Hydrological Summary for Great Britain

MARCH 1996

Rainfall

March was generally dull, cold and relatively dry with persistent high pressure, centred mostly between Iceland and Scandinavia, allowing little opportunity for rain-bearing westerlies to cross the British Isles. An unsettled period around the 18-25th produced significant precipitation in most areas but heralded a protracted sequence of rainless days. A few, mostly coastal, districts (e.g. in the eastern Scotland and Dorset) reported above average March rainfall but regional totals were mostly well below average with much of Scotland and northern England registering less than 65% of the 1961-90 mean. More significantly, rainfall deficiencies for 1996 thus far are substantial in most regions - notably so in parts of northern Scotland where rainfall accumulations in the 3-5 month timeframes are remarkably low. A run of nine wet (some extremely so) winter half-years for Scotland was ended by the driest October-March for 20 years. Over the same timespan, England and Wales recorded its third driest winter (88/89 and 90/91 were drier; 75/76 was much drier) but deficiencies in parts of northern England - the North-West particularly - are exceptional. The overall severity of the drought and its regional focus is best illustrated by the April-March rainfall. The 12-month total for Scotland is the lowest since 1973 and for England and Wales only in 1933/34 and 1975/76 (when the spatial distribution was very different) has a lower total been recorded in the last 140 years; since 1976 there have been no lower 12-month accumulations (for any start month). A number of raingauges in the North-West and the Pennines have recorded unprecedented 12-month rainfall totals - in some cases in series extending beyond 100 years. Rainfall deficiencies in such areas are remarkable - equivalent to around five months average rainfall; deficiencies equivalent to three months or more extend across large parts of northern England, and into the Midlands and North Wales.

River Flow

The upturn in runoff rates during February proved short-lived and apart from some minor spates around the 12th & 25th, river flows were mostly in recession during March. Monthly runoff totals were a little above average in a number of catchments in the South-West (Wessex particularly). Elsewhere, flows were within the normal range in most of southern Britain, albeit considerably below average, but notably depressed in a broad zone from western Scotland to the Midlands - and in a few impermeable catchments in the South-East. New minimum March runoff totals were established in rivers as widely separated as the Kent Stour and the Carron - depressed runoff rates in north-west Scotland are a matter of concern to the hydro-power industry. Most Pennine rivers recorded flow rates more typical of the late summer. The severity of the runoff deficiency in such areas is evident from the 3-, 6-, and 12-month accumulated totals (see Table 3). The Wharfe has established new minima for each timespan and catchments registering unprecedented April-March runoff totals show a wide distribution in northern Britain; the Welsh Dee (at Manley Hall) eclipsing the previous minimum in a 56-year record.

Groundwater

The cold weather in March produced relatively stable (and modest) soil moisture deficits but the brisk increases in early April may signal the end of the infiltration season in some eastern aquifers; some further recovery in the deeper Chalk wells may be anticipated as late-winter recharge reaches the water-table. Provisional data suggest that the 1995/96 recharge total has been less than 20% of average in some districts and very modest in many northern aquifers. By contrast, most south-western aquifers have benefitted from near normal replenishment. March levels in parts of the eastern Chalk were close to the seasonal minimum and causing concern (e.g. in parts of Kent and East Sussex) but overall groundwater resources are considerably healthier than at the same time in 1976 or 1992. Water-tables in the Jurassic, Carboniferous and Lincolnshire Limestones are close to or below the seasonal mean but, away from the South-West, levels in the Permo-Triassic sandstones outcrops are amongst the lowest on record for the spring. Given typical April/May rainfall, however, some further recovery may be anticipated in these areas.

General

Most reservoir stocks increased appreciably in March but in Yorkshire and the North-West (and parts of the South-West and Wales) they remain well short of the near-capacity to be expected in the early spring. With evaporation rates now accelerating, a very wet late spring and above average summer rainfall is now needed to extend the replenishment season and thence to suppress water demand. Currently the drought has a clear regional focus but a repeat of the spring and summer conditions experienced in 1990 or 1995 would trigger widespread demand restrictions, create considerable environmental stress in many river systems and fuel concern regarding the resources prospects for late-1996 and 1997.

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

Tel: 01344 856858 Fax: 01344 854024

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

 12 April 1996

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

		Mar 1995	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan 1996	Feb	Mar
England and Wales	mm	67	27	49	23	40	10	112	54	80	82	65	84	50
	%	93	45	77	35	65	13	145	64	89	87	74	133	69
North West	mm	107	28	65	39	65	18	94	86	65	37	55	98	45
	%	113	39	87	48	76	17	82	67	53	30	45	125	48
Northumbrian	mm	59	38	53	30	29	12	111	56	112	78	46	80	32
	%	84	68	85	50	45	15	152	74	130	96	55	135	46
Severn Trent	mm	51	20	49	13	35	9	93	38	64	79	45	66	38
	%	84	36	83	22	66	13	145	59	90	103	64	121	63
Yorkshire	mm	65	27	44	23	29	9	97	29	61	69	48	74	47
	%	96	46	73	38	49	12	143	40	76	83	61	128	69
Anglian	mm	51	16	30	25	25	8	101	16	42	66	34	51	22
	%	109	35	63	49	51	15	206	31	72	120	68	137	46
Thames	mm	51	18	37	16	31	4	114	35	64	92	52	58	34
	%	91	36	66	29	63	7	193	56	98	131	81	129	60
Southern	mm	59	18	23	20	31	5	140	34	63	94	69	67	42
	%	94	34	43	37	65	9	203	43	74	115	86	124	67
Wessex	mm	57	35	53	14	26	10	143	69	123	103	77	75	61
	%	81	66	87	25	50	15	199	87	148	111	89	116	86
South West	mm	93	50	55	19	47	16	135	104	132	127	157	129	79
	%	94	72	76	28	68	19	145	90	106	91	114	127	79
Welsh	mm	88	37	77	27	69	14	125	110	129	101	102	109	77
	%	82	46	94	34	90	14	109	80	91	66	71	112	72
Scotland	mm	143	67	84	43	86	34	195	228	125	53	90	130	96
	%	114	88	98	50	91	29	137	146	83	35	60	127	77
Highland	mm	177	97	89	47	101	45	245	249	161	46	61	126	118
	%	109	107	97	48	95	35	143	126	79	23	32	99	73
North East	mm	74	68	80	53	45	27	293	104	99	67	75	90	75
	%	95	113	116	80	62	31	337	107	100	72	76	138	96
Tay	mm	110	39	96	32	67	20	180	217	116	61	132	135	113
	%	101	63	116	44	87	21	158	167	96	48	92	142	104
Forth	mm	92	35	71	31	70	21	135	197	90	54	73	82	63
	%	98	59	96	45	93	22	123	171	80	49	62	104	67
Tweed	mm	75	36	65	35	43	23	122	134	97	63	72	95	40
	%	95	63	92	54	59	26	137	141	104	68	72	142	51
Solway	mm	145	40	84	44	79	23	102	251	111	51	134	192	99
	%	124	52	99	52	88	19	71	160	77	34	86	190	85
Clyde	mm	196	66	83	44	125	40	137	319	118	48	117	160	92
	%	133	79	91	47	115	30	77	165	66	27	62	136	63

Note: The monthly regional rainfall figures for England and Wales for February & March 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 February & March 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 RETURN PERIOD ESTIMATES

