Hydrological Summary for Great Britain

FEBRUARY 1996

Rainfall

February was generally cold, sunny and relatively wet with occasional blizzards and significant snowfall on high ground. High pressure dominated early and late in the month but many regions registered only two or three dry days in the three weeks from the 5th. This unsettled spell helped produce above average February rainfall in almost all regions, terminating some very lengthy sequences of dry months - from March 1995 in north-west England, parts of Wales and the southern Pennines. On average, February is one of the driest months of the year and the widespread 110-130% rainfall totals, whilst extremely valuable, produced only moderate reductions in the longer term rainfall deficiencies. Winter (Dec-Feb) rainfall was a little above average throughout most of southern Britain but well below to the north; the North West NRA region recorded less than 60% and, remarkably, some localities in northern Scotland less than half. In the context of the recent past, the 1995/96 winter (E&W) has been notably cool and quite dry (see Appendix). England and Wales has registered only two drier April-February periods this century (33/34 and 75/76) and in this timeframe the regional focus of the drought is clear. Very substantial rainfall deficiencies extend throughout much of northern and western Britain, encompassing a number of strategically important gathering grounds. Notwithstanding the relatively wet February, 11-month rainfall totals for a number of raingauges in north-west England and the Pennines are unprecedented (some records extend over more than 100 years); exceptionally low rainfall in this timespan also characterises parts of North Wales. A deepening high pressure system which became established to the west of Ireland around the 24th produced, from a water resources viewpoint, a very unhelpful synoptic pattern at a critical time.

River Flow

Flows in most responsive western and northern catchments picked up briskly in February with snowmelt making a significant contribution to upland rivers. By contrast, flow recoveries were sluggish in many permeable catchments where, in the east particularly, spring outflows remain very modest. As a result, some Chalk rivers (e.g. the Lud and Stringside) reported flows amongst the lowest on record (although greater than those for early 1992). Away from such catchments percentage runoff totals for February exhibited considerable spatial uniformity; most index rivers recording 80-130% of the monthly mean. Relatively healthy flow characterised many rivers in regions where the resources outlook is fragile. But more significantly, accumulated runoff totals are very low over wide areas. In north-western Britain the Rivers Eden and Ewe both established new winter (Dec-Feb) runoff minima, the latter recording only 34% of the preceding average. In the 8-month timeframe, depressed runoff totals show a wide distribution. The Rivers South Tyne, Wharfe, Dove, Great Stour, Welsh Dee and Eden all established new July-Feb runoff minima and the contrast between mean flows over the March-February period with those for the preceding 12 months is often remarkable.

Groundwater

Above average rainfall in most outcrop areas, combined with minimal soil moisture deficits, produced substantial recharge in February; the lag before deeper water-tables respond implies that the full benefit is not evident on some of the index hydrographs. Normally, many borehole levels reach their seasonal peak about now - somewhat later in the east - but currently groundwater levels display little regional coherence. In the western and central Chalk outcrops, levels are close to the seasonal average but levels are notably depressed in the east where significant recharge has only recently begun. Levels in parts of Kent are a matter of concern and, in Yorkshire, Dalton Holme levels are close to the February minima in a 107-year record - as elsewhere, however, water-tables were lower in early 1992. Brisk February recoveries were registered in the Lincolnshire and Carboniferous Limestones but generalisation is difficult in the Permo-Triassic sandstones. Levels now exceed the seasonal average in parts of the South-West but no sustained seasonal recovery can yet be recognised in the north-west; levels at Llanfair and Skirwith are closely comparable with the minimum on record. With evaporation rates set to accelerate through the spring substantial rainfall is required over the coming weeks to extend the 1995/96 recharge season.

General

Overall reservoir contents increased considerably in February but still remain appreciably below late-winter stocks in recent drought years. Regional differences are marked (see Appendix) but stocks are very depressed in the North-West, the southern Pennines and North Wales. Some large reservoirs are now very unlikely to fill before the summer drawdown begins and the fragility of the water resources outlook could extend well beyond this summer. Although significant water resource difficulties may now be anticipated their magnitude and extent will, in large part, be dependent on rainfall over the next 6-8 weeks (and water demand over the coming summer).

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, Balquhidder (Central Region, Scotland) and Plynlimon. 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. The text of the monthly report, together with details of other National Water Archive Facilities, is available on the World Wide Web: http://www.nwl.ac.uk:80/~nrfadata/nwa.html

* 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

Tel: 01344 856858 Fax: 01344 854024

Institute of Hydrology/British Geological Survey
Maclean Building
Crowmarsh Gifford
Wallingford
Oxfordshire
OX10 8BB

 13 March 1996

TABLE 1 1995/96 RAINFALL AS A PERCENTAGE OF THE 1961-90 AVERAGE

		Feb 1995	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan* 1996	Feb
England and	mm	115	67	27	49	23	40	13	112	54	80	82	64	84
Wales	%	183	93	45	77	35	65	17	145	64	89	87	73	133
NRA REGIONS														
North West	mm	165	107	28	65	39	65	19	94	86	65	37	50	98
	%	212	113	39	87	48	76	18	82	67	53	30	41	125
Northumbrian	mm	108	59	38	53	30	29	11	111	56	112	78	34	80
	%	183	84	68	85	50	45	14	152	74	130	96	40	135
Severn Trent	mm	89	51	20	49	13	35	9	93	38	64	79	43	66
	%	165	84	36	83	22	66	13	145	59	90	103	61	121
Yorkshire	mm	100	65	27	44	23	29	9	97	29	61	69	43	74
	%	172	96	46	73	38	49	12	143	40	76	83	54	128
Anglian	mm	62	51	16	30	25	25	8	101	16	42	66	32	51
	%	168	109	35	63	49	51	15	206	31	72	120	64	137
Thames	mm	82	51	18	37	16	31	4	114	35	64	92	49	58
	%	182	91	36	66	29	63	7	193	56	98	131	76	129
Southern	mm	112	59	18	23	20	31	5	140	34	63	94	63	67
	%	207	94	34	43	37	65	9	203	43	74	115	79	124
Wessex	mm	111	57	35	53	14	26	9	143	69	123	103	66	75
	%	171	81	66	87	25	50	14	199	87	148	111	75	116
South West	mm	165	93	50	55	19	47	16	135	104	132	127	160	129
	%	163	94	72	76	28	68	19	145	90	106	91	116	127
Welsh	mm	182	88	37	77	27	69	33	125	110	129	101	84	109
	%	188	82	46	94	34	90	33	109	80	91	66	59	112
Scotland	mm	205	143	67	84	43	86	35	195	228	125	53	105	130
	%	201	114	88	98	50	91	30	137	146	83	35	69	127
RIVER PURIFICATION BOARDS														
Highland	mm	271	177	97	89	47	101	47	245	249	161	46	69	126
	%	213	109	107	97	48	95	37	143	126	79	23	37	99
North East	mm	83	74	68	80	53	45	28	293	104	99	67	85	90
	%	128	95	113	116	80	62	32	337	107	100	72	86	138
Tay	mm	185	110	39	96	32	67	20	180	217	116	61	168	135
	%	195	101	63	116	44	87	21	158	167	96	48	117	142
Forth	mm	171	92	35	71	31	70	21	135	197	90	54	87	82
	%	216	98	59	96	45	93	22	123	171	80	49	74	104
Tweed	mm	109	75	36	65	35	43	22	122	134	97	63	70	95
	%	163	95	63	92	54	59	25	137	141	104	68	70	142
Solway	mm	173	145	40	84	44	79	23	102	251	111	51	147	192
	%	171	124	52	99	52	88	19	71	160	77	34	94	190
Clyde	mm	251	196	66	83	44	125	41	137	319	118	48	135	160
	%	213	133	79	91	47	115	31	77	165	66	27	71	136

* Because of the substantial proportion of snowfall and associated access difficulties, these estimates may be subject to significant error.

