Hydrological Summary for Great Britain

OCTOBER 1996

Rainfall

October was mild and generally sunny with large spatial variations in rainfall. Anticyclonic conditions predominated over the first three weeks but the weather became increasingly boisterous thereafter - damaging gales were associated with the passage of the remnant of Hurricane Lili around the 28th. Most Atlantic frontal systems - which brought abundant rainfall to much of northern and western Britain - weakened as they approached the English lowlands where monthly rainfall totals were modest. Nationwide, the October rainfall was appreciably above average but there were wide regional differences. Some catchments in western Scotland reported twice the October average - terminating a notable drought sequence from early spring. Short and long term rainfall deficiencies were also reduced, albeit modestly, in most western areas of England and Wales (boosted by heavy rainfall on the 31st). By contrast, most of eastern England registered another relatively dry month - some districts recorded less than 60% of the October average, intensifying the drought conditions. Accumulated rainfall deficiencies are notable in the English lowlands for the period since February, exceptional in parts of northern Britain in the 12-month timeframe, and outstanding in a number of regions over the period from March 1995. The 19 months ending in October 1996 is the driest such sequence in the national rainfall series which begins in 1767; lower 19-month rainfall totals (for *any* start month) are restricted to the 1975/76 and 1854/55 droughts over the last 200 years. Drought conditions eased a little in northern England during October as the focus of the drought continued to shift towards the English lowlands.

River Flow

Seasonal flow recoveries often gain momentum in western and northern Britain during October, whilst only sluggish runoff increases characterise the eastern lowlands. In 1995 these normal regional runoff differences were heavily accentuated. Flows increased markedly through October in much of Scotland where spate conditions were common on the 28/29th - and a number of flood warnings were issued - in the Tay basin especially. Early November saw bankfull conditions also approached in many Pennine rivers. By contrast, flow recessions continued through October in many eastern and southern rivers - and runoff rates were exceptionally depressed in mid-month. Above average monthly runoff totals were largely restricted to North Wales and parts of Scotland, the west particularly - both the Carron and Luss Water registered their second highest October runoff on record. In England, runoff was generally well below average; many rivers (from the Yorkshire Derwent to the Great Stour in Kent) established new October minima; naturalised flows for the Thames were the lowest, for October, since 1934. 1996 has added to a recent cluster of years (including '89, '90, '91 and '95) with notably depressed autumn flows in the lowlands. A measure of the exceptional severity of the drought in river flow terms is provided by the May-October runoff accumulations - for a significant minority of rivers in the Midlands and eastern England (including the Dove, Little Ouse and Gt Stour) the 6-month total is the lowest (for any start month) on record; for others, the 1976 minima has been closely approached. Runoff totals for most GB rivers are also very depressed in the 12- and 18-month timeframes.

Groundwater

The continuation of relatively dry conditions over most aquifer outcrop areas in October allowed only a modest increase in soil moisture in the English lowlands. At month-end soil moisture deficits throughout much of the Chalk remained the equivalent of around 8-10 weeks rainfall and recessions continued. October groundwater levels were very close to the monthly minimum in many outcrop areas (see hydrographs for Dalton Holme, Washpit Farm and Little Bucket - which was dry) and very depressed in most others. A tentative recovery - from a very low base - can be identified in some Permo-Triassic sandstones boreholes in western and northern Britain, but in others (for example Llanfair D.C. in North Wales and Skirwith in the Eden Valley) levels are below any previously recorded. October levels in the Carboniferous and Lincolnshire Limestones were also at, or approaching, the monthly minima. There is still scope for winter and spring rainfall to return most water-tables to within the normal range but a dry end to 1996 would produce a very fragile groundwater outlook.

General

The October rainfall reversed the decline in most reservoir stocks but not the depletion in groundwater resources. Large recoveries were reported for reservoirs in much of northern Britain and the overall (England and Wales) total is around 10% greater than last year. But stocks in some lowland impoundments (and a few reservoirs in the south Pennines) are below 50% capacity; this combined with depressed groundwater levels - in the Chalk especially - underlines the need for significant rainfall throughout the winter to ensure a reasonably lengthy 1996/97 replenishment season.

Institute of Hydrology

British Geological Survey

Data for this report have been provided principally by the regional divisions of the newly formed Environment Agency (England and Wales) and the Scottish Environment Protection Agency. For reasons of consistency and to provide greater spatial discrimination, the original regional divisions of the precursor organisations have been retained for use in the Hydrological Summaries. The majority of the areal rainfall figures have been provided 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 Environment Agency and, in Scotland, West of Scotland Water Authority and East of Scotland Water.

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, the Environment Agency, the Scottish Environment Protection Agency and the Office of Water Services (OFWAT).

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

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 raingauge sites.

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

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 13 November 1996

TABLE 1 1995/96 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.

		Oct 1995	Nov	Dec	Jan 1996	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
England and Wales	mm	58	83	84	63	83	43	49	57	29	40	79	34	85
	%	68	92	89	72	132	60	82	89	45	65	104	44	100
North West	mm	105	76	42	53	105	36	71	56	45	58	84	62	141
	%	82	62	34	44	135	38	100	75	56	68	79	54	110
Northumbrian	mm	57	118	79	46	89	31	63	53	22	52	76	35	70
	%	75	137	98	55	151	44	113	85	37	80	94	48	93
Severn Trent	mm	39	65	81	44	67	41	49	48	30	33	68	22	74
	%	61	92	105	63	124	67	89	81	51	62	101	34	115
Yorkshire	mm	29	65	70	46	78	31	41	52	35	41	74	31	59
	%	40	81	84	58	134	46	69	87	58	69	100	45	80
Anglian	mm	15	42	69	33	50	20	15	23	18	41	75	17	47
	%	29	72	125	66	135	43	33	48	35	84	136	34	92
Thames	mm	34	64	96	50	64	35	35	34	15	38	60	22	46
	%	55	98	137	78	142	63	70	61	27	78	103	37	75
Southern	mm	33	65	95	67	68	40	23	51	16	31	78	31	55
	%	41	76	116	84	126	63	43	94	30	65	137	45	69
Wessex	mm	68	124	104	76	85	68	57	59	30	27	86	33	76
	%	86	149	112	87	131	97	108	97	53	52	130	45	96
South West	mm	104	134	126	156	119	72	78	99	35	31	97	49	118
	%	90	107	91	113	118	73	113	138	51	45	115	53	102
Welsh	mm	115	133	103	102	127	73	85	104	47	46	100	55	158
	%	84	94	67	71	131	68	106	127	59	60	99	48	115
Scotland	mm	228	126	55	89	141	60	107	77	65	77	69	63	226
	%	146	83	36	59	138	48	141	90	76	82	59	45	145
Highland	mm	246	160	48	58	152	55	110	83	83	91	78	86	241
	%	124	79	24	31	120	34	121	90	85	86	61	50	122
North East	mm	103	100	70	69	114	59	62	66	32	66	64	31	121
	%	106	101	75	70	175	76	103	96	48	90	74	36	125
Tay	mm	220	120	68	136	116	76	106	64	41	52	64	50	195
	%	169	99	54	94	122	70	171	77	56	68	68	44	150
Forth	mm	199	90	54	72	86	53	86	70	43	55	62	48	173
	%	173	80	49	61	109	56	146	95	62	73	66	44	150
Tweed	mm	134	97	64	68	103	30	78	63	31	53	64	30	144
	%	141	104	69	68	154	38	137	89	48	73	73	34	152
Solway	mm	249	113	52	135	160	74	133	80	75	70	68	62	324
	%	159	78	35	87	158	63	173	94	89	78	57	43	206
Clyde	mm	324	119	47	119	180	62	138	90	88	97	65	75	296
	%	168	66	26	63	153	42	164	99	95	89	49	42	153

Note: The monthly regional rainfall figures for England and Wales for September & October 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 Scottish regions (and also for Scotland) for September & October 1996 were derived by IH in collaboration with the SEPA regions. 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 ACCUMULATIONS AND RETURN PERIOD ESTIMATES