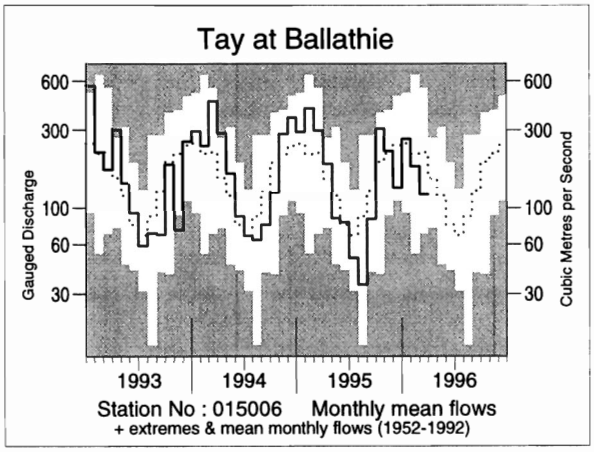
		Jan 96-Mar 96		Oct 95-Mar 96		Apr 95-Mar 96		Sep 94-Mar 96	
		Est Return Period, years		Est Return Period, years		Est Return Period, years		Est Return Period, years	
England and Wales	mm	198		414		675		1449	
	% LTA	89	2-5	84	5	75	30-50	99	2-5
North West	mm	198		386		695		1754	
	% LTA	67	5-15	58	80-120	58	>>200	88	5-10
Northumbria	mm	158		404		677		1334	
	% LTA	74	5-10	89	2-5	79	10-20	97	2-5
Severn Trent	mm	149		330		549		1203	
	% LTA	80	5	83	5	73	30-50	99	2-5
Yorkshire	mm	169		328		557		1241	
	% LTA	82	2-5	74	5-15	68	80-120	93	2-5
Anglian	mm	106		230		435		896	
	% LTA	79	5	77	5-10	73	30-50	95	2-5
Thames	mm	144		335		555		1130	
	% LTA	87	2-5	92	2-5	81	5-15	102	2-5
Southern	mm	178		369		606		1337	
	% LTA	90	2-5	83	5	78	10-20	103	2-5
Wessex	mm	213		508		789		1590	
	% LTA	96	2-5	106	2-5	94	2-5	115	5-10
South West	mm	364		727		1049		2152	
	% LTA	108	2-5	101	2-5	89	2-5	108	2-5
Welsh	mm	287		627		976		2146	
	% LTA	83	2-5	81	5-10	74	30-45	97	2-5
Scotland	mm	316		722		1231		2420	
	% LTA	84	5	86	5-10	86	10-15	100	<2
Highland	mm	305		761		1385		2874	
	% LTA	64	20-40	71	30-45	79	30-45	96	2-5
North East	mm	240		510		1076		1725	
	% LTA	99	2-5	96	2-5	111	5-10	108	5-10
Tay	mm	380		774		1208		2208	
	% LTA	109	2-5	107	2-5	98	2-5	107	2-5
Forth	mm	218		559		922		1829	
	% LTA	75	5-10	89	2-5	83	5-15	99	2-5
Tweed	mm	207		501		825		1566	
	% LTA	84	2-5	95	2-5	85	5-10	99	2-5
Solway	mm	425		838		1210		2373	
	% LTA	114	2-5	102	2-5	85	5-10	99	2-5
Clyde	mm	369		854		1349		2790	
	% LTA	81	5	85	5-10	80	20-30	97	2-5

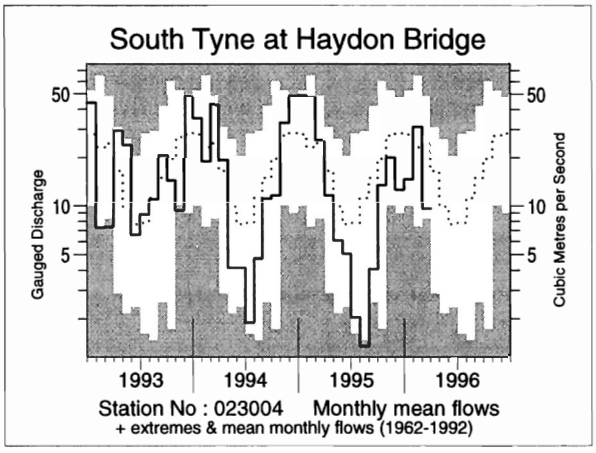
LTA refers to the period 1961-90.

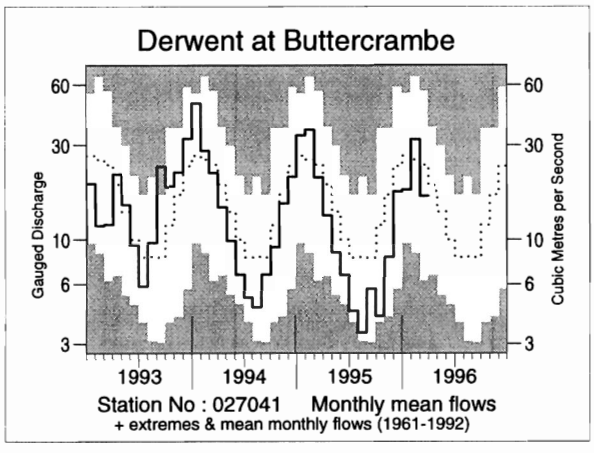
Return period assessments are based on tables provided by the Meteorological Office*. The tables reflect rainfall totals over the period 1911-70 only and the estimate assumes a sensibly stable climate. They assume a start in a specified month; return periods for a start in any month may be expected to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

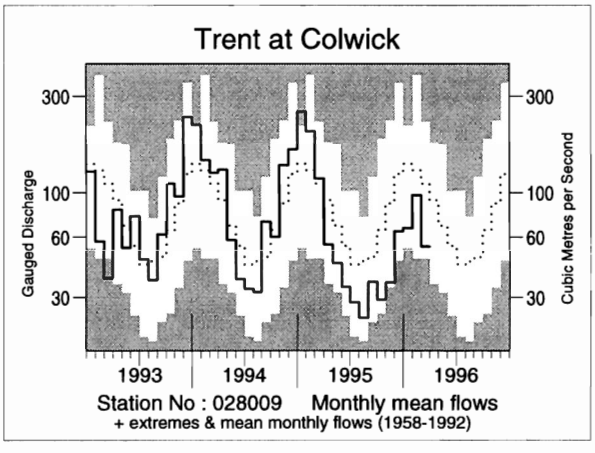
* Tabony, R.C., 1977, The Variability of long duration rainfall over Great Britain, Scientific Paper No. 37, Meteorological Office.

