Hydrological summary for Great Britain

May 1999

General

May was a relatively warm but unsettled month characterised by large regional and local variations in rainfall totals. Nonetheless, stocks in all index reservoir groups (for E&W) exceeded 90% of capacity and overall stocks are exceptionally healthy for the early summer. May river flows were mostly well within the normal range but significantly below average in many impervious south-eastern catchments. Levels in most major aquifers are above, or close to, the seasonal average – however groundwater resources remain relatively low in parts of the eastern Chalk (and in a few sandstone outcrops).

Rainfall

May set the seal on a very unsettled spring with very variable weather conditions throughout Britain Intense – but mostly very localised - storms caused substantial transport disruption, damage to crops and triggered flash flooding on a number of occasions. Notable downpours included: 26.3 mm at Crowthorne in 1.3 hours on the 19th (when hail damage in Hampshire and the Isle of Wight was significant) and 34 mm in an hour at Chipping Norton (estimated return period: 35-40 years) on the 29th. But the well publicised thunderstorms provided a misleading perspective on regional rainfall totals, in southern England especially where there were several dry spells e.g. early in the month and the 22-29th. The very limited spatial coherence in the rainfall totals implies that the provisional May rainfall totals should be treated with caution but catchment totals were below average in many lowland areas – notably so in parts of Essex and Hampshire where totals fell below 40% of the mean. By contrast, large parts of northern Britain were wetter than average, May totals exceeding 200% in a few localities (e.g. Hermitage in the Southern Uplands). The NW/SE contrast is even more evident over the spring period as a whole. In some south-eastern catchments, relatively dry conditions can be traced back to the late winter; provisional data indicate that the Roding catchment (Essex) registered its third driest Feb-May period in at least 50 years; the very unsettled beginning to June was particularly welcome in such areas. In the 12-month (June-May) timeframe regional rainfall totals are healthy throughout Britain.

River flows

Generally the uneven flow recessions which were a feature of the early spring continued through May but were interrupted by spates (mostly minor and short-lived) - particularly around month end when surface runoff increased flows in many lowland catchments. Where thunderstorms coincided with urban areas, the ensuing rapid runoff triggered local flooding (e.g. in Bristol on the 29th). Monthly runoff totals exceeded the average in most northern and many western catchments but, in the English lowlands, mean flows for May were generally below average. Particularly low runoff totals characterised some impermeable catchments which missed the main thunderstorms – the River Wallington (Hants), for example, registered its fourth lowest May runoff in a series from 1951. By month-end, flows were also relatively depressed in number of East Anglian rivers (e.g. the Wensum and Colne). Reflecting the rainfall patterns, spring runoff totals were above average throughout most of western and northern Britain but below average in much of the South East - notably so in some impervious catchments where modest flows have been a feature since January – the Sussex Ouse registered its second lowest Feb-May runoff total since 1976. In the 12-month timeframe runoff totals are generally healthy, and unprecedented in a few catchments (e.g. the Cynon). The outlook for the summer is generally good but a combination of low baseflows and low surface runoff in a dry summer could produce depressed flows in a number of (mostly) eastern streams.

Groundwater

Thundery activity made for very large local variations in soil moisture deficits during May but soils were significantly drier than normal entering the summer in most of the English lowlands In the eastern Thames basin little significant recharge has occurred since February – confirmed by the levels in the deep Therfield well which are once more in decline. In some more westerly aquifers - e.g. the Jurassic Limestone - significant infiltration in May extended the recharge season and, as happened in the early summer of 1997 and 1998, isolated recharge was reported for a few Chalk outcrops (mostly where thunderstorms coincided with a thin soil cover). However, hydrographs for the index boreholes in the Chalk confirms that recessions are now well established with late spring levels mostly well within the normal range. Healthy to very healthy levels characterise most major limestone aquifer outcrops with particularly high levels in the Magnesian Limestone. Groundwater status in the Permo-Triassic sandstones shows only limited regional coherence, very healthy levels in the majority of the more westerly outcrops contrasting with depressed (but rising) levels in some eastern areas (e.g. at Morris Dancers in the Sherwood Sandstones).

Institute of Hydrology

British Geological Survey

Rainfall . . . Rainfall . . . Rainfall. .

Rainfall accumulations and return period estimates

Area	Rainfall	May 1999	Mar 99-May 99	RP	Jan 99-May 99	RP	Oct 98-May 99	RP	Jun 98-May 99	RP
England & Wales	**mm**	**53**	**188**		**355**		**664**		**982**	
	%	**82**	**96**	**2-5**	**102**	**2-5**	**108**	**2-5**	**110**	**2-5**
North West	mm	89	263		514		951		1385	
	%	118	109	2-5	117	2-5	117	5-10	115	5-10
Northumbrian	mm	89	241		391		675		1039	
	%	144	128	5-10	118	5-10	118	5-10	122	10-20
Severn Trent	mm	60	200		364		636		922	
	%	102	114	2-5	122	5-10	124	10-15	122	10-20
Yorkshire	mm	63	240		375		651		936	
	%	106	129	5-10	116	2-5	116	5-10	114	5-10
Anglian	mm	37	139		237		456		694	
	%	76	98	2-5	104	2-5	116	5-10	116	5-10
Thames	mm	49	143		265		523		784	
	%	88	88	2-5	98	2-5	112	2-5	114	5-10
Southern	mm	34	139		271		576		841	
	%	62	82	2-5	89	2-5	105	2-5	108	2-5
Wessex	mm	51	187		350		667		972	
	%	84	102	2-5	104	2-5	113	2-5	116	5-10
South West	mm	59	253		477		952		1344	
	%	82	105	2-5	100	<2	111	2-5	114	5-10
Welsh	mm	80	287		596		1097		1568	
	%	97	107	2-5	117	2-5	117	5-10	119	10-15
Scotland	**mm**	**110**	**335**		**695**		**1272**		**1747**	
	%	**128**	**117**	**2-5**	**129**	**20-30**	**127**	**35-50**	**122**	**30-50**
Highland	mm	124	414		913		1589		2078	
	%	135	120	5-10	138	40-60	126	20-35	118	10-20
North East	mm	66	208		374		710		1104	
	%	96	100	<2	101	2-5	108	2-5	113	5-10
Tay	mm	121	304		620		1130		1559	
	%	146	119	2-5	126	5-15	130	20-35	127	30-45
Forth	mm	102	250		484		994		1453	
	%	137	110	2-5	114	2-5	131	30-45	131	80-120
Tweed	mm	93	230		428		791		1137	
	%	130	111	2-5	114	2-5	121	5-15	117	5-15
Solway	mm	123	358		680		1302		1860	
	%	145	128	5-10	127	10-15	132	30-45	131	70-100
Clyde	mm	114	373		786		1480		2027	
	%	125	116	2-5	125	10-15	125	20-30	120	10-20

