Hydrological Summary for Great Britain

AUGUST 1995

Rainfall

August was a remarkably warm, dry and sunny month with heatwave conditions widespread until the fourth week. Throughout August, as for most of the summer, a northward extension of the high pressure cell normally located over the Azores served to exclude rain-bearing frontal systems and introduced warm, sub-tropical air across the British Isles. August regional rainfall totals were mostly in the 10-25% range; large parts of central southern England recorded less than five mm. *Provisional* data for the recent run of dry months confirm the exceptional rainfall deficiencies over periods of one to five months. For England and Wales, August was the equal second driest (after 1947) in a series from 1767. The summer (June-August) failed only marginally to eclipse 1976 as the driest in at least 220 years but with Scotland recording its second driest summer on record (in a series from 1869), the Great Britain June-August total has established a new minimum. In the five-month timeframe the aridity of England and Wales is even more exceptional: the April-August rainfall total is the lowest (for *any* start month) in more than 200 years. In rainfall terms, the late-spring and summer constitutes an intense drought throughout much of Britain and is extreme in those pockets failing to benefit from the patchy rainfall which has characterised most of this period. Rainfall over the last twelve months remains very close to the average in all regions helping to underline the important distinction between the 1995 deficiencies and the substantially more protracted events of 1975/76 and 1989/92. Patchy rainfall over the Bank Holiday heralded a dramatic change in weather patterns, some areas registering more rainfall in the first 10 days of September than in the preceding 10 weeks.

River Flow

Very limited rainfall, abetted by evaporation rates typically 20% above average, has resulted in steep and extended seasonal flow recessions. Parallels can be drawn with 1984 and 1990 but the intensification of the 1995 drought from mid-July to late-August resulted in progressively more notable river flows. A number of low flow measurement difficulties and the impact of artificial influences (including regulation) dictate that the August flows need to be treated with caution. Clearly though, runoff rates are very depressed away from those rivers, mostly in lowland England, still benefitting from healthy baseflow support. In most of western and northern Britain, August mean flows were between 10% and 40% of the monthly average and several absolute monthly minima were established (e.g. in the Tweed basin and on the South Tyne and the Eden). More generally, August runoff totals ranked amongst the three or four lowest on record and the 1976 monthly minima were approached in some impervious catchments (see Table 3) - a revealing index of the stress on the river network. At the time, the 1976 minima were associated with extremely long return periods; this year's minima - and those established over the 1989-92 period - imply that updated return periods will suggest a significantly greater frequency of occurrence.

Groundwater

Particularly depressed late-summer groundwater levels have been reported for some minor aquifers (e.g. in southern Scotland where Redbank levels remain below pre-1995 minima, and in Northern Ireland); there is concern for local supplies in a few districts. Levels are also very low in parts of the Cotswolds and in some, mostly western, Permo-Triassic outcrops. Generally however, water-tables remain within the normal range albeit mostly below average. Resources are particularly healthy in parts of the eastern Chalk outcrop but, to the west, spatial variability is considerable. As in the similar - but less severe - 1984 drought, groundwater has greatly moderated the impact of the spring/summer rainfall deficiency in eastern and southern England. However with soil moisture deficits at the end of August the equivalent of three months residual rainfall (in an average autumn) over much of the major aquifer outcrop areas, there is concern for winter recharge and the 1996 outlook.

General

Reservoir contents dipped steeply through August and total storage fell below corresponding levels in 1989 and 1990. Limited stocks in a number of supply reservoirs resulted in some restrictions on canal usage. Unprecedented demand early in the month continued to stretch distribution systems and, latterly, restrictions on river abstractions have increased the pressure on reservoir stocks. As demand eases into the autumn, concern will focus on the long term resources outlook. The wet start to the autumn is encouraging but substantially more rainfall is required to generate sustained recoveries in runoff and recharge. The rainfall (and temperatures) experienced over the spring and summer of 1995, when reviewed in the context of the lengthy historical data available, are indicative of extreme conditions. However, the clustering of dry/warm summers in the recent past suggest that there may not be a direct equivalence between historical rarity and contemporary frequency.

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 and Balquhidder (Central Region, Scotland). 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.

* 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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12 September 1995

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

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

		Aug 1994	Sep	Oct	Nov	Dec	Jan 1995	Feb	Mar	Apr	May	Jun	Jul	Aug
England and Wales	mm	72	106	97	86	142	161	111	64	27	48	22	38	15
	%	95	138	114	96	151	183	176	89	45	75	34	62	19
NRA REGIONS														
North West	mm	103	113	123	36	207	208	148	88	28	62	35	74	21
	%	96	98	96	111	167	172	190	93	39	83	43	87	20
Northumbrian	mm	81	77	71	97	124	121	107	60	38	53	31	34	15
	%	100	105	93	113	153	144	181	86	68	85	52	52	18
Severn Trent	mm	56	127	68	73	115	131	88	52	20	49	13	30	10
	%	84	198	106	103	149	187	163	85	36	83	22	57	15
Yorkshire	mm	58	101	73	89	123	133	100	65	26	44	22	29	13
	%	78	149	100	111	148	168	172	96	44	73	37	49	18
Anglian	mm	57	89	70	32	59	98	62	51	16	31	25	25	9
	%	104	182	137	55	107	196	168	109	35	65	49	52	16
Thames	mm	50	74	85	53	93	137	83	50	18	37	16	29	4
	%	86	125	137	82	133	214	184	89	36	66	29	59	7
Southern	mm	68	90	118	66	123	163	112	58	18	25	20	29	8
	%	119	130	148	78	150	204	207	92	34	46	37	61	13
Wessex	mm	68	99	115	96	139	184	111	57	34	53	14	24	12
	%	103	138	146	116	149	211	171	81	64	87	25	47	18
South West	mm	103	131	140	127	214	233	163	92	50	55	19	49	18
	%	123	141	121	102	154	169	161	93	72	76	28	70	21
Welsh	mm	94	134	139	134	255	238	181	84	36	72	26	61	18
	%	93	117	101	94	167	166	187	79	45	88	33	79	17
Scotland	mm	101	103	110	156	245	227	205	147	67	85	44	63	29
	%	86	73	71	103	162	150	201	118	88	99	51	67	25
RIVER PURIFICATION BOARDS														
Highland	mm	112	153	116	169	304	299	271	185	99	90	47	74	43
	%	88	89	59	83	154	159	213	114	109	98	48	70	34
North East	mm	47	89	87	89	93	134	83	72	65	79	54	39	20
	%	54	102	90	90	100	135	128	92	108	114	82	53	23
Tay	mm	81	56	115	154	196	184	188	125	38	99	32	51	15
	%	86	49	88	127	154	128	198	115	61	119	44	66	16
Forth	mm	80	56	90	134	210	154	167	91	33	69	32	61	15
	%	85	51	78	120	191	131	211	97	56	93	46	81	16
Tweed	mm	71	57	75	123	173	129	109	75	37	66	35	36	19
	%	81	64	79	132	186	129	163	95	65	93	54	49	22
Solway	mm	121	76	117	184	246	222	175	146	41	85	43	61	24
	%	102	53	75	128	166	142	173	125	53	100	51	68	20
Clyde	mm	142	98	128	189	322	257	248	192	65	81	45	83	32
	%	106	55	66	105	180	136	210	131	77	89	48	76	24

Note: The monthly rainfall figures for the NRA regions for July & August correspond to the MORECS areal assessments derived by the Meteorological Office. In northern England these initial assessments may have a particularly wide error band associated with them. The figures for the RPB regions for July & August 1995 were derived by IH in collaboration with the RPBs. The provisional figures for England and Wales and for Scotland are derived using a different raingauge network. Regional areal rainfall figures are regularly updated (normally one or two months in arrears) using figures derived from a far denser raingauge network.