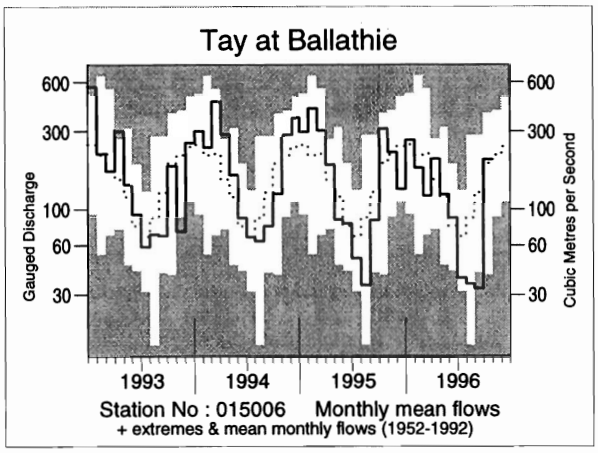
		Jun 96-Oct 96		Mar 96-Oct 96		Nov 95-Oct 96		Apr 95-Oct 96	
			Est Return Period, years		Est Return Period, years		Est Return Period, years		Est Return Period, years
England and Wales	mm	267		416		729		1049	
	% LTA	73	10-15	74	15-25	81	10-20	76	70-100
North West	mm	391		554		830		1247	
	% LTA	76	5-10	73	15-25	69	70-100	67	>>200
Northumbria	mm	256		403		735		1065	
	% LTA	72	10-15	74	15-25	86	5-10	80	30-40
Severn Trent	mm	227		365		622		881	
	% LTA	74	5-10	76	10-15	82	5-10	75	50-80
Yorkshire	mm	239		363		622		879	
	% LTA	72	10-15	70	25-40	76	20-35	69	>200
Anglian	mm	198		256		450		670	
	% LTA	78	5-10	65	40-60	75	20-35	71	>200
Thames	mm	181		285		559		816	
	% LTA	64	15-25	64	30-50	81	5-10	76	35-50
Southern	mm	212		326		621		891	
	% LTA	69	10-15	68	20-35	80	5-15	75	40-60
Wessex	mm	251		435		824		1174	
	% LTA	77	5-10	85	2-5	98	2-5	92	2-5
South West	mm	330		579		1114		1541	
	% LTA	77	5-10	86	2-5	95	2-5	88	5-10
Welsh	mm	406		668		1133		1597	
	% LTA	80	5-10	86	2-5	86	5-10	80	25-40
Scotland	mm	500		744		1155		1895	
	% LTA	84	5-10	84	5-10	80	30-40	86	15-25
Highland	mm	579		827		1245		2121	
	% LTA	83	5-10	79	10-20	71	>200	80	50-80
North East	mm	314		501		854		1527	
	% LTA	77	5-15	81	5-15	88	5-10	101	2-5
Tay	mm	402		648		1088		1740	
	% LTA	82	5-10	87	2-5	89	5-10	93	2-5
Forth	mm	381		590		892		1455	
	% LTA	82	5-10	86	5-10	80	15-25	85	10-20
Tweed	mm	322		493		825		1284	
	% LTA	79	5-10	80	5-15	85	5-10	85	10-20
Solway	mm	599		886		1346		1967	
	% LTA	101	2-5	102	2-5	95	2-5	90	5-10
Clyde	mm	621		911		1376		2196	
	% LTA	88	2-5	88	2-5	81	15-25	85	15-25

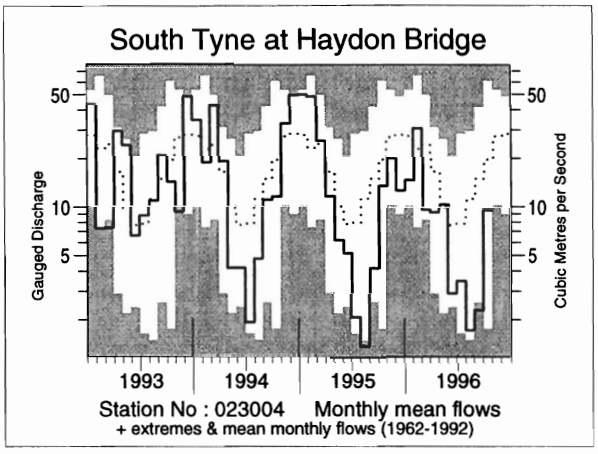
LTA refers to the period 1961-90.

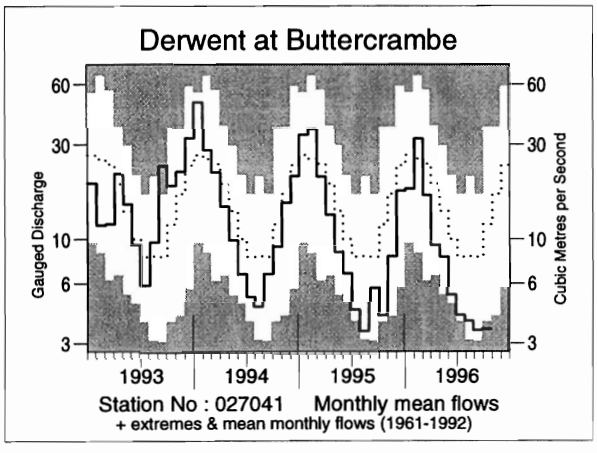
Return period assessments are based on tables provided by the Meteorological Office*. The tables reflect rainfall totals over the period 1911-70 only and the estimate assumes a sensibly stable climate. They assume a start in a specified month; return periods for a start in any month may be expected to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

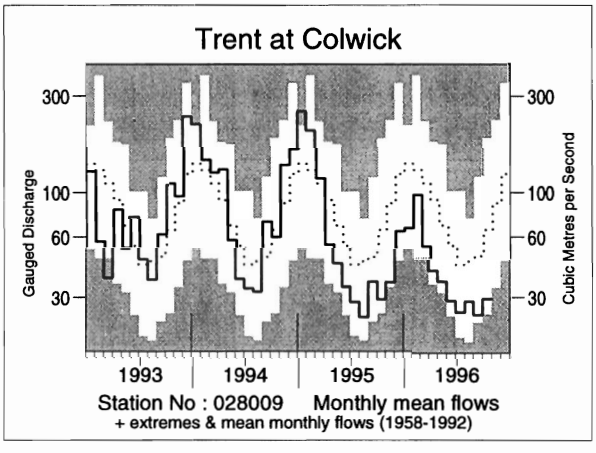
* Tabony, R.C., 1977, The Variability of long duration rainfall over Great Britain, Scientific Paper No. 37, Meteorological Office.