RP = Return period

The monthly rainfall figures* are copyright of the Met. Office and may not be passed on to any unauthorised person or organisation. **All monthly totals since July 1998 are provisional (see page 12).** 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. *See page 12.

Rainfall . . . Rainfall . . . Rainfall

Key

00% Percentage of 1961-90 average

Very wet

Substantially above average

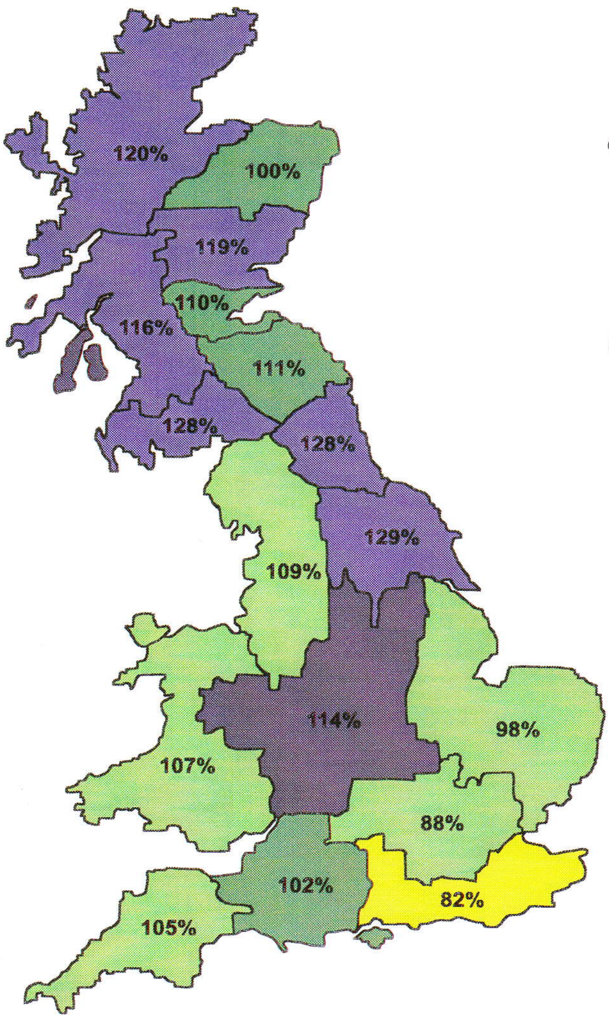
Above average

Normal range

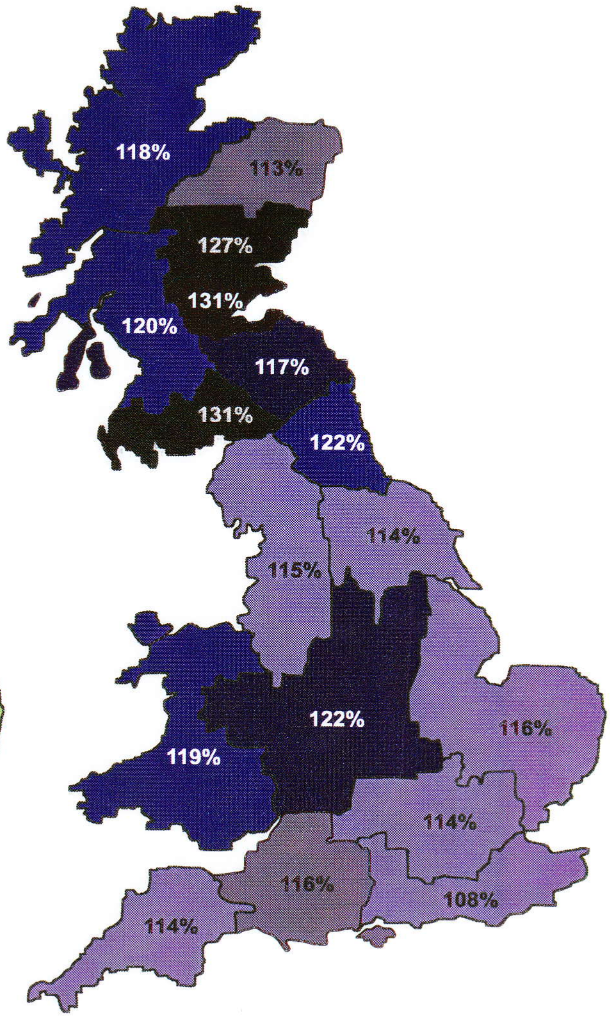
Below average

Substantially below average

Exceptionally low rainfall



March 1999 - May 1999



June 1998 - May 1999

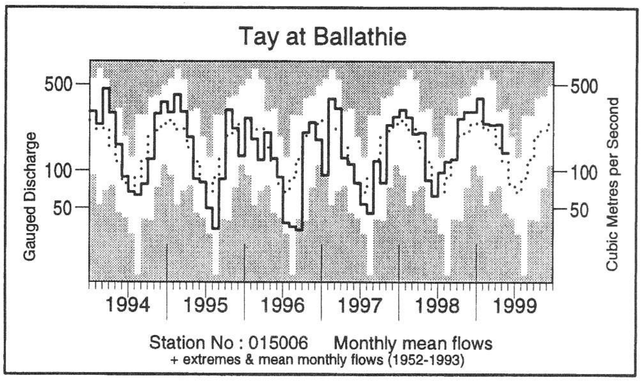
Rainfall accumulation maps

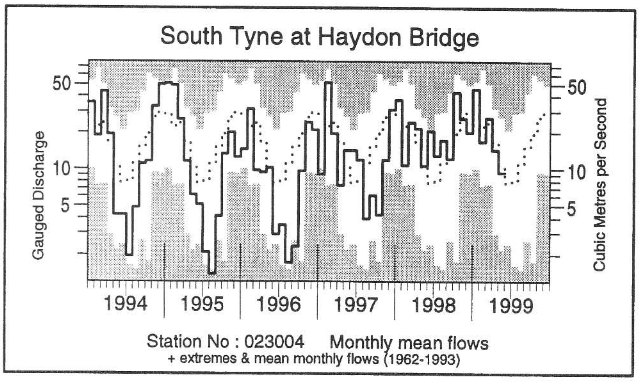