TABLE 2 RAINFALL RETURN PERIOD ESTIMATES

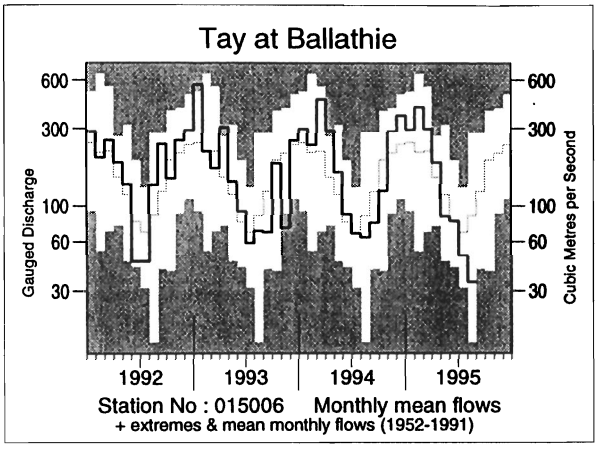
		Jun 76-Aug 76	Jun 95-Aug 95		Apr 95-Aug 95		Jan 95-Aug 95		Apr 93-Aug 95	
			Est Return Period, years		Est Return Period, years		Est Return Period, years		Est Return Period, years	
England and Wales	mm	*74*	75		150		486		2337	
	% LTA	*36*	37	>200	46	>200	88	2-5	110	5-10
NRA REGIONS										
North West	mm	*102*	130		220		664		2970	
	% LTA	*37*	48	50-80	53	110-150	93	2-5	105	2-5
Northumbria	mm	*74*	79		170		458		2155	
	% LTA	*36*	38	>200	52	120-170	85	5-10	106	2-5
Severn Trent	mm	*66*	53		122		393		1981	
	% LTA	*37*	30	>200	42	>200	82	5-10	110	5-10
Yorkshire	mm	*54*	64		134		432		2089	
	% LTA	*28*	33	>200	43	>200	84	5-10	107	2-5
Anglian	mm	*78*	59		106		317		1600	
	% LTA	*50*	38	120-170	43	>200	83	5-10	110	5-10
Thames	mm	*68*	49		104		374		1773	
	% LTA	*42*	30	150-250	39	>200	86	2-5	108	2-5
Southern	mm	*59*	57		100		433		2152	
	% LTA	*37*	36	80-120	37	>200	93	2-5	118	20-30
Wessex	mm	*68*	50		137		489		2320	
	% LTA	*39*	29	>200	48	80-120	96	2-5	118	20-30
South West	mm	*73*	85		190		678		3312	
	% LTA	*33*	38	80-120	52	70-100	97	2-5	122	60-90
Welsh	mm	*85*	104		212		715		3395	
	% LTA	*33*	41	80-120	51	120-170	93	2-5	112	5-10
Scotland	mm	*154*	136		288		867		3475	
	% LTA	*52*	46	>200	63	80-120	104	2-5	104	2-5
RIVER PURIFICATION BOARDS										
Highland	mm	*201*	164		353		1108		4079	
	% LTA	*61*	50	110-150	69	30-40	112	5-10	101	2-5
North East	mm	*90*	113		257		546		2290	
	% LTA	*40*	50	70-100	72	10-20	91	2-5	100	<2
Tay	mm	*124*	98		235		732		3080	
	% LTA	*51*	40	150-250	60	40-60	99	2-5	108	5-10
Forth	mm	*131*	108		210		622		2773	
	% LTA	*55*	45	110-150	57	110-150	94	2-5	107	5-10
Tweed	mm	*100*	90		193		506		2431	
	% LTA	*44*	40	>200	55	120-170	84	5-10	106	2-5
Solway	mm	*137*	128		254		797		3466	
	% LTA	*47*	43	110-150	56	110-150	96	2-5	105	2-5
Clyde	mm	*198*	160		306		1003		4131	
	% LTA	*59*	48	80-120	60	70-100	104	2-5	106	2-5

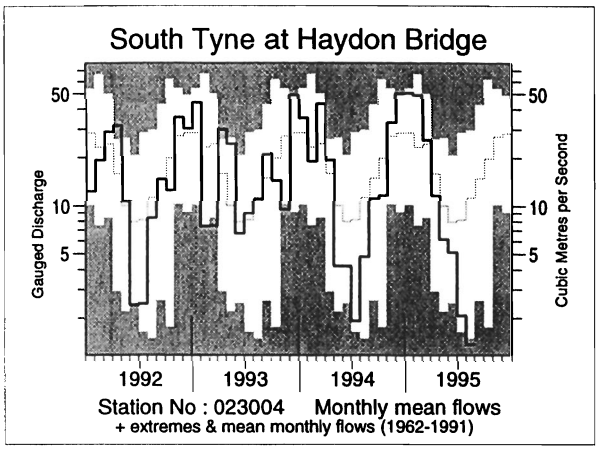
LTA refers to the period 1961-90.

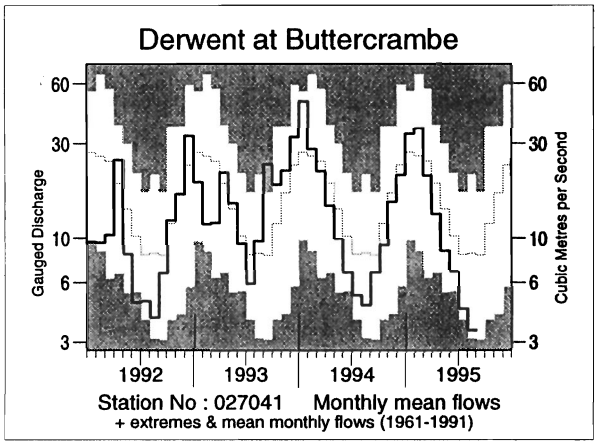
Return period assessments are based on tables provided by the Meteorological Office*. The tables reflect rainfall totals over the period 1911-70 only and the estimate assumes a sensibly stable climate. They assume a start in a specified month; return periods for a start in any month may be expected to be an order of magnitude less - for the longest durations the return period estimates converge. "Wet" return periods underlined. The ranking of accumulated rainfall totals for England & Wales and for Scotland can be affected by artifacts in the historical series - on balance these tend to exaggerate the relative wetness of the recent past.

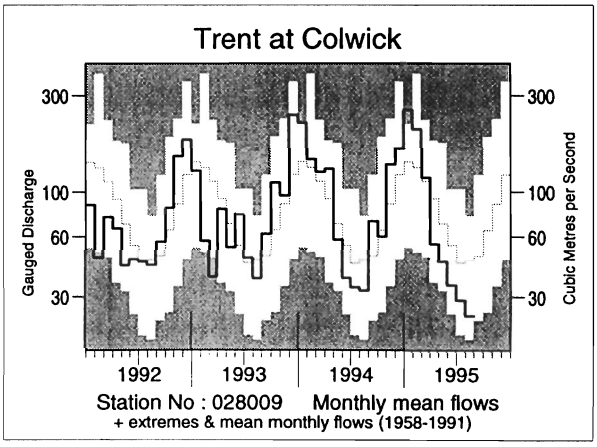
* Tabony, R.C., 1977, The Variability of long duration rainfall over Great Britain, Scientific Paper No. 37, Meteorological Office.

