Hydrological Summary
for the United Kingdom

December 2004

General

December was a generally mild and, in most regions, a relatively dry month. A notably dry spell which began in mid November stretched beyond four weeks in much of southern and eastern Britain – contributing to the second (provisionally) driest November/December since 1953 for England and Wales; rainfall was especially meagre in parts of eastern England. Notwithstanding limited December replenishment, overall reservoir stocks for England and Wales were approximately 4% above average entering 2005 – but stocks in most reservoirs across southern England were appreciably below average, albeit well above drought minima. In Scotland, most reservoirs were at, or close to, capacity. December catchment runoff totals and groundwater levels were mostly below average but well within the normal range. The water resources outlook is generally healthy but the limited late autumn and early winter rainfall has been insufficient to generate a groundwater recovery in much of the eastern and southern Chalk; groundwater levels will require careful monitoring over the next three months.

Rainfall

December began with high pressure, which dominated the latter half of November, still acting as the most influential synoptic feature. The associated very dry spell extended to 25-30 days in much of eastern Britain. A vigorous frontal system on the 14th proved pivotal – bringing significant rainfall to much of Britain (a 75mm daily total was reported from Lussa, Kintyre) and heralding a sequence of deep Atlantic depressions; importantly, however, most followed tracks relatively remote from southern England. A cold snap was associated with significant snowfall (as far south as Dorset) around Christmas. December rainfall totals reflected the dominant synoptic patterns – with rain-shadow effects particularly influential in the east. In parts of the Scottish Highlands, totals approached 200%, some western catchments in Wales and Northern Ireland were also notably wet. By contrast, much of eastern Britain reported less than half the average rainfall with December totals of <30% in parts of the Midlands. More significantly, the regional rainfall deficiencies for the Nov/Dec period were very substantial across much of the UK, and especially notable in a zone from Kent to Northumbria; in the south these deficiencies continued to build well into January. 2004 was a notably wet year for Scotland as a whole whilst rainfall totals for Northern Ireland and England & Wales were near average. Although most regions of England reported above average rainfall, its distribution through the year was unfavourable in relation to the resources outlook.

River Flow

Unusually steep recessions characterised the first half of December, resulting in flows in a number of index rivers (including the Taw, Great Stour and Faughan) approaching their mid-December minima. Thereafter, a spatially uneven recovery gained momentum. By year-end, flows were generally within the normal range (in much of northern Britain this recovery heralded exceptionally high flows in early January). The recoveries were sufficient to produce above average December flows in a few, mostly north-western, catchments but, generally, runoff totals were appreciably below average – typically in the 40-80% range across England. Flows were particularly depressed in some sheltered eastern catchments – the Whiteadder and Soar reported their second lowest December runoff in the last 30 years. Runoff deficiencies for the Nov/Dec period were also substantial in many responsive catchments across southern England. Flows in many rivers draining permeable catchments remained more than usually stable over the latter half of 2004, confirming the limited groundwater recharge (see below). In contrast to the regional rainfall figures, catchment runoff totals for 2004 as a whole are mostly below average (notably so for the Medway) reflecting, in large part, the notably high actual evaporation losses – across the English Lowlands especially.

Groundwater

Despite the low rainfall across most aquifer outcrop areas, residual soil moisture deficits were sensibly eliminated in all but a few parts of eastern England by early January. However, infiltration totals for December were well below average, declining to less than 20% in much of the eastern Chalk. As a consequence, the 2004 groundwater level recessions for the eastern Chalk have extended into the new year, and levels in parts of the Chalk (e.g. Stonor, Redlands) are at their lowest since 1998 and levels in most index wells are significantly below average for the late winter. However, the residual benefit of abundant recharge, to the Chalk, over previous winters can still be identified – thus levels remain substantially above winter drought minima (e.g. those for 1991, 1992 and 1997). Groundwater levels in the limestone aquifers have generally declined from their very healthy early autumn levels but remain in the normal end-of-year range. This is true of levels in most Permo-Triassic sandstones outcrops also although levels in many index wells begin 2005 at their lowest January level for around seven years. Overall groundwater resources for England and Wales remain close to average but the barely discernible seasonal recovery in the eastern (and parts of the southern) Chalk implies a need for substantial late winter and spring recharge to avoid depressed groundwater levels in the summer.

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Rainfall . . . Rainfall . . .