The well above average spring rainfall for Scotland adds to a notable cluster of wet March-May periods but the recent wetness of northern Britain is even more evident in the 12-month timeframe. The provisional June 1998-May 1999 total for Scotland ranks amongst the six highest on record (all of which have been registered since 1980). Regional rainfall totals over the last year are also healthy throughout England and Wales but the spring has been distinctly dry in some parts of the English Lowlands.

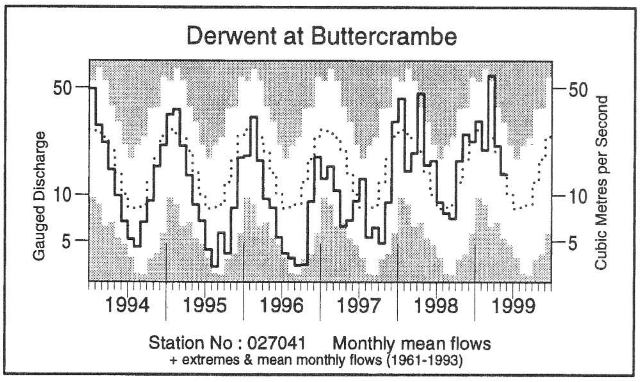
River flow . . . River flow . . .

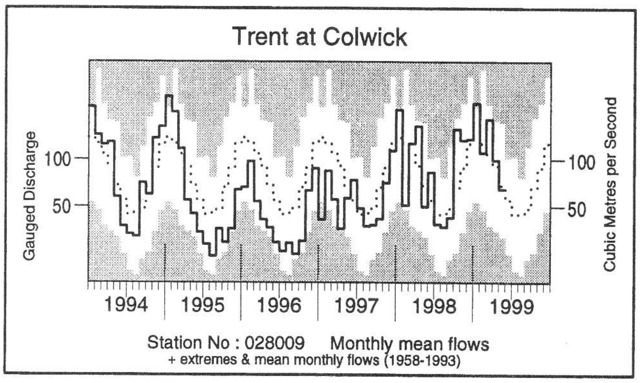
River flows - May 1999

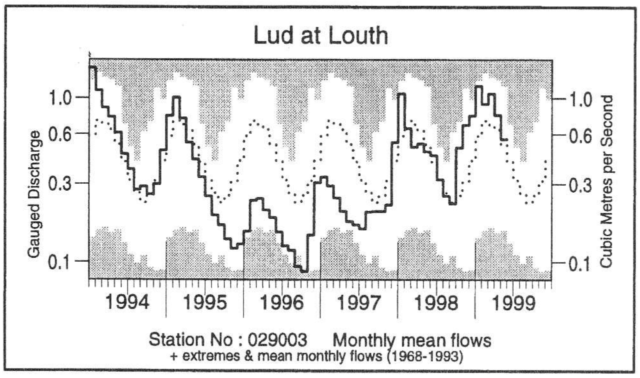
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

