Rutland	(R)	130061	71	78	80	85	80	81	75
Thames	London[6]	(G)	206232	90	89	91	90	91	90	73
	Farmoor[7]	(G)	13843	64	95	100	100	100	100	84
Southern	Bewl	(R)	31300	60	68	79	69	76	78	51
	Ardingly	(R)	4627	100	100	100	100	100	100	84
Wessex	Clatworthy	(R)	5364*	98*	100*	95*	84*	71*	59*	59*
	Bristol WW[8]	(G)	36620	77	93	95	91	79	71	53
South West	Colliford	(R)	28540	85	92	94	91	89	90	80
	Roadford	(R)	34500	87	94	98	98	94	95	55[9]
	Wimbleball[10]	(R)	21320	74	82	84	81	75	73	57
	Stithians	(R)	5205	98	100	96	83	77	66	39
Welsh	Celyn + Brenig	(G)	131155	100	100	99	96	94	89	77
	Brianne	(R)	62140	100	100	97	88	93	93	80
	Big Five[11]	(G)	69762	93	95	96	87	94	87	51
	Elan Valley[12]	(G)	99106	100	99	97	91	91	92	72

● Live or usable capacity (unless indicated otherwise)

* Gross storage/percentage of gross storage

▲ Percentage of live or usable capacity in storage at or close to the beginning of the month according to data availability (unless indicated otherwise)

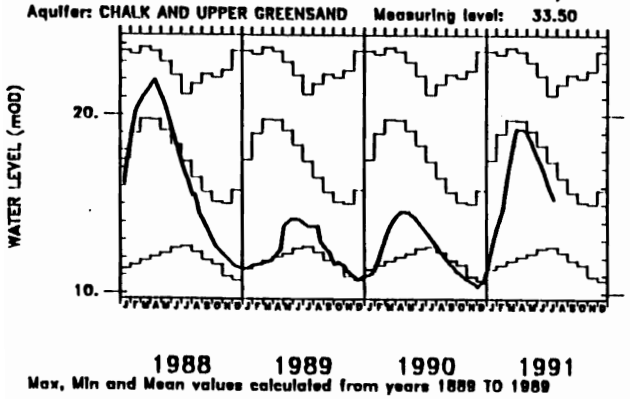
1. Includes Haweswater, Thirlmere, Stocks and Barnacre.
2. Cow Green, Selset, Grassholme, Balderhead, Blackton and Hury.
3. Howden, Derwent and Ladybower,
4. Swinsty, Fewston, Thruscross and Eccup.
5. The Nidd/Barden group (Scar House, Angram, Upper Barden, Lower Barden and Chelker) plus Grimwith.
6. 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.

FIGURE 3 GROUNDWATER HYDROGRAPHS

Site name: DALTON HOLME

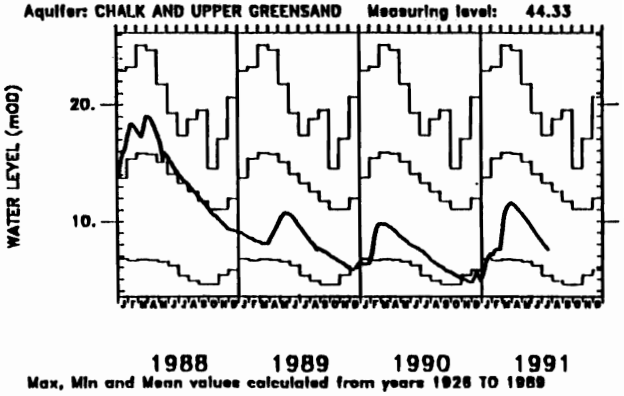
National grid reference: SE 9651 4530 Well number: SE94/5
Aquifer: CHALK AND UPPER GREENSAND Measuring level: 33.50



