Hydrological Summary for Great Britain

JUNE 1995

Rainfall

June was initially cool and cloudy but temperatures climbed during the latter half of the month and heatwave conditions were experienced over the final week. The weather was, in large part, determined by a persistent anticyclone centred to the NW of the British Isles. This unusual synoptic pattern encouraged northerly and north-easterly airflows over much of the month bringing light rain and drizzle to many eastern localities but little significant rainfall over the bulk of the UK. The provisional Great Britain rainfall total for June is around 40% of the monthly average. A few coastal districts in the north-east of Great Britain recorded average rainfall but regional totals were typically in the 30-60% range; some southern and inland areas registered below 15%. In many regions June was the fourth successive month with rainfall substantially below average. Since early March the frequency of frontal rainfall systems has declined markedly leading to large rainfall deficiencies. Over the three-months, April-June, the 1995 rainfall total is similar to that of 1976; only 1921 has been drier this century. Over much of central, southern and eastern England provisional data indicate that well under half the average rainfall has been recorded since the first week of March; lower 12-16 week rainfall totals have occurred on only a handful of occasions over the last 30 years. England and Wales registered its sixth driest March-June period this century (1921, 1929, 1938, 1976, and 1990 were correspondingly lower). Much of the rainfall has been showery and/or convectional and variable in amount - important in relation to stress on water supplies.

River Flow

River flows continued their lengthy recessions following the widespread January spates. In much of the South and East, baseflow support has maintained flows well within the normal range but rapid declines in runoff rates have characterised many catchments with little storage; typically upland rivers draining from the Pennines and the Welsh Mountains and impermeable lowland catchments like the Mole. Chalk catchments aside, above average June flows were confined to north-eastern Scotland. Even here, steep recessions resulted in very modest flows at month-end. Although the June mean flows were generally well below average, they significantly exceeded those of recent drought years (e.g. 1990, 1989, 1984 and 1976). Spatial variation in runoff produced some notably low flows, such as the River Teme, which recorded a new extreme well below the corresponding 1976 and 1990 June figures in a 25-year series. Thus, many daily flows in early July were depressed and, in the short term, stream vulnerability will focus particularly on small impermeable southern catchments subject to abstraction for irrigation purposes.

Groundwater

As usual, no appreciable recharge occurred in June in the major aquifers and the seasonal recessions continue. In the Chalk, levels generally remain within the normal range - commonly above average in the east but below in the more westerly outcrop areas. Declines in water levels have been steepest in some of the older, more fissured, limestone aquifers. Thus, in the Jurassic at Ampney Crucis the early summer minimum was approached and levels at Alstonfield (Carboniferous) have fallen nearly 40 metres since the early 1995 peak. Isolated well failures have been encountered in some shallow minor aquifers of local importance (e.g. in the North-East and parts of Wales) but groundwater resources are, as expected, holding up well in the major water supply aquifers - providing an important buffer against the impact of the current rainfall deficiency.

General

In common with a number of recent years, Britain's normally modest seasonal rainfall contrasts have been greatly accentuated over the last 12 months. The recent run of dry months has been accompanied by high evaporative demands, has created short-term drought conditions over wide areas. Reservoir stocks generally declined rapidly through the month with reduction of 3% a week typical of a number of major systems. However, overall stocks (for England and Wales) remain around 80% of capacity - appreciably greater than at the same time in 1989 or 1990 and, currently, resources are not a matter of concern. The combination of hot and dry weather has produced surges in peak demand, commonly associated with heavy garden watering in the active growing season, triggering the introduction of hosepipe and sprinkler bans in a number of areas (mostly in southern England). In the South West Water area a record volume was put into supply during the last week in June.

The situation reminds us of our continuing vulnerability to sharp rainfall deficiencies and the need for responsible water usage. Rainfall within the normal range over the next couple of months should restrict supply problems to localised pockets only. A late summer and autumn similar to 1990 would, however, make for a fragile resource outlook.

Institute of Hydrology

British Geological Survey

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. Figure 3 is based on weather data collected by the Institute of Hydrology at Wallingford and Balquhidder (Central Region, Scotland). Reservoir contents information has been supplied by the Water Services Companies, the NRA or, in Scotland, the Lothian and Strathclyde Regional Councils. The most recent areal rainfall figures are derived from a restricted network of raingauges 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.

Financial support towards the production of the Hydrological Summaries is given by the Department of the Environment and the National Rivers Authority.

The Hydrological Summaries are available on annual subscription at a current cost of £48 per year - enquiries should be directed to the National Water Archive Office at the address below. No charge is made to those organisations providing data for the Summaries.

* For reasons of consistency and to provide greater spatial discrimination, the original ten regional divisions of the NRA have been retained for use in the Hydrological Summaries.

MORECS

Most of the recent monthly regional rainfall data featured in the Hydrological Summaries are MORECS assessments. MORECS is the generic name for The Meteorological Office services involving the calculation of evaporation and soil moisture routinely for Great Britain. Products include a weekly issue of maps and tables of potential and actual evaporation, soil moisture deficits, effective rainfall and the hydrometeorological variables used to calculate them. The data are used to provide values for 40 km squares - or larger areas - and various sets of maps and tables are available according to user requirements. Options include a day-by-day retrospective calculation of soil moisture at any of 4000 rain-gauge sites.

Further information about MORECS services may be obtained from: The Meteorological Office, Sutton House, London Road, Bracknell, RG12 2SY

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 11 July 1995

TABLE 1 1994/95 RAINFALL AS A PERCENTAGE OF THE 1961-90 AVERAGE

		Jun 1994	Jul	Aug	Sep	Oct	Nov	Dec	Jan 1995	Feb	Mar	Apr	May	Jun
England and Wales	mm	36	47	72	106	97	86	139	157	111	64	27	49	26
	%	55	76	95	138	114	96	148	178	176	89	45	76	40
NRA REGIONS														
North West	mm	70	70	103	113	123	36	204	210	148	88	28	77	38
	%	86	82	96	98	96	111	165	174	190	93	39	103	47
Northumbrian	mm	39	41	81	77	71	97	124	123	107	60	38	54	39
	%	65	63	100	105	93	113	153	146	181	86	68	87	65
Severn Trent	mm	24	44	56	127	68	73	115	128	88	52	20	51	14
	%	41	83	84	198	106	103	149	183	163	85	36	86	24
Yorkshire	mm	28	53	58	101	73	89	121	125	100	65	26	56	27
	%	47	90	78	149	100	111	146	158	172	96	44	94	45
Anglian	mm	25	41	57	89	70	32	58	98	62	51	16	32	25
	%	49	84	104	182	137	55	105	196	168	109	35	68	49
Thames	mm	25	21	50	74	85	53	90	136	83	50	18	38	18
	%	45	43	86	125	137	82	129	213	184	89	36	67	32
Southern	mm	39	29	68	90	118	66	123	163	112	58	18	28	22
	%	72	60	119	130	148	78	150	204	207	92	34	51	40
Wessex	mm	24	34	68	99	115	96	139	179	111	57	34	48	19
	%	42	65	103	138	146	116	149	206	171	81	64	78	34
South West	mm	32	49	103	131	140	127	213	230	163	92	50	52	23
	%	46	71	123	141	121	102	153	167	161	93	72	73	33
Welsh	mm	57	68	94	134	139	134	240	235	181	84	36	81	25
	%	72	88	93	117	101	94	157	164	187	79	45	99	32
Scotland	mm	110	67	101	103	110	156	240	225	205	147	67	80	39
	%	128	71	86	73	71	103	159	149	201	118	88	93	46
RIVER PURIFICATION BOARDS														
Highland	mm	148	62	112	153	116	169	297	293	271	185	99	80	40
	%	151	58	88	89	59	83	151	156	213	114	109	87	41
North East	mm	55	40	47	89	87	89	90	136	83	72	65	75	48
	%	83	55	54	102	90	90	97	137	128	92	108	109	73
Tay	mm	89	47	81	56	115	154	197	184	188	125	38	93	25
	%	122	61	86	49	88	127	155	128	198	115	61	112	34
Forth	mm	75	59	80	56	90	134	203	150	167	91	33	62	29
	%	109	79	85	51	78	120	185	127	211	97	56	84	42
Tweed	mm	52	46	71	57	75	123	171	127	109	75	37	65	39
	%	80	63	81	64	79	132	184	127	163	95	65	92	60
Solway	mm	79	106	121	76	117	184	243	219	175	146	41	93	49
	%	94	118	102	53	75	128	164	140	173	125	53	109	58
Clyde	mm	143	97	142	98	128	189	312	258	248	192	65	80	39
	%	154	89	106	55	66	105	174	137	210	131	77	88	42

