Hydrological summary

for Great Britain

October 1997

General

Notwithstanding the unsettled start to November, and the wet summer, the current drought is widespread and severe. Levels in some southern and eastern reservoirs are low but, nationally, surface water stocks are close to the early November mean. By contrast, groundwaters are very depressed over wide areas. October river flows were also exceptionally low in many catchments; a substantial number of new long term runoff minima have been established. With late-October soils notably dry, the contraction of the lowland stream network continues. The very welcome early November rainfall will need to herald a protracted wet episode to give impetus to the seasonal recoveries in runoff and aquifer recharge rates. Thereafter, above average winter rainfall will be required to restore groundwater levels to within their normal range by the spring of 1998.

Rainfall

October was mild and wet initially but, from mid-month, persistent anticyclonic conditions produced, large diurnal temperature variations, notably high sunshine totals and a very dry interlude. Unusually, the lowest monthly rainfall totals were in Scotland where parts of the east were especially dry; provisional data indicate that the August-October period for Scotland was the third driest since 1939 (1993 was almost as dry). In England and Wales rainfall totals were close to the average in the English lowlands but, to the west and north, rainfall totals were generally in the 50-80% range. 12-month rainfall totals are mostly within the normal range but the rainfall distribution during 1997 has favoured the summer months when evaporation demands are highest; the wet June-August period had little beneficial impact (demand reductions aside) on overall water resources in the drought affected regions. Long term rainfall deficiencies remain outstanding in some areas. Parts of E&W (eg the north-west and south-east) have registered above average rainfall in only six or seven of the last 31 months. The April 95-Oct 97 period has established a new post-1850s 31-month rainfall minimum for England and Wales (new minima in the 27-33 month timeframes have also been established during 1997). At the end of October, accumulated deficiencies were the equivalent of more than 6 months rainfall in parts of the English lowlands, north-west England also.

River Flow

The combination of limited autumn rainfall in impermeable catchments in the west and north, and long term deficiencies in the much less responsive permeable catchments of the east and south produced very low October runoff throughout most of Britain. Some modest spates were reported over the first fortnight, in urban catchments particularly, but recessions resumed thereafter and monthly flows were well below average for almost all index stations - many registering less than half the October mean. In Scotland, the Dee (at Woodend) registered its second lowest October mean flow in a series from 1929 and, in the Tweed basin, new October daily minimum flows were established on the Tima Water and Eye Water. In England rivers were close to long term minima over wide areas. In the east particularly some rivers have registered below average flows for 30 or more successive months, overall runoff for the period since the spring of 1995 being less than half the long term average. For rivers such as the South Tyne, Trent, Essex Colne and the Gt Stour runoff since April 1995 has been lower than for any other 30-month period on record. Currently flows are most depressed in southern and eastern England - new October minima were established on, for example, the Little Ouse, Kennet and Test (Hants).

Groundwater

October normally heralds the onset of recoveries in groundwater levels, and soil moisture deficits declined briskly in early October. With soils in the west close to field capacity, modest infiltration was reported. However, smds began to build again from mid-month and, entering November, were at levels which - prior to the last decade - would have been very exceptional in much of eastern Britain. Recharge to the Chalk was thus minimal and the long term declines continue. Levels in the northern Chalk outcrops (the Lincs. and Jurassic Limestones also) remain in the normal range but are very depressed throughout most of the aquifer, in the Chilterns especially. Most Chalk index boreholes are close to drought minima, Rockley and Therfield remain dry. On the basis of very limited historical data it is possible that overall groundwater levels in the southern Chalk are at their lowest this century (but very substantial resources remain at depth). Apart from the most south-westerly outcrops, levels in most Permo-Triassic sandstones index wells are also close to period-of-record minima. The 1997 groundwater level recoveries will need to be generated from a very low base; well above average late autumn/early winter rainfall is needed to trigger this recovery in the east. A combination of a wet winter and an extended recharge season is required to restore water-tables to their normal levels by late-spring 1998.

Institute of Hydrology

British Geological Survey

Rainfall accumulations and return period estimates

Area	Rainfall	Oct 1997	Aug 97-Oct 97	RP	Mar 97-Oct 97	RP	Nov 96-Oct 97	RP	Apr 95-Oct 97	RP
England & Wales	**mm**	**72**	**197**		**498**		**814**		**1874**	
	%	**85**	**83**	**2-5**	**89**	**2-5**	**91**	**2-5**	**82**	**50-80**
NorthWest	mm	67	202		584		1020		2300	
	%	52	58	15-25	77	5-15	85	5-10	75	>200
Northumbrian	mm	44	120		478		827		1878	
	%	58	52	30-50	88	2-5	97	2-5	86	15-25
SevernTrent	mm	58	172		474		719		1597	
	%	91	88	2-5	98	2-5	95	2-5	83	30-50
Yorkshire	mm	45	137		456		782		1660	
	%	61	64	10-15	88	2-5	95	2-5	79	80-120
Anglian	mm	52	127		378		571		1239	
	%	101	82	2-5	95	2-5	96	2-5	80	50-80
Thames	mm	64	165		380		602		1422	
	%	104	92	2-5	85	2-5	87	2-5	80	40-60
Southern	mm	86	187		406		695		1594	
	%	107	91	2-5	85	2-5	89	2-5	81	40-60
Wessex	mm	63	251		501		807		1991	
	%	79	116	2-5	98	2-5	96	2-5	94	2-5
SouthWest	mm	99	317		641		1083		2644	
	%	86	108	2-5	95	2-5	92	2-5	91	5-10
Welsh	mm	94	302		683		1130		2760	
	%	69	86	2-5	88	2-5	86	5-10	84	30-40
Scotland	**mm**	**83**	**268**		**782**		**1395**		**3293**	
	%	**53**	**65**	**20-35**	**89**	**5-10**	**97**	**2-5**	**91**	**10-15**
Highland	mm	86	326		966		1755		3890	
	%	43	66	15-25	92	2-5	100	<2	88	15-25
North East	mm	35	147		601		956		2502	
	%	36	54	35-50	97	2-5	98	2-5	101	2-5
Tay	mm	68	212		636		1144		2889	
	%	52	63	10-20	86	5-10	93	2-5	93	2-5
Forth	mm	60	188		596		1089		2542	
	%	52	59	20-35	86	5-10	98	2-5	90	5-10
Tweed	mm	47	147		545		1015		2286	
	%	49	54	30-50	88	2-5	105	2-5	92	5-10
Solway	mm	108	314		761		1314		3214	
	%	69	75	5-10	87	2-5	92	2-5	89	5-15
Clyde	mm	129	341		857		1543		3737	
	%	67	67	10-20	83	5-10	91	2-5	87	15-25