Note: The monthly rainfall figures for the NRA regions for January & February 1996 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, especially when snow is a significant component in the precipitation total. The figures for the RPB regions (and for Scotland) for January & February 1996 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

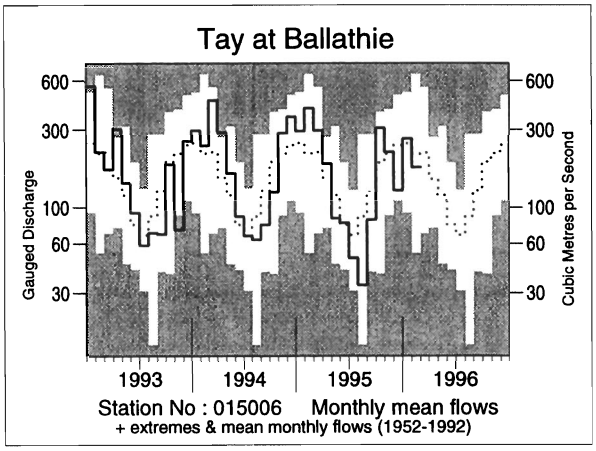
		Dec 95-Feb 96		Oct 95-Feb 96		Apr 95-Feb 96		Sep 94-Feb 96	
			Est Return Period, years		Est Return Period, years		Est Return Period, years		Est Return Period, years
England and Wales	mm	230		364		628		1402	
	% LTA	94	2-5	87	2-5	76	20-35	101	2-5
NRA REGIONS									
North West	mm	184		335		645		1704	
	% LTA	57	20-30	58	40-60	58	>>200	90	5-10
Northumbria	mm	191		359		631		1288	
	% LTA	85	5	93	2-5	81	10-15	98	2-5
Severn Trent	mm	188		290		509		1163	
	% LTA	93	2-5	86	5	73	25-40	101	2-5
Yorkshire	mm	186		276		505		1189	
	% LTA	84	5	74	10	67	70-100	94	2-5
Anglian	mm	149		207		412		873	
	% LTA	105	2-5	82	5	75	20-30	97	2-5
Thames	mm	199		298		518		1093	
	% LTA	111	2-5	97	2-5	82	5-10	104	2-5
Southern	mm	224		321		558		1289	
	% LTA	104	2-5	84	5	78	10-15	105	2-5
Wessex	mm	244		436		716		1517	
	% LTA	100	<2	107	2-5	93	2-5	115	5-10
South West	mm	416		652		974		2077	
	% LTA	110	2-5	105	2-5	91	2-5	110	2-5
Welsh	mm	293		532		900		2070	
	% LTA	75	5-10	79	5-10	75	25-40	99	2-5
Scotland	mm	287		640		1150		2339	
	% LTA	71	10-15	90	2-5	88	5-10	102	2-5
RIVER PURIFICATION BOARDS									
Highland	mm	241		651		1277		2766	
	% LTA	47	80-120	71	20-30	80	20-30	97	2-5
North East	mm	242		445		1012		1661	
	% LTA	94	2-5	98	2-5	113	5-10	110	5-10
Tay	mm	364		697		1131		2131	
	% LTA	99	2-5	113	2-5	101	2-5	109	2-5
Forth	mm	223		510		873		1780	
	% LTA	73	10	96	2-5	86	5-10	102	2-5
Tweed	mm	228		459		782		1523	
	% LTA	88	2-5	102	2-5	88	5-10	101	2-5
Solway	mm	390		752		1124		2287	
	% LTA	96	2-5	107	2-5	86	5-10	101	2-5
Clyde	mm	343		780		1276		2717	
	% LTA	71	10	91	2-5	82	10-20	99	2-5

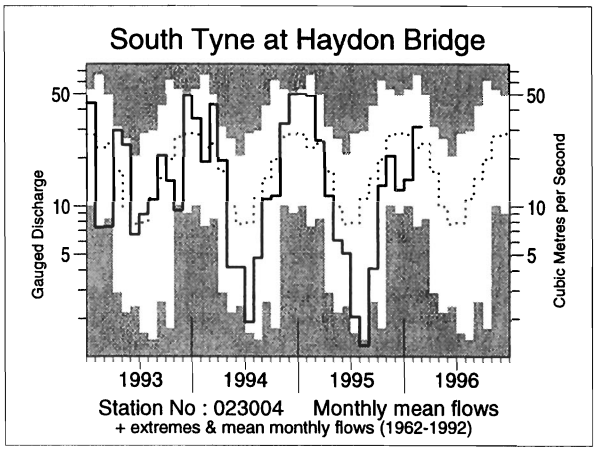
LTA refers to the period 1961-90.

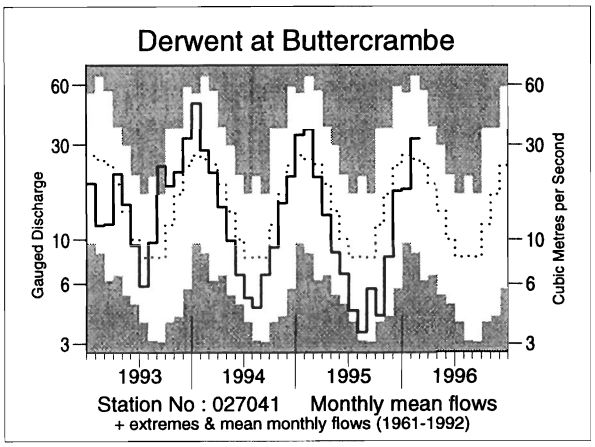
Return period assessments are based on tables provided by the Meteorological Office*. The tables reflect rainfall totals over the period 1911-70 only and the estimate assumes a sensibly stable climate. They assume a start in a specified month; return periods for a start in any month may be expected to be an order of magnitude less - for the longest durations the return period estimates converge. "Wet" return periods underlined. The ranking of accumulated rainfall totals for England & Wales and for Scotland can be affected by artifacts in the historical series - on balance these tend to exaggerate the relative wetness of the recent past.

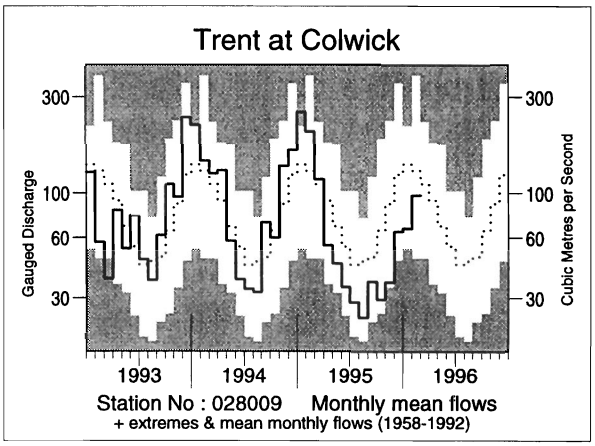
* Tabony, R.C., 1977, The Variability of long duration rainfall over Great Britain, Scientific Paper No. 37, Meteorological Office.

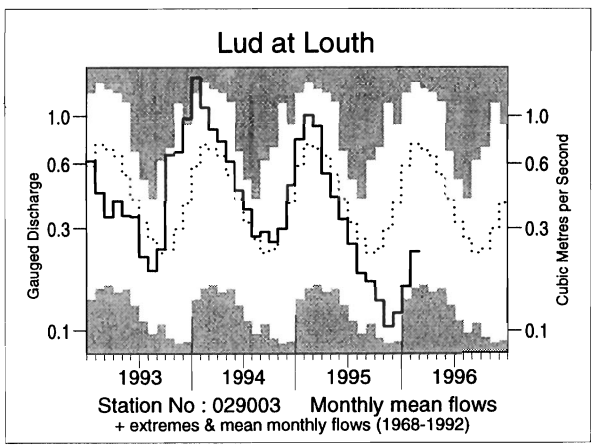
FIGURE 1 MONTHLY RIVER FLOW HYDROGRAPHS

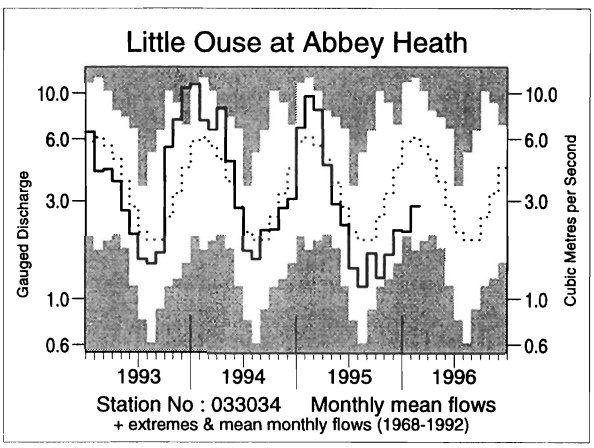


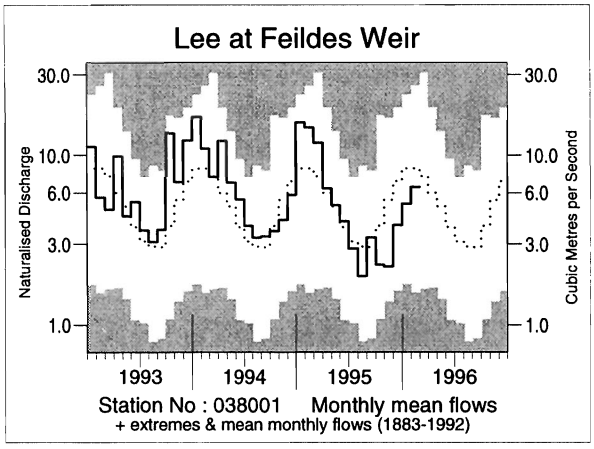


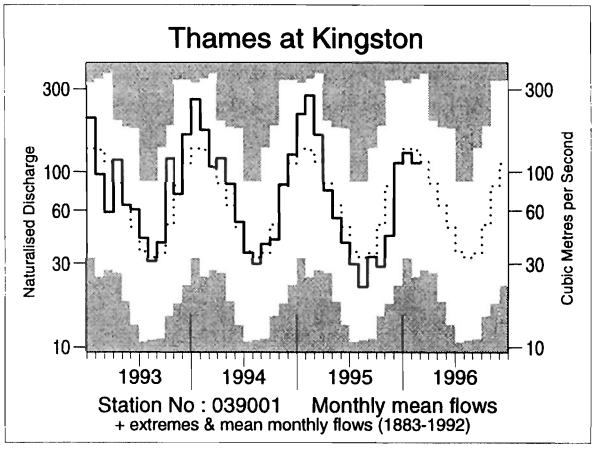


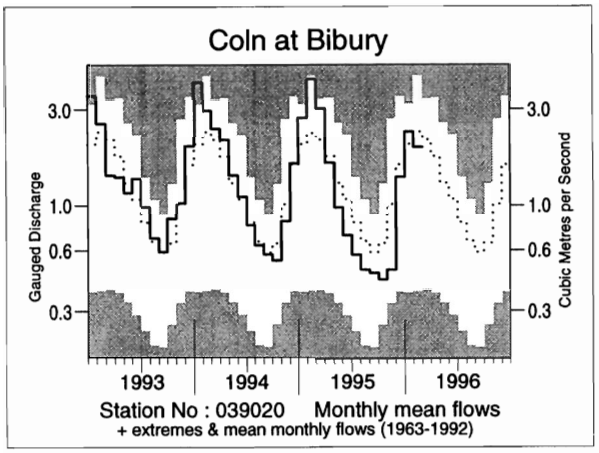


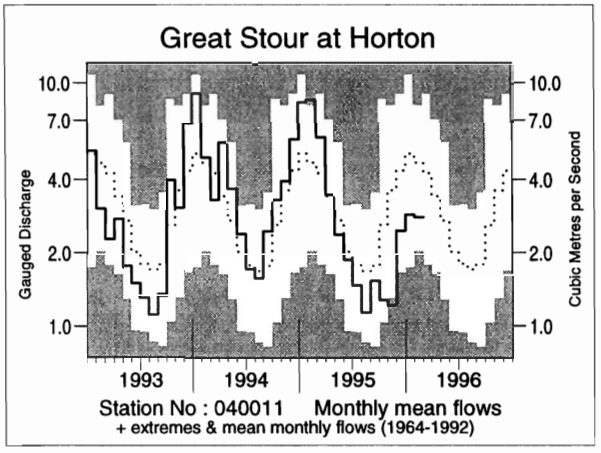


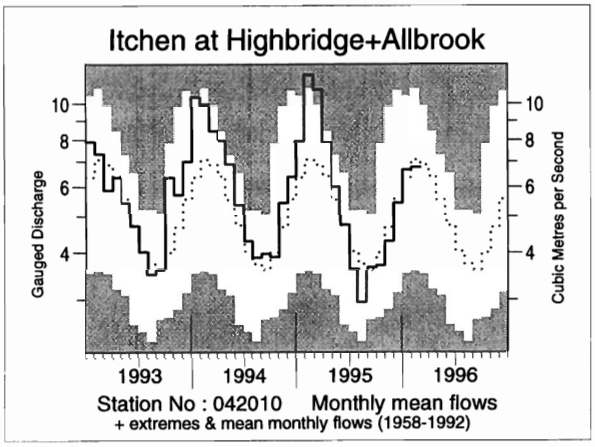


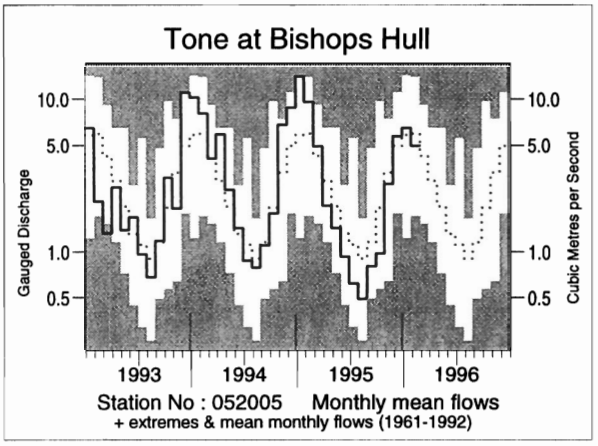


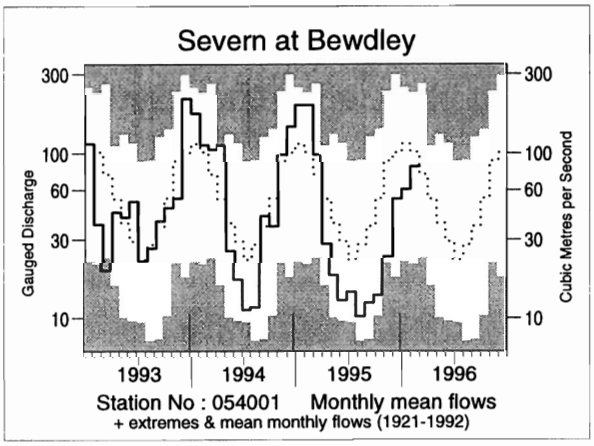


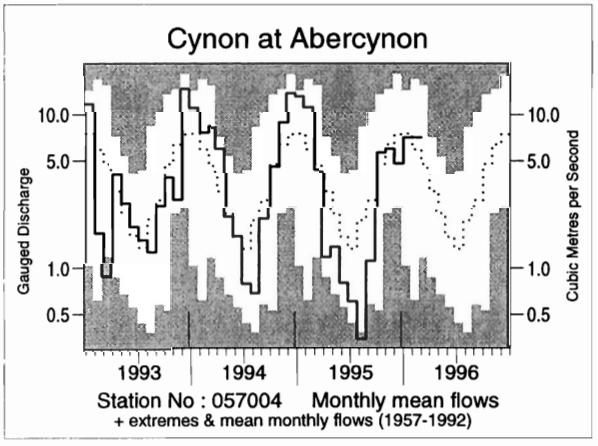

Coln at Bibury
Gauged Discharge
Cubic Metres per Second
3.0
1.0
0.6
0.3
1993
1994
1995
1996
Station No : 039020 Monthly mean flows
+ extremes & mean monthly flows (1963-1992)

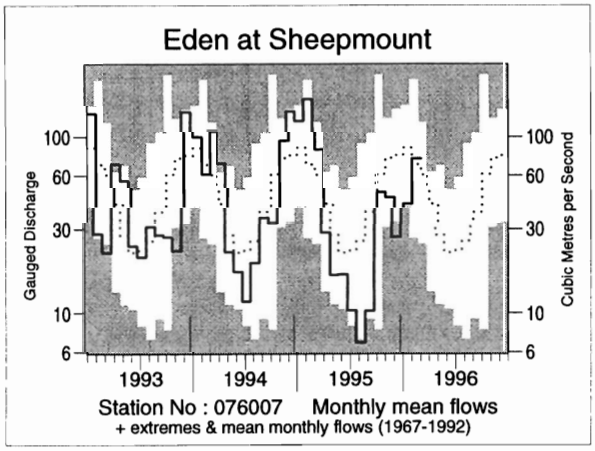

Great Stour at Horton
Gauged Discharge
Cubic Metres per Second
10.0
7.0
4.0
2.0
1.0
1993
1994
1995
1996
Station No : 040011 Monthly mean flows
+ extremes & mean monthly flows (1964-1992)


Itchen at Highbridge+Allbrook
Gauged Discharge
Cubic Metres per Second
10
8
6
4
1993
1994
1995
1996
Station No : 042010 Monthly mean flows
+ extremes & mean monthly flows (1958-1992)


Tone at Bishops Hull
Gauged Discharge
Cubic Metres per Second
10.0
5.0
1.0
0.5
1993
1994
1995
1996
Station No : 052005 Monthly mean flows
+ extremes & mean monthly flows (1961-1992)


Severn at Bewdley
Gauged Discharge
Cubic Metres per Second
300
100
60
30
10
1993
1994
1995
1996
Station No : 054001 Monthly mean flows
+ extremes & mean monthly flows (1921-1992)


Cynon at Abercynon
Gauged Discharge
Cubic Metres per Second
10.0
5.0
1.0
0.5
1993
1994
1995
1996
Station No : 057004 Monthly mean flows
+ extremes & mean monthly flows (1957-1992)


Eden at Sheepmount
Gauged Discharge
Cubic Metres per Second
100
60
30
10
6
1993
1994
1995
1996
Station No : 076007 Monthly mean flows
+ extremes & mean monthly flows (1967-1992)

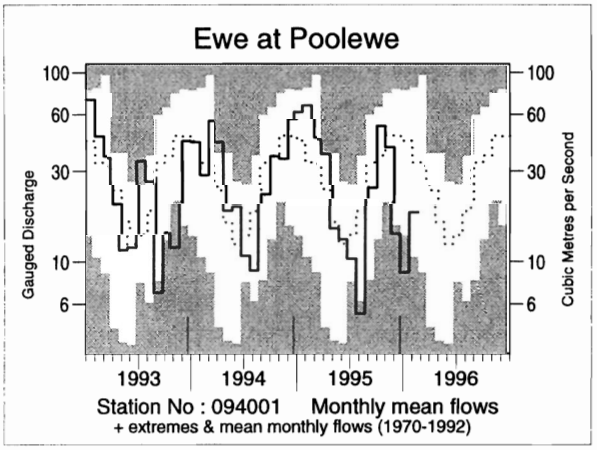

Ewe at Poolewe
Gauged Discharge
Cubic Metres per Second
100
60
30
10
6
1993
1994
1995
1996
Station No : 094001 Monthly mean flows
+ extremes & mean monthly flows (1970-1992)

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	Oct 1995	Nov	Dec	Jan	Feb 1996		12/95 to 2/96		7/95 to 2/96		3/95 to 2/96		3/94 to 2/96	
	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	98 120	105 138	73 86	156 167	99 138	20 /24	329 129	23 /24	692 132	22 /23	945 119	21 /23	1768 111	20 /22
Tay at Ballathie	183 166	125 104	76 53	155 104	98 86	20 /44	330 81	10 /44	734 91	18 /43	1111 97	19 /43	2649 116	36 /42
Tweed at Boleside	107 149	82 94	36 36	90 84	113 148	32 /36	239 84	8 /35	475 85	8 /35	668 88	8 /35	1659 109	26 /34
Whiteadder Water at Hutton Castle	10 34	38 104	46 98	54 89	64 135	21 /27	164 106	15 /27	235 91	9 /26	304 78	7 /26	590 76	7 /25
South Tyne at Haydon Bridge	48 70	71 76	45 42	52 51	104 142	27 /34	201 71	6 /34	347 61	1 /32	519 67	2 /32	1505 96	12 /30
Wharfe at Flint Mill Weir	16 26	22 28	17 17	34 34	68 92	21 /41	119 44	3 /41	186 35	1 /40	326 46	1 /40	1223 85	7 /39
Derwent at Buttercrambe	7 35	13 48	30 73	30 66	51 131	26 /35	111 89	14 /35	154 72	7 /34	236 73	6 /34	538 83	8 /33
Trent at Colwick	11 45	13 40	23 50	24 47	32 78	17 /38	79 57	6 /38	134 56	2 /37	223 63	3 /37	679 95	17 /36
Lud at Louth	7 54	5 34	6 29	8 26	11 32	5 /28	24 30	4 /28	65 46	3 /27	170 /68	6 /27	476 95	12 /26
Witham at Claypole Mill	4 45	6 43	7 35	13 49	17 66	12 /37	37 51	8 /37	59 51	8 /37	116 62	6 /36	384 103	18 /35
Little Ouse at Abbey Heath	5 49	6 49	8 48	8 35	10 48	4 /28	27 43	4 /28	54 51	3 /28	122 73	5 /27	318 96	9 /26
Mimram at Panshanger Park	8 99	7 83	9 86	10 83	10 83	14 /44	28 84	17 /44	73 94	19 /43	145 115	32 /43	328 130	41 /42
Lee at Feildes Weir (natr.)	6 58	6 41	10 55	13 61	16 80	48 /111	39 /65	30 /111	71 67	29 /110	141 86	40 /109	357 110	69 /107
Thames at Kingston (natr.)	8 57	11 52	30 100	35 94	28 86	53 /114	94 94	50 /113	135 83	35 /113	225 91	43 /113	541 110	71 /112
Coln at Bibury	11 66	12 48	35 86	58 110	46 85	11 /33	139 93	13 /33	199 83	9 /32	357 90	9 /32	820 103	16 /31
Great Stour at Horton	10 49	9 34	19 55	22 55	20 62	8 /32	61 56	3 /31	113 58	1 /31	218 75	5 /29	603 103	16 /27
Itchen at Highbridge+Allbrook	28 91	31 91	40 97	49 102	47 97	14 /38	137 98	19 /38	271 94	15 /37	488 106	25 /37	1044 113	30 /36
Stour at Throop Mill	12 51	37 112	56 96	67 107	64 112	15 /24	187 100	11 /23	256 93	11 /23	377 95	10 /23	966 121	21 /22
Exe at Thorverton	35 47	72 73	124 90	109 83	89 87	19 /40	322 86	14 /40	459 73	6 /40	621 75	7 /39	1861 111	30 /38
Taw at Umberleigh	17 27	52 56	99 82	91 78	67 79	15 /38	258 79	8 /38	340 63	5 /37	464 67	3 /37	1508 108	24 /36
Tone at Bishops Hull	13 49	36 82	77 108	87 108	62 87	18 /36	226 100	19 /35	301 89	14 /35	425 89	12 /35	1184 124	31 /34
Severn at Bewdley	9 26	14 27	33 51	37 52	48 85	36 /75	118 62	8 /75	164 50	3 /75	261 58	3 /74	860 95	28 /73
Teme at Knightsford Bridge	3 14	13 39	40 69	57 86	57 113	15 /26	154 87	10 /26	177 70	5 /26	262 72	5 /25	763 104	14 /24
Cynon at Abercynon	143 120	146 94	121 61	178 91	167 124	24 /38	467 87	16 /38	808 83	8 /36	1003 79	7 /36	2828 111	25 /34
Dee at New Inn	105 56	119 50	82 31	136 57	173 107	17 /27	391 59	2 /27	733 54	1 /27	1022 57	1 /26	3375 94	9 /25
Eden at Sheepmount	57 82	51 61	31 32	49 47	82 114	18 /26	162 59	1 /25	302 58	1 /24	471 68	2 /24	1420 102	12 /22
Clyde at Daldowie	135 170	68 69	30 28	65 58	95 126	27 /33	190 65	4 /33	452 76	5 /32	674 86	9 /32	1789 113	24 /31
Carron at New Kelso	326 133	201 71	27 8	47 15	151 72	7 /18	226 26	1 /17	1034 54	1 /17	1622 64	1 /17	4644 90	3 /16
Ewe at Poolewe	315 146	236 90	86 31	54 20	104 56	7 /26	244 34	1 /26	1035 65	2 /25	1700 80	4 /25	4292 100	11 /24

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 1994. For the long periods (at the right of this table), the end date for the long term is 1996.

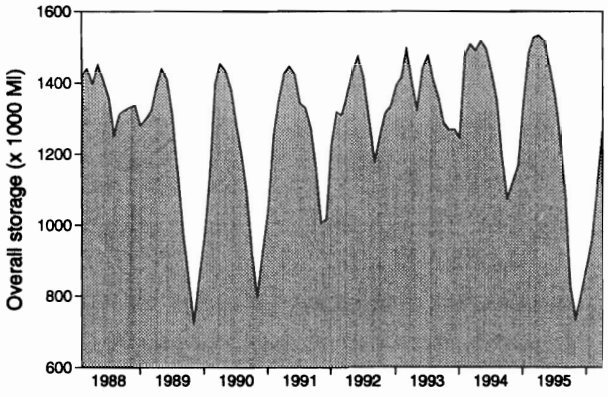
TABLE 4 START-MONTH RESERVOIR STORAGES UP TO MARCH 1996

Area	Reservoir (R)/ Group (G)		Capacity ● (Ml)	1995 Oct	Nov	Dec	1996 Jan	Feb	Mar	1995 Mar
North West	N.Command Zone[1]	(G)	133375	13	44	57	51	63	78	100
	Vyrnwy	(R)	55146	26	25	33	35	45	59	100
Northumbria	Teesdale[2]	(G)	87936	31	33	39	41	51	72	100
	Kielder	(R)	199175*	82*	88*	91*	89*	93*	95*	100*
Severn-Trent+	Clywedog	(R)	44922	36	38	43	54	62	77	94
	Derwent Valley[3]	(G)	39525	25	15	9	10	15	46	100
Yorkshire	Washburn[4]	(G)	22035	24	15	16	23	34	53	100
	Bradford supply[5]	(G)	41407	15	16	20	22	33	53	99
Anglian	Grafham	(R)	58707	72	72	72	83	92	94	93
	Rutland	(R)	130061	61	59	57	61	72	82	95
Thames	London[6]	(G)	206399	66	67	71	82	89	94	95
	Farmoor [7]	(G)	13843	76	87	98	89	99	96	96
Southern	Bewl	(R)	28170	69	65	60	65	82	96	99
	Ardingly	(R)	4685	46	47	45	67	84	100	100
Wessex	Clatworthy	(R)	5364	30	35	63	92	91	100	100
	Bristol W [8]	(G)	38666*	44*	37*	43*	60*	73*	86*	99*
South West	Colliford	(R)	28540	47	45	42	46	55	61	96
	Roadford[9]	(R)	34500	26	18	19	23	30	35	97
	Wimbleball[10]	(R)	21320	30	26	34	46	60	72	100
	Stithians	(R)	5205	27	26	31	54	100	100	100
Welsh	Celyn + Brenig	(G)	131155	48	49	50	54	61	69	100
	Brianne	(R)	62140	48	57	72	76	97	100	100
	Big Five[11]	(G)	69762	19	41	56	67	84	94	100
	Elan Valley[12]	(G)	99106	34	37	47	56	73	95	100
Lothian	Edin./Mid Lothian[13]	(G)	97639	64	85	91	91	96	100	100
	East Lothian[14]	(G)	10206	72	74	95	99	99	100	100
Strathclyde	Loch Katrine	(G)	111363	43	92	95	80	91	96	99
	Daer	(R)	22412	32	83	93	83	97	100	100
	Loch Thom	(G)	11840	56	100	97	93	100	98	100

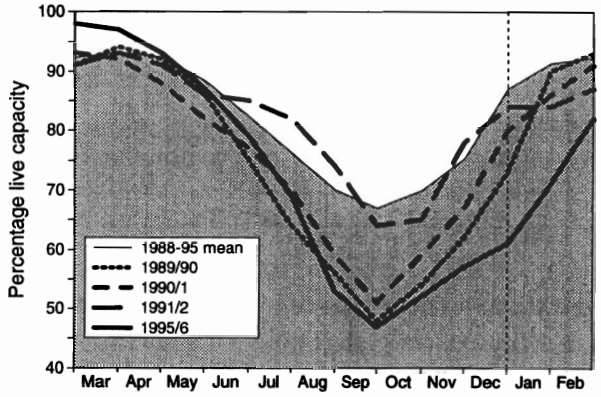
● Live or usable capacity (unless indicated otherwise) * Gross storage/percentage of gross storage + revised (net) figures

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 storage), 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



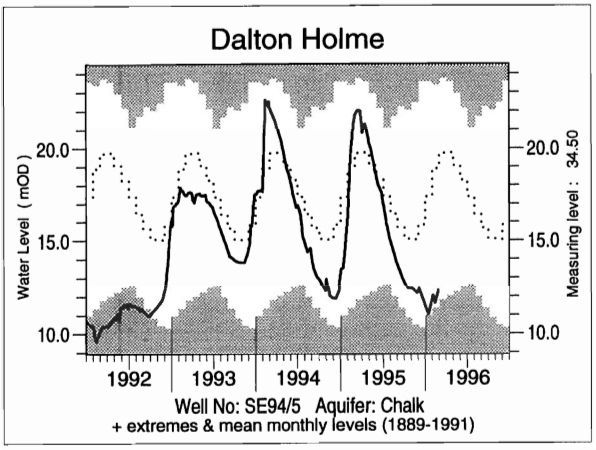
A COMPARISON BETWEEN OVERALL RESERVOIR STOCKS FOR ENGLAND AND WALES IN RECENT DROUGHT YEARS

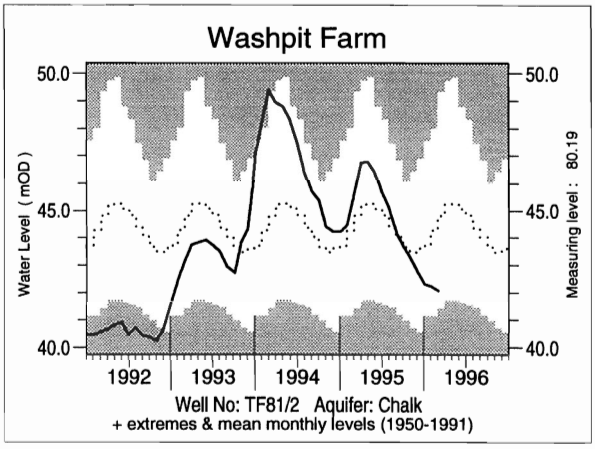


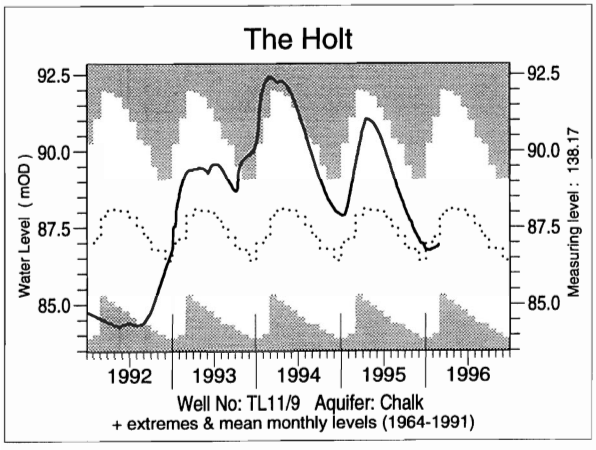
These plots are based on the reservoirs featured in Table 4 only

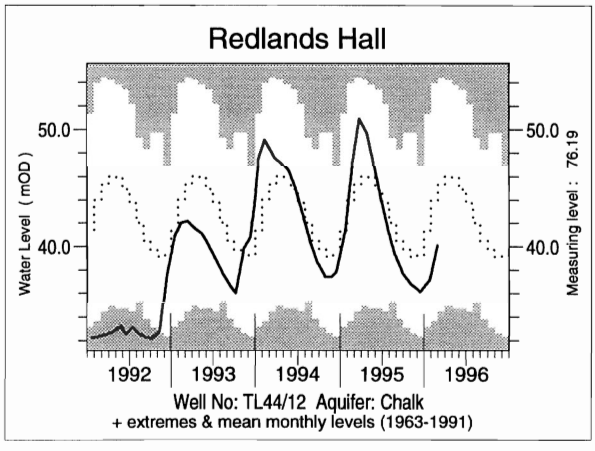
Note: Variations in storage depend on the balance between inputs (from catchment rainfall and any pumping) and outputs (to supply, compensation flow, HEP, amenity). There will be additional losses due to evaporation, especially in the summer months. Operational strategies for making the most efficient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

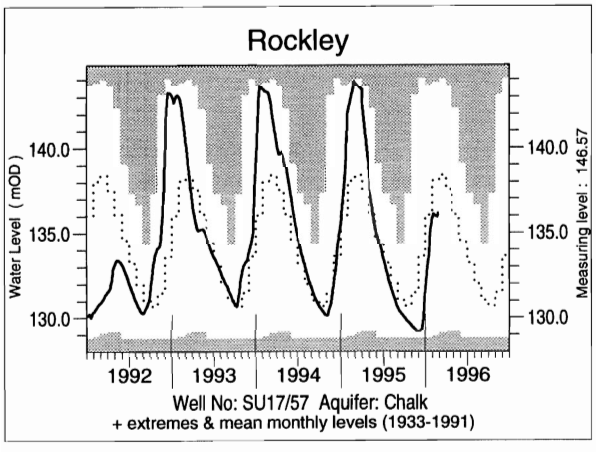
FIGURE 2 GROUNDWATER LEVEL HYDROGRAPHS

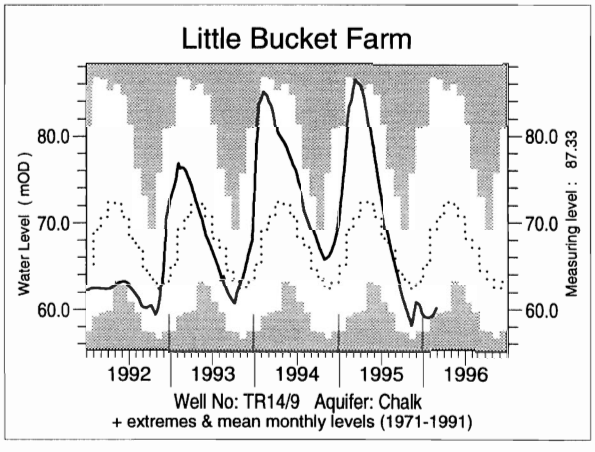


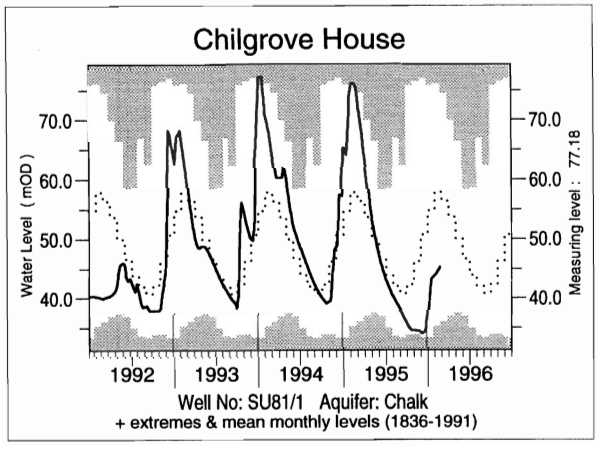


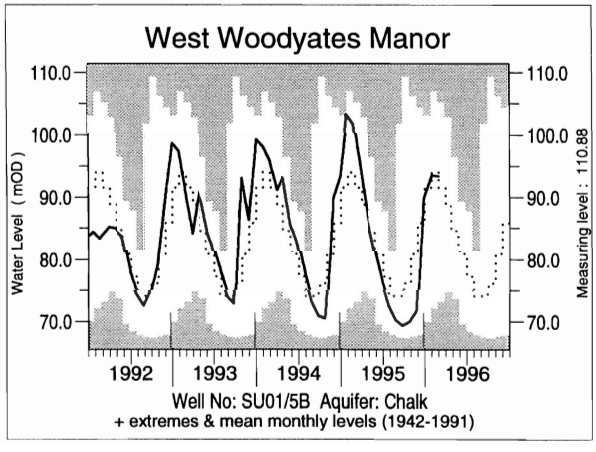


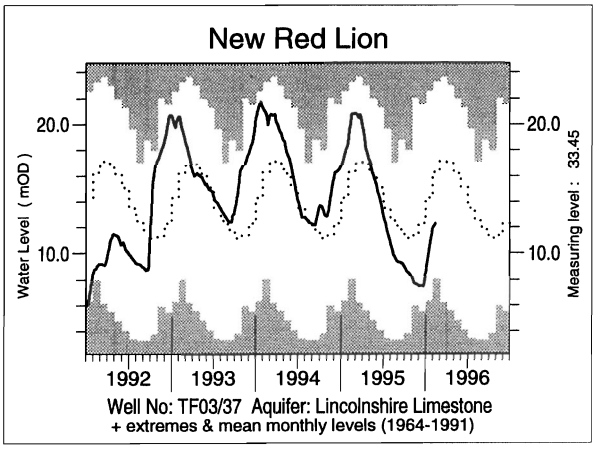


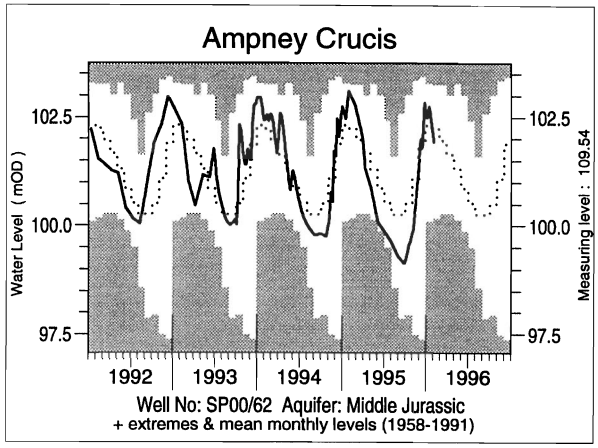


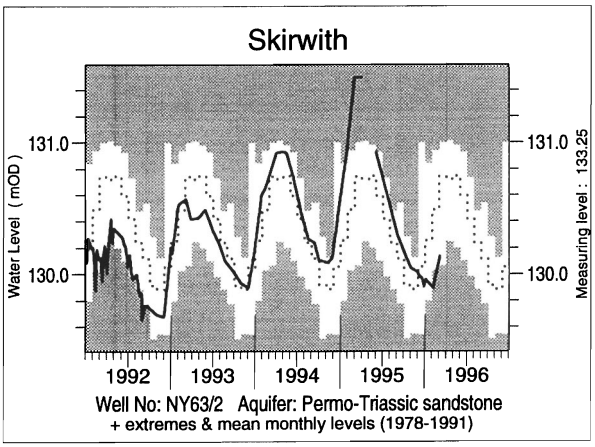


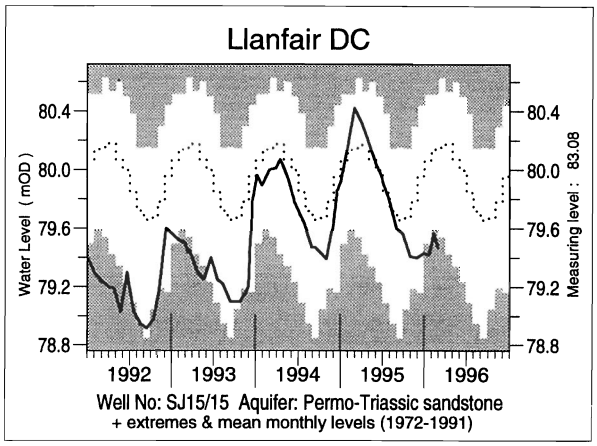


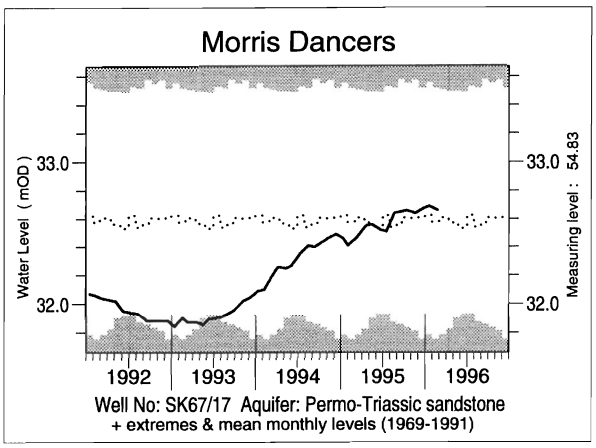


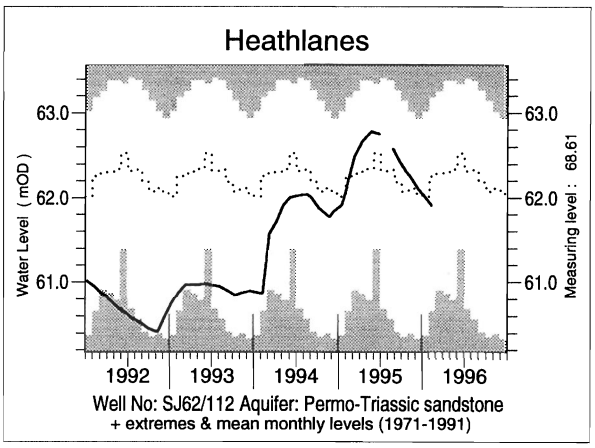

New Red Lion
Water Level (mOD)
20.0
10.0
Measuring level : 33.45
1992
1993
1994
1995
1996
Well No: TF03/37 Aquifer: Lincolnshire Limestone
+ extremes & mean monthly levels (1964-1991)

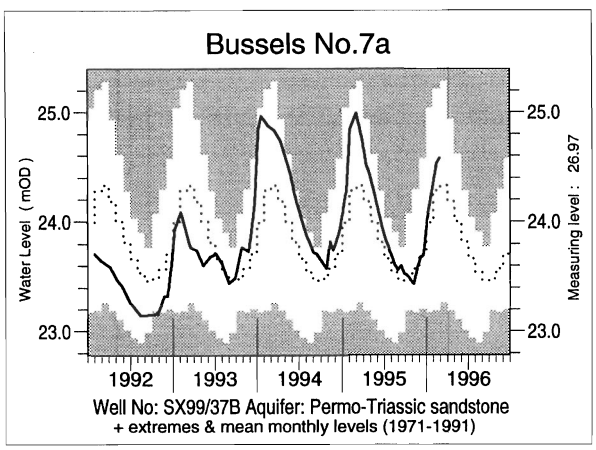

Ampney Crucis
Water Level (mOD)
102.5
100.0
97.5
Measuring level : 109.54
1992
1993
1994
1995
1996
Well No: SP00/62 Aquifer: Middle Jurassic
+ extremes & mean monthly levels (1958-1991)


Skirwith
Water Level (mOD)
131.0
130.0
Measuring level : 133.25
1992
1993
1994
1995
1996
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
1996
Well No: SJ15/15 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1972-1991)


Morris Dancers
Water Level (mOD)
33.0
32.0
Measuring level : 54.83
1992
1993
1994
1995
1996
Well No: SK67/17 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1969-1991)


Heathlanes
Water Level (mOD)
63.0
62.0
61.0
Measuring level : 68.61
1992
1993
1994
1995
1996
Well No: SJ62/112 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1971-1991)


Bussels No.7a
Water Level (mOD)
25.0
24.0
23.0
Measuring level : 26.97
1992
1993
1994
1995
1996
Well No: SX99/37B Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1971-1991)

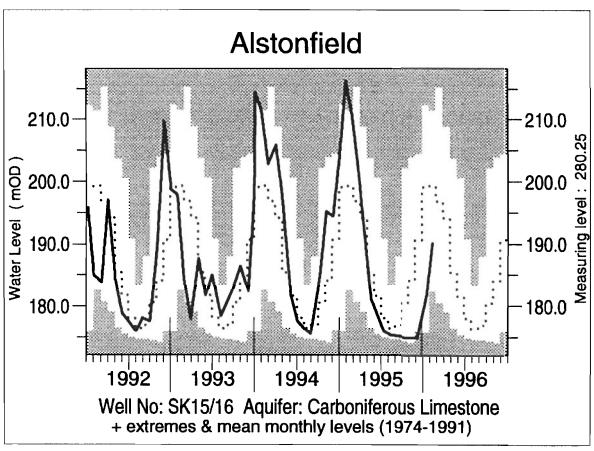

Alstonfield
Water Level (mOD)
210.0
200.0
190.0
180.0
Measuring level : 280.25
1992
1993
1994
1995
1996
Well No: SK15/16 Aquifer: Carboniferous Limestone
+ extremes & mean monthly levels (1974-1991)

