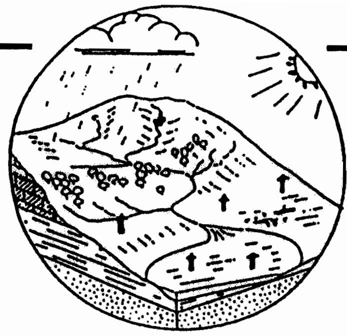
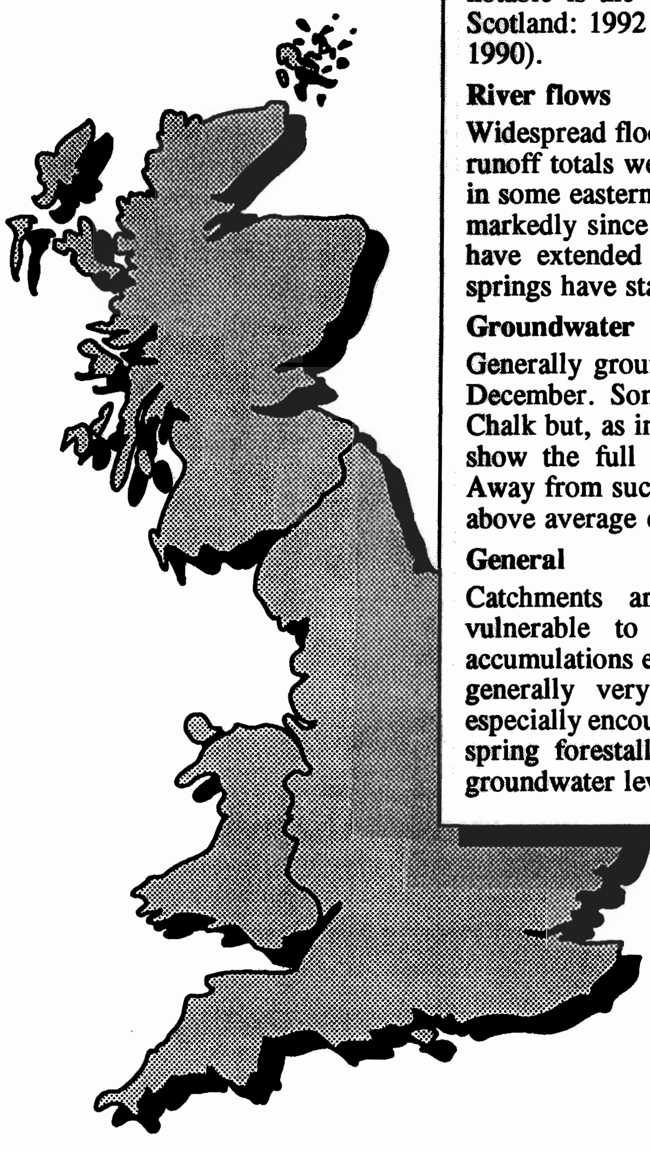
Hydrological Summary for Great Britain





DECEMBER 1992

Rainfall

Despite a wet beginning, December rainfall totals were a little below average throughout most of Britain. Modest long term deficiencies still exist in some eastern areas. More notable is the exceptionally wet phase which continues in Scotland: 1992 was the second wettest year on record (after 1990).

River flows

Widespread flooding occurred early in the month. December runoff totals were generally well above average, notably so in some eastern catchments where baseflows have increased markedly since the early autumn. Lowland stream networks have extended well into the headwaters and many more springs have started to flow once more.

Groundwater

Generally groundwater levels rose rapidly through most of December. Some dramatic level increases occurred in the Chalk but, as in other aquifers, a few deep wells have yet to show the full benefit of the recent abundant infiltration. Away from such areas groundwater levels were mostly well above average entering 1993.

General

Catchments are saturated over wide areas and very vulnerable to further rainfall especially where snow accumulations exacerbate the flood risk. Water resources are generally very healthy and the 1993 outlook will be especially encouraging if average rainfall persists into the late spring forestalling the onset of the seasonal recession in groundwater levels.

Institute of Hydrology

British Geological Survey

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

HYDROLOGICAL SUMMARY FOR GREAT BRITAIN - December 1992

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. Reservoir contents information has been supplied by the Water Services Companies, the NRA or, in Scotland, the Lothians Regional Council. The most recent areal rainfall figures are derived from a restricted network of raingauges (particularly in Scotland) 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.

Rainfall

December was a month of two halves. The weather was initially mild but very unsettled with substantial rainfall accompanying the passage of a sequence of active frontal systems across the British Isles. Following widespread flooding early in the month - around the 2nd especially - catchments remained saturated and many rivers continued in spate until about the 18th - another very wet day nationwide. Subsequently, an anticyclone across northern Europe extended westwards producing stable weather conditions, fog and frost were widespread and little or no rainfall occurred during the last twelve days of December in most areas.

The December rainfall total for Britain was around 85 per cent of the 1941-70 average and spatial variations were muted. A few districts in northern Scotland recorded well above average monthly totals and some localities in eastern England registered less than 70 per cent but most regions received between 75 and 90 per cent of the monthly mean.

For England and Wales, December ended a sequence of five consecutive wet months but the latter half of the year was still notably wet especially in those areas where the drought achieved its greatest severity. Over the full year, England and Wales rainfall was also above average, albeit modestly. Scotland however registered another exceptionally wet year. Provisional data suggest that 1992 was the second wettest year (after 1990) in a series from 1869. A wet phase began in Scotland in 1977 and in subsequent years only 1987 has been drier than average. The period 1988-92 constitutes the wettest five-year sequence for Scotland - more than 15 per cent above the 1941-70 average, with the anomaly largely accounted for by the remarkably sustained wet conditions which have characterised the west and the Highlands.

By the end of 1992 long term rainfall deficiencies were moderate in all regions, in marked contrast to the beginning of the year in the English lowlands. The continuing unsettled weather, since the early autumn especially, has seen a relatively rapid termination to the meteorological drought followed by a brisk decline in runoff and recharge deficiencies echoing the swift end to the 1959, 1976 and 1984 droughts. However, the UK climate is notoriously capricious and, as during the protracted droughts at the turn of the century (and in some regions in 1990 also) rapid improvements in the water resources outlook can be followed by an equally brisk deterioration.

Evaporation and Soil Moisture Deficits (SMDs)

The mild weather which characterised November continued into December but the latter half of the month was notably cold; overall nationwide temperatures were more than 1°C below average. Anticyclonic conditions from mid-month helped to boost sunshine totals and evaporation rates were well within the normal early-winter range.

For 1992 as a whole, MORECS potential evaporation totals were modest compared with 1989 and 1990 but still, typically, ranked within the highest half dozen in a record from 1961. Actual evaporation losses were even more notable. With SMDs, in the east particularly, much lower than in the preceding three years, transpiration losses were inhibited for relatively short periods and the annual shortfall of AE relative to PE was very modest compared with the preceding few years (1989 and 1990 especially) in much of the English lowlands. As a consequence, 1992 AE totals were the highest, or close to the highest, on record over wide areas.

At year-end, soil moisture deficits were zero, or trivial, in all areas. For much of December soils remained saturated and conditions favoured substantial infiltration to build on the heavy percolation in the previous month.