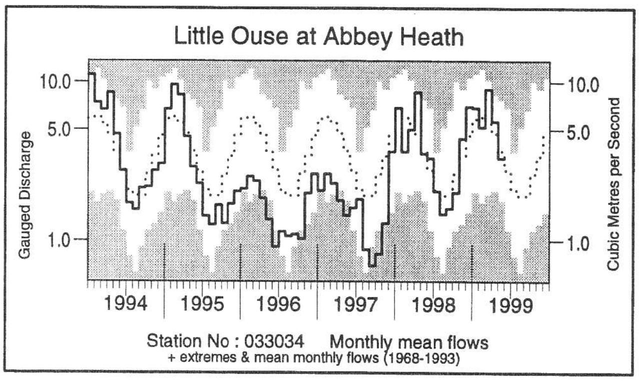


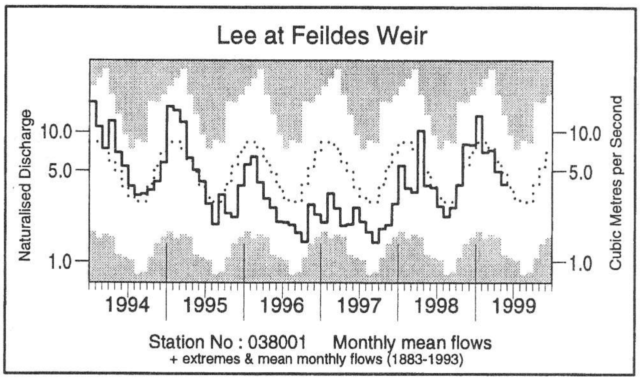


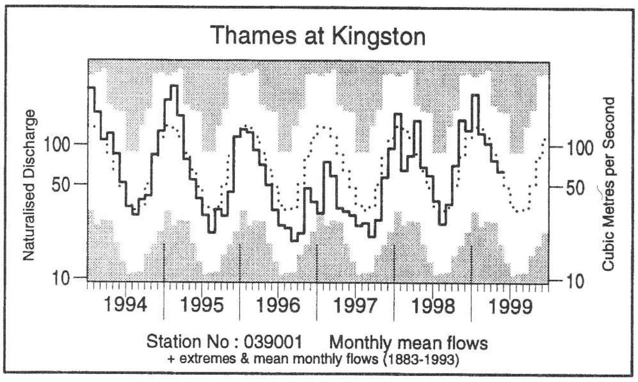








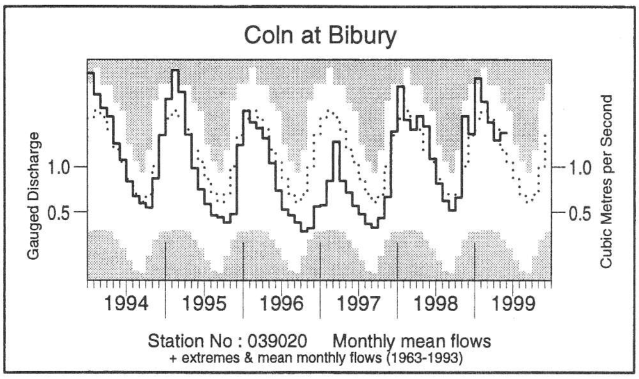


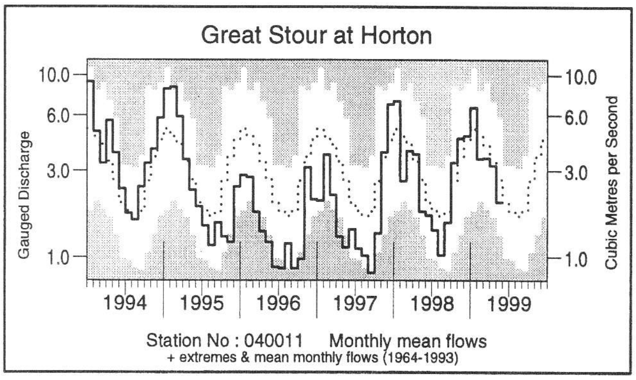


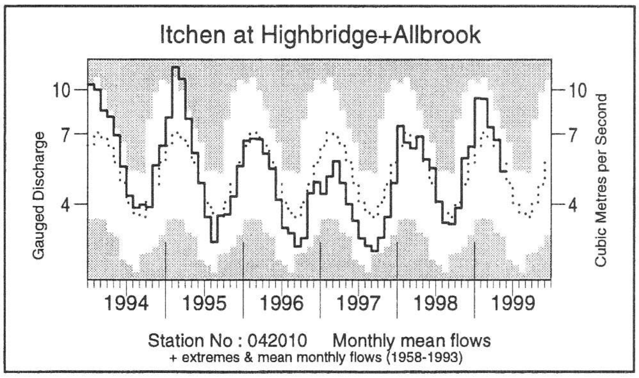
Monthly river flow hydrographs

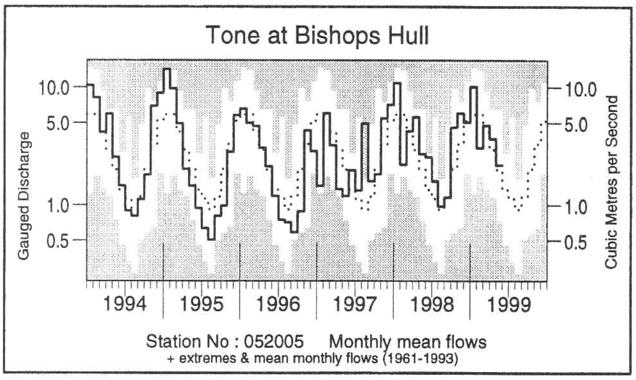
The river flow hydrographs show the monthly mean flow (bold trace), the long term average monthly flow (dotted trace) and the maximum and minimum flow prior to 1994 (shown by the shaded areas). Monthly flows falling outside the maximum/ minimum range are indicated where the bold trace enters the shaded areas.

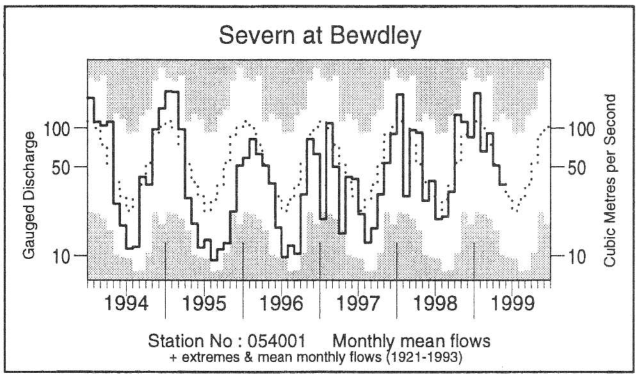
River flow . . . River flow . . .

