Hydrological Summary for Great Britain

MAY 1996

Rainfall

The predominance of airflows from the northerly quadrant - a persistent feature over the last six months - continued well into May and although westerly incursions were common towards month-end, mean temperatures in May were notably low, around 2.0°C below average over wide areas. Provisional data suggest that last month was the third coldest May this century. The cool conditions usefully moderated the normal seasonal acceleration in evaporation rates. This, together with a nationwide May rainfall approaching the 1961-90 mean produced a minor reduction in overall drought severity. However, the rainfall exhibited large spatial variations: regional rainfall totals for May were appreciably above average in much of south-western Britain and most of northern Britain registered totals in the 80-95% range. But parts of northern Scotland were relatively dry and the spring drought intensified throughout much of the English lowlands (East Anglia especially) causing significant agricultural stress. A few eastern catchments (e.g. in Norfolk) reported substantially less than half the average March-May rainfall and, in some areas, only the spring of 1990 has been drier in the last 40 years at least. Significant rainfall deficiencies for the year thus far now extend across most of England (and parts of northern Scotland) but the drought remains most severe over the period beginning April 1995. In this timeframe the provisional England and Wales rainfall total is the third lowest since 1855 (only 1933/34 and 1975/76 were drier). The unbroken sequence of relatively dry months continues in parts of the Pennines (the south particularly) and a number of raingauges have recorded their lowest 14-month rainfall total (for any start month) in series extending back over 100 years. In a broad zone from north-west England, through Yorkshire to East Anglia the rainfall deficiency since March 1995 is the equivalent of 4-5 months average rainfall.

River Flow

Although evaporation rates for 1996 have generally been only a little below average, the relatively cool conditions have produced evaporative demands which are typically 20% below those for the 1990-95 period. This, together with substantial rainfall over the latter half of May, helped ease the seasonal flow recessions and provided a valuable boost to reservoir stocks. However, a combination of low spring rainfall and very modest groundwater contributions to lowland river flows has produced very depressed runoff rates in parts of eastern England; in Norfolk especially where the failure of springs and the contraction of headwaters has been a feature of the late spring. Correspondingly, new minimum May runoff totals were established on the Rivers Stringside and Little Ouse and, in Kent, on the Great Stour. Away from these areas, May runoff totals were relatively healthy, exceeding the average throughout much of the South-West and Wales. However, clear evidence for the fragile nature of current reservoir storages (in northern England and the Midlands particularly) is provided by the accumulated runoff totals for the periods beginning in June and October 1995. Rivers establishing new minimum June-May runoff totals show a wide distribution, from the Ewe in Highland Region to the Great Stour in Kent. Any repetition of the hot, dry summers of 1990 and 1995 would greatly extend the region experiencing depressed runoff rates - and produce a considerable loss, albeit temporary, of aquatic habitats.

Groundwater

By late May soil moisture deficits exceeded 70 mm over much of eastern England - and 100 mm in parts of East Anglia - confirming the end of the 1995/96 infiltration season. In the west, soil moisture conditions allowed some modest recharge over the latter half of May. Apart from the deepest Chalk wells, and slow responding confined aquifers, the 1996 recession in groundwater levels is well established - but the current status of groundwater storage exhibits only limited spatial coherence. Groundwater levels are at, or close to, early summer minimum in parts of the eastern Chalk (e.g. in Lincolnshire, Norfolk and parts of Kent) but within the normal range - but below average - for most of the more westerly outcrops. Levels in the southern Permo-Triassic sandstones outcrops are also relatively healthy but water-tables remain depressed in most of the northerly index wells - at Skirwith, late May levels were unprecedented. Levels are also low in most minor aquifers and overall groundwater storage is much lower than in the early summer of 1995.

General

The drought extended its range across the English lowlands in May but runoff over the latter half of the month increased overall reservoir stocks to marginally greater than those of early June 1995 (and appreciably greater than 1990). Demand levels will determine, in large part, the stress on water supplies over the summer but without above average rainfall over the latter half of 1996 the resources outlook for 1997 will be a matter of concern.

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 June 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.

		May 1995	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan 1996	Feb	Mar	Apr	May
England and Wales	mm	49	23	40	10	113	58	80	82	65	82	44	49	57
	%	77	35	65	13	147	68	89	87	74	130	61	81	89
North West	mm	65	39	65	18	97	105	65	37	55	105	36	77	66
	%	87	48	76	17	84	82	53	30	45	135	38	109	88
Northumbrian	mm	53	30	29	12	111	57	112	78	46	89	33	59	51
	%	85	50	45	15	152	75	130	96	55	151	47	104	82
Severn Trent	mm	49	13	35	9	94	39	64	79	45	66	42	48	48
	%	83	22	66	13	147	61	90	103	64	122	69	88	81
Yorkshire	mm	44	23	29	9	96	29	61	69	48	78	31	48	53
	%	73	38	49	12	141	40	76	83	61	134	46	82	88
Anglian	mm	30	25	25	8	101	15	42	66	34	49	20	17	25
	%	63	49	51	15	206	29	72	120	68	132	43	38	51
Thames	mm	37	16	31	4	117	34	64	92	52	63	35	36	32
	%	66	29	63	7	198	55	98	131	81	140	63	71	57
Southern	mm	23	20	31	5	140	33	63	94	69	70	42	24	48
	%	43	37	65	9	203	41	74	115	86	130	67	46	88
Wessex	mm	53	14	26	10	144	68	123	103	77	84	68	50	59
	%	87	25	50	15	200	86	148	111	89	129	97	93	96
South West	mm	55	19	47	16	136	104	132	127	157	118	73	72	101
	%	76	28	68	19	146	90	106	91	114	117	74	104	140
Welsh	mm	77	27	69	14	125	115	129	101	102	121	72	90	99
	%	94	34	90	14	109	84	91	66	71	125	67	113	121
Scotland	mm	84	43	86	34	198	228	125	53	90	140	59	89	71
	%	98	50	91	29	139	146	83	35	60	137	47	116	82
Highland	mm	89	47	101	45	251	246	161	46	61	149	55	85	72
	%	97	48	95	35	147	124	79	23	32	117	34	93	78
North East	mm	80	53	45	27	297	103	99	67	75	114	57	61	61
	%	116	80	62	31	341	106	100	72	76	175	73	102	88
Tay	mm	96	32	67	20	178	220	116	61	132	117	79	87	59
	%	116	44	87	21	156	169	96	48	92	123	72	140	71
Forth	mm	71	31	70	21	136	199	90	54	73	82	52	74	66
	%	96	45	93	22	124	173	80	49	62	104	55	125	89
Tweed	mm	65	35	43	23	123	134	97	63	72	104	30	74	59
	%	92	54	59	26	138	141	104	68	72	155	38	130	83
Solway	mm	84	44	79	23	102	249	111	51	134	157	73	116	80
	%	99	52	88	19	71	159	77	34	86	155	62	151	94
Clyde	mm	83	44	125	40	138	324	118	48	117	181	62	112	85
	%	91	47	115	30	77	168	66	27	62	153	42	133	93

Note: The monthly regional rainfall figures for England and Wales for April & May 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 April & May 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