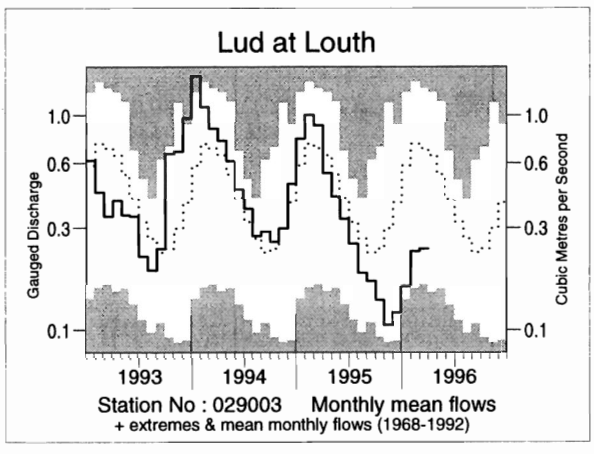
FIGURE 1 MONTHLY RIVER FLOW HYDROGRAPHS

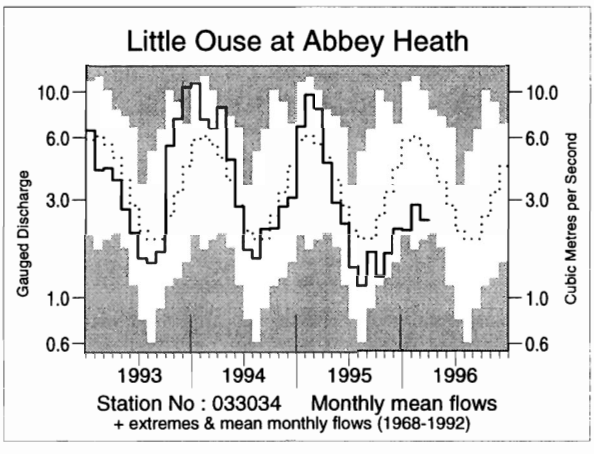


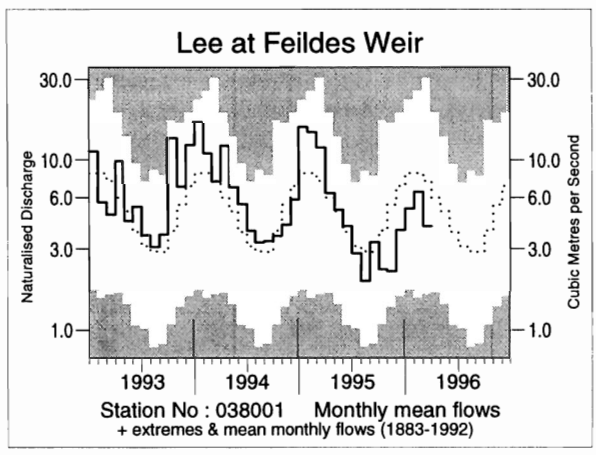


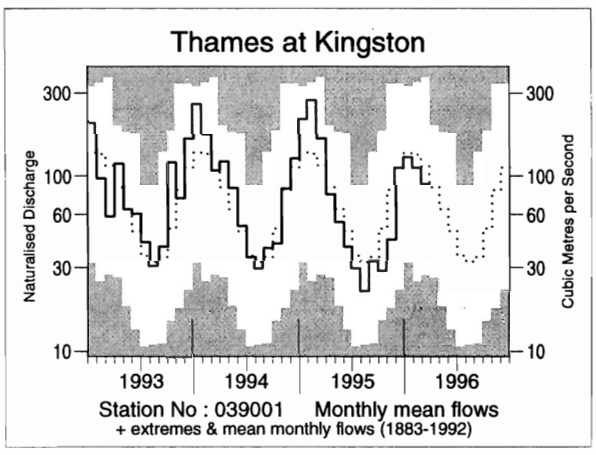


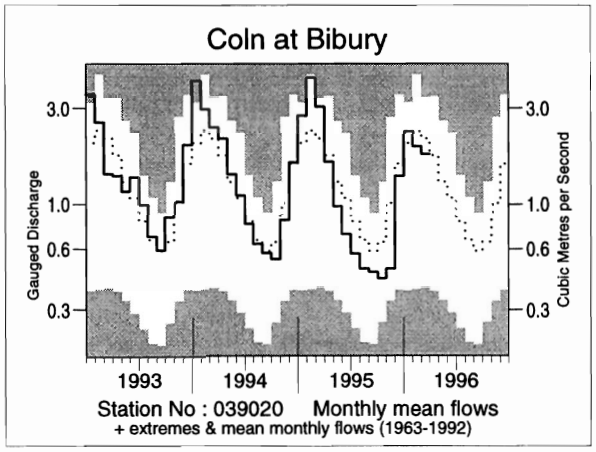


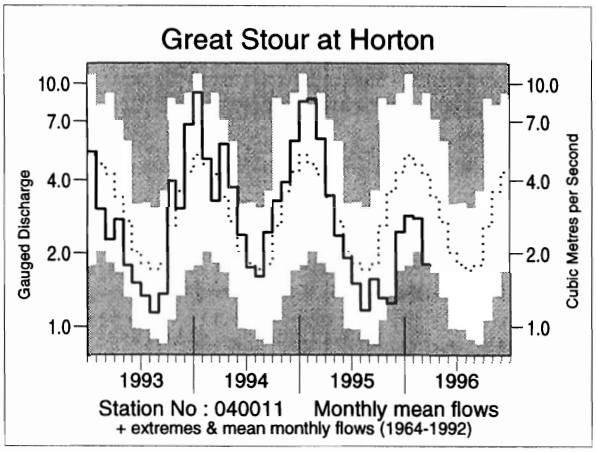


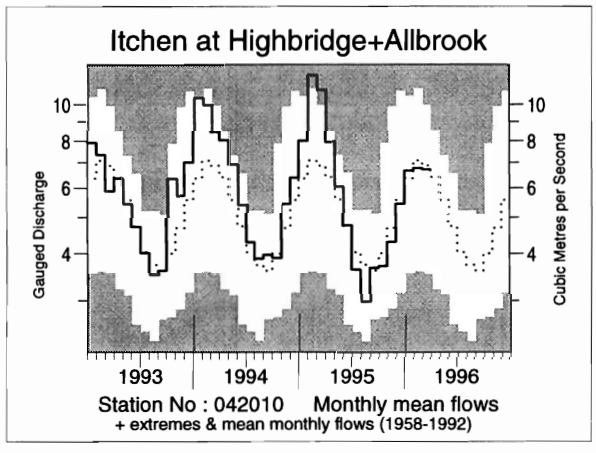


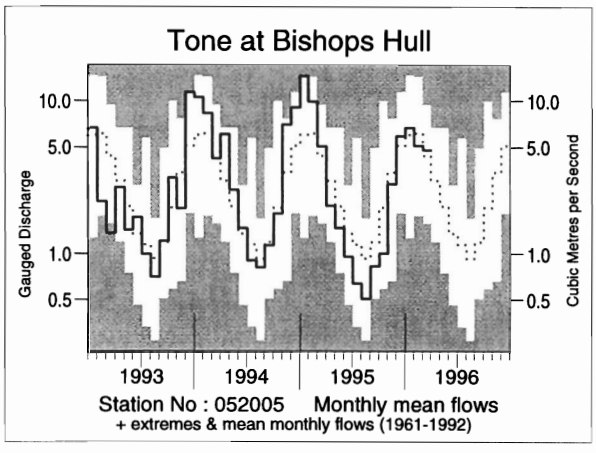


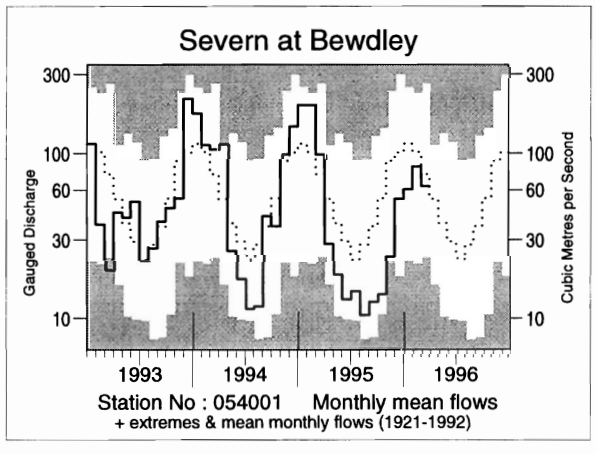


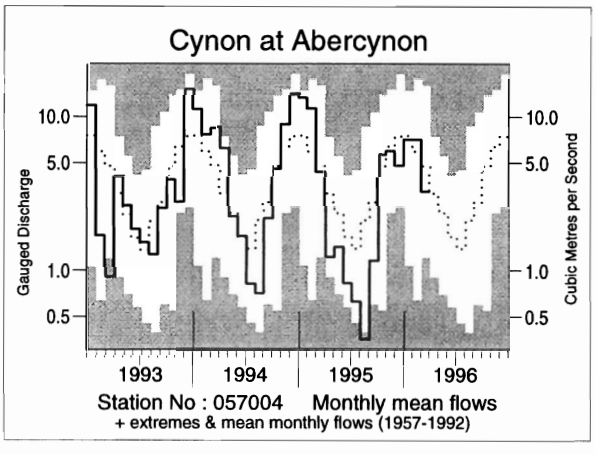

Coln at Bibury
Gauged Discharge
Cubic Metres per Second
3.0
1.0
0.6
0.3
1993
1994
1995
1996
Station No : 039020 Monthly mean flows
+ extremes & mean monthly flows (1963-1992)