River Flow

Early in December spate conditions characterised many rivers throughout Britain. Floodplain inundation was widespread and the exceptionally high flows in parts of South Wales and the West Country in late November continued into December. Catchments remained very vulnerable to further significant rainfall over the first week of the month and rivers in southern Britain exceeded bankfull for considerable periods. Modest flooding extended into the English lowlands; for example, Flood Alerts were called on the Thames and, interestingly, overbank flows were reported from some headwaters of Chalk streams (including the Pang and the Lambourn). Flows associated with the flooding over the eight days to the 6th of December in the lower reaches of the Severn and the Warwickshire Avon were estimated to have return periods of about ten years. Runoff rates were maintained at a high level until the third week of December when flooding again affected the West Country and many Welsh rivers approached danger levels. In the east, rapidly rising groundwater levels resulted in healthy outflows from headwater springs and a substantial extension in the stream network. Except in rivers supported principally from baseflow, discharges declined steeply over the last ten days of the month but recovered smartly again in early January.

Runoff totals for December were above, to well above, average in almost all index catchments and close to record levels in some areas; the December average flow was unprecedented on, for example, the Kennet, Coln, Stour (Dorset) and Kenwyn (Cornwall). The accumulated totals for the last three months are also notably high in many areas. This is particularly true of much of the English lowlands where, typically, over half the 1992 runoff is attributable to the period since the beginning of October. Despite the recent abundant runoff, annual totals are appreciably below average throughout most of England, substantially so in some impermeable eastern catchments. The recent transformation in hydrological conditions is perhaps best illustrated on the Kennet where runoff over the 44 months ending in December 1990 is the lowest on record (for sequences starting in May) whilst the October-December total is a new maximum in the 32-year record for the Theale gauging station. The October-December flows signal the end of the drought in most lowland catchments. In Scotland, away from the north-east where long term runoff deficiencies can still be recognised, annual runoff totals were again close to or above average. The rankings of the accumulated catchment runoff totals presented in Table 3 for the Tay and the Clyde testify to the remarkably high flows which have characterised much of Scotland over recent years.

For many western and northern reservoirs flood drawdown releases were employed during December - when downstream flows allowed. Surface water stocks remain very healthy throughout Britain and there was a notable increase in storage for the Wessex region where, as elsewhere, reservoir contents are close, or at, capacity.

Groundwater

Late December appears to have signalled the end of the drought in groundwater terms. The abundant infiltration (greater than the normal winter total over large areas) during the autumn and early winter manifested itself as steep, sometimes dramatic, rises in groundwater levels in December throughout most of the drought affected areas. However, some deep Chalk wells have yet to show the full effect of the rainfall since the late summer.

In southern England, water-tables are either above the mean or, more commonly, approaching the seasonal maxima. In the Chalk at Ashton Farm, the groundwater level reached its highest value in an 18-year record, and at Rockley its highest in a 59-year record. Groundwater level rises exceeding 10 metres were widely reported for December. These recoveries resemble closely those observed in late 1976 when particularly wet weather terminated an intense but less protracted drought event; exceptionally steep recoveries also occurred early in 1990 in some aquifers. December groundwater levels were still depressed in parts of the East Anglian Chalk - see for example the Washpit Farm trace - but brisk winter recoveries may be confidently expected as the recent infiltration reaches the water-table (the normal lag in response to surface infiltration has, of course, been increased by the remarkable depth of the water-table in 1992).

Recoveries are as yet least in those parts of the eastern lowlands that were most severely affected by the long drought. At Redlands Hall, for example, groundwater levels are rising but have scarcely breached the long-term seasonal minima. In the Chalk at Little Brocklesby, Dalton Holme and Wetwang, the water-table is rising rapidly and should surpass the seasonal mean early in 1993. In the Permo-Triassic sandstones of north Wales, at the Llanfair DC site, the groundwater level is rising but had not quite reached the seasonal mean by mid-December; the same is true of the Bussels site in south-west England where end-of-year groundwater levels in some boreholes were still relatively depressed. The Midlands also present a rather patchy picture. Levels are rising briskly in most areas but are still very low in, for example, Nottinghamshire and the Weeford Flats borehole remains dry. By contrast, early winter levels at Stone approached the seasonal maximum. Here, as elsewhere in the fissured aquifers, there have been several slight falls during the last week of the month, but these have been insignificant compared with the preceding rise.

Average rainfall from January through March 1993 should see groundwater resources in an very healthy state by the early spring over most of the country. Prospects for groundwater resources throughout 1993 will be enhanced if above average rainfall continues through the late-winter and spring serves to delay, or slow, the onset of the summer recession.

Institute of Hydrology/British Geological Survey
14 January 1993

TABLE 1 1991/92 RAINFALL AS A PERCENTAGE OF THE 1941-70 AVERAGE

		Dec 1991	Jan 1992	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
England and	mm	49	48	47	85	75	49	45	87	126	103	90	135	75
Wales	%	54	56	72	144	129	73	74	119	140	124	108	139	84
NRA REGIONS														
North West	mm	119	57	100	142	89	62	31	72	137	114	128	163	107
	%	99	51	123	197	116	76	37	70	110	93	109	135	89
Northumbria	mm	78	33	45	107	103	31	19	61	104	108	84	99	69
	%	104	41	68	206	187	48	31	79	103	137	112	105	92
Severn-Trent	mm	39	59	31	67	50	59	55	87	117	72	73	111	60
	%	56	86	58	129	96	92	98	134	144	107	113	141	85
Yorkshire	mm	62	47	42	96	66	34	33	81	94	98	80	104	67
	%	84	61	66	170	118	56	57	116	104	136	115	116	90
Anglian	mm	24	45	17	63	43	48	34	89	82	92	72	86	40
	%	45	87	40	158	108	102	69	156	128	176	138	140	75
Thames	mm	16	28	25	52	65	60	39	77	107	89	76	112	57
	%	24	45	53	113	141	107	75	128	153	144	118	153	86
Southern	mm	23	18	33	59	84	30	26	75	105	73	81	132	70
	%	28	24	58	113	175	55	52	127	144	102	103	141	87
Wessex	mm	30	36	39	57	81	24	49	64	127	94	50	149	82
	%	33	43	66	98	150	35	91	103	155	119	61	153	91
South West	mm	52	44	69	75	100	31	23	83	171	100	96	197	104
	%	39	34	77	89	141	37	35	99	169	96	85	147	77
Welsh	mm	65	76	80	129	91	80	48	93	212	112	100	196	124
	%	45	56	83	148	107	88	59	98	178	89	77	137	85
Scotland	mm	141	139	167	208	123	80	52	103	217	187	148	196	141
	%	90	101	161	226	137	88	57	92	168	136	99	138	90
RIVER PURIFICATION BOARDS														
Highland	mm	166	197	229	248	138	105	46	97	250	177	144	241	190
	%	85	120	172	218	121	102	42	76	169	112	78	143	101
North-East	mm	53	67	52	113	68	57	50	48	128	113	107	97	90
	%	52	74	70	182	111	74	71	52	120	130	110	94	88
Tay	mm	97	117	111	172	90	57	30	78	197	152	92	165	106
	%	72	99	121	210	120	60	36	76	167	132	76	153	79
Forth	mm	108	110	111	164	76	45	25	67	174	156	80	167	81
	%	99	111	144	238	112	54	33	68	150	144	75	155	74
Tweed	mm	92	63	70	138	98	52	27	60	151	126	80	123	75
	%	102	68	101	238	161	68	40	67	132	135	91	118	83
Solway	mm	162	91	140	206	144	66	30	99	214	166	114	190	119
	%	107	65	151	226	164	72	33	90	165	110	79	131	79
Clyde	mm	208	170	231	267	144	93	41	123	270	195	135	272	142
	%	112	106	204	254	140	96	40	95	190	111	74	163	76