Max, Min and Mean values calculated from years 1888 TO 1989

Site name: LITTLE BROCKLESBY

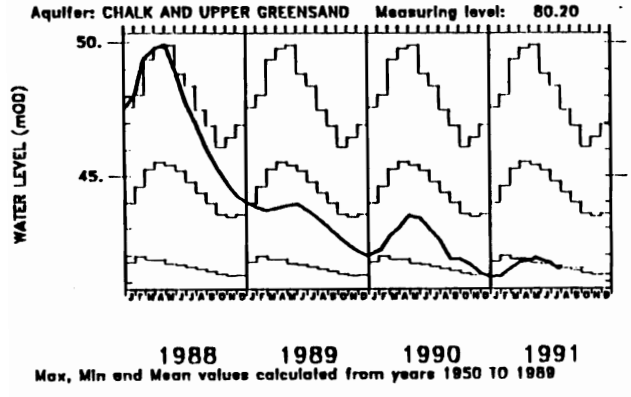
National grid reference: TA 1371 0888 Well number: TA10/40
Aquifer: CHALK AND UPPER GREENSAND Measuring level: 44.33



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

Site name: WASHPIT FARM

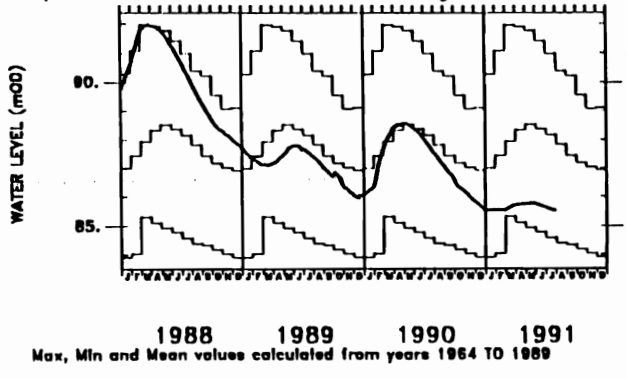
National grid reference: TF 8138 1960 Well number: TF81/2
Aquifer: CHALK AND UPPER GREENSAND Measuring level: 80.20



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

Site name: THE HOLT

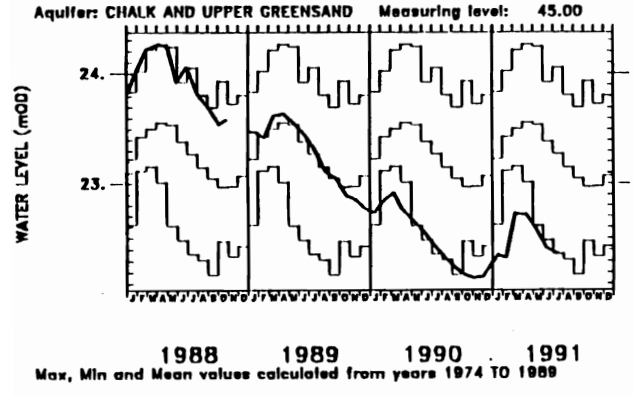
National grid reference: TL 1692 1965 Well number: TL11/9
Aquifer: CHALK AND UPPER GREENSAND Measuring level: 140.21



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

Site name: FAIRFIELDS

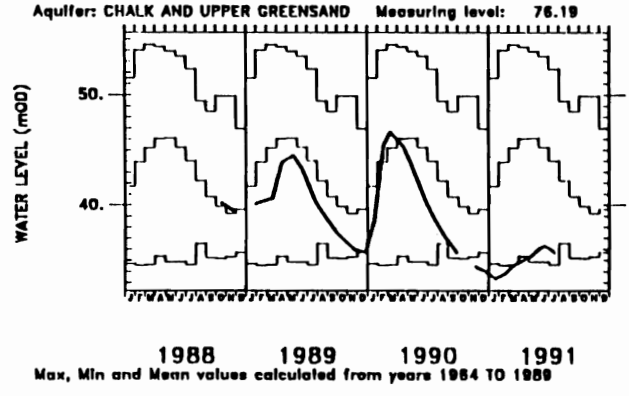
National grid reference: TM 2461 6109 Well number: TM26/46
Aquifer: CHALK AND UPPER GREENSAND Measuring level: 45.00



