Hydrological Summary for Great Britain

JANUARY 1996

Rainfall

Following a mild, dull and generally wet start to 1996, wintry conditions returned to dominate the latter half of January. Anticyclonic cells centred over north-western Europe blocked the progress of Atlantic frontal systems and, for extended periods, produced very cold easterly airflows across the British Isles. Appreciable snowfall occurred in many areas towards month-end but generally water equivalents were modest. Some districts registered an absolute drought (15 days without significant rainfall) over the period ending in early February and regional rainfall totals for January were, mostly, well below average. Parts of northern Britain recorded below half of the 1961-90 monthly average and in England and Wales the lowest percentage totals again tended to coincide with those regions having the largest longer term rainfall deficiencies. Nationally, the dryness of the winter half-year (from October) would be expected around once every 5-10 years. However, in much of Wales and northern England precipitation in each of the last four months has been below average and winter rainfall totals are exceptionally low. During the recent past in the North-West, only 1962/63 approaches the 1995/96 October-January deficiency. This paucity of winter rainfall follows the intense spring/summer drought of 1995 - as a result a number of Pennine and north-west raingauges have recorded their lowest 10-month rainfall totals on record (some extending back over 100 years). For England and Wales the rainfall total in the April-January timeframe is the third lowest (after 1921/22 and 1933/34) since 1888 with the more extreme deficiencies in the west and north. The return periods featured in Table 2 underline the important regional contrasts in the rainfall deficiencies but the actual figures should be treated with caution; the assumption of long term climatic stability *may* no longer hold.

River Flow

With catchments saturated at the turn of the year river flows picked up smartly through the first week of January and spates were common from the 8-14th; bankfull flows were exceeded in a few southern catchments. Thereafter extended recessions became established and by month-end flows were very depressed throughout most of northern Britain. Above average January runoff totals were mostly confined to parts of northern Scotland and south-western Britain where the Kenwyn exceeded its previous January maximum in a 22-year record. In the rest of southern, and most of eastern, England monthly runoff totals were considerably below average but well within the normal range. To the north, a clear increase in drought intensity is evident. The Trent and Severn registered their second and third lowest January flows respectively in the last 32 years and the Lud, with a baseflow dominated regime, exceeded the 1976 minimum only by a modest margin. Runoff for rivers draining the Pennines confirmed the regional focus of the drought: the Wharfe and Lune both registered their lowest January runoff totals since the big freeze of 1963. Exceptionally low January runoff also characterised some catchments in north-west Scotland. Rivers with accumulated winter runoff totals of less than half the average show a wide distribution and explain the very sluggish nature of reservoir replenishment.

Groundwater

As a result of the residual benefit from the exceptionally high water-tables a year ago, and the relatively moderate winter rainfall deficiencies in most major outcrop areas, groundwater resources are generally showing less drought stress than rivers or reservoirs. However, 1995/96 recoveries have as yet been patchy and the groundwater hydrographs (Figure 3) display little spatial coherence. In the Chalk, levels are depressed in northern outcrop areas and well below average in the east (Kent especially) but still significantly above corresponding levels in recent drought years (e.g. 1990-92). Significant upturns have been registered to the west with near average levels at West Woodyates and Rockley. The Permo-Triassic sandstones of the South West present a similar picture but elsewhere levels continued to decline in early 1996. Belated recoveries are underway in the Lincolnshire and Carboniferous Limestones. The window of opportunity for further recharge, before evaporation rates accelerate in the spring, is now relatively narrow emphasising the importance of rainfall over the next 8-10 weeks.

General

Limited precipitation at a time when reservoir replenishment and aquifer recharge rates are - on average - at a maximum has produced a significant deterioration in the water resources outlook. Overall reservoir stocks for late January were around 71% of average and below those registered during recent droughts. Stocks in reservoirs in northern England remain especially depressed. In such areas (extending into the Midlands and parts of Wales) the situation is very fragile. Substantial and sustained rainfall, delaying the onset of recessions until the late spring, is now required; a repeat of the spring/summer conditions of 1990 and 1995 would create widespread supply difficulties and considerable stress on river systems.

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

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 13 February 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.

		Jan 1995	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan* 1996
England and	mm	161	115	67	27	49	23	40	13	112	54	80	82	64
Wales	%	183	183	93	45	77	35	65	17	145	64	89	87	73
NRA REGIONS														
North West	mm	208	165	107	28	65	39	65	19	94	86	65	37	50
	%	172	212	113	39	87	48	76	18	82	67	53	30	41
Northumbrian	mm	121	108	59	38	53	30	29	11	111	56	112	78	34
	%	144	183	84	68	85	50	45	14	152	74	130	96	40
Severn Trent	mm	131	89	51	20	49	13	35	9	93	38	64	79	43
	%	187	165	84	36	83	22	66	13	145	59	90	103	61
Yorkshire	mm	133	100	65	27	44	23	29	9	97	29	61	69	43
	%	168	172	96	46	73	38	49	12	143	40	76	83	54
Anglian	mm	98	62	51	16	30	25	25	8	101	16	42	66	32
	%	196	168	109	35	63	49	51	15	206	31	72	120	64
Thames	mm	137	82	51	18	37	16	31	4	114	35	64	92	49
	%	214	182	91	36	66	29	63	7	193	56	98	131	76
Southern	mm	163	112	59	18	23	20	31	5	140	34	63	94	63
	%	204	207	94	34	43	37	65	9	203	43	74	115	79
Wessex	mm	184	111	57	35	53	14	26	9	143	69	123	103	66
	%	211	171	81	66	87	25	50	14	199	87	148	111	75
South West	mm	233	165	93	50	55	19	47	16	135	104	132	127	160
	%	169	163	94	72	76	28	68	19	145	90	106	91	116
Welsh	mm	238	182	88	37	77	27	69	33	125	110	129	101	84
	%	166	188	82	46	94	34	90	33	109	80	91	66	59
Scotland	mm	227	205	143	67	84	43	86	35	195	228	125	53	105
	%	150	201	114	88	98	50	91	30	137	146	83	35	69
RIVER PURIFICATION BOARDS														
Highland	mm	299	271	177	97	89	47	101	47	245	249	161	46	69
	%	159	213	109	107	97	48	95	37	143	126	79	23	37
North East	mm	134	83	74	68	80	53	45	28	293	104	99	67	85
	%	135	128	95	113	116	80	62	32	337	107	100	72	86
Tay	mm	184	185	110	39	96	32	67	20	180	217	116	61	168
	%	128	195	101	63	116	44	87	21	158	167	96	48	117
Forth	mm	154	171	92	35	71	31	70	21	135	197	90	54	87
	%	131	216	98	59	96	45	93	22	123	171	80	49	74
Tweed	mm	129	109	75	36	65	35	43	22	122	134	97	63	70
	%	129	163	95	63	92	54	59	25	137	141	104	68	70
Solway	mm	222	173	145	40	84	44	79	23	102	251	111	51	147
	%	142	171	124	52	99	52	88	19	71	160	77	34	94
Clyde	mm	257	251	196	66	83	44	125	41	137	319	118	48	135
	%	136	213	133	79	91	47	115	31	77	165	66	27	71

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

Note: The monthly rainfall figures for the NRA regions for January 1996 correspond to the MORECS areal assessments derived by the Meteorological Office. In northern England these initial assessments may have a particularly wide error band associated with them, especially when snow is a significant component in the precipitation total. The figures for the RPB regions (and for Scotland) for January 1996 were derived by IH in collaboration with the RPBs. The provisional figures for England and Wales and for Scotland are derived using a different raingauge network. Regional areal rainfall figures are regularly updated (normally one or two months in arrears) using figures derived from a far denser raingauge network.