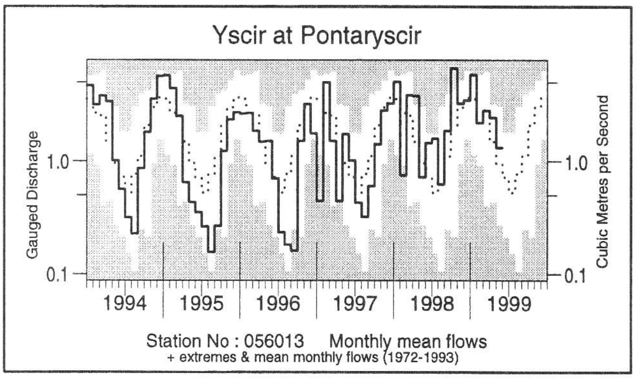


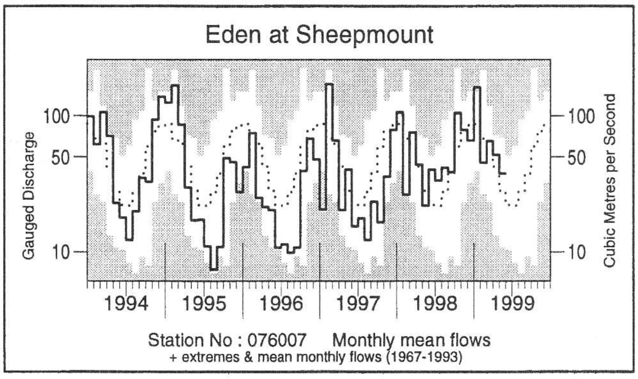


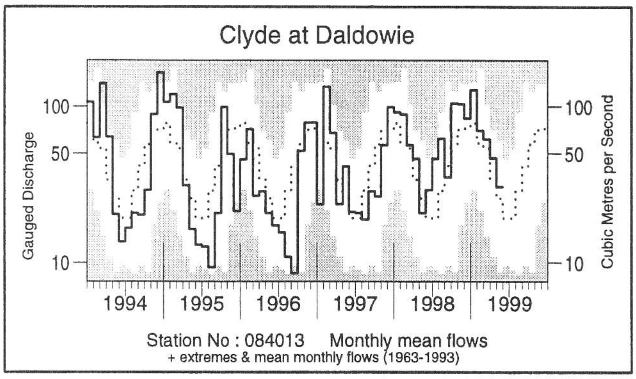










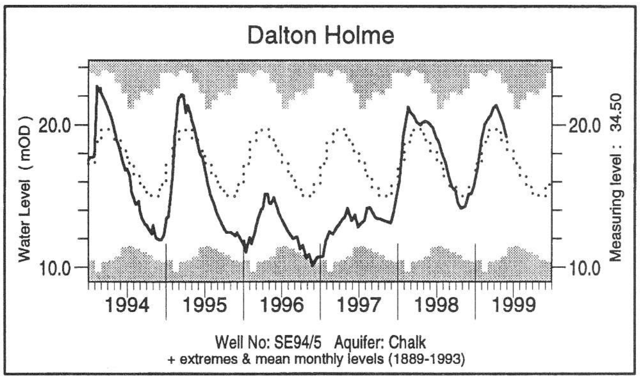


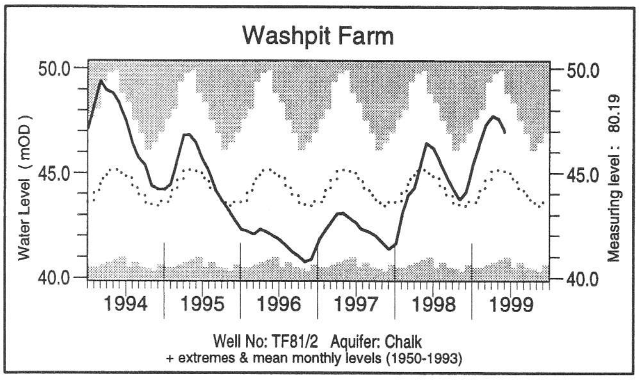
Notable runoff accumulations June 1998 - May 1999 (a); March 1999 - May 1999 (b)

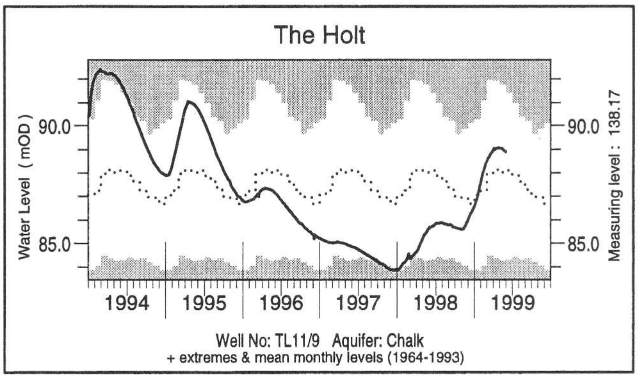
(a) River	%lta	Rank	(b) River	%lta	Rank	River	%lta	Rank
Tweed	128	37/38	Leven	201	38/40	Wallington	51	7/47
Witham	168	37/40	Derwent	169	36/38	Lymington	78	11/39
Exe	135	41/43	Trent	131	36/41	Avon	90	8/35
Cynon	137	39/39	Witham	169	37/40	Stour	80	8/27
Lune	130	35/37	Medway	63	7/38	Exe	128	36/43
Clyde	140	35/35	Ouse	57	5/39			

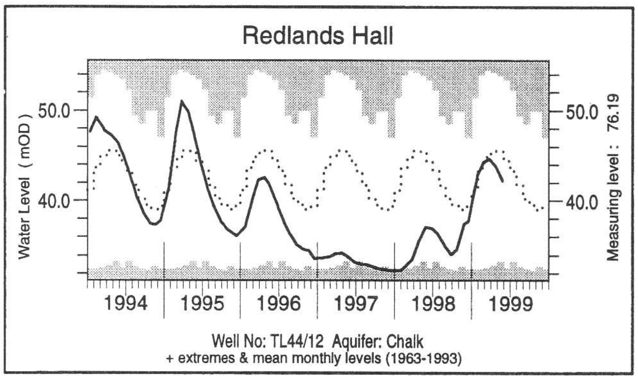
lta = long term average
Rank 1 = lowest on record