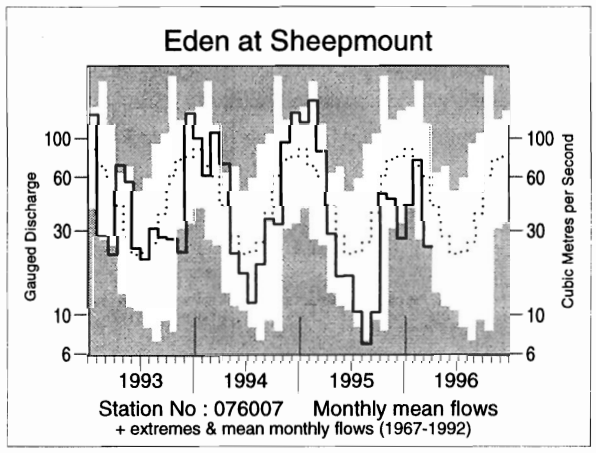

Great Stour at Horton
Gauged Discharge
Cubic Metres per Second
10.0
7.0
4.0
2.0
1.0
1993
1994
1995
1996
Station No : 040011 Monthly mean flows
+ extremes & mean monthly flows (1964-1992)


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)

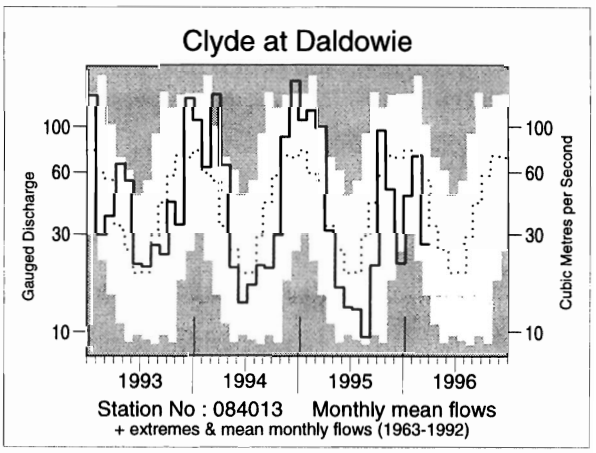

Clyde at Daldowie
Gauged Discharge
Cubic Metres per Second
100
60
30
10
1993
1994
1995
1996
Station No : 084013 Monthly mean flows
+ extremes & mean monthly flows (1963-1992)

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	Nov 1995	Dec	Jan 1996	Feb	Mar 1996		1/96 to 3/96		10/95 to 3/96		4/95 to 3/96		4/94 to 3/96	
	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	105	73	156	99	71	8	327	20	603	19	932	19	1161	13
Park	138	86	167	138	74	/24	123	/24	116	/23	117	/23	104	/22
Tay at	125	77	155	98	71	8	324	15	710	14	1010	11	2458	30
Ballathie	104	54	104	86	54	/44	82	/44	92	/44	88	/43	107	/42
Tweed at	82	36	90	113	42	7	245	17	469	9	595	5	1536	12
Boleside	94	36	84	148	51	/36	91	/36	89	/35	78	/35	100	/34
Whiteadder Water at	38	46	54	64	37	11	155	13	249	12	317	9	576	6
Hutton Castle	104	98	89	135	75	/27	100	/27	93	/27	82	/26	74	/25
South Tyne at	69	45	52	104	35	4	191	4	353	3	460	1	1384	5
Haydon Bridge	74	42	51	142	40	/34	72	/34	67	/34	59	/32	88	/30
Wharfe at	22	17	34	68	23	2	125	1	181	1	258	1	1129	1
Flint Mill Weir	28	17	34	92	30	/41	50	/41	37	/41	36	/40	78	/39
Derwent at	13	30	30	51	28	12	109	15	159	8	229	6	530	8
Buttercrambe	48	73	66	131	71	/35	88	/35	75	/35	71	/34	82	/33
Trent at	13	23	24	32	19	3	76	3	122	2	200	2	654	13
Colwick	40	50	47	78	49	/38	57	/38	53	/38	57	/37	92	/36
Lud at	5	6	8	11	12	3	30	4	47	3	138	3	446	10
Louth	34	29	26	32	34	/28	31	/28	34	/28	/55	/27	89	/26
Witham at	6	7	13	17	16	10	46	8	63	8	103	6	372	18
Claypole Mill	43	35	49	66	63	/37	59	/37	53	/37	55	/36	100	/35
Little Ouse at	6	8	8	10	9	3	27	3	47	4	99	4	301	10
Abbey Heath	49	48	35	48	43	/28	42	/28	45	/28	59	/28	89	/27
Mimram at	7	9	10	10	10	10	30	14	54	12	132	27	315	39
Panshanger Park	83	86	83	83	79	/44	81	/44	85	/43	104	/43	125	/42
Lee at	6	10	13	16	11	19	39	21	61	23	121	30	349	61
Feildes Weir (natr.)	41	55	61	80	54	/110	/64	/110	59	/110	74	/108	107	/106
Thames at	11	30	35	28	25	44	88	46	137	=37	205	36	536	69
Kingston (natr.)	52	100	94	86	80	/114	87	/114	83	/113	83	/113	109	/112
Coln at	12	35	58	46	45	12	149	12	206	9	325	9	805	16
Bibury	48	86	110	85	84	/33	92	/33	85	/33	82	/32	101	/31
Great Stour at	9	19	22	20	14	1	56	5	95	1	186	2	592	15
Horton	34	55	55	62	43	/32	53	/32	50	/31	64	/29	101	/27
Itchen at	31	40	49	47	50	15	147	16	246	18	457	18	1031	29
Highbridge+Allbrook	91	97	102	97	98	/38	98	/38	96	/38	99	/37	112	/36
Stour at	37	56	67	64	49	11	180	13	285	11	356	9	960	19
Throop Mill	112	96	107	112	99	/24	102	/24	97	/23	89	/23	119	/22
Exe at	72	124	109	89	64	17	263	10	494	8	585	3	1795	25
Thorverton	73	90	83	87	76	/40	82	/40	78	/40	70	/39	107	/38
Taw at	52	99	91	67	38	7	197	8	365	4	416	2	1434	22
Umberleigh	56	82	78	79	56	/38	72	/38	67	/38	60	/37	102	/36
Tone at	36	77	87	62	63	24	212	20	338	17	421	13	1191	31
Bishops Hull	82	108	108	87	112	/36	100	/35	96	/35	88	/35	124	/34
Severn at	14	33	37	48	39	38	125	13	180	3	239	3	834	26
Bewdley	27	51	52	85	85	/75	71	/75	56	/75	53	/75	92	/74
Teme at	13	40	57	57	48	17	162	12	218	6	254	5	773	14
Knightsford Bridge	39	69	86	113	103	/26	97	/26	79	/26	69	/26	105	/25
Cynon at	146	121	178	167	82	16	428	16	838	13	975	5	2698	22
Abercynon	94	61	91	124	69	/38	94	/38	90	/38	77	/36	106	/34
Dee at	119	82	136	173	68	3	377	4	684	1	932	1	3210	7
New Inn	50	31	57	106	37	/27	64	/27	54	/27	52	/26	89	/25
Eden at	51	31	49	82	28	2	159	3	298	1	400	1	1323	11
Sheepmount	61	32	47	114	40	/26	64	/26	60	/25	58	/24	96	/22
Clyde at	68	30	65	95	38	5	197	6	430	6	573	5	1627	17
Daldowie	69	28	58	126	47	/33	73	/33	78	/33	73	/32	103	/31
Carron at	201	27	47	151	70	1	268	1	822	1	1402	1	4236	1
New Kelso	71	8	15	72	24	/18	33	/18	49	/17	55	/17	82	/16
Ewe at	236	86	54	104	106	5	264	2	900	2	1532	2	4062	9
Poolewe	90	31	20	56	51	/26	40	/26	63	/25	72	/25	94	/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.