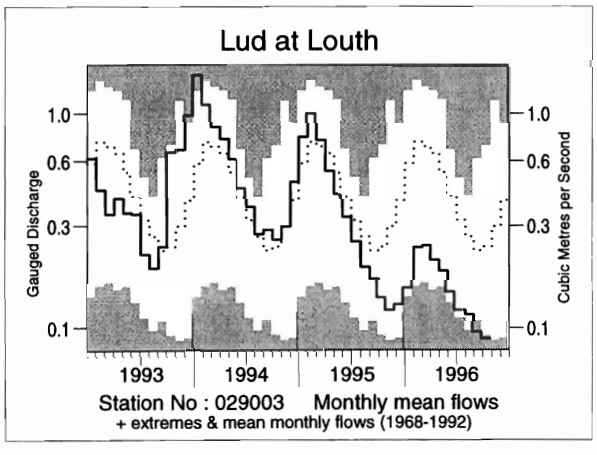
FIGURE 1 MONTHLY RIVER FLOW HYDROGRAPHS

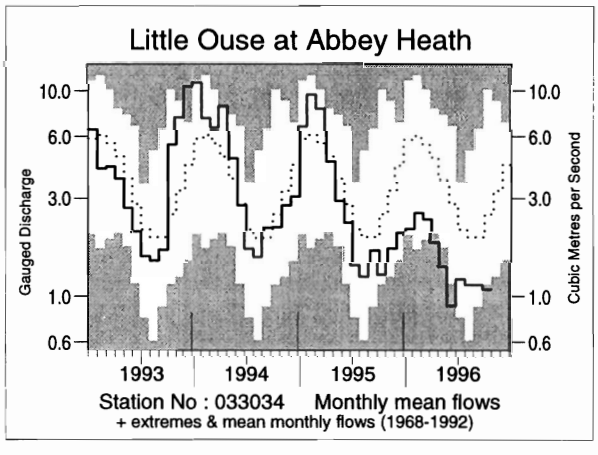


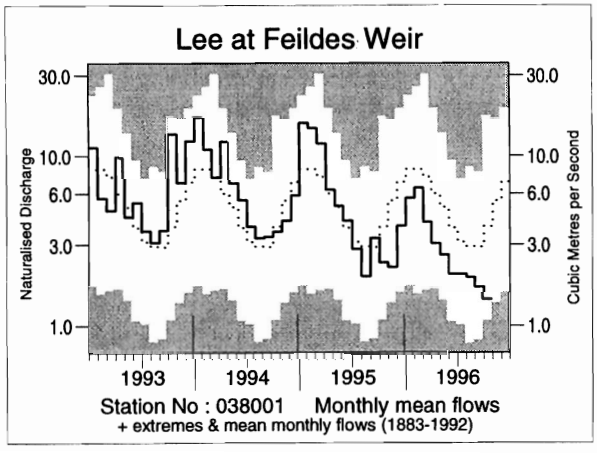


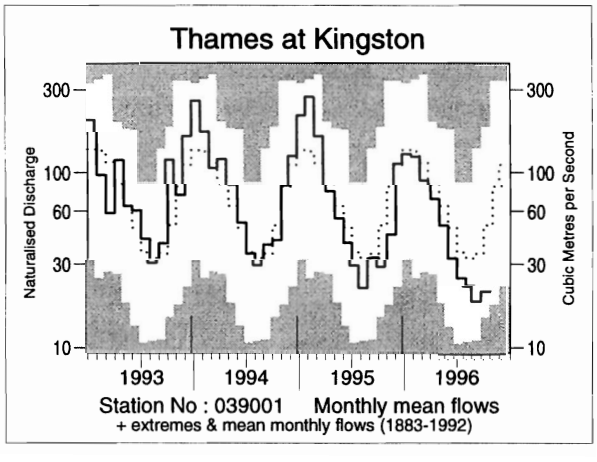


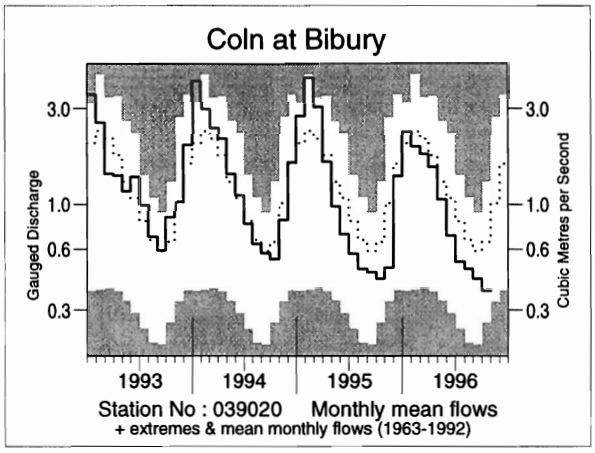


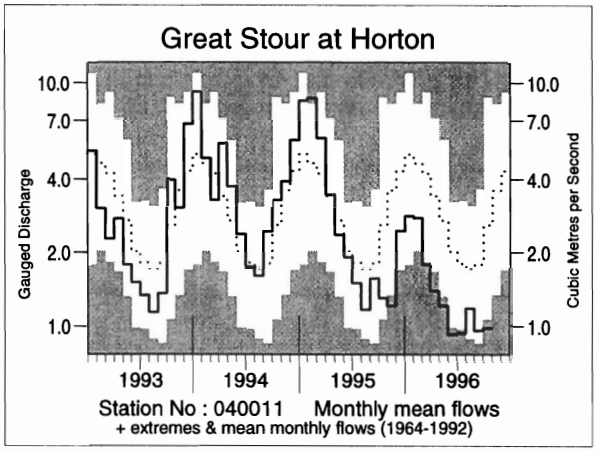


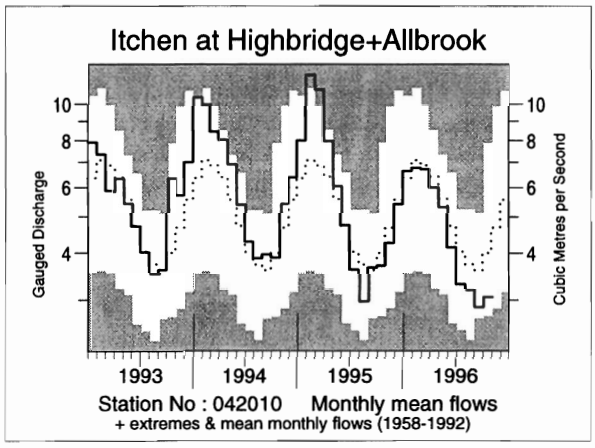


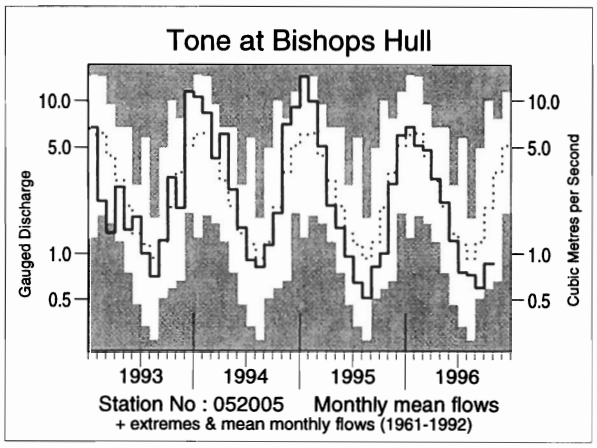


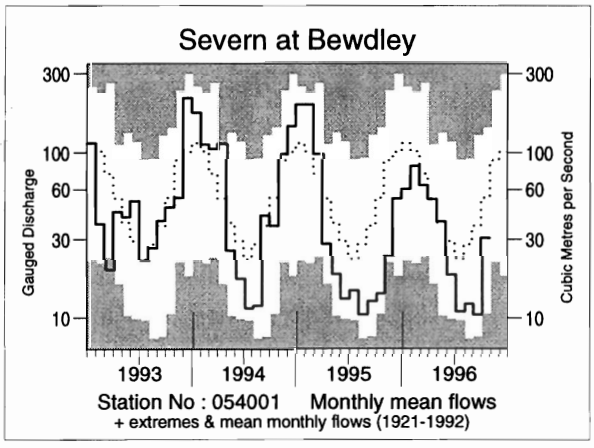


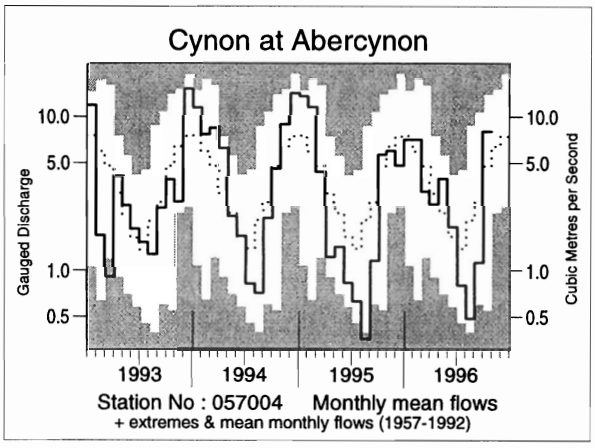

Coln at Bibury
Gauged Discharge
Cubic Metres per Second
3.0
1.0
0.6
0.3
1993
1994
1995
1996
Station No : 039020 Monthly mean flows
+ extremes & mean monthly flows (1963-1992)