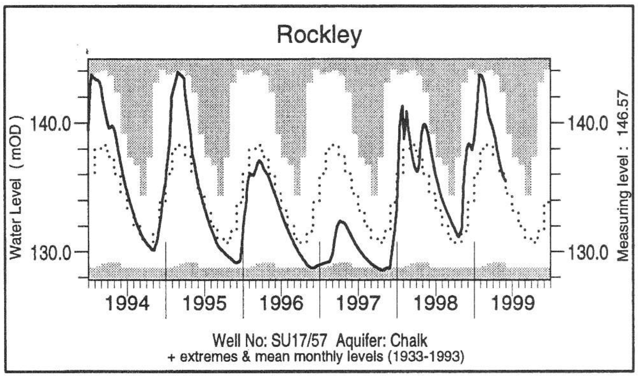
Groundwater . . . Groundwater

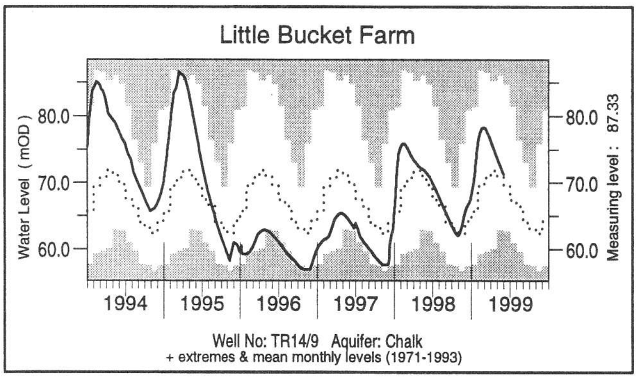


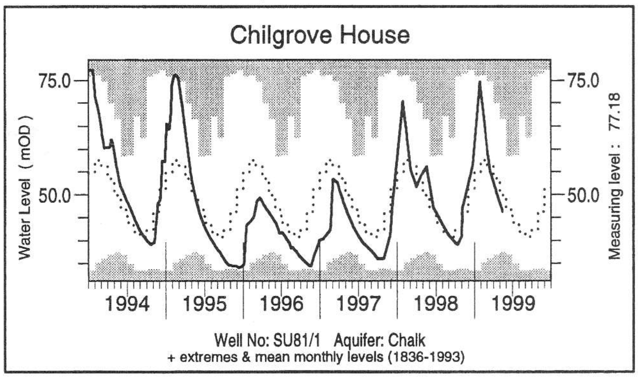


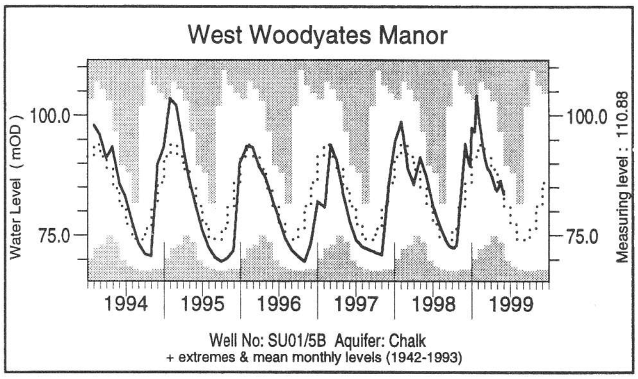








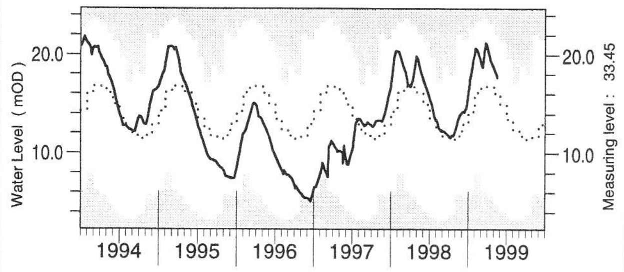




What is groundwater?

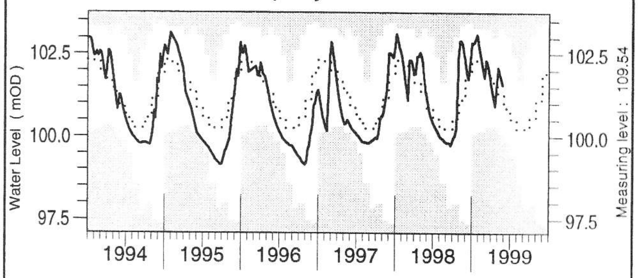
Groundwater is stored in the natural water bearing rock strata (or aquifers) which are found mostly in southern and eastern England (see page 11) where groundwater is the major water supply source. Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment 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.

New Red Lion



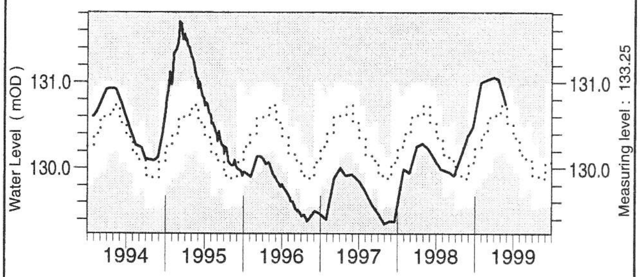
Well No: TF03/37 Aquifer: Lincolnshire Limestone
+ extremes & mean monthly levels (1964-1993)

Ampney Crucis



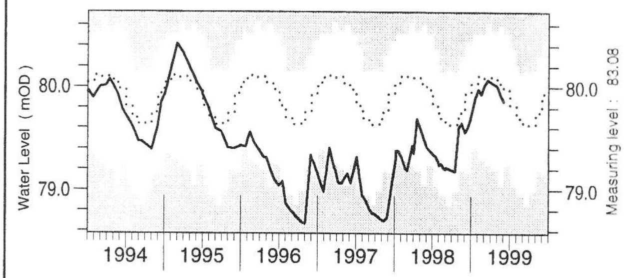
Well No: SP00/62 Aquifer: Middle Jurassic
+ extremes & mean monthly levels (1958-1993)

Skirwith



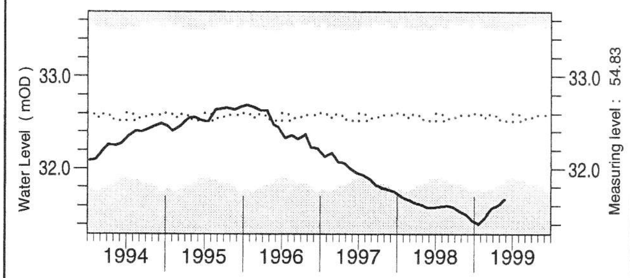
Well No: NY63/2 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1978-1993)