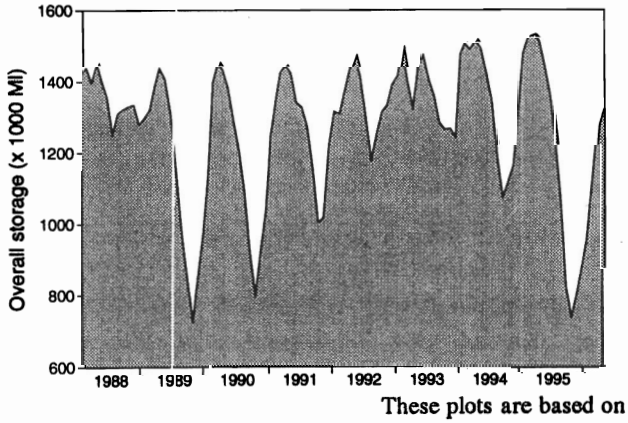
TABLE 4 START-MONTH RESERVOIR STORAGES UP TO APRIL 1996

Area	Reservoir (R)/ Group (G)		Capacity ● (Ml)	1995 Nov	Dec	1996 Jan	Feb	Mar	Apr	1995 Apr
North West	N.Command Zone[1]	(G)	133375	44	57	51	63	78	78	99
	Vyrnwy	(R)	55146	25	33	35	45	59	64	97
Northumbria	Teesdale[2]	(G)	87936	33	39	41	51	72	77	99
	Kielder	(R)	199175*	88*	91*	89*	93*	95*	96*	97*
Severn-Trent	Clywedog	(R)	44922	38	43	54	62	77	86	97
	Derwent Valley[3]	(G)	39525	15	9	10	15	46	54	100
Yorkshire	Washburn[4]	(G)	22035	15	16	23	34	53	70	98
	Bradford supply[5]	(G)	41407	16	20	22	33	53	59	98
Anglian	Grafham	(R)	58707	72	72	83	92	94	94	95
	Rutland	(R)	130061	59	57	61	72	82	92	91
Thames	London[6]	(G)	206399	67	71	82	89	94	94	97
	Farmoor [7]	(G)	13843	87	98	89	99	96	99	97
Southern	Bewl	(R)	28170	65	60	65	82	96	99	99
	Ardingly	(R)	4685	47	45	67	84	100	100	100
Wessex	Clatworthy	(R)	5364	35	63	92	91	100	100	100
	Bristol W [8]	(G)	38666*	37*	43*	60*	73*	86*	95*	99*
South West	Colliford	(R)	28540	45	42	46	55	61	63	97
	Roadford[9]	(R)	34500	18	19	23	30	35	37	96
	Wimbleball[10]	(R)	21320	26	34	46	60	72	78	100
	Stithians	(R)	5205	26	31	54	100	100	99	96
Welsh	Celyn + Brenig	(G)	131155	49	50	54	61	69	72	100
	Brianne	(R)	62140	57	72	76	97	100	100	100
	Big Five[11]	(G)	69762	41	56	67	84	94	94	99
	Elan Valley[12]	(G)	99106	37	47	56	73	95	98	95
East of Scotland	Edin./Mid Lothian[13]	(G)	97639	85	91	91	96	100	96	99
	East Lothian[14]	(G)	10206	74	95	99	99	100	99	100
West of Scotland	Loch Katrine	(G)	111363	92	95	80	91	96	94	100
	Daer	(R)	22412	83	93	83	97	100	96	96
	Loch Thom	(G)	11840	100	97	93	100	98	98	100

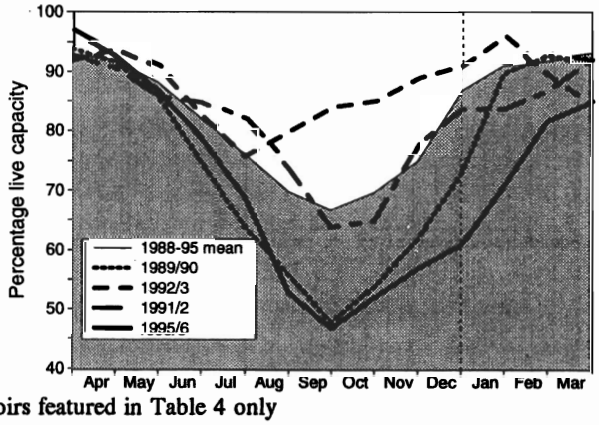
● Live or usable capacity (unless indicated otherwise) * Gross storage/percentage of gross storage

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 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



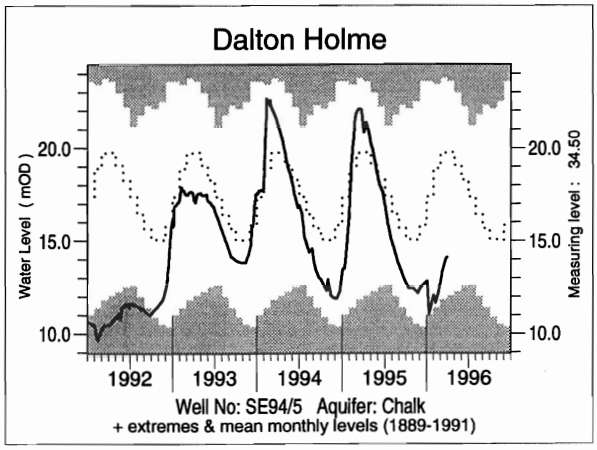
A COMPARISON BETWEEN OVERALL RESERVOIR STOCKS FOR ENGLAND AND WALES IN RECENT YEARS

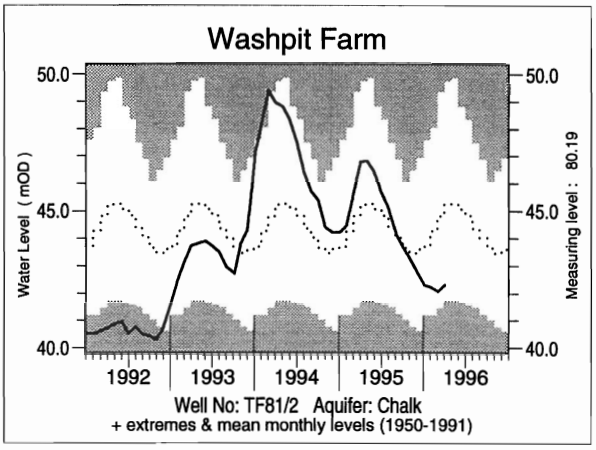


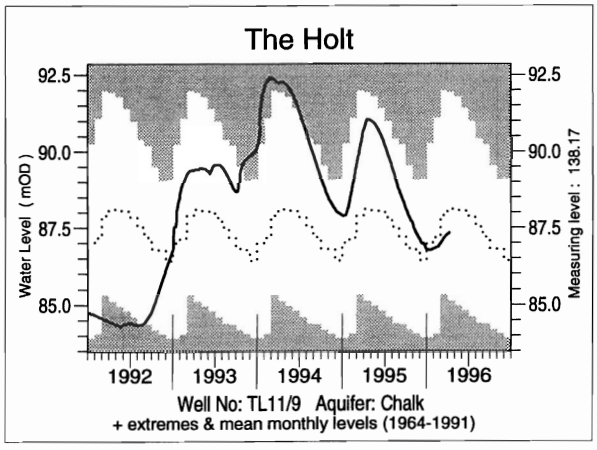
These plots are based on the reservoirs featured in Table 4 only

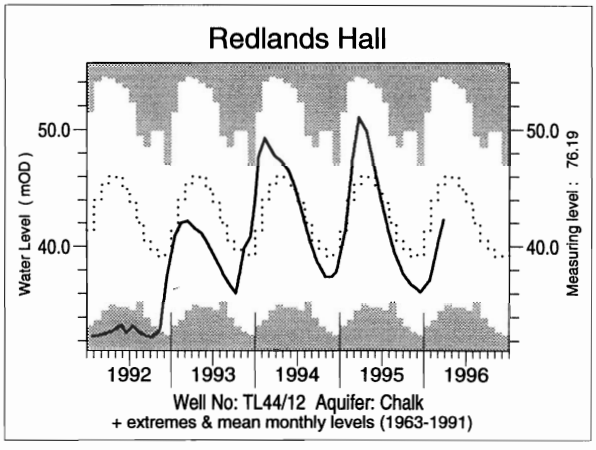
Note: Variations in storage depend on the balance between inputs (from catchment rainfall and any pumping) and outputs (to supply, compensation flow, HEP, amenity). There will be additional losses due to evaporation, especially in the summer months. Operational strategies for making the most efficient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