Note: The most recent monthly rainfall figures correspond to the MORECS areal assessments derived by the Meteorological Office. The 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 FOR SELECTED PERIODS WITH CORRESPONDING RETURN PERIOD ESTIMATES

		Jul - Dec92	Est Return Period, years	Jan - Dec92	Est Return Period, years	Mar90-Dec92	Est Return Period, years	Aug88-Dec92	Est Return Period, years
England and	mm	614		963		2322		3744	
Wales	% LTA	119	5-10	106	<5	89	5-10	91	10-15
NRA REGIONS									
North West	mm	721		1202		3147		5173	
	% LTA	102	<5	99	<5	91	5-10	95	<5
Northumbria	mm	525		863		2218		3434	
	% LTA	105	<5	98	<5	92	5-10	89	20-25
Severn Trent	mm	519		840		1898		3087	
	% LTA	122	5-10	109	<5	89	5-10	91	10-15
Yorkshire	mm	523		835		1989		3215	
	% LTA	113	<5	100	<5	87	10-15	88	20-25
Anglian	mm	460		710		1485		2342	
	% LTA	135	20-25	116	5-10	88	10-15	88	20-25
Thames	mm	518		787		1679		2739	
	% LTA	131	10-15	112	<5	87	10-15	89	10-15
Southern	mm	536		786		1861		3012	
	% LTA	118	5-10	99	<5	86	10-15	86	20-25
Wessex	mm	565		851		1995		3372	
	% LTA	115	<5	98	<5	84	20-25	88	15-20
South West	mm	751		1093		2823		4828	
	% LTA	112	<5	92	<5	87	10-15	92	5-10
Welsh	mm	837		1341		3282		5539	
	% LTA	111	<5	101	<5	91	5-10	95	<5
Scotland	mm	992		1761		4230		7310	
	% LTA	120	20-25	123	50-70	115	70-100	116	>>200
RIVER PURIFICATION BOARDS †									
Highland	mm	1099		2062		5455		8991	
	% LTA	112	<5	120	20-25	117	80-120	119	>>200
North-East	mm	583		990		2633		4084	
	% LTA	99	<5	97	<5	94	<5	91	15-20
Tay	mm	790		1367		3528		5892	
	% LTA	111	<5	109	<5	103	<5	107	5-10
Forth	mm	725		1256		3250		5287	
	% LTA	112	<5	112	5-10	106	<5	108	10-15
Tweed	mm	615		1063		2735		4256	
	% LTA	106	<5	106	<5	99	<5	96	<5
Solway	mm	901		1586		4033		6612	
	% LTA	108	<5	111	5-10	104	<5	105	<5
Clyde	mm	1137		2083		5404		8774	
	% LTA	116	5-10	125	40-50	119	150-200	120	>>200

Return period assessments are based on tables provided by the Meteorological Office*. These 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 tables reflect rainfall totals over the period 1911-70 only and the estimate assumes a sensibly stable climate.

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

† **Note: The RPB accumulations given in the November report related to the period up to October 1992 only**