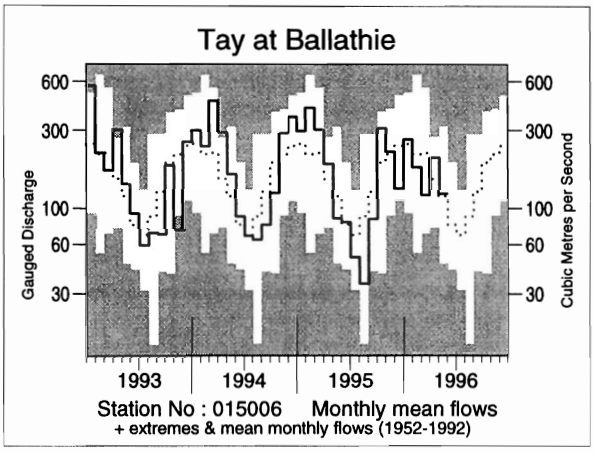
		Mar 96-May 96		Jan 96-May 96		Oct 95-May 96		Apr 95-May 96	
		Est Return Period, years		Est Return Period, years		Est Return Period, years		Est Return Period, years	
England and Wales	mm	150		297		517		779	
	% LTA	76	5-10	86	2-5	84	5-10	76	35-50
North West	mm	180		340		547		859	
	% LTA	75	5-10	77	5-10	67	40-60	64	>>200
Northumbria	mm	143		278		525		798	
	% LTA	76	5-10	84	5	91	2-5	82	10-20
Severn Trent	mm	138		249		431		651	
	% LTA	79	5	83	5	84	5-10	75	30-45
Yorkshire	mm	132		258		417		645	
	% LTA	70	5-10	80	5-10	74	10-20	69	120-170
Anglian	mm	62		145		268		473	
	% LTA	44	70-100	64	20-35	68	30-45	69	110-150
Thames	mm	103		218		408		631	
	% LTA	63	5-10	80	5	87	2-5	79	10-20
Southern	mm	114		253		443		680	
	% LTA	67	5-10	83	5	80	5-10	77	15-25
Wessex	mm	176		337		631		913	
	% LTA	96	2-5	100	2-5	107	2-5	96	2-5
South West	mm	246		521		884		1207	
	% LTA	102	2-5	109	2-5	103	2-5	92	2-5
Welsh	mm	261		484		829		1178	
	% LTA	97	2-5	95	2-5	88	2-5	80	15-25
Scotland	mm	218		448		854		1366	
	% LTA	76	5-10	83	5-10	86	5-10	85	10-20
Highland	mm	212		422		875		1505	
	% LTA	61	25-40	64	50-80	70	60-90	77	50-80
North East	mm	179		368		637		1207	
	% LTA	86	2-5	99	2-5	97	2-5	110	5-10
Tay	mm	225		474		871		1303	
	% LTA	89	2-5	96	2-5	100	<2	95	2-5
Forth	mm	192		347		690		1054	
	% LTA	85	2-5	82	5-10	91	2-5	85	5-15
Tweed	mm	163		339		633		958	
	% LTA	79	5	91	2-5	97	2-5	87	5-10
Solway	mm	269		560		971		1343	
	% LTA	96	2-5	104	2-5	99	2-5	85	5-15
Clyde	mm	259		557		1047		1543	
	% LTA	80	5	89	2-5	89	2-5	82	10-20

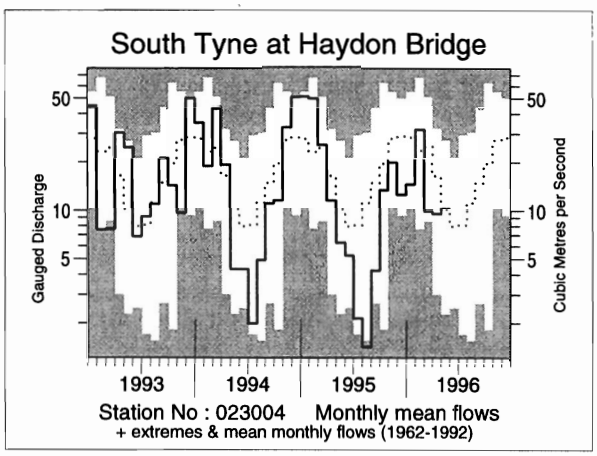
LTA refers to the period 1961-90.

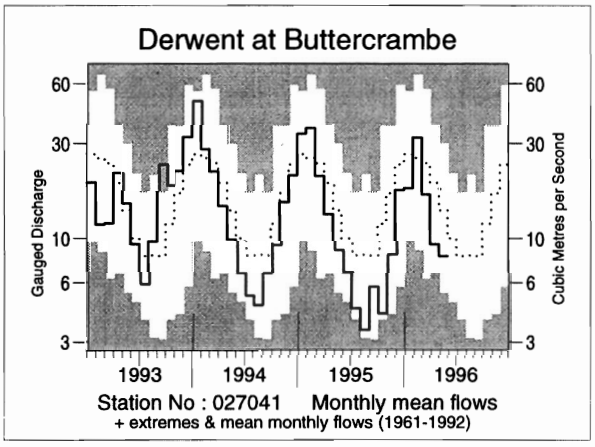
Return period assessments are based on tables provided by the Meteorological Office*. The tables reflect rainfall totals over the period 1911-70 only and the estimate assumes a sensibly stable climate. They assume a start in a specified month; return periods for a start in any month may be expected to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

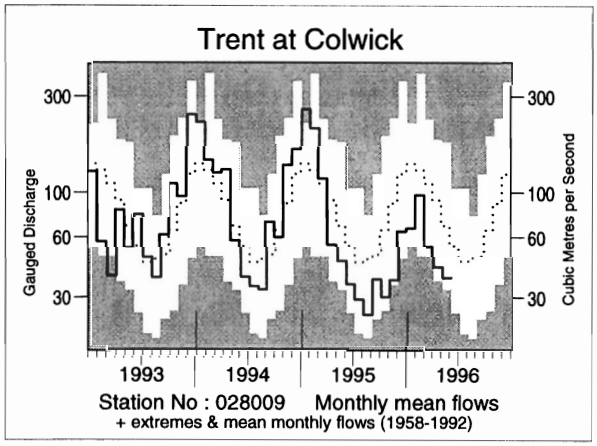
* Tabony, R.C., 1977, The Variability of long duration rainfall over Great Britain, Scientific Paper No. 37, Meteorological Office.

