Hydrological Summary for Great Britain

OCTOBER 1995

Rainfall

October was a remarkably warm and sunny month. Spring-like weather predominated over the first 25 days and provisional data suggest that it was the warmest October in the Central England Temperature series which begins in 1659 - a suitable culmination to a 12-month sequence that is also without precedent. The very unsettled early autumn weather patterns continued through the first week of October - rainfall exceeded 120 mm in parts of South Wales on the 6-8th - but over the latter half of the month precipitation was largely restricted to fog-drip in parts of southern England. Frontal systems continued to bring plentiful rainfall to western Scotland where catchment rainfall totals approached twice the long term monthly average and Glasgow registered its wettest October in over 100 years. By contrast, regional totals in England were mostly in the 40-80% range. Notwithstanding the wet September, the April-October rainfall total is the second lowest in the 229-year England and Wales rainfall series (only 1921 was drier). Return periods associated with the seven-month deficiencies are notable throughout much of England and Wales and confirm the drought's focus on northern England. But within-region variations are substantial; the severe drought in the southern Pennines continues; October rainfall was below half the average in parts of West Yorkshire and some areas registered their seventh successive month with below average rainfall, accumulated deficiencies since March - in a timeframe which is crucial to water resources - are the highest on record for a number of reservoired catchments and return periods associated with individual raingauge sites extend to beyond 200 years.

River Flow

Following the wet September, a seasonal recovery in river flows began in early October in much of western Britain. To the east, dry early-autumn soils limited the hydrological effectiveness of the rainfall and with baseflows still in decline, surface runoff produced only patchy and temporary recoveries. Rainfall patterns and soil moisture conditions made for large spatial variations in monthly runoff. Spate conditions were common early in the month in northern and western Britain - around the 7th particularly and around the 27th when minor flooding affected parts of Scotland. Most rivers draining from the Highlands recorded notably high October runoff totals; the Luss Water established a new October maximum (in a series from 1976). By contrast, a new October minimum was established on the River Teme and the Severn recorded its second lowest October flow - after 1947 - in a series from 1921. Depressed runoff rates characterised most impervious catchments in southern Britain by late October and a number of flow augmentation schemes were operational to support rivers reliant mainly on baseflows. The Wharfe and the Soar were amongst a number of rivers recording their second lowest October mean flow but, in eastern and southern England, lower runoff totals were commonly recorded during the drought years of 1990 and 1991. Accumulated runoff totals in the three- and six-month timeframes provide a guide to the severity of the spring-autumn drought. Long term runoff totals are mostly still healthy but protracted drought conditions characterise catchments near the north-eastern seaboard.

Groundwater

Potential evaporation totals for October were at least 40% above average in most regions and soil moisture deficits in the eastern lowlands were 30-50 mm above average at month-end. Unsurprisingly, no substantial seasonal groundwater level recoveries have yet been reported for any index borehole - a minor upturn occurred at Ampney Crucis in the fissured Jurassic Limestone of the Cotswolds. Groundwater recessions now extend over almost 10 months in some areas and, showing some similarities with both 1988 and 1990, a very healthy groundwater resources outlook has been transformed into a much more fragile situation. At Chilgrove, levels in the Chalk have fallen over 40 metres since the late winter - there are very few comparably steep declines in the 150-year record. Very steep recessions also characterise other Chalk wells in southern England. Levels are less depressed in the deeper boreholes of the Chilterns. The Chilgrove recession has been matched at Alstonfield (Carboniferous Limestone) where levels are approaching the period of record minima. Levels also continue to decline throughout the Permo-Triassic sandstones - though water-tables are generally well above drought minima. In much of the Chalk area, SMDs are the equivalent of about two months rainfall and a dry end to 1995 would leave a narrow window of opportunity for winter recharge.

General

The notably wet September failed to generate a significant recovery in overall reservoir stocks and the October increase was very modest. Stocks now stand below corresponding totals in 1989 and 1990. In West Yorkshire some gravity-fed impoundments are around 10% of capacity. Short term water supply stress remains severe in areas reliant on the southern Pennine reservoirs. Substantial rainfall is needed over the next 4-8 weeks to allay concern for the 1996 water resources outlook across a very much wider area.

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.

* 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 November 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.

		Oct 1994	Nov	Dec	Jan 1995	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
England and	mm	97	86	142	161	115	67	27	48	22	39	13	126	55
Wales	%	114	96	151	183	183	93	45	75	34	63	17	164	65
NRA REGIONS														
North West	mm	123	36	207	208	165	107	28	62	35	63	19	117	78
	%	96	111	167	172	212	113	39	83	43	74	18	101	61
Northumbrian	mm	71	97	124	121	108	59	38	53	31	29	11	114	53
	%	93	113	153	144	183	84	68	85	52	45	14	156	70
Severn Trent	mm	68	73	115	131	89	51	20	49	13	36	9	89	44
	%	106	103	149	187	165	84	36	83	22	68	13	139	69
Yorkshire	mm	73	89	123	133	100	65	26	44	22	29	9	111	27
	%	100	111	148	168	172	96	44	73	37	49	12	163	37
Anglian	mm	70	32	59	98	62	51	16	31	25	26	8	105	21
	%	137	55	107	196	168	109	35	65	49	53	15	213	42
Thames	mm	85	53	93	137	82	51	18	37	16	32	4	117	34
	%	137	82	133	214	182	91	36	66	29	65	7	198	55
Southern	mm	118	66	123	163	112	59	18	25	20	31	5	138	34
	%	148	78	150	204	207	94	34	46	37	65	9	200	42
Wessex	mm	115	96	139	184	111	57	34	53	14	26	9	136	63
	%	146	116	149	211	171	81	64	87	25	50	14	189	79
South West	mm	140	127	214	233	165	93	50	55	19	45	16	129	101
	%	121	102	154	169	163	94	72	76	28	65	19	139	87
Welsh	mm	139	134	255	238	182	88	36	72	26	67	33	123	103
	%	101	94	167	166	188	82	45	88	33	87	33	107	75
Scotland	mm	110	156	245	227	205	143	67	85	44	85	35	199	236
	%	71	103	162	150	201	114	88	99	51	90	30	140	151
RIVER PURIFICATION BOARDS														
Highland	mm	116	169	304	299	271	177	99	90	47	99	47	271	245
	%	59	83	154	159	213	109	109	98	48	93	37	158	124
North East	mm	87	89	93	134	83	74	65	79	54	46	28	262	94
	%	90	90	100	135	128	95	108	114	82	63	32	301	97
Tay	mm	115	154	196	184	185	110	38	99	32	69	20	179	234
	%	88	127	154	128	195	101	61	119	44	90	21	157	180
Forth	mm	90	134	210	154	171	92	33	69	32	69	21	133	205
	%	78	120	191	131	216	98	56	93	46	92	22	121	178
Tweed	mm	75	123	173	129	109	75	37	66	35	43	22	110	142
	%	79	132	186	129	163	95	65	93	54	59	25	124	149
Solway	mm	117	184	246	222	173	145	41	85	43	77	23	116	297
	%	75	128	166	142	171	124	53	100	51	86	19	81	189
Clyde	mm	128	189	322	257	251	196	65	81	45	124	41	137	340
	%	66	105	180	136	213	133	77	89	48	114	31	77	176

Note: The monthly rainfall figures for the NRA regions for September & October 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 September & October 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