FIGURE 1. MONTHLY RAINFALL FOR 1990-1992 AS A PERCENTAGE OF THE 1941-1970 AVERAGE

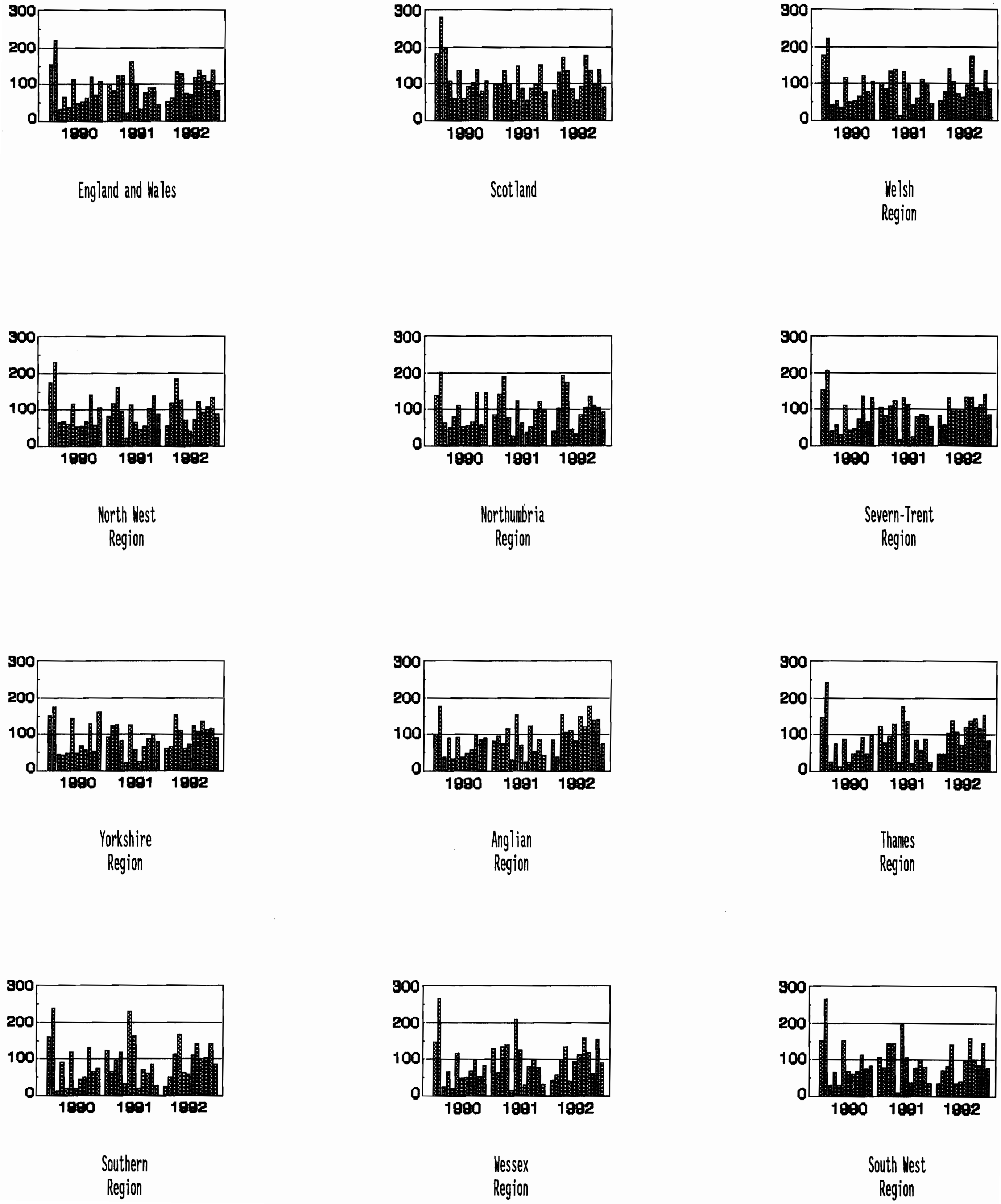
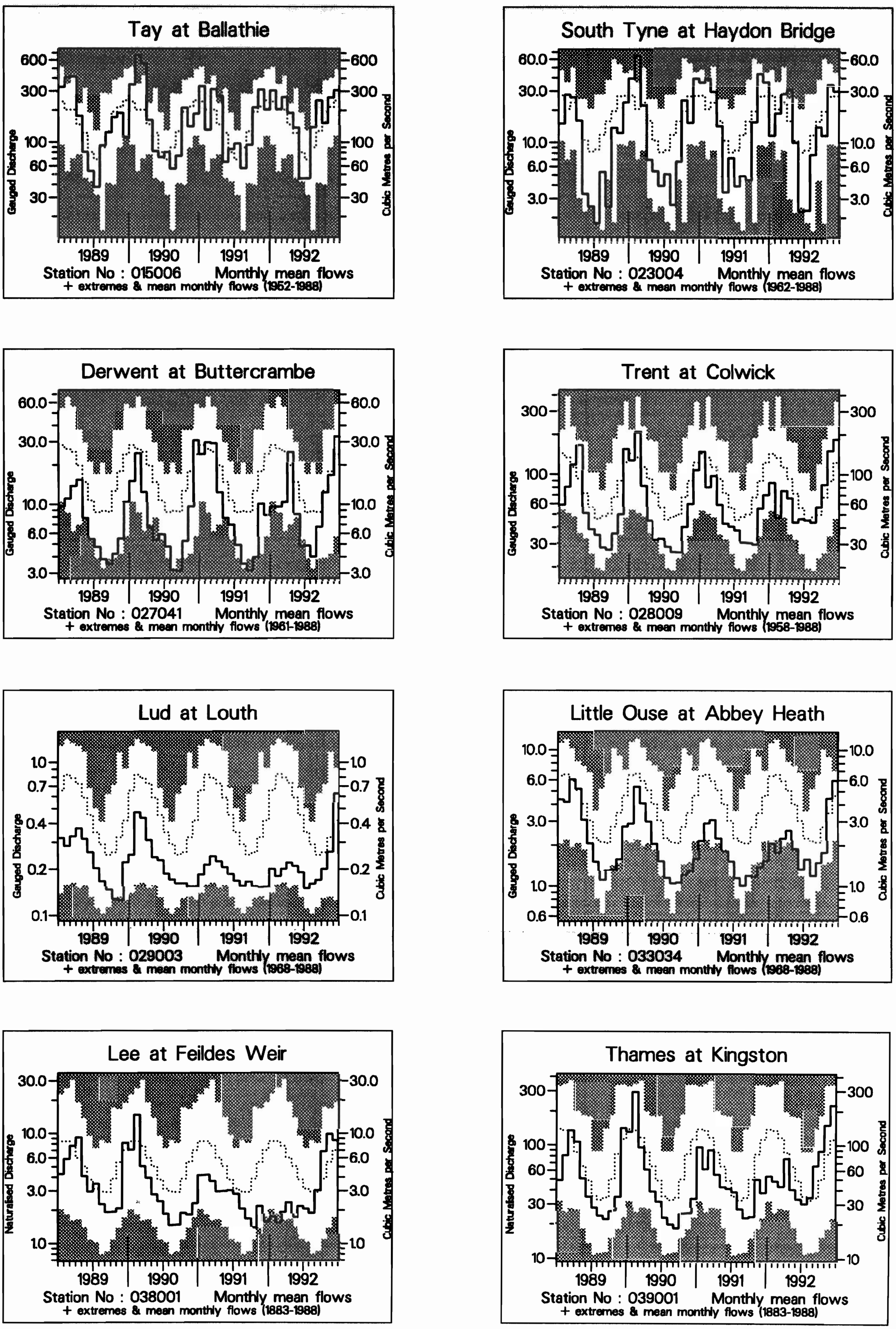
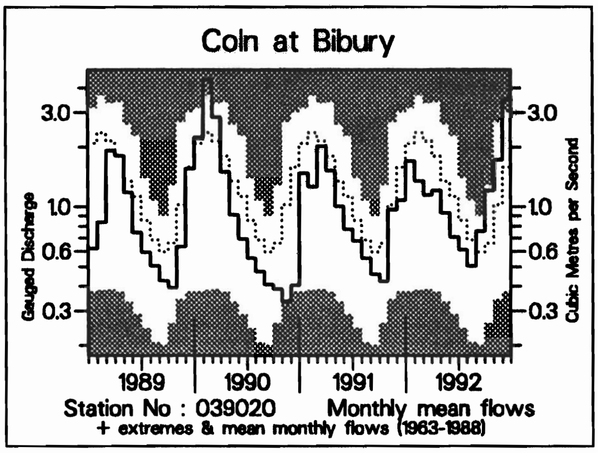
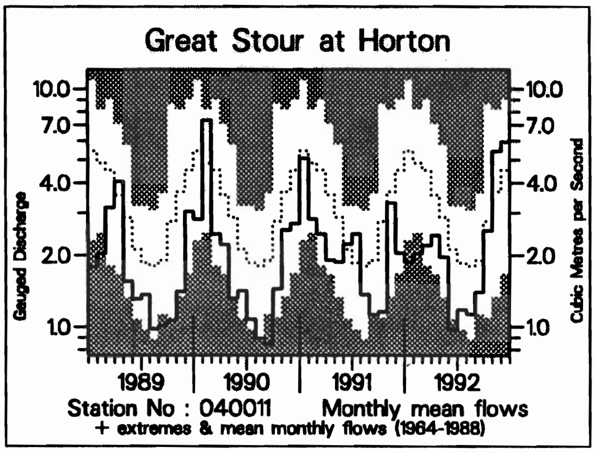
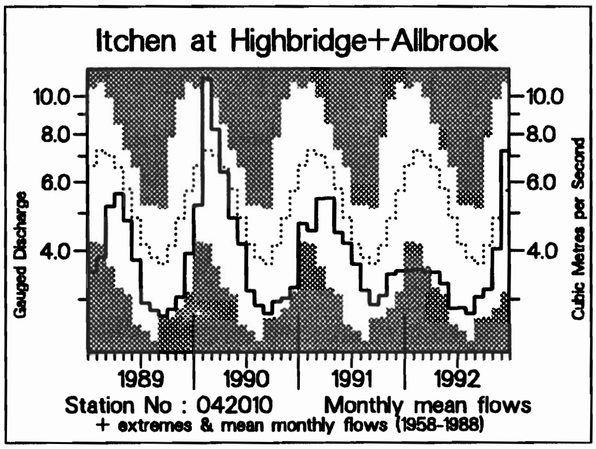