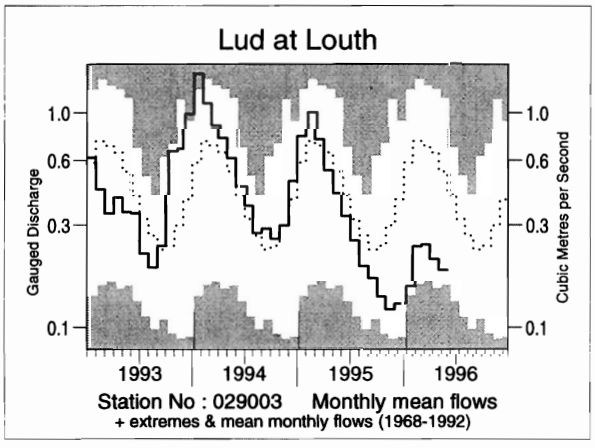
FIGURE 1 MONTHLY RIVER FLOW HYDROGRAPHS

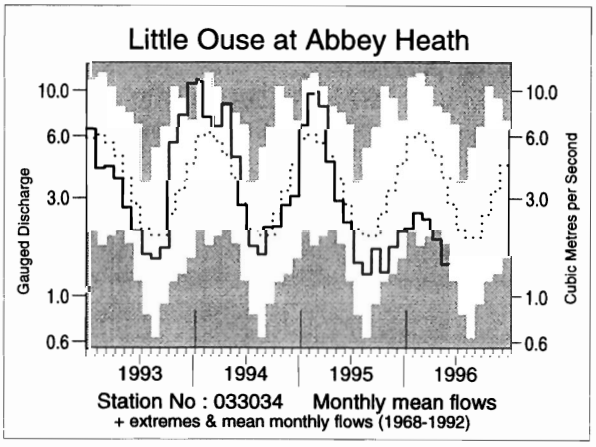


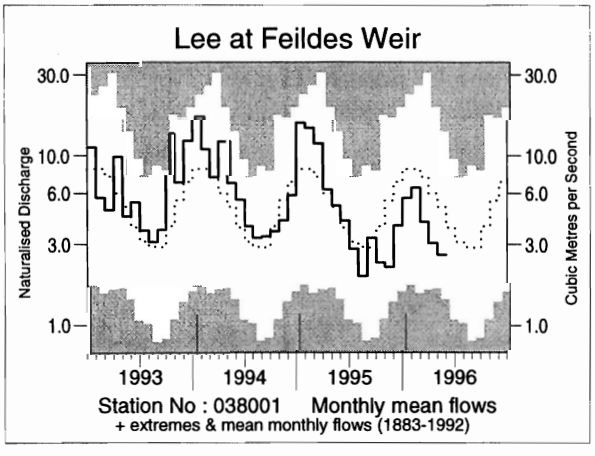


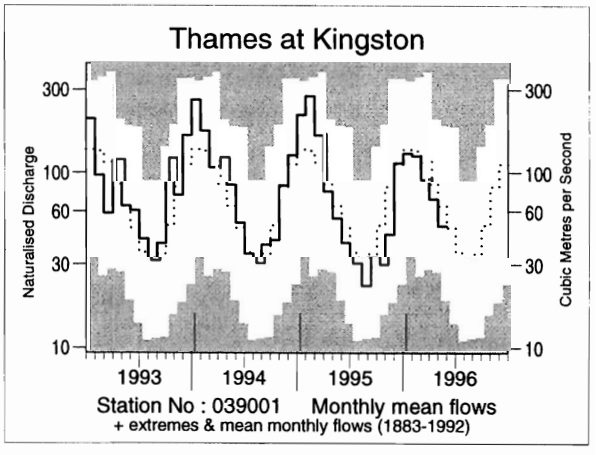


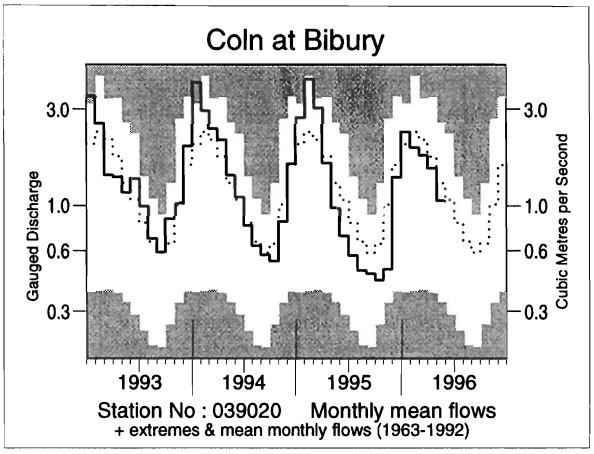


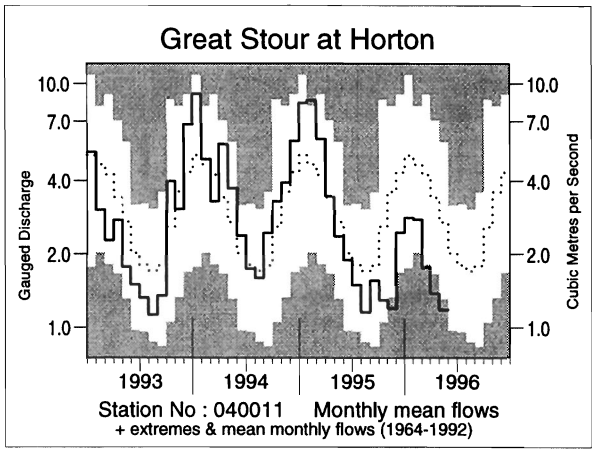


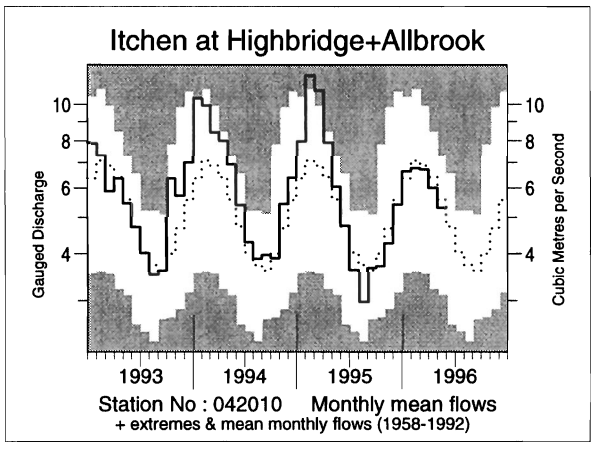


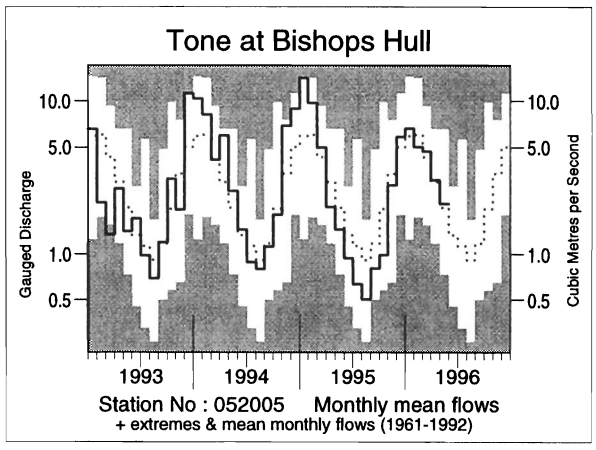


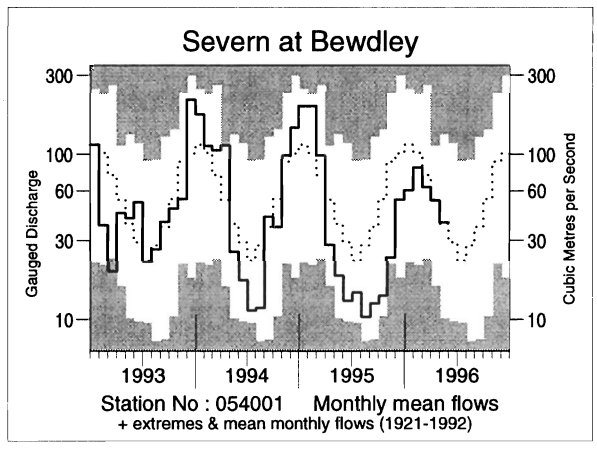


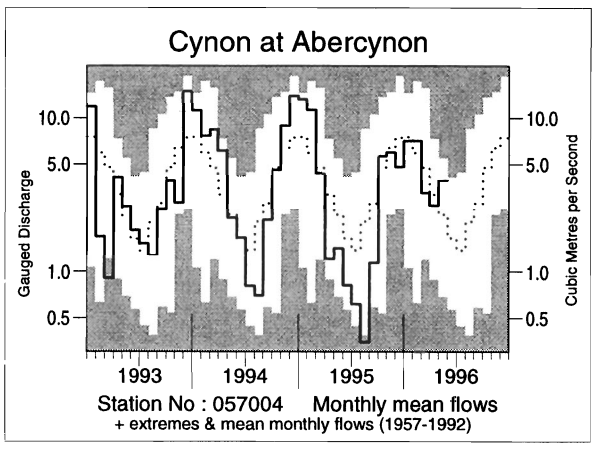

Coln at Bibury
Gauged Discharge
Cubic Metres per Second
3.0
1.0
0.6
0.3
1993
1994
1995
1996
Station No : 039020 Monthly mean flows
+ extremes & mean monthly flows (1963-1992)

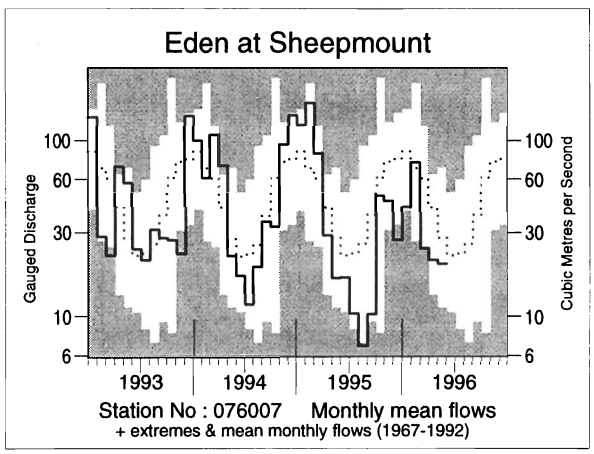

Great Stour at Horton
Gauged Discharge
Cubic Metres per Second
10.0
7.0
4.0
2.0
1.0
1993
1994
1995
1996
Station No : 040011 Monthly mean flows
+ extremes & mean monthly flows (1964-1992)