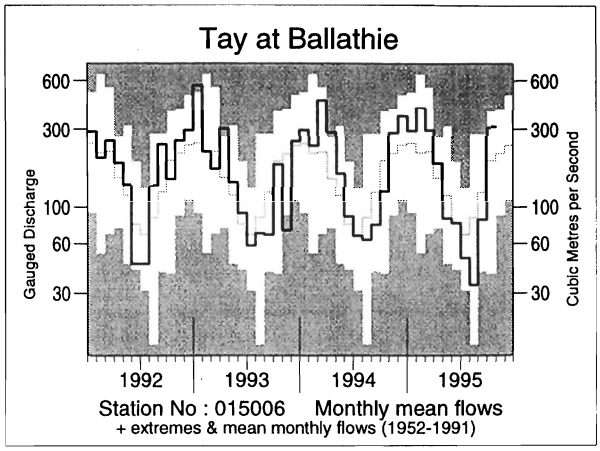
		Aug 95-Oct 95	Est Return Period, years	Apr 95-Oct 95	Est Return Period, years	Jan 95-Oct 95	Est Return Period, years	Sep 94-Oct 95	Est Return Period, years
England and Wales	mm	195		331		674		1105	
	% LTA	82	2-5	68	35-50	95	2-5	104	2-5
NRA REGIONS									
North West	mm	214		402		882		1461	
	% LTA	61	10-20	61	80-120	92	2-5	101	2-5
Northumbria	mm	178		329		617		986	
	% LTA	77	2-5	70	20-35	90	2-5	98	2-5
Severn Trent	mm	142		260		531		914	
	% LTA	73	5-10	62	50-80	88	2-5	104	2-5
Yorkshire	mm	147		268		566		952	
	% LTA	68	5-10	59	80-120	86	5-10	99	2-5
Anglian	mm	134		232		443		693	
	% LTA	86	2-5	66	30-45	92	2-5	100	<2
Thames	mm	155		258		528		833	
	% LTA	87	2-5	66	20-30	95	2-5	103	2-5
Southern	mm	177		271		605		1002	
	% LTA	86	2-5	65	25-40	99	2-5	108	2-5
Wessex	mm	208		335		687		1136	
	% LTA	96	2-5	76	5-10	104	2-5	115	5-10
South West	mm	246		415		906		1518	
	% LTA	84	2-5	73	10-20	100	<2	110	2-5
Welsh	mm	259		460		968		1630	
	% LTA	73	5-10	69	25-40	95	2-5	104	2-5
Scotland	mm	470		751		1326		1940	
	% LTA	113	2-5	99	2-5	117	10-20	112	5-10
RIVER PURIFICATION BOARDS									
Highland	mm	563		898		1645		2387	
	% LTA	114	2-5	102	2-5	121	15-25	112	5-10
North East	mm	384		628		919		1277	
	% LTA	142	15-25	117	5-10	118	10-15	110	5-10
Tay	mm	433		671		1150		1671	
	% LTA	128	5-10	106	2-5	117	5-10	113	5-10
Forth	mm	359		562		979		1469	
	% LTA	113	2-5	94	2-5	110	2-5	110	5-10
Tweed	mm	274		455		768		1196	
	% LTA	101	2-5	85	5-10	98	2-5	104	2-5
Solway	mm	436		682		1222		1845	
	% LTA	104	2-5	90	2-5	108	2-5	107	2-5
Clyde	mm	518		833		1537		2274	
	% LTA	102	2-5	94	2-5	115	5-10	110	5-10

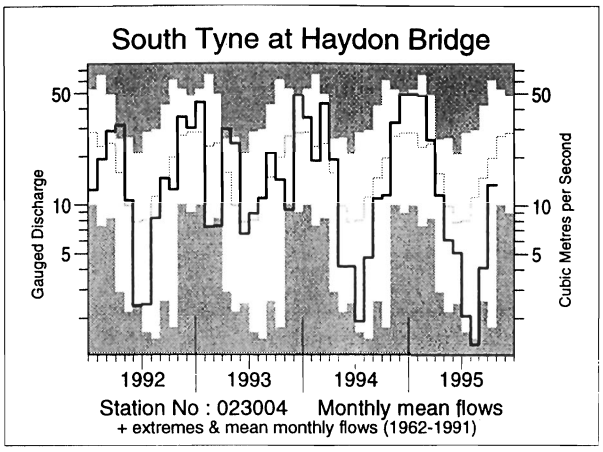
LTA refers to the period 1961-90.

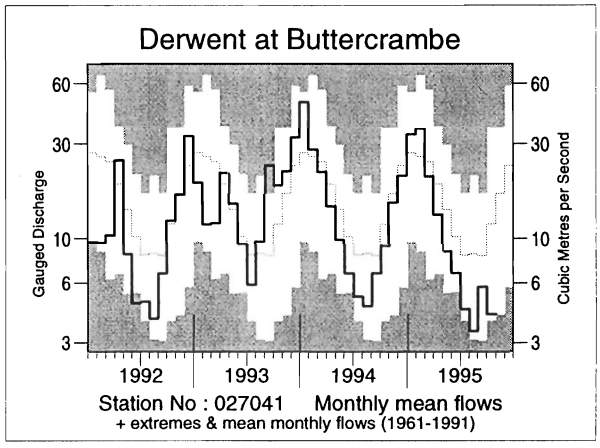
Return period assessments are based on tables provided by the Meteorological Office*. The tables reflect rainfall totals over the period 1911-70 only and the estimate assumes a sensibly stable climate. They assume a start in a specified month; return periods for a start in any month may be expected to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

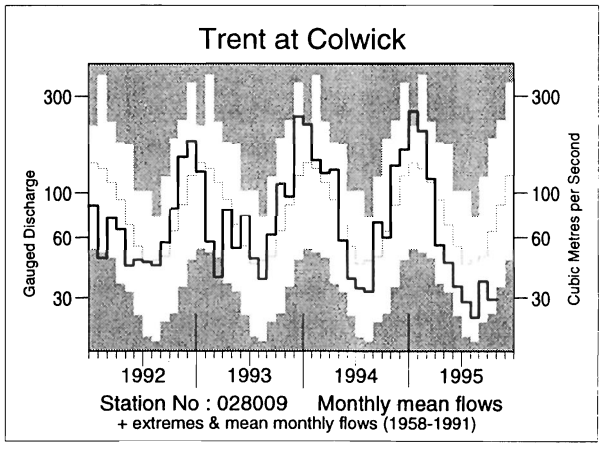
* Tabony, R.C., 1977, The Variability of long duration rainfall over Great Britain, Scientific Paper No. 37, Meteorological Office.