Note: The monthly rainfall figures for the NRA regions for May & June correspond to the MORECS areal assessments derived by the Meteorological Office. In northern England these initial assessments may have a particularly wide error band associated with them. The figures for the RPB regions for May & June 1995 were derived by IH in collaboration with the RPBs. The provisional figures for England and Wales and for Scotland are derived using a different raingauge network. 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

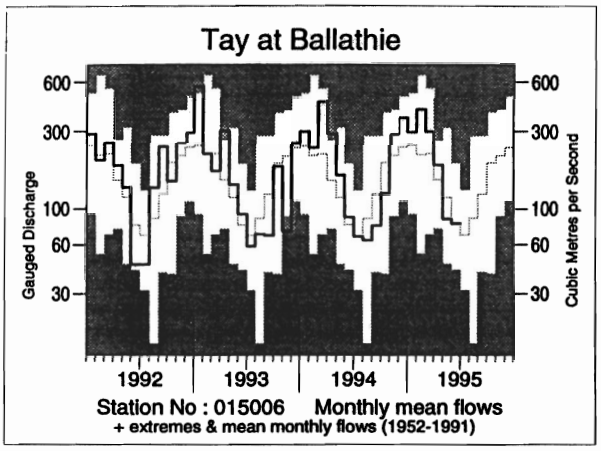
		Apr 95-Jun 95		Jan 95-Jun 95		Jul 94-Jun 95		Apr 93-Jun 95	
		Est Return Period, years		Est Return Period, years		Est Return Period, years		Est Return Period, years	
England and Wales	mm	102		434		981		2282	
	% LTA	54	30-45	105	2-5	109	2-5	115	15-25
NRA REGIONS									
North West	mm	143		589		1338		2892	
	% LTA	63	10-20	113	2-5	111	2-5	110	5-10
Northumbria	mm	131		421		912		2118	
	% LTA	73	5-10	108	2-5	107	2-5	112	5-15
Severn Trent	mm	85		353		836		1941	
	% LTA	49	30-45	99	2-5	111	2-5	115	10-20
Yorkshire	mm	109		399		894		2054	
	% LTA	61	10-20	104	2-5	109	2-5	113	5-15
Anglian	mm	74		285		632		1567	
	% LTA	51	30-45	102	2-5	106	2-5	117	20-30
Thames	mm	73		342		715		1738	
	% LTA	45	30-45	105	2-5	104	2-5	113	5-10
Southern	mm	67		400		894		2119	
	% LTA	42	40-60	112	2-5	115	5-10	123	50-80
Wessex	mm	101		448		999		2279	
	% LTA	59	10-15	114	2-5	119	5-10	123	50-80
South West	mm	125		610		1373		3243	
	% LTA	60	10-20	111	2-5	117	5-10	127	150-250
Welsh	mm	142		642		1451		3307	
	% LTA	59	10-20	109	2-5	111	2-5	115	15-25
Scotland	mm	186		763		1540		3366	
	% LTA	75	5-10	122	10-20	107	2-5	108	5-10
RIVER PURIFICATION BOARDS									
Highland	mm	219		968		1877		3932	
	% LTA	78	5-10	128	15-25	107	2-5	103	2-5
North East	mm	188		479		921		2220	
	% LTA	96	2-5	110	2-5	95	2-5	104	2-5
Tay	mm	156		653		1303		3002	
	% LTA	72	5-10	115	2-5	106	2-5	112	5-15
Forth	mm	124		532		1154		2676	
	% LTA	61	15-25	108	2-5	104	2-5	111	5-10
Tweed	mm	141		452		995		2375	
	% LTA	73	5-10	103	2-5	103	2-5	111	5-10
Solway	mm	183		723		1570		3389	
	% LTA	74	5-10	117	5-10	110	2-5	110	5-10
Clyde	mm	184		882		1848		4000	
	% LTA	69	10-15	122	5-15	109	2-5	109	5-10

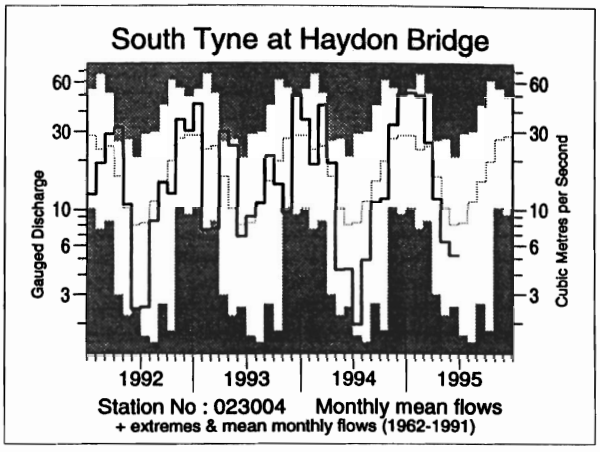
LTA refers to the period 1961-90.

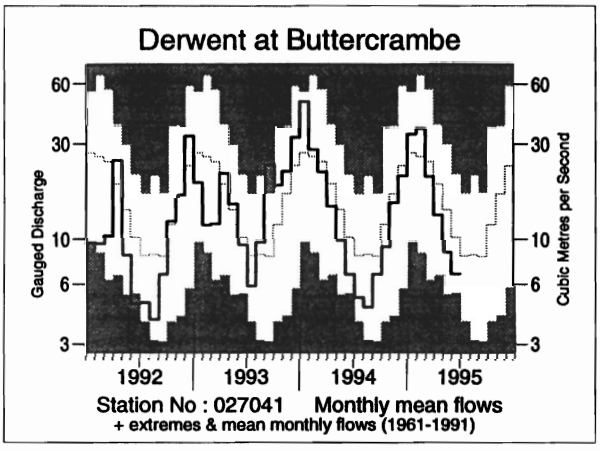
Return period assessments are based on tables provided by the Meteorological Office*. The tables reflect rainfall totals over the period 1911-70 only and the estimate assumes a sensibly stable climate. They assume a start in a specified month; return periods for a start in any month may be expected to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

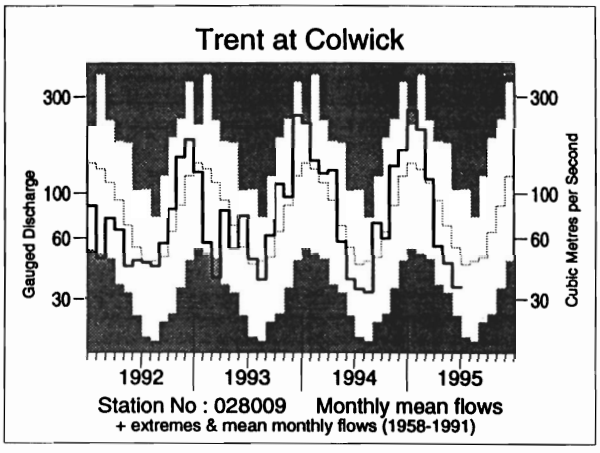
* Tabony, R.C., 1977, The Variability of long duration rainfall over Great Britain, Scientific Paper No. 37, Meteorological Office.