TABLE 2 RAINFALL RETURN PERIOD ESTIMATES

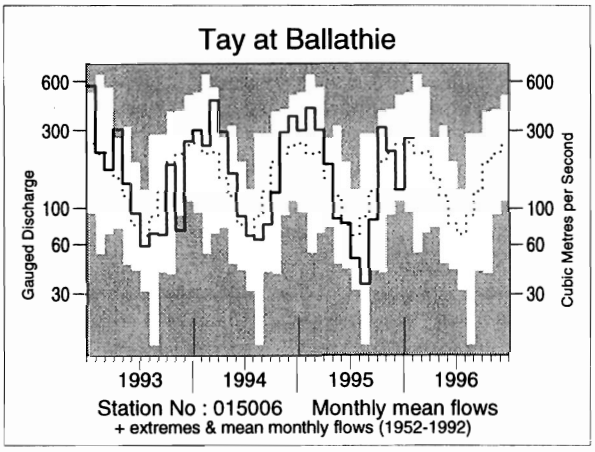
		Oct 95-Jan 96		Apr 95-Jan 96		Feb 95-Jan 96		Sep 94-Jan 96	
		Est Return Period, years		Est Return Period, years		Est Return Period, years		Est Return Period, years	
England and	mm	280		544		726		1318	
Wales	% LTA	78	5-10	72	40-60	81	10-20	99	2-5
NRA REGIONS									
North West	mm	238		548		820		1607	
	% LTA	48	110-150	53	>>200	68	110-150	89	5-10
Northumbria	mm	280		552		719		1209	
	% LTA	86	5	76	15-25	84	5-10	96	2-5
Severn Trent	mm	224		443		583		1097	
	% LTA	79	5	69	35-50	77	15-25	100	<2
Yorkshire	mm	202		431		596		1115	
	% LTA	64	10-20	62	>200	73	40-60	93	2-5
Anglian	mm	156		361		474		822	
	% LTA	73	5-10	71	35-50	80	10-20	96	2-5
Thames	mm	240		460		593		1035	
	% LTA	92	2-5	78	5-15	86	5-10	103	2-5
Southern	mm	254		491		662		1222	
	% LTA	78	5	74	10-20	85	5-10	104	2-5
Wessex	mm	361		641		809		1442	
	% LTA	105	2-5	91	2-5	96	2-5	115	5-10
South West	mm	523		845		1103		1948	
	% LTA	101	2-5	87	2-5	94	2-5	109	2-5
Welsh	mm	424		792		1062		1962	
	% LTA	74	5-10	71	30-50	81	10-15	98	2-5
Scotland	mm	511		1021		1369		2210	
	% LTA	84	5-10	84	10-15	95	2-5	101	2-5
RIVER PURIFICATION BOARDS									
Highland	mm	525		1151		1599		2640	
	% LTA	67	20-35	78	20-35	91	2-5	97	2-5
North East	mm	355		922		1079		1571	
	% LTA	91	2-5	111	2-5	111	5-10	108	2-5
Tay	mm	562		996		1291		1996	
	% LTA	108	2-5	97	2-5	105	2-5	107	2-5
Forth	mm	428		791		1054		1698	
	% LTA	94	2-5	85	5-10	95	2-5	101	2-5
Tweed	mm	364		687		871		1428	
	% LTA	96	2-5	83	5-10	90	2-5	99	2-5
Solway	mm	560		932		1250		2095	
	% LTA	93	2-5	77	15-25	88	5-10	97	2-5
Clyde	mm	620		1116		1563		2557	
	% LTA	84	2-5	78	20-30	92	2-5	98	2-5

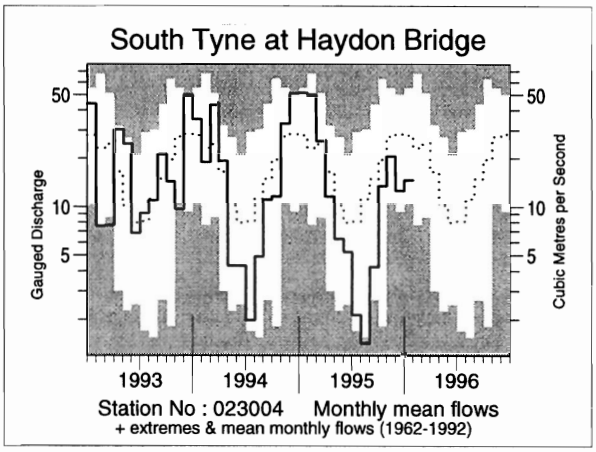
LTA refers to the period 1961-90.

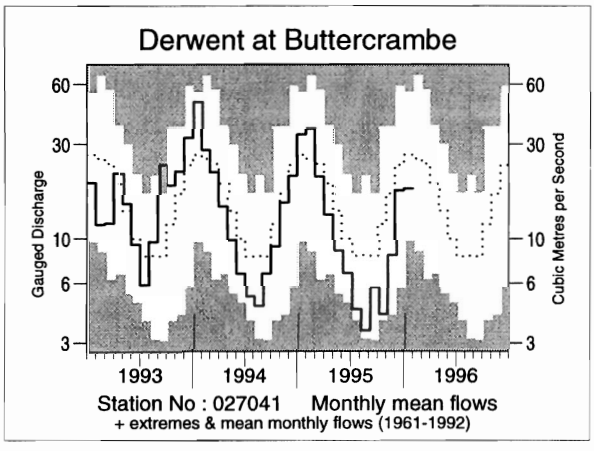
Return period assessments are based on tables provided by the Meteorological Office*. The tables reflect rainfall totals over the period 1911-70 only and the estimate assumes a sensibly stable climate. They assume a start in a specified month; return periods for a start in any month may be expected to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

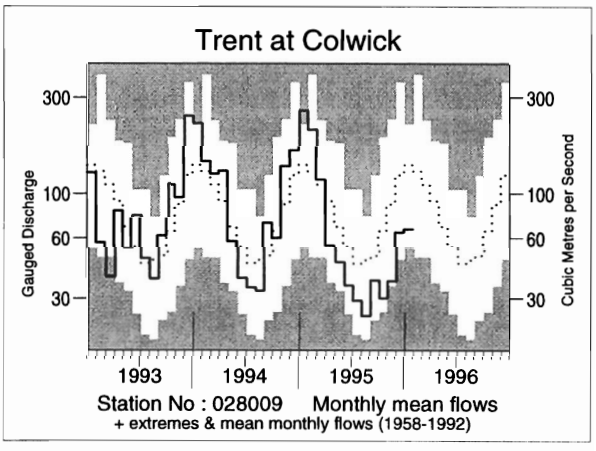
* Tabony, R.C., 1977, The Variability of long duration rainfall over Great Britain, Scientific Paper No. 37, Meteorological Office.