%= % of 1961-90

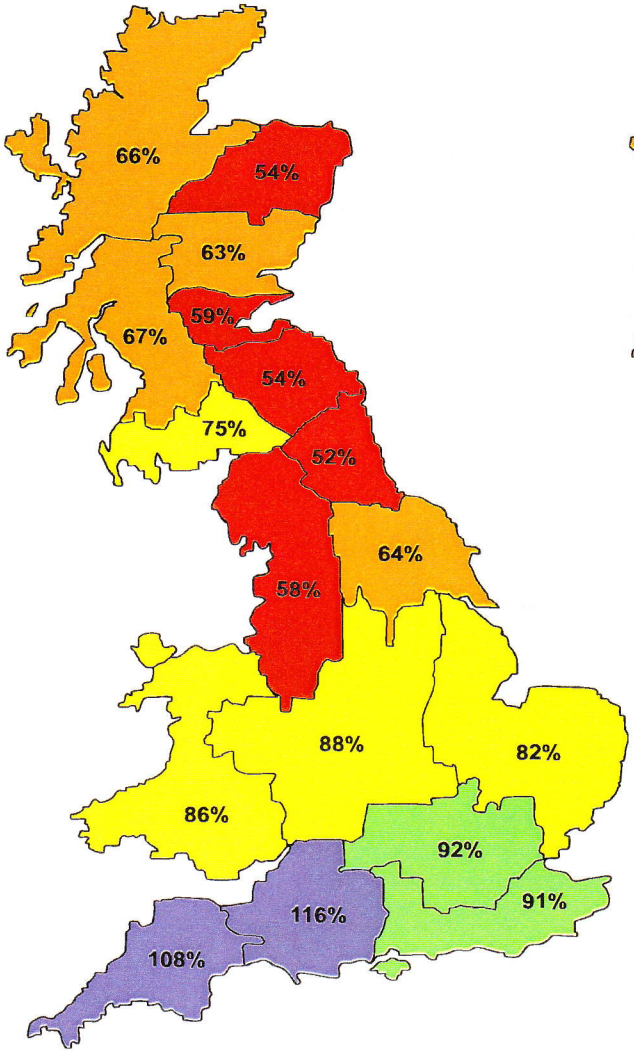
RP = Return period

 Recent monthly rainfall figures for the Scottish regions have ben compiled using data provided by the Scottish Environment Protection Agency. The return period estimates are based on tables provided by the Meteorological Office (see Tabony, R.C., 1977, *The variability of long duration rainfall over Great Britain*, Scientific Paper No. 37) and relate to the specified span of months only, (return periods may be up to an order of magnitude less if n-month periods beginning in any month are considered). The tables reflect rainfall over the period 1911-70 and assume a stable climate. Artifacts in the England & Wales and Scotland rainfall series can exaggerate the relative wetness of the recent past.

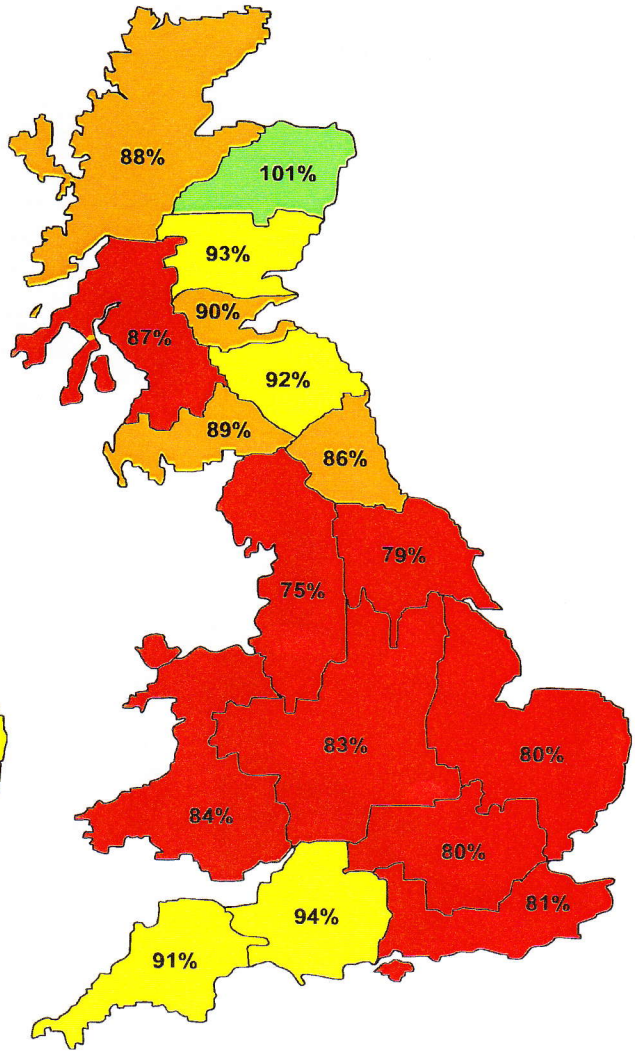
Rainfall . . . Rainfall . . . Rainfall

Key

00%	Percentage of 1961-90 average		Normal range
	Very wet		Below average
	Substantially above average		Substantially below average
	Above average		Exceptionally low rainfall