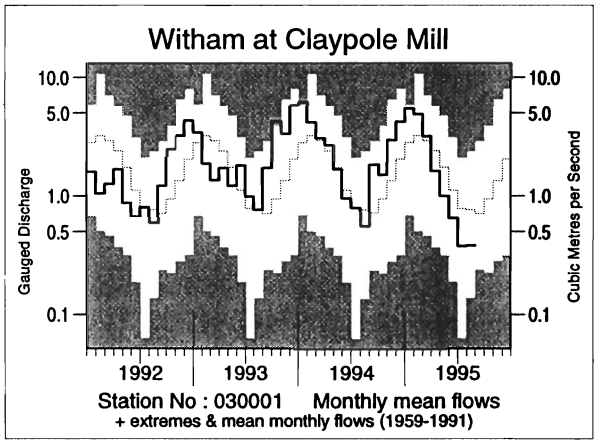
FIGURE 1 MONTHLY RIVER FLOW HYDROGRAPHS

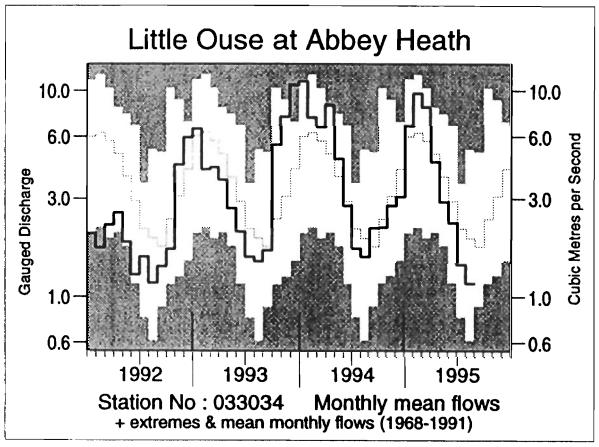


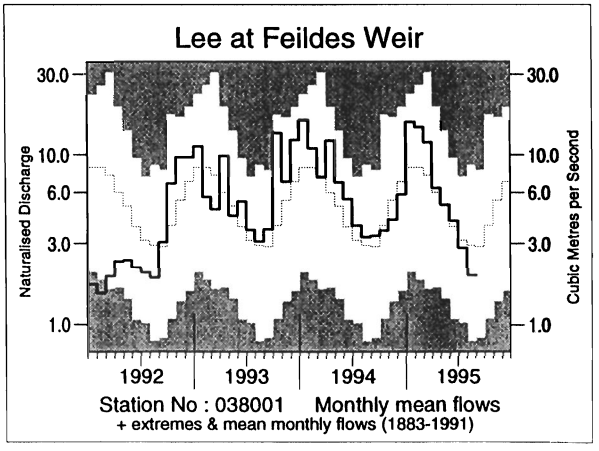


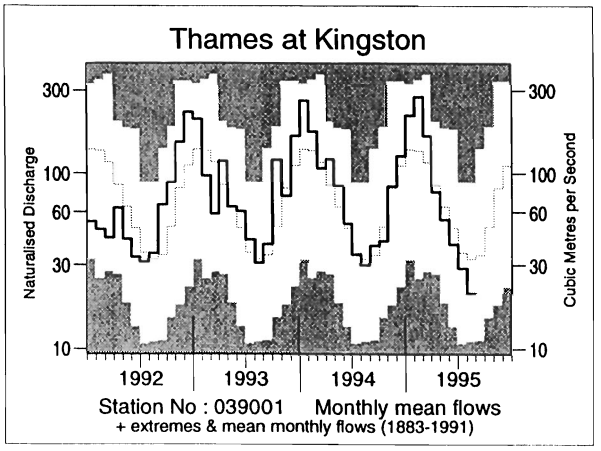


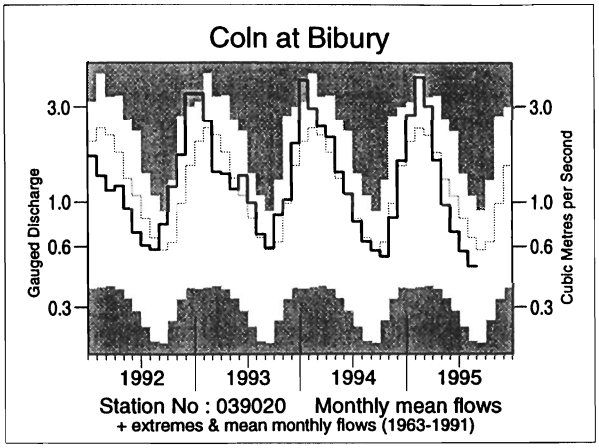


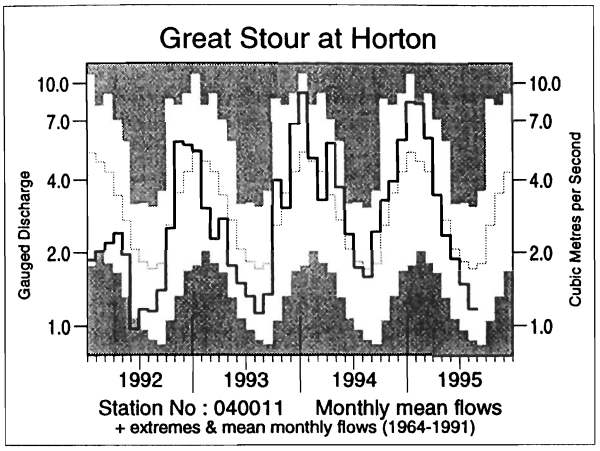


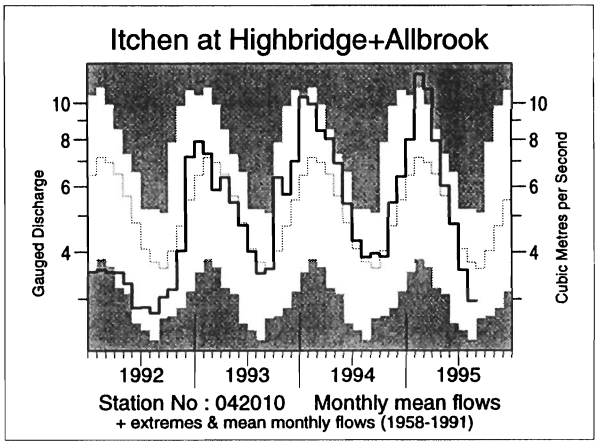


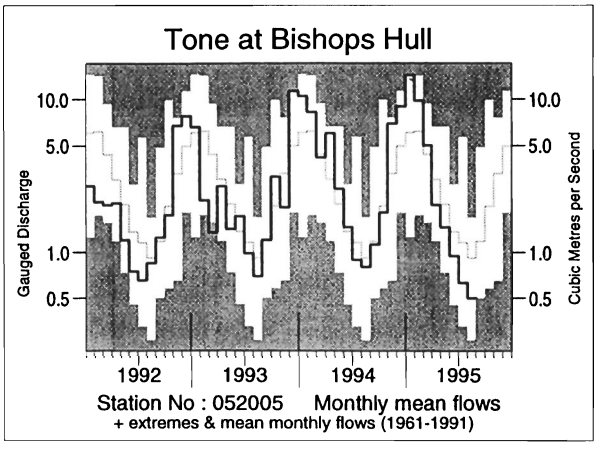


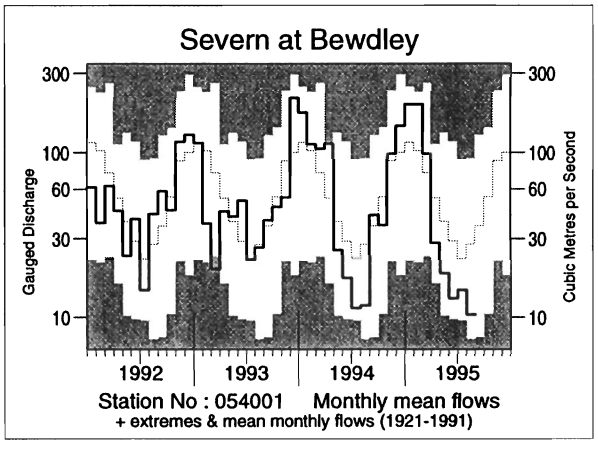


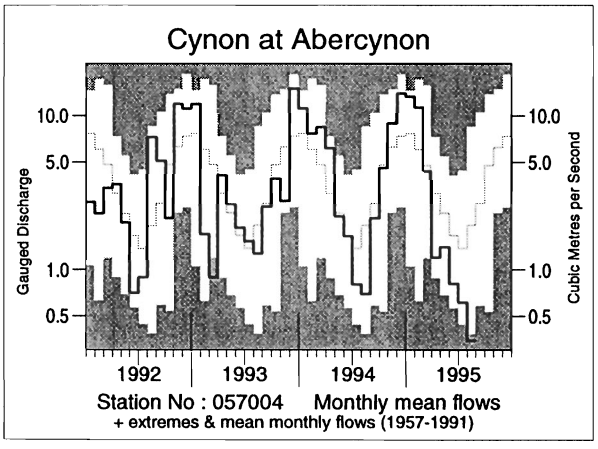

Coln at Bibury
Gauged Discharge
Cubic Metres per Second
3.0
1.0
0.6
0.3
1992
1993
1994
1995
Station No : 039020 Monthly mean flows
+ extremes & mean monthly flows (1963-1991)

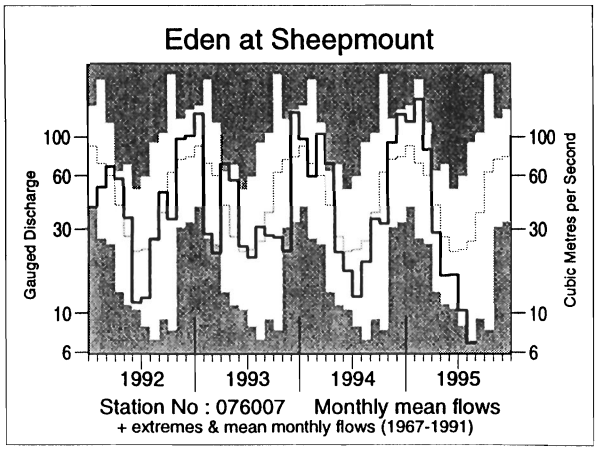

Great Stour at Horton
Gauged Discharge
Cubic Metres per Second
10.0
7.0
4.0
2.0
1.0
1992
1993
1994
1995
Station No : 040011 Monthly mean flows
+ extremes & mean monthly flows (1964-1991)