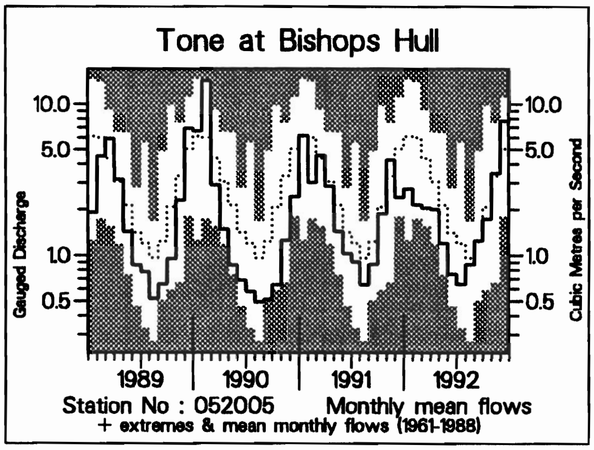
FIGURE 2 MONTHLY RIVER FLOW HYDROGRAPHS

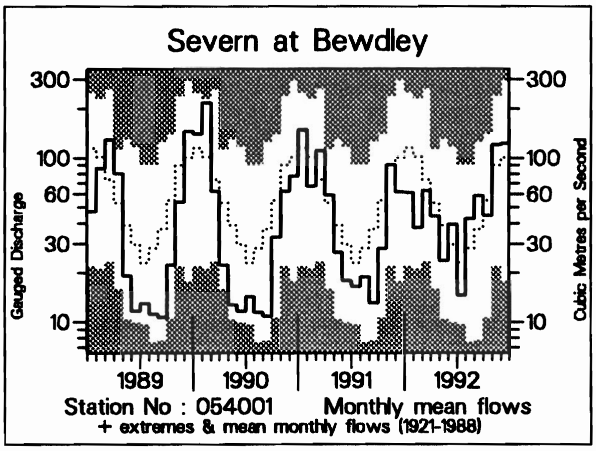


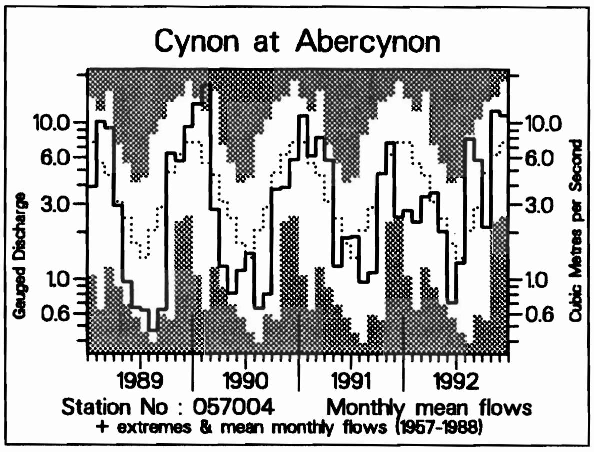

Coln at Bibury
3.0
1.0
0.6
0.3
Gauged Discharge
Cubic Metres per Second
1989
1990
1991
1992
Station No : 039020 Monthly mean flows
+ extremes & mean monthly flows (1963-1988)

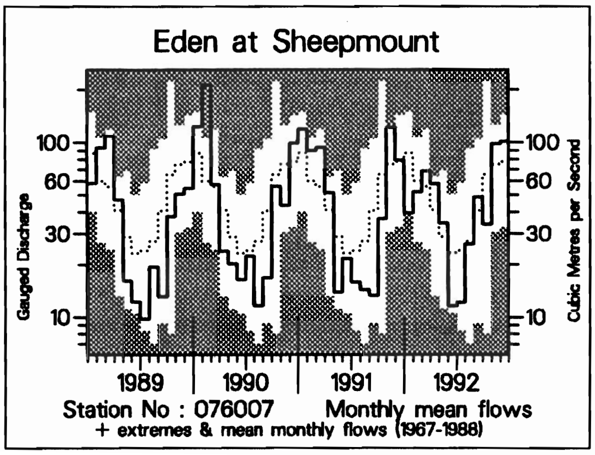

Great Stour at Horton
10.0
7.0
4.0
2.0
1.0
Gauged Discharge
Cubic Metres per Second
1989
1990
1991
1992
Station No : 040011 Monthly mean flows
+ extremes & mean monthly flows (1964-1988)


Itchen at Highbridge+Allbrook
10.0
8.0
6.0
4.0
Gauged Discharge
Cubic Metres per Second
1989
1990
1991
1992
Station No : 042010 Monthly mean flows
+ extremes & mean monthly flows (1958-1988)


Tone at Bishops Hull
10.0
5.0
1.0
0.5
Gauged Discharge
Cubic Metres per Second
1989
1990
1991
1992
Station No : 052005 Monthly mean flows
+ extremes & mean monthly flows (1961-1988)


Severn at Bewdley
300
100
60
30
10
Gauged Discharge
Cubic Metres per Second
1989
1990
1991
1992
Station No : 054001 Monthly mean flows
+ extremes & mean monthly flows (1921-1988)


Cynon at Abercynon
10.0
6.0
3.0
1.0
0.6
Gauged Discharge
Cubic Metres per Second
1989
1990
1991
1992
Station No : 057004 Monthly mean flows
+ extremes & mean monthly flows (1957-1988)


Eden at Sheepmount
100
60
30
10
Gauged Discharge
Cubic Metres per Second
1989
1990
1991
1992
Station No : 076007 Monthly mean flows
+ extremes & mean monthly flows (1967-1988)

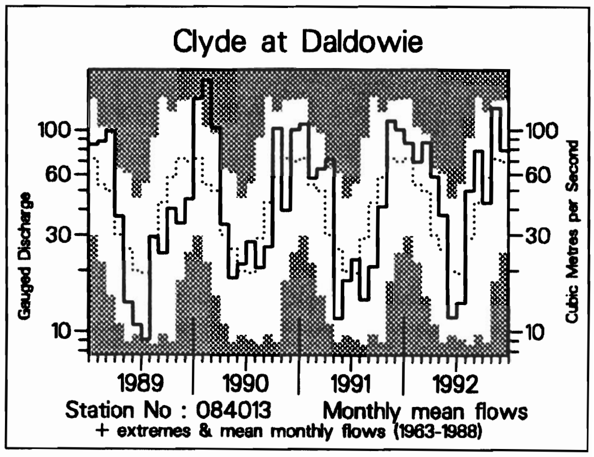

Clyde at Daldowie
100
60
30
10
Gauged Discharge
Cubic Metres per Second
1989
1990
1991
1992
Station No : 084013 Monthly mean flows
+ extremes & mean monthly flows (1963-1988)

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	Aug 1992	Sep 1992	Oct 1992	Nov 1992	Dec 1992		10/92 to 12/92		1/92 to 12/92		5/90 to 12/92		5/89 to 12/92	
	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	42	55	61	90	80	11	231	8	667	4	1783	5	2409	1
Park	134	137	76	118	93	/21	94	/20	86	/20	88	/18	84	/17
Tay at	80	139	88	148	179	30	415	30	1311	34	3069	26	4523	30
Ballathie	157	200	79	123	128	/41	111	/41	116	/40	106	/38	112	/37
Whiteadder Water at	12	19	32	48	46	14	126	14	370	11	934	9	1112	6
Hutton Castle	78	123	118	129	102	/24	114	/24	95	/23	94	/21	80	/20
South Tyne at	28	48	41	117	107	20	265	16	700	8	1879	10	2556	5
Haydon Bridge	72	95	59	127	108	/31	102	/31	93	/29	95	/25	92	/23
Wharfe at	26	41	40	98	112	28	251	22	639	9	1605	6	2192	2
Flint Mill Weir	65	93	63	123	116	/38	104	/38	89	/37	86	/35	85	/34
Derwent at	7	11	21	27	55	26	104	22	241	7	590	3	760	1
Buttercrambe	49	82	105	97	139	/32	118	/32	74	/31	71	/29	65	/28
Trent at	16	20	30	52	65	31	147	32	327	12	703	3	1007	3
Colwick	97	121	130	173	149	/35	150	/35	92	/34	78	/32	80	/31
Lud at	8	8	10	12	30	23	52	20	132	4	307	1	450	1
Louth	60	72	84	85	159	/25	115	/25	52	/24	49	/22	51	/21
Witham at	5	11	23	28	39	32	90	32	176	16	331	8	487	7
Claypole Mill	73	179	274	239	214	/34	226	/34	96	/33	74	/32	77	/31
Little Ouse at	4	5	7	16	23	20	46	19	106	5	224	1	336	1
Abbey Heath	53	69	72	135	140	/25	119	/25	63	/24	53	/23	57	/22
Colne at	3	9	16	28	26	29	71	30	122	11	216	2	325	1
Lexden	75	216	193	232	159	/34	188	/34	90	/33	66	/31	70	/30
Lee at	5	8	18	24	22	77	64	90	111	19	234	8	378	7
Feildes Weir (natr.)	66	111	182	178	122	/108	155	/108	68	/106	57	/103	66	/101
Thames at	9	17	24	39	60	105	124	105	235	49	447	11	690	19
Kingston (natr.)	103	191	180	182	201	/110	189	/110	96	/110	73	/108	80	/107
Coln at	13	18	30	42	88	30	160	30	378	12	781	6	1193	8
Bibury	78	128	189	176	230	/30	198	/30	97	/29	80	/27	87	/26
Great Stour at	9	11	20	41	46	24	106	23	222	6	526	4	725	2
Horton	67	81	99	154	138	/28	130	/28	76	/26	71	/23	70	/21
Itchen at	20	22	24	29	54	31	106	22	317	1	869	1	1287	1
Highbridge+Allbrook	71	84	80	86	132	/35	101	/35	70	/34	74	/32	78	/31
Exe at	47	61	63	169	158	26	390	30	767	14	1830	7	2577	8
Thorverton	169	161	85	175	121	/37	128	/37	93	/36	87	/35	88	/34
Tone at	11	16	23	45	102	27	170	25	346	4	833	1	1336	2
Bishops Hull	90	106	87	107	156	/32	126	/32	74	/31	71	/30	81	/29
Severn at	26	35	28	72	76	56	175	52	409	26	950	8	1384	12
Bewdley	152	163	84	135	122	/72	118	/72	91	/71	83	/70	87	/69
Cynon at	199	140	55	291	280	30	625	32	1360	21	3117	12	4560	16
Abercynon	408	213	45	191	151	/35	135	/35	109	/33	97	/29	102	/27
Dee at	160	156	123	302	232	13	657	12	1700	9	4159	4	5835	2
New Inn	178	120	62	124	95	/24	96	/24	94	/23	88	/21	88	/20
Eden at	31	55	40	110	118	19	268	14	668	8	1761	8	2468	8
Sheepmount	104	132	55	131	131	/23	108	/23	97	/22	101	/18	101	/16
Clyde at	70	107	61	174	111	20	346	23	1021	28	2394	26	3295	25
Daldowie	176	189	74	181	112	/30	124	/30	132	/29	119	/27	119	/26