August 1997 - October 1997

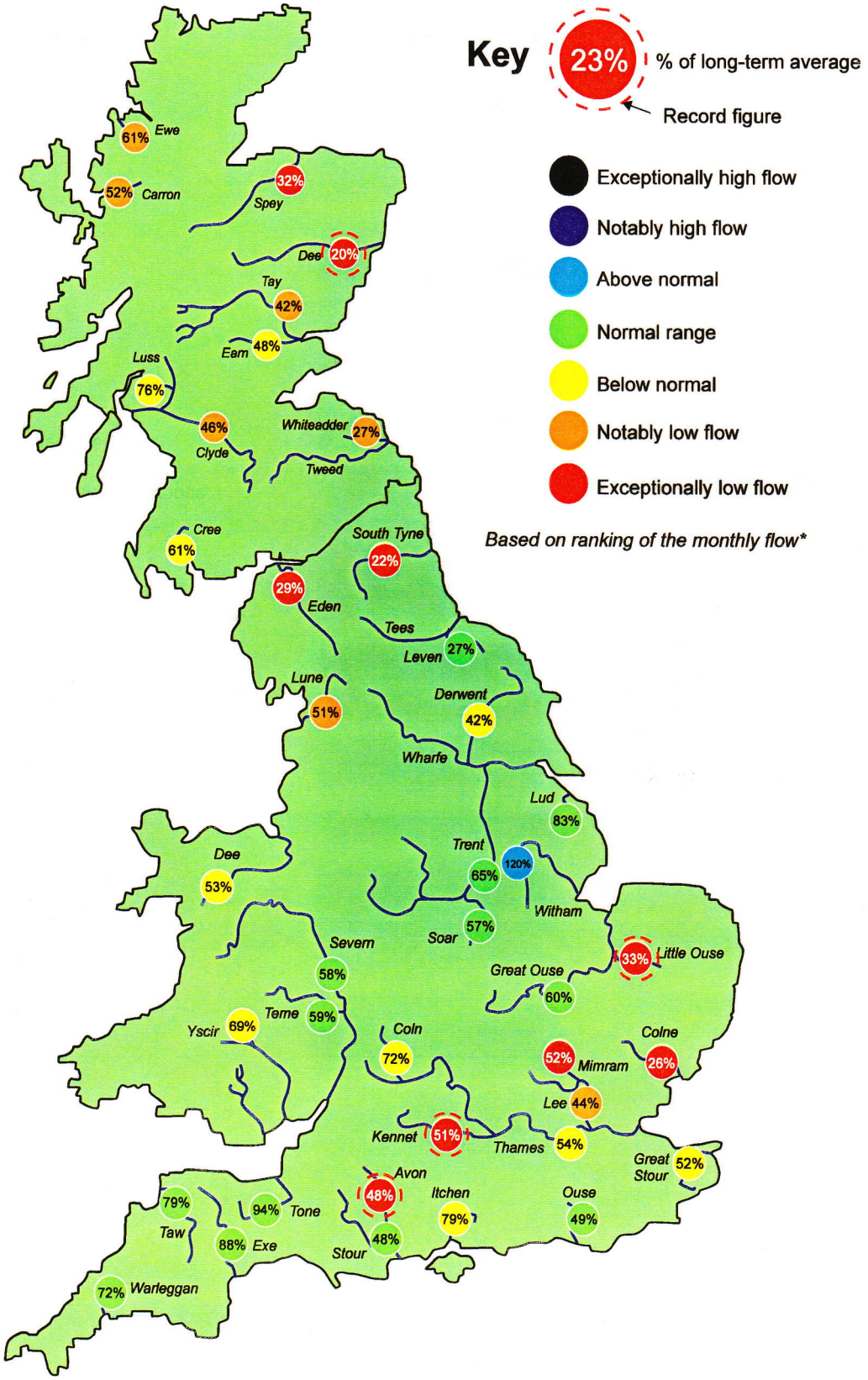


April 1995 - October 1997

Rainfall accumulation maps

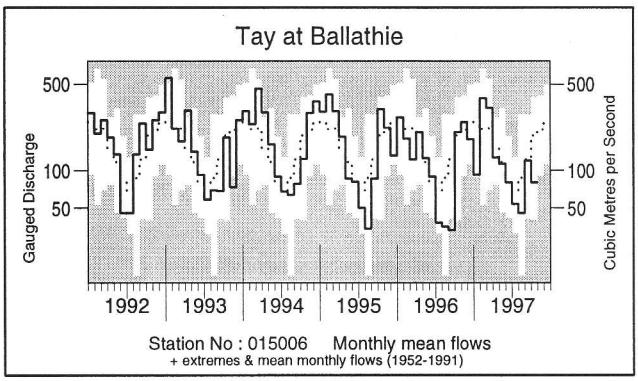
The last three months have produced notable short-term drought conditions in much of northern Britain. However, in water resources terms the exceptional rainfall deficiencies in the 31-month timeframe are much more significant - in relation to groundwaters especially.

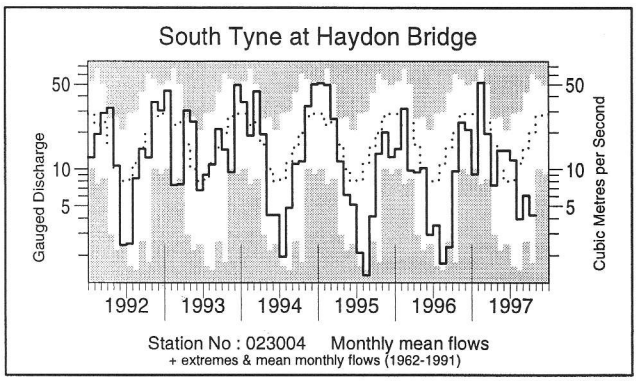
River flow . . . River flow . . .

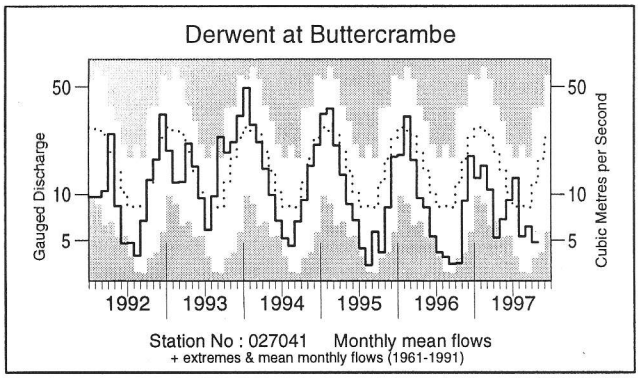


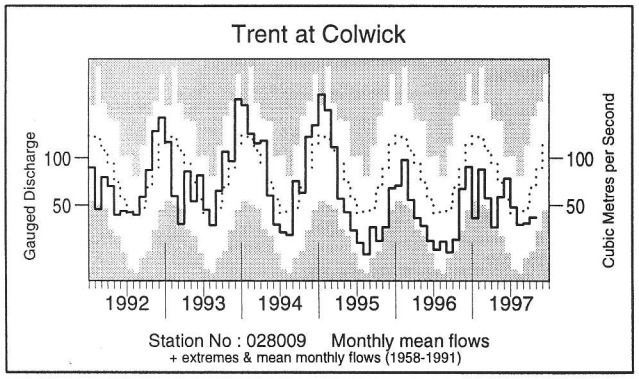
River flows - October 1997

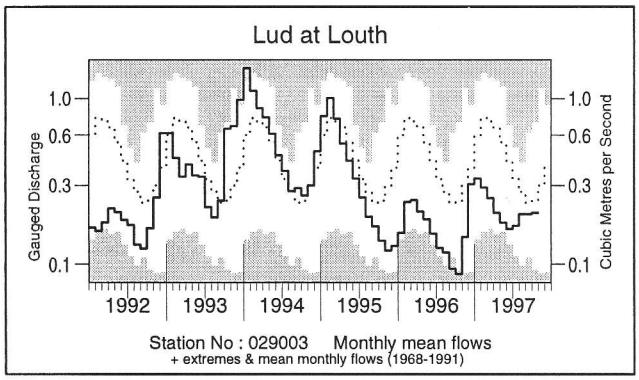
Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much greater.