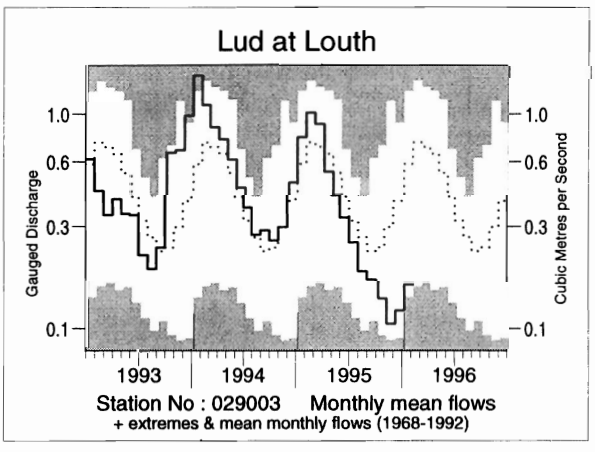
FIGURE 1 MONTHLY RIVER FLOW HYDROGRAPHS

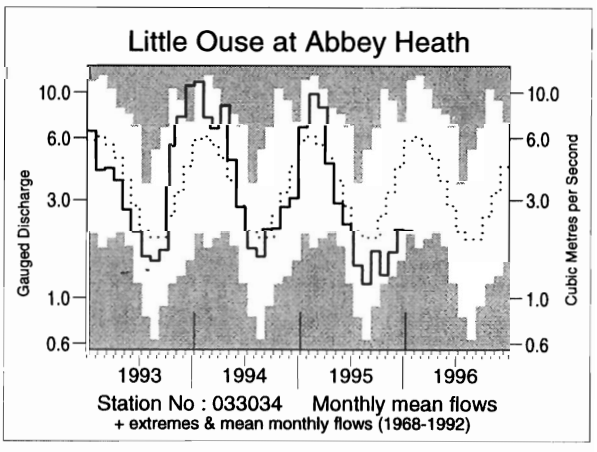


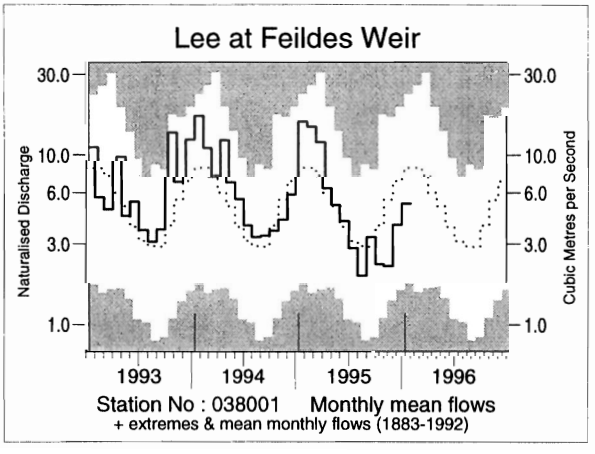


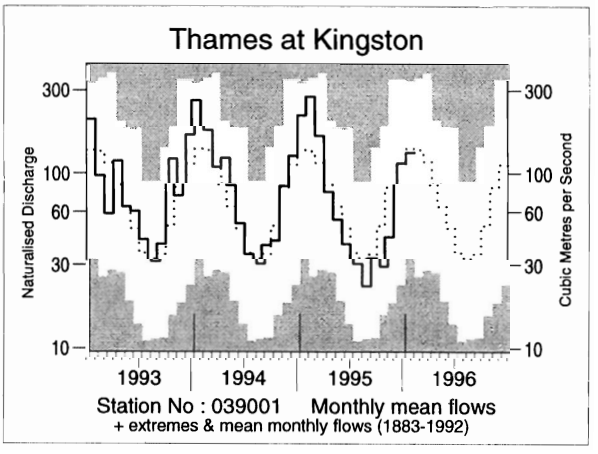


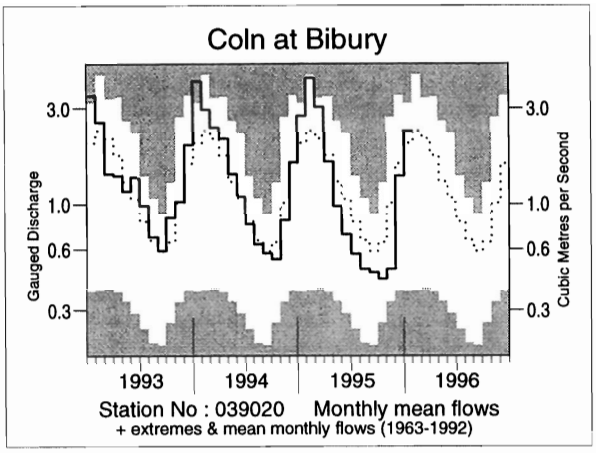


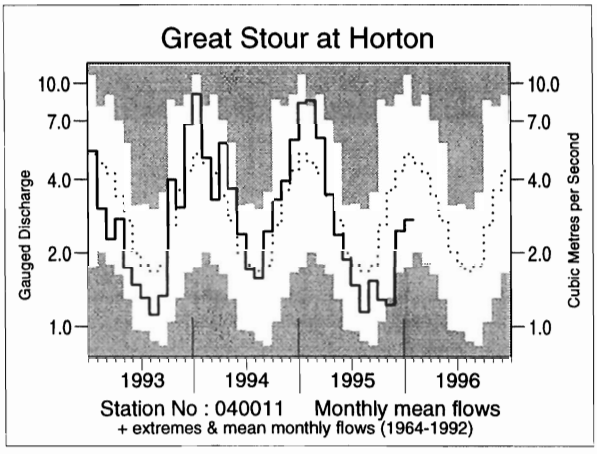


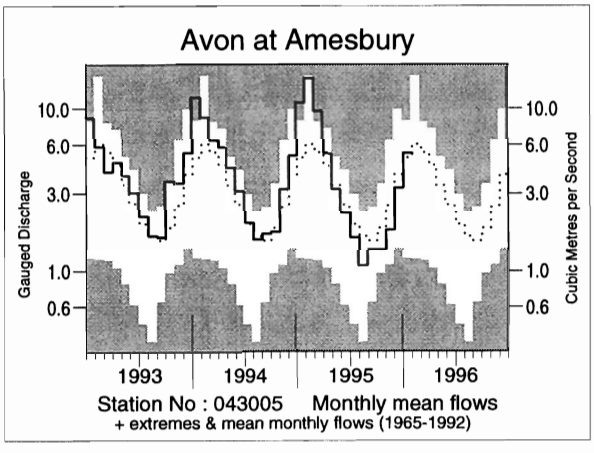


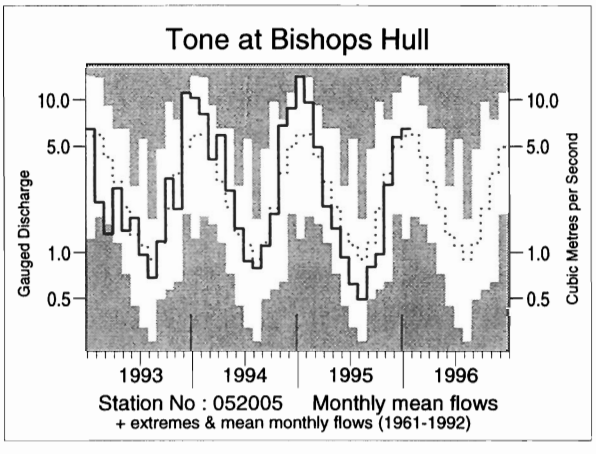


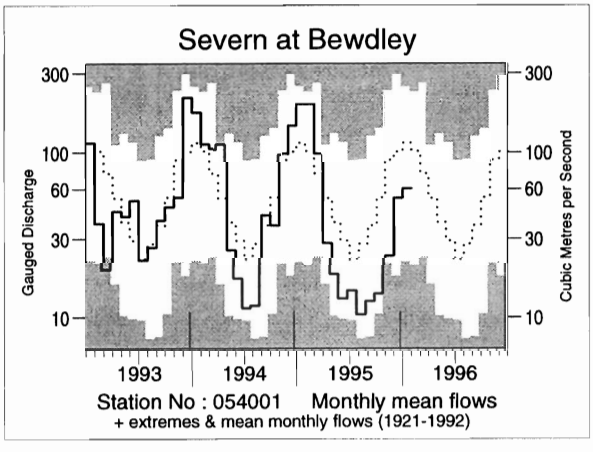


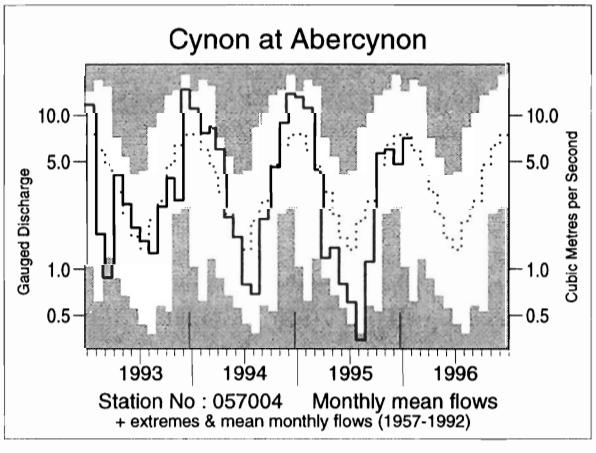

Coln at Bibury
Gauged Discharge
Cubic Metres per Second
3.0
1.0
0.6
0.3
1993
1994
1995
1996
Station No : 039020 Monthly mean flows
+ extremes & mean monthly flows (1963-1992)

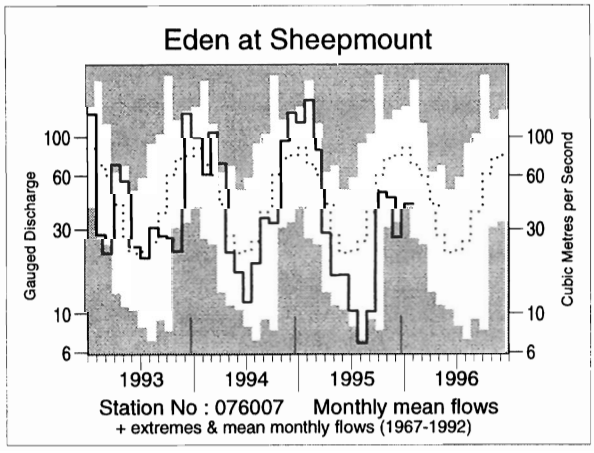

Great Stour at Horton
Gauged Discharge
Cubic Metres per Second
10.0
7.0
4.0
2.0
1.0
1993
1994
1995
1996
Station No : 040011 Monthly mean flows
+ extremes & mean monthly flows (1964-1992)