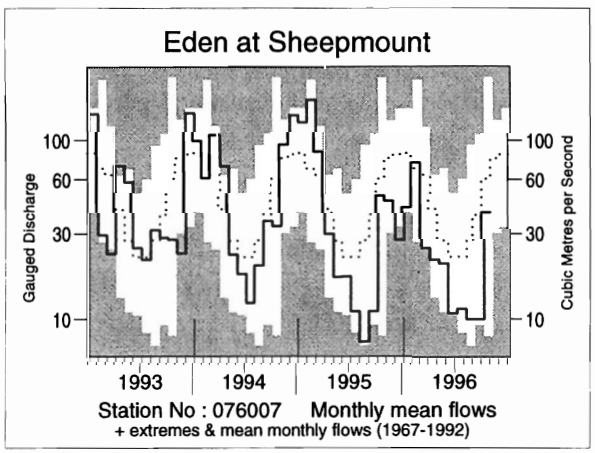

Great Stour at Horton
Gauged Discharge
Cubic Metres per Second
10.0
7.0
4.0
2.0
1.0
1993
1994
1995
1996
Station No : 040011 Monthly mean flows
+ extremes & mean monthly flows (1964-1992)


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
1993
1994
1995
1996
Station No : 076007 Monthly mean flows
+ extremes & mean monthly flows (1967-1992)

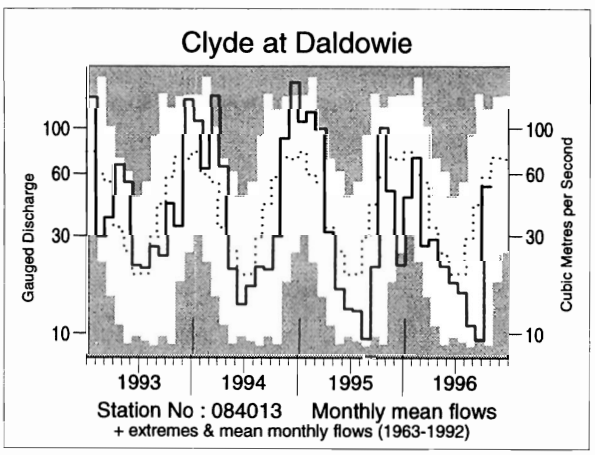

Clyde at Daldowie
Gauged Discharge
Cubic Metres per Second
100
60
30
10
1993
1994
1995
1996
Station No : 084013 Monthly mean flows
+ extremes & mean monthly flows (1963-1992)

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	Jun	Jul	Aug	Sep	Oct 1996		5/96 to 10/96		1/96 to 10/96		11/95 to 10/96		5/95 to 10/96	
	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	28	19	13	12	58	9	180	3	621	11	798	12	1158	14
Park	78	71	44	27	70	/24	64	/24	99	/24	102	/24	107	/23
Tay at	50	22	20	19	118	28	301	9	741	9	943	7	1320	7
Ballathie	111	56	41	27	105	/45	78	/44	85	/44	83	/44	86	/43
Tweed at	26	16	13	11	67	17	175	9	460	4	577	4	774	4
Boleside	97	62	35	23	93	/36	70	/36	80	/36	76	/35	76	/35
Whiteadder Water at	10	8	7	6	8	4	69	7	243	6	328	8	387	6
Hutton Castle	63	64	47	38	27	/28	62	/27	80	/27	85	/27	77	/26
South Tyne at	10	13	6	8	34	5	108	1	331	1	445	1	560	1
Haydon Bridge	39	47	16	16	50	/35	44	/33	58	/33	58	/33	55	/31
Wharfe at	10	13	22	19	39	11	134	5	279	1	319	1	386	1
Flint Mill Weir	43	53	58	43	64	/42	59	/41	52	/41	45	/41	41	/40
Derwent at	9	7	7	6	6	1	48	2	172	4	215	5	270	4
Buttercrambe	54	53	49	41	30	/36	49	/35	68	/35	67	/35	64	/34
Trent at	10	9	10	9	11	5	63	1	152	2	188	2	258	2
Colwick	55	59	66	51	46	/39	56	/38	55	/38	53	/38	55	/37
Lud at	7	6	6	5	4	1	36	1	76	3	88	2	160	3
Louth	36	38	44	42	35	/29	39	/28	35	/28	35	/28	48	/27
Witham at	4	3	3	3	4	7	25	2	81	3	96	3	126	3
Claypole Mill	43	46	49	39	37	/38	46	/38	53	/37	52	/37	53	/37
Little Ouse at	3	5	4	4	4	1	26	1	60	1	74	1	115	3
Abbey Heath	33	59	61	60	42	/29	47	/29	43	/28	44	/28	51	/28
Colne at	3	2	3	2	3	3	17	3	57	5	71	5	93	5
Lexden	50	53	77	56	33	/38	50	/37	54	/37	52	/36	55	/35
Lee at	5	5	5	4	4	7	30	10	78	17	94	19	144	20
Feildes Weir (natr.)	53	64	66	58	36	/112	54	/111	60	/110	57	/110	66	/109
Thames at	8	7	6	5	6	12	45	22	155	38	197	35	252	36
Kingston (natr.)	67	71	69	54	42	/114	64	/114	80	/114	80	/113	80	/113
Coln at	17	13	12	10	9	2	89	5	274	9	321	8	411	8
Bibury	65	64	73	74	58	/34	71	/33	83	/33	82	/33	79	/32
Great Stour at	7	7	9	7	8	1	47	1	114	1	142	1	216	1
Horton	46	52	71	53	37	/33	50	/31	50	/30	49	/29	56	/29
Itchen at	30	25	24	21	23	5	161	7	350	8	421	9	603	10
Highbridge+Allbrook	87	82	86	79	75	/39	85	/38	91	/38	91	/38	93	/37
Stour at	12	9	8	6	8	2	64	6	276	8	369	8	427	7
Throop Mill	82	79	78	54	36	/24	70	/24	91	/24	92	/23	87	/23
Exe at	21	9	12	9	53	19	157	12	462	6	657	6	754	2
Thorverton	86	46	46	24	72	/41	72	/41	78	/40	79	/40	72	/40
Taw at	13	4	6	4	20	9	79	7	323	5	474	4	521	2
Umberleigh	76	30	31	18	33	/39	49	/38	68	/38	69	/38	61	/37
Tone at	15	10	9	8	11	7	82	8	334	12	447	13	518	11
Bishops Hull	89	67	79	50	43	/36	74	/36	92	/35	94	/35	88	/35
Severn at	11	7	7	6	19	25	74	10	231	5	277	4	328	3
Bewdley	62	49	44	29	58	/76	59	/76	69	/75	62	/75	57	/75
Teme at	10	5	4	2	3	1	48	7	247	9	300	5	329	5
Knightsford Bridge	77	62	43	25	17	/27	64	/27	90	/26	82	/26	74	/26
Cynon at	46	20	12	27	203	34	407	26	900	18	1167	17	1417	8
Abercynon	116	59	24	41	170	/39	110	/37	100	/37	93	/37	87	/35
Dee at	42	29	41	69	255	22	546	12	997	2	1198	1	1507	1
New Inn	71	44	46	55	138	/28	91	/27	77	/27	67	/27	63	/26
Eden at	12	13	12	11	46	11	118	1	303	2	387	1	517	1
Sheepmount	49	53	38	27	68	/30	56	/29	59	/29	55	/29	57	/28
Clyde at	24	22	15	13	74	18	176	6	413	4	511	3	751	2
Daldowie	92	82	39	23	91	/34	67	/33	71	/33	65	/33	72	/32
Carron at	85	102	83	112	371	17	809	5	1185	1	1438	1	2215	1
New Kelso	105	87	53	45	148	/18	86	/18	62	/18	57	/17	64	/17
Ewe at	110	124	61	59	272	18	692	8	1027	2	1352	1	2081	2
Poolewe	147	141	56	32	124	/26	90	/26	65	/26	64	/26	71	/25

Notes:
(i) Values based on gauged flow data unless flagged (natr.), when naturalised data have been used.
(ii) Values are ranked so that lowest runoff is rank 1.
(iii) %LT means percentage of long term average from the start of the record to 1995. For the long periods (at the right of this table), the end date for the long term is 1996.