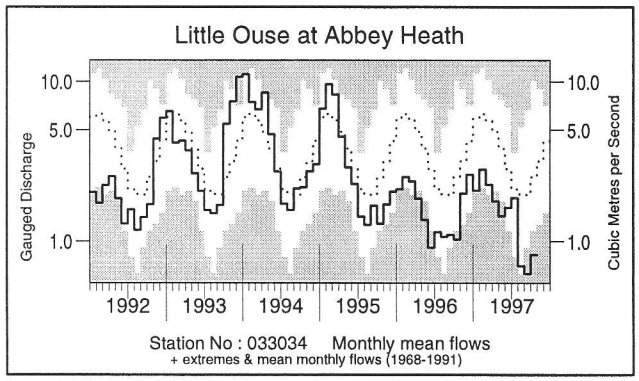


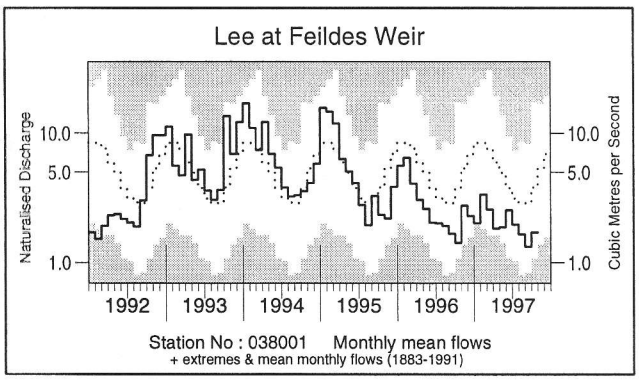


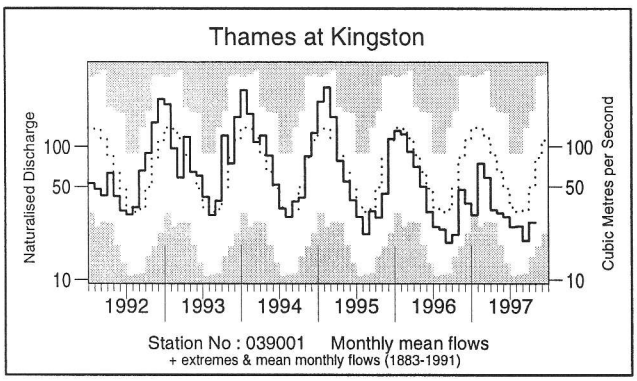








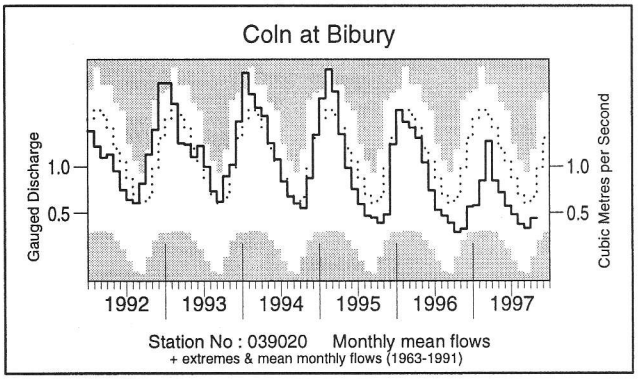


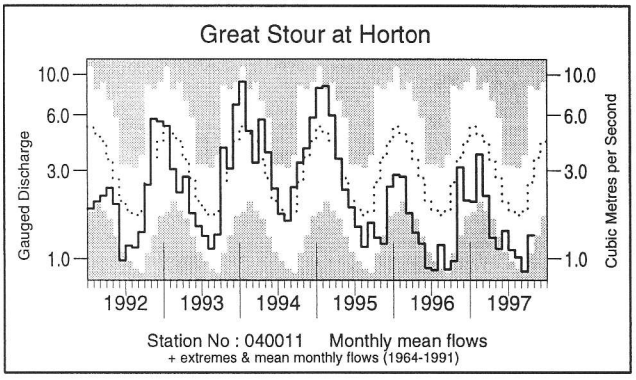


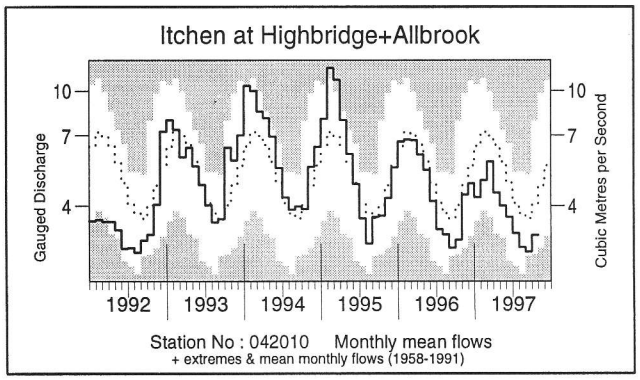
Monthly river flow hydrographs

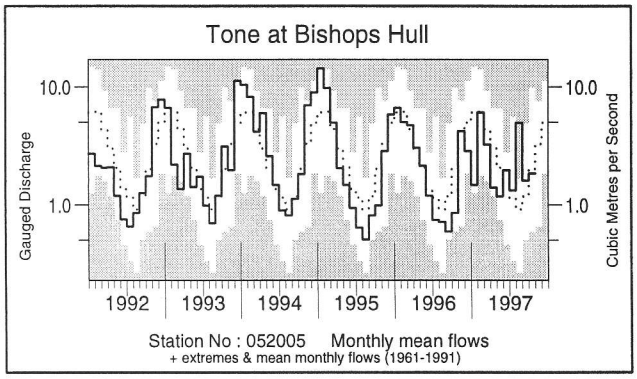
The river flow hydrographs show the monthly mean flow (bold trace), the long term average monthly flow (dotted trace) and the maximum and minimum flow prior to 1992 (shown by the shaded areas). Monthly flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas.

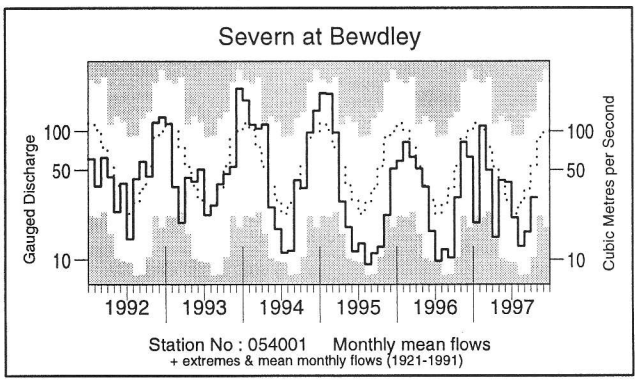
River flow . . . River flow . . .