Avon at Amesbury
Gauged Discharge
Cubic Metres per Second
10.0
6.0
3.0
1.0
0.6
1993
1994
1995
1996
Station No : 043005 Monthly mean flows
+ extremes & mean monthly flows (1965-1992)


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)

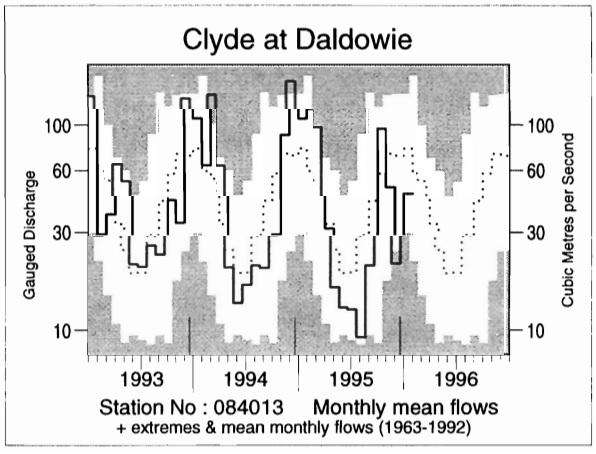

Clyde at Daldowie
Gauged Discharge
Cubic Metres per Second
100
60
30
10
1993
1994
1995
1996
Station No : 084013 Monthly mean flows
+ extremes & mean monthly flows (1963-1992)

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	Sep 1995	Oct	Nov	Dec	Jan 1996		10/95 to 1/96		6/95 to 1/96		2/95 to 1/96		1/94 to 1/96	
	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	136	98	105	73	156	23	432	20	638	21	950	21	1875	21
Park	332	120	138	86	167	/24	126	/23	132	/23	120	/23	112	/22
Tay at	48	183	125	76	155	27	539	28	682	20	1230	32	2853	37
Ballathie	69	166	104	53	104	/44	103	/44	93	/43	108	/43	117	/42
Tweed at	23	107	82	42	90	15	321	10	386	6	702	12	1782	27
Boleside	48	149	94	42	84	/36	88	/35	77	/35	92	/35	109	/34
Whiteadder Water at	11	10	38	47	54	13	149	11	185	7	290	5	695	7
Hutton Castle	70	34	104	100	89	/27	87	/27	81	/26	75	/26	83	/25
South Tyne at	14	48	71	45	52	4	216	1	260	1	573	4	1588	11
Haydon Bridge	28	70	76	42	51	/34	59	/34	50	/32	74	/32	95	/30
Wharfe at	11	16	22	17	34	2	90	1	128	1	410	1	1374	8
Flint Mill Weir	25	26	28	17	34	/41	27	/41	27	/40	57	/40	89	/39
Derwent at	9	7	13	30	30	10	80	5	114	4	240	6	613	12
Buttercrambe	66	35	48	73	66	/35	60	/35	60	/34	75	/34	88	/33
Trent at	13	11	13	23	24	4	70	2	113	2	256	4	772	19
Colwick	74	45	40	50	47	/38	47	/38	53	/37	73	/37	101	/36
Lud at	8	7	5	6	8	3	25	2	70	3	204	10	588	15
Louth	73	54	34	29	26	/28	33	/28	54	/27	/81	/27	111	/26
Witham at	5	4	6	7	13	7	30	6	47	5	139	12	456	25
Claypole Mill	69	45	43	35	49	/37	44	/37	48	/37	74	/36	115	/35
Little Ouse at	6	5	6	8	8	3	27	3	52	3	145	8	376	13
Abbey Heath	86	49	49	48	35	/28	44	/28	55	/28	87	/27	105	/26
Mimram at	10	8	7	9	10	16	34	17	76	22	154	34	368	41
Panshanger Park	119	99	83	86	83	/44	88	/43	100	/43	122	/43	139	/42
Lee at	8	6	6	10	13	30	35	25	65	28	159	52	411	85
Feildes Weir (natr.)	114	58	41	55	61	/111	/54	/111	68	/110	98	/109	118	/107
Thames at	9	8	11	30	35	54	84	46	117	41	263	65	625	84
Kingston (natr.)	95	57	52	100	94	/114	82	/113	82	/113	107	/113	118	/112
Coln at	11	11	12	35	58	21	115	13	170	10	407	16	944	23
Bibury	79	66	48	86	110	/33	86	/33	81	/32	103	/32	112	/31
Great Stour at	12	10	9	19	21	4	60	2	106	2	257	9	688	17
Horton	87	49	34	55	52	/32	49	/31	60	/30	88	/29	109	/27
Avon at	11	11	14	27	44	16	96	13	148	9	412	24	951	29
Amesbury	88	72	69	81	99	/31	84	/31	83	/31	122	/31	132	/29
Stour at	9	12	37	56	67	15	171	14	201	12	435	15	1110	21
Throop Mill	75	51	112	96	107	/24	95	/23	88	/23	110	/23	129	/22
Exe at	15	35	72	124	109	14	340	11	382	4	703	8	2124	33
Thorverton	39	47	73	90	83	/40	77	/40	69	/40	84	/39	118	/38
Taw at	6	17	52	99	91	11	260	6	279	4	542	6	1758	31
Umberleigh	25	27	56	82	78	/38	66	/38	60	/37	78	/37	116	/36
Tone at	10	13	36	77	87	18	213	17	251	16	479	18	1358	33
Bishops Hull	69	49	82	108	108	/35	95	/35	88	/35	100	/35	130	/33
Severn at	7	9	14	33	37	11	93	2	124	2	322	4	982	39
Bewdley	34	26	27	51	52	/75	42	/75	43	/75	71	/74	101	/73
Teme at	3	3	13	40	57	11	112	4	125	3	289	3	867	17
Knightsford Bridge	28	14	39	69	86	/26	64	/26	58	/26	79	/25	109	/24
Cynon at	28	143	146	121	178	19	589	12	661	7	1093	12	3120	29
Abercynon	41	120	94	61	91	/38	88	/38	75	/36	86	/36	114	/34
Dee at	37	105	119	82	136	7	443	1	588	1	1107	1	3619	11
New Inn	29	56	50	31	57	/27	48	/27	46	/26	62	/26	94	/25
Eden at	12	57	51	31	49	3	188	1	238	1	560	5	1520	10
Sheepmount	28	82	61	32	47	/26	54	/25	52	/24	81	/24	102	/22
Clyde at	28	135	68	30	65	5	298	5	375	3	732	12	1927	26
Daldowie	50	170	69	28	58	/33	76	/33	69	/32	93	/32	114	/31
Carron at	164	326	201	27	47	1	601	1	932	1	1915	1	4969	3
New Kelso	65	133	71	8	15	/18	51	/17	52	/17	75	/17	91	/16
Ewe at	145	315	236	86	54	1	690	4	1008	2	1964	9	4605	14
Poolewe	77	146	90	31	20	/26	67	/25	68	/25	92	/25	101	/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.