Itchen at Highbridge+Allbrook
Gauged Discharge
Cubic Metres per Second
10
8
6
4
1992
1993
1994
1995
Station No : 042010 Monthly mean flows
+ extremes & mean monthly flows (1958-1991)


Tone at Bishops Hull
Gauged Discharge
Cubic Metres per Second
10.0
5.0
1.0
0.5
1992
1993
1994
1995
Station No : 052005 Monthly mean flows
+ extremes & mean monthly flows (1961-1991)


Severn at Bewdley
Gauged Discharge
Cubic Metres per Second
300
100
60
30
10
1992
1993
1994
1995
Station No : 054001 Monthly mean flows
+ extremes & mean monthly flows (1921-1991)


Cynon at Abercynon
Gauged Discharge
Cubic Metres per Second
10.0
5.0
1.0
0.5
1992
1993
1994
1995
Station No : 057004 Monthly mean flows
+ extremes & mean monthly flows (1957-1991)


Eden at Sheepmount
Gauged Discharge
Cubic Metres per Second
100
60
30
10
6
1992
1993
1994
1995
Station No : 076007 Monthly mean flows
+ extremes & mean monthly flows (1967-1991)

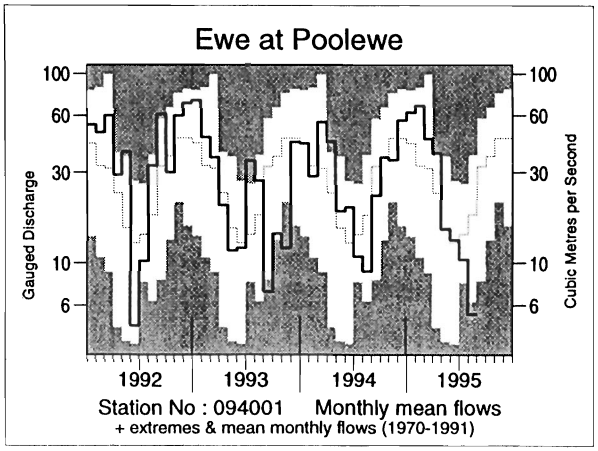

Ewe at Poolewe
Gauged Discharge
Cubic Metres per Second
100
60
30
10
6
1992
1993
1994
1995
Station No : 094001 Monthly mean flows
+ extremes & mean monthly flows (1970-1991)

TABLE 3 RUNOFF AS MM. AND AS A PERCENTAGE OF THE PERIOD OF RECORD AVERAGE WITH SELECTED PERIODS RANKED IN THE RECORD

River/ Station name	Apr 1995	May	Jun	Jul	Aug 1995		*Aug 1976*		6/95 to 8/95		1/95 to 8/95		9/94 to 8/95	
	mm %LT	mm %LT	mm %LT	mm %LT	mm %LT	rank /yrs	*mm %LT*	*rank /yrs*	mm %LT	rank /yrs	mm %LT	rank /yrs	mm %LT	rank /yrs
Dee at	67	55	46	16	9	4	*9*	*1*	71	9	463	7	696	6
Park	84	88	126	59	30	/23	*29*	*/23*	76	/23	93	/23	88	/22
Tay at	105	50	46	29	20	4	*22*	*5*	94	6	817	35	1310	37
Ballathie	118	72	102	73	39	/43	*44*	*/43*	70	/43	118	/43	114	/42
Tweed at	36	24	19	14	12	4	*9*	*1*	45	2	560	33	933	33
Boleside	66	55	72	52	32	/35	*24*	*/35*	50	/35	123	/35	121	/34
Whiteadder Water at	19	13	13	7	5	1	*6*	*5*	26	7	171	5	253	5
Hutton Castle	50	48	79	59	36	/26	*44*	*/26*	60	/26	66	/26	65	/26
South Tyne at	40	22	18	7	5	1	*5*	*2*	30	1	524	25	896	23
Haydon Bridge	69	60	67	27	13	/32	*14*	*/32*	33	/32	116	/32	114	/30
Wharfe at	26	13	11	10	7	3	*4*	*1*	28	2	465	26	805	27
Flint Mill Weir	47	35	44	39	17	/40	*9*	*/40*	31	/40	107	/40	112	/39
Derwent at	22	15	11	7	6	3	*5*	*2*	24	4	207	16	293	13
Buttercrambe	70	63	68	55	42	/34	*40*	*/34*	57	/34	93	/34	90	/33
Trent at	19	16	12	10	9	2	*7*	*1*	31	3	265	24	417	27
Colwick	60	66	63	65	54	/37	*41*	*/37*	61	/37	111	/37	117	/36
Lud at	25	20	15	12	9	8	*5*	*2*	37	9	209	14	272	14
Louth	83	80	80	80	70	/28	*39*	*/28*	78	/27	104	/27	105	/27
Witham at	14	9	6	3	3	5	*1*	*1*	12	5	153	22	246	27
Claypole Mill	69	59	58	48	51	/37	*18*	*/37*	54	/37	112	/36	132	/36
Little Ouse at	17	11	8	5	4	7	*2*	*1*	18	8	138	16	176	15
Abbey Heath	91	77	82	68	62	/27	*34*	*/27*	73	/27	111	/27	106	/26
Mimram at	19	17	13	11	9	19	*3*	*1*	33	30	125	38	168	38
Panshanger Park	148	136	125	112	98	/43	*33*	*/43*	112	/43	137	/43	133	/42
Lee at	16	13	10	7	5	27	*- NA -*		23	48	157	92	200	77
Feildes Weir (natr.)	105	102	108	90	67	/110			90	/110	137	/109	122	/108
Thames at	20	15	10	8	6	26	*3*	*1*	24	35	228	97	305	85
Kingston (natr.)	91	84	81	88	64	/113	*34*	*/113*	78	/113	132	/113	124	/112
Coln at	39	24	17	14	12	4	*5*	*1*	44	6	350	24	438	18
Bibury	93	75	66	69	72	/32	*32*	*/32*	69	/32	116	/32	110	/31
Great Stour at	26	18	14	12	9	9	*7*	*1*	35	8	249	26	367	24
Horton	100	87	94	83	70	/31	*53*	*/31*	83	/30	126	/29	125	/28
Itchen at	57	45	34	27	22	5	*17*	*1*	83	9	406	34	550	30
Highbridge+Allbrook	123	107	100	89	79	/37	*63*	*/37*	90	/37	123	/37	119	/36
Stour at	26	16	10	6	4	2	*3*	*1*	21	2	375	20	547	20
Throop Mill	73	70	64	57	45	/23	*35*	*/23*	58	/23	139	/23	136	/22
Exe at	29	20	12	8	6	2	*3*	*1*	27	3	587	37	1076	36
Thorverton	50	54	51	41	22	/40	*11*	*/40*	37	/40	120	/39	128	/39
Taw at	21	11	6	4	3	3	*1*	*1*	13	4	484	31	904	34
Umberleigh	47	39	34	27	15	/37	*8*	*/37*	26	/37	122	/37	129	/36
Tone at	26	19	12	8	7	3	*4*	*1*	27	3	445	33	690	33
Bishops Hull	67	72	70	56	55	/35	*30*	*/35*	62	/35	138	/34	144	/34
Severn at	17	11	8	9	6	4	*5*	*1*	23	6	343	63	538	58
Bewdley	53	49	44	65	38	/75	*27*	*/75*	48	/75	122	/74	119	/74
Teme at	14	9	5	4	2	2	*2*	*3*	11	3	294	20	457	24
Knightsford Bridge	42	47	37	48	19	/26	*22*	*/26*	36	/26	119	/25	125	/25
Cynon at	29	35	20	15	9	1	*10*	*2*	44	4	811	25	1548	32
Abercynon	37	60	50	46	17	/37	*20*	*/37*	36	/37	113	/37	122	/35
Dee at	38	45	31	69	9	2	*8*	*1*	108	5	1017	14	1967	21
New Inn	35	67	52	107	9	/27	*9*	*/27*	50	/26	104	/26	109	/26
Eden at	32	19	19	12	8	1	*8*	*2*	39	1	504	23	842	21
Sheepmount	65	58	76	47	26	/25	*28*	*/25*	49	/25	122	/25	121	/23
Clyde at	43	23	18	18	13	3	*13*	*2*	49	2	558	28	981	30
Daldowie	90	64	69	66	33	/32	*33*	*/32*	53	/32	125	/32	124	/31
Carron at	188	61	49	89	29	1	*- NA -*		167	2	1533	12	2551	10
New Kelso	127	64	61	75	18	/17			47	/17	106	/17	99	/16
Ewe at	222	92	78	63	33	1	*66*	*7*	173	3	1509	21	2410	18
Poolewe	155	93	104	71	29	/25	*60*	*/25*	/64	/25	126	/25	111	/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 1992. For the long periods (at the right of this table), the end date for the long term is 1995.
(iiii) NA August 1976 flows were not available.