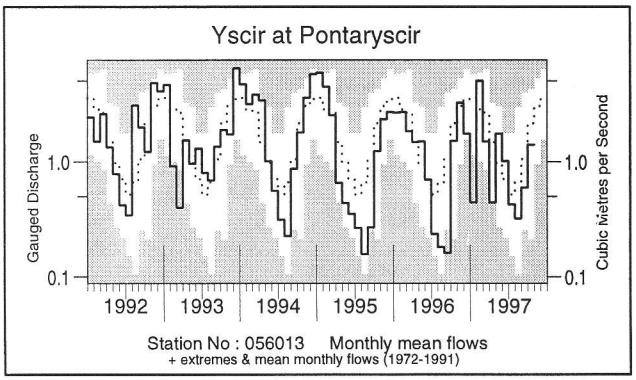


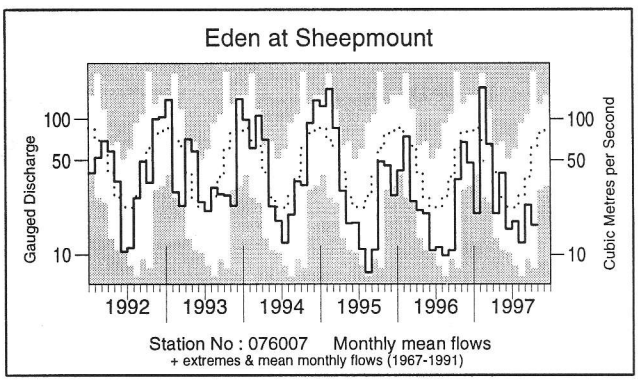


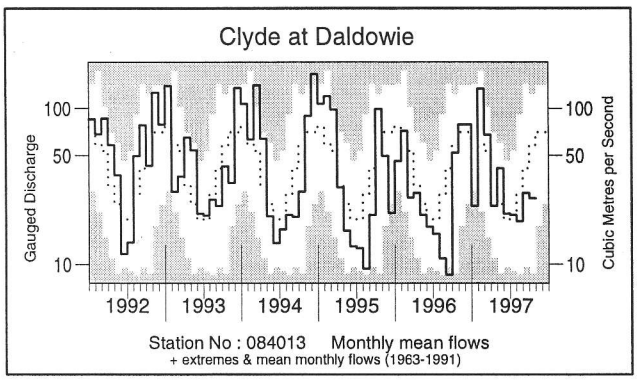










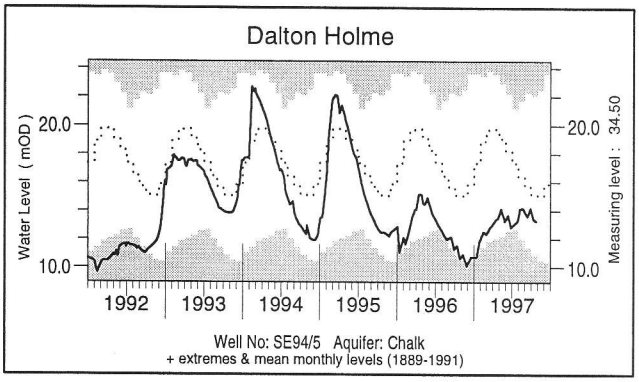


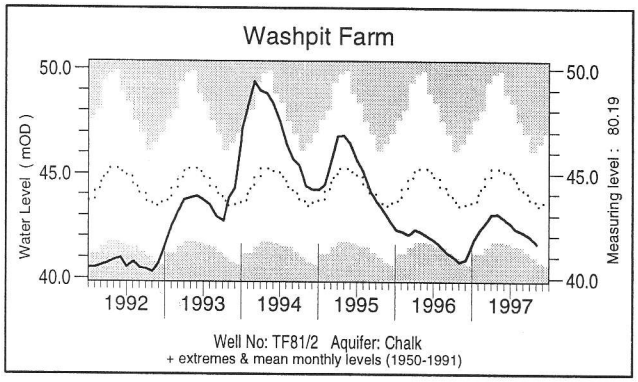
Notable runoff accumulations August - October 1997 (a); November 1995 - October 1997 (b)

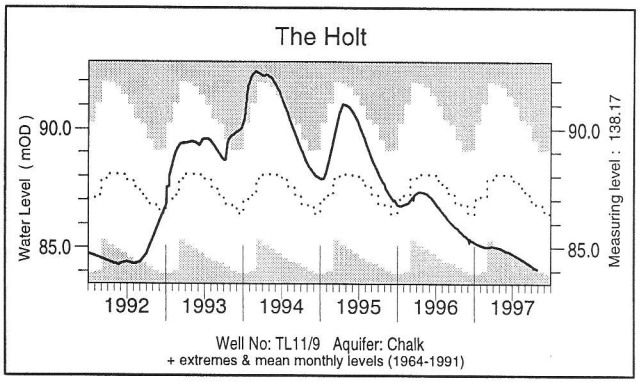
(a) River	%lta	Rank	(b) River	%lta	Rank	River	%lta	Rank
Dee (Scot)	43	1/25	Wharfe	62	1/41	Medway	51	1/30
Spey	47	2/45	Trent	60	1/38	Taw	74	1/38
L.Ouse	35	1/30	Dove	57	1/35	Brue	72	1/32
Colne	55	1/38	Soar	52	1/25	Severn	63	1/75
Kennet	55	1/36	L.Ouse	46	1/28	Dee (Welsh)	70	1/59
Test	67	1/40	Colne	45	1/35	Lune	68	1/33

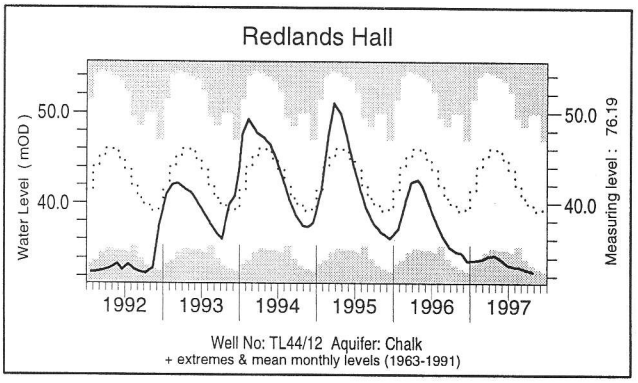
lta = long term average
Rank 1 = lowest on record