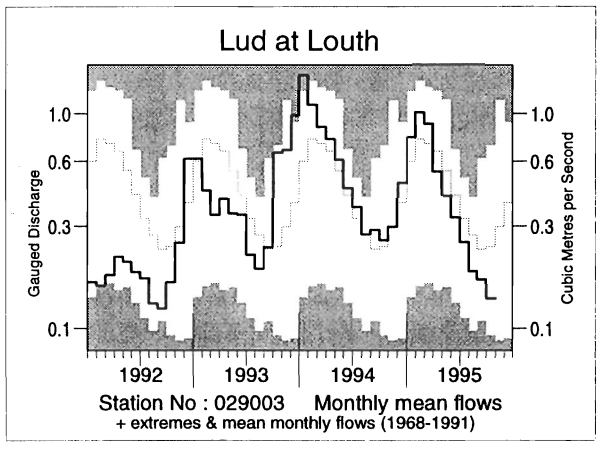
FIGURE 1 MONTHLY RIVER FLOW HYDROGRAPHS

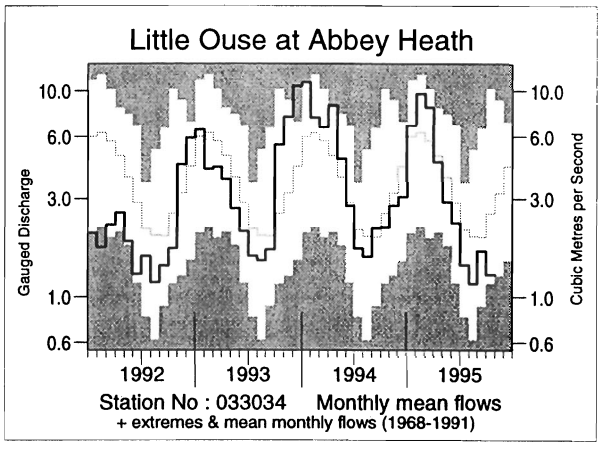


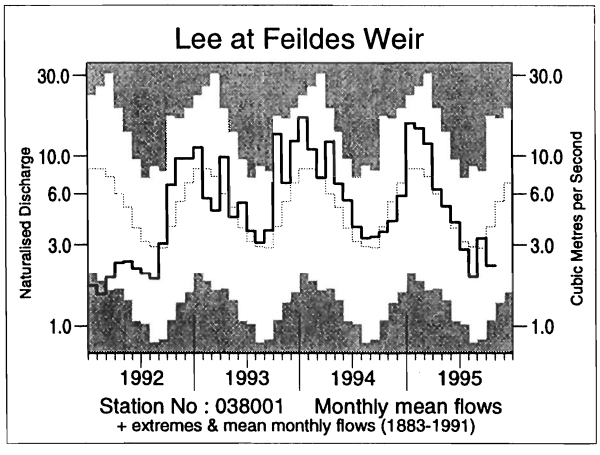


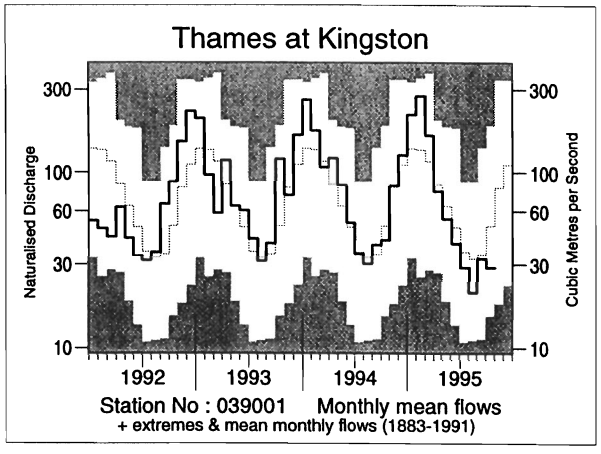


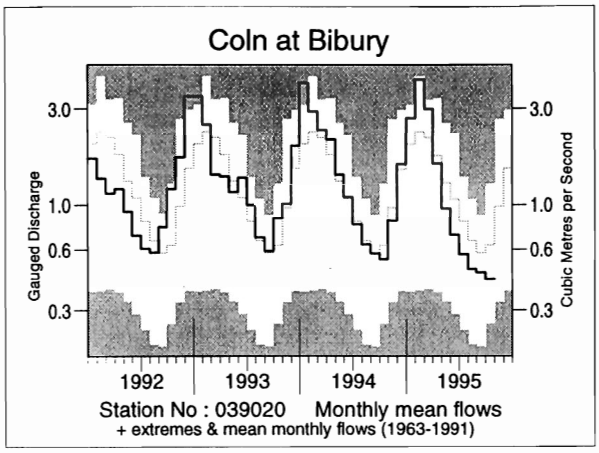


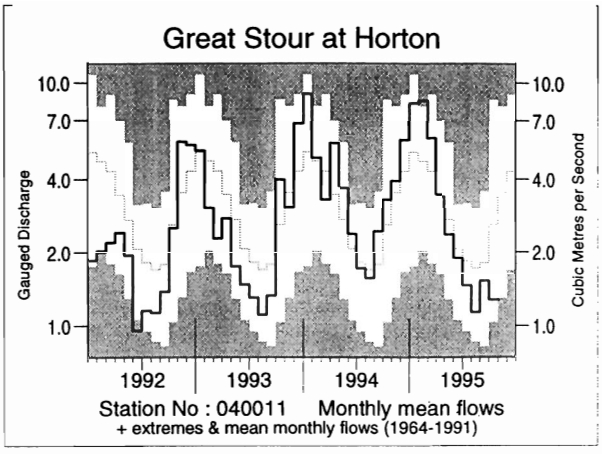


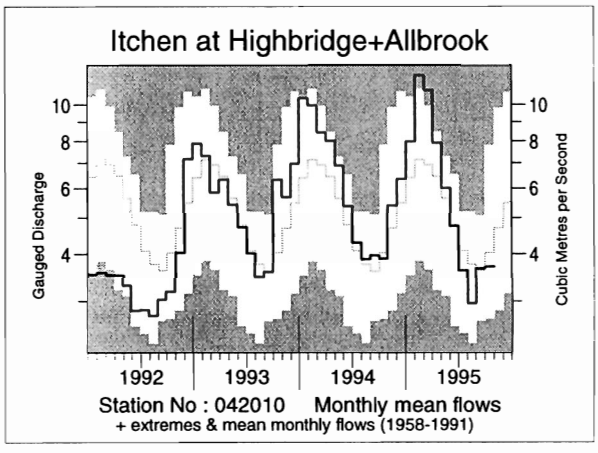


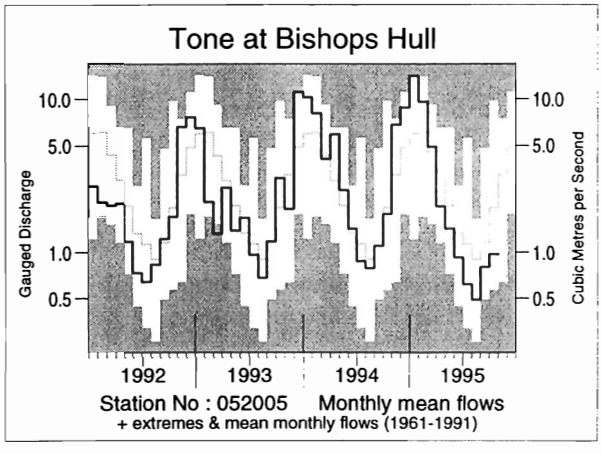


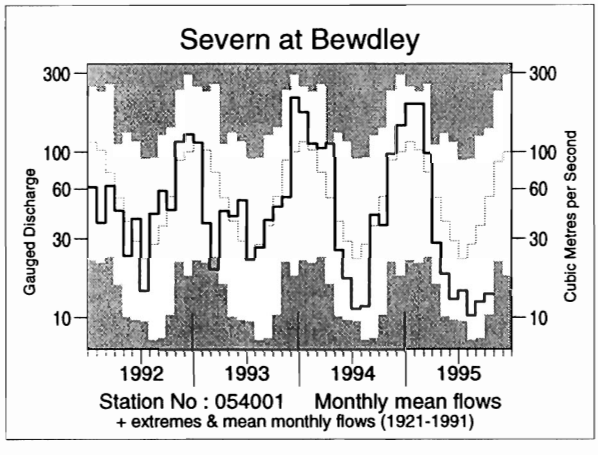


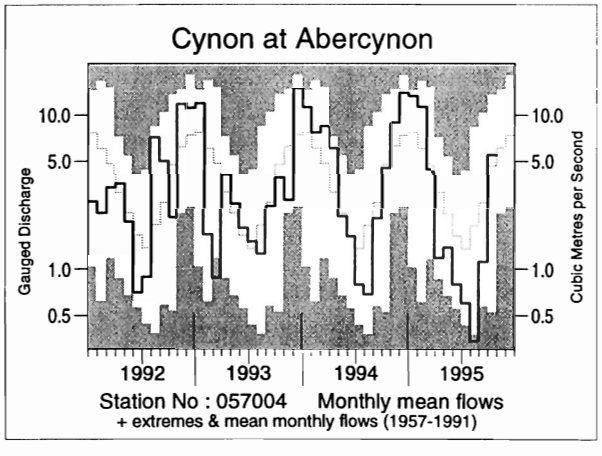

Coln at Bibury
Gauged Discharge
Cubic Metres per Second
3.0
1.0
0.6
0.3
1992
1993
1994
1995
Station No : 039020 Monthly mean flows
+ extremes & mean monthly flows (1963-1991)