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 as rank 1.
(iii) %LT means percentage of long term average from the start of the record to 1991. For the long periods (at the right of this table), the end date for the long term is 1992.

TABLE 4 START-MONTH RESERVOIR STORAGES UP TO JANUARY 1993

Area	Reservoir (R)/ Group (G)		Capacity● (Ml)	1992 Aug	Sep	Oct	Nov	Dec	1993 Jan	1992 Jan
North West	Northern Command Zone[1]	(G)	133375	55	60	66	64	79	88	79
	Vyrnwy	(R)	55146	80	96	93	81	88	89	95
Northumbria	Teesdale[2]	(G)	87936	58	63	68	79	95	90	88
	Kielder	(R)	199175*	77*	84*	89*	87*	77*	74*	99*
Severn-Trent	Clywedog	(R)	44922	85	87	92	86	92	84	87
	Derwent Valley[3]	(G)	39525	73	66	62	79	95	88	84
Yorkshire	Washburn[4]	(G)	22035	72	64	64	70	89	95	65
	Bradford supply[5]	(G)	41407	58	56	65	65	83	94	86
Anglian	Grafham	(R)	58707	95	94	94	95	94	94	88
	Rutland	(R)	130061	81	86	93	95	96	95	63
Thames	London[6]	(G)	206232	85	89	94	96	96	96	75
	Farmoor[7]	(G)	13843	97	99	99	99	95	96	99
Southern	Bewl	(R)	28170	64	60	68	69	72	82	58
	Ardingly	(R)	4685	88	71	79	81	100	100	88
Wessex	Clatworthy	(R)	5364*	43*	35*	40*	49*	70	100	87
	Bristol WW[8]	(G)	38666*	61*	58*	65*	61*	63*	94*	53*
South West	Colliford	(R)	28540	66	63	65	67	73	82	83
	Roadford	(R)	34500	75	70	72	76	85	90	85
	Wimbleball[9]	(R)	21320	53	48	50	55	71	90	73
	Stithians	(R)	5205	54	53	63	69	82	100	37
Welsh	Celyn + Brenig	(G)	131155	87	89	93	96	98	96	94
	Brianne	(R)	62140	77	90	99	100	100	99	100
	Big Five[10]	(G)	69762	66	83	86	87	91	94	93
	Elan Valley[11]	(G)	99106	87	100	100	100	100	98	94
Lothian	Edinburgh/Mid Lothian	(G)	97639	79	86	92	90	100	98	95
	West Lothian	(G)	5613	49	60	82	84	95	98	90
	East Lothian	(G)	10206	72	68	78	82	91	100	95

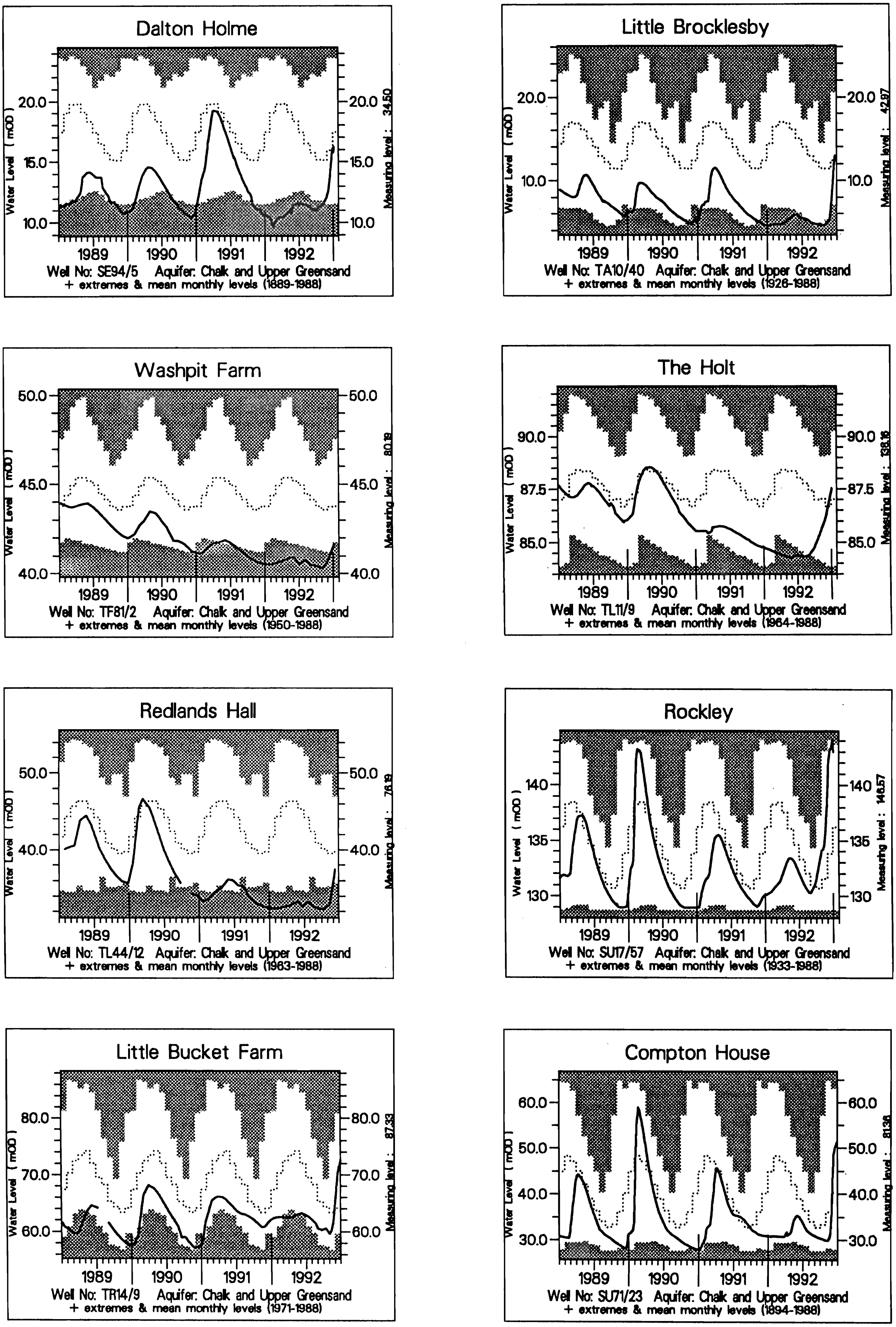
● Live or usable capacity (unless indicated otherwise)
* Gross storage/percentage of gross storage