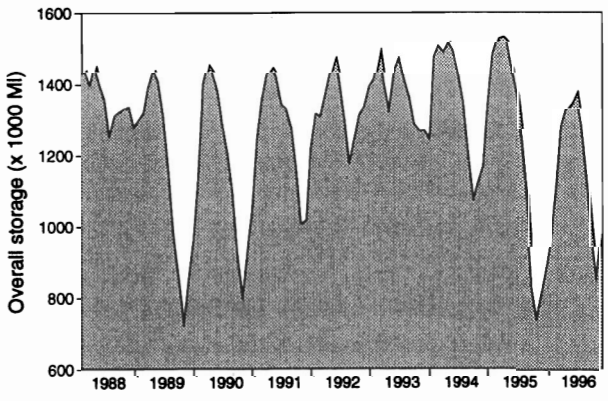
TABLE 4 START-MONTH RESERVOIR STORAGES UP TO NOVEMBER 1996

Area	Reservoir (R)/ Group (G)		Capacity● (Ml)	1996 Jun	Jul	Aug	Sep	Oct	Nov	*1995 Nov*
North West	N.Command Zone[1]	(G)	133375	80	75	64	45	36	69	*44*
	Vyrnwy	(R)	55146	74	66	56	43	35	65	*25*
Northumbria	Teesdale[2]	(G)	87936	81	68	62	42	34	35	*33*
	Kielder	(R)	199175*	96	91	89	83	81	86	*88*
Severn-Trent	Clywedog	(R)	44922	100	97	81	67	46	66	*38*
	Derwent Valley[3]	(G)	39525	56	53	43	36	27	30	*15*
Yorkshire	Washburn[4]	(G)	22035	87	82	75	69	62	64	*15*
	Bradford supply[5]	(G)	41407	70	63	56	55	48	59	*16*
Anglian	Grafham	(R)	58707	95	89	83	78	71	67	*72*
	Rutland	(R)	130061	93	88	83	78	72	70	*59*
Thames	London[6]	(G)	206399	95	88	77	67	54	46	*67*
	Farmoor [7]	(G)	13843	99	98	95	97	91	92	*87*
Southern	Bewl	(R)	28170	88	80	72	65	58	52	*65*
	Ardingly	(R)	4685	100	86	68	47	37	33	*47*
Wessex	Clatworthy	(R)	5364	97	89	70	62	48	44	*35*
	Bristol W [8]	(G)	38666*	95	87	76	66	57	59	*37*
South West	Colliford	(R)	28540	69	67	59	52	43	42	*45*
	Roadford[9]	(R)	34500	48	49	46	42	38	40	*18*
	Wimbleball[10]	(R)	21320	86	81	64	53	43	42	*26*
	Stithians	(R)	5205	98	93	79	68	57	50	*26*
Welsh	Celyn + Brenig	(G)	131155	82	77	66	55	48	63	*49*
	Brianne	(R)	62140	100	95	85	77	63	87	*57*
	Big Five[11]	(G)	69762	97	90	73	54	46	64	*41*
	Elan Valley[12]	(G)	99106	97	90	81	67	57	82	*37*
East of Scotland	Edin./Mid Lothian[13]	(G)	97639	98	95	89	77	68	74	*85*
	East Lothian[14]	(G)	10206	99	95	86	76	67	63	*74*
West of Scotland	Loch Katrine	(G)	111363	99	91	76	62	56	90	*92*
	Daer	(R)	22412	96	93	85	66	53	89	*83*
	Loch Thom	(G)	11840	94	90	82	70	59	88	*100*

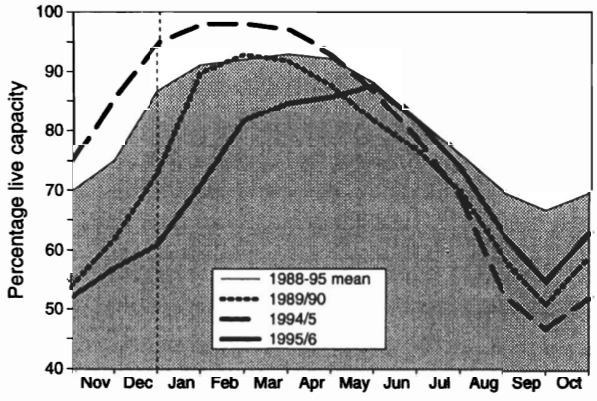
● Live or usable capacity (unless indicated otherwise) * Gross storage/percentage of gross storage

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



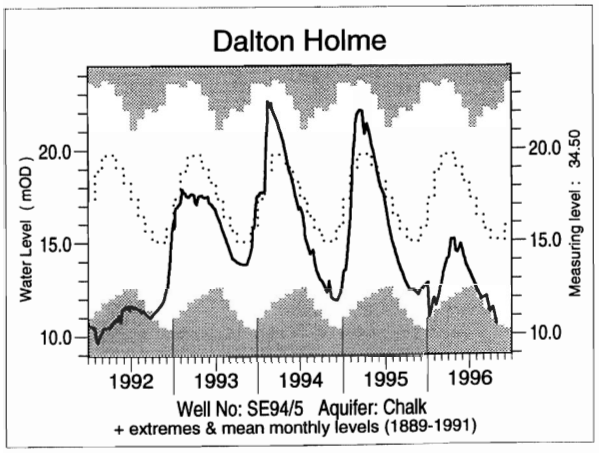
A COMPARISON BETWEEN OVERALL RESERVOIR STOCKS FOR ENGLAND AND WALES IN RECENT YEARS

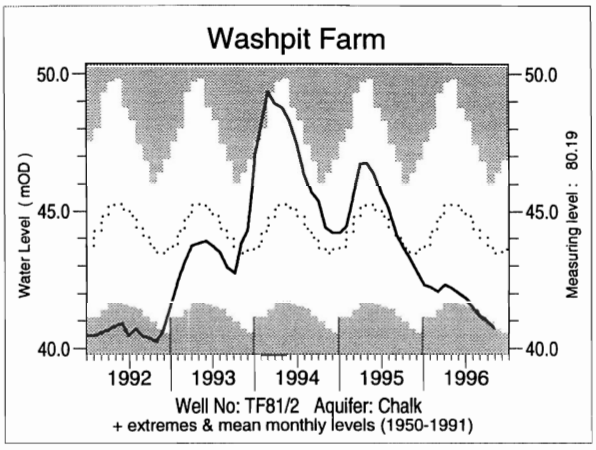


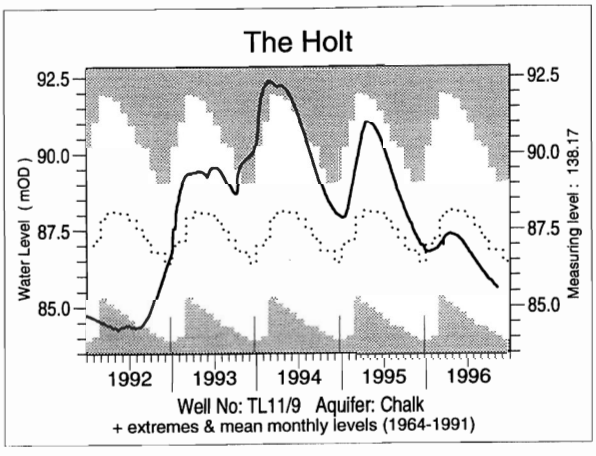
These plots are based on the reservoirs featured in Table 4 only

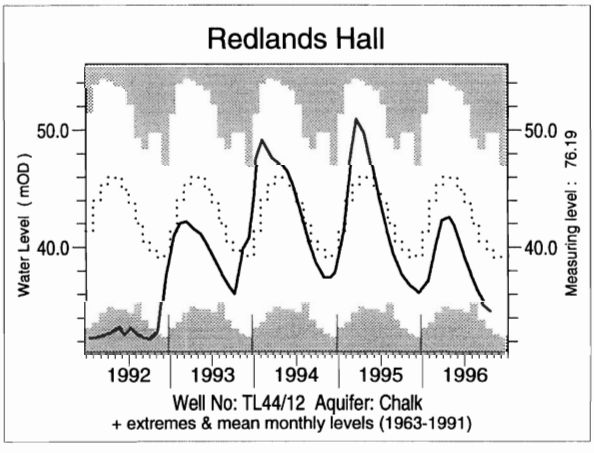
Note: Variations in storage depend on the balance between inputs (from catchment rainfall and any pumping) and outputs (to supply, compensation flow, HEP, amenity). There will be additional losses due to evaporation, especially in the summer months. Operational strategies for making the most efficient use of water stocks will further affect reservoir storages. Table 4 is intended to provide a link between the hydrological conditions described elsewhere in the report and the water resources situation. The reservoirs featured may not be representative of storage conditions across the individual regions; this can be particularly important during drought conditions (eg, in the Severn-Trent region during 1995/96).