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

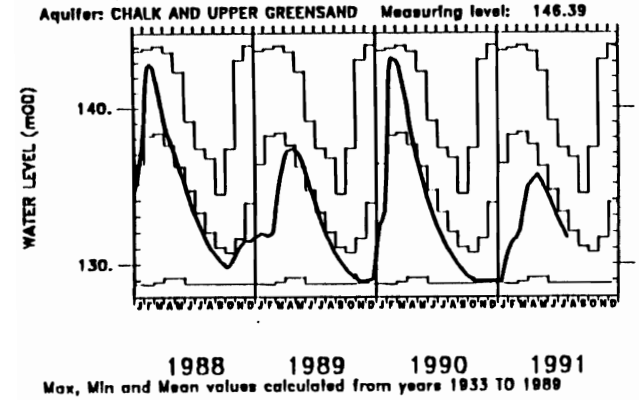


Max, Min and Mean values calculated from years 1964 TO 1989

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

Site name: ROCKLEY

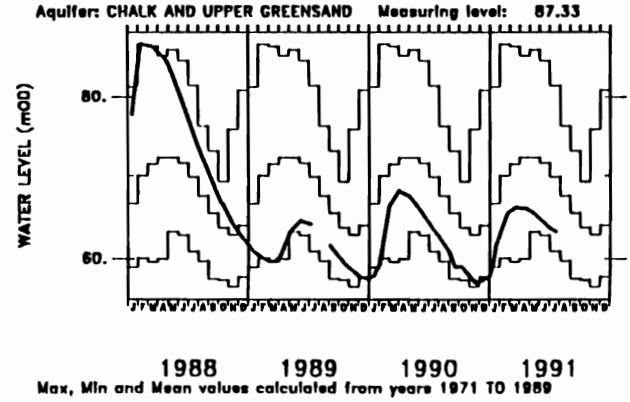
National grid reference: SU 1655 7174 Well number: SU17/57
Aquifer: CHALK AND UPPER GREENSAND Measuring level: 146.39



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

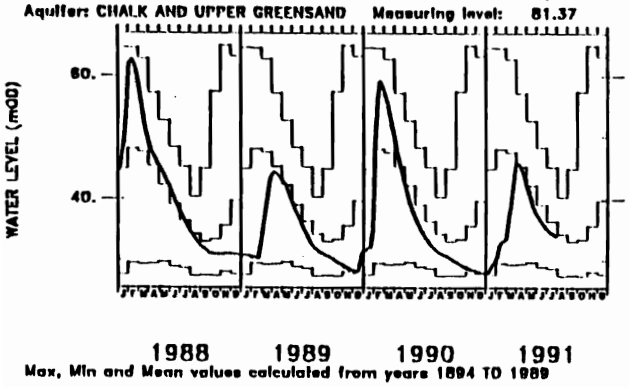


Max, Min and Mean values calculated from years 1971 TO 1989

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

Site name: COMPTON HOUSE

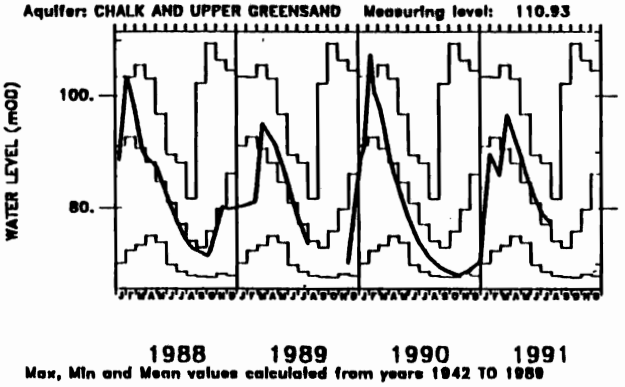
National grid reference: SU 7755 1490 Well number: SU71/23
Aquifer: CHALK AND UPPER GREENSAND Measuring level: 81.37



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

Site name: WEST WOODYATES MANOR

National grid reference: SU 0160 1980 Well number: SU01/58
Aquifer: CHALK AND UPPER GREENSAND Measuring level: 110.93