Llanfair DC



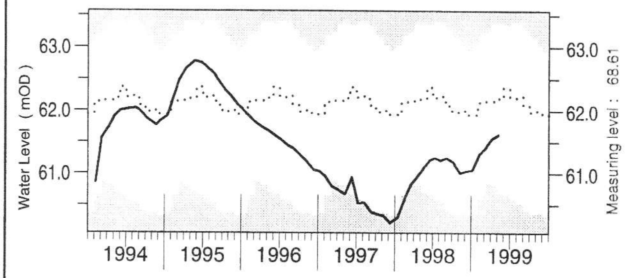
Well No: SJ15/15 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1972-1993)

Morris Dancers



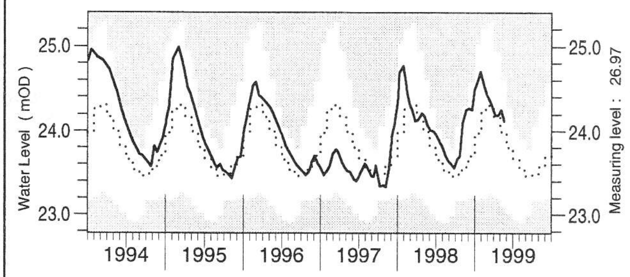
Well No: SK67/17 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1969-1993)

Heathlanes



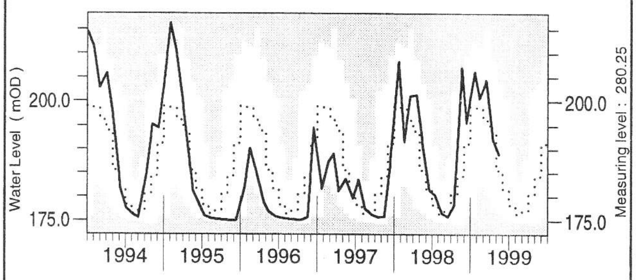
Well No: SJ62/112 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1971-1993)

Bussels No.7a



Well No: SX99/37B Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1971-1993)

Alstonfield

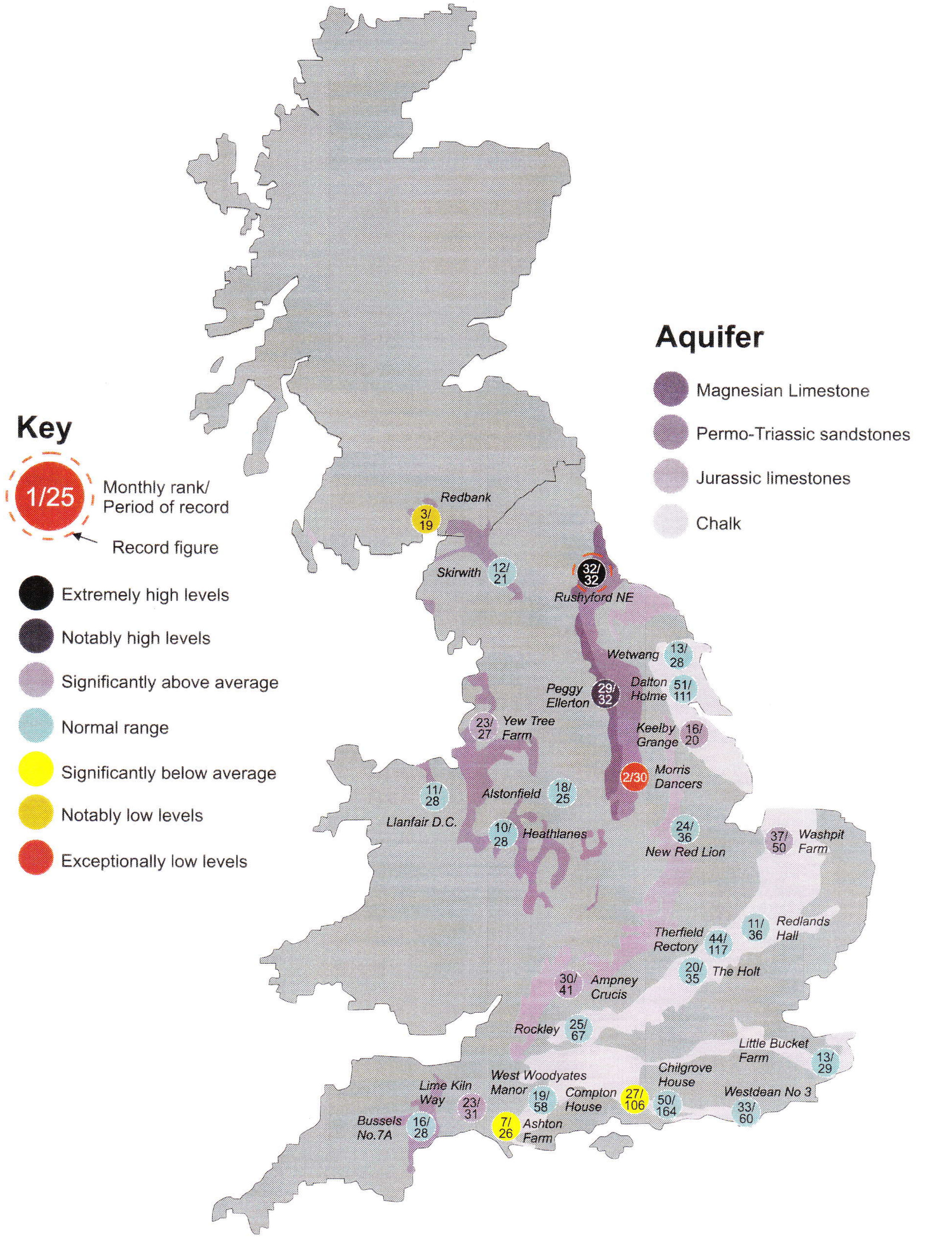


Well No: SK15/16 Aquifer: Carboniferous Limestone
+ extremes & mean monthly levels (1974-1993)