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)

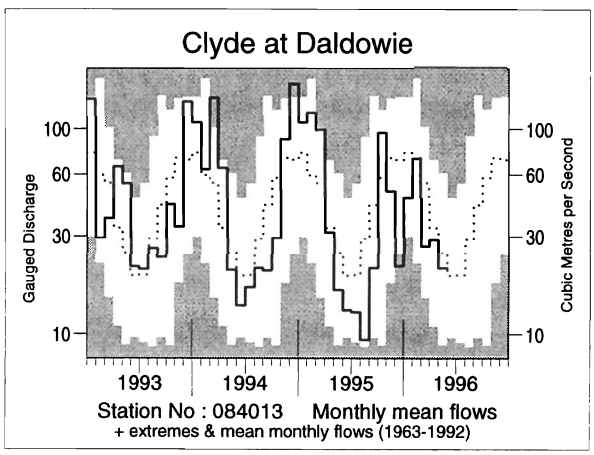

Clyde at Daldowie
Gauged Discharge
Cubic Metres per Second
100
60
30
10
1993
1994
1995
1996
Station No : 084013 Monthly mean flows
+ extremes & mean monthly flows (1963-1992)

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	Jan 1996	Feb	Mar	Apr	May 1996		3/96 to 5/96		10/95 to 5/96		6/95 to 5/96		6/94 to 5/96	
	mm %LT	mm %LT	mm %LT	mm %LT	mm %LT	rank /yrs	mm %LT	rank /yrs	mm %LT	rank /yrs	mm %LT	rank /yrs	mm %LT	rank /yrs
Dee at Park	156 168	99 135	71 74	114 143	49 78	11 /24	234 99	14 /24	765 115	20 /23	971 121	20 /23	1660 104	13 /22
Tay at Ballathie	155 103	98 84	71 54	115 128	72 104	26 /44	258 89	18 /44	897 96	16 /44	1041 91	13 /43	2385 104	29 /42
Tweed at Boleside	90 84	113 144	42 51	40 73	42 98	24 /36	124 69	6 /36	552 88	9 /35	617 81	6 /35	1504 98	12 /34
Whiteadder Water at Hutton Castle	54 90	64 135	37 77	20 53	31 116	20 /27	88 79	9 /27	299 91	9 /27	336 87	8 /26	587 76	6 /25
South Tyne at Haydon Bridge	52 50	104 137	35 40	32 56	37 101	19 /34	104 58	3 /34	422 68	3 /34	467 60	1 /32	1371 87	6 /30
Wharfe at Flint Mill Weir	34 33	68 90	23 30	20 37	30 83	21 /41	74 45	1 /41	232 40	1 /41	270 38	1 /40	1091 76	1 /39
Derwent at Buttercrambe	30 66	51 130	28 71	15 50	14 60	6 /35	57 62	4 /35	188 71	7 /35	222 69	6 /34	518 80	8 /33
Trent at Colwick	24 46	32 77	19 49	14 45	13 54	3 /38	47 50	2 /38	149 52	2 /38	193 55	2 /37	616 87	12 /36
Lud at Louth	7 25	11 32	12 35	10 32	9 35	2 /28	31 35	3 /28	67 34	3 /28	112 46	3 /27	393 80	10 /26
Witham at Claypole Mill	13 48	17 65	16 63	10 52	8 51	6 /38	34 57	7 /37	84 54	5 /37	100 54	5 /37	354 95	15 /36
Little Ouse at Abbey Heath	8 35	9 42	9 42	7 38	5 38	1 /29	21 40	1 /28	58 42	2 /28	83 49	3 /28	263 78	5 /27
Mimram at Panshanger Park	10 83	10 82	10 77	9 69	8 63	7 /44	27 70	7 /44	71 80	8 /43	113 89	15 /43	289 114	34 /42
Lee at Feildes Weir (natr.)	14 66	16 79	11 54	8 50	7 53	15 /111	25 53	14 /110	77 58	23 /110	107 66	23 /109	317 97	48 /107
Thames at Kingston (natr.)	35 93	31 94	25 80	18 82	13 77	41 /114	56 80	38 /114	173 84	39 /113	206 84	37 /113	518 105	61 /112
Coln at Bibury	58 108	46 83	45 83	37 87	27 83	10 /33	108 85	9 /33	270 85	9 /33	324 82	8 /32	781 98	14 /31
Great Stour at Horton	22 53	20 60	14 42	10 40	9 44	1 /32	33 43	1 /31	114 49	1 /30	160 55	1 /30	539 92	11 /28
Itchen at Highbridge+Allbrook	49 102	47 95	50 96	43 93	39 94	13 /38	133 94	12 /38	328 95	15 /38	437 95	13 /37	1004 109	29 /36
Stour at Throop Mill	67 103	64 106	49 97	33 93	21 91	16 /24	102 95	11 /24	338 96	10 /23	368 92	10 /23	928 115	18 /22
Exe at Thorverton	109 81	89 86	63 74	45 79	53 144	32 /41	160 90	16 /40	589 81	8 /40	631 76	4 /40	1723 103	24 /39
Taw at Umberleigh	91 76	67 78	44 65	41 92	32 114	27 /38	118 84	13 /38	445 72	7 /38	463 66	4 /37	1377 98	18 /36
Tone at Bishops Hull	88 105	62 85	63 112	39 101	28 106	23 /36	130 107	22 /36	407 97	17 /35	445 93	13 /35	1149 120	30 /34
Severn at Bewdley	37 52	48 84	39 84	31 99	24 103	46 /76	94 93	34 /75	236 62	5 /75	266 59	4 /75	806 89	23 /74
Teme at Knightsford Bridge	57 83	57 110	48 102	36 110	24 126	19 /27	108 109	17 /26	279 85	7 /26	295 80	5 /26	776 106	14 /25
Cynon at Abercynon	178 89	167 121	82 69	65 84	99 171	34 /38	247 97	17 /38	1003 94	15 /38	1075 84	8 /36	2657 104	19 /34
Dee at New Inn	136 56	173 103	68 37	74 68	112 166	22 /27	253 72	7 /27	870 61	1 /27	1022 57	1 /26	3138 87	4 /25
Eden at Sheepmount	49 46	82 108	28 39	23 48	23 70	9 /26	74 49	1 /26	345 60	1 /25	395 58	1 /24	1262 91	8 /22
Clyde at Daldowie	65 57	95 122	38 46	39 83	29 82	20 /33	106 65	7 /33	499 79	6 /33	576 73	4 /32	1579 100	13 /31
Carron at New Kelso	47 14	151 68	70 24	108 72	55 59	6 /18	234 45	2 /18	1010 53	1 /17	1383 55	1 /17	4116 80	1 /16
Ewe at Poolewe	54 20	104 54	106 51	71 49	65 66	9 /26	242 54	3 /26	1044 62	1 /25	1362 64	1 /25	3835 89	4 /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 1995. For the long periods (at the right of this table), the end date for the long term is 1996.