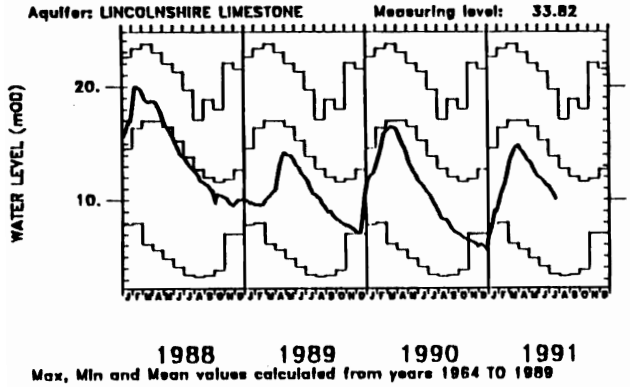


Max, Min and Mean values calculated from years 1942 TO 1989

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

Site name: NEW RED LION

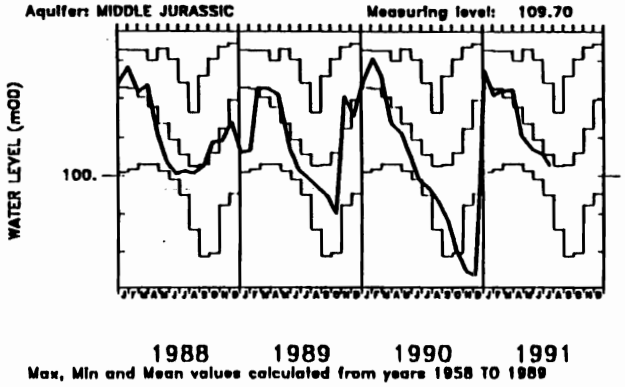
National grid reference: TF 0885 3034 Well number: TF03/37
Aquifer: LINCOLNSHIRE LIMESTONE Measuring level: 33.82



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

Site name: AMPNEY CRUCIS

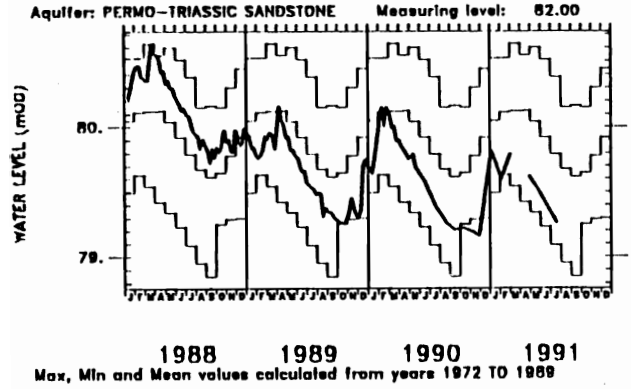
National grid reference: SP 0595 0190 Well number: SP00/62
Aquifer: MIDDLE JURASSIC Measuring level: 109.70



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: 82.00

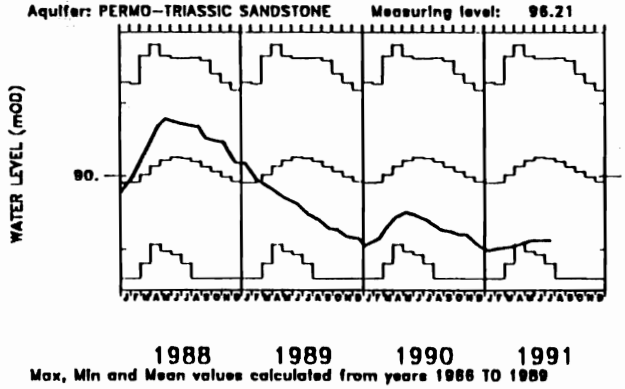


Max, Min and Mean values calculated from years 1972 TO 1989

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

Site name: WEEFORD FLATS,WEEFORD

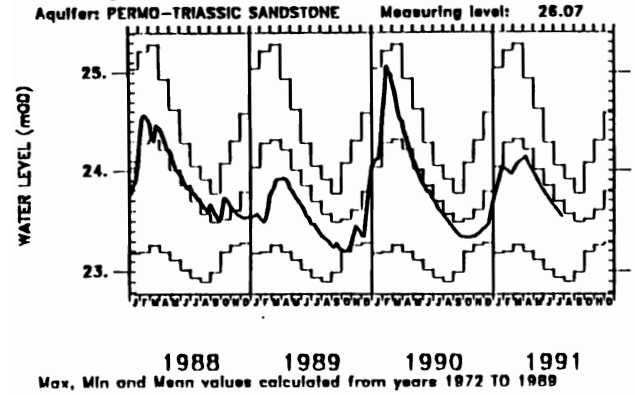
National grid reference: SK 1440 0464 Well number: SK10/9
Aquifer: PERMO-TRIASSIC SANDSTONE Measuring level: 96.21