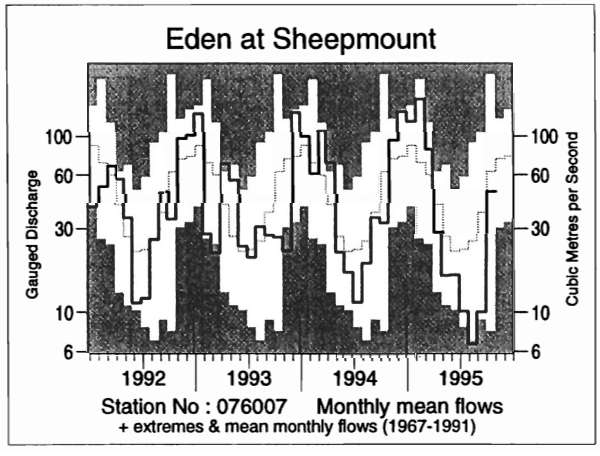

Great Stour at Horton
Gauged Discharge
Cubic Metres per Second
10.0
7.0
4.0
2.0
1.0
1992
1993
1994
1995
Station No : 040011 Monthly mean flows
+ extremes & mean monthly flows (1964-1991)


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)

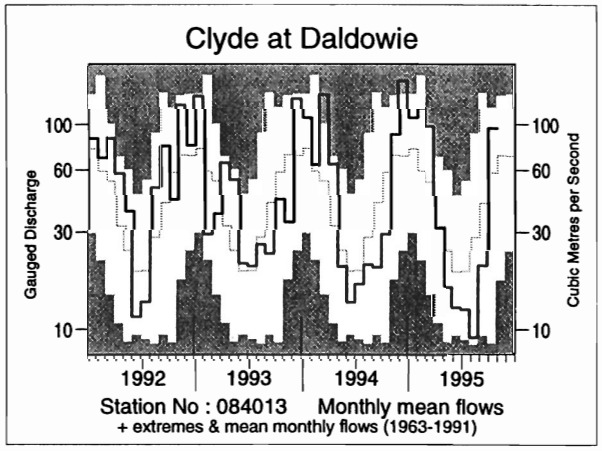

Clyde at Daldowie
Gauged Discharge
Cubic Metres per Second
100
60
30
10
1992
1993
1994
1995
Station No : 084013 Monthly mean flows
+ extremes & mean monthly flows (1963-1991)

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	Jun 1995	Jul	Aug	Sep	Oct 1995		8/95 to 10/95		5/95 to 10/95		1/95 to 10/95		9/94 to 10/95	
	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	46	16	9	136	98	18	243	19	360	19	697	19	930	11
Park	126	59	30	332	120	/23	154	/23	127	/23	112	/23	101	/22
Tay at	46	29	20	48	183	39	251	28	376	21	1048	35	1541	36
Ballathie	102	73	39	69	166	/44	108	/43	97	/43	120	/43	116	/42
Tweed at	19	13	10	23	107	30	140	14	196	10	631	24	1003	29
Boleside	72	51	26	48	149	/35	89	/35	78	/35	110	/35	113	/34
Whiteadder Water at	13	7	5	11	10	8	26	7	59	5	194	3	276	4
Hutton Castle	79	59	36	70	34	/27	44	/26	52	/26	64	/26	64	/26
South Tyne at	18	7	5	14	48	12	67	1	115	2	586	18	958	21
Haydon Bridge	67	27	13	28	70	/34	42	/32	46	/32	102	/32	105	/30
Wharfe at	11	10	7	11	16	2	34	1	68	1	492	11	833	22
Flint Mill Weir	44	39	17	25	26	/41	24	/40	30	/40	91	/40	101	/39
Derwent at	11	7	6	9	7	3	22	5	55	4	223	11	310	10
Buttercrambe	68	55	42	66	35	/35	47	/34	56	/34	88	/34	87	/33
Trent at	12	10	9	13	11	4	32	5	70	3	288	21	441	24
Colwick	63	65	54	74	45	/38	57	/37	62	/37	103	/37	111	/36
Lud at	15	12	9	8	7	5	24	5	72	8	223	14	287	14
Louth	80	80	70	73	54	/28	66	/28	76	/27	101	/27	102	/27
Witham at	6	3	3	5	4	12	12	9	31	6	162	19	255	26
Claypole Mill	58	48	51	69	45	/37	54	/37	56	/37	105	/36	125	/36
Little Ouse at	8	5	4	6	5	3	16	5	41	8	149	15	187	15
Abbey Heath	82	68	62	95	52	/27	68	/27	73	/27	106	/27	103	/26
Mimram at	13	11	9	10	8	23	26	25	67	31	143	37	185	36
Panshanger Park	125	112	98	119	99	/43	105	/43	116	/43	132	/43	130	/42
Lee at	10	7	5	8	6	33	19	41	50	48	171	88	214	75
Feildes Weir (natr.)	108	90	67	114	58	/111	77	110	90	/110	130	/109	118	/108
Thames at	10	8	6	8	8	33	22	34	54	37	244	89	321	79
Kingston (natr.)	81	82	63	94	57	/113	70	/113	77	/113	125	/113	119	/112
Coln at	17	14	12	11	11	8	34	6	90	5	372	22	460	16
Bibury	66	69	72	79	66	/33	73	/32	72	/32	112	/32	108	/31
Great Stour at	14	12	9	12	10	5	31	4	75	8	273	22	391	22
Horton	94	83	69	87	49	/32	66	/31	77	/30	118	/29	119	/28
Itchen at	34	27	22	26	28	16	76	11	182	16	460	34	604	29
Highbridge+Allbrook	100	89	79	101	91	/38	91	/37	96	/37	119	/37	117	/36
Stour at	10	6	4	9	12	9	25	5	57	4	395	20	568	20
Throop Mill	64	57	45	75	51	/23	57	/23	62	/23	130	/23	130	/22
Exe at	12	8	6	15	35	9	56	4	97	2	637	25	1126	33
Thorverton	51	41	22	39	47	/40	41	/40	44	/40	106	/39	119	/39
Taw at	6	4	3	6	17	8	26	4	47	1	507	24	927	28
Umberleigh	34	27	15	25	27	/38	25	/37	29	/37	105	/37	117	/36
Tone at	12	8	7	10	13	10	30	7	70	4	468	31	714	33
Bishops Hull	70	56	55	69	49	/35	57	/35	63	/35	129	/34	137	/34
Severn at	8	9	6	7	9	2	23	3	51	1	359	45	554	49
Bewdley	44	65	38	34	26	/75	32	/75	40	/75	107	/74	110	/74
Teme at	5	4	2	3	3	1	7	1	25	1	299	17	476	23
Knightsford Bridge	37	48	19	28	14	/26	19	/26	33	/26	108	/25	120	/25
Cynon at	20	15	9	28	143	26	180	14	250	9	981	23	1719	29
Abercynon	50	46	17	41	120	/38	76	/36	68	/36	109	/36	119	/34
Dee at	31	69	9	37	105	6	151	3	296	1	1159	8	2109	15
New Inn	52	107	9	29	56	/27	38	/27	49	/26	89	/26	99	/26
Eden at	19	12	8	12	57	14	76	=3	126	2	572	19	919	19
Sheepmount	76	47	26	28	82	/26	59	/25	59	/25	111	/25	117	/23
Clyde at	18	18	13	28	135	31	176	16	235	13	721	29	1144	31
Daldowie	68	66	33	50	170	/33	100	/32	89	/32	123	/32	123	/31
Carron at	49	89	29	164	326	16	519	3	717	4	2023	12	3040	9
New Kelso	61	75	18	65	133	/17	79	/17	76	/17	104	/17	99	/16
Ewe at	78	63	33	145	315	22	492	12	724	10	1968	21	2869	18
Poolewe	104	71	29	77	146	/25	96	/25	93	/25	123	/25	112	/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.