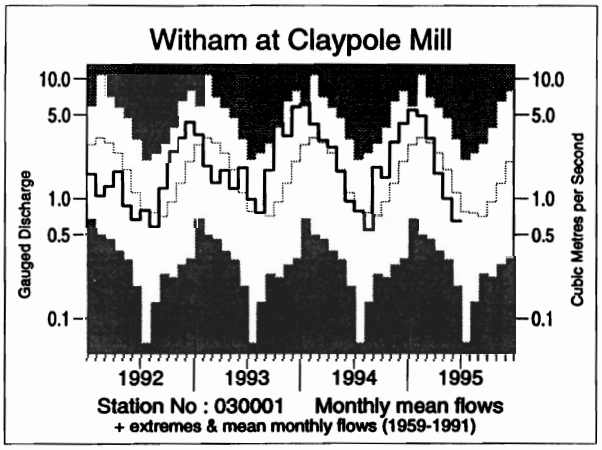
FIGURE 1 MONTHLY RIVER FLOW HYDROGRAPHS

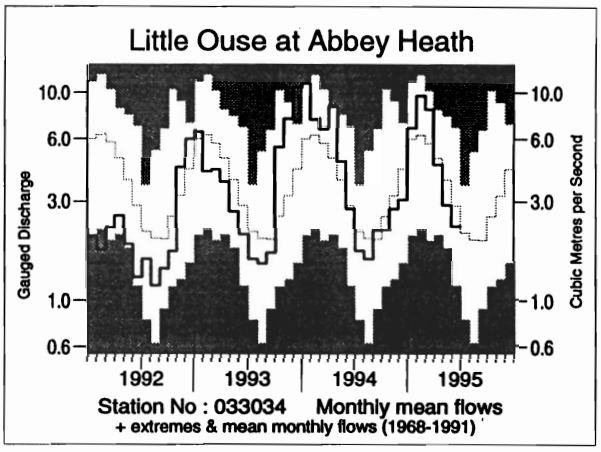


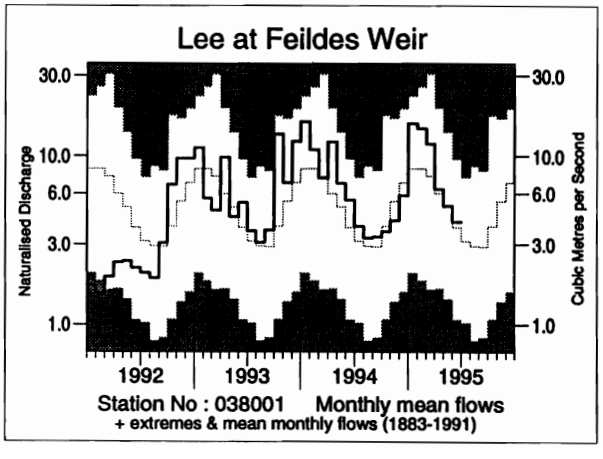


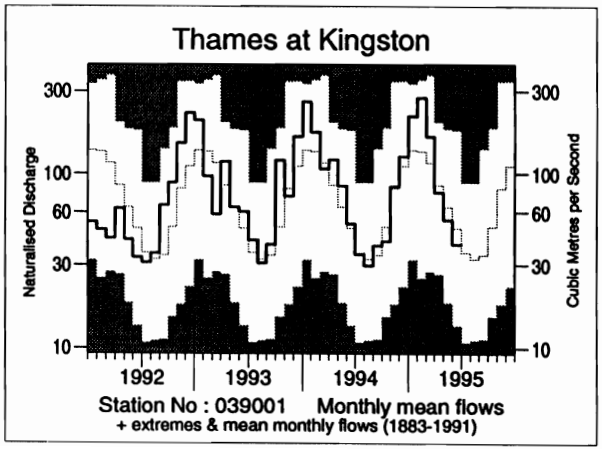


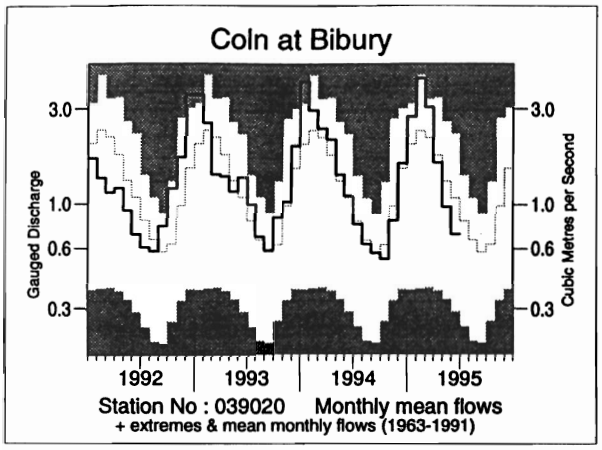


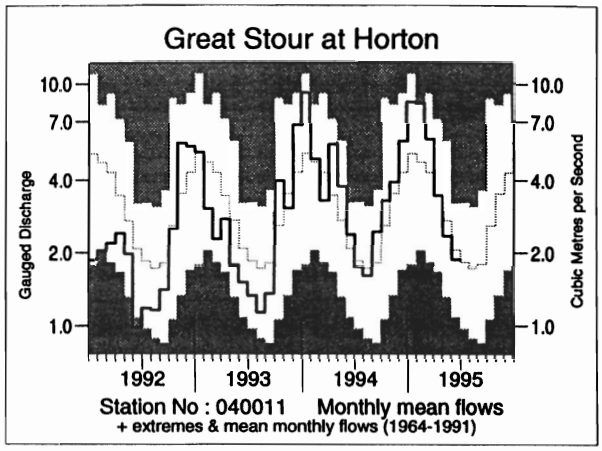


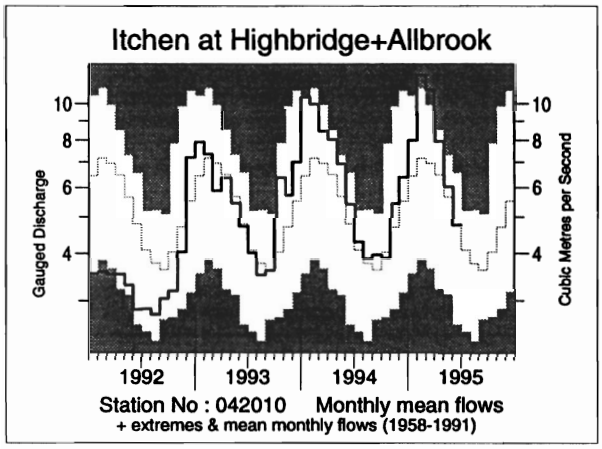


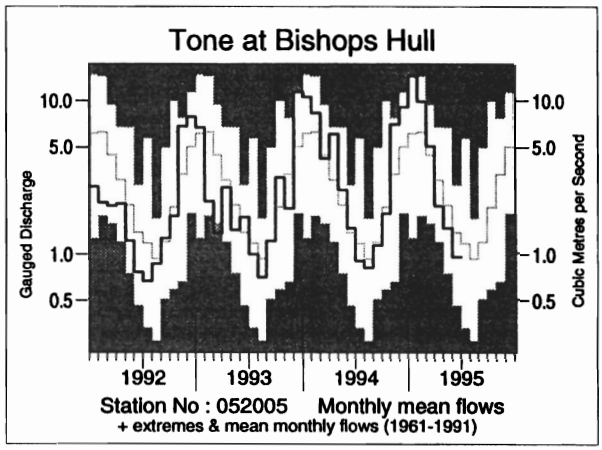


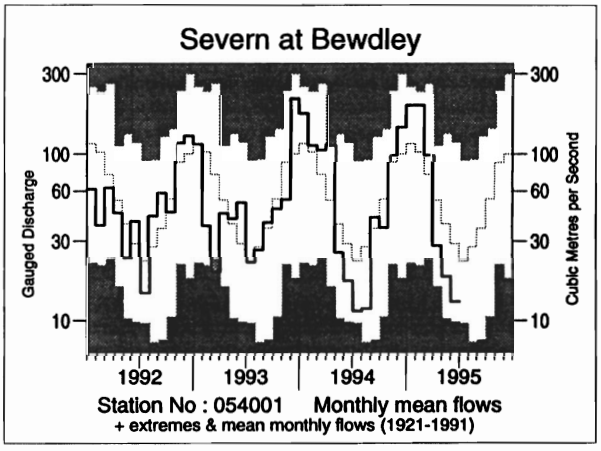


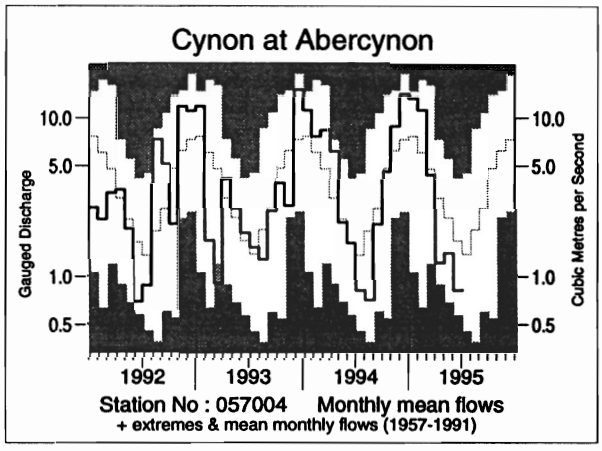

Coln at Bibury
Gauged Discharge
Cubic Metres per Second
3.0
1.0
0.6
0.3
1992
1993
1994
1995
Station No : 039020 Monthly mean flows
+ extremes & mean monthly flows (1963-1991)