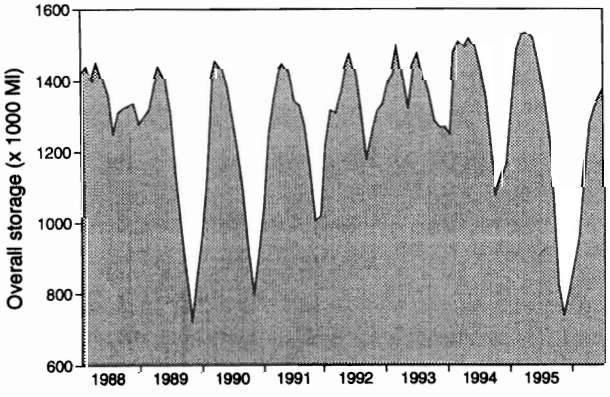
TABLE 4 START-MONTH RESERVOIR STORAGES UP TO JUNE 1996

Area	Reservoir (R)/ Group (G)		Capacity● (Ml)	1996 Jan	Feb	Mar	Apr	May	Jun	1995 Jun
North West	N.Command Zone[1]	(G)	133375	51	63	78	78	80	80	73
	Vyrnwy	(R)	55146	35	45	59	64	70	74	81
Northumbria	Teesdale[2]	(G)	87936	41	51	72	77	81	81	89
	Kielder	(R)	199175*	89*	93*	95*	96*	93*	96*	90*
Severn-Trent	Clywedog	(R)	44922	54	62	77	86	93	100	96
	Derwent Valley[3]	(G)	39525	10	15	46	54	54	56	86
Yorkshire	Washburn[4]	(G)	22035	23	34	53	70	76	87	78
	Bradford supply[5]	(G)	41407	22	33	53	59	60	70	70
Anglian	Grafham	(R)	58707	83	92	94	94	95	95	95
	Rutland	(R)	130061	61	72	82	92	94	93	83
Thames	London[6]	(G)	206399	82	89	94	94	95	95	96
	Farmoor [7]	(G)	13843	89	99	96	99	97	99	97
Southern	Bewl	(R)	28170	65	82	96	99	94	88	94
	Ardingly	(R)	4685	67	84	100	100	100	100	99
Wessex	Clatworthy	(R)	5364	92	91	100	100	94	97	69
	Bristol W [8]	(G)	38666*	60*	73*	86*	95*	97*	95*	86*
South West	Colliford	(R)	28540	46	55	61	63	66	69	88
	Roadford[9]	(R)	34500	23	30	35	37	41	48	85
	Wimbleball[10]	(R)	21320	46	60	72	78	81	86	89
	Stithians	(R)	5205	54	100	100	99	97	98	77
Welsh	Celyn + Brenig	(G)	131155	54	61	69	72	75	82	96
	Brianne	(R)	62140	76	97	100	100	100	100	85
	Big Five[11]	(G)	69762	67	84	94	94	94	97	79
	Elan Valley[12]	(G)	99106	56	73	95	98	99	97	90
East of Scotland	Edin./Mid Lothian[13]	(G)	97639	91	96	100	96	98	98	90
	East Lothian[14]	(G)	10206	99	99	100	99	98	99	96
West of Scotland	Loch Katrine	(G)	111363	80	91	96	94	100	99	85
	Daer	(R)	22412	83	97	100	96	100	96	85
	Loch Thom	(G)	11840	93	100	98	98	97	94	84

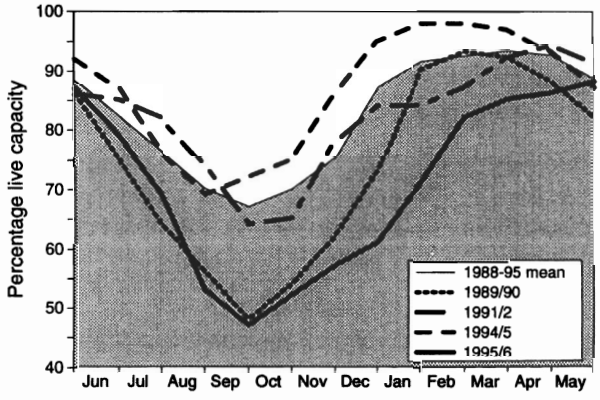
● Live or usable capacity (unless indicated otherwise) * Gross storage/percentage of gross storage

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



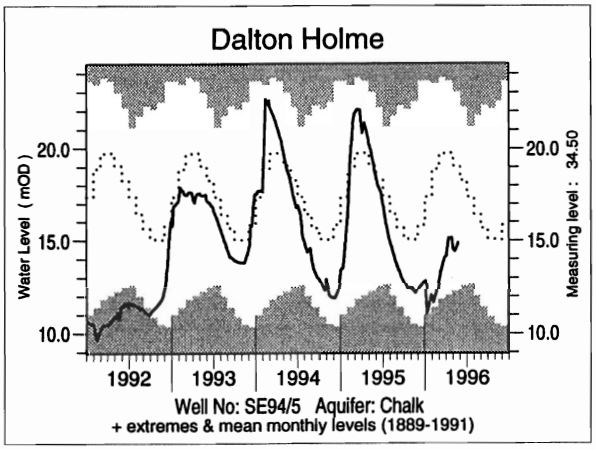
A COMPARISON BETWEEN OVERALL RESERVOIR STOCKS FOR ENGLAND AND WALES IN RECENT YEARS

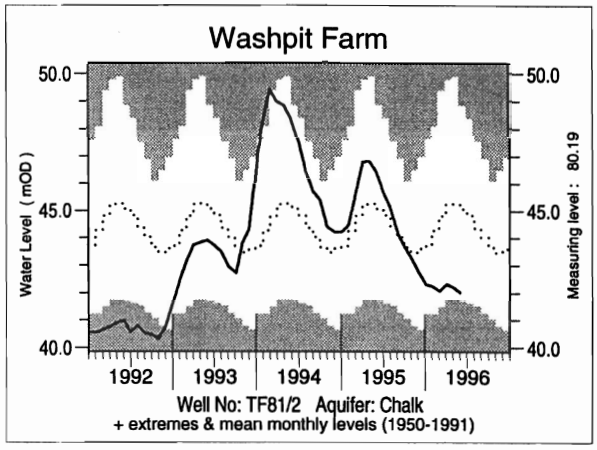


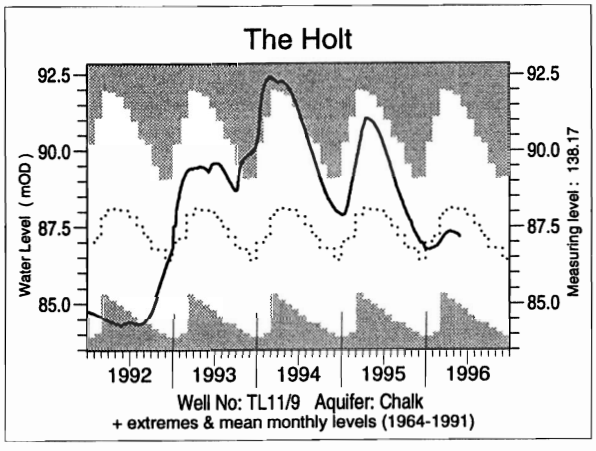
These plots are based on the reservoirs featured in Table 4 only

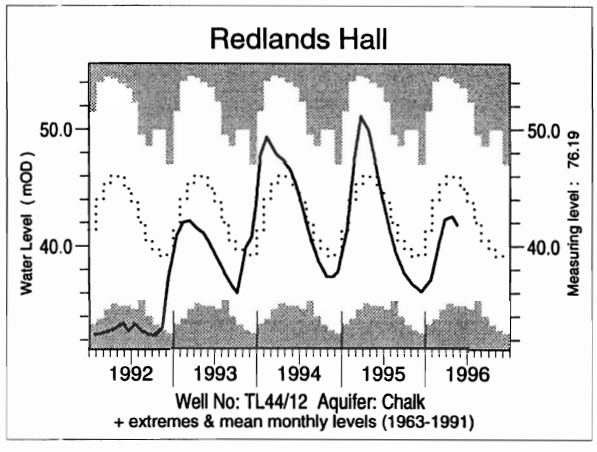
Note: Variations in storage depend on the balance between inputs (from catchment rainfall and any pumping) and outputs (to supply, compensation flow, HEP, amenity). There will be additional losses due to evaporation, especially in the summer months. Operational strategies for making the most efficient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