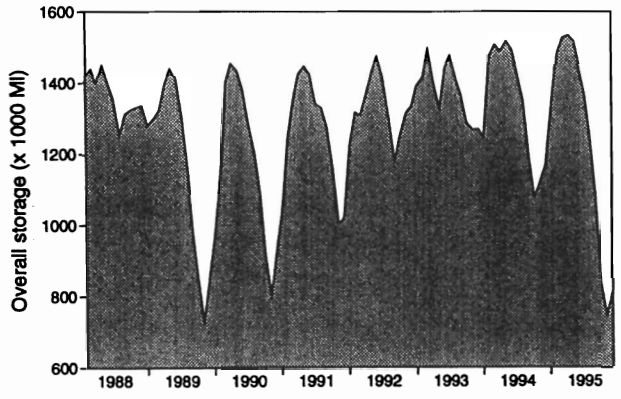
TABLE 4 START-MONTH RESERVOIR STORAGES UP TO NOVEMBER 1995

Area	Reservoir (R)/ Group (G)		Capacity • (Ml)	1995 Jun	Jul	Aug	Sep	Oct	Nov	1994 Nov
North West	N.Command Zone[1]	(G)	133375	73	58	44	24	13	44	50
	Vyrnwy	(R)	55146	81	69	59	36	26	25	65
Northumbria	Teesdale[2]	(G)	87936	89	70	59	38	31	33	53
	Kielder	(R)	199175*	90*	91*	87*	85*	82*	88*	90*
Severn-Trent	Clywedog	(R)	44922	96	86	73	48	43	44	82
	Derwent Valley[3]	(G)	39525	86	72	59	44	36	28	64
Yorkshire	Washburn[4]	(G)	22035	78	63	50	34	24	15	52
	Bradford supply[5]	(G)	41407	70	54	38	21	15	16	57
Anglian	Grafham	(R)	58707	95	94	88	71	72	72	89
	Rutland	(R)	130061	83	80	74	66	61	59	86
Thames	London[6]	(G)	206399	96	93	82	62	66	67	85
	Farmoor [7]	(G)	13843	97	94	86	64	76	87	99
Southern	Bewl	(R)	28170	94	88	81	72	69	65	83
	Ardingly	(R)	4685	99	97	66	48	46	47	80
Wessex	Clatworthy	(R)	5364	69	61	44	31	30	35	53
	Bristol W [8]	(G)	38666*	86*	79*	67*	48*	44*	37*	52*
South West	Colliford	(R)	28540	88	80	70	54	47	45	70
	Roadford[9]	(R)	34500	85	76	60	40	26	18	66
	Wimbleball[10]	(R)	21320	89	74	59	40	30	26	64
	Stithians	(R)	5205	77	61	45	31	27	26	50
Welsh	Celyn + Brenig	(G)	131155	96	87	79	57	48	49	75
	Brianne	(R)	62140	85	76	67	55	48	57	83
	Big Five[11]	(G)	69762	79	65	49	29	19	41	66
	Elan Valley[12]	(G)	99106	90	80	65	46	34	37	83
Lothian	Edin./Mid Lothian[13]	(G)	97639	90	88	79	69	64	85	69
	East Lothian[14]	(G)	10206	86	91	84	71	72	74	57
Strathclyde	Loch Katrine	(G)	111363	85	71	69	50	43	92	90
	Daer	(R)	22412	85	73	62	41	32	83	99
	Loch Thom	(G)	11840	84	77	72	59	56	100	83

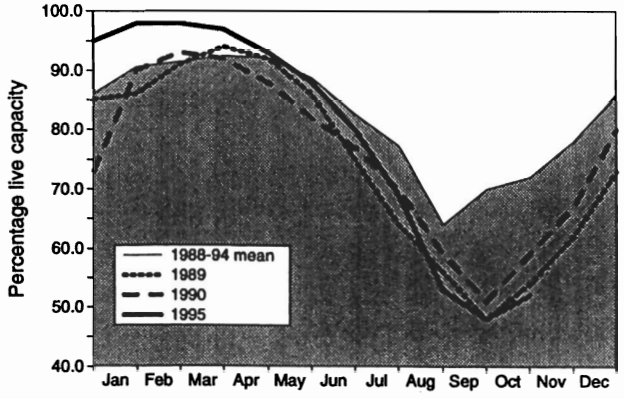
• Live or usable capacity (unless indicated otherwise) * Gross storage/percentage of gross storage

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



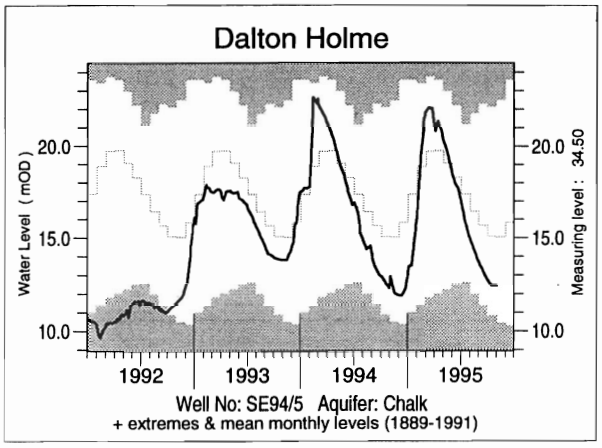
A COMPARISON BETWEEN OVERALL RESERVOIR STOCKS IN RECENT DROUGHT YEARS

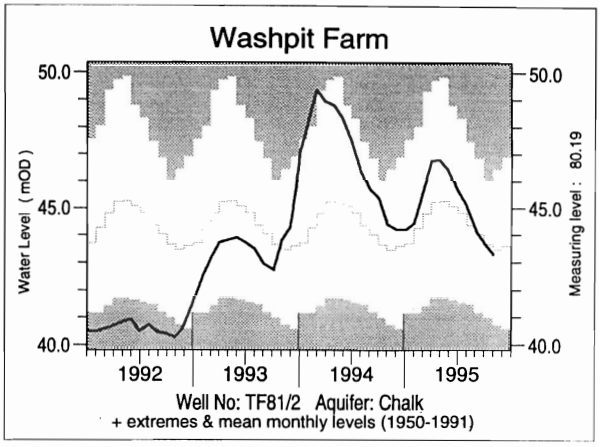


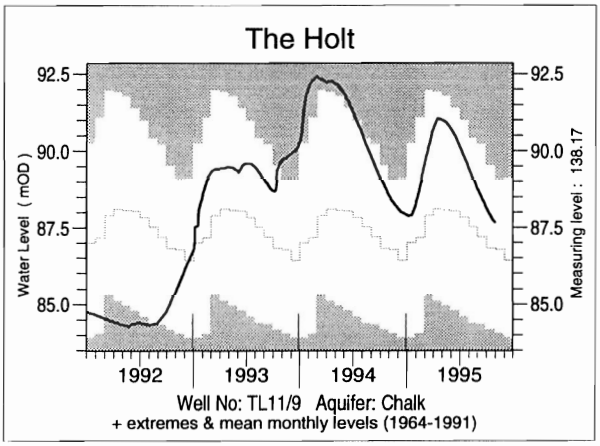
These plots are based on the reservoirs featured in Table 4 only

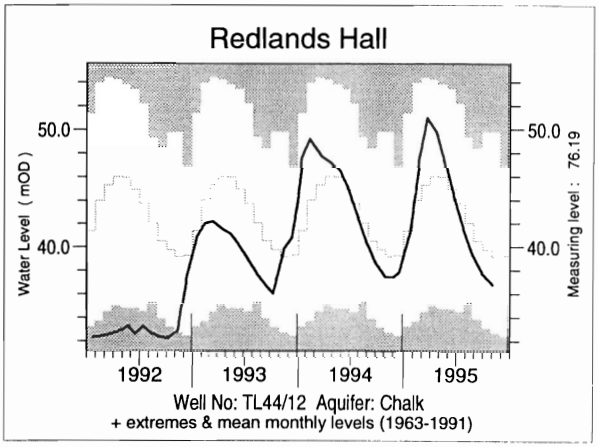
Note: Variations in storage depend on the balance between inputs (from catchment rainfall and any pumping) and outputs (to supply, compensation flow, HEP, amenity). There will be additional losses due to evaporation, especially in the summer months. Operational strategies for making the most efficient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