Max, Min and Mean values calculated from years 1986 TO 1989

Site name: BUSSELS NO.7A

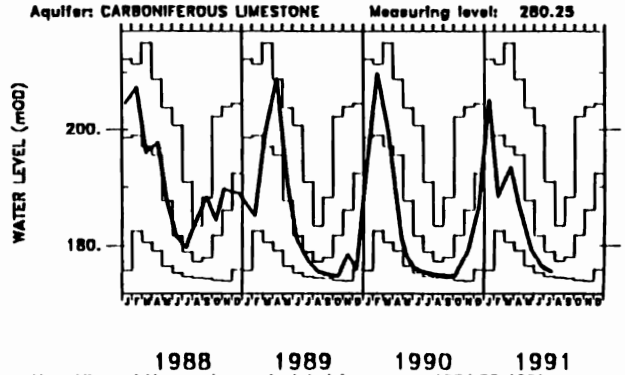
National grid reference: SX 9528 9872 Well number: SX99/378
Aquifer: PERMO-TRIASSIC SANDSTONE Measuring level: 26.07



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 5 A COMPARISON OF JUNE GROUNDWATER LEVELS: 1991, 1976 and 1973

Borehole	Aquifer	First year of record	Av. July level	July 1973		July 1976		July/Aug 1991		No. of years with July levels ≤ 1991	Lowest pre-1991 level for any month
				Day	level	Day	level	Day	level		
Dalton Holme	C&UG	1889	17.39	28	13.80	31	13.00	23/07	15.30	12	10.34
L. Brocklesby	"	1926	13.12	20	8.79	30	5.26	15/07	7.64	2	4.56
Washpit Farm	"	1950	44.96	01	41.56	01	42.20	01/08	41.51	0	41.24
The Holt	"	1964	88.16	29	84.58	29	85.00	31/07	85.51	3	83.90
Fairfields	"	1974	23.27	-	-	30	22.61	17/07	22.36	1	22.15
Redlands Farm	"	1964	43.67	01	37.08	01	37.20	22/07	35.42	1	34.53
Rockley	"	1933	133.24	29	131.27	25	128.78	31/07	131.59	12	128.78 dry
L. Bucket Farm	"	1971	69.88	05	62.24	13	60.97	22/07	63.29	3	56.77
Compton House	"	1894	35.49	26	31.52	22	28.75	31/07	35.23	45	27.64
Lime Kiln Way	"	1969	125.31	04	125.04	15	124.29	18/07	124.66	1	124.09
Ashton Farm	"	1974	66.72	-	-	20	64.21	01/08	64.30	1	63.10
West Woodyates	"	1942	75.77	29	74.20	01	69.73	02/08	77.70	34	67.62
New Red Lion	L.L.	1964	13.83	29	12.48	27	3.45	23/07	10.00	4	3.29
Ampney Crucis	M.J.	1958	100.54	29	100.09	25	99.48	22/07	100.26	18	97.38
Dunmurry (N.I.)	PTS	1985	28.04	-	-	-	-	20/07	27.80	2	27.47
Llanfair D.C.	"	1972	79.79	01	79.35	01	79.09	21/07	79.26	1	78.85
Morris Dancers	"	1969	32.60	25	32.27	13	31.92	08/07	32.04	1	30.87
Weeford Flats	"	1966	90.25	27	90.03	14	88.81	19/07	89.12	1	88.61
Bussels 7A	"	1972	23.64	25	23.38	27	22.94	30/07	23.58	6	22.90
Rushyford N.E.	M.L.	1967	76.15	01	65.19	27	65.67	17/07	75.42	12	64.77
Peggy Ellerton	"	1968	34.62	29	32.35	26	31.20	09/07	33.32	4	31.10
Alstonfield	C.B.	1974	178.95	-	-	21	174.90	25/07	175.64	5	174.22

Groundwater levels are in metres above Ordnance Datum

C & U.G.	Chalk and Upper Greensand;
L.L.	Lincolnshire Limestone
PTS	Permo-Triassic Sandstones
M.J.	Middle Jurassic Limestone
C.B.	Carboniferous Limestone
M.L.	Magnesian Limestone

FIGURE 4 LOCATION MAP OF GAUGING STATIONS AND GROUNDWATER INDEX WELLS