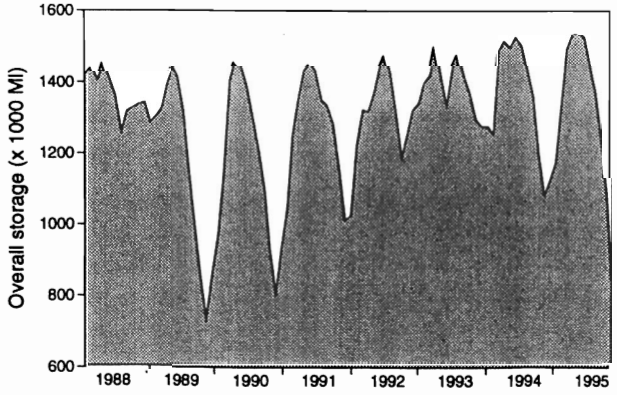
TABLE 4 START-MONTH RESERVOIR STORAGES UP TO SEPTEMBER 1995

Area	Reservoir (R)/ Group (G)		Capacity • (Ml)	1995 Apr	May	Jun	Jul	Aug	Sep	1994 Sep
North West	N.Command Zone[1]	(G)	133375	99	86	73	58	44	24	52
	Vyrnwy	(R)	55146	97	89	81	69	59	36	61
Northumbria	Teesdale[2]	(G)	87936	99	95	89	70	59	38	46
	Kielder	(R)	199175*	97*	89*	90*	91*	87*	85*	92*
Severn-Trent	Clywedog	(R)	44922	97	96	96	86	73	48	61
	Derwent Valley[3]	(G)	39525	100	97	86	72	59	44	43
Yorkshire	Washburn[4]	(G)	22035	98	88	78	63	50	34	40
	Bradford supply[5]	(G)	41407	98	89	70	54	38	21	38
Anglian	Grafham	(R)	58707	95	96	95	94	88	71	83
	Rutland	(R)	130061	91	87	83	80	74	66	86
Thames	London[6]	(G)	206399	97	95	96	93	82	62	77
	Farmoor [7]	(G)	13843	97	97	97	94	86	64	96
Southern	Bewl	(R)	28170	99	97	94	88	81	72	88
	Ardingly	(R)	4685	100	100	99	97	66	48	85
Wessex	Clatworthy	(R)	5364	100	85	69	61	44	31	54
	Bristol W [8]	(G)	38666*	99*	94*	86*	79*	67*	48*	61*
South West	Colliford	(R)	28540	97	93	88	80	70	54	68
	Roadford[9]	(R)	34500	96	92	85	76	60	40	67
	Wimbleball[10]	(R)	21320	100	95	89	74	59	40	60
	Stithians	(R)	5205	96	86	77	61	45	31	57
Welsh	Celyn + Brenig	(G)	131155	100	100	96	87	79	57	66
	Brianne	(R)	62140	100	97	85	76	67	55	72
	Big Five[11]	(G)	69762	99	86	79	65	49	29	58
	Elan Valley[12]	(G)	99106	95	99	90	80	65	46	62
Lothian	Edin./Mid Lothian[13]	(G)	97639	99	98	90	88	79	69	73
	East Lothian[14]	(G)	10206	100	100	96	91	84	71	66
Strathclyde	Loch Katrine	(G)	111363	100	92	85	71	69	50	86
	Daer	(R)	22412	96	91	85	73	62	41	59
	Loch Thom	(G)	11840	100	92	84	77	72	59	76

• 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

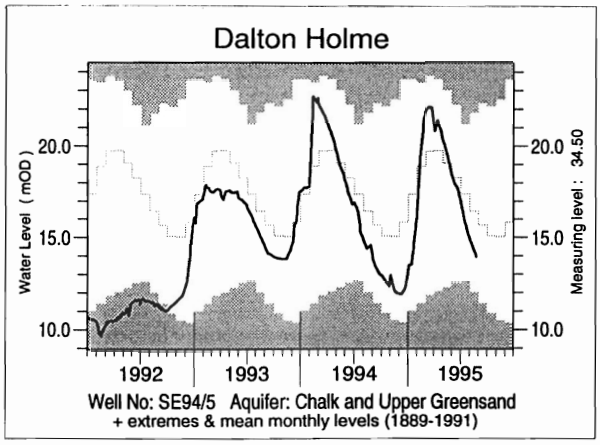
A GUIDE TO THE VARIATION IN OVERALL RESERVOIR STOCKS FOR ENGLAND AND WALES

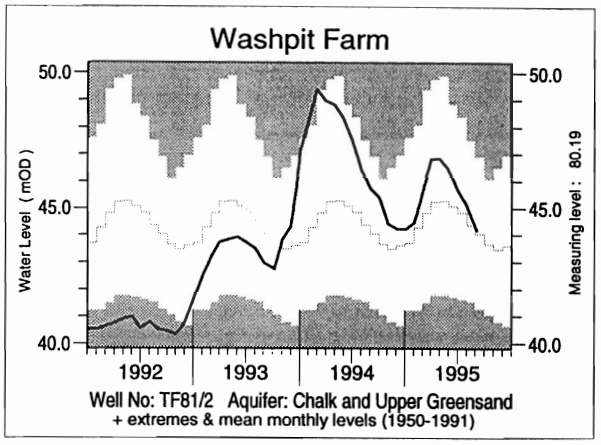


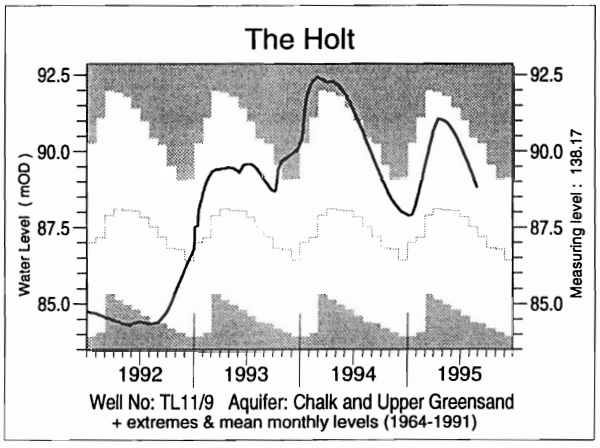
This plot is based on the reservoirs featured in Table 4 only.

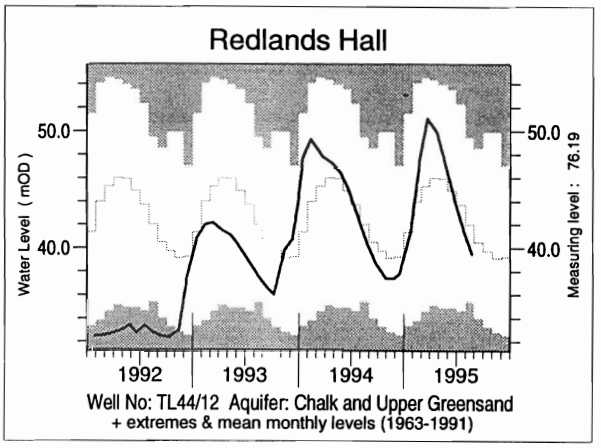
Note: Variations in storage depend on the balance between inputs (from catchment rainfall and any pumping) and outputs (to supply, compensation flow, HEP, amenity). There will be additional losses due to evaporation, especially in the summer months. Operational strategies for making the most efficient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