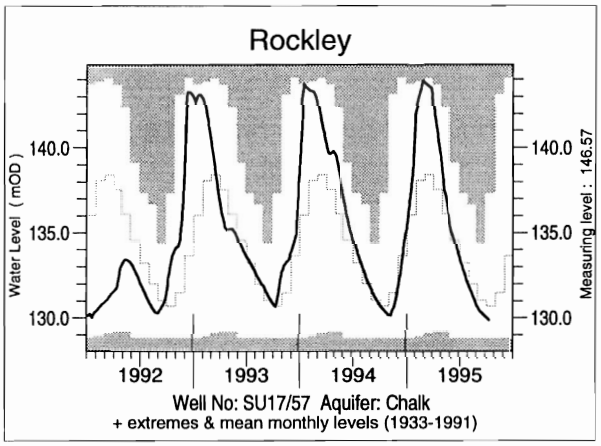
FIGURE 2 GROUNDWATER LEVEL HYDROGRAPHS

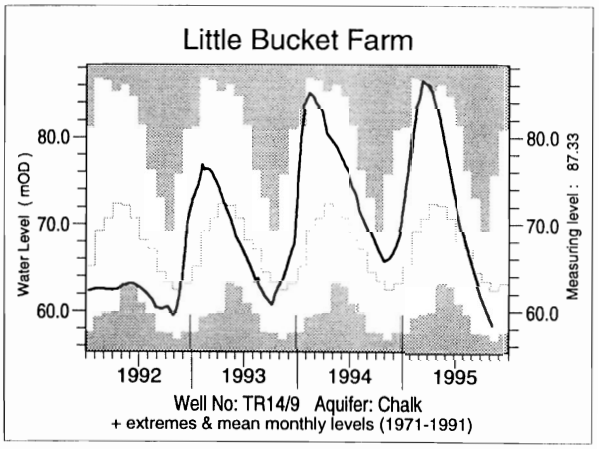


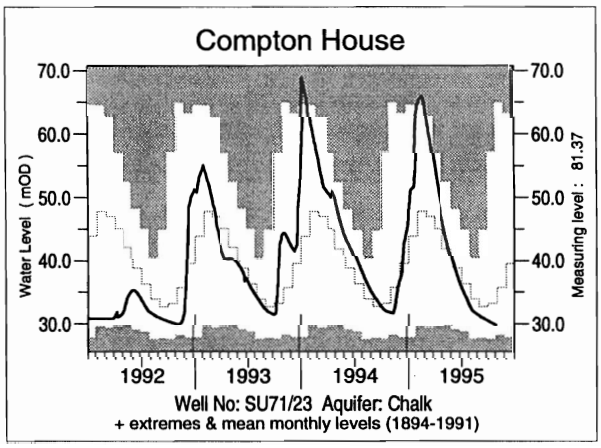


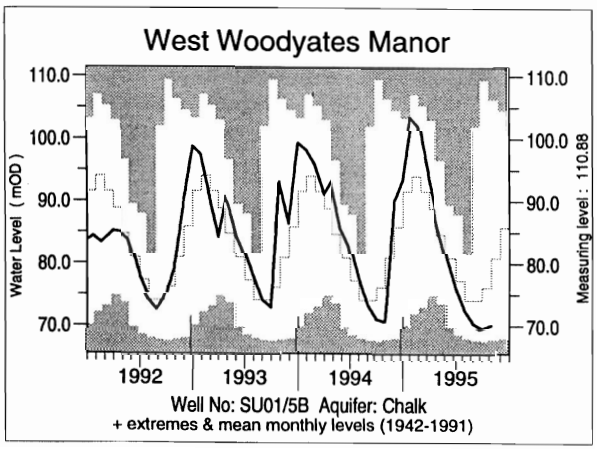


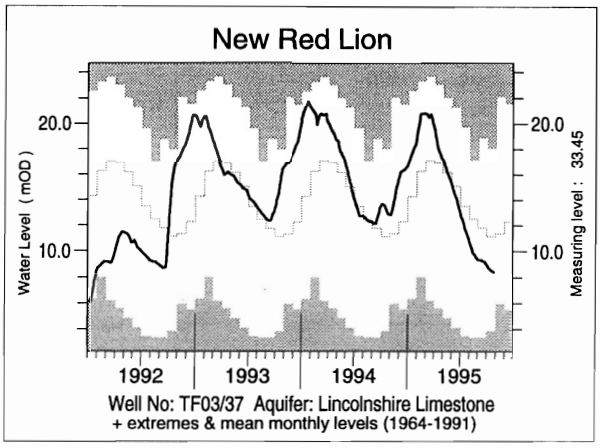


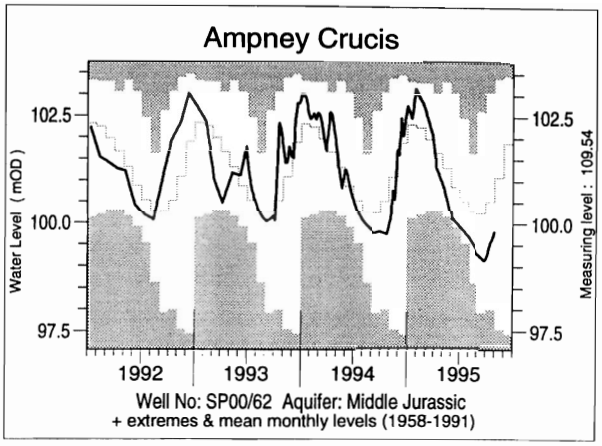


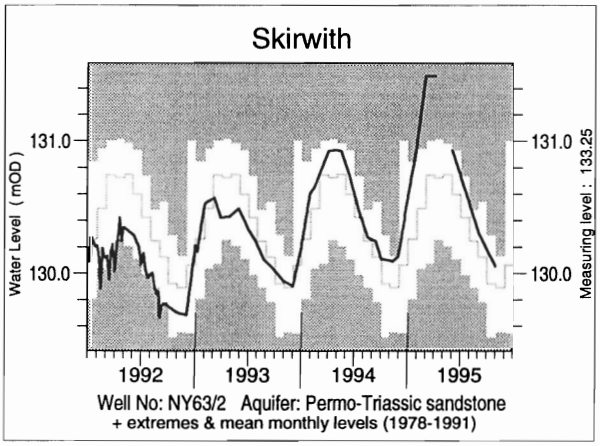


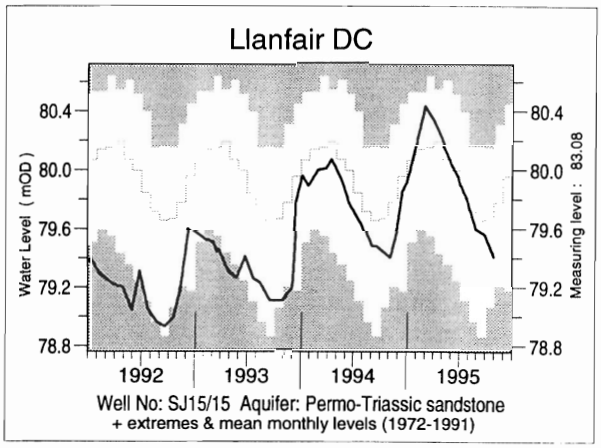


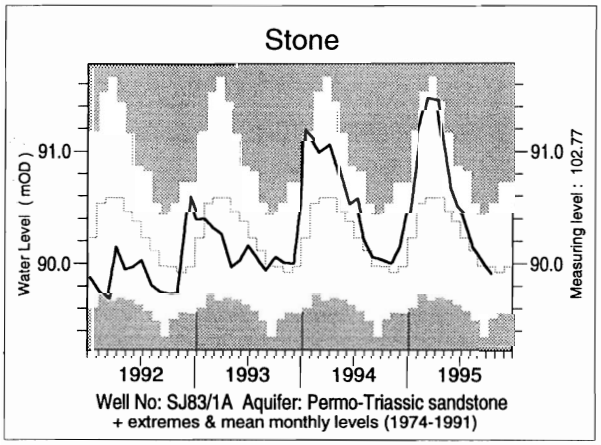


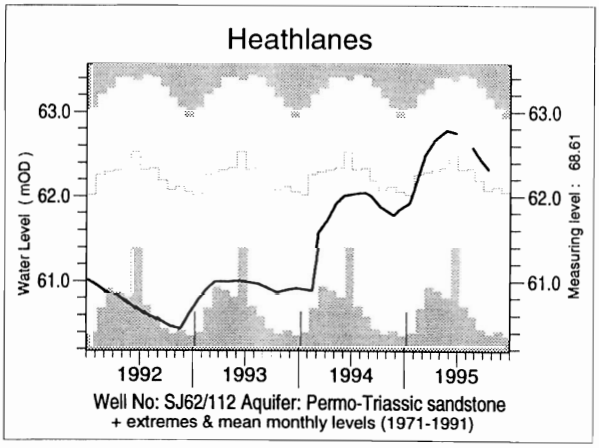

New Red Lion
Water Level (mOD)
20.0
10.0
Measuring level : 33.45
1992
1993
1994
1995
Well No: TF03/37 Aquifer: Lincolnshire Limestone
+ extremes & mean monthly levels (1964-1991)