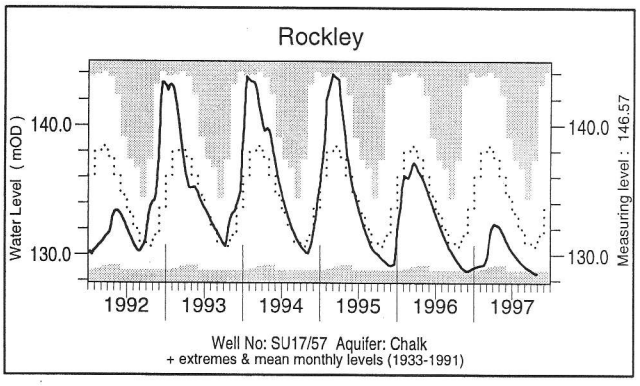
Groundwater . . . Groundwater

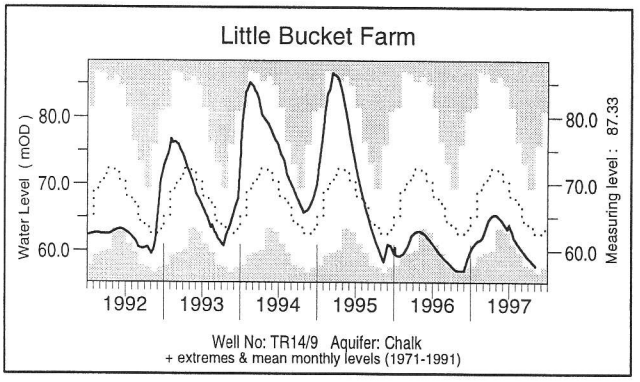


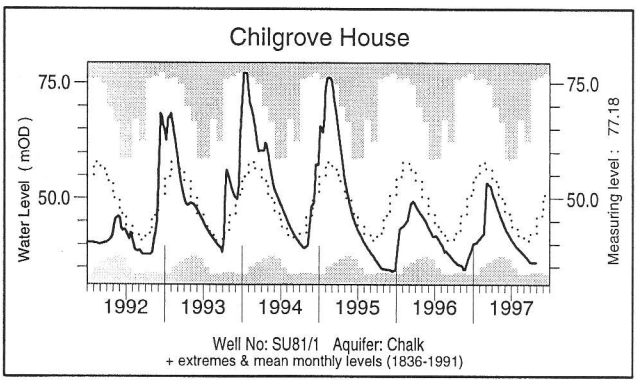


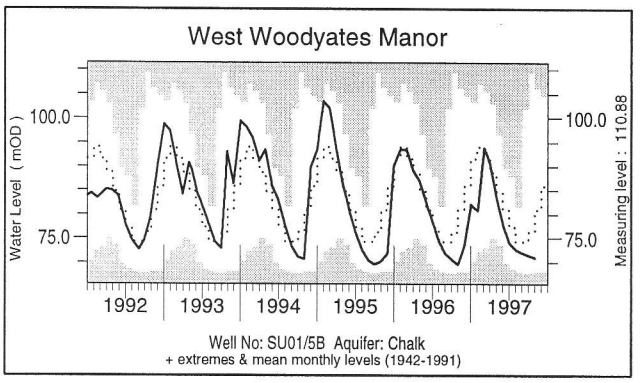








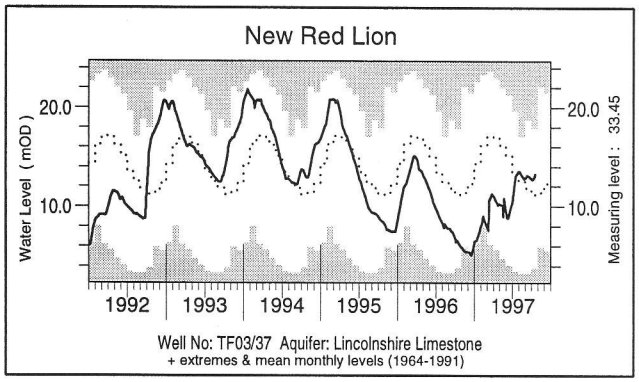


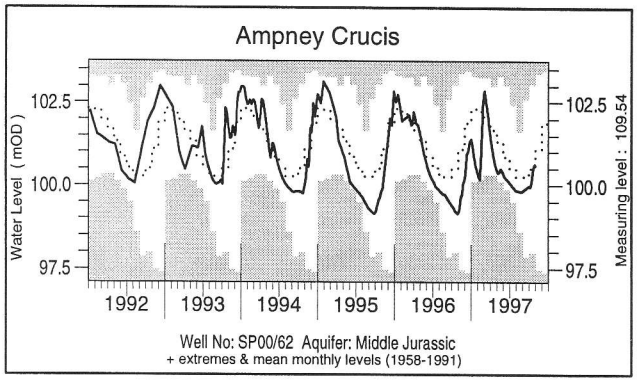


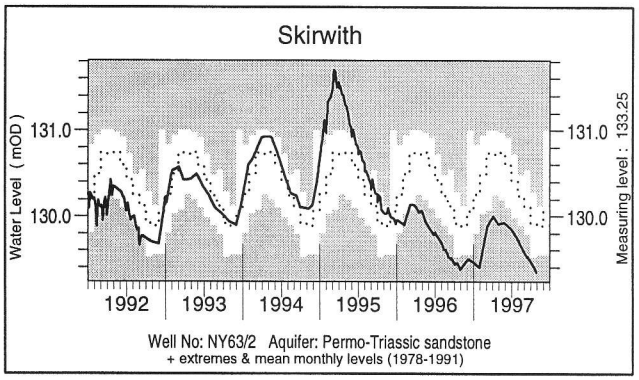
What is groundwater?

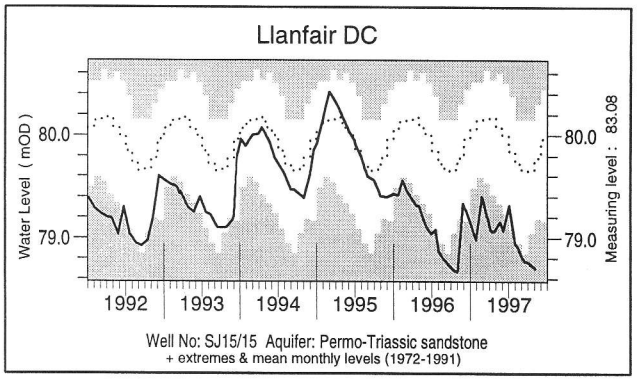
Groundwater is stored in the natural water bearing rock strata (or aquifers) which are found mostly in southern and eastern England (see page 11) where groundwater is the major water supply source. Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined below overlying impermeable strata. The monthly max., min. and mean levels are displayed in a similar style to the river flow hydrographs, note that most groundwater levels are not measured continuously — the latest recorded levels are listed overleaf.