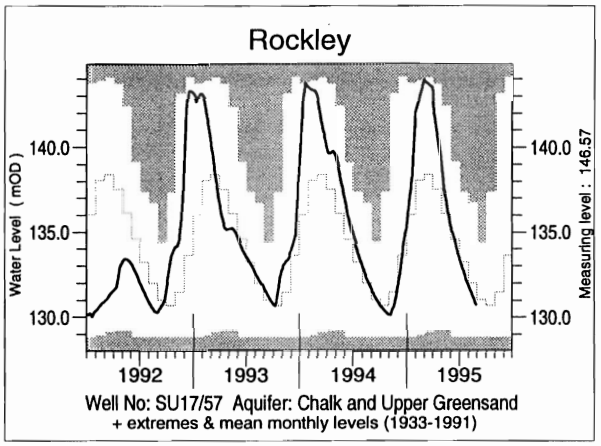
FIGURE 2 GROUNDWATER LEVEL HYDROGRAPHS

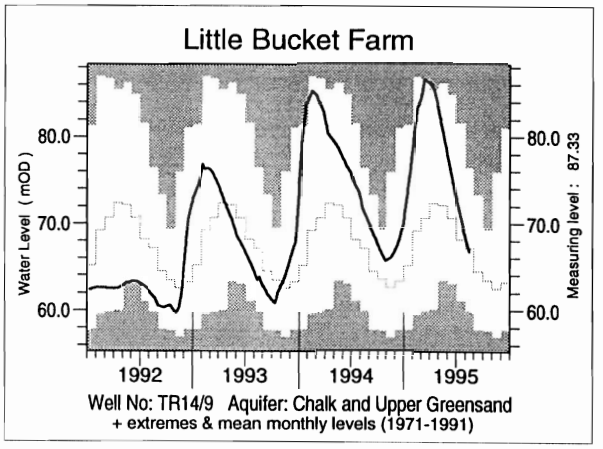


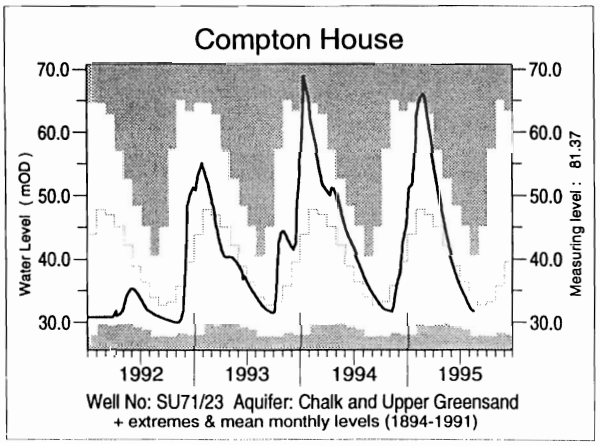


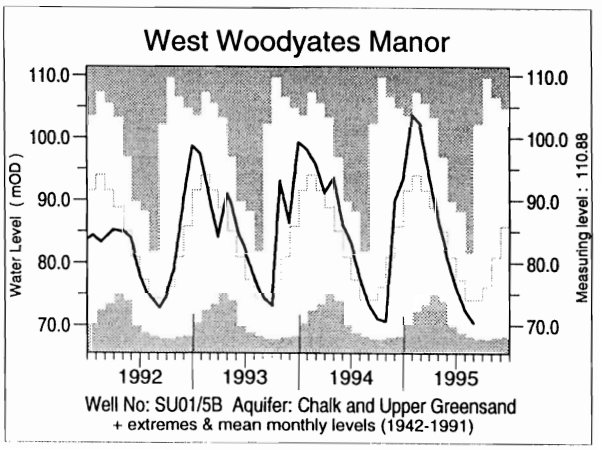


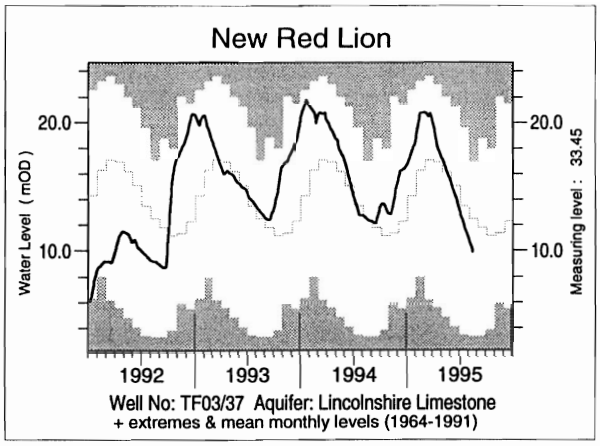


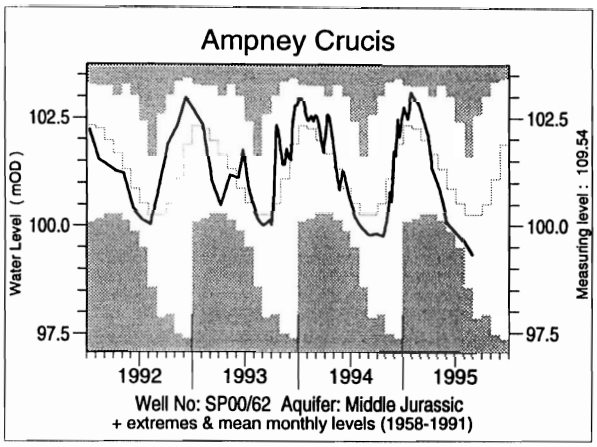


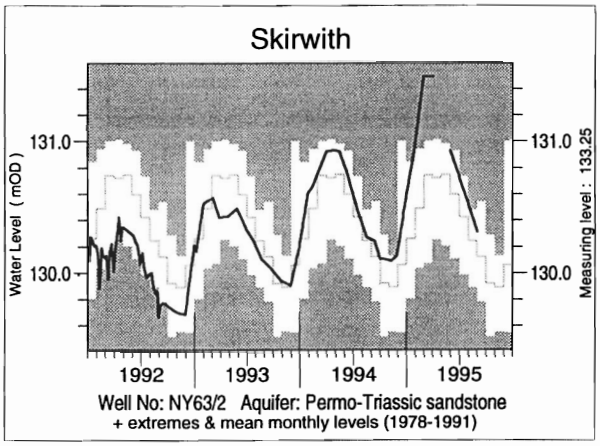


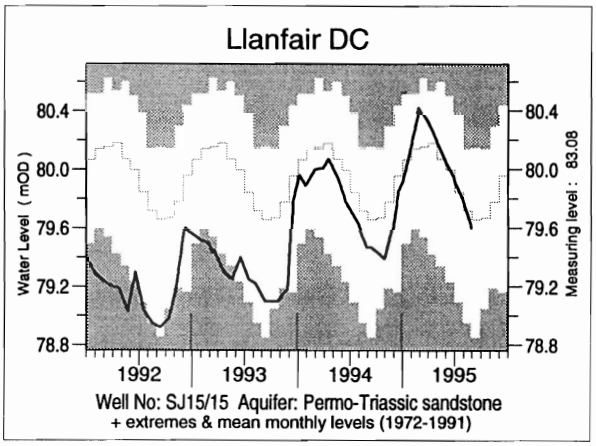


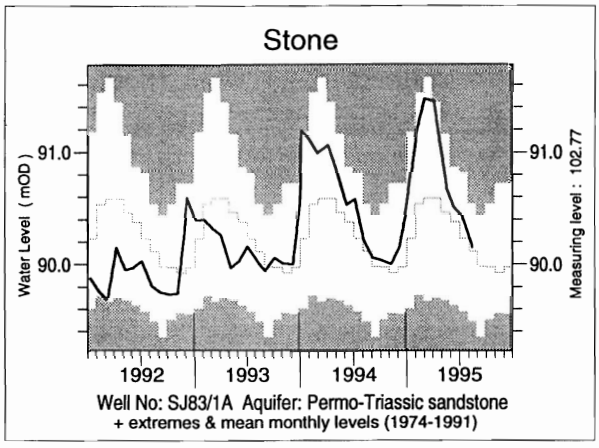


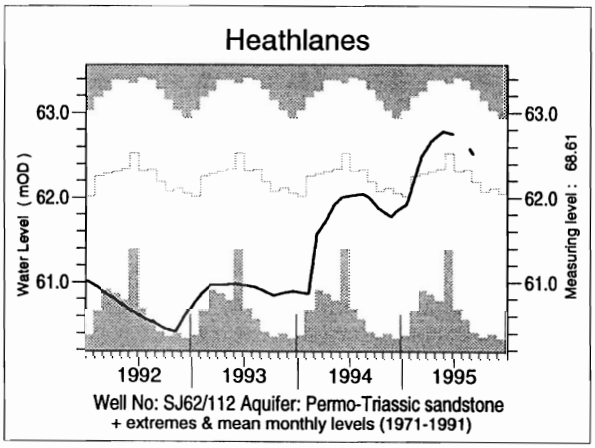

New Red Lion
Water Level (mOD)
20.0
10.0
Measuring level : 33.45
1992
1993
1994
1995
Well No: TF03/37 Aquifer: Lincolnshire Limestone
+ extremes & mean monthly levels (1964-1991)