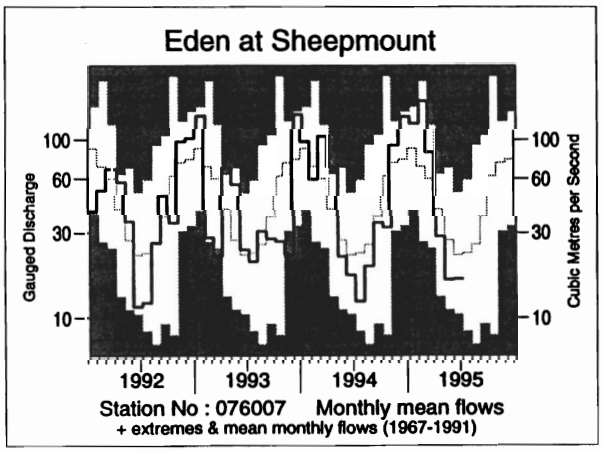

Great Stour at Horton
Gauged Discharge
Cubic Metres per Second
10.0
7.0
4.0
2.0
1.0
1992
1993
1994
1995
Station No : 040011 Monthly mean flows
+ extremes & mean monthly flows (1964-1991)


Itchen at Highbridge+Allbrook
Gauged Discharge
Cubic Metres per Second
10
8
6
4
1992
1993
1994
1995
Station No : 042010 Monthly mean flows
+ extremes & mean monthly flows (1958-1991)


Tone at Bishops Hull
Gauged Discharge
Cubic Metres per Second
10.0
5.0
1.0
0.5
1992
1993
1994
1995
Station No : 052005 Monthly mean flows
+ extremes & mean monthly flows (1961-1991)


Severn at Bewdley
Gauged Discharge
Cubic Metres per Second
300
100
60
30
10
1992
1993
1994
1995
Station No : 054001 Monthly mean flows
+ extremes & mean monthly flows (1921-1991)


Cynon at Abercynon
Gauged Discharge
Cubic Metres per Second
10.0
5.0
1.0
0.5
1992
1993
1994
1995
Station No : 057004 Monthly mean flows
+ extremes & mean monthly flows (1957-1991)


Eden at Sheepmount
Gauged Discharge
Cubic Metres per Second
100
60
30
10
1992
1993
1994
1995
Station No : 076007 Monthly mean flows
+ extremes & mean monthly flows (1967-1991)

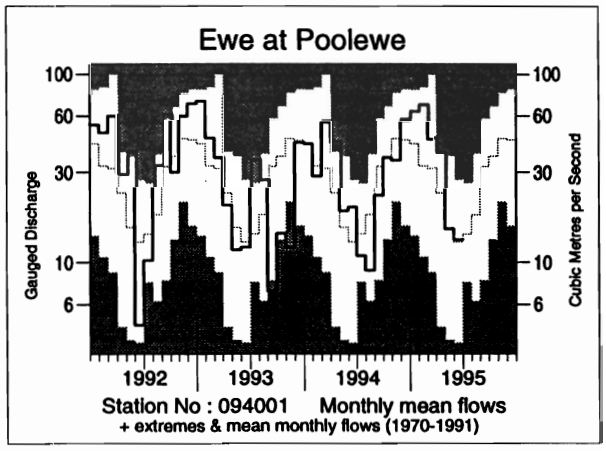

Ewe at Poolewe
Gauged Discharge
Cubic Metres per Second
100
60
30
10
6
1992
1993
1994
1995
Station No : 094001 Monthly mean flows
+ extremes & mean monthly flows (1970-1991)

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	Feb 1995	Mar	Apr	May	June 1995		4/95 to 6/95		1/95 to 6/95		7/94 to 6/95		9/93 to 6/95	
	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	98 136	84 88	67 84	55 88	46 126	17 /23	168 94	10 /23	431 98	9 /23	694 87	5 /22	1639 107	15 /21
Tay at Ballathie	217 189	176 134	105 118	50 72	46 102	24 /43	201 98	24 /43	768 127	38 /43	1338 117	37 /42	2554 116	34 /41
Tweed at Boleside	160 209	133 163	36 66	24 55	19 72	14 /35	79 64	6 /35	534 136	34 /35	944 123	32 /34	1799 123	33 /33
Whiteadder Water at Hutton Castle	47 100	24 49	19 50	13 48	13 79	13 /26	45 56	6 /26	159 68	5 /26	254 65	5 /25	725 96	11 /25
South Tyne at Haydon Bridge	158 216	92 105	40 69	22 60	18 67	12 /33	80 66	7 /33	511 132	32 /33	907 115	25 /31	1679 111	23 /29
Wharfe at Flint Mill Weir	152 204	91 119	26 47	13 35	11 44	7 /40	50 43	5 /40	455 123	34 /40	824 114	30 /39	1574 114	33 /38
Derwent at Buttercrambe	55 142	35 88	22 70	15 63	11 68	7 /34	47 68	6 /34	194 100	18 /34	297 91	14 /33	671 108	22 /32
Trent at Colwick	66 158	42 108	19 60	16 66	12 63	7 /37	47 63	4 /37	246 119	28 /37	422 118	28 /36	850 125	34 /35
Lud at Louth	45 136	44 129	25 83	20 80	15 80	9 /27	61 82	10 /27	187 108	14 /27	282 113	16 /26	656 137	23 /26
Witham at Claypole Mill	40 154	28 113	14 69	9 59	6 58	9 /37	29 64	12 /36	146 119	25 /36	251 134	28 /36	548 152	35 /35
Little Ouse at Abbey Heath	33 158	32 150	17 93	11 78	8 83	11 /28	36 86	12 /28	128 117	18 /27	179 104	17 /27	428 132	23 /26
Mimram at Panshanger Park	19 162	24 178	19 148	17 136	13 125	33 /43	49 136	36 /43	106 145	39 /43	174 137	39 /42	367 157	41 /41
Lee at Feildes Weir (natr.)	34 174	31 157	16 105	13 102	10 108	71 /110	39 105	64 /109	144 146	95 /109	206 126	81 /108	446 144	99 /106
Thames at Kingston (natr.)	67 204	44 143	20 91	15 84	10 81	46 /113	45 86	44 /113	214 139	99 /113	309 125	88 /112	625 132	101 /111
Coln at Bibury	97 180	77 145	39 93	24 75	17 66	8 /32	81 81	9 /32	323 123	28 /32	447 113	21 /31	902 119	27 /30
Great Stour at Horton	58 178	46 144	26 100	18 87	14 94	13 /30	58 95	14 /29	228 134	26 /29	373 127	24 /28	710 127	23 /26
Itchen at Highbridge+Allbrook	80 165	81 159	57 123	45 107	34 100	18 /37	136 111	29 /37	357 131	36 /37	562 122	33 /36	1085 125	34 /35
Stour at Throop Mill	122 212	70 142	26 73	16 70	10 64	3 /23	52 71	6 /23	364 146	22 /23	554 138	20 /22	1138 146	21 /21
Piddle at Baggs Mill	117 202	77 138	44 103	26 81	19 82	10 /32	89 91	12 /32	363 135	29 /31	542 132	26 /30	1119 142	28 /28
Exe at Thorverton	171 167	101 120	29 50	20 54	12 51	13 /40	61 52	6 /39	572 130	38 /39	1084 129	36 /39	2198 136	38 /38
Taw at Umberleigh	145 172	85 126	21 47	11 39	6 34	8 /37	38 43	6 /37	477 131	36 /37	908 129	32 /36	1900 139	35 /35
Tone at Bishops Hull	117 162	66 118	26 67	19 72	12 70	7 /35	57 70	8 /35	429 146	34 /34	698 146	33 /34	1350 146	33 /33
Severn at Bewdley	109 192	61 131	17 53	11 49	8 44	7 /75	36 50	10 /75	327 131	68 /74	537 119	58 /74	1082 124	69 /73
Teme at Knightsford Bridge	83 163	53 113	10 31	6 29	2 17	1 /26	18 28	1 /26	272 118	20 /25	439 120	22 /25	867 122	23 /24
Cynon at Abercynon	257 190	111 92	29 37	35 60	20 50	9 /37	84 48	6 /37	786 124	31 /37	1562 122	32 /35	3083 126	33 /33
Dee at New Inn	292 180	144 79	38 35	45 67	31 52	7 /26	114 49	3 /26	940 114	18 /26	1965 109	19 /26	3781 110	21 /25
Eden at Sheepmount	172 239	99 139	32 65	19 58	19 76	11 /25	70 66	6 /25	484 135	24 /25	859 123	21 /23	1531 116	18 /21
Clyde at Daldowie	152 203	139 174	43 90	23 64	18 69	11 /32	83 77	8 /32	527 138	30 /32	1003 126	29 /31	1897 125	30 /30
Carron at New Kelso	445 213	289 98	188 127	61 64	49 61	4 /17	298 92	9 /17	1415 121	13 /17	2561 99	9 /16	4631 94	5 /15
Ewe at Poolewe	369 198	274 133	222 155	92 93	78 104	15 /25	391 122	18 /25	1413 142	24 /25	2435 113	18 /24	4137 100	13 /23