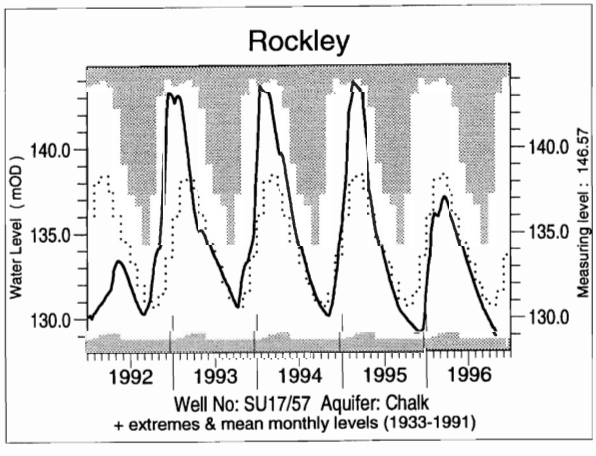
FIGURE 2 GROUNDWATER LEVEL HYDROGRAPHS

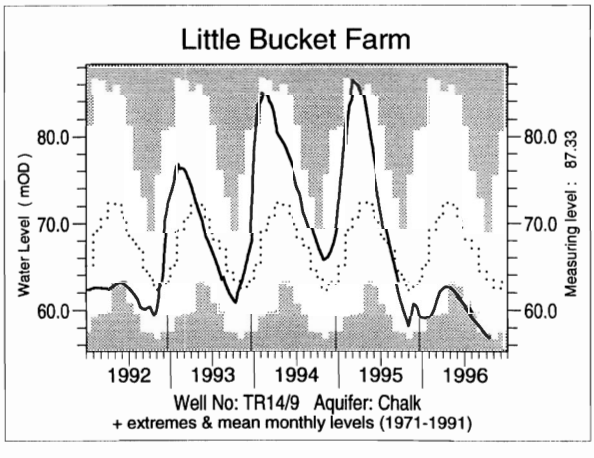


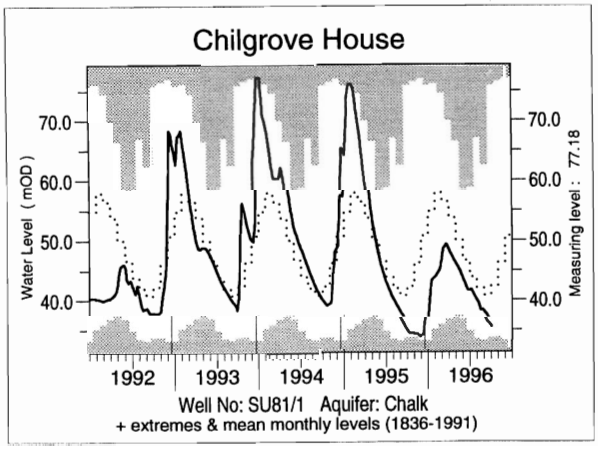


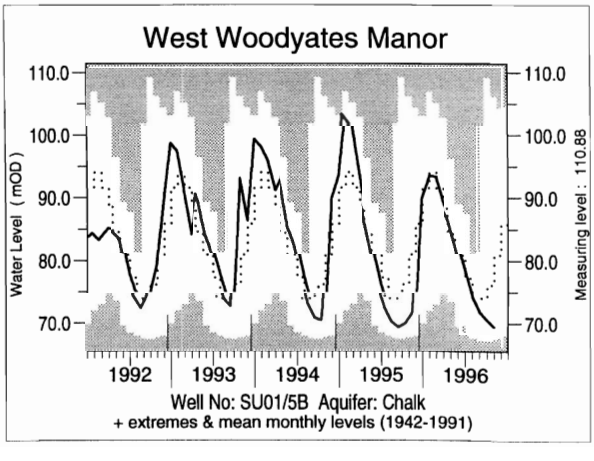


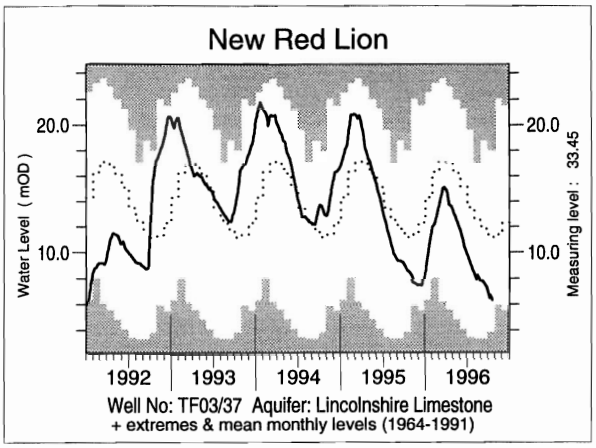


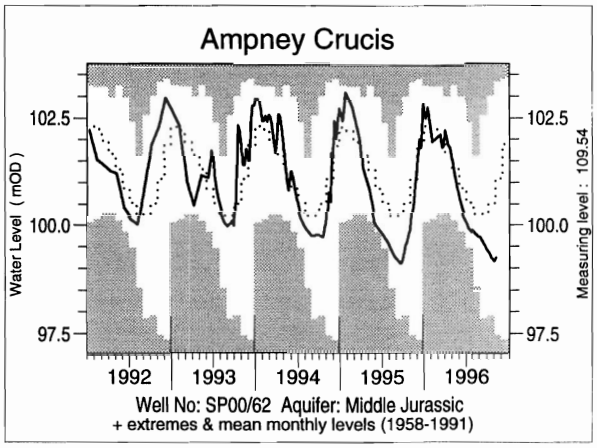


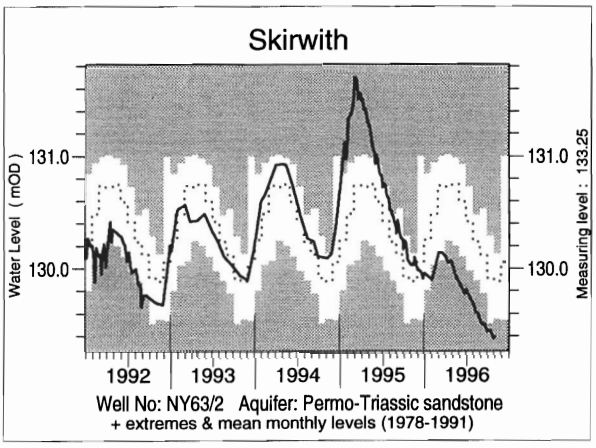


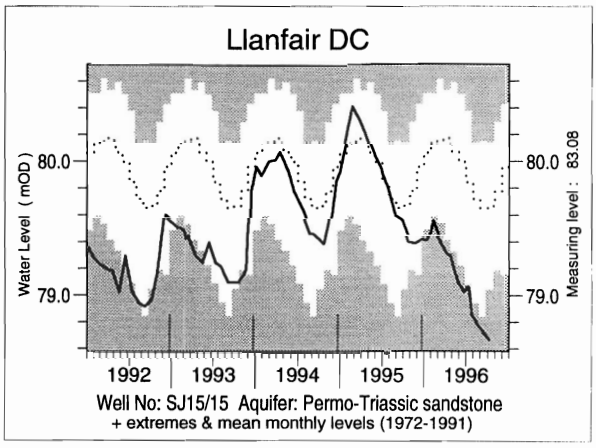


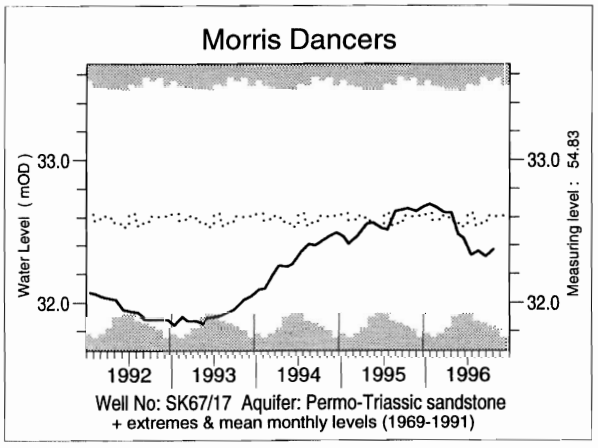


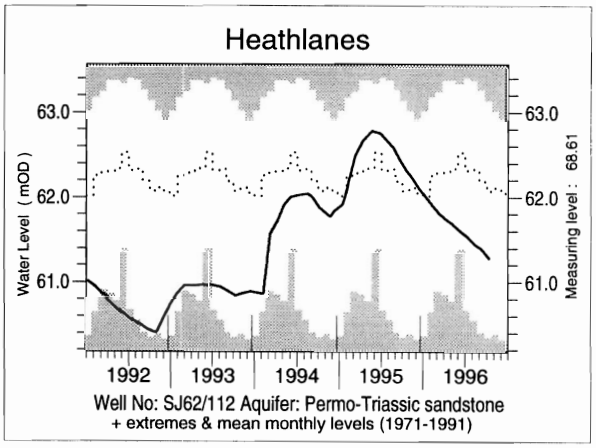

New Red Lion
Water Level (mOD)
20.0
10.0
Measuring level : 33.45
1992
1993
1994
1995
1996
Well No: TF03/37 Aquifer: Lincolnshire Limestone
+ extremes & mean monthly levels (1964-1991)

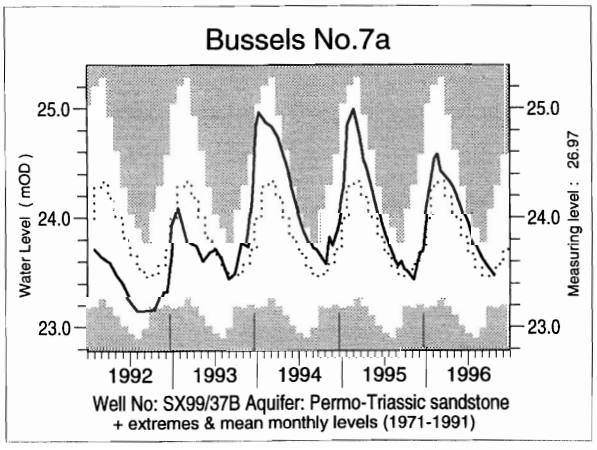

Ampney Crucis
Water Level (mOD)
102.5
100.0
97.5
Measuring level : 109.54
1992
1993
1994
1995
1996
Well No: SP00/62 Aquifer: Middle Jurassic
+ extremes & mean monthly levels (1958-1991)


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)
80.0
79.0
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)

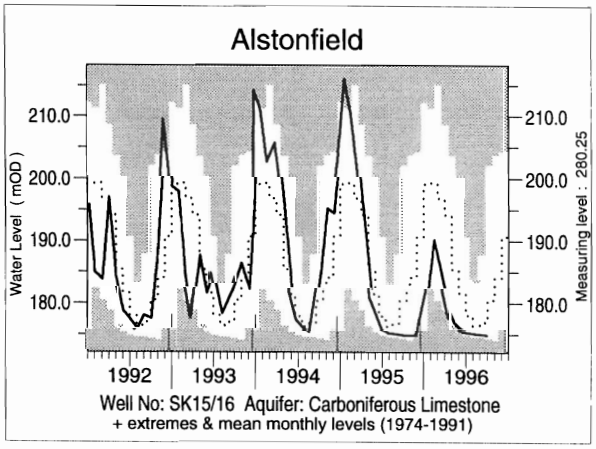

Alstonfield
Water Level (mOD)
210.0
200.0
190.0
180.0
Measuring level : 280.25
1992
1993
1994
1995
1996
Well No: SK15/16 Aquifer: Carboniferous Limestone
+ extremes & mean monthly levels (1974-1991)