Groundwater levels May/June 1999

Borehole	Level	Date	May av.	Borehole	Level	Date	May av.	Borehole	Level	Date	May av.
Dalton Holme	19.14	28/05	18.92	Chilgrove	46.31	14/05	48.88	Llanfair DC	79.86	01/06	79.89
Washpit Farm	46.97	02/06	45.27	W Woodyates	83.61	31/05	84.35	Morris Dancers	31.67	25/05	32.46
The Holt	88.89	01/06	88.24	New Red Lion	17.70	18/05	15.80	Heathlanes	61.62	06/05	62.12
Redlands Hall	42.23	25/05	44.65	Ampney Crucis	101.58	24/05	101.22	Bussels	24.12	20/05	23.98
Ashton Farm	67.98	31/05	68.52	Skirwith	130.75	25/05	130.59	Alstonfield	188.87	14/05	185.86
Little Bucket	71.23	01/06	72.02								

Levels in metres above Ordnance Datum

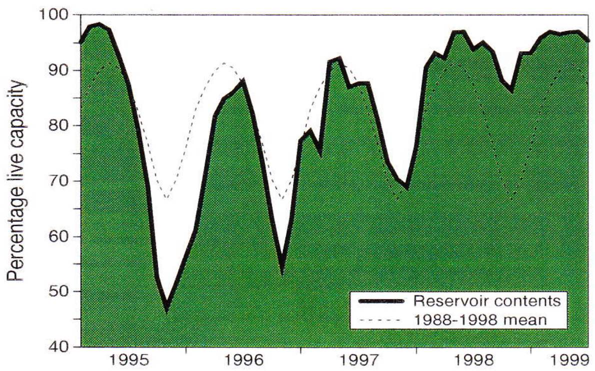


Groundwater levels - May 1999

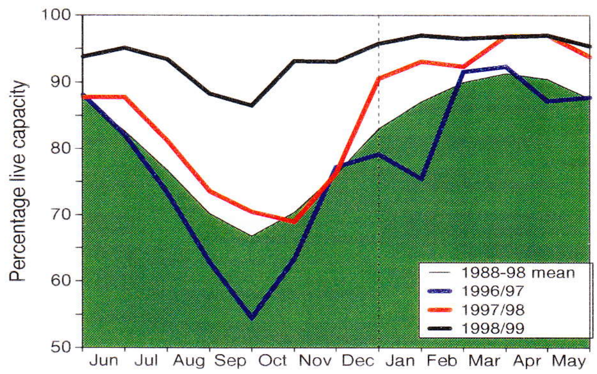
The rankings are based on a comparison of current levels (usually a single reading in a month) with the average level in each corresponding month on record. They need to be interpreted with caution especially when groundwater levels are changing rapidly or when comparing wells with very different periods of record.

Reservoirs . . . Reservoirs . .

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)	1999 Jan	Feb	Mar	Apr	May	Jun	Min. Jun	Year* of min
North West	N Command Zone	• 133375	98	96	93	93	96	94	72	1991
	Vyrnwy	55146	100	99	100	97	98	96	72	1990
Northumbrian	Teesdale	• 87936	98	99	97	98	95	94	64	1991
	Kielder	(199175)	(94)	(97)	(95)	(95)	(95)	(95)	(85)	1989
Severn Trent	Clywedog	44922	85	91	93	94	99	99	83	1989
	Derwent Valley	• 39525	100	100	100	100	100	95	56	1996
Yorkshire	Washburn	• 22035	99	99	98	96	98	96	72	1990
	Bradford supply	• 41407	98	98	96	96	98	94	70	1996
Anglian	Grafham	(55490)	(90)	(91)	(93)	(98)	(98)	(96)	(72)	1997
	Rutland	(116580)	(91)	(95)	(95)	(97)	(96)	(92)	(75)	1997
Thames	London	• 206399	94	94	94	98	95	93	83	1990
	Farmoor	• 13843	90	85	98	98	95	96	96	1999
Southern	Bewl	28170	92	99	100	99	98	92	57	1990
	Ardingly	4685	100	100	100	100	100	99	96	1990
Wessex	Clatworthy	5364	100	100	97	97	99	98	67	1990
	Bristol WW	• (38666)	(98)	(97)	(98)	(98)	(97)	(91)	(70)	1990
South West	Colliford	28540	98	100	100	100	100	100	52	1997
	Roadford	34500	100	98	94	95	96	93	48	1996
	Wimbleball	21320	100	100	100	99	100	100	76	1992
	Stithians	5205	100	100	99	99	99	98	66	1990
Welsh	Celyn and Brenig	• 131155	98	100	100	100	100	100	82	1996
	Brianne	62140	100	99	99	97	99	100	85	1995
	Big Five	• 69762	94	99	99	95	97	96	70	1990
	Elan Valley	99106	100	100	100	97	99	98	85	1990
East of Scotland	Edinburgh/Mid Lothian	• 97639	60	72	73	76	81	82	52	1998
	East Lothian	• 10206	99	100	99	99	99	97	84	1990
West of Scotland	Loch Katrine	• 111363	90	90	93	95	93	95	85	1995
	Daer	22412	100	99	100	100	97	100	70	1994
	Loch Thom	• 11840	100	100	100	100	97	93	83	1994

() figures in parentheses relate to gross storage

* last occurence

• denotes reservoir groups

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 1988-1999 period only. In some gravity-fed reservoirs (e.g. Clywedog) stocks are kept below capacity during the winter to provide scope for flood attenuation purposes.

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 (but the figures for England and Wales are derived independently and may not equate to a combination of the MORECS figures). 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 discontinuation of the CARP system used by the Met. Office to provide more definitive regional rainfall assessments means that the recent MORECS figures have not been updated. Negotiations are continuing with the Met. Office to provide more accurate areal figures. Until the negotiations are concluded the regional rainfall figures (and the return periods associated with them) should be regarded as a guide only.

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Institute of Terrestrial Ecology
Institute of Virology & Environmental Microbiology
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Selected text and maps are available on the WWW at http://www.nwl.ac.uk/ih

Hydrological Summary for May 1999 - *Errata*

A printing problem has resulting in an unconventional rendering of the colour for the maps on pages 3-4 and 9-10. The percentages and ranking figures are correct but the presentation has been degraded. Please accept my apologies for this lapse in production standards; the technical problem is being addressed.

Terry Marsh

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