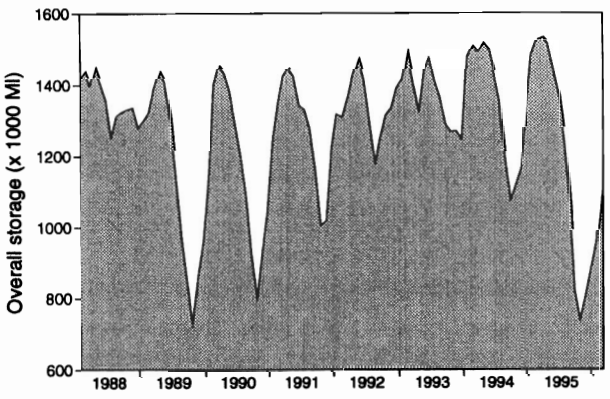
TABLE 4 START-MONTH RESERVOIR STORAGES UP TO FEBRUARY 1996

Area	Reservoir (R)/ Group (G)		Capacity • (Ml)	1995 Sep	Oct	Nov	Dec	1996 Jan	Feb	1995 Feb
North West	N.Command Zone[1]	(G)	133375	24	13	44	57	51	63	100
	Vyrnwy	(R)	55146	36	26	25	33	35	45	99
Northumbria	Teesdale[2]	(G)	87936	38	31	33	39	41	51	100
	Kielder	(R)	199175*	85*	82*	88*	91*	89*	93*	100*
Severn-Trent+	Clywedog	(R)	44922	42	36	38	43	54	62	100
	Derwent Valley[3]	(G)	39525	34	25	15	9	10	15	100
Yorkshire	Washburn[4]	(G)	22035	34	24	15	16	23	34	100
	Bradford supply[5]	(G)	41407	21	15	16	20	22	33	99
Anglian	Grafham	(R)	58707	71	72	72	72	83	92	92
	Rutland	(R)	130061	66	61	59	57	61	72	96
Thames	London[6]	(G)	206399	62	66	67	71	82	89	94
	Farmoor [7]	(G)	13843	64	76	87	98	89	99	95
Southern	Bewl	(R)	28170	72	69	65	60	65	82	96
	Ardingly	(R)	4685	48	46	47	45	67	84	100
Wessex	Clatworthy	(R)	5364	31	30	35	63	92	91	100
	Bristol W [8]	(G)	38666*	48*	44*	37*	43*	60*	73*	99*
South West	Colliford	(R)	28540	54	47	45	42	46	55	90
	Roadford[9]	(R)	34500	40	26	18	19	23	30	91
	Wimbleball[10]	(R)	21320	40	30	26	34	46	60	100
	Stithians	(R)	5205	31	27	26	31	54	100	100
Welsh	Celyn + Brenig	(G)	131155	57	48	49	50	54	61	100
	Brianne	(R)	62140	55	48	57	72	76	97	100
	Big Five[11]	(G)	69762	29	19	41	56	67	84	97
	Elan Valley[12]	(G)	99106	46	34	37	47	56	73	100
Lothian	Edin./Mid Lothian[13]	(G)	97639	69	64	85	91	91	96	99
	East Lothian[14]	(G)	10206	71	72	74	95	99	99	98
Strathclyde	Loch Katrine	(G)	111363	50	43	92	95	80	91	97
	Daer	(R)	22412	41	32	83	93	83	97	100
	Loch Thom	(G)	11840	59	56	100	97	93	100	100

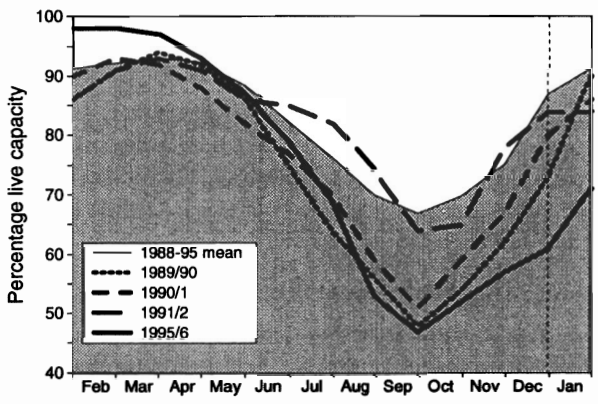
• Live or usable capacity (unless indicated otherwise) * Gross storage/percentage of gross storage + revised (net) figures

1. Includes Haweswater, Thirlmere, Stocks and Barnacre.
2. Cow Green, Selset, Grassholme, Balderhead, Blackton and Hury.
3. Howden, Derwent and Ladybower.
4. Swinsty, Fewston, Thruscross and Eccup.
5. The Nidd/Barden group (Scar House, Angram, Upper Barden, Lower Barden and Chelker) plus Grimwith.
6. Lower Thames (includes Queen Mother, Wraysbury, Queen Mary, King George VI and Queen Elizabeth II) and Lee Valley (includes King George and William Girling) groups -pumped storages.
7. Farmoor 1 and 2 - pumped storages.
8. Blagdon, Chew Valley and others.
9. Roadford began filling in November 1989.
10. Shared between South West (river regulation for abstraction) and Wessex (direct supply).
11. Usk, Talybont, Llandegfedd (pumped storage), Taf Fechan, Taf Fawr.
12. Claerwen, Caban Coch, Pen-y-garreg and Craig Goch.
13. Megget, Talla, Fruid, Gladhouse, Torduff, Clubbiedean, Glencorse, Loganlea and Morton (upper and lower).
14. Thorters, Donolly, Stobshiel, Lammerloch, Hopes and Whiteadder

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



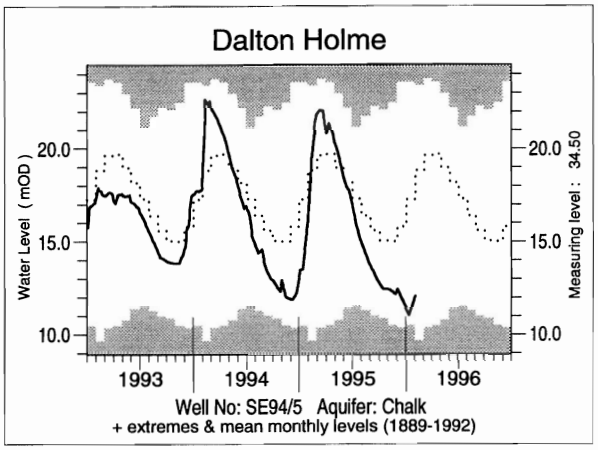
A COMPARISON BETWEEN OVERALL RESERVOIR STOCKS FOR ENGLAND AND WALES IN RECENT DROUGHT YEARS

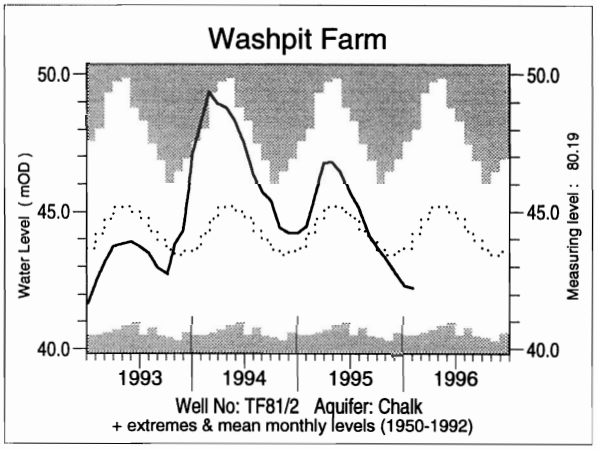


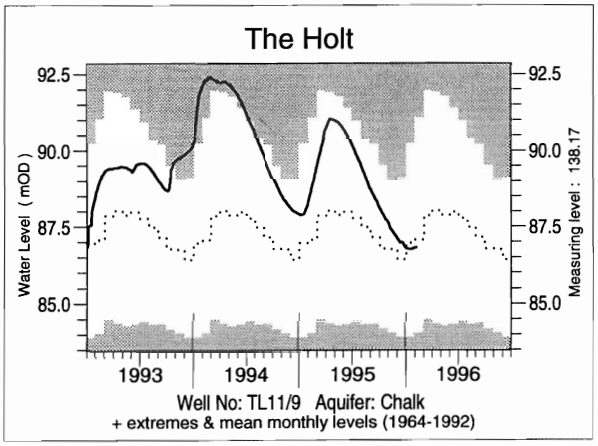
These plots are based on the reservoirs featured in Table 4 only

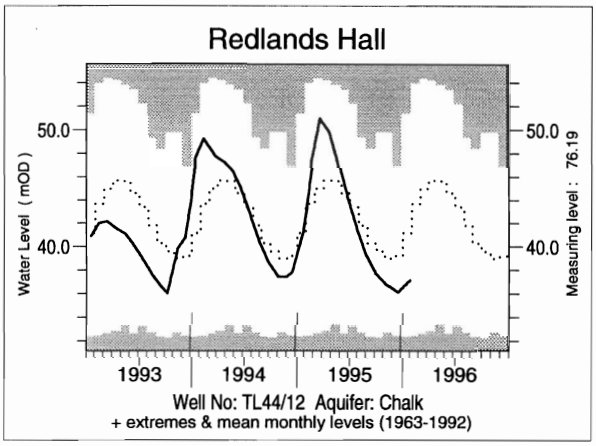
Note: Variations in storage depend on the balance between inputs (from catchment rainfall and any pumping) and outputs (to supply, compensation flow, HEP, amenity). There will be additional losses due to evaporation, especially in the summer months. Operational strategies for making the most efficient use of water stocks will further affect reservoir storages. Table 4 provides a link between the hydrological conditions described elsewhere in the report and the water resources situation.