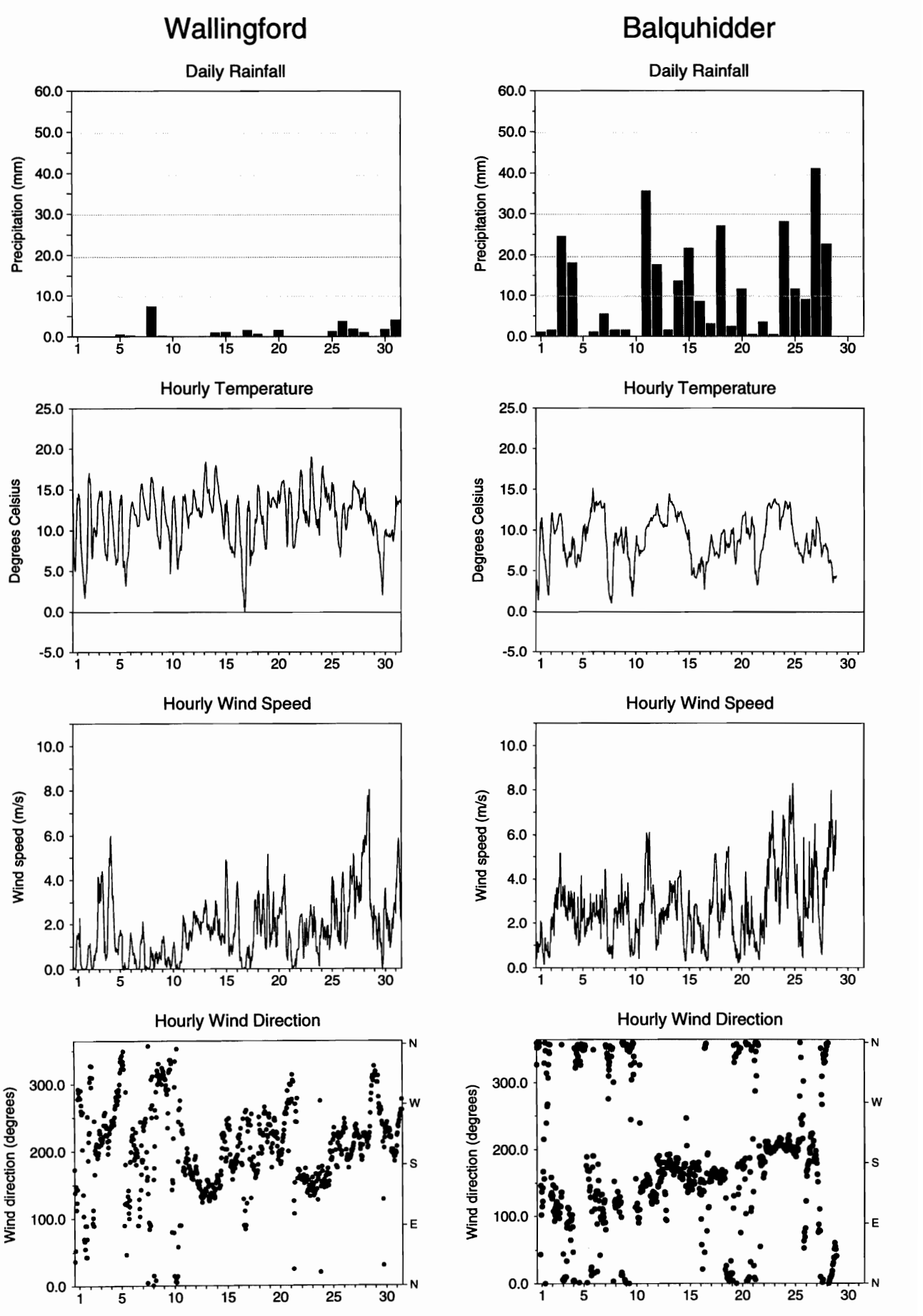
TABLE 5 OCTOBER GROUNDWATER LEVELS 1996

Site	Aquifer	Records commence	Minimum Oct	Average Oct	Maximum Oct	No. of years Oct/Nov	Oct/Nov 1996	
			<1996	<1996	<1996	level<1996	day	level
Dalton Holme	C & UGS	1889	10 .86	15.01	22.12	0	25/10	10.61
Wetwang	C & UGS	1971	17.26	19.01	20.80	2	25/10	17.69
Keelby Grange	C & UGS	1980	3.50	9.55	12.34	1	21/10	4.37
Washpit Farm	C & UGS	1950	40.43	43.62	46.09	1	01/11	40.77
The Holt	C & UGS	1964	84.19	87.11	89.65	6	28/10	85.64
Therfield Rectory	C&UGS	1883	dry <70.72	79.35	97.72	>10	28/10	74.80
Redlands Hall	C & UGS	1964	32.29	39.45	49.10	2	25/10	34.63
Rockley	C & UGS	1933	128.78	131.71	137.35	7	28/10	129.09
Little Bucket Farm	C & UGS	1971	57.48	63.30	69.33	1	28/10	dry< 57.05
Compton House	C & UGS	1894	27.64	33.27	57.30	5	15/10	29.70
Chilgrove House	C & UGS	1836	33.88	42.26	75.90	6	15/10	35.71
Westdean No.3	C & UGS	1940	1.11	1.55	3.68	>10	24/10	1.33
Lime Kiln Way	C & UGS	1969	123.75	125.06	125.53	>10	31/10	125.36
Ashton Farm	C & UGS	1974	63.48	65.24	69.12	4	01/11	64.16
West Woodyates Manor	C & UGS	1942	67.62	76.27	109.40	>10	01/11	69.48
Killyglen (NI)	C & UGS	1985	113.30	114.94	117.00	>10	31/10	114.85
New Red Lion	LLst	1964	3.82	11.44	17.98	2	17/10	6.29
Ampney Crucis	Mid Jur	1958	97.95	100.51	103.05	4	28/10	99.24
Redbank	PTS	1981	7.34	7.99	8.82	8	31/10	7.79