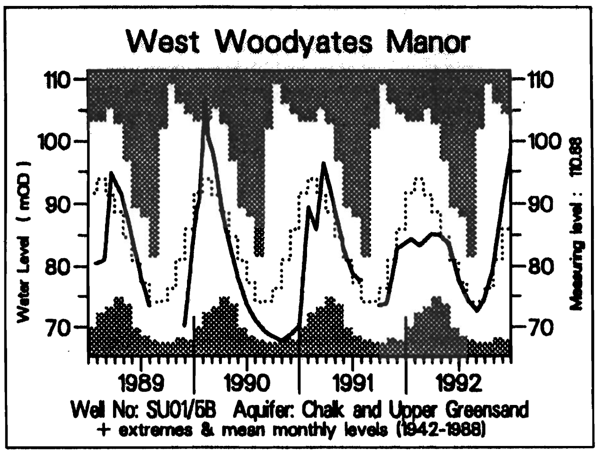
☐ Kielder drawn down for ecological management

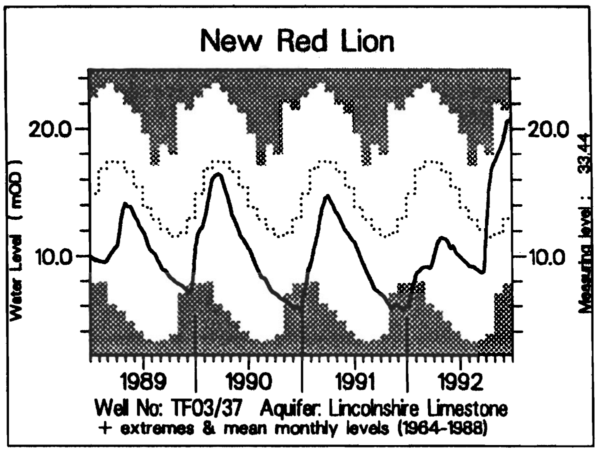
1. Includes Haweswater, Thirlmere, Stocks and Barnacre.
2. Cow Green, Selset, Grassholme, Balderhead, Blackton and Hury.
3. Howden, Derwent and Ladybower.
4. Swinsty, Fewston, Thruscross and Eccup.
5. The Nidd/Barden group (Scar House, Angram, Upper Barden, Lower Barden and Chelker) plus Grimwith.
6. 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. Shared between South West (river regulation for abstraction) and Wessex (direct supply).
10. Usk, Talybont, Llandegfedd (pumped storage), Taf Fechan, Taf Fawr.
11. Claerwen, Caban Coch, Pen y Garreg and Craig Goch.

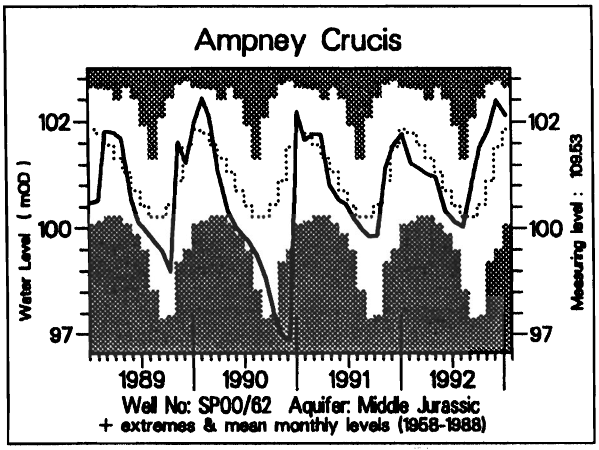
Note: Variations in storage depend on the balance between inputs (from catchment rainfall and any pumping) and outputs (to supply, compensation flow, HEP, amenity). There will be additional losses due to evaporation, especially in the summer months. Operational strategies for making the most efficient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

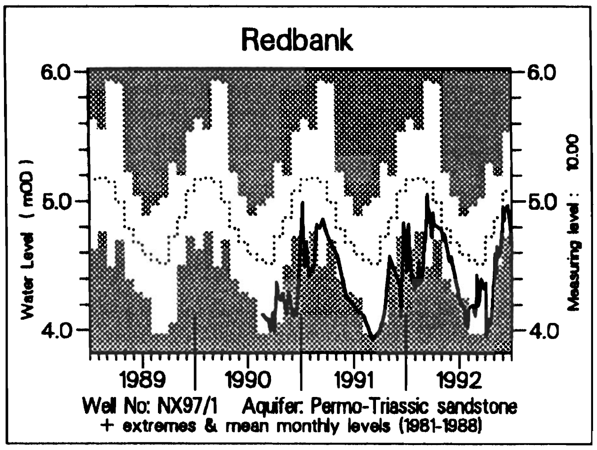
FIGURE 3 GROUNDWATER LEVEL HYDROGRAPHS

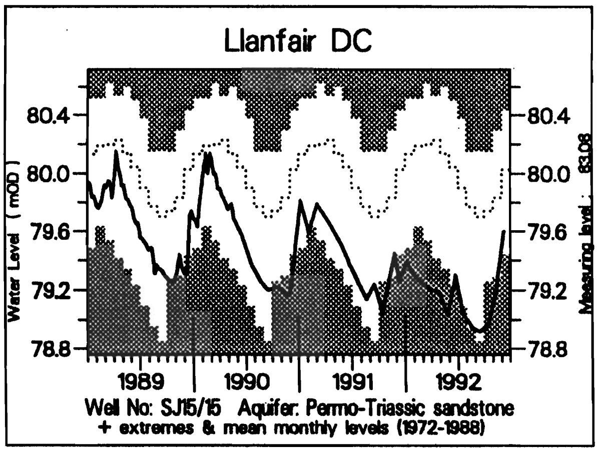


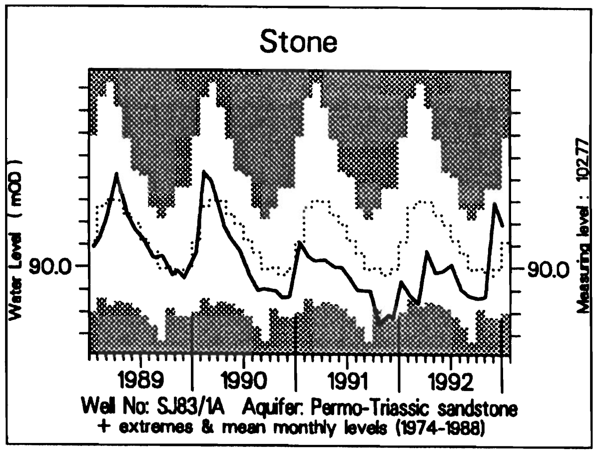

West Woodyates Manor
110
100
90
80
70
Water Level (mOD)
Measuring level : 110.88
1989
1990
1991
1992
Well No: SU01/5B Aquifer: Chalk and Upper Greensand
+ extremes & mean monthly levels (1942-1988)