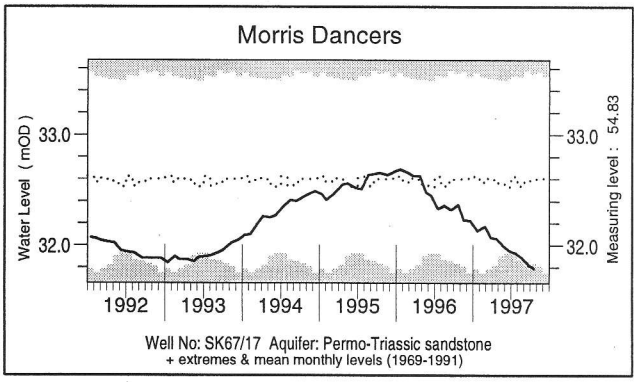
Groundwater . . . Groundwater

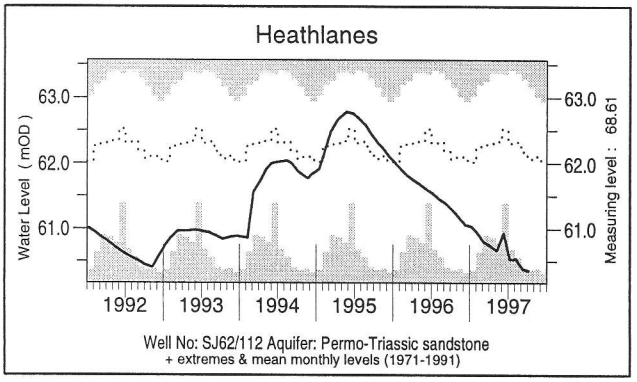


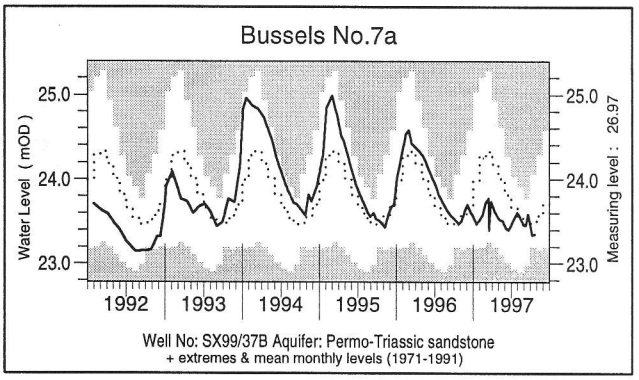


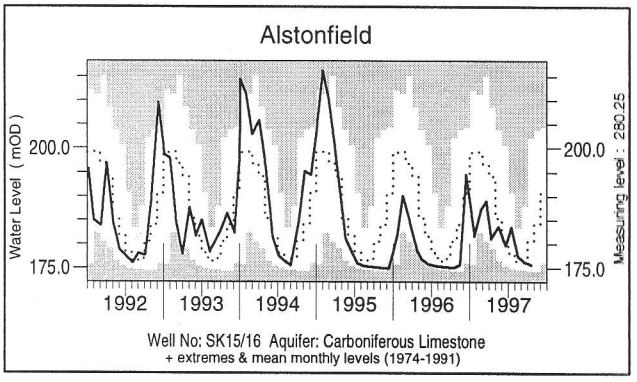












Groundwater levels October/November 1997

Borehole	Level	Date	Oct av.
Dalton Holme	13.27	24/10	14.91
Washpit Farm	41.65	04/11	43.41
The Holt	84.10	27/10	86.96
Redlands Hall	32.46	24/10	38.71
Rockley *	128.6	27/10	130.7
Little Bucket	57.72	04/11	63.18

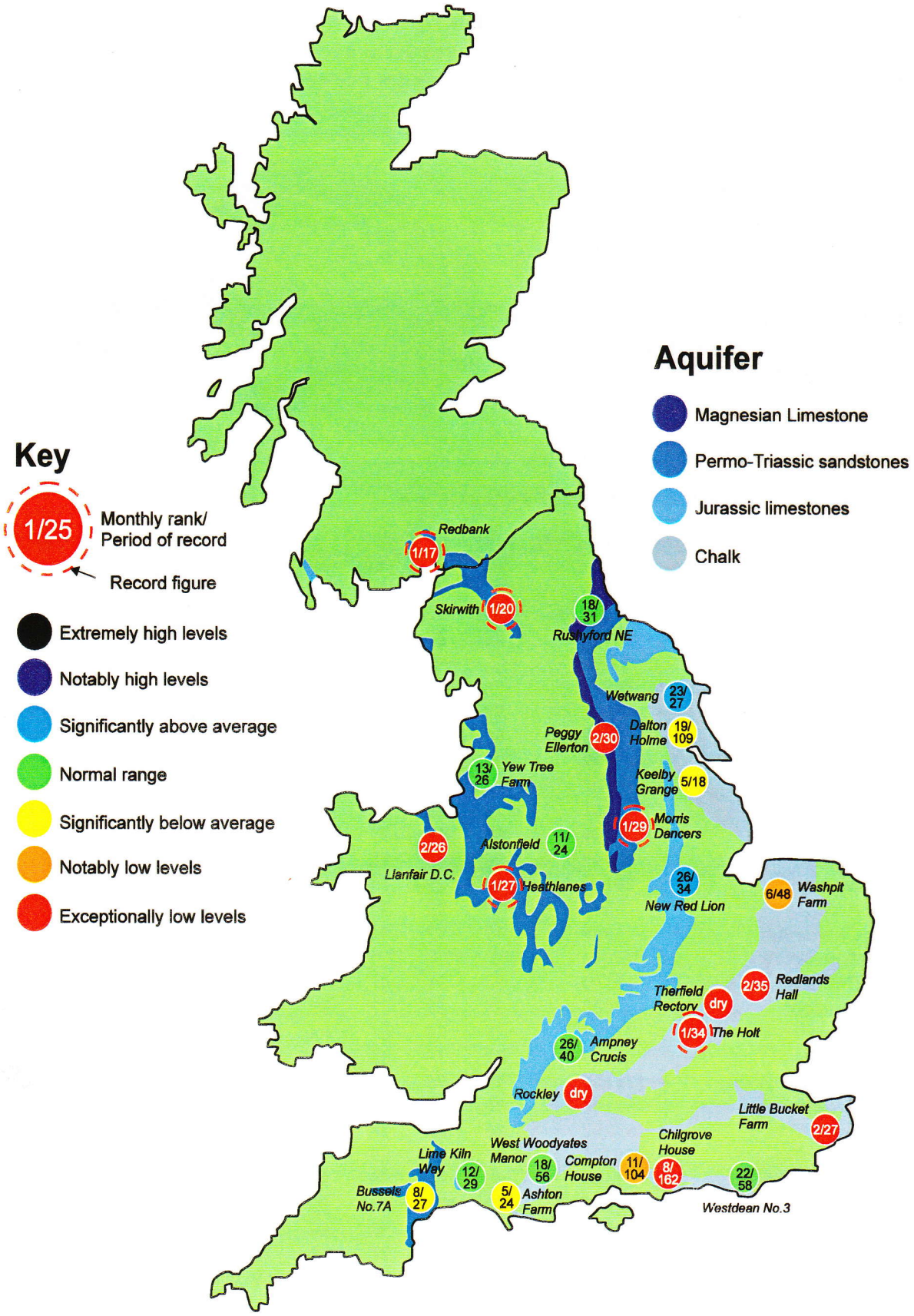
Borehole	Level	Date	Oct av.
Chilgrove	36.03	29/10	42.43
W Woodyates	70.91	31/10	75.29
New Red Lion	13.25	20/10	11.38
Ampney Crucis	100.6	27/10	100.4
Skirwith	129.4	28/10	129.9