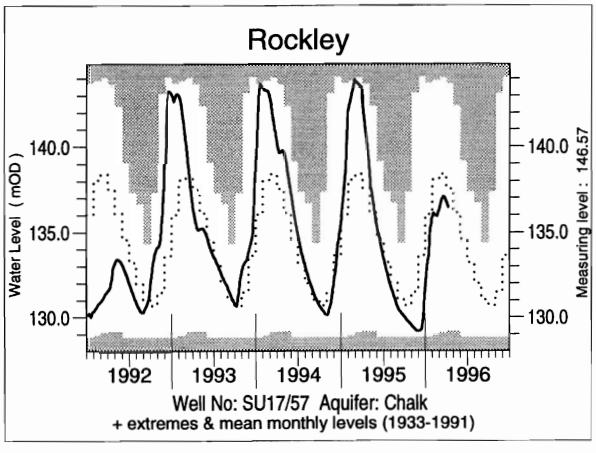
FIGURE 2 GROUNDWATER LEVEL HYDROGRAPHS

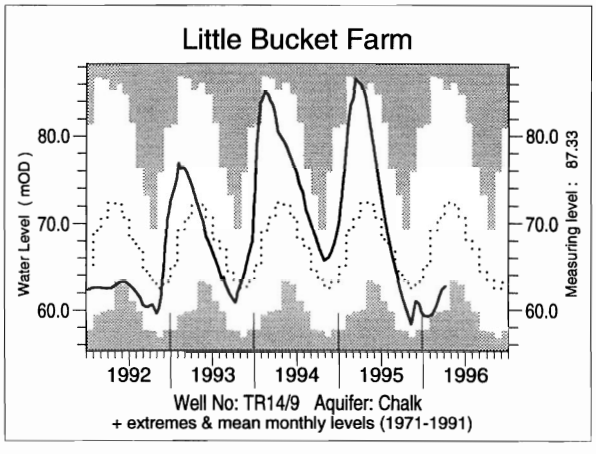


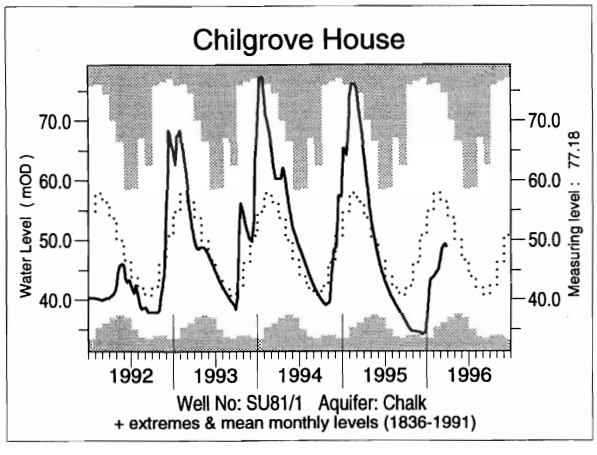


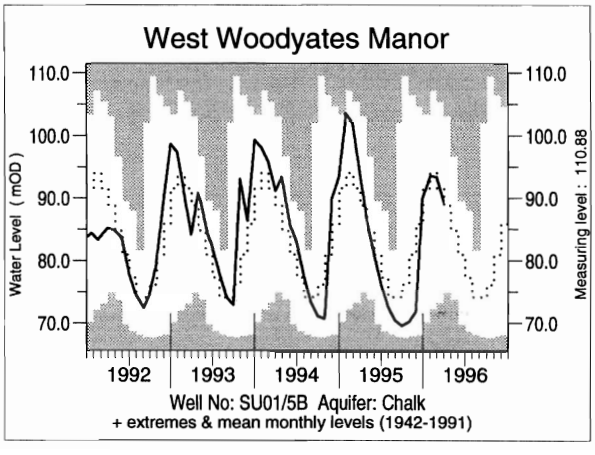


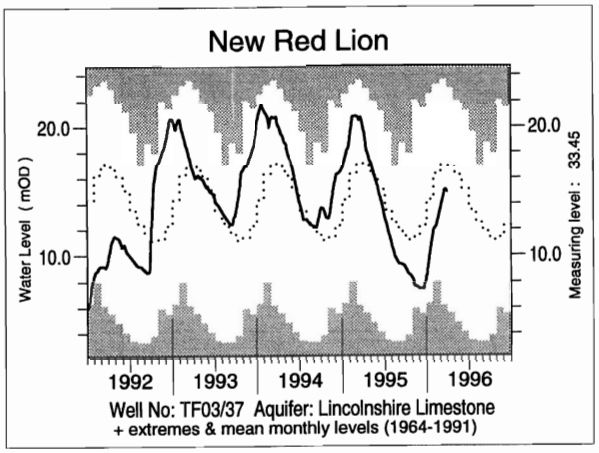


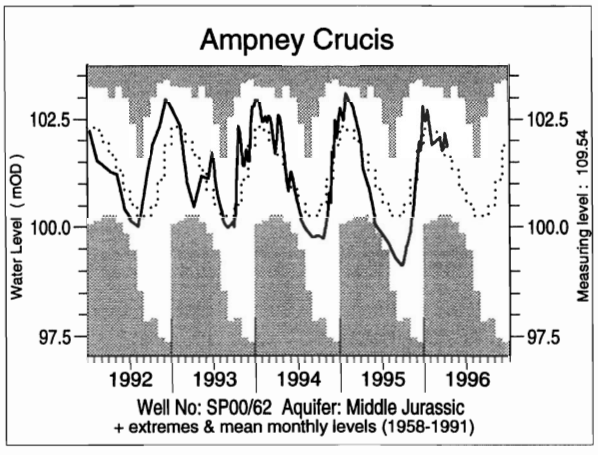


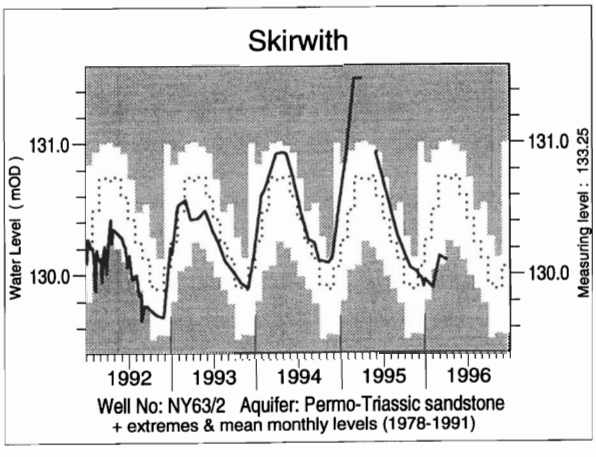


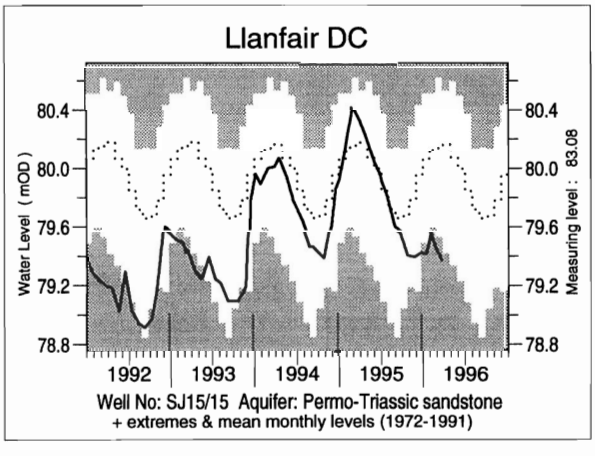


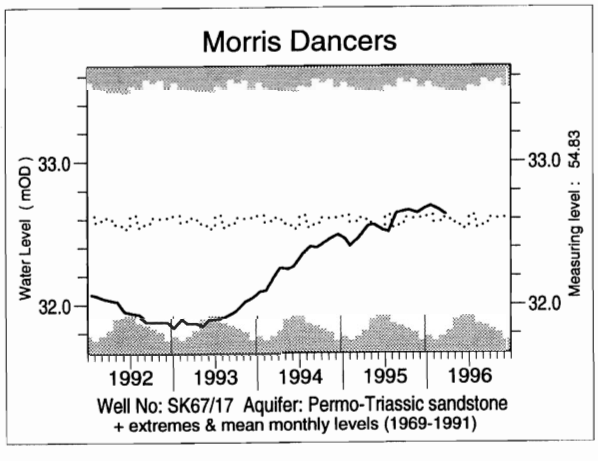


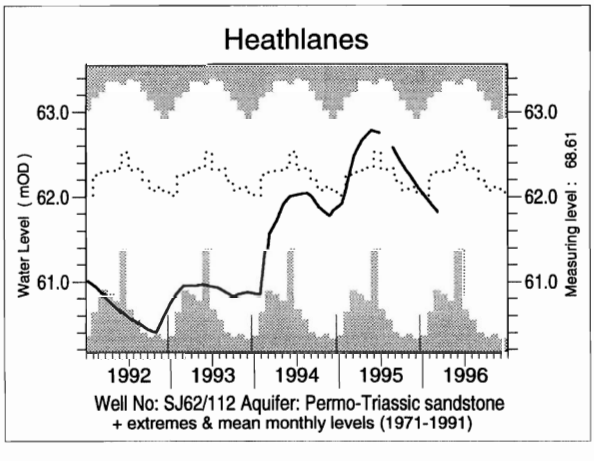

New Red Lion
Water Level (mOD)
20.0
10.0
Measuring level : 33.45
1992
1993
1994
1995
1996
Well No: TF03/37 Aquifer: Lincolnshire Limestone
+ extremes & mean monthly levels (1964-1991)

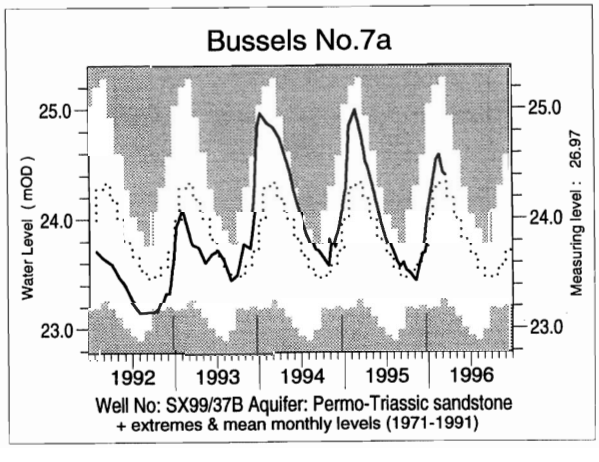

Ampney Crucis
Water Level (mOD)
102.5
100.0
97.5
Measuring level : 109.54
1992
1993
1994
1995
1996
Well No: SP00/62 Aquifer: Middle Jurassic
+ extremes & mean monthly levels (1958-1991)


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)

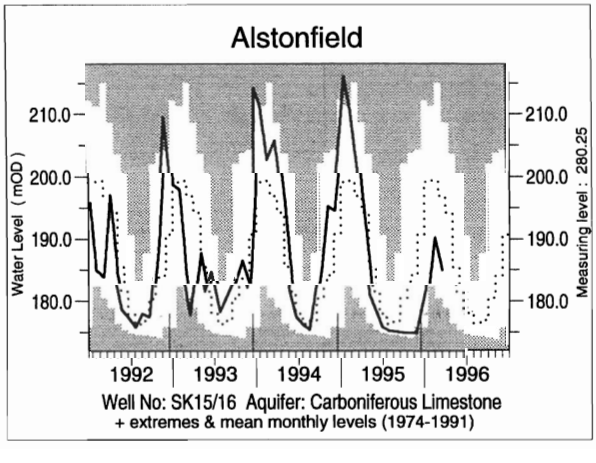

Alstonfield
Water Level (mOD)
210.0
200.0
190.0
180.0
Measuring level : 280.25
1992
1993
1994
1995
1996
Well No: SK15/16 Aquifer: Carboniferous Limestone
+ extremes & mean monthly levels (1974-1991)