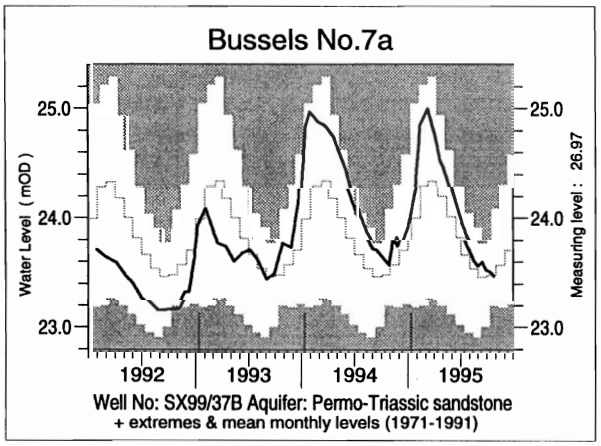

Ampney Crucis
Water Level (mOD)
102.5
100.0
97.5
Measuring level : 109.54
1992
1993
1994
1995
Well No: SP00/62 Aquifer: Middle Jurassic
+ extremes & mean monthly levels (1958-1991)


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)

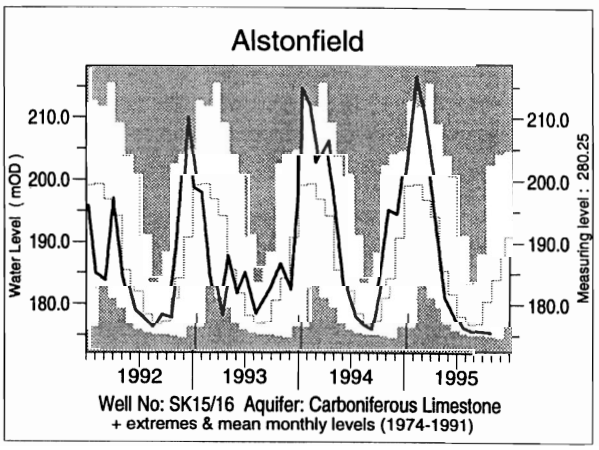

Alstonfield
Water Level (mOD)
210.0
200.0
190.0
180.0
Measuring level : 280.25
1992
1993
1994
1995
Well No: SK15/16 Aquifer: Carboniferous Limestone
+ extremes & mean monthly levels (1974-1991)