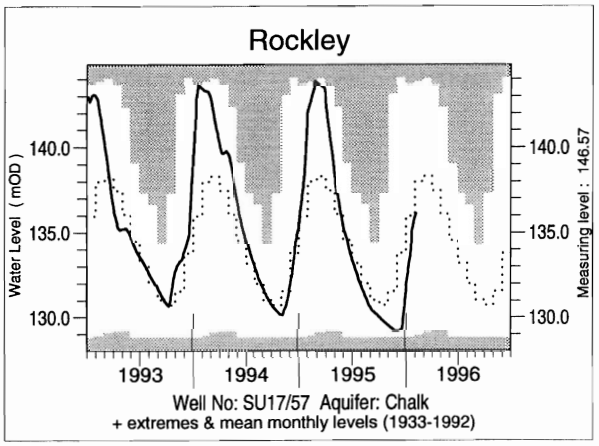
FIGURE 2 GROUNDWATER LEVEL HYDROGRAPHS

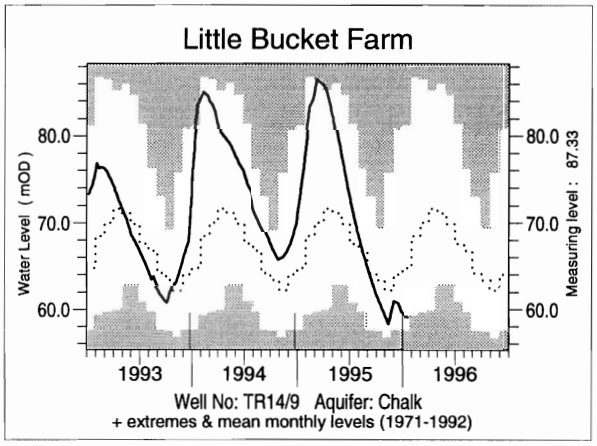


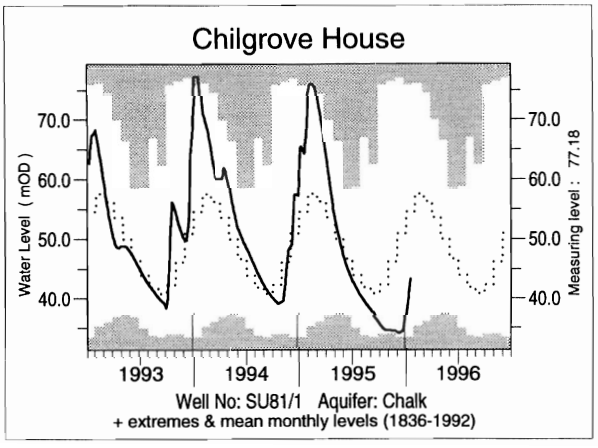


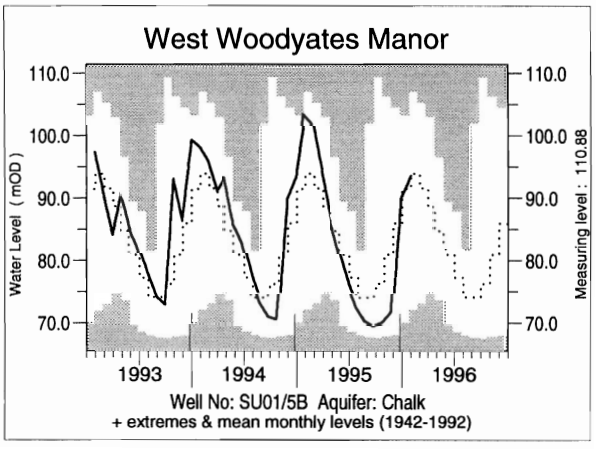


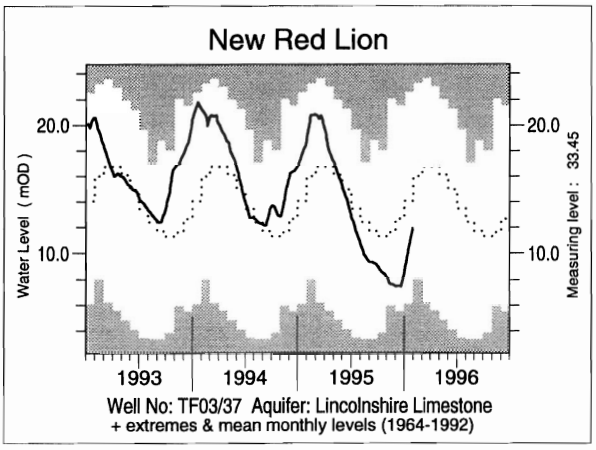


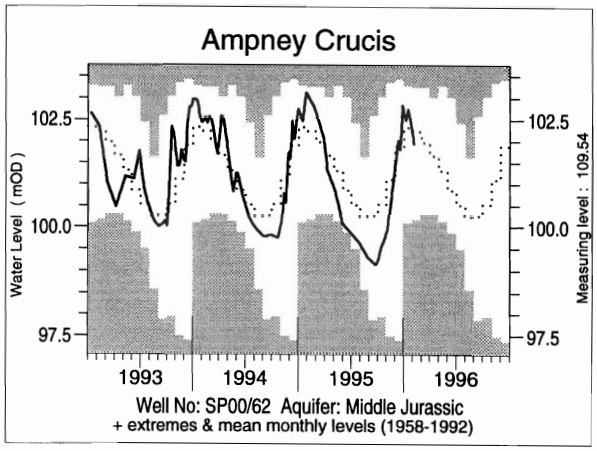


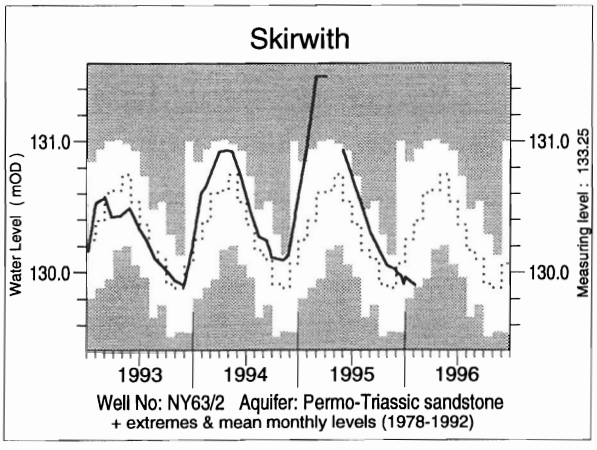


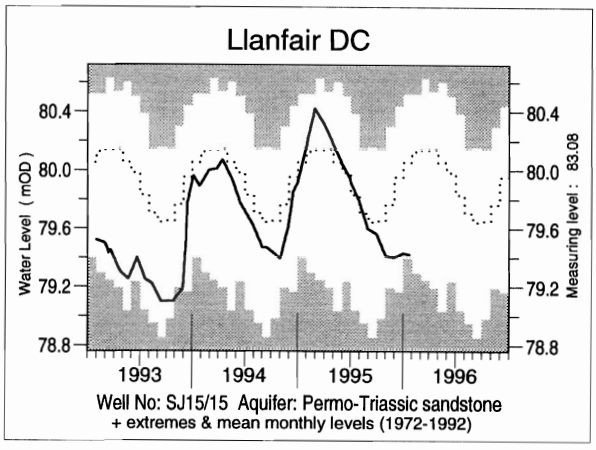


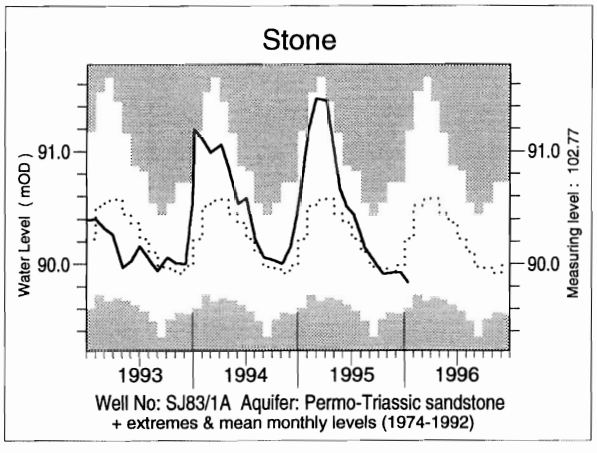


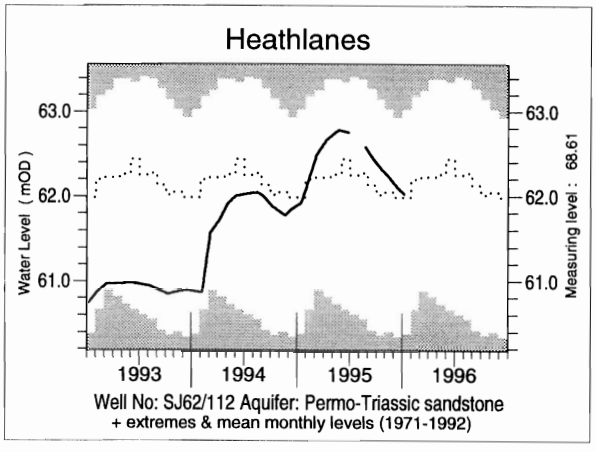

New Red Lion
Water Level (mOD)
20.0
10.0
Measuring level : 33.45
1993
1994
1995
1996
Well No: TF03/37 Aquifer: Lincolnshire Limestone
+ extremes & mean monthly levels (1964-1992)

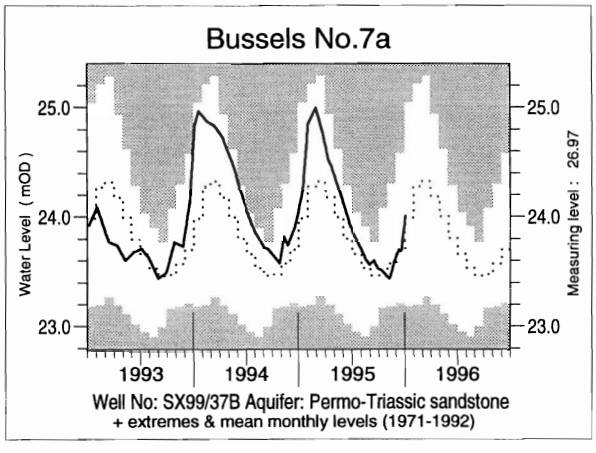

Ampney Crucis
Water Level (mOD)
102.5
100.0
97.5
Measuring level : 109.54
1993
1994
1995
1996
Well No: SP00/62 Aquifer: Middle Jurassic
+ extremes & mean monthly levels (1958-1992)