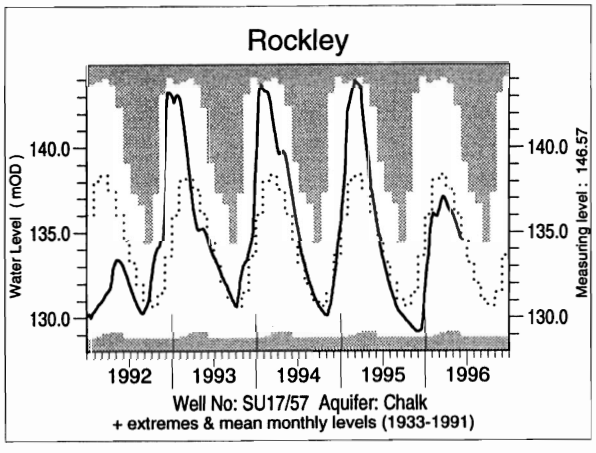
FIGURE 2 GROUNDWATER LEVEL HYDROGRAPHS

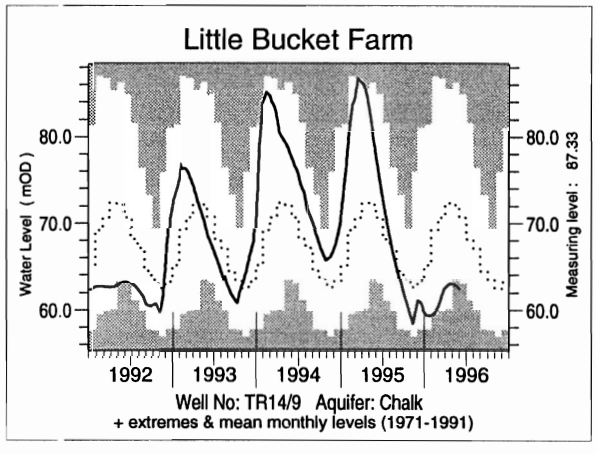


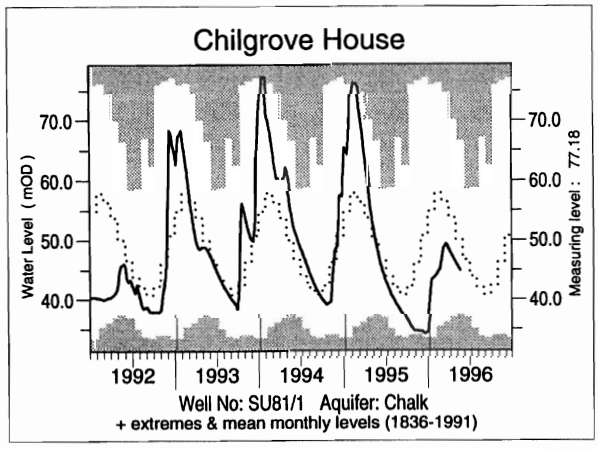


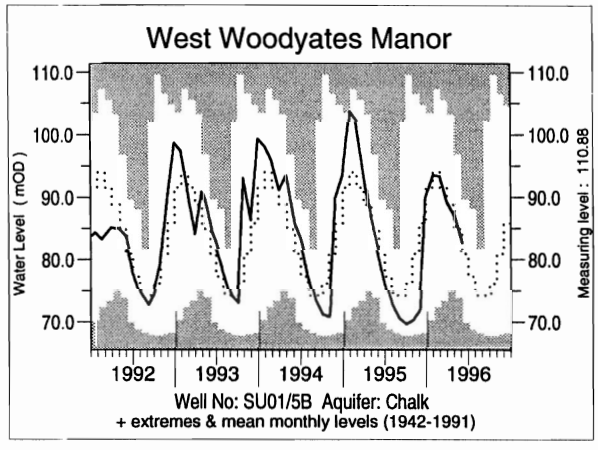


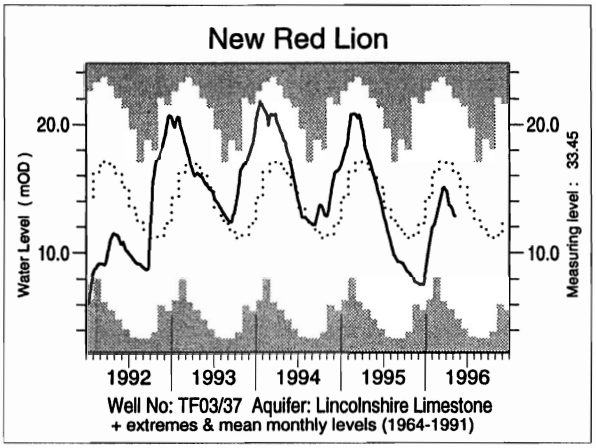


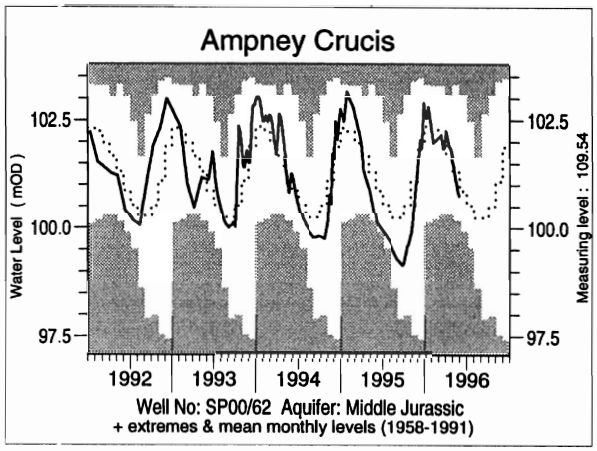


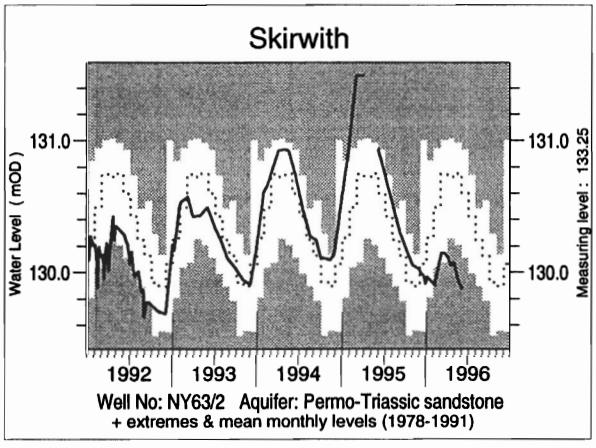


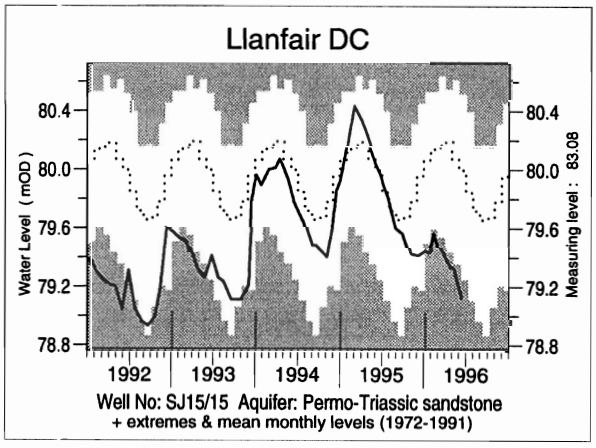


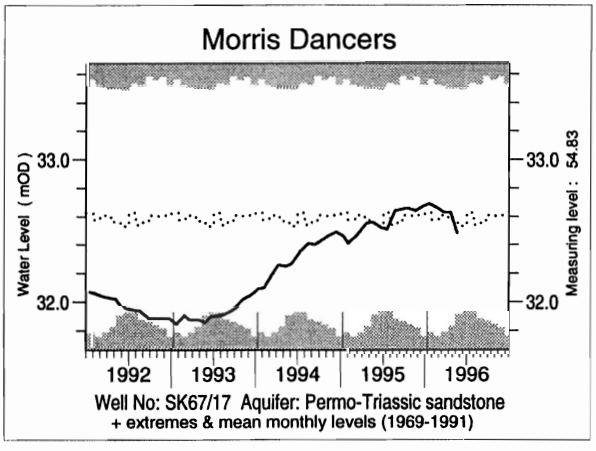


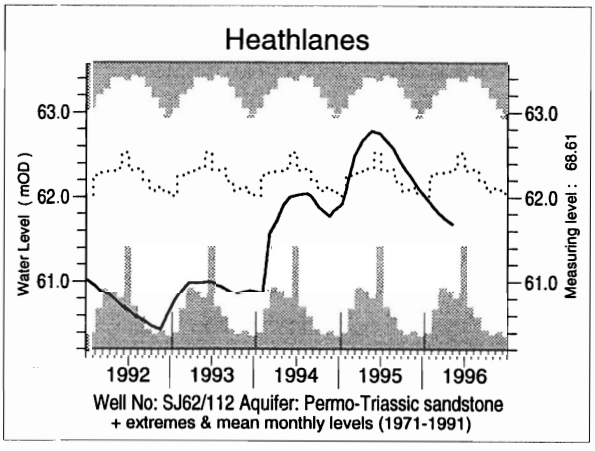

New Red Lion
Water Level (mOD)
20.0
10.0
Measuring level : 33.45
1992
1993
1994
1995
1996
Well No: TF03/37 Aquifer: Lincolnshire Limestone
+ extremes & mean monthly levels (1964-1991)