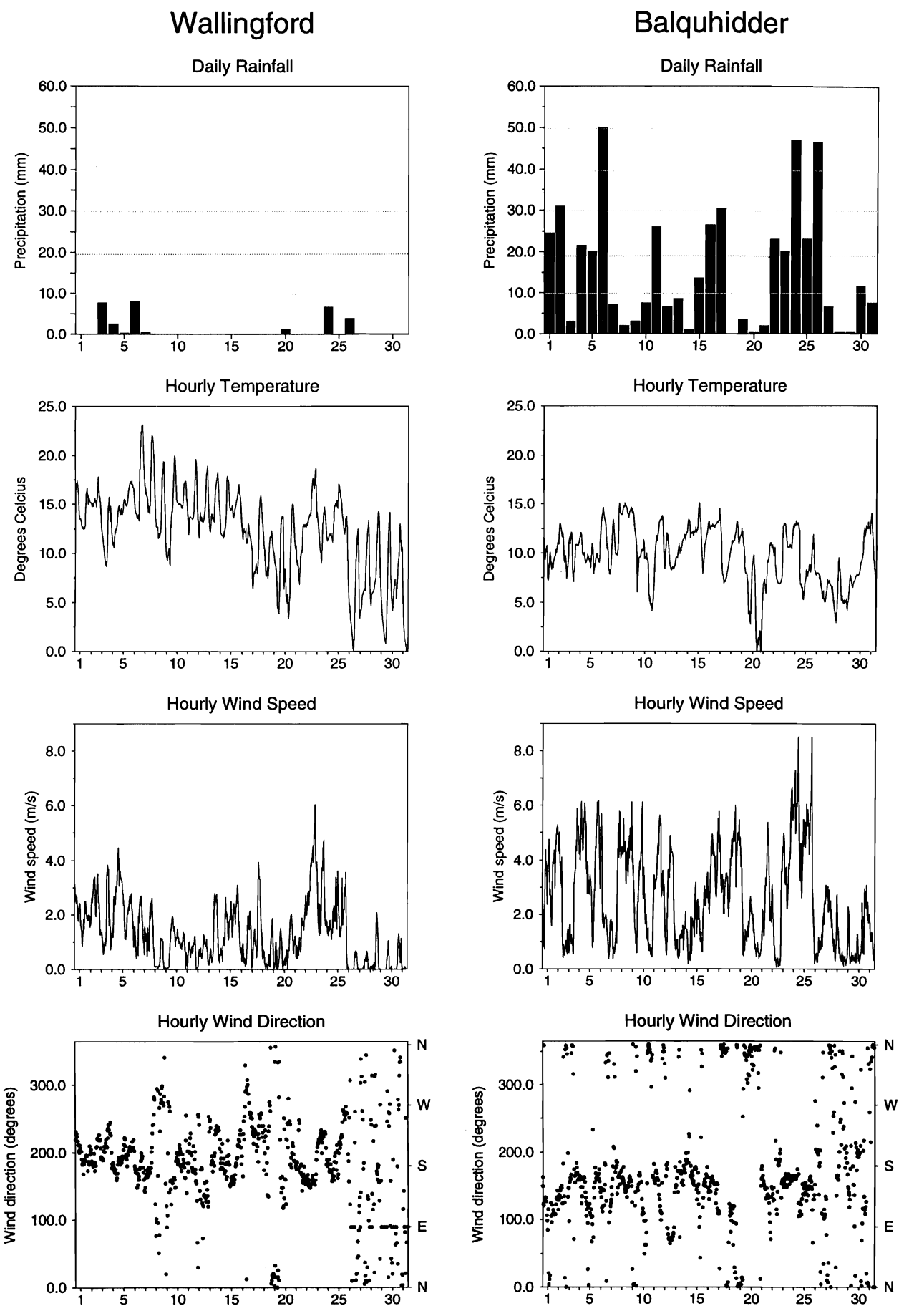
TABLE 5 OCTOBER GROUNDWATER LEVELS 1995

Site	Aquifer	Records commence	Minimum Oct	Average Oct	Maximum Oct	No. of years Oct/Nov	Oct/Nov 1995	
			<1995	<1995	<1995	level<1995	day	level
Dalton Holme	C & UGS	1889	10.86	15.05	22.12	8	01/11	12.44
Wetwang	C & UGS	1971	17.26	19.15	20.80	3	01/11	18.13
Keelby Grange	C & UGS	1980	3.50	9.13	12.34	5	01/11	8.60
Washpit Farm	C & UGS	1950	40.43	43.49	46.09	>10	01/11	43.29
The Holt	C & UGS	1964	84.19	87.07	89.65	>10	30/10	87.68
Therfield Rectory	C & UGS	1883	dry <71.6	79.23	97.72	>10	01/10	80.69
Redlands Hall	C & UGS	1964	32.29	39.04	49.90	9	03/11	36.79
Rockley	C & UGS	1933	dry <128.44	130.72	137.35	>10	09/10	129.87
Little Bucket Farm	C & UGS	1971	57.48	63.74	69.33	2	09/11	58.55
Compton House	C & UGS	1984	27.64	33.57	57.30	7	27/10	29.81
Chilgrove House	C & UGS	1836	33.88	42.36	75.90	1	27/10	34.59
Westdean No.3	C & UGS	1940	1.11	1.54	3.68	>10	26/10	1.27
Lime Kiln Way	C & UGS	1969	123.75	124.86	123.53	>10	31/10	125.35
Ashton Farm	C & UGS	1974	63.48	65.19	69.12	3	31/10	63.98
West Woodyates Manor	C & UGS	1942	67.62	75.49	109.40	>10	31/10	70.17
Killyglen (NI)	C & UGS	1985	113.30	114.79	117.55	1	05/10	113.42
New Red Lion	LLst	1964	3.82	11.58	17.98	5	26/10	8.37
Ampney Crucis	Mid Jur	1958	97.95	100.47	103.05	9	30/10	99.82
Redbank	PTS	1981	7.47	8.09	8.82	4	01/11	7.54
Skirwith	PTS	1978	129.51	129.93	130.29	8	30/10	130.05
Yew Tree Farm	PTS	1973	11.54	13.28	13.73	3	31/10	13.06
Llanfair D.C	PTS	1972	78.98	79.52	80.15	8	31/10	79.41
Stone	PTS	1974	89.50	90.00	90.54	8	18/10	89.91
Heathlanes	PTS	1971	60.36	61.97	63.15	>10	18/10	62.32
Bussels No.7A	PTS	1972	23.16	23.50	24.07	>10	25/10	23.47
Rushyford NE	MgLst	1967	64.82	72.41	76.41	>10	20/10	75.86
Peggy Ellerton	MgLst	1968	31.46	33.86	36.38	>10	23/10	33.92
Alstonfield	CLst	1974	175.96	180.62	202.28	7	17/10	175.04

groundwater levels are in metres above Ordnance Datum

C & UGS	Chalk and Upper Greensand	Mid Jur	Middle Jurassic limestones
LLst	Lincolnshire Limestone	MgLst	Magnesian Limestone
PTS	Permo-Triassic sandstones	CLst	Carboniferous Limestone

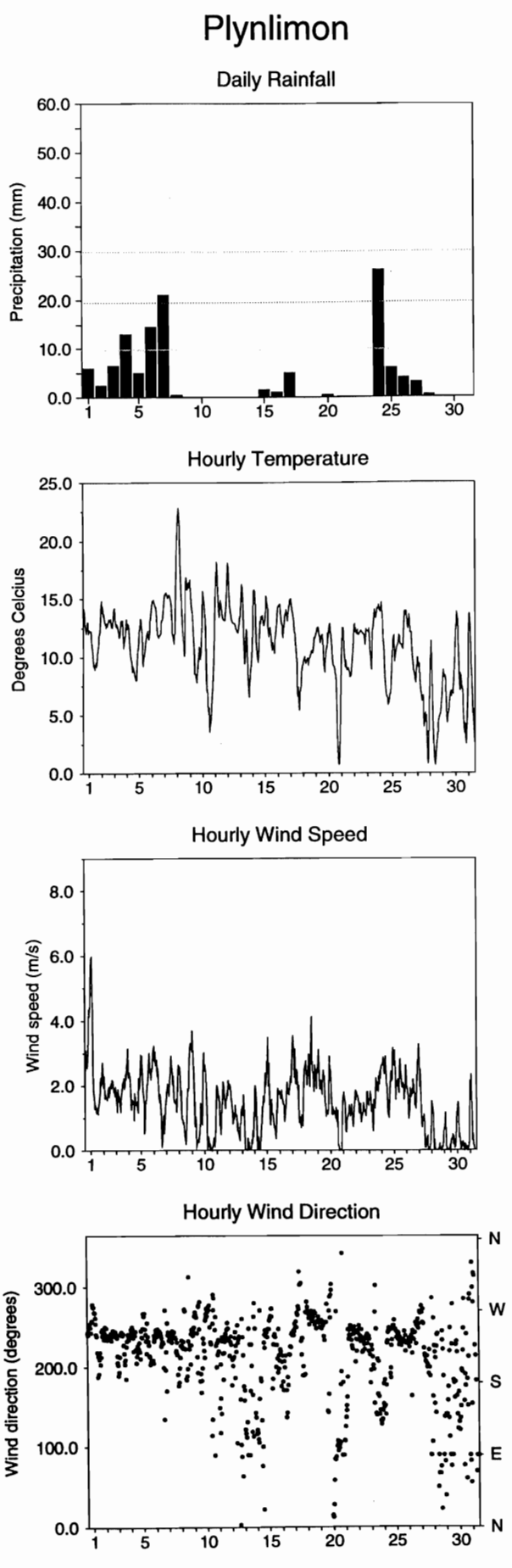
FIGURE 3 METEOROLOGICAL SUMMARY - OCTOBER 1995



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

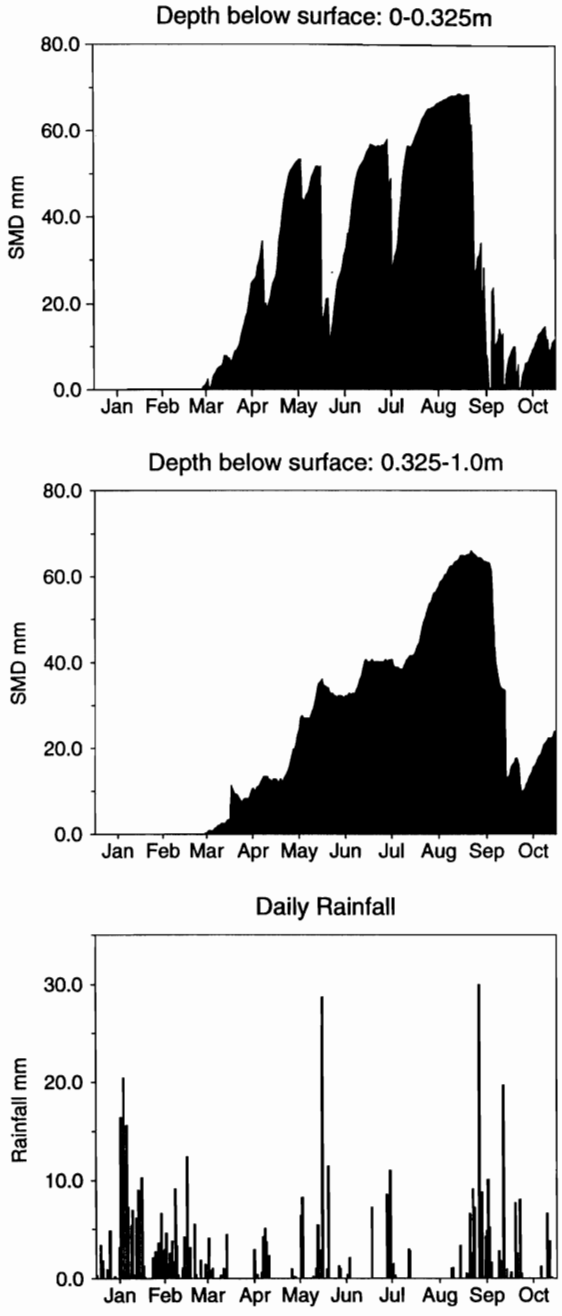
The Lower Kirkton automatic weather station (Balquhidder) occupies a relatively sheltered position at the mouth of the SSE trending Kirkton Glen. Station elevation is 270m aOD and average annual rainfall exceeds 2000mm; snow cover is expected for 10-30 days a year.

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