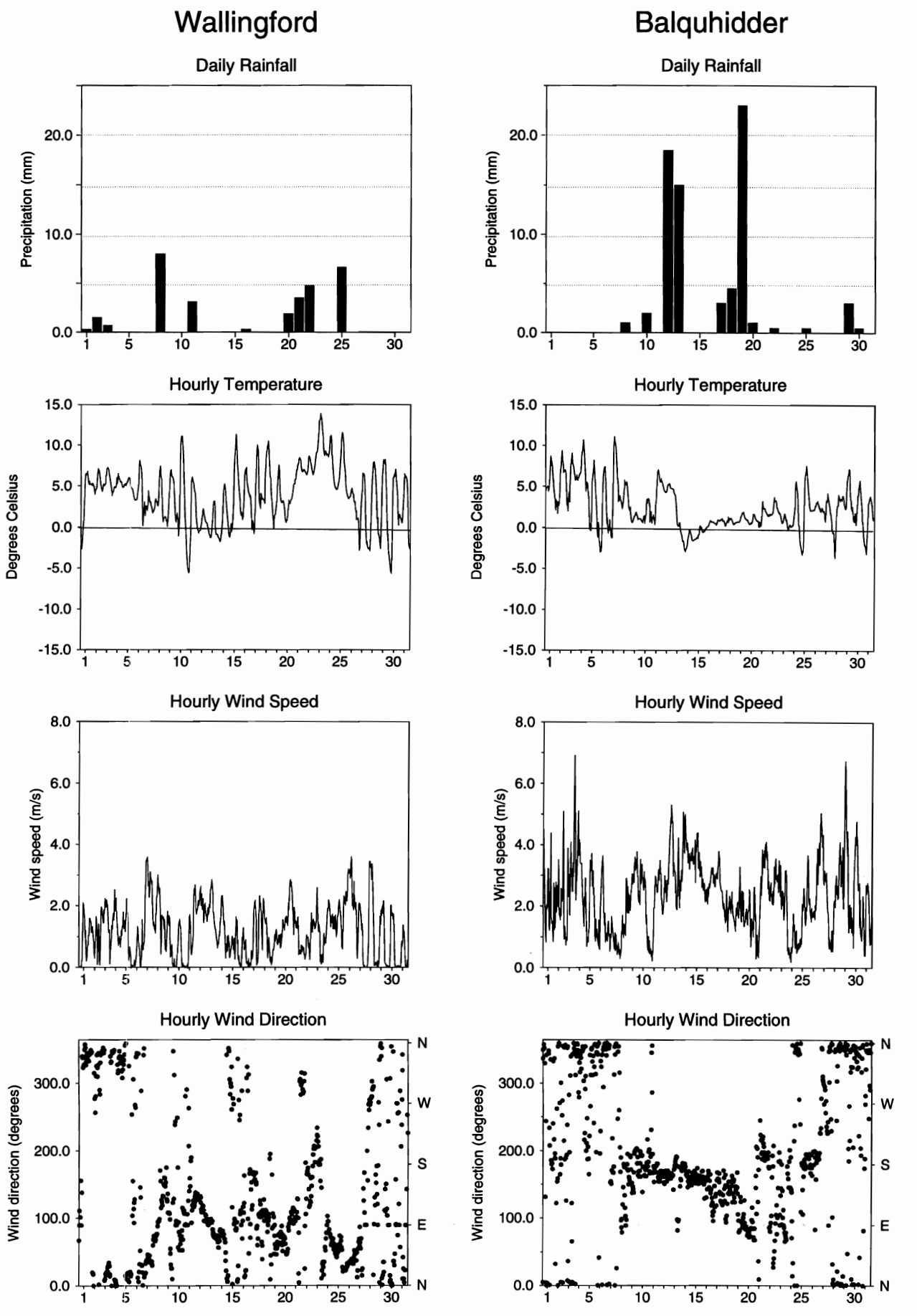
TABLE 5 MARCH GROUNDWATER LEVELS 1996

Site	Aquifer	Records commence	Minimum Mar <1996	Average Mar <1996	Maximum Mar <1996	No. of years Mar/Apr level<1996	Mar/Apr 1996 day	Mar/Apr 1996 level
Dalton Holme	C & UGS	1889	10 .34	19.72	23.82	9	01/04	14.10
Wetwang	C & UGS	1971	17.16	25.24	35.15	6	01/04	22.87
Keelby Grange	C & UGS	1980	3.74	13.29	18.73	1	03/04	6.28
Washpit Farm	C & UGS	1950	40.61	44.94	49.39	3	03/04	42.32
The Holt	C & UGS	1964	84.47	87.89	92.34	>10	09/04	87.33
Therfield Rectory	C&UGS	1883	dry <71.60	79.13	96.83	>10	09/04	79.28
Redlands Hall	C & UGS	1964	32.62	44.41	54.50	>10	25/03	42.28
Rockley	C & UGS	1933	129.10	138.47	144.06	>10	09/04	136.46
Little Bucket Farm	C & UGS	1971	59.67	72.25	86.58	2	11/04	62.74
Compton House	C & UGS	1984	29.40	46.86	65.00	>10	15/03	39.19
Chilgrove House	C & UGS	1836	35.97	55.89	74.68	>10	26/03	48.93
Westdean No.3	C & UGS	1940	1.31	2.20	4.14	4	31/03	1.46
Lime Kiln Way	C & UGS	1969	124.07	125.48	126.48	>10	21/03	126.16
Ashton Farm	C & UGS	1974	64.67	69.55	71.10	>10	29/03	70.47
West Woodyates Manor	C & UGS	1942	73.18	90.67	105.44	>10	29/03	89.39
New Red Lion	LLst	1964	6.14	16.75	23.69	8	30/03	14.88