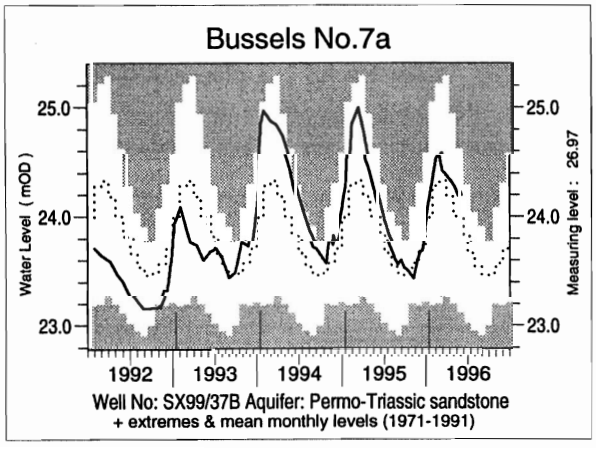

Ampney Crucis
Water Level (mOD)
102.5
100.0
97.5
Measuring level : 109.54
1992
1993
1994
1995
1996
Well No: SP00/62 Aquifer: Middle Jurassic
+ extremes & mean monthly levels (1958-1991)


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)

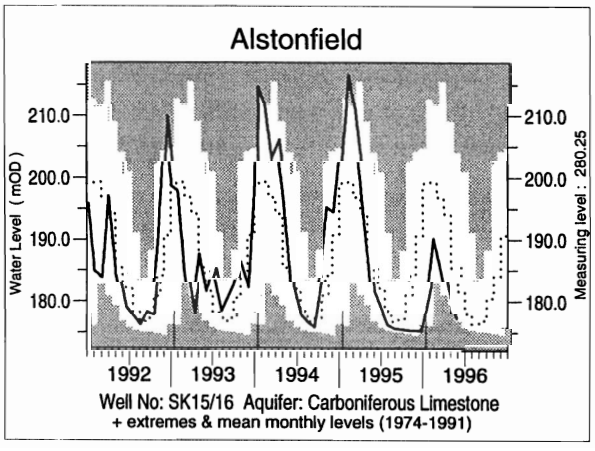

Alstonfield
Water Level (mOD)
210.0
200.0
190.0
180.0
Measuring level : 280.25
1992
1993
1994
1995
1996
Well No: SK15/16 Aquifer: Carboniferous Limestone
+ extremes & mean monthly levels (1974-1991)