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 is rank 1.
(iii) %LT means percentage of long term average from the start of the record to 1992. For the long periods (at the right of this table), the end date for the long term is 1995.

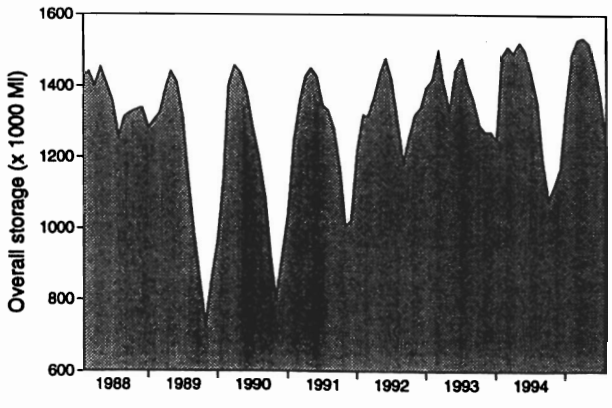
TABLE 4 START-MONTH RESERVOIR STORAGES UP TO JULY 1995

Area	Reservoir (R)/ Group (G)		Capacity • (Ml)	1995 Feb	Mar	Apr	May	June	July	1994 July
North West	N.Command Zone[1]	(G)	133375	100	100	99	86	73	58	73
	Vyrnwy	(R)	55146	99	100	97	89	81	69	79
Northumbria	Teesdale[2]	(G)	87936	100	100	99	95	89	70	72
	Kielder	(R)	199175*	100*	100*	97*	89*	90*	91*	93*
Severn-Trent	Clywedog	(R)	44922	100	94	97	96	96	86	93
	Derwent Valley[3]	(G)	39525	100	100	100	97	86	72	78
Yorkshire	Washburn[4]	(G)	22035	100	100	98	88	78	63	68
	Bradford supply[5]	(G)	41407	99	99	98	89	70	54	66
Anglian	Grafham	(R)	58707	92	93	95	96	95	94	94
	Rutland	(R)	130061	96	95	91	87	83	80	93
Thames	London[6]	(G)	206399	94	95	97	95	96	93	86
	Farmoor [7]	(G)	13843	95	96	97	97	97	94	95
Southern	Bewl	(R)	28170	96	99	99	97	94	88	98
	Ardingly	(R)	4685	100	100	100	100	99	97	100
Wessex	Clatworthy	(R)	5364	100	100	100	85	69	61	85
	Bristol W [8]	(G)	38666*	99*	99*	99*	94*	86*	79*	85*
South West	Colliford	(R)	28540	90	96	97	93	88	80	87
	Roadford[9]	(R)	34500	91	97	96	92	85	76	87
	Wimbleball[10]	(R)	21320	100	100	100	95	89	74	92
	Stithians	(R)	5205	100	100	96	86	77	61	82
Welsh	Celyn + Brenig	(G)	131155	100	100	100	100	96	87	94
	Brianne	(R)	62140	100	100	100	97	85	76	90
	Big Five[11]	(G)	69762	97	100	99	86	79	65	89
	Elan Valley[12]	(G)	99106	100	100	95	99	90	80	91
Lothian	Edin./Mid Lothian[13]	(G)	97639	99	100	99	98	90	88	84
	East Lothian[14]	(G)	10206	98	100	100	100	96	91	86
Strathclyde	Loch Katrine	(G)	111363	97	99	100	92	85	71	87
	Daer	(R)	22412	100	100	96	91	85	73	62
	Loch Thom	(G)	11840	100	100	100	92	84	77	82

• 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. Roadford began filling in November 1989.
10. Shared between South West (river regulation for abstraction) and Wessex (direct supply).
11. Usk, Talybont, Llandegfedd (pumped stroage), Taf Fechan, Taf Fawr.
12. Claerwen, Caban Coch, Pen-y-garreg and Craig Goch.
13. Megget, Talla, Fruid, Gladhouse, Torduff, Clubbiedean, Glencorse,Loganlea and Morton (upper and lower).
14. Thorters, Donolly, Stobshiel, Lammerloch, Hopes and Whiteadder

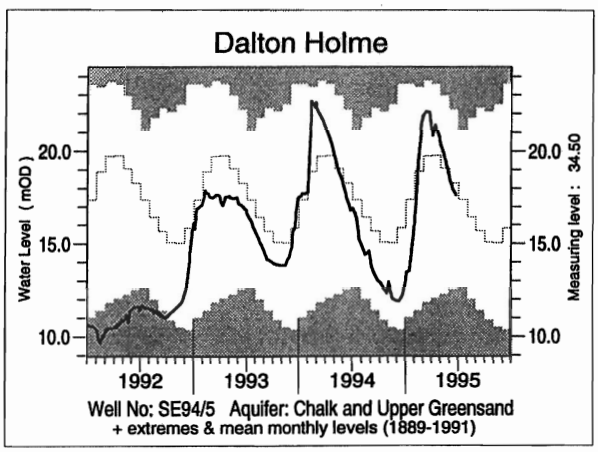
A GUIDE TO THE VARIATION IN OVERALL RESERVOIR STOCKS FOR ENGLAND AND WALES

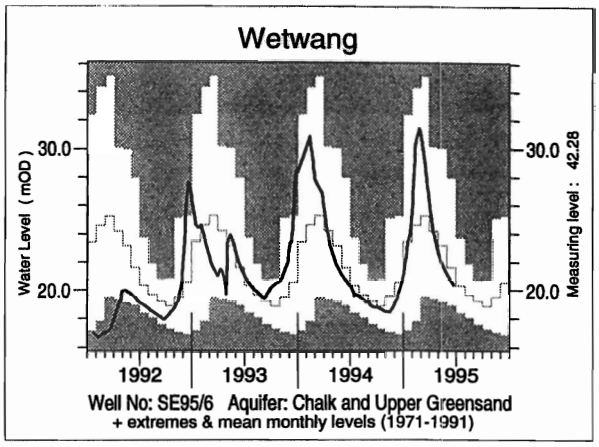


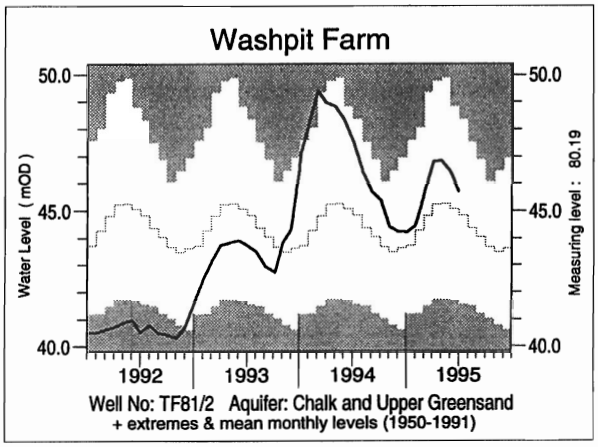
This plot is based on the reservoirs featured in Table 4 only.