Yew Tree Farm	PTS	1973	11.54	13.17	13.73	7	06/11	13.29
Skirwith	PTS	1978	129.51	129.95	130.29	0	29/10	129.40
Llanfair D.C	PTS	1972	78.98	79.63	80.15	0	16/10	78.68
Morris Dancers	PTS	1969	31.83	32.58	33.55	>10	21/10	32.37
Heathlanes	PTS	1971	60.36	61.99	63.15	4	11/10	61.28
Bussels No.7A	PTS	1972	23.16	23.48	24.07	>10	23/10	23.47
Rushyford NE	MgLst	1967	64.82	73.38	76.41	>10	22/10	75.78
Peggy Ellerton	MgLst	1968	31.46	33.87	36.38	4	17/10	32.48
Alstonfield	CLst	1974	174.35	180.50	202.28	7	14/10	175.02

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

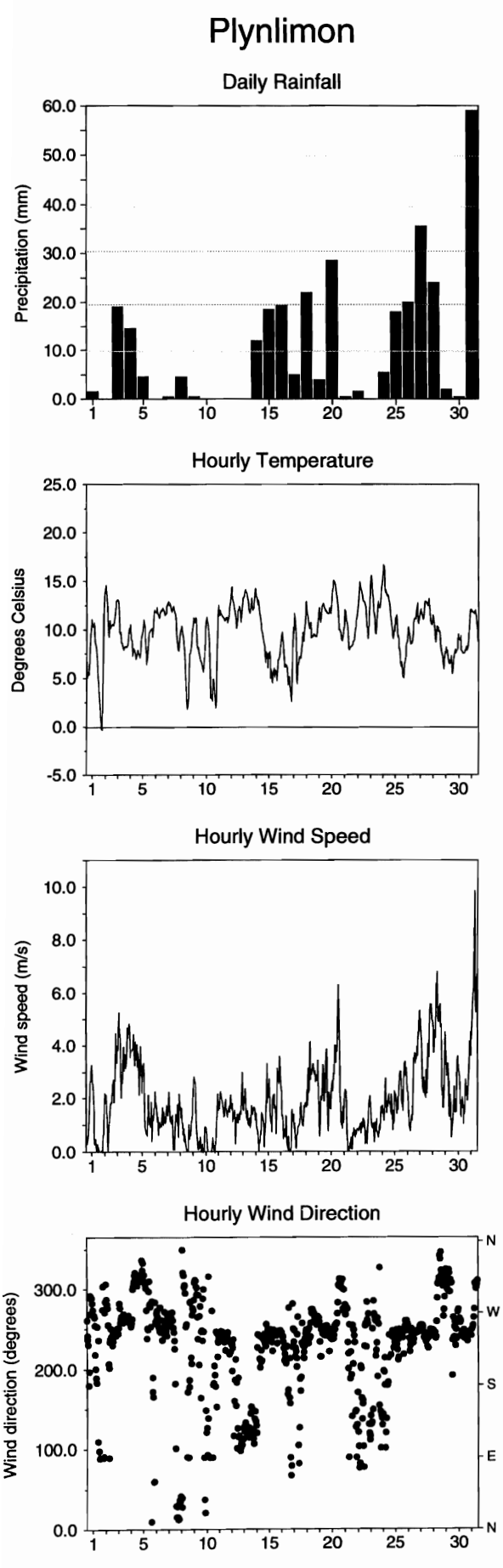
FIGURE 3 METEOROLOGICAL SUMMARY - OCTOBER 1996



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.

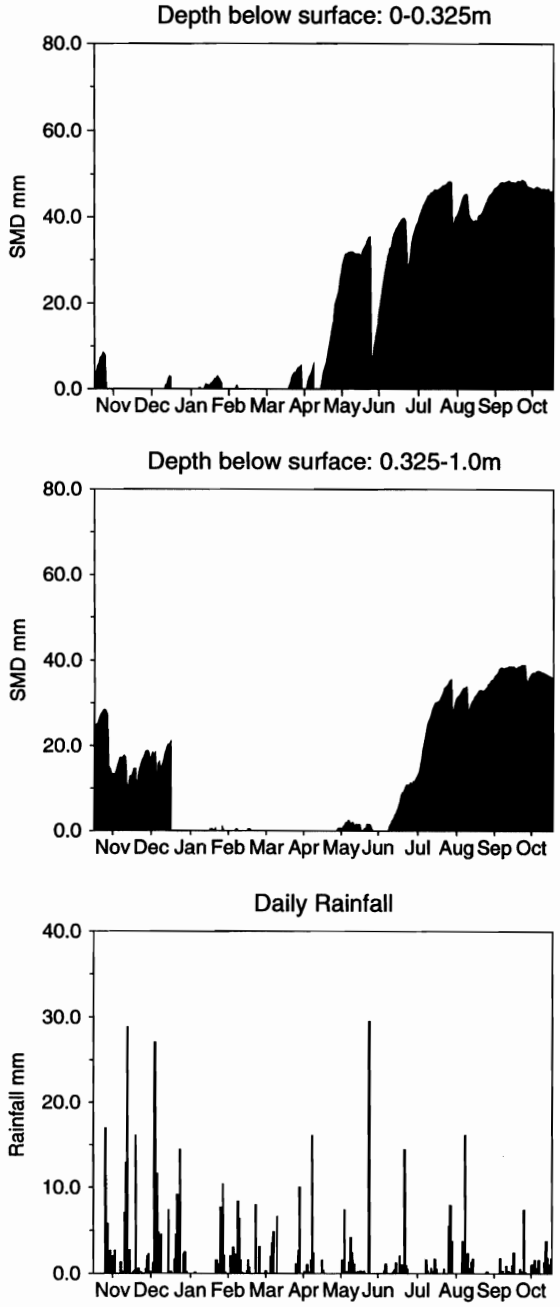
The Lower Kirkton automatic weather station (Balquhidder) occupies a relatively sheltered position at the mouth of the SSE trending Kirkton Glen. Station elevation is 270m aOD and average annual rainfall exceeds 2000mm; snow cover is expected for 10-30 days a year.
Data for October 1996 is from this AWS only until the 22nd. From the 23rd data is from the Monachyle AWS. There is no data from the 29th.

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 300m 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 met station from November 1995 is presented.

FIGURE 4 LOCATION MAP OF GAUGING STATIONS AND GROUNDWATER INDEX WELLS