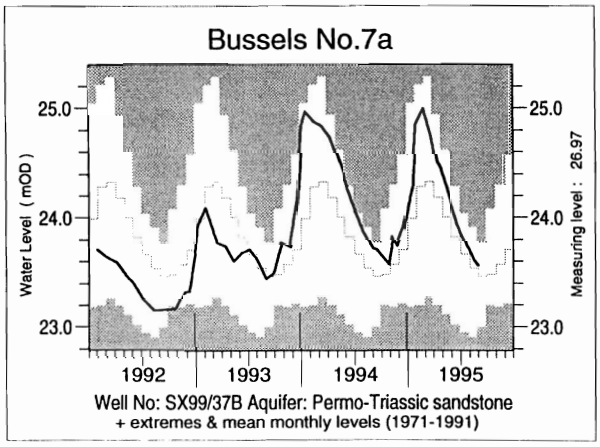

Ampney Crucis
Water Level (mOD)
102.5
100.0
97.5
Measuring level : 109.54
1992
1993
1994
1995
Well No: SP00/62 Aquifer: Middle Jurassic
+ extremes & mean monthly levels (1958-1991)


Skirwith
Water Level (mOD)
131.0
130.0
Measuring level : 133.25
1992
1993
1994
1995
Well No: NY63/2 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1978-1991)


Llanfair DC
Water Level (mOD)
80.4
80.0
79.6
79.2
78.8
Measuring level : 83.08
1992
1993
1994
1995
Well No: SJ15/15 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1972-1991)


Stone
Water Level (mOD)
91.0
90.0
Measuring level : 102.77
1992
1993
1994
1995
Well No: SJ83/1A Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1974-1991)


Heathlanes
Water Level (mOD)
63.0
62.0
61.0
Measuring level : 68.61
1992
1993
1994
1995
Well No: SJ62/112 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1971-1991)


Bussels No.7a
Water Level (mOD)
25.0
24.0
23.0
Measuring level : 26.97
1992
1993
1994
1995
Well No: SX99/37B Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1971-1991)

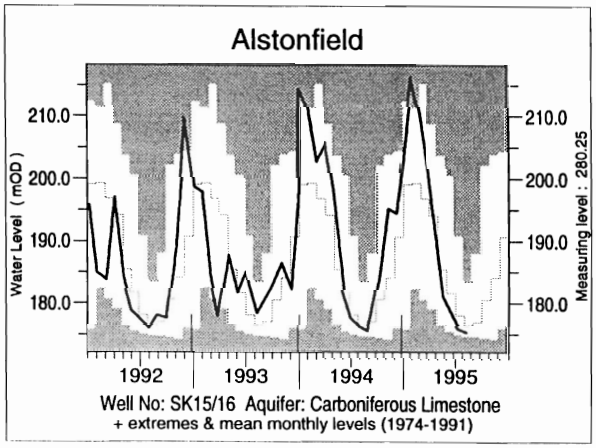

Alstonfield
Water Level (mOD)
210.0
200.0
190.0
180.0
Measuring level : 280.25
1992
1993
1994
1995
Well No: SK15/16 Aquifer: Carboniferous Limestone
+ extremes & mean monthly levels (1974-1991)