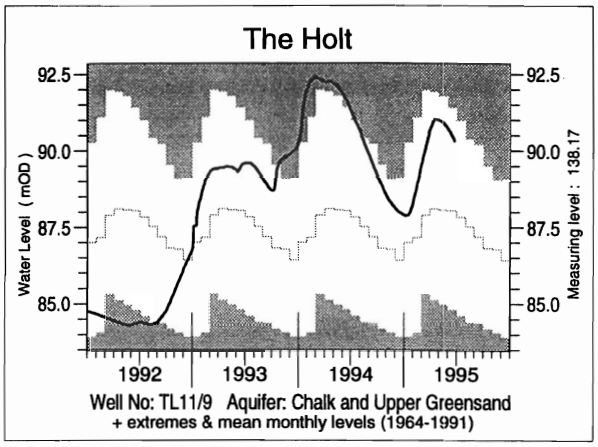
Note: Variations in storage depend on the balance between inputs (from catchment rainfall and any pumping) and outputs (to supply, compensation flow, HEP, amenity). There will be additional losses due to evaporation, especially in the summer months. Operational strategies for making the most efficient 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.

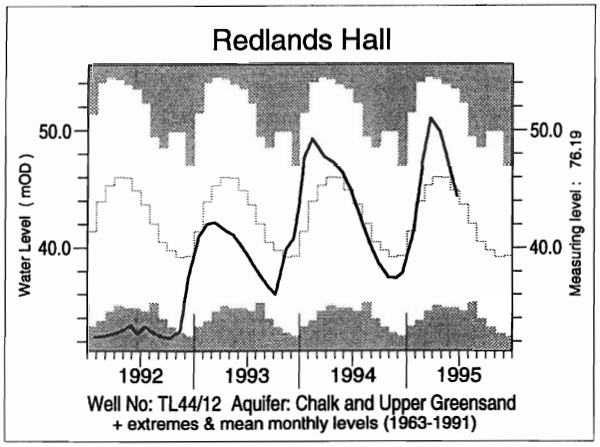
FIGURE 2 GROUNDWATER LEVEL HYDROGRAPHS

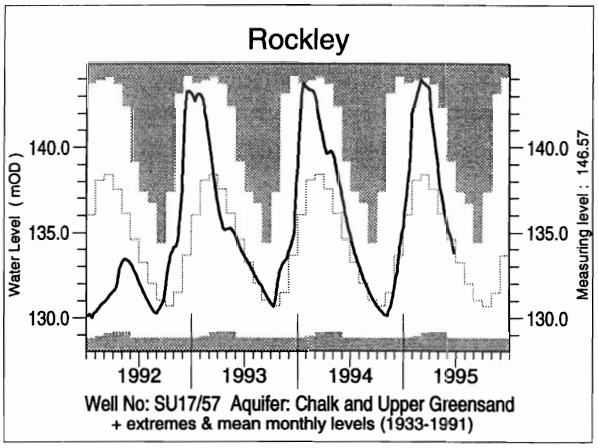


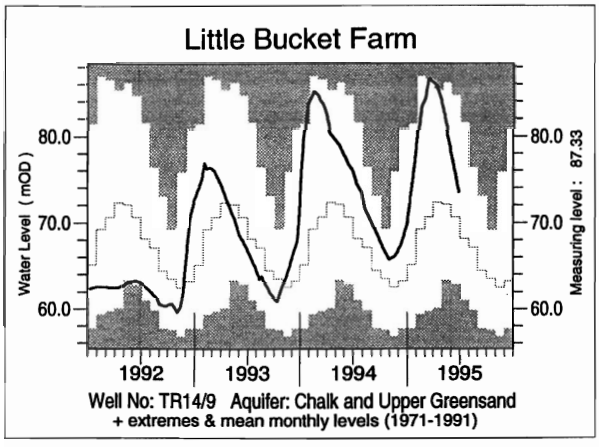


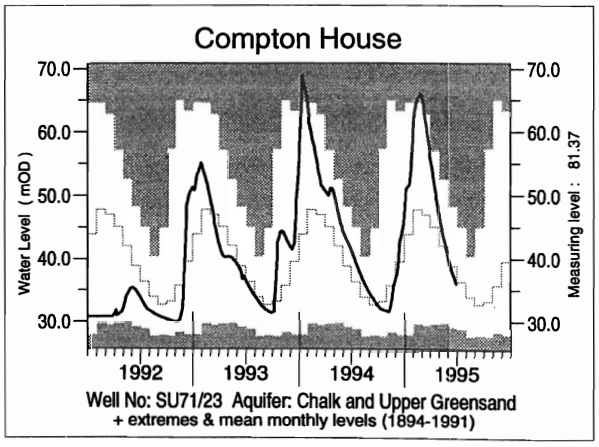


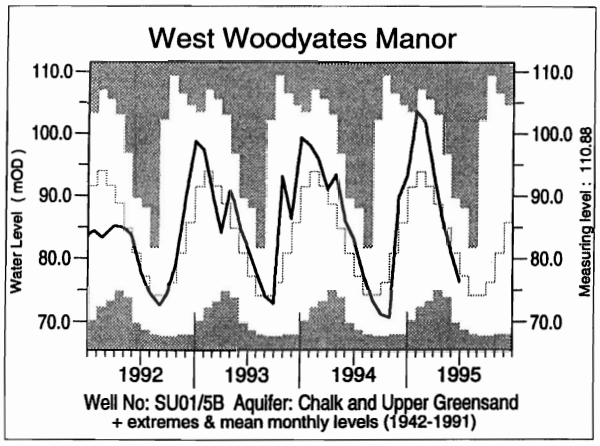


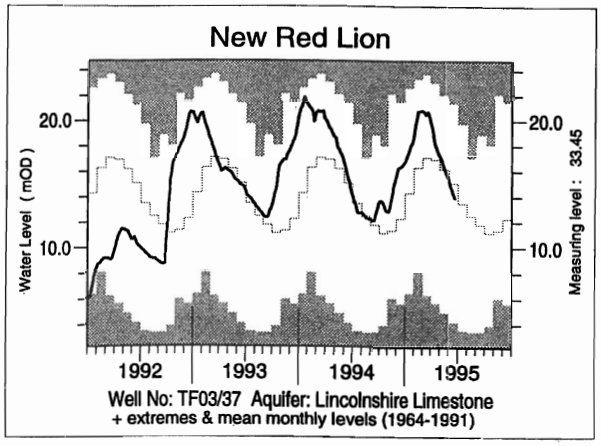


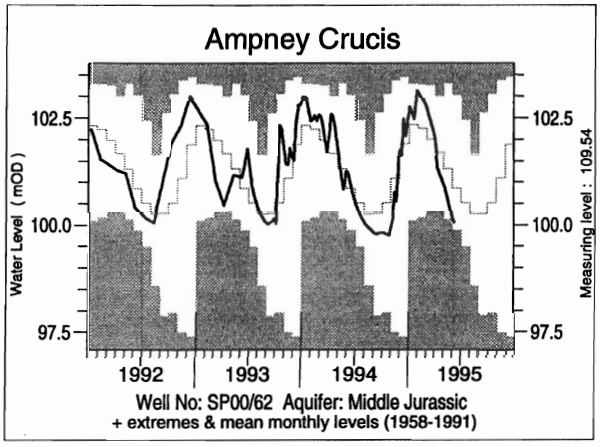


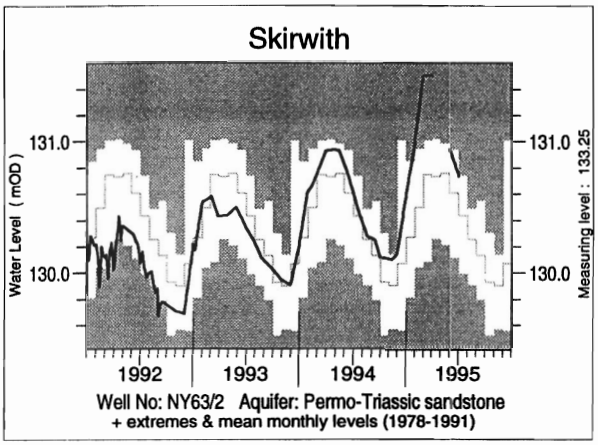


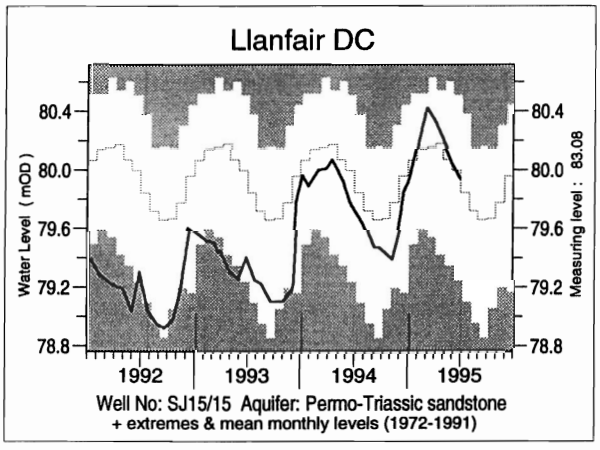


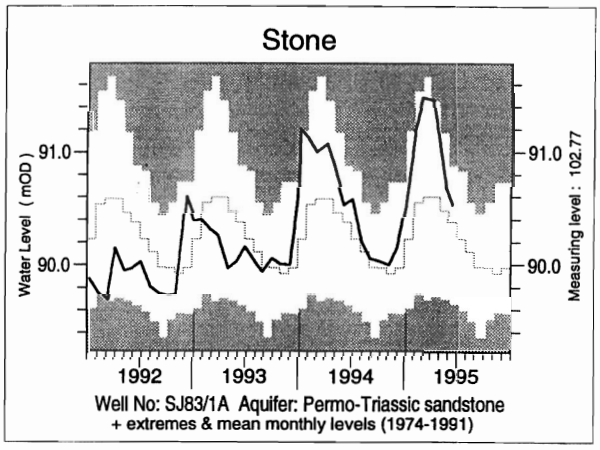

West Woodyates Manor
Water Level (mOD)
110.0
100.0
90.0
80.0
70.0
Measuring level : 110.88
1992
1993
1994
1995
Well No: SU01/5B Aquifer: Chalk and Upper Greensand
+ extremes & mean monthly levels (1942-1991)

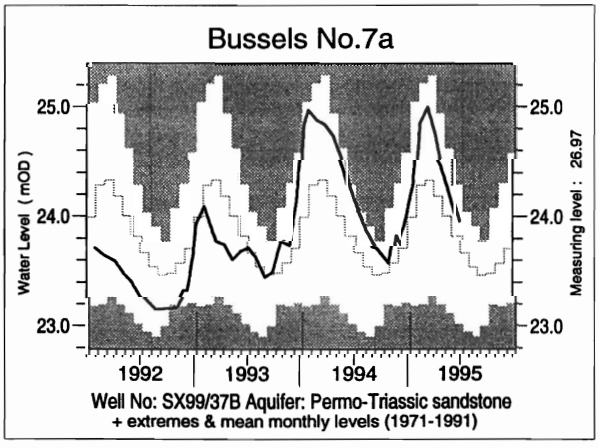

New Red Lion
Water Level (mOD)
20.0
10.0
Measuring level : 33.45
1992
1993
1994