Ampney Crucis	Mid Jur	1958	100.29	102.03	103.26	>10	11/04	101 .90
Redbank	PTS	1981	7.88	8.55	9.45	2	01/04	8.08
Skirwith	PTS	1978	129.95	130.71	131.49	2	02/04	130.11
Llanfair D.C	PTS	1972	79.24	80.03	80.63	1	15/03	79.38
Morris Dancers	PTS	1969	31.78	32.50	33.51	>10	22/03	32.63
Heathlanes	PTS	1971	60.88	62.09	63.25	9	07/03	61.82
Bussels No.7A	PTS	1972	23.26	24.32	25.28	>10	27/03	24.39
Rushyford NE	MgLst	1967	65.59	72.68	76.97	>10	18/03	76.34
Peggy Ellerton	MgLst	1968	31.64	34.52	36.93	10	18/03	34.02
Alstonfield	CLst	1974	180.54	196.28	215.15	4	18/03	184.98

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

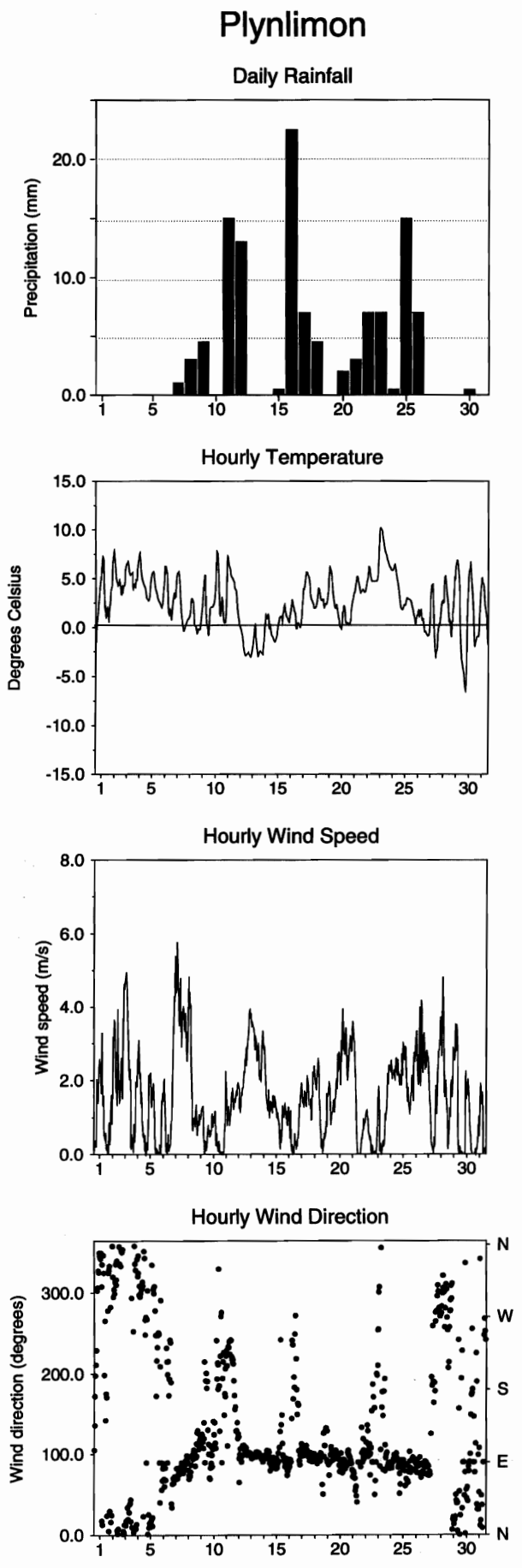
FIGURE 3 METEOROLOGICAL SUMMARY - MARCH 1996



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

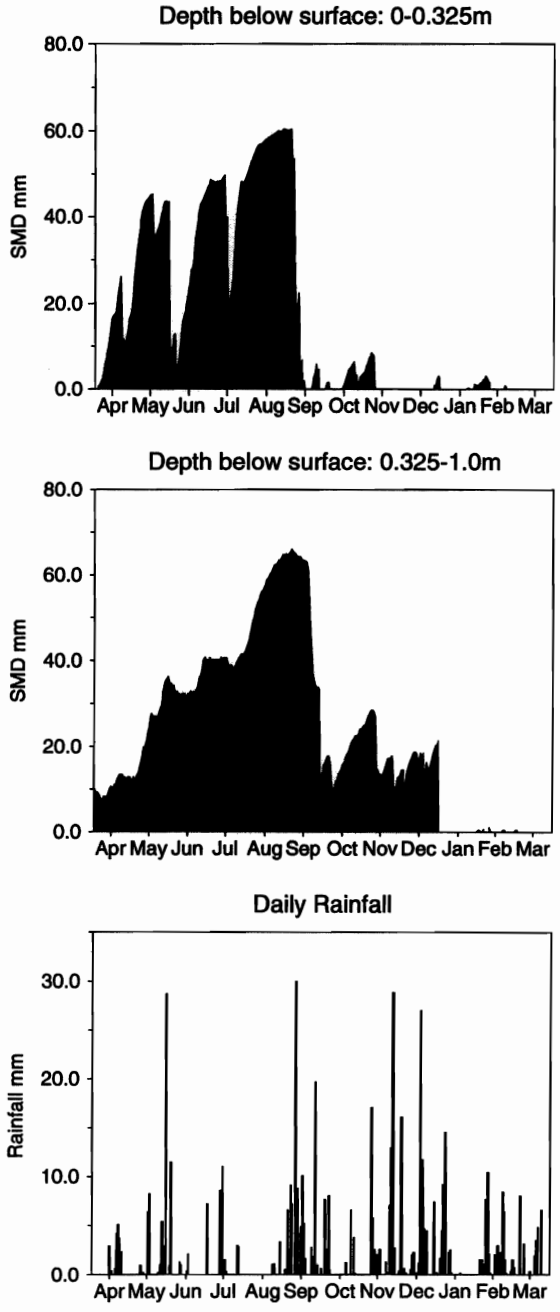
The Lower Kirkton automatic weather station (Balquhidder) occupies a relatively sheltered position at the mouth of the SSE trending Kirkton Glen. Station elevation is 270m aOD and average annual rainfall exceeds 2000mm; snow cover is expected for 10-30 days a year.

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 April 1995 is presented.

FIGURE 4 LOCATION MAP OF GAUGING STATIONS AND GROUNDWATER INDEX WELLS