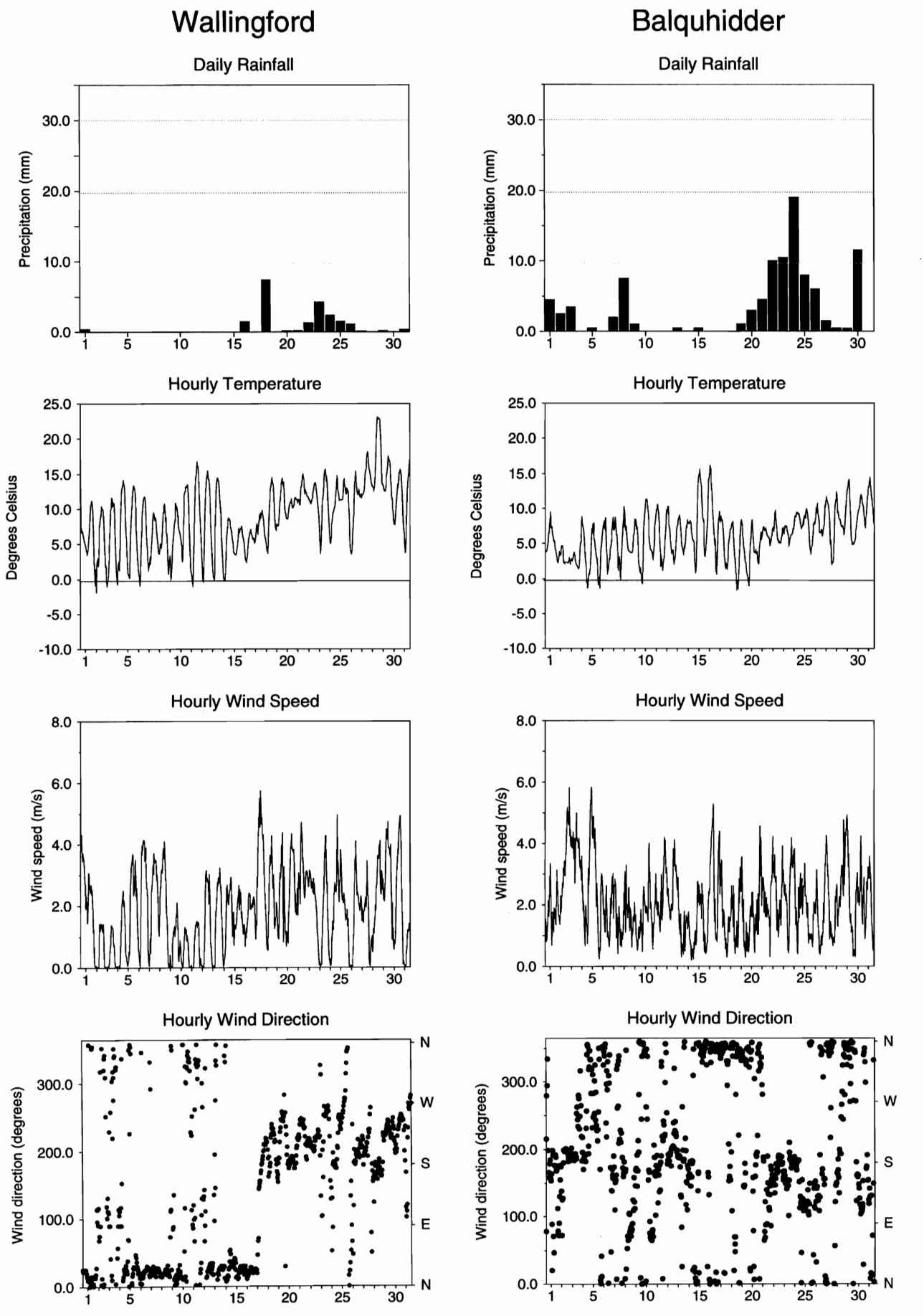
TABLE 5 MAY GROUNDWATER LEVELS 1996

Site	Aquifer	Records commence	Minimum May	Average May	Maximum May	No. of years May/June	May/June 1996	
			<1996	<1996	<1996	level<1996	day	level
Dalton Holme	C & UGS	1889	10 .77	19.11	22.99	8	24/05	14.88
Wetwang	C & UGS	1971	19.14	23.45	30.02	4	24/05	20.34
Keelby Grange	C & UGS	1980	3.88	13.39	19.19	1	15/05	6.05
Washpit Farm	C & UGS	1950	40.87	45.39	49.90	3	30/05	42.02
The Holt	C & UGS	1964	84.26	88.40	92.18	5	28/05	87.18
Therfield Rectory	C&UGS	1883	dry <71.60	81.66	97.72	>10	28/05	78.28
Redlands Hall	C & UGS	1964	33.34	45.09	53.89	7	17/05	41.82
Rockley	C & UGS	1933	129.16	136.11	142.36	>10	28/05	134.65
Little Bucket Farm	C & UGS	1971	62.84	72.72	86.15	0	28/05	62.35
Compton House	C & UGS	1894	29.71	41.28	52.55	>10	20/05	36.37
Chilgrove House	C & UGS	1836	37.49	49.40	66.54	>10	20/05	44.85
Westdean No.3	C & UGS	1940	1.24	1.88	2.84	>10	31/05	1.57
Lime Kiln Way	C & UGS	1969	124.02	125.44	126.18	>10	16/05	126.06
Ashton Farm	C & UGS	1974	65.29	68.60	70.33	10	30/05	68.44
West Woodyates Manor	C & UGS	1942	73.74	84.51	96.74	>10	30/05	82.61
New Red Lion	LLst	1964	4.80	16.07	22.00	7	08/05	12.87
Ampney Crucis	Mid Jur	1958	100.12	101.25	103.30	>10	28/05	100 .74
Redbank	PTS	1981	7.14	8.22	8.80	2	01/06	8.03
Yew Tree Farm	PTS	1973	13.07	13.57	13.84	5	05/06	13.45
Skirwith	PTS	1978	130.20	130.65	130.98	0	03/06	129.87
Llanfair D.C	PTS	1972	79.03	79.94	80.60	1	04/06	79.11
Morris Dancers	PTS	1969	31.85	32.48	33.51	>10	20/05	32.48
Stone	PTS	1974	89.67	90.48	91.16	1	20/05	89.90
Heathlanes	PTS	1971	60.72	62.21	63.38	7	08/05	61.68
Bussels No.7A	PTS	1972	23.11	23.99	24.62	>10	22/05	24.20
Rushyford NE	MgLst	1967	65.31	72.86	76.75	>10	18/05	76.36
Peggy Ellerton	MgLst	1968	31.45	34.56	37.24	8	22/05	33.79
Alstonfield	CLst	1974	176.53	186.39	203.79	1	13/05	176.92

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

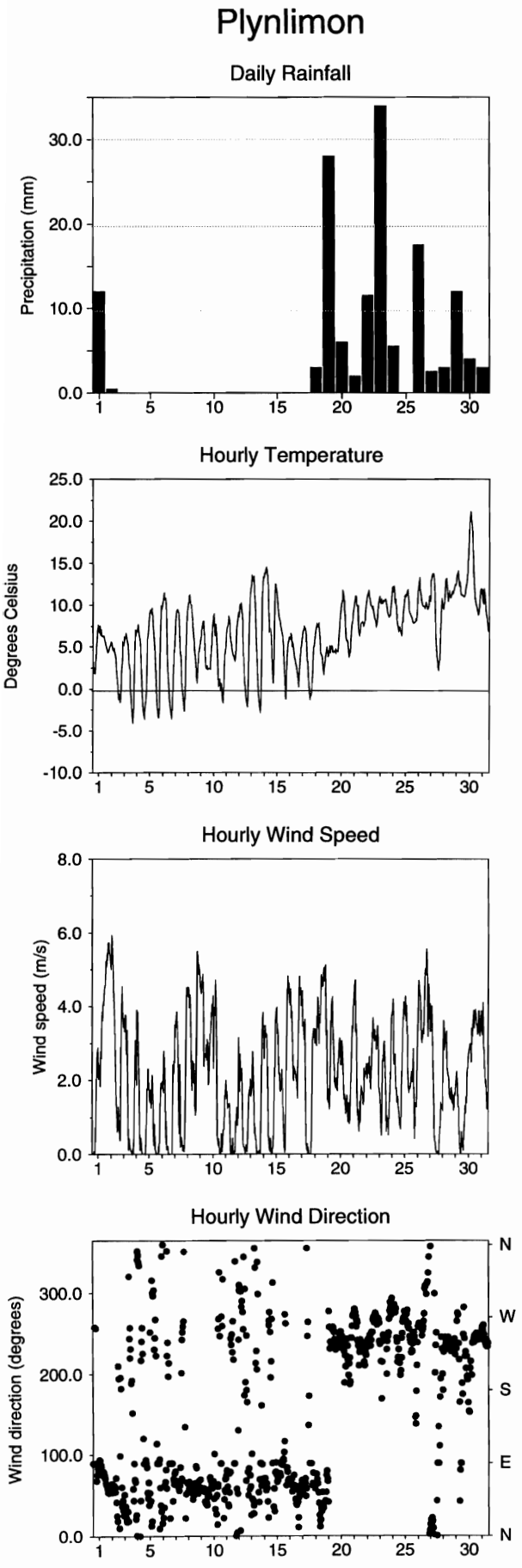
FIGURE 3 METEOROLOGICAL SUMMARY - MAY 1996



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

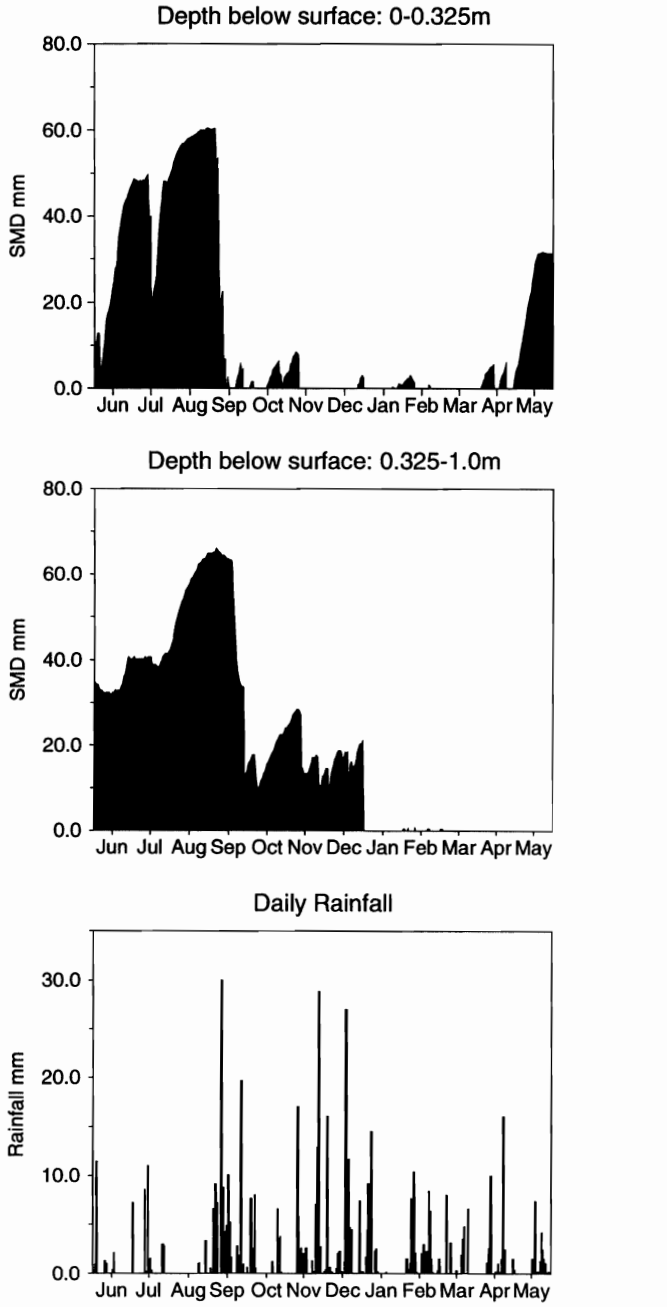
The Lower Kirkton automatic weather station (Balquhidder) occupies a relatively sheltered position at the mouth of the SSE trending Kirkton Glen. Station elevation is 270m aOD and average annual rainfall exceeds 2000mm; snow cover is expected for 10-30 days a year.

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 June 1995 is presented.

FIGURE 4 LOCATION MAP OF GAUGING STATIONS AND GROUNDWATER INDEX WELLS