1995
Well No: TF03/37 Aquifer: Lincolnshire Limestone
+ extremes & mean monthly levels (1964-1991)


Ampney Crucis
Water Level (mOD)
102.5
100.0
97.5
Measuring level : 109.54
1992
1993
1994
1995
Well No: SP00/62 Aquifer: Middle Jurassic
+ extremes & mean monthly levels (1958-1991)


Skirwith
Water Level (mOD)
131.0
130.0
Measuring level : 133.25
1992
1993
1994
1995
Well No: NY63/2 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1978-1991)


Llanfair DC
Water Level (mOD)
80.4
80.0
79.6
79.2
78.8
Measuring level : 83.08
1992
1993
1994
1995
Well No: SJ15/15 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1972-1991)


Stone
Water Level (mOD)
91.0
90.0
Measuring level : 102.77
1992
1993
1994
1995
Well No: SJ83/1A Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1974-1991)


Bussels No.7a
Water Level (mOD)
25.0
24.0
23.0
Measuring level : 26.97
1992
1993
1994
1995
Well No: SX99/37B Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1971-1991)

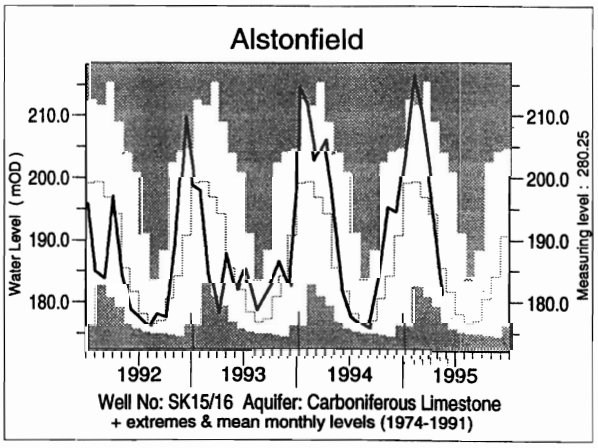

Alstonfield
Water Level (mOD)
210.0
200.0
190.0
180.0
Measuring level : 280.25
1992
1993
1994
1995
Well No: SK15/16 Aquifer: Carboniferous Limestone
+ extremes & mean monthly levels (1974-1991)