Skirwith
Water Level (mOD)
131.0
130.0
Measuring level : 133.25
1993
1994
1995
1996
Well No: NY63/2 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1978-1992)


Llanfair DC
Water Level (mOD)
80.4
80.0
79.6
79.2
78.8
Measuring level : 83.08
1993
1994
1995
1996
Well No: SJ15/15 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1972-1992)


Stone
Water Level (mOD)
91.0
90.0
Measuring level : 102.77
1993
1994
1995
1996
Well No: SJ83/1A Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1974-1992)


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


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

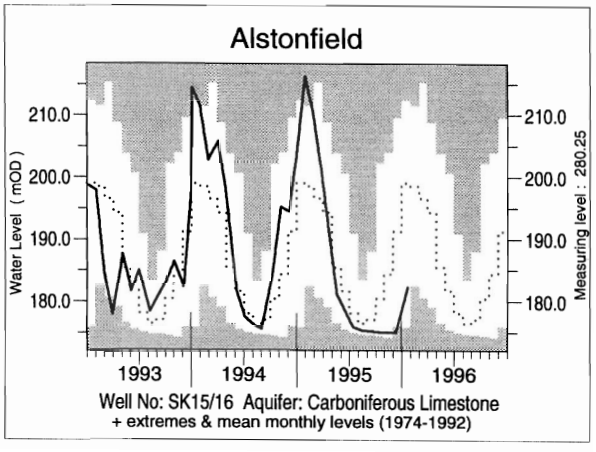

Alstonfield
Water Level (mOD)
210.0
200.0
190.0
180.0
Measuring level : 280.25
1993
1994
1995
1996
Well No: SK15/16 Aquifer: Carboniferous Limestone
+ extremes & mean monthly levels (1974-1992)