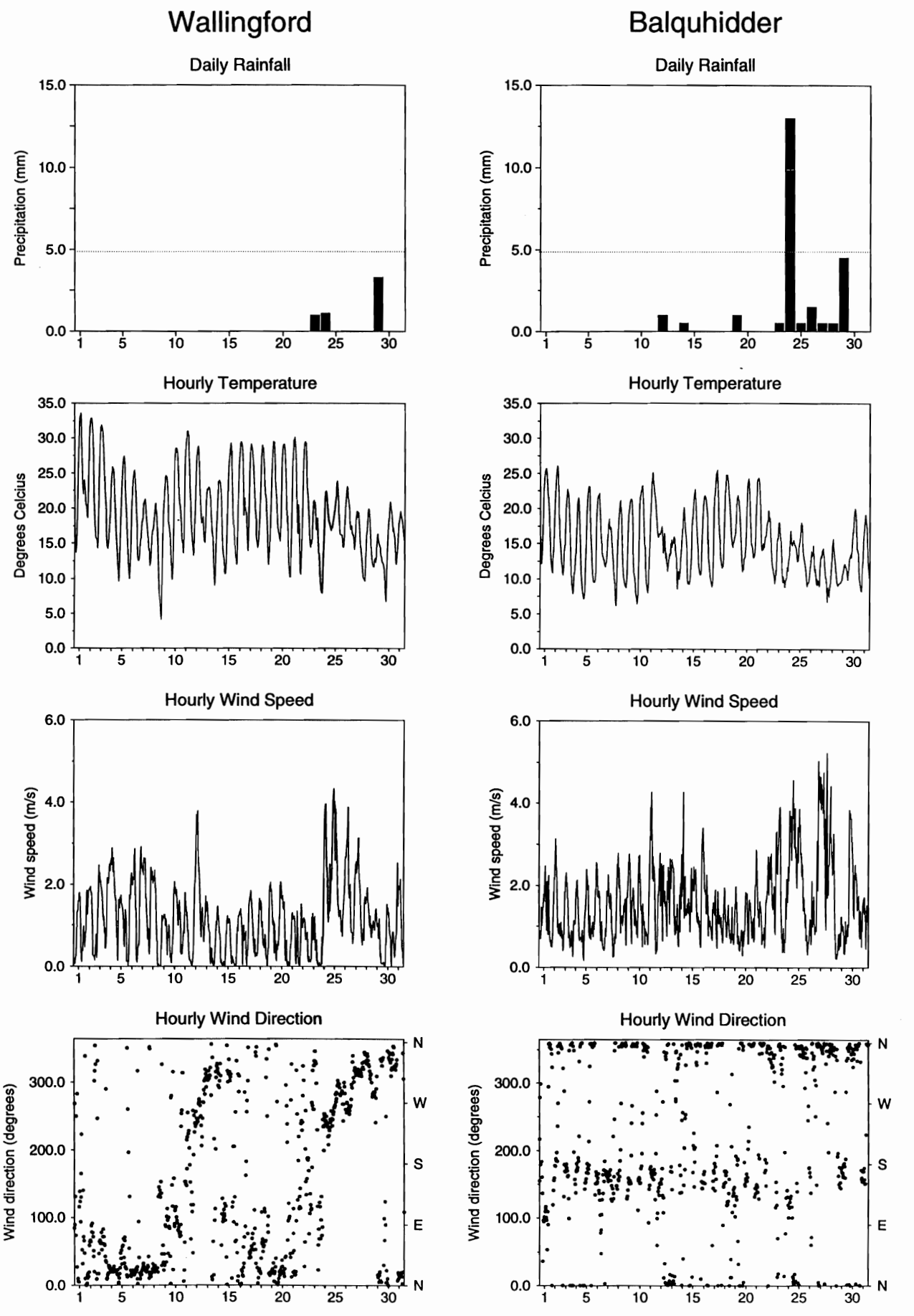
TABLE 5 AUGUST GROUNDWATER LEVELS 1995

Site	Aquifer	Records commence	Minimum Aug <1995	Average Aug <1995	Maximum Aug <1995	No. of years Aug/Sept level <1995	Aug/Sept 1995 day	Aug/Sept 1995 level
Dalton Holme	C & UGS	1889	11.28	16.40	21.77	10	25/08	13.93
Wetwang	C & UGS	1971	18.02	19.80	21.84	5	25/08	19.01
Washpit Farm	C & UGS	1950	40.77	44.38	47.50	>10	04/09	44.16
Keelby Grange	C & UGS	1980	3.45	10.57	14.66	5	07/08	11.60
The Holt	C & UGS	1964	84.32	87.67	90.53	>10	28/08	88.82
Therfield Rectory	C & UGS	1883	dry <71.6	81.04	98.97	>10	28/08	82.45
Redlands Hall	C & UGS	1964	32.73	41.36	49.47	>10	23/08	39.52
Rockley	C & UGS	1933	dry <128.44	131.98	136.70	>10	28/08	130.71
Little Bucket Farm	C & UGS	1971	59.75	67.22	76.35	>10	15/08	66.74
Compton House	C & UGS	1984	27.65	33.80	40.39	>10	17/08	31.75
Chilgrove House	C & UGS	1836	33.68	41.69	67.06	>10	17/08	39.15
Westdean No.3	C & UGS	1940	1.01	1.45	1.98	>10	01/09	1.32
Lime Kiln Way	C & UGS	1969	123.86	125.08	125.78	>10	10/08	125.75
Ashton Farm	C & UGS	1974	63.80	65.78	68.17	3	30/08	64.49
West Woodyates Manor	C & UGS	1942	67.95	74.02	81.67	9	30/08	70.42
Killyglen (NI)	C & UGS	1985	113.11	114.08	117.46	0	10/08	112.78
New Red Lion	LLst	1964	3.29	12.40	17.08	7	14/08	9.93
Ampney Crucis	Mid Jur	1958	98.58	100.23	101.64	8	28/08	99.32
Redbank	PTS	1981	7.49	7.95	8.52	0	04/09	7.44
Skirwith	PTS	1978	129.66	130.17	130.48	>10	01/09	130.31
Yew Tree Farm	PTS	1973	10.23	13.17	13.61	2	08/09	12.85
Llanfair D.C	PTS	1972	78.95	79.59	80.15	9	29/08	79.60
Stone	PTS	1974	89.48	90.11	90.54	>10	14/08	90.15
Heathlanes	PTS	1971	60.54	62.16	63.38	>10	24/08	62.58
Bussels No.7A	PTS	1972	22.90	23.55	23.91	>10	30/08	23.56
Rushyford NE	MgLst	1967	64.98	72.55	76.49	>10	22/08	76.05
Peggy Ellerton	MgLst	1968	31.17	34.01	36.68	10	16/08	33.93
Alstonfield	CLst	1974	174.70	176.95	183.39	7	14/08	175.35

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

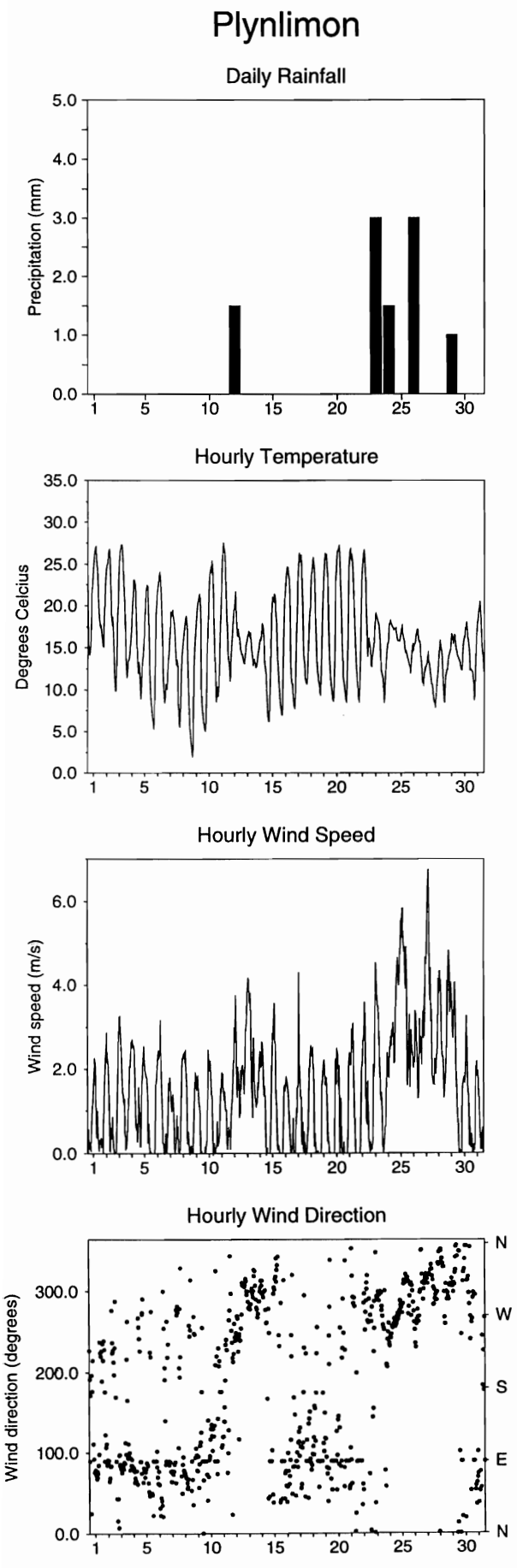
FIGURE 3 METEOROLOGICAL SUMMARY - AUGUST 1995



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

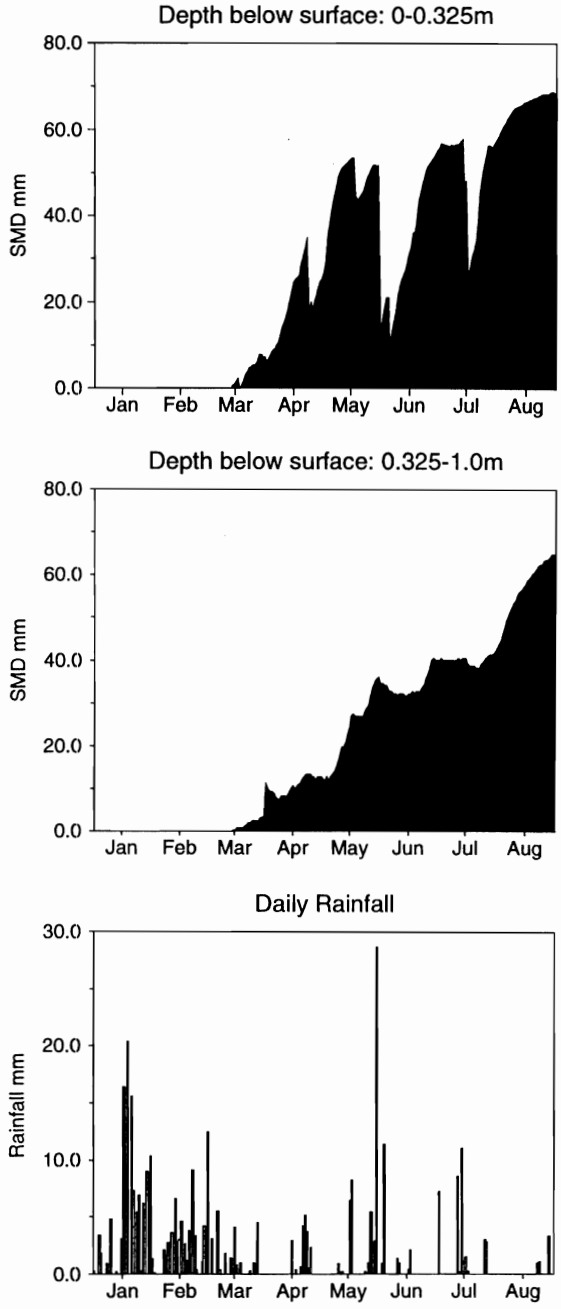
The Lower Kirkton automatic weather station (Balquhidder) occupies a relatively sheltered position at the mouth of the SSE trending Kirkton Glen. Station elevation is 270m aOD and average annual rainfall exceeds 2000mm; snow cover is expected for 10-30 days a year.

FIGURE 3 (continued)



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

FIGURE 3a. WALLINGFORD SMD DATA 1995



Note

Soil moisture deficit is defined as the amount by which the water stored in the soil is below the quantity held at field capacity. The data presented here are calculated from readings taken at the two automatic soil water stations (ASWSs) at Wallingford. They employ capacitance soil water sensors installed at depths of 5, 15 and 50 cm. Figure 3a shows deficits calculated from one of the stations for the depth ranges 0-0.325m (15cm probe) and 0.325-1.0m (50cm probe) at 0100 GMT on each day; slight discontinuities in the SMD trace can occur when switching between the ASWSs. The data presented give a good representative picture of soil moisture variations - avoiding the short term changes that can be dominant close to the surface.

Daily rainfall from the Wallingford meteorological station from the start of 1995 is presented.

FIGURE 4 LOCATION MAP OF GAUGING STATIONS AND GROUNDWATER INDEX WELLS