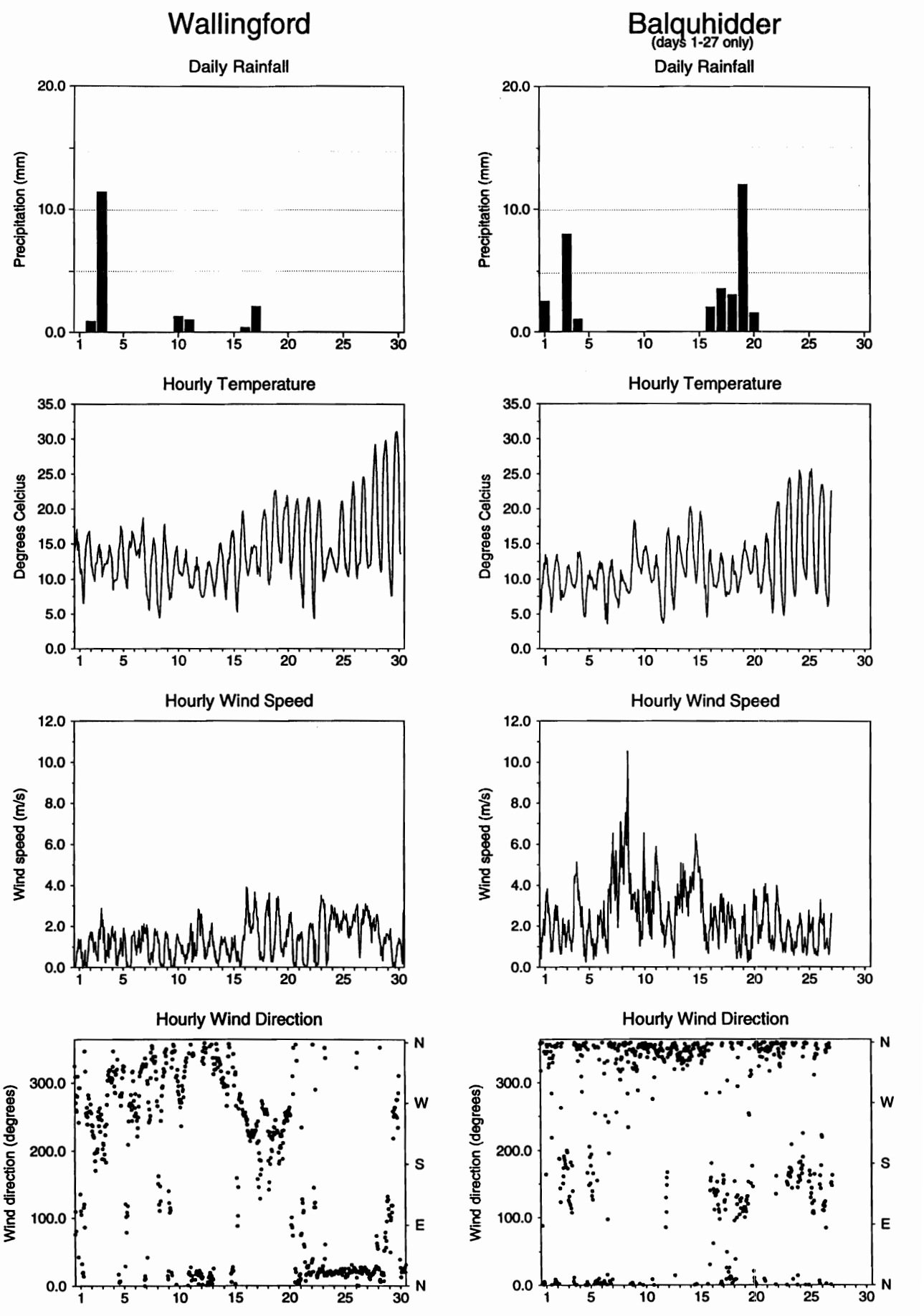
TABLE 5 A COMPARISON OF JUNE GROUNDWATER LEVELS: 1994 AND 1995

Site	Aquifer	Records commence	Minimum June <1995	Average June <1995	Maximum June <1995	June 1994 day	June 1994 level	June/July 1995 day	June/July 1995 level
Dalton Holme	C & UGS	1889	11.40	18.28	22.23	24/06	16.79	23/06	17.60
Wetwang	C & UGS	1971	18.97	21.78	27.95	24/06	20.45	23/06	20.39
Washpit Farm	C & UGS	1950	40.96	45.12	48.84	02/06	48.32	30/06	45.70
The Holt	C & UGS	1964	84.33	88.12	91.80	26/06	91.38	26/06	90.30
Therfield Rectory	C & UGS	1883	dry <71.6	81.93	98.77	30/06	85.97	26/06	86.32
Redlands Hall	C & UGS	1964	32.64	44.21	53.46	24/06	44.84	23/06	44.36
Rockley	C & UGS	1933	dry <128.44	134.56	139.11	26/06	135.09	26/06	133.78
Little Bucket Farm	C & UGS	1971	62.83	71.14	84.75	30/06	75.88	28/06	73.49
Compton House	C & UGS	1984	29.06	38.28	48.28	29/06	41.44	29/06	36.00
Chilgrove House	C & UGS	1836	36.91	46.29	58.52	29/06	48.77	29/06	43.32
Westdean No.3	C & UGS	1940	1.11	1.65	2.38	24/06	2.10	30/06	1.58
Lime Kiln Way	C & UGS	1969	123.97	125.32	126.03	17/06	125.76	14/06	126.04
Ashton Farm	C & UGS	1974	64.78	67.83	69.79	30/06	68.09	30/06	66.11
West Woodyates Manor	C & UGS	1942	69.78	81.06	89.58	30/06	82.92	30/06	76.32
Killyglen (NI)	C & UGS	1985	113.21	113.95	114.58	27/06	113.21	12/06	113.29
New Red Lion	LLst	1964	4.11	14.88	21.28	27/06	14.34	20/06	13.96
Ampney Crucis	Mid Jur	1958	99.87	100.87	103.03	26/06	100.64	08/06	100.05
Yew Tree Farm	PTS	1973	13.01	13.51	13.87	06/06	13.68	30/06	13.59
Llanfair D.C	PTS	1972	79.23	79.86	80.51	15/06	79.78	30/06	79.94
Morris Dancers	PTS	1969	31.89	32.46	33.49	07/06	32.27	23/06	32.52
Stone	PTS	1974	89.63	90.34	90.87	06/06	90.53	13/06	90.51
Skirwith	PTS	1978	130.06	130.54	130.93	15/06	130.72	03/07	130.72
Redbank	PTS	1981	7.79	8.15	8.56	30/06	8.00	30/06	7.44
Bussels No.7A	PTS	1972	23.01	23.83	24.28	22/06	24.16	21/06	23.95
Rushyford NE	MgLst	1967	65.22	72.73	76.62	27/06	76.55	21/06	76.40
Peggy Ellerton	MgLst	1968	31.38	34.27	36.78	22/06	33.55	16/06	34.47
Alstonfield	CLst	1974	175.45	181.25	200.66	07/06	181.74	no	level

groundwater levels are in metres above Ordnance Datum

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

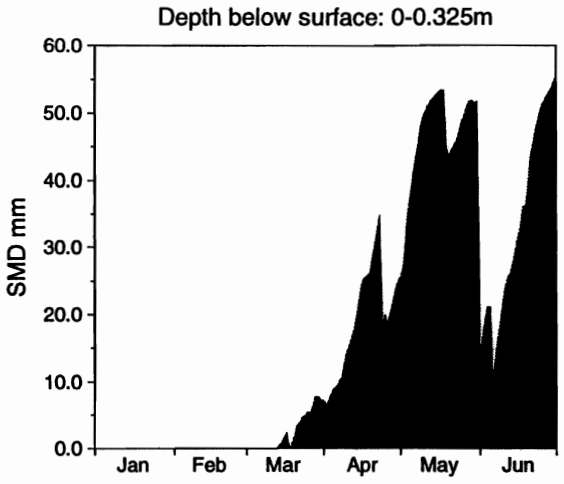
FIGURE 3 METEOROLOGICAL SUMMARY - JUNE 1995

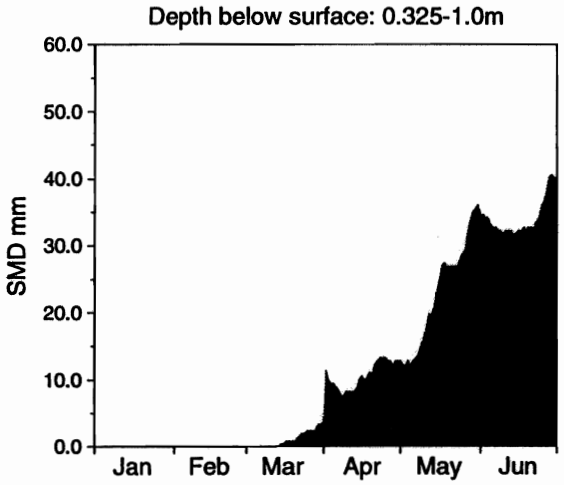


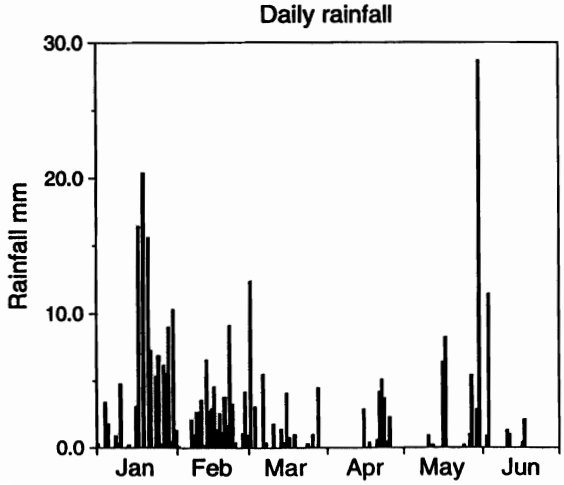
The Institute of Hydrology Meteorological Station occupies a relatively open site on the Thames floodplain about 5km NW of the Chilterns escarpment. Station elevation is 48m

The Lower Kirkton automatic weather station (Balquhidder) occupies a relatively sheltered position at the mouth of the SSE trending Kirkton Glen. Station elevation is 270m aOD and average annual rainfall exceeds 2000mm; snow cover is expected for 10-30 days a year.

FIGURE 3a. WALLINGFORD SMD DATA 1995.







Note

Soil moisture deficit is defined as the amount by which the water stored in the soil is below the quantity held at field capacity. The data presented here are calculated from readings taken at the two automatic soil water stations (ASWSs) at Wallingford. They employ capacitance soil water sensors installed at depths of 5, 15 and 50 cm. Figure 3a shows deficits calculated from one of the stations for the depth ranges 0 - 0.325 m and 0.325 - 1.00 m at 0100 GMT on each day; slight discontinuities in the SMD trace can occur when switching between the ASWSs. The data presented give a good representative picture of soil moisture variations - avoiding the short term changes that can be dominant close to the surface.

Daily rainfall for the Wallingford meteorological station from Figure 3 is repeated here for comparison.

FIGURE 4 LOCATION MAP OF GAUGING STATIONS AND GROUNDWATER INDEX WELLS