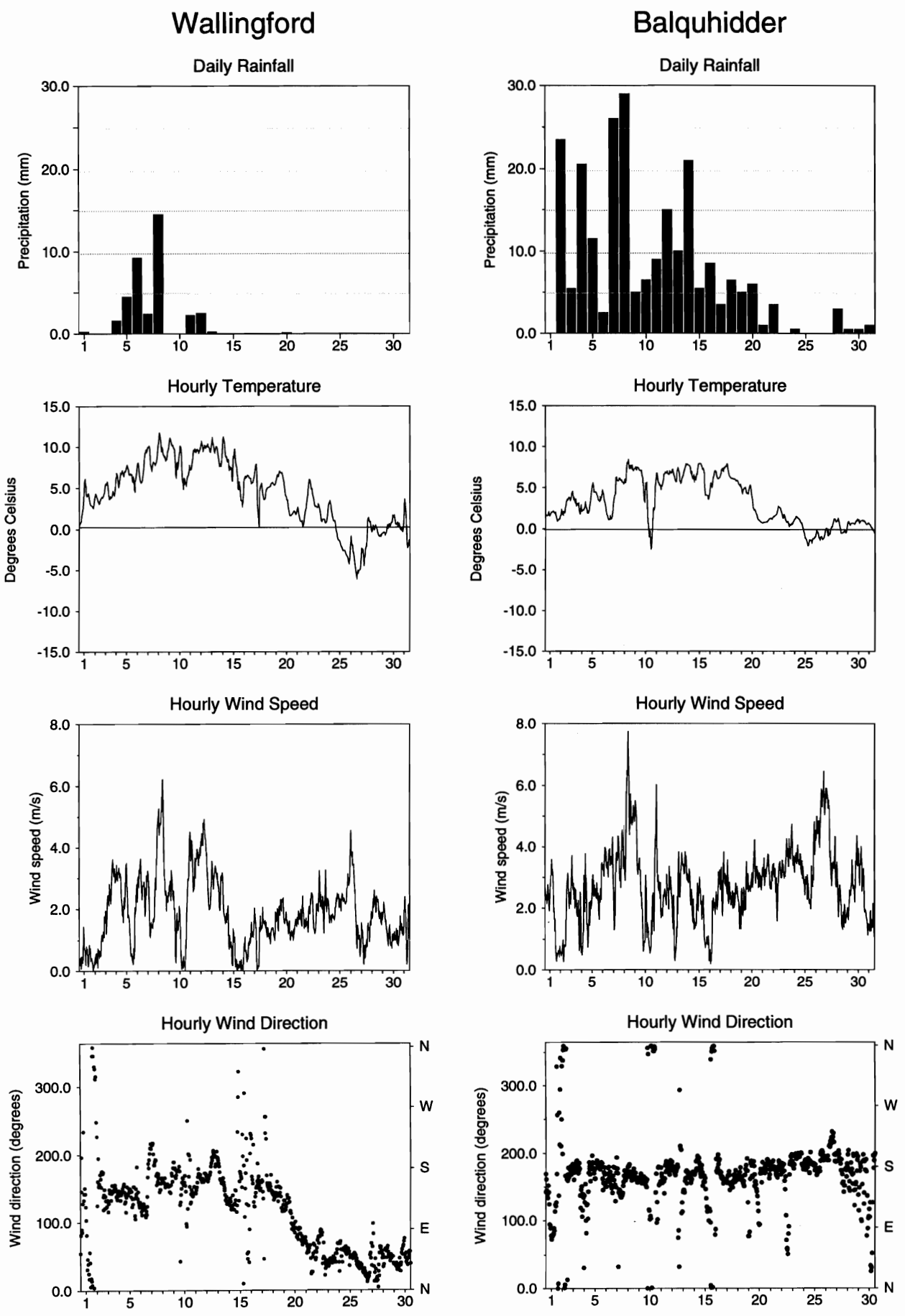
TABLE 5 JANUARY GROUNDWATER LEVELS 1996

Site	Aquifer	Records commence	Minimum Jan	Average Jan	Maximum Jan	No. of years Jan/Feb	Jan/Feb 1996	
			<1996	<1996	<1996	level<1996	day	level
Dalton Holme	C & UGS	1889	10.47	17.33	23.64	7	01/02	12.08
Wetwang	C & UGS	1971	17.00	23.66	32.36	7	01/02	21.09
Keelby Grange	C & UGS	1980	4.09	10.69	17.23	3	10/01	6.74
Washpit Farm	C & UGS	1950	40.51	43.67	47.60	8	02/02	42.23
The Holt	C & UGS	1964	83.90	87.11	92.02	>10	05/02	86.82
Redlands Hall	C & UGS	1964	32.38	40.81	51.48	4	25/01	37.16
Rockley	C & UGS	1933	dry <128.44	136.18	143.75	>10	05/02	136.10
Little Bucket Farm	C & UGS	1971	57.64	67.54	84.05	3	26/01	59.21
Compton House	C & UGS	1984	27.84	46.00	68.75	>10	24/01	32.92
Chilgrove House	C & UGS	1836	33.46	55.97	77.19	>10	16/01	43.28
Westdean No.3	C & UGS	1940	1.14	2.17	4.29	>10	26/01	1.47
Lime Kiln Way	C & UGS	1969	124.16	125.05	125.89	>10	25/01	125.96
Ashton Farm	C & UGS	1974	63.80	68.85	71.43	>10	31/01	70.93
West Woodyates Manor	C & UGS	1942	70.08	90.97	103.45	>10	31/01	93.56
New Red Lion	LLst	1964	6.06	14.56	22.58	>10	30/01	11.90
Ampney Crucis	Mid Jur	1958	100.09	102.34	103.28	9	05/02	101 .95
Redbank	PTS	1981	7.91	8.52	9.16	0	01/02	7.81
Skirwith	PTS	1978	129.80	130.42	130.97	2	05/02	129.90
Llanfair D.C	PTS	1972	79.39	79.93	80.52	1	23/01	79.42
Stone	PTS	1974	89.60	90.33	91.19	2	13/01	89.83
Heathlanes	PTS	1971	60.37	61.92	63.03	>10	08/01	62.02
Bussels No.7A	PTS	1972	23.18	24.05	25.04	>10	30/01	24.45
Rushyford NE	MgLst	1967	64.79	72.38	76.84	>10	19/01	76.02
Peggy Ellerton	MgLst	1968	31.78	34.16	36.18	10	22/01	33.65
Alstonfield	CLst	1974	175.81	200.33	214.39	1	22/01	182.27

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

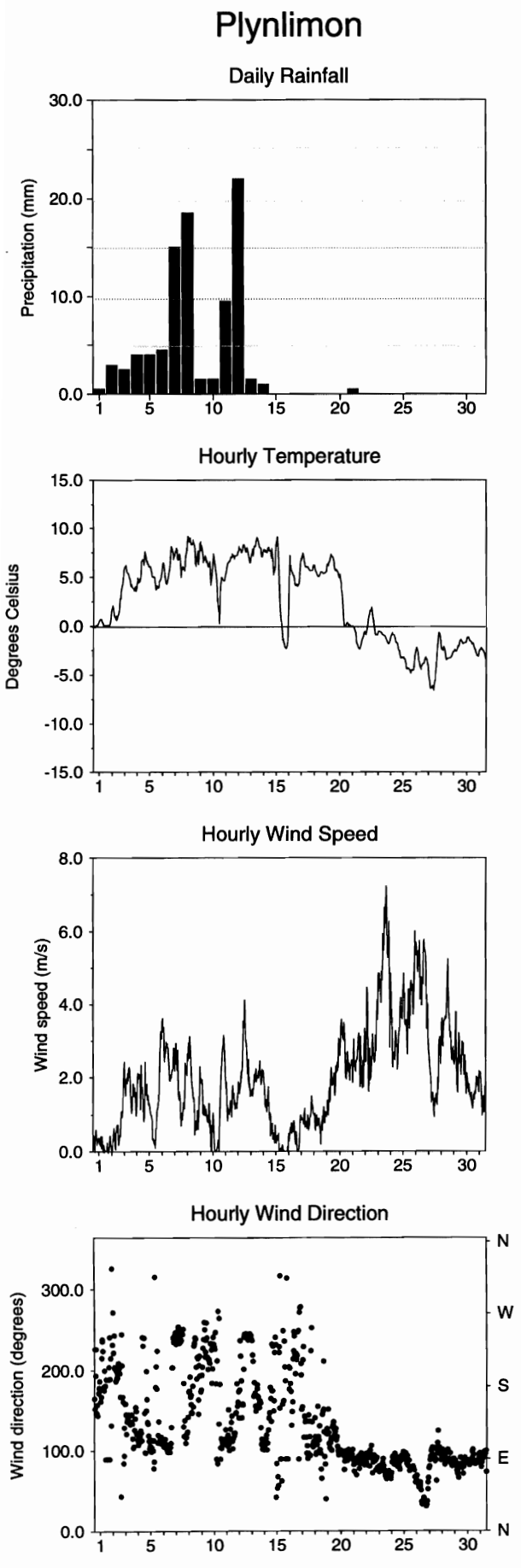
FIGURE 3 METEOROLOGICAL SUMMARY - JANUARY 1996



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

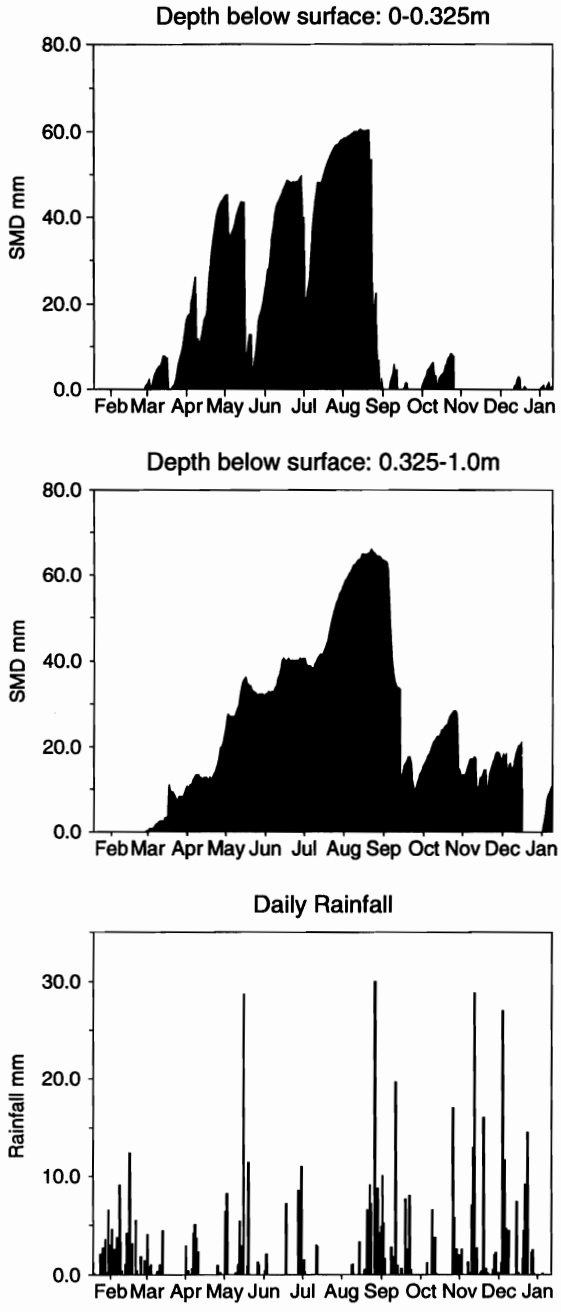
The Lower Kirkton automatic weather station (Balquhidder) occupies a relatively sheltered position at the mouth of the SSE trending Kirkton Glen. Station elevation is 270m aOD and average annual rainfall exceeds 2000mm; snow cover is expected for 10-30 days a year.

FIGURE 3 (continued)



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

FIGURE 3a. WALLINGFORD SMD DATA 1995/6.



Note

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

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

FIGURE 4 LOCATION MAP OF GAUGING STATIONS AND GROUNDWATER INDEX WELLS