Borehole	Level	Date	Oct av.
Llanfair DC	78.70	03/11	79.50
Morris Dancers	31.79	20/10	32.48
Heathlanes	60.36	06/10	61.89
Bussels	23.35	23/10	23.49
Alstonfield	175.7	17/10	180.0

**Data from new Rockley borehole*

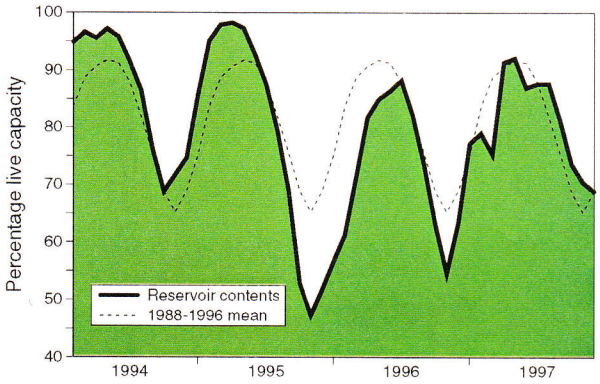
Levels in metres above Ordnance Datum

Groundwater . . . Groundwater

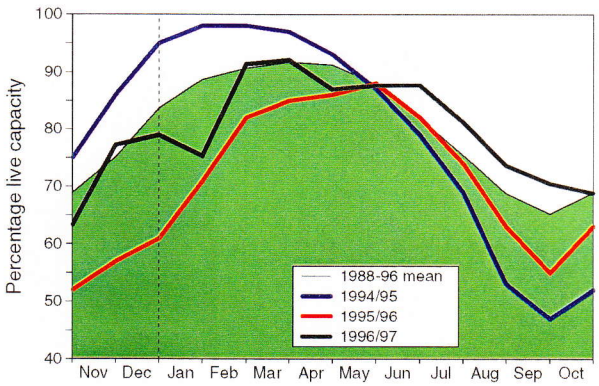


Groundwater levels - October 1997

Guide to the variation in overall reservoir stocks for England and Wales



Comparison between overall reservoir stocks for England and Wales in recent years



These plots are based on the England and Wales figures listed below.

Percentage live capacity of selected reservoirs

Area	Reservoir	Capacity (Ml)	1997 Jun	Jul	Aug	Sep	Oct	**Nov**	Min. Nov	Year* of min
North West	N Command Zone	• 133375	88	78	66	53	60	53	38	1993
	Vyrnwy	55146	87	90	75	65	61	59	25	1995
Northumbrian	Teesdale	• 87936	85	87	84	74	73	65	33	1995
	Kielder	(199175)	(92)	(94)	(94)	(85)	(82)	(82)	(63)	1989
Severn Trent	Clywedog	44922	98	98	91	80	82	81	38	1995
	Derwent Valley	• 39525	98	100	90	80	72	73	15	1995
Yorkshire	Washburn	• 22035	89	99	87	77	72	60	15	1995
	Bradford supply	• 41407	95	96	87	76	76	72	16	1995
Anglian	Grafham	58707	72	70	66	59	46	44	44	**1997**
	Rutland	130061	75	75	78	76	72	71	59	1995
Thames	London	• 206399	88	88	77	67	53	51	46	1996
	Farmoor	• 13843	98	100	98	99	96	97	53	1990
Southern	Bewl	28170	84	79	74	65	58	56	33	1990
	Ardingly	4685	98	92	93	86	68	68	33	1996
Wessex	Clatworthy	5364	79	97	91	91	85	85	19	1989
	Bristol WW	• (38666)	(88)	(85)	(74)	(72)	(67)	(62)	(24)	1990
South West	Colliford	28540	52	51	47	43	43	44	42	1996
	Roadford	34500	59	58	57	56	56	56	18	1995
	Wimbleball	21320	79	84	81	84	79	80	26	1995
	Stithians	5205	79	76	66	70	70	68	18	1990
Welsh	Celyn and Brenig	• 131155	97	98	93	83	83	82	48	1989
	Brianne	62140	96	99	93	92	94	97	57	1995
	Big Five	• 69762	88	88	74	71	68	69	41	1995
	Elan Valley	• 99106	97	99	89	84	87	92	37	1995
East of Scotland	Edinburgh/Mid	• 97639	94	92	90	71	66	62	62	**1997**
	East Lothian	• 10206	100	100	94	80	71	62	48	1989
West of Scotland	Loch Katrine	• 111363	94	82	68	56	72	76	76	**1997**
	Daer	22412	94	87	74	60	73	70	70	**1997**
	Loch Thom	• 11840	95	77	69	58	69	74	74	**1997**

( ) figures in parentheses relate to gross storage • denotes reservoir groups * last occurrence

Details of the individual reservoirs in each of the groupings listed above are available on request. The featured reservoirs may not be representative of the storage conditions across each area; this can be particularly important during droughts. The minimum storage figures relate to the 1988-1997 period only.

Location map . . . Location map

Where the information comes from

The National Hydrological Monitoring Programme was instigated in 1988 and is undertaken jointly by the Institute of Hydrology (IH) and the British Geological Survey (BGS). Financial support for the production of the monthly Hydrological Summaries is provided by the Department of the Environment, Transport and the Regions, the Environment Agency (EA), the Scottish Environment Protection Agency (SEPA) and the Office of Water Services (OFWAT).

River flow and groundwater levels

The National River Flow Archive (maintained by IH) and the National Groundwater Level Archive (maintained by BGS) provide the historical perspective within which to examine contemporary hydrological conditions.

River flow and groundwater level data are provided by the regional divisions of the EA (England and Wales) and SEPA (Scotland). In all cases the data are subject to revision following validation (flood and drought data in particular may be subject to significant revision).

Reservoirs

Reservoir level information is provided by the Water Service Companies, the EA and, in Scotland, the West of Scotland and East of Scotland Water Authorities.

Rainfall

Most rainfall data are provided by the Met Office. To allow better spatial differentiation the rainfall data are presented for the regional divisions of the precursor organisations of the EA and SEPA. The recent rainfall estimates for the Scottish regions are derived by IH in collaboration with the SEPA regions. In England and Wales the recent rainfall figures derive from MORECS. MORECS is the generic name for the Meteorological Office services involving the routine calculation of evaporation and soil moisture throughout Great Britain. The provisional regional rainfall figures are regularly updated using figures derived from a much denser rainguage network. Further details of Met. Office services can be obtained from:

The Meteorological Office
Sutton House
London Road
Bracknell
RG12 2SY.
Tel. 01344 856858; 01344 854024.

The cooperation of all data suppliers is gratefully acknowledged.

Subscription

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