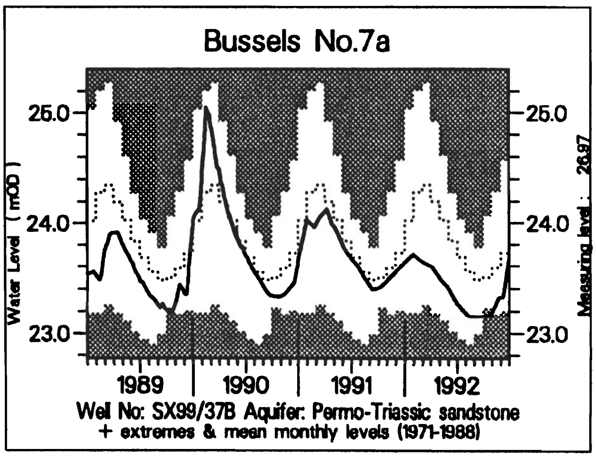

New Red Lion
20.0
10.0
Water Level (mOD)
Measuring level : 33.44
1989
1990
1991
1992
Well No: TF03/37 Aquifer: Lincolnshire Limestone
+ extremes & mean monthly levels (1964-1988)


Ampney Crucis
102
100
97
Water Level (mOD)
Measuring level : 109.53
1989
1990
1991
1992
Well No: SP00/62 Aquifer: Middle Jurassic
+ extremes & mean monthly levels (1958-1988)


Redbank
6.0
5.0
4.0
Water Level (mOD)
Measuring level : 10.00
1989
1990
1991
1992
Well No: NX97/1 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1981-1988)


Llanfair DC
80.4
80.0
79.6
79.2
78.8
Water Level (mOD)
Measuring level : 83.08
1989
1990
1991
1992
Well No: SJ15/15 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1972-1988)


Stone
90.0
Water Level (mOD)
Measuring level : 102.77
1989
1990
1991
1992
Well No: SJ83/1A Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1974-1988)


Bussels No.7a
25.0
24.0
23.0
Water Level (mOD)
Measuring level : 26.97
1989
1990
1991
1992
Well No: SX99/37B Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1971-1988)

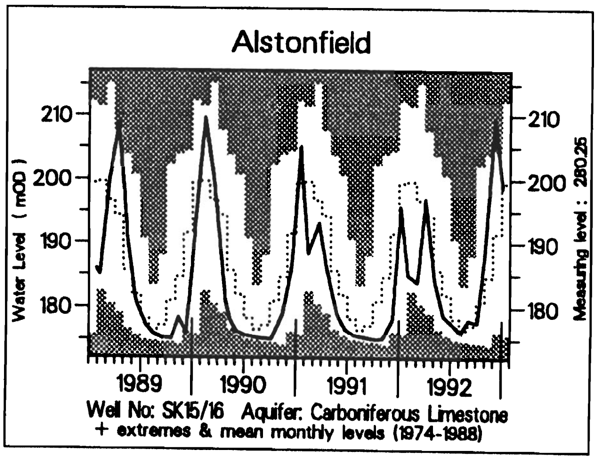

Alstonfield
210
200
190
180
Water Level (mOD)
Measuring level : 280.25
1989
1990
1991
1992
Well No: SK15/16 Aquifer: Carboniferous Limestone
+ extremes & mean monthly levels (1974-1988)

TABLE 5 A COMPARISON OF DECEMBER GROUNDWATER LEVELS : 1990, 1991 AND 1992

Site	Aquifer	Records commence	Average December Level	December 1990		December 1991		Dec/Jan 1992/3		No of years Dec/level <1992	Lowest pre-1992 level (any month)
				Day	Level	Day	Level	Day	Level		
Wetwang	C & UGS	1971	21.72	13/12	21.27	11/12	17.12	04/01	25.90	>10	16.84
Dalton Holme	C & UGS	1889	15.79	06/12	10.34	27/12	10.59	06/01	16.24	>10	10.34
Little Brocklesby	C & UGS	1926	11.99	27/12	4.86	31/12	4.54	22/12	12.97	>10	4.54
Washpit Farm	C & UGS	1950	43.54	04/12	41.31	02/12	40.61	04/01	41.66	3	40.61
The Holt	C & UGS	1964	86.79	06/12	85.81	29/12	84.80	03/01	87.53	>10	83.90
Therfield Rectory	C & UGS	1883	77.84	06/12	76.56	29/12	72.00	04/01	74.72	>10	dry (below 71.59)
Redlands Farm	C & UGS	1964	39.61	21/12	34.04	24/12	32.46	11/12	37.46	7	32.46
Rockley	C & UGS	1933	133.82	31/12	dry	29/12	130.11	03/01	143.00	>10	dry (below 128.94)
Little Bucket Farm	C & UGS	1971	64.05	31/12	57.63	27/12	61.97	31/12	72.71	>10	56.77
Compton House	C & UGS	1894	39.77	28/12	27.96	23/12	30.91	30/12	51.29	>10	27.64
Chilgrove House	C & UGS	1836	50.08	28/12	33.81	23/12	40.26	30/12	64.78	>10	33.46
West Dean No 3	C & UGS	1940	1.96	28/12	1.39	24/12	1.72	23/12	2.48	>10	1.01
Lime Kiln Way	C & UGS	1969	124.92	05/12	124.69	05/12	124.24	30/12	124.07	0	124.09
Ashton Farm	C & UGS	1974	67.15	05/12	63.20	30/12	68.60	31/12	71.29	>10	63.10
West Woodyates	C & UGS	1942	86.19	03/12	68.90	02/12	82.80	31/12	98.72	>10	67.62
New Red Lion	LLst	1964	12.70	31/12	5.49	31/12	6.02	31/12	20.60	>10	3.29
Ampney Crucis	Mid Jur	1958	101.26	10/12	97.38	09/12	101.94	11/01	102.64	>10	97.38
Dunmurry (NI)	PTS	1985	28.24	18/12	28.15	30/12	28.28	31/12	28.27	5	27.47
Redbank	PTS	1981	5.08	31/12	4.66	30/12	4.63	31/12	4.66	3	3.93
Yew Tree Farm	PTS	1972	13.49	19/12	13.33	11/12	13.25	30/12	13.69	>10	8.43
Llanfair DC	PTS	1972	79.92	01/12	79.16	10/12	79.25	07/12	79.60	5	78.85
Morris Dancers	PTS	1969	32.61	28/12	32.11	12/12	32.11	14/12	31.88	1	30.87
Stone	PTS	1974	90.10	11/12	89.74	12/12	89.55	04/01	90.39	>10	89.34
Bussels 7A	PTS	1972	23.79	19/12	23.46	31/12	23.63	06/01	23.92	>10	22.90
Rushyford NE	MgLst	1967	68.89	17/12	74.37	16/12	74.80	04/12	74.78	>10	64.77
Peggy Ellerton	MgLst	1968	34.14	06/12	32.40	10/12	32.71	07/12	32.29	1	31.10
Alstonfield	CLst	1974	192.33	18/12	186.64	10/12	178.23	04/01	198.70	>10	174.22

Groundwater levels are in metres above Ordnance Datum

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

FIGURE 4 LOCATION MAP OF GAUGING STATIONS AND GROUNDWATER INDEX WELLS