Rainfall accumulations and return period estimates

Area	Rainfall	Dec 2004	Nov 04-Dec 04	RP	Sep 04-Dec 04	RP	Apr 04-Dec 04	RP	Jan 04-Dec 04	RP
England & Wales	**mm**	**60**	**108**		**313**		**742**		**965**	
	%	**63**	**58**	**10-20**	**89**	**2-5**	**109**	**2-5**	**106**	**2-5**
North West	mm	**114**	190		486		1030		1358	
	%	**91**	76	2-5	98	2-5	112	2-5	112	5-10
Northumbrian	mm	**51**	83		283		731		975	
	%	**63**	49	20-30	88	2-5	112	2-5	113	5-10
Severn Trent	mm	**38**	83		255		637		814	
	%	**48**	55	5-15	91	2-5	110	2-5	106	2-5
Yorkshire	mm	**38**	76		249		696		914	
	%	**47**	46	20-30	81	2-5	111	2-5	109	2-5
Anglian	mm	**27**	70		194		561		712	
	%	**49**	62	5-10	90	2-5	120	5-10	118	5-15
Thames	mm	**47**	89		235		567		729	
	%	**66**	65	5-10	90	2-5	107	2-5	104	2-5
Southern	mm	**64**	99		260		573		755	
	%	**78**	59	5-10	82	2-5	98	2-5	96	2-5
Wessex	mm	**70**	109		302		629		846	
	%	**74**	60	5-10	90	2-5	100	<2	99	2-5
South West	mm	**112**	172		426		851		1189	
	%	**80**	64	5-10	89	2-5	100	<2	100	<2
Welsh	mm	**140**	234		593		1047		1432	
	%	**90**	78	2-5	107	2-5	106	2-5	106	2-5
Scotland	**mm**	**192**	**311**		**687**		**1265**		**1680**	
	%	**123**	**99**	**2-5**	**111**	**2-5**	**117**	**10-20**	**114**	**5-15**
Highland	mm	**292**	473		939		1556		2104	
	%	**151**	121	2-5	125	5-15	122	15-25	121	25-40
North East	mm	**79**	153		399		896		1158	
	%	**81**	76	2-5	101	2-5	116	5-10	112	5-10
Tay	mm	**118**	186		533		1142		1429	
	%	**88**	71	5-10	103	2-5	123	10-20	111	2-5
Forth	mm	**109**	167		471		995		1266	
	%	**96**	72	5-10	102	2-5	117	5-15	111	5-10
Tweed	mm	**65**	104		365		863		1134	
	%	**67**	54	10-20	95	2-5	115	5-10	113	5-10
Solway	mm	**157**	243		616		1183		1578	
	%	**105**	82	2-5	103	2-5	111	2-5	110	2-5
Clyde	mm	**241**	372		805		1483		1968	
	%	**130**	101	2-5	107	2-5	115	5-10	112	5-10
Northern Ireland	**mm**	**94**	**154**		**394**		**801**		**1072**	
	%	**86**	**71**	**5-10**	**91**	**2-5**	**99**	**2-5**	**98**	**2-5**

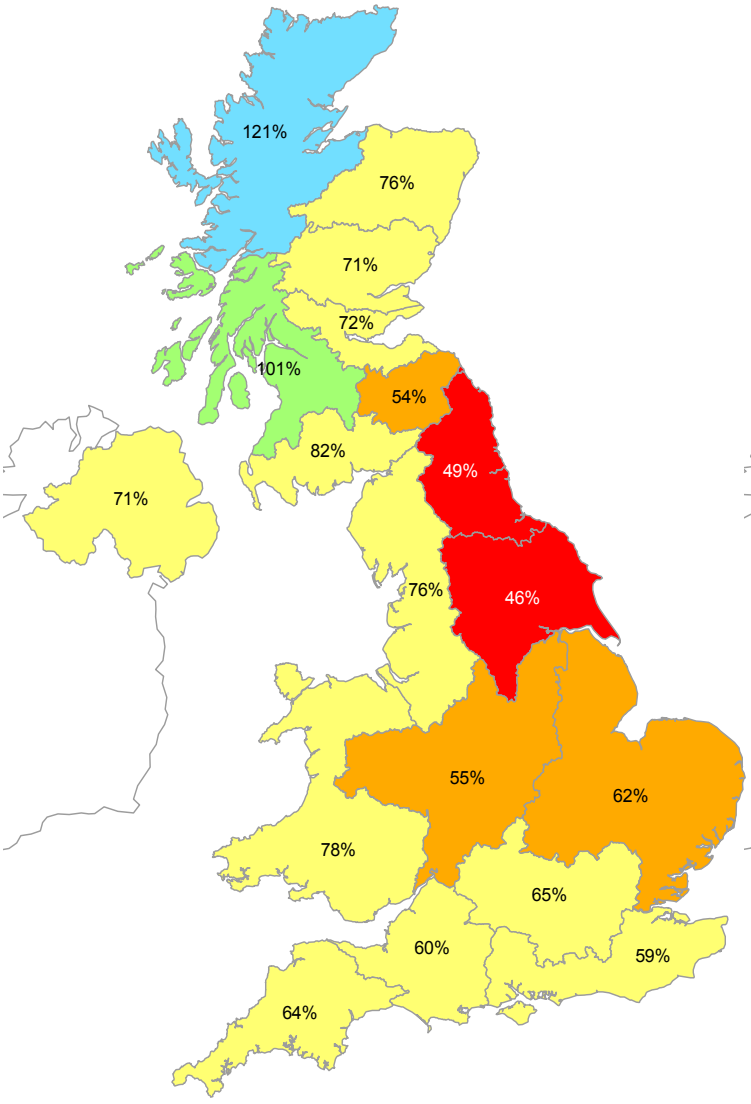
% = percentage of 1961-90 average *RP = Return period*

The monthly rainfall figures* provided by the Met Office are Crown Copyright and may not be passed on to, or published by, any unauthