Hydrological Summary for Great Britain

NOVEMBER 1995

Rainfall

November was another notably mild month reflecting the predominance of a south-westerly airstream over the latter half of the month. The first week was generally cool with little rainfall - continuing a relatively dry spell which began in late September. The subsequent return of rain-bearing frontal systems generally produced above average rainfall from around the 10th with the period from the 20th being especially unsettled. Some localised flooding was reported, especially where thunderstorms boosted rainfall totals (e.g. in Southampton). Provisional November rainfall totals for England and Wales and for Scotland are close to the 1961-90 average. Regional rainfall totals were also well within the normal range but spatial variability was substantial: south-western Britain, and parts of the North-East, were relatively wet whilst some districts in East Anglia and north-western Britain had less than two-thirds of the 1961-90 mean. Rainfall was again below average in much of the southern Pennines and in a number of other strategically important gathering grounds. Notwithstanding the near-average November rainfall, the England and Wales total for the April-November period is the second lowest, after 1921, in a series from 1767 (1990 ranks 4th and 1989, 9th). Very notable rainfall deficiencies still extend across wide areas of the Midlands and northern England. The North-West NRA region registered its eighth successive month with below average rainfall and a number of long term index raingauges - some with records extending back over 100 years - reported their lowest April-November rainfall totals on record.

River Flow

Soil moisture deficits continued to decline erratically through the late autumn and at the end of November the range of SMDs was exceptional with deficits still exceeding 100 mm in the east. Correspondingly, the seasonal runoff recovery displayed considerable regional contrasts. Apart from a few scattered southern catchments, above average November flows were confined largely to eastward-draining Scottish rivers. Throughout most of England and Wales flows were substantially below average, and notably depressed in a number of index catchments from the Lake District to Kent; the Wharfe, Dove and Kent Stour were amongst those rivers establishing new November runoff minima. Some responsive lowland rivers (e.g. the Lymington in Hampshire) produced very healthy runoff totals but generally the protracted decline in baseflows - see, for example, the hydrograph for the River Lud - has resulted in spring-fed rivers flowing at well below the early winter average (but above drought minima). Over wide areas, mean flows in the May-November timeframe are exceptionally low - unprecedented on the Wharfe, Welsh Dee, Teme and the Severn (the latter in a series from 1921).

Groundwater

With soil moisture deficits still exceeding 50 mm across many outcrop areas at month-end, infiltration to most aquifers in November was modest and patchy. The late-autumn has seen minor recoveries in a few aquifers (e.g. the Jurassic Limestone of the Cotswolds) but generally only a slackening in the rate of water-table decline. Throughout much of the Chalk, the duration and magnitude of the 1995 recession is exceptional. Although levels in East Anglia remain generally well above the 1989-92 minima; the water-table in parts of the southern Chalk approached the lowest on record during November. A measure of the dramatic transformation in groundwater resources since early in the year is provided by the hydrograph for the Chilgrove House well. A fall of over 42 metres has occurred since the February 1995 peak; the greatest within-year decline in a record extending back to 1836. Preliminary analyses suggest that the 1995 recessions at Rockley, Little Bucket Farm (in the Chalk) and Alstonfield (in the Carboniferous Limestone) are also without precedent. Levels in the major Permo-Triassic aquifers are mostly well within the normal range but substantially below average in a zone from North Wales to southern Scotland.

General

The 1995 drought is now less intense and less extensive than at the beginning of autumn. Nonetheless, the water resources picture remains very fragile. Reservoir stocks are very depressed in the southern Pennines - and overall reservoir contents are below corresponding totals in the drought years of 1989 and 1990. Groundwater resources, which have mitigated the drought's impact in the English lowlands during much of 1995, have declined steeply since the spring and the winter recovery will need to be generated from a low base. A wet winter (continuing into the spring in order to prolong the period available for aquifer and reservoir replenishment) is needed to allay concern for the longer term water resources 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, 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

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13 December 1995

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

Note: The monthly rainfall figures are the copyright of The Meteorological Office.
These data may not be published or passed on to any unauthorised person or organisation.

		Nov 1994	Dec	Jan 1995	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
England and	mm	86	142	161	115	67	27	48	22	39	13	112	55	89
Wales	%	96	151	183	183	93	45	75	34	63	17	145	65	99
NRA REGIONS														
North West	mm	136	207	208	165	107	28	62	35	63	19	94	78	79
	%	111	167	172	212	113	39	83	43	74	18	82	61	64
Northumbrian	mm	97	124	121	108	59	38	53	31	29	11	111	53	107
	%	113	153	144	183	84	68	85	52	45	14	152	70	124
Severn Trent	mm	73	115	131	89	51	20	49	13	36	9	93	44	65
	%	103	149	187	165	84	36	83	22	68	13	145	69	92
Yorkshire	mm	89	123	133	100	65	27	44	22	29	9	97	27	67
	%	111	148	168	172	96	46	73	37	49	12	143	37	84
Anglian	mm	32	59	98	62	51	16	31	25	26	8	101	21	45
	%	55	107	196	168	109	35	65	49	53	15	206	42	77
Thames	mm	53	93	137	82	51	18	37	16	32	4	114	34	66
	%	82	133	214	182	91	36	66	29	65	7	193	55	101
Southern	mm	66	123	163	112	59	18	25	20	31	5	140	34	70
	%	78	150	204	207	94	34	46	37	65	9	203	42	83
Wessex	mm	96	139	184	111	57	35	53	14	26	9	143	63	109
	%	116	149	211	171	81	66	87	25	50	14	199	79	132
South West	mm	127	214	233	165	93	50	55	19	45	16	135	101	146
	%	102	154	169	163	94	72	76	28	65	19	145	87	117
Welsh	mm	134	255	238	182	88	37	72	26	67	33	125	103	132
	%	94	167	166	188	82	46	88	33	87	33	109	75	93
Scotland	mm	156	245	227	205	143	67	85	44	85	35	195	236	128
	%	103	162	150	201	114	88	99	51	90	30	137	151	85
RIVER PURIFICATION BOARDS														
Highland	mm	169	304	299	271	177	97	90	47	99	47	245	245	168
	%	83	154	159	213	109	107	98	48	93	37	143	124	83
North East	mm	89	93	134	83	74	68	79	54	46	28	293	94	94
	%	90	100	135	128	95	113	114	82	63	32	337	97	95
Tay	mm	154	196	184	185	110	39	99	32	69	20	180	234	111
	%	127	154	128	195	101	63	119	44	90	21	158	180	92
Forth	mm	134	210	154	171	92	35	69	32	69	21	135	205	104
	%	120	191	131	216	98	59	93	46	92	22	123	178	93
Tweed	mm	123	173	129	109	75	36	66	35	43	22	122	142	70
	%	132	186	129	163	95	63	93	54	59	25	137	149	75
Solway	mm	184	246	222	173	145	40	85	43	77	23	102	297	118
	%	128	166	142	171	124	52	100	51	86	19	71	189	82
Clyde	mm	189	322	257	251	196	66	81	45	124	41	137	340	130
	%	105	180	136	213	133	79	89	48	114	31	77	176	72

Note: The monthly rainfall figures for the NRA regions for October & November 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 (and for Scotland) for October & November 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.

The November 1994 rainfall total for the NRA North West region have been corrected, (accumulated rainfall totals were not affected).

TABLE 2 RAINFALL RETURN PERIOD ESTIMATES

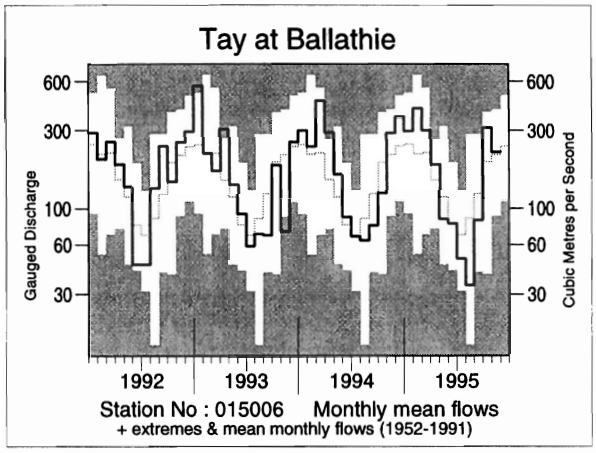
		Sep 95-Nov 95		Apr 95-Nov 95		Jan 95-Nov 95		Sep 94-Nov 95	
		Est Return Period, years		Est Return Period, years		Est Return Period, years		Est Return Period, years	
England and Wales	mm	256		405		748		1179	
	% LTA	102	2-5	70	35-50	93	2-5	103	2-5
NRA REGIONS									
North West	mm	250		457		937		1516	
	% LTA	68	5-10	58	>200	87	5-10	97	2-5
Northumbria	mm	271		433		721		1090	
	% LTA	115	2-5	77	10-15	93	2-5	100	<2
Severn Trent	mm	202		329		600		983	
	% LTA	102	2-5	67	35-50	89	2-5	103	2-5
Yorkshire	mm	191		322		620		1006	
	% LTA	86	2-5	60	110-150	84	5-10	97	2-5
Anglian	mm	167		273		484		734	
	% LTA	106	2-5	67	35-50	89	2-5	97	2-5
Thames	mm	214		321		591		896	
	% LTA	115	2-5	71	15-25	95	2-5	102	2-5
Southern	mm	244		343		677		1074	
	% LTA	104	2-5	69	20-30	97	2-5	106	2-5
Wessex	mm	315		452		804		1253	
	% LTA	134	5-10	86	2-5	108	2-5	117	5-10
South West	mm	383		568		1059		1671	
	% LTA	115	2-5	81	5-10	102	2-5	111	2-5
Welsh	mm	360		595		1103		1765	
	% LTA	91	2-5	73	15-25	95	2-5	103	2-5
Scotland	mm	559		875		1450		2064	
	% LTA	124	5-10	96	2-5	113	5-10	109	5-10
RIVER PURIFICATION BOARDS									
Highland	mm	658		1038		1785		2527	
	% LTA	115	2-5	96	2-5	114	5-10	108	2-5
North East	mm	481		756		1047		1405	
	% LTA	170	>200	118	5-10	119	10-20	112	5-10
Tay	mm	525		784		1263		1784	
	% LTA	144	15-25	104	2-5	115	5-10	112	5-10
Forth	mm	444		670		1087		1577	
	% LTA	132	5-15	95	2-5	109	2-5	109	2-5
Tweed	mm	334		536		849		1277	
	% LTA	121	2-5	85	5-10	97	2-5	102	2-5
Solway	mm	517		785		1325		1948	
	% LTA	116	2-5	87	2-5	104	2-5	104	2-5
Clyde	mm	607		964		1668		2405	
	% LTA	110	2-5	91	2-5	110	2-5	107	2-5

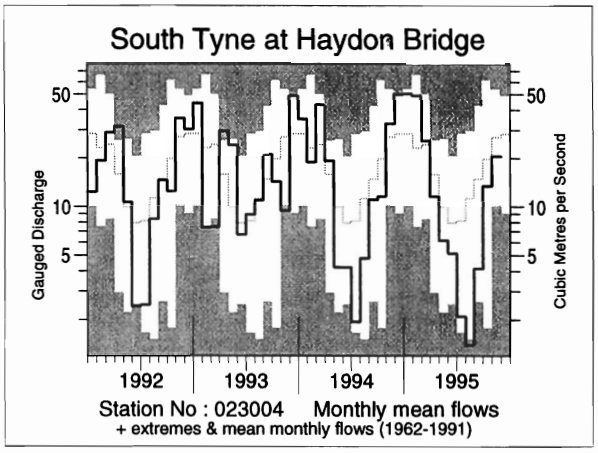
LTA refers to the period 1961-90.

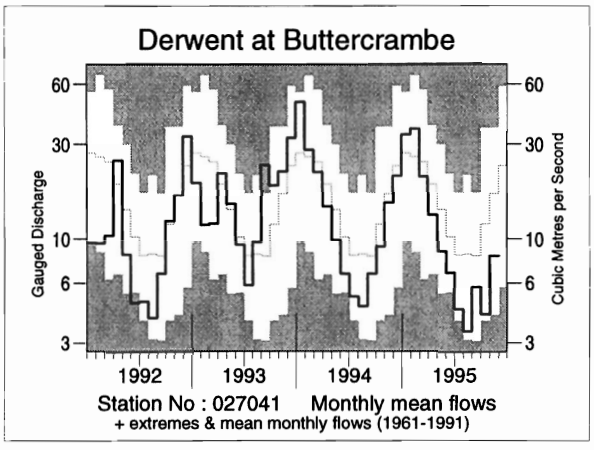
Return period assessments are based on tables provided by the Meteorological Office*. The tables reflect rainfall totals over the period 1911-70 only and the estimate assumes a sensibly stable climate. They assume a start in a specified month; return periods for a start in any month may be expected to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

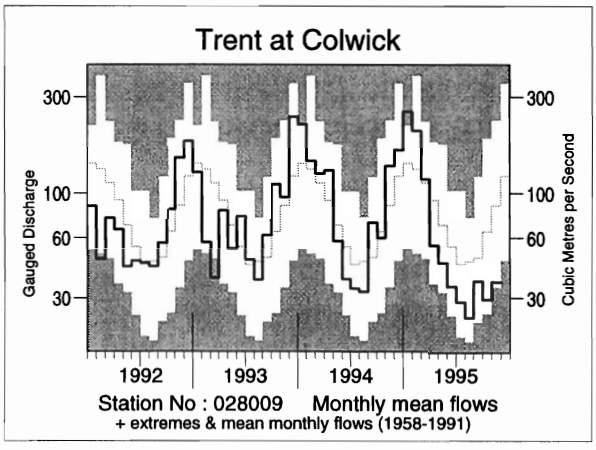
* Tabony, R.C., 1977, The Variability of long duration rainfall over Great Britain, Scientific Paper No. 37, Meteorological Office.

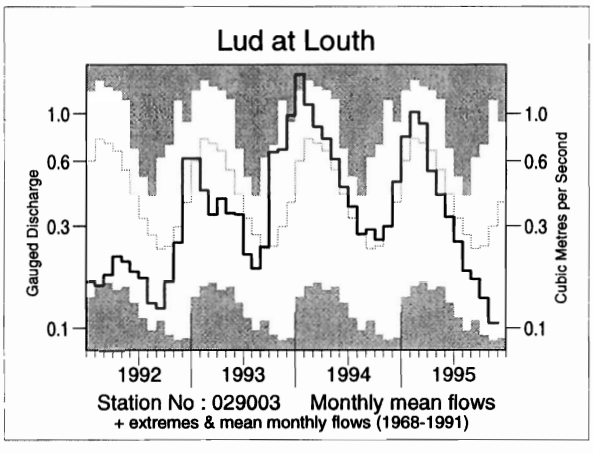
FIGURE 1 MONTHLY RIVER FLOW HYDROGRAPHS

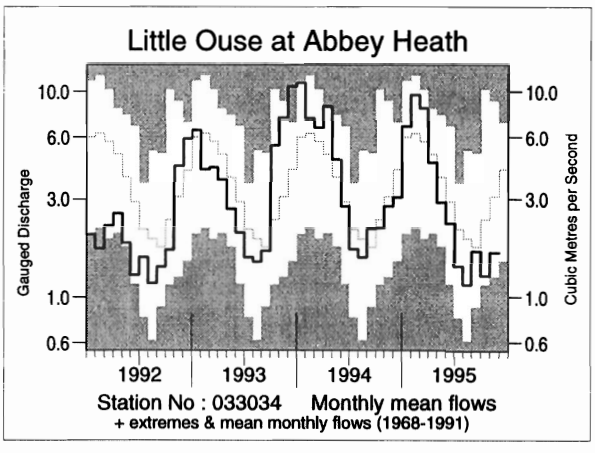


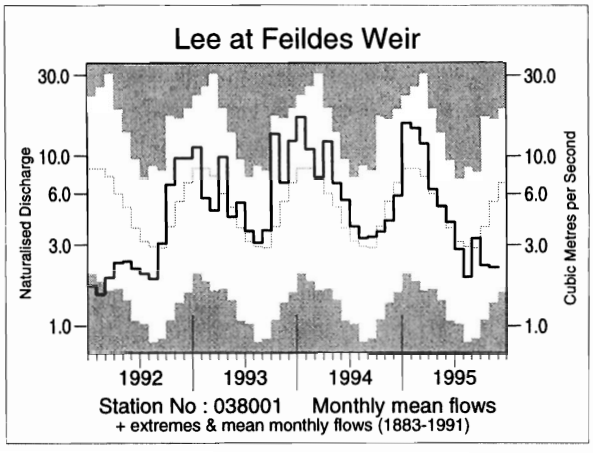


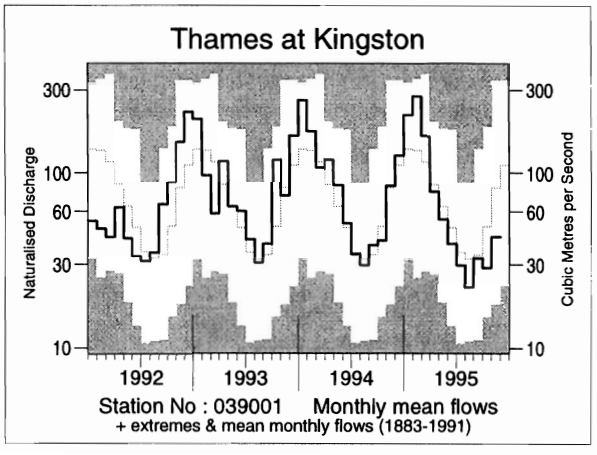


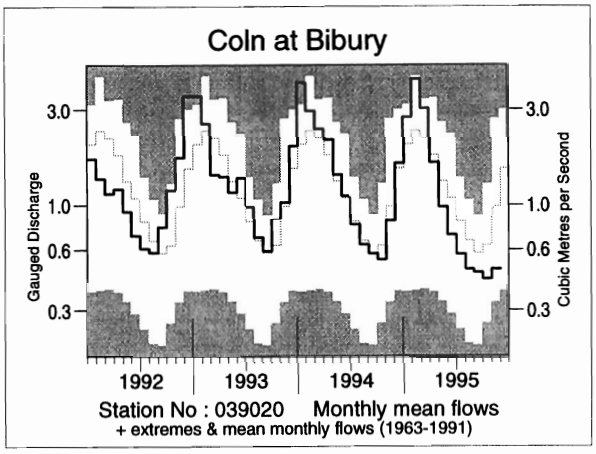


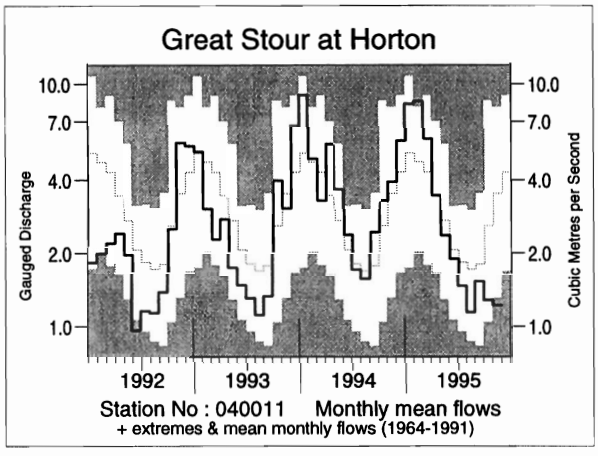


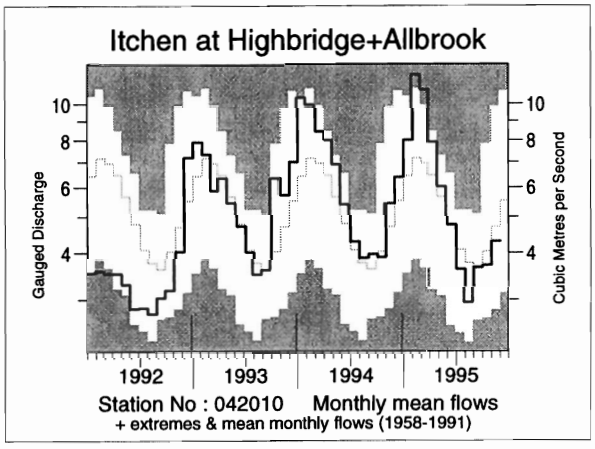


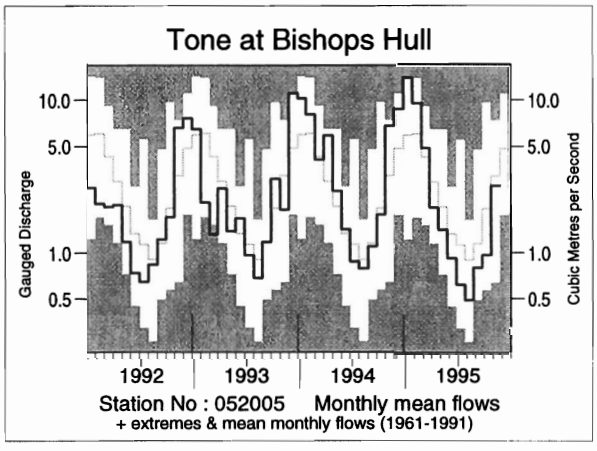


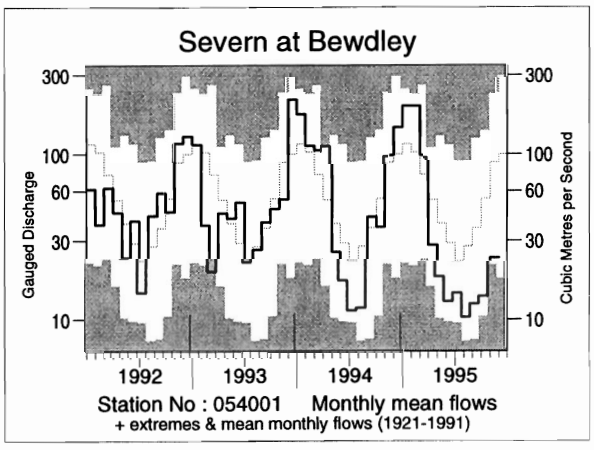


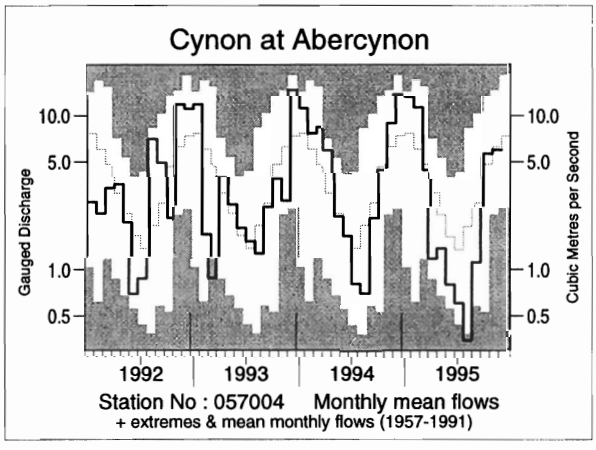

Coln at Bibury
Gauged Discharge
Cubic Metres per Second
3.0
1.0
0.6
0.3
1992
1993
1994
1995
Station No : 039020 Monthly mean flows
+ extremes & mean monthly flows (1963-1991)

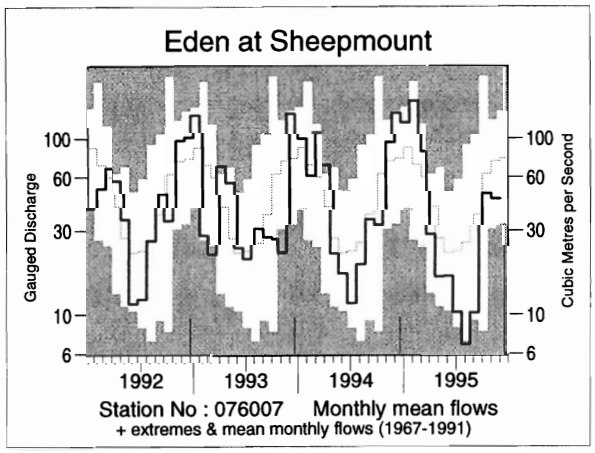

Great Stour at Horton
Gauged Discharge
Cubic Metres per Second
10.0
7.0
4.0
2.0
1.0
1992
1993
1994
1995
Station No : 040011 Monthly mean flows
+ extremes & mean monthly flows (1964-1991)


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
6
1992
1993
1994
1995
Station No : 076007 Monthly mean flows
+ extremes & mean monthly flows (1967-1991)

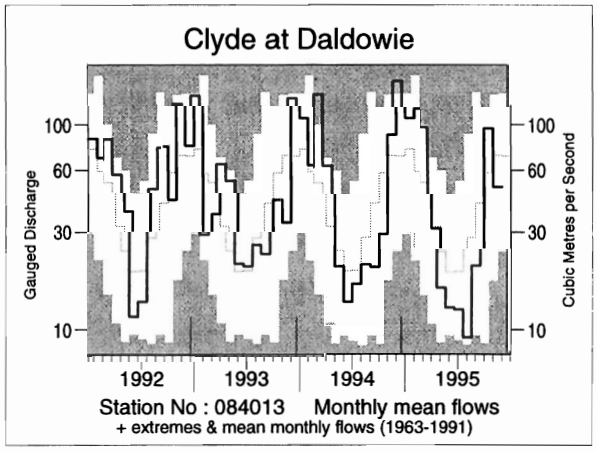

Clyde at Daldowie
Gauged Discharge
Cubic Metres per Second
100
60
30
10
1992
1993
1994
1995
Station No : 084013 Monthly mean flows
+ extremes & mean monthly flows (1963-1991)

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	Jul 1995	Aug	Sep	Oct	Nov 1995		9/95 to 11/95		5/95 to 11/95		1/95 to 11/95		12/93 to 11/95	
	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	16 59	9 30	136 332	98 120	105 138	20 /24	339 164	21 /23	465 128	21 /23	802 114	19 /23	1736 109	16 /22
Tay at Ballathie	29 73	20 39	48 69	183 166	125 104	26 /44	356 117	32 /43	500 99	21 /43	1173 118	37 /43	2770 122	42 /42
Tweed at Boleside	13 51	10 26	23 48	107 149	82 94	19 /35	212 102	18 /35	278 82	9 /35	713 108	21 /35	1816 119	33 /33
Whiteadder Water at Hutton Castle	7 59	5 36	11 70	10 34	38 104	16 /27	59 74	11 /27	97 65	6 /26	232 68	3 /26	692 89	9 /25
South Tyne at Haydon Bridge	7 27	5 13	14 28	48 70	71 76	13 /34	133 62	4 /32	185 54	2 /32	657 98	13 /32	1668 107	23 /30
Wharfe at Flint Mill Weir	10 39	7 17	11 25	16 26	22 28	1 /41	50 27	1 /40	90 29	1 /40	515 83	8 /40	1489 103	26 /39
Derwent at Buttercrambe	7 55	6 42	9 66	7 35	13 48	5 /35	30 49	5 /34	69 54	5 /34	237 84	8 /34	608 94	15 /33
Trent at Colwick	10 65	9 54	13 74	11 45	13 40	2 /38	36 51	3 /37	83 57	2 /37	301 97	18 /37	811 114	27 /36
Lud at Louth	12 80	9 70	8 73	7 54	5 34	2 /28	20 53	3 /28	77 72	8 /27	228 97	14 /27	622 123	19 /26
Witham at Claypole Mill	3 48	3 51	5 69	4 45	6 43	12 /37	15 50	12 /37	36 54	7 /37	168 100	18 /36	488 131	32 /35
Little Ouse at Abbey Heath	5 68	4 61	6 86	5 49	6 49	5 /28	17 59	5 /28	47 68	6 /28	155 102	14 /27	400 119	23 /26
Mimram at Panshanger Park	11 112	9 98	10 119	8 99	7 83	12 /43	25 100	22 /43	74 112	29 /43	150 129	37 /43	367 145	42 /42
Lee at Feildes Weir (natr.)	7 90	5 67	8 114	6 58	6 41	18 /111	20 64	30 110	55 80	39 /110	176 121	80 /109	419 129	89 /107
Thames at Kingston (natr.)	8 85	6 68	9 95	8 57	11 52	33 /113	28 63	32 /113	66 72	31 /113	256 118	78 /113	604 123	91 /111
Coln at Bibury	14 69	12 72	11 79	11 66	12 48	7 /33	34 63	6 /32	102 68	4 /32	383 108	20 /32	901 114	25 /31
Great Stour at Horton	12 83	9 69	12 87	10 49	9 34	1 /32	31 51	3 /31	84 68	4 /30	282 109	18 /29	700 120	22 /26
Itchen at Highbridge+Allbrook	27 89	22 79	26 101	28 91	31 91	20 /38	85 95	17 /37	213 95	13 /37	491 117	31 /37	1104 120	35 /36
Stour at Throop Mill	6 57	4 45	9 75	12 51	37 112	16 /23	58 86	12 /23	95 75	7 /23	433 128	20 /23	1082 136	21 /21
Exe at Thorverton	8 41	6 22	15 39	35 47	72 73	13 /40	122 58	6 /40	169 53	3 /40	709 102	21 /39	2160 130	37 /38
Taw at Umberleigh	4 27	3 15	6 25	17 27	52 56	11 /38	76 43	3 /37	99 39	2 /37	560 97	18 /37	1797 129	36 /36
Tone at Bishops Hull	8 56	7 55	10 69	13 49	36 82	18 /35	60 70	13 /35	106 68	6 /35	504 124	32 /34	1343 141	33 /33
Severn at Bewdley	9 65	6 38	7 34	9 26	14 27	2 /75	30 28	1 /75	65 36	1 /75	373 96	35 /74	1044 116	62 /73
Teme at Knightsford Bridge	4 48	2 19	3 28	3 14	13 39	5 /26	18 30	3 /26	38 35	1 /26	312 102	13 /25	874 120	23 /24
Cynon at Abercynon	15 46	9 17	28 41	143 120	146 94	23 /38	317 92	17 /36	396 75	8 /36	1127 106	22 /36	3195 128	34 /34
Dee at New Inn	69 107	9 9	37 29	105 56	119 50	4 /27	261 48	2 /27	415 50	1 /26	1279 83	5 /26	3914 109	21 /25
Eden at Sheepmount	12 47	8 26	12 28	57 82	51 61	7 /26	119 65	5 /25	177 60	2 /25	623 104	15 /25	1600 117	20 /22
Clyde at Daldowie	18 66	13 33	28 50	135 170	68 69	15 /33	231 100	15 /32	303 84	10 /32	788 116	27 /32	2023 129	31 /31
Carron at New Kelso	89 75	29 18	164 65	326 133	201 71	7 /17	691 89	6 /17	918 75	3 /17	2223 100	10 /17	5220 101	9 /15
Ewe at Poolewe	63 71	33 29	145 77	315 146	236 90	13 /26	695 105	15 /25	960 93	10 /25	2204 119	21 /25	4729 110	20 /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 1995.

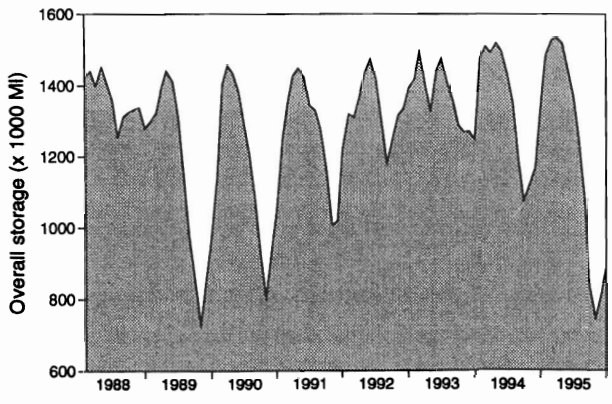
TABLE 4 START-MONTH RESERVOIR STORAGES UP TO DECEMBER 1995

Area	Reservoir (R)/ Group (G)		Capacity ● (Ml)	1995 Jul	Aug	Sep	Oct	Nov	Dec	1994 Dec
North West	N.Command Zone[1]	(G)	133375	58	44	24	13	44	57	67
	Vyrnwy	(R)	55146	69	59	36	26	25	33	83
Northumbria	Teesdale[2]	(G)	87936	70	59	38	31	33	39	80
	Kielder	(R)	199175*	91*	87*	85*	82*	88*	91*	91*
Severn-Trent	Clywedog	(R)	44922	86	73	48	43	44	49	83
	Derwent Valley[3]	(G)	39525	72	59	44	36	28	23	89
Yorkshire	Washburn[4]	(G)	22035	63	50	34	24	15	16	73
	Bradford supply[5]	(G)	41407	54	38	21	15	16	20	74
Anglian	Grafham	(R)	58707	94	88	71	72	72	72	95
	Rutland	(R)	130061	80	74	66	61	59	57	93
Thames	London[6]	(G)	206399	93	82	62	66	67	71	89
	Farmoor [7]	(G)	13843	94	86	64	76	87	98	96
Southern	Bewl	(R)	28170	88	81	72	69	65	60	85
	Ardingly	(R)	4685	97	66	48	46	47	45	90
Wessex	Clatworthy	(R)	5364	61	44	31	30	35	63	100
	Bristol W [8]	(G)	38666*	79*	67*	48*	44*	37*	43*	71*
South West	Colliford	(R)	28540	80	70	54	47	45	42	75
	Roadford[9]	(R)	34500	76	60	40	26	18	19	69
	Wimbleball[10]	(R)	21320	74	59	40	30	26	34	80
	Stithians	(R)	5205	61	45	31	27	26	31	66
Welsh	Celyn + Brenig	(G)	131155	87	79	57	48	49	50	86
	Brianne	(R)	62140	76	67	55	48	57	72	99
	Big Five[11]	(G)	69762	65	49	29	19	41	56	83
	Elan Valley[12]	(G)	99106	80	65	46	34	37	47	99
Lothian	Edin./Mid Lothian[13]	(G)	97639	88	79	69	64	85	91	85
	East Lothian[14]	(G)	10206	91	84	71	72	74	95	70
Strathclyde	Loch Katrine	(G)	111363	71	69	50	43	92	95	95
	Daer	(R)	22412	73	62	41	32	83	93	99
	Loch Thom	(G)	11840	77	72	59	56	100	97	94

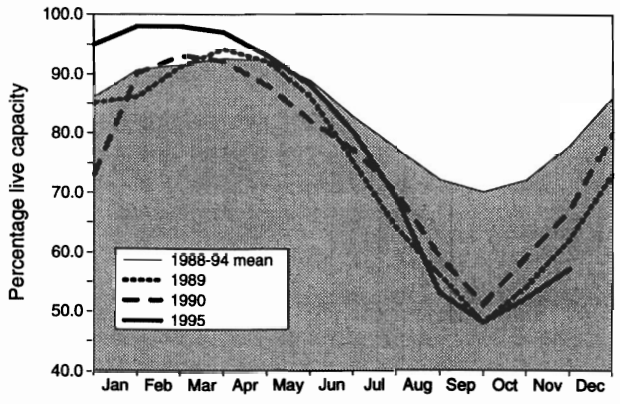
● Live or usable capacity (unless indicated otherwise) * Gross storage/percentage of gross storage

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



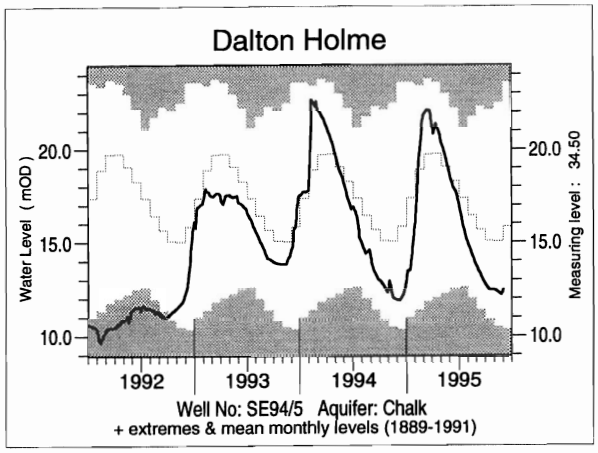
A COMPARISON BETWEEN OVERALL RESERVOIR STOCKS IN RECENT DROUGHT YEARS

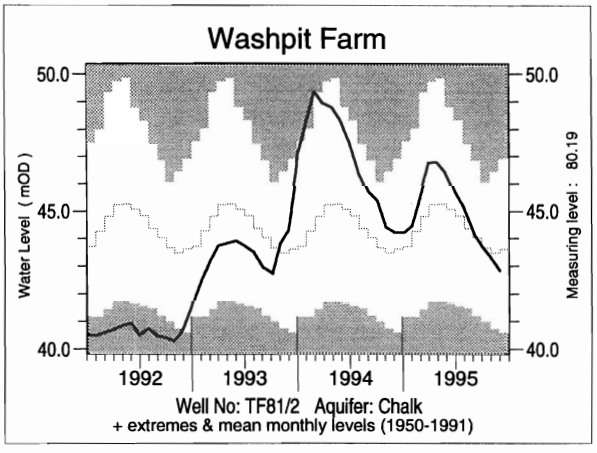


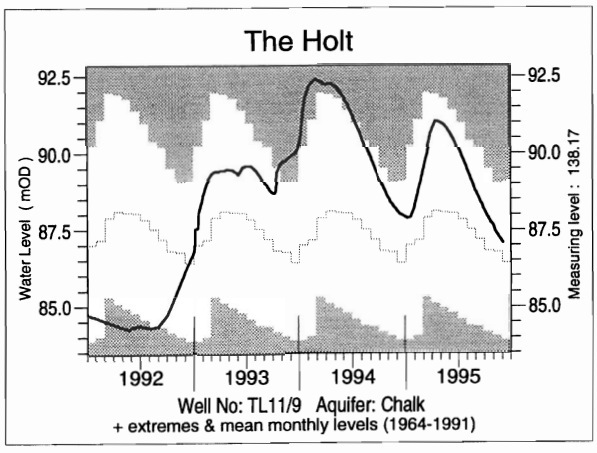
These plots are based on the reservoirs featured in Table 4 only

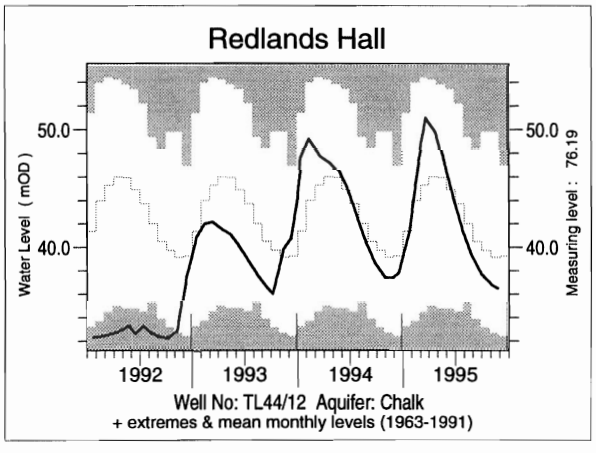
Note: Variations in storage depend on the balance between inputs (from catchment rainfall and any pumping) and outputs (to supply, compensation flow, HEP, amenity). There will be additional losses due to evaporation, especially in the summer months. Operational strategies for making the most efficient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

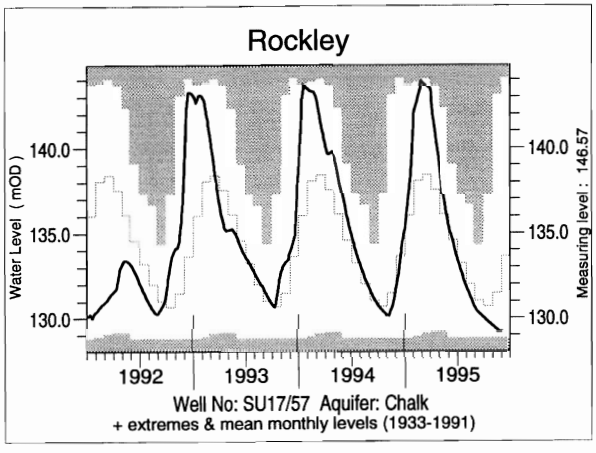
FIGURE 2 GROUNDWATER LEVEL HYDROGRAPHS

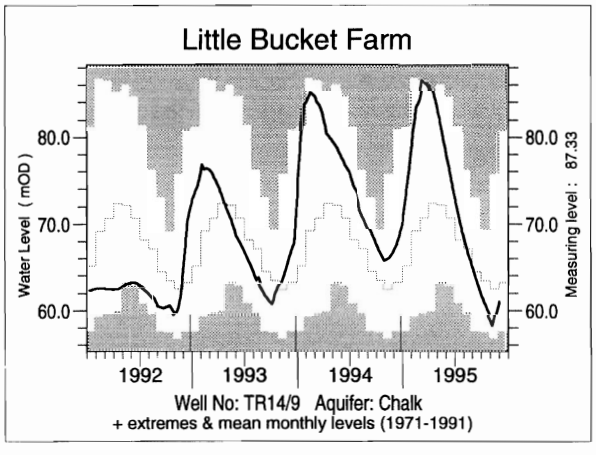


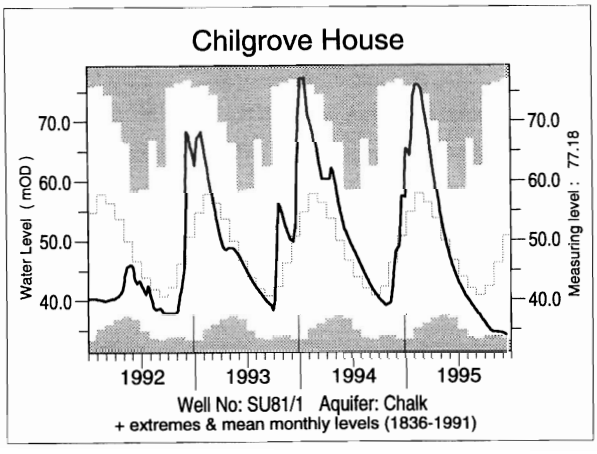


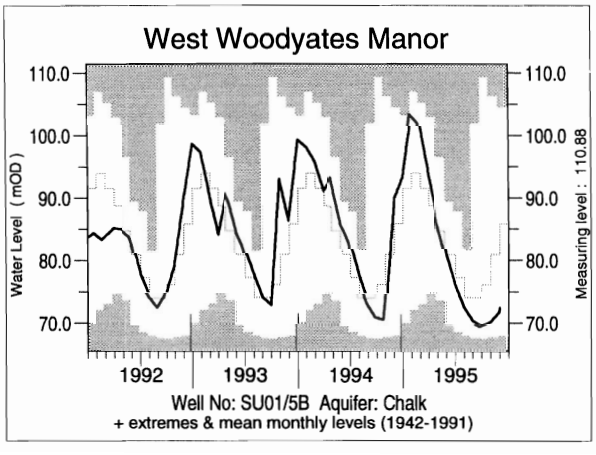


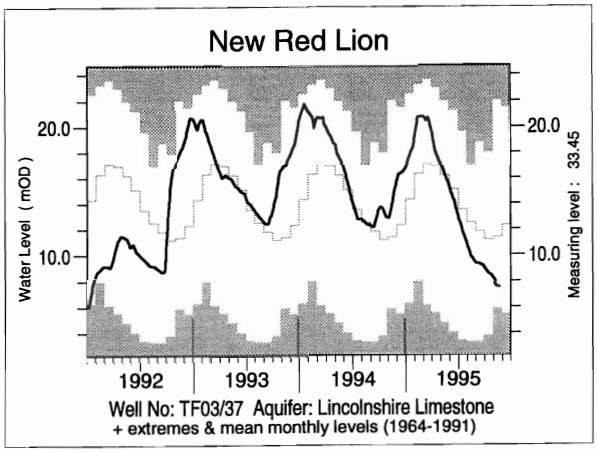


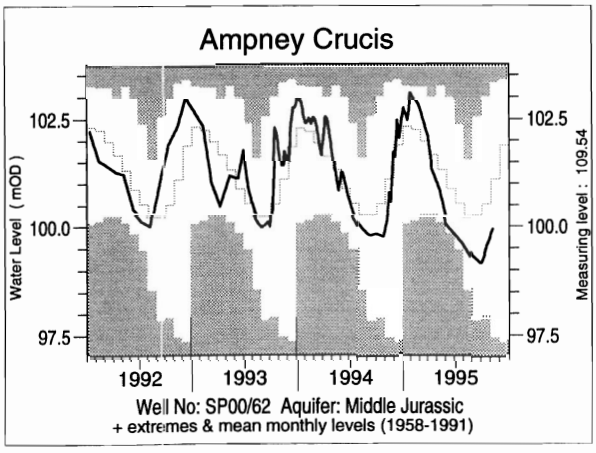


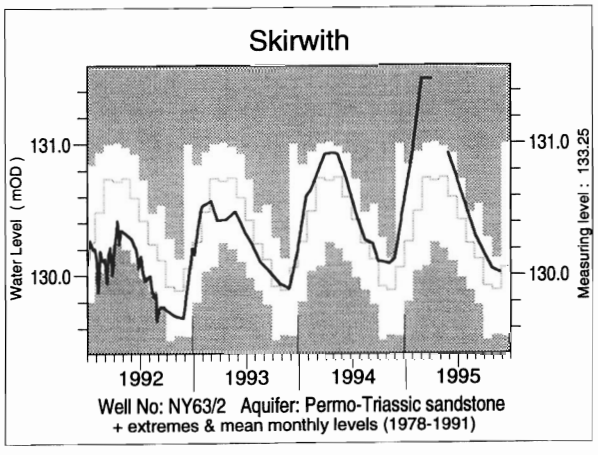


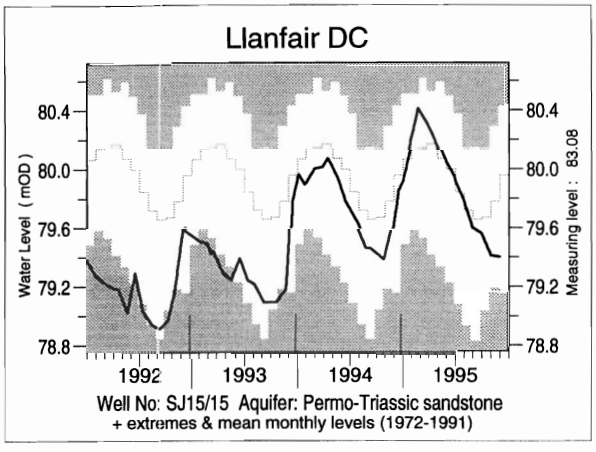


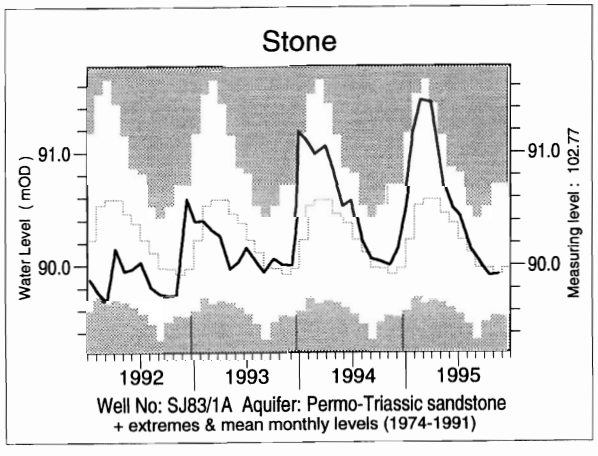


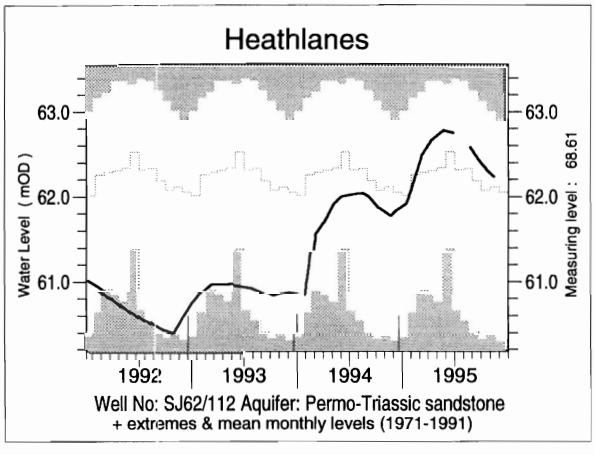

New Red Lion
Water Level (mOD)
20.0
10.0
Measuring level : 33.45
1992
1993
1994
1995
Well No: TF03/37 Aquifer: Lincolnshire Limestone
+ extremes & mean monthly levels (1964-1991)

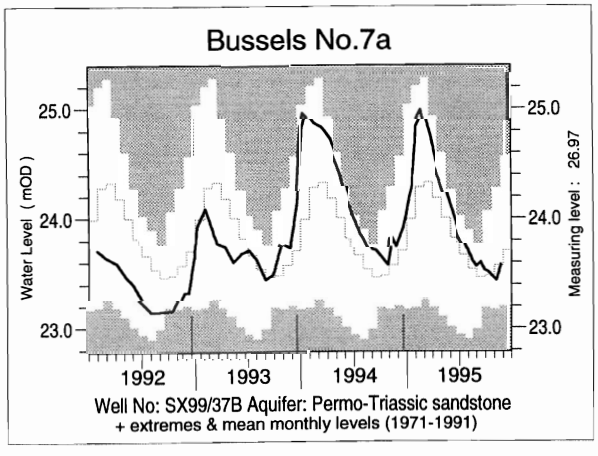

Ampney Crucis
Water Level (mOD)
102.5
100.0
97.5
Measuring level : 109.54
1992
1993
1994
1995
Well No: SP00/62 Aquifer: Middle Jurassic
+ extremes & mean monthly levels (1958-1991)


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)


Heathlanes
Water Level (mOD)
63.0
62.0
61.0
Measuring level : 68.61
1992
1993
1994
1995
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
Well No: SX99/37B Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1971-1991)

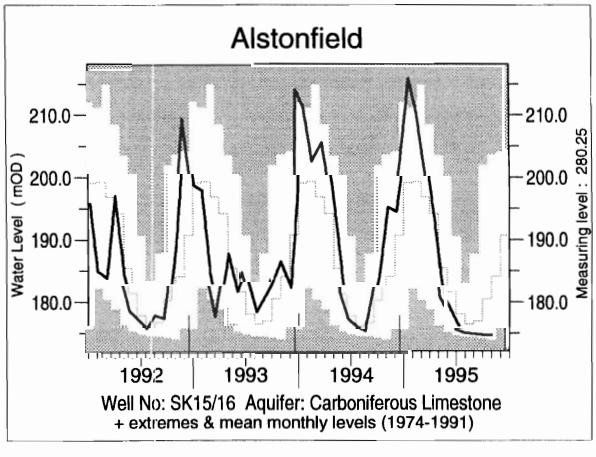

Alstonfield
Water Level (mOD)
210.0
200.0
190.0
180.0
Measuring level : 280.25
1992
1993
1994
1995
Well No: SK15/16 Aquifer: Carboniferous Limestone
+ extremes & mean monthly levels (1974-1991)

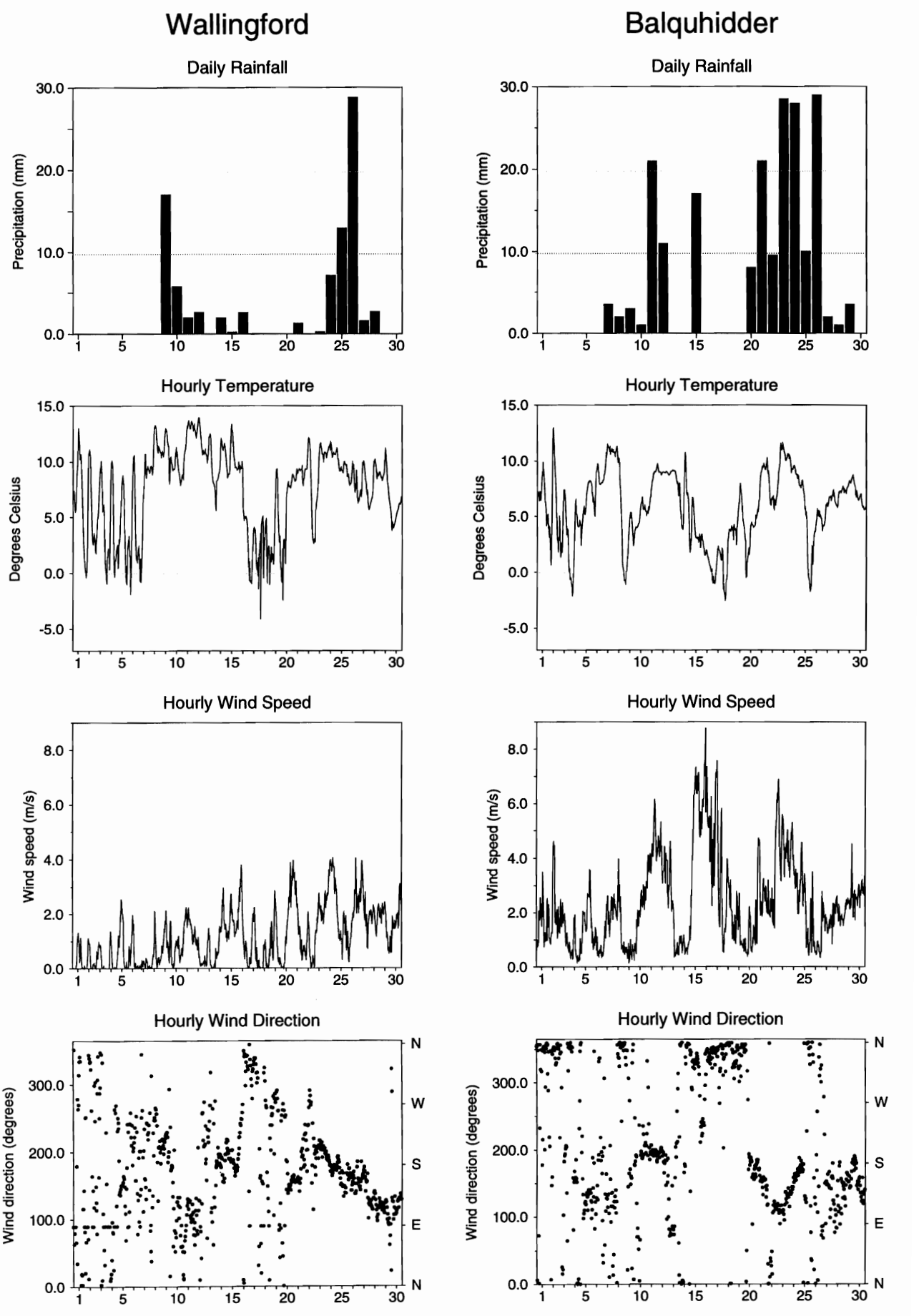
TABLE 5 NOVEMBER GROUNDWATER LEVELS 1995

Site	Aquifer	Records commence	Minimum Oct	Average Oct	Maximum Oct	No. of years Oct/Nov	Oct/Nov 1995	
			<1995	<1995	<1995	level<1995	day	level
Dalton Holme	C & UGS	1889	10.86	15.05	22.12	8	01/11	12.44
Wetwang	C & UGS	1971	17.26	19.15	20.80	3	01/11	18.13
Keelby Grange	C & UGS	1980	3.50	9.13	12.34	5	01/11	8.60
Washpit Farm	C & UGS	1950	40.43	43.49	46.09	>10	01/11	43.29
The Holt	C & UGS	1964	84.19	87.07	89.65	>10	30/10	87.68
Therfield Rectory	C & UGS	1883	dry <71.6	79.23	97.72	>10	01/10	80.69
Redlands Hall	C & UGS	1964	32.29	39.04	49.90	9	03/11	36.79
Rockley	C & UGS	1933	dry <128.44	130.72	137.35	>10	09/10	129.87
Little Bucket Farm	C & UGS	1971	57.48	63.74	69.33	2	09/11	58.55
Compton House	C & UGS	1984	27.64	33.57	57.30	7	27/10	29.81
Chilgrove House	C & UGS	1836	33.88	42.36	75.90	1	27/10	34.59
Westdean No.3	C & UGS	1940	1.11	1.54	3.68	>10	26/10	1.27
Lime Kiln Way	C & UGS	1969	123.75	124.86	123.53	>10	31/10	125.35
Ashton Farm	C & UGS	1974	63.48	65.19	69.12	3	31/10	63.98
West Woodyates Manor	C & UGS	1942	67.62	75.49	109.40	>10	31/10	70.17
Killyglen (NI)	C & UGS	1985	113.30	114.79	117.55	1	05/10	113.42
New Red Lion	LLst	1964	3.82	11.58	17.98	5	26/10	8.37
Ampney Crucis	Mid Jur	1958	97.95	100.47	103.05	9	30/10	99.82
Redbank	PTS	1981	7.47	8.09	8.82	4	01/11	7.54
Skirwith	PTS	1978	129.51	129.93	130.29	8	30/10	130.05
Yew Tree Farm	PTS	1973	11.54	13.28	13.73	3	31/10	13.06
Llanfair D.C	PTS	1972	78.98	79.52	80.15	8	31/10	79.41
Stone	PTS	1974	89.50	90.00	90.54	8	18/10	89.91
Heathlanes	PTS	1971	60.36	61.97	63.15	>10	18/10	62.32
Bussels No.7A	PTS	1972	23.16	23.50	24.07	>10	25/10	23.47
Rushyford NE	MgLst	1967	64.82	72.41	76.41	>10	20/10	75.86
Peggy Ellerton	MgLst	1968	31.46	33.86	36.38	>10	23/10	33.92
Alstonfield	CLst	1974	175.96	180.62	202.28	7	17/10	175.04

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

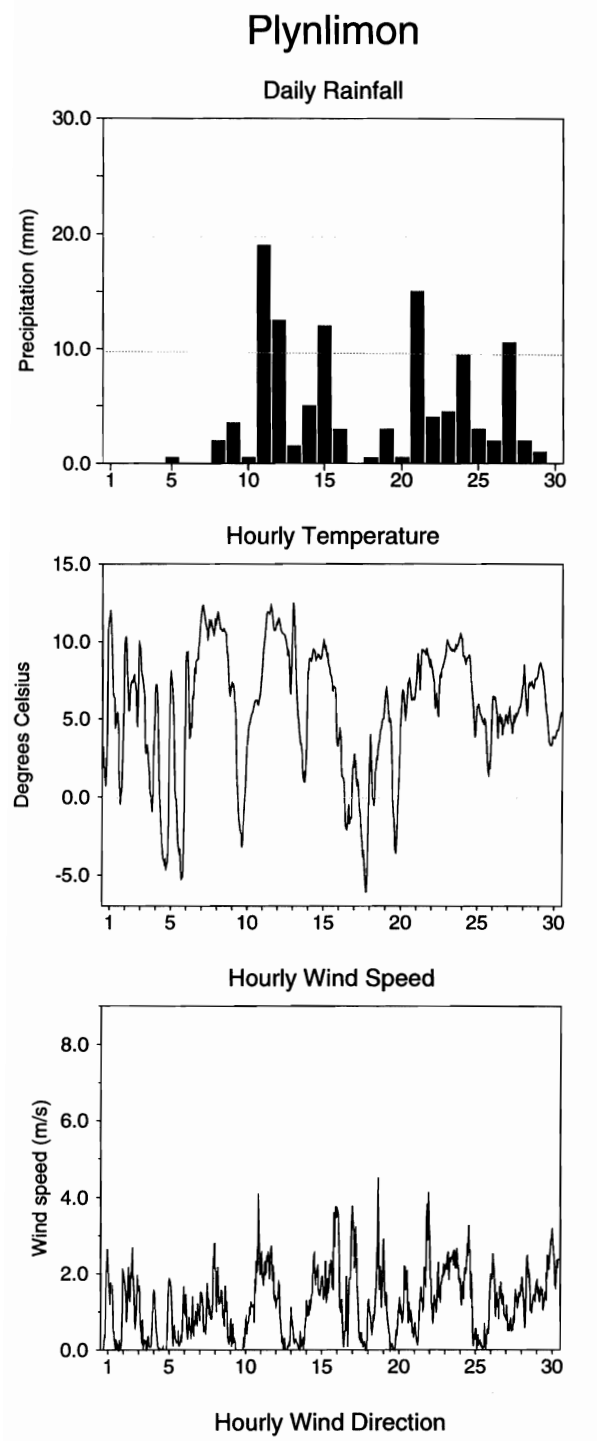
FIGURE 3 METEOROLOGICAL SUMMARY - NOVEMBER 1995



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

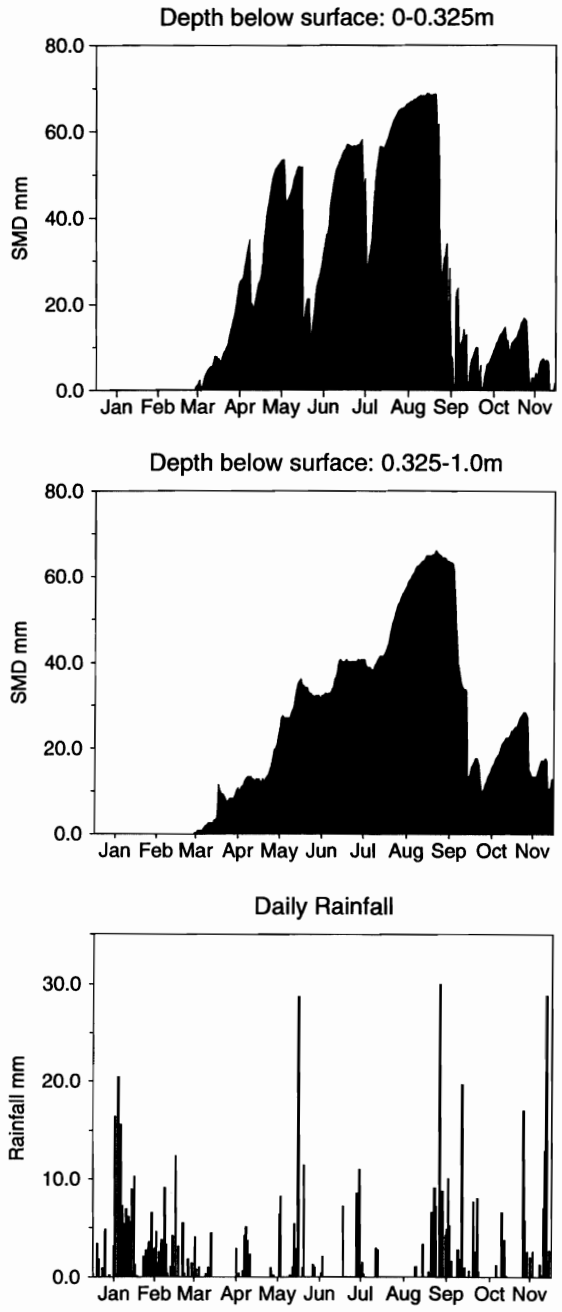
The Lower Kirkton automatic weather station (Balquhidder) occupies a relatively sheltered position at the mouth of the SSE trending Kirkton Glen. Station elevation is 270m aOD and average annual rainfall exceeds 2000mm; snow cover is expected for 10-30 days a year.

FIGURE 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



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 0-0.325m (15cm probe) and 0.325-1.0m (50cm probe) 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 from the Wallingford meteorological station from the start of 1995 is presented.

FIGURE 4 LOCATION MAP OF GAUGING STATIONS AND GROUNDWATER INDEX WELLS