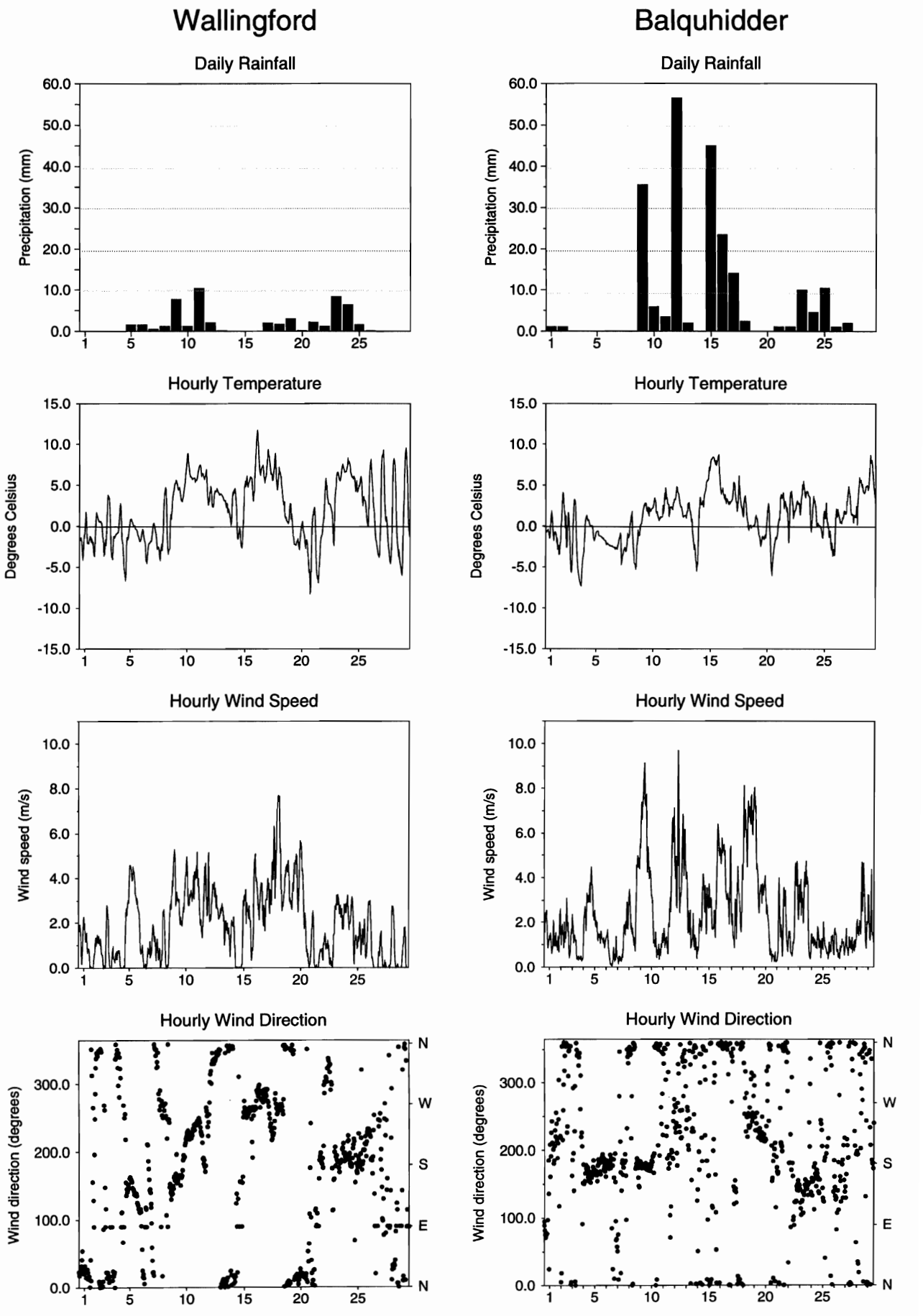
TABLE 5 FEBRUARY GROUNDWATER LEVELS 1996

Site	Aquifer	Records commence	Minimum Feb <1996	Average Feb <1996	Maximum Feb <1996	No. of years Feb/Mar level<1996	Feb/Mar 1996 day	Feb/Mar 1996 level
Dalton Holme	C & UGS	1889	9.64	18.90	23.44	6	23/02	12.36
Wetwang	C & UGS	1971	16.66	25.31	34.31	>10	01/03	25.56
Keelby Grange	C & UGS	1980	3.87	12.54	19.70	3	21/02	6.82
Washpit Farm	C & UGS	1950	40.51	44.27	48.20	3	04/03	42.07
The Holt	C & UGS	1964	84.03	87.42	92.41	>10	26/02	86.94
Therfield Rectory	C&UGS	1883	dry <71.60	78.15	96.17	>10	26/02	78.31
Redlands Hall	C & UGS	1964	32.47	43.45	54.01	8	27/02	40.12
Rockley	C & UGS	1933	dry <128.44	138.26	143.90	>10	26/02	136.14
Little Bucket Farm	C & UGS	1971	59.34	69.67	86.87	2	01/03	60.38
Compton House	C & UGS	1984	29.60	48.39	66.10	>10	14/02	34.72
Chilgrove House	C & UGS	1836	35.36	57.78	76.20	>10	23/02	45.30
Westdean No.3	C & UGS	1940	1.19	2.33	5.03	4	29/02	1.42
Lime Kiln Way	C & UGS	1969	124.12	125.29	126.34	>10	21/02	126.13
Ashton Farm	C & UGS	1974	64.84	69.70	71.18	>10	29/02	71.01
West Woodyates Manor	C & UGS	1942	72.22	93.29	107.10	>10	29/02	93.37
New Red Lion	LLst	1964	7.97	16.27	23.29	6	12/02	12.33
Ampney Crucis	Mid Jur	1958	100.17	102.27	103.27	>10	05/02	101 .95
Redbank	PTS	1981	7.84	8.50	9.08	2	29/02	8.10
Yew Tree Farm	PTS	1973	12.69	13.57	13.86	3	08/03	13.38
Skirwith	PTS	1978	129.88	130.51	130.94	2	04/03	130.14
Llanfair D.C	PTS	1972	79.29	80.02	80.52	1	01/03	79.47
Morris Dancers	PTS	1969	31.78	32.49	33.51	>10	25/02	32.66
Heathlanes	PTS	1971	60.65	61.99	63.19	9	08/02	61.91
Bussels No.7A	PTS	1972	23.19	24.30	25.21	>10	28/02	24.48
Rushyford NE	MgLst	1967	65.32	72.54	76.84	>10	21/02	76.18
Peggy Ellerton	MgLst	1968	31.73	34.47	36.84	9	22/02	33.83
Alstonfield	CLst	1974	182.47	199.90	216.18	6	15/02	190.18

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

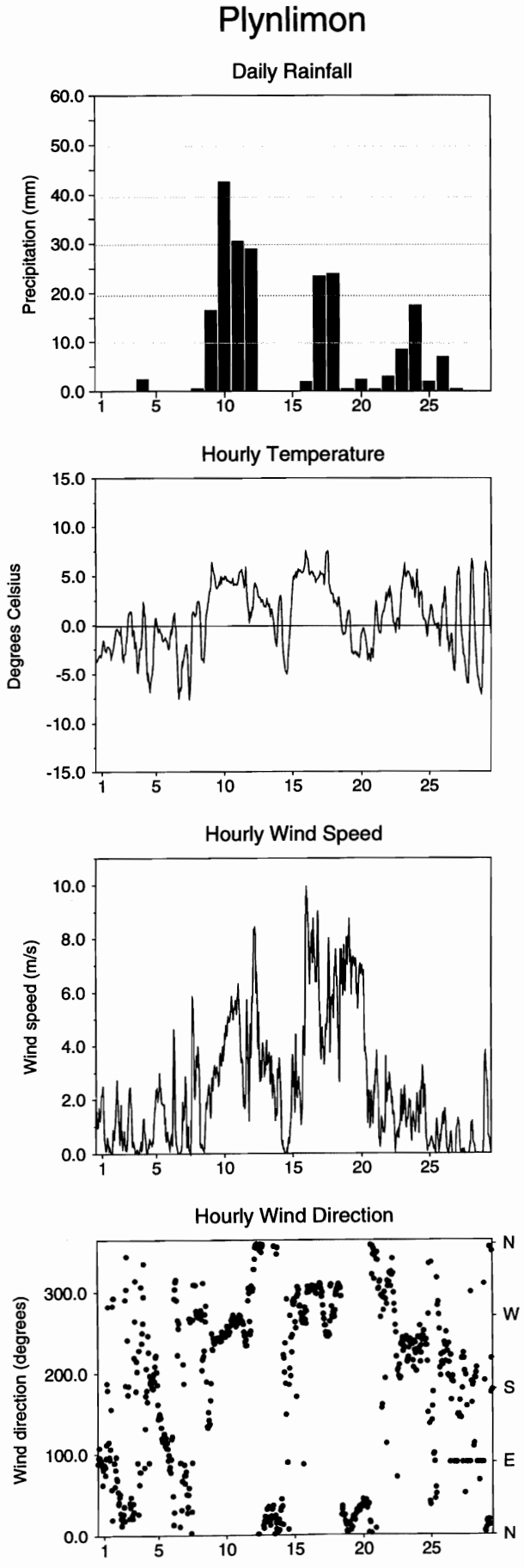
FIGURE 3 METEOROLOGICAL SUMMARY - FEBRUARY 1996



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

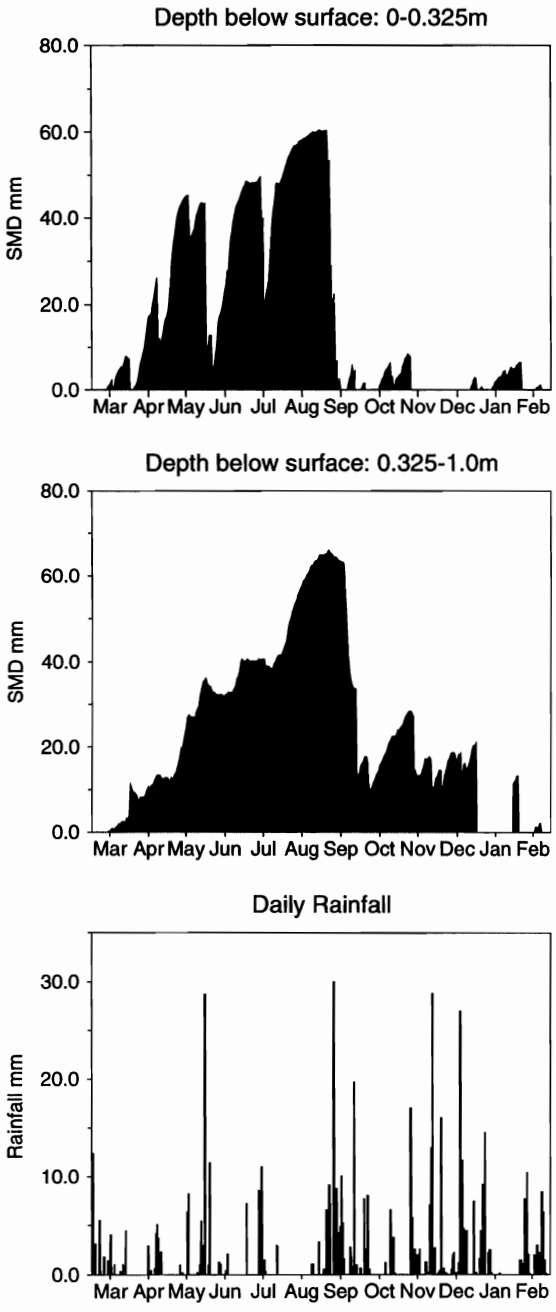
The Lower Kirkton automatic weather station (Balquhidder) occupies a relatively sheltered position at the mouth of the SSE trending Kirkton Glen. Station elevation is 270m aOD and average annual rainfall exceeds 2000mm; snow cover is expected for 10-30 days a year.

FIGURE 3 (continued)



The Dolydd automatic weather station at Plynlimon is sited in an exposed field with a forested area to the south. Surrounding land reaches a peak height of around 400m. Station elevation is 270m aOD and average annual rainfall exceeds 2300mm.

FIGURE 3a. WALLINGFORD SMD DATA 1995/6.



Note

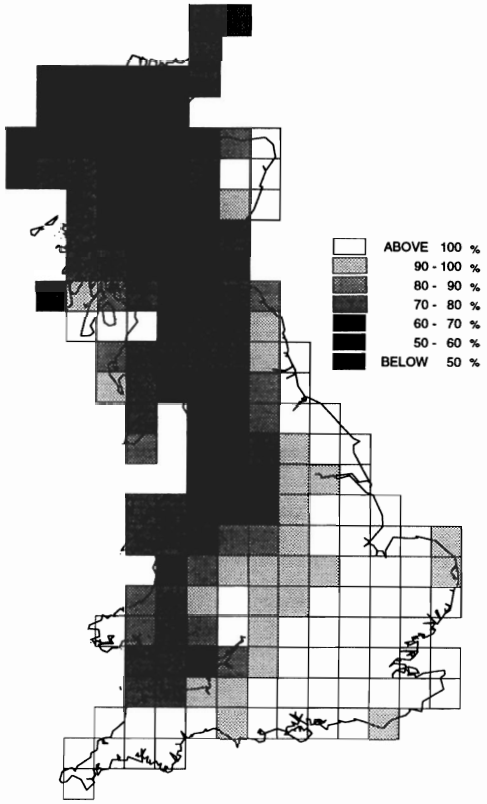
Soil moisture deficit is defined as the amount by which the water stored in the soil is below the quantity held at field capacity. Two automatic soil water stations (ASWSs) deployed at Wallingford, which use capacitance soil water sensors installed at depths of 5,15 and 50 cm, are the sources of the data. Figure 3a shows deficits calculated from one of the stations for the depth ranges 0-0.325m (15cm probe) and 0.325-1.0m (50cm probe) at 0100 GMT on each day. At the end of January 1996, field capacity was re-estimated using recent data and the soil moisture deficit values for the previous months were recalculated accordingly.

Daily rainfall from the Wallingford meteorological station from February 1995 is presented.

FIGURE 4 LOCATION MAP OF GAUGING STATIONS AND GROUNDWATER INDEX WELLS

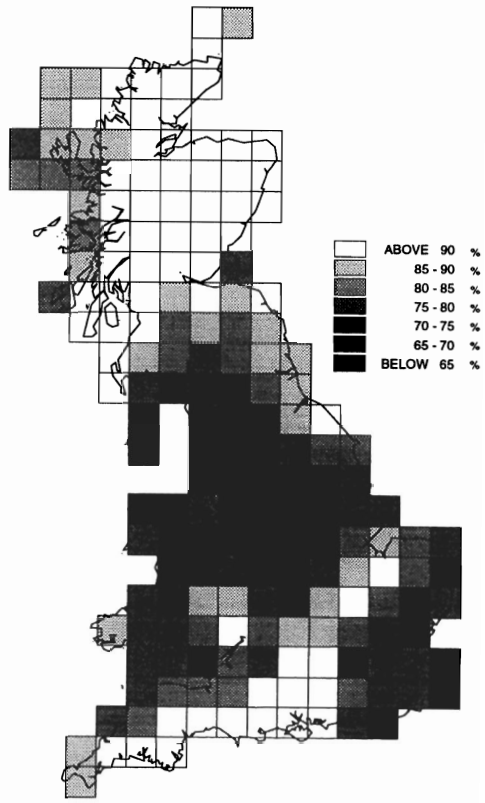
APPENDIX I

RAINFALL DEC 1995 - FEB 96 AS A PERCENTAGE OF 1961-90 AV



Data Source:MORECS

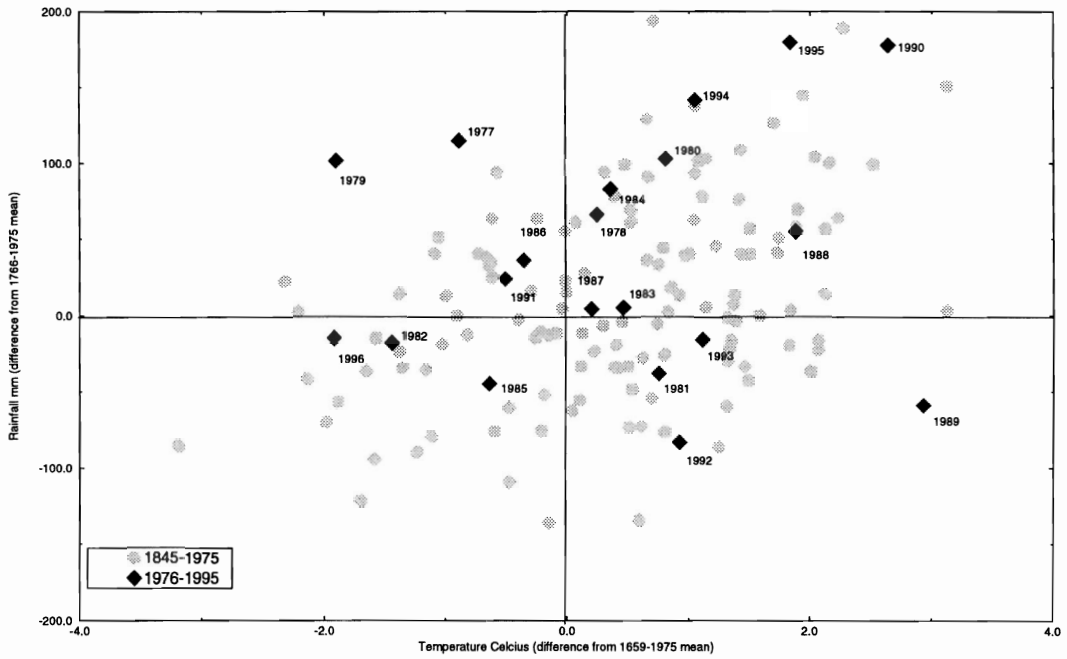
RAINFALL APR 1995 - FEB 96 AS A PERCENTAGE OF 1961-90 AV



Data Source:MORECS

E&W Rainfall And CET Temperature Anomalies 1845-1996

Winter (Dec-Feb)



NB: CET anomaly for Dec 1995 - Feb 1996 is estimated.

A REGIONAL GUIDE TO RESERVOIR STOCKS FOR ENGLAND & WALES IN 1996 AND OTHER RECENT DROUGHT YEARS

Note: The regional plots are based solely on the index reservoirs listed in Table 4 - for some regions this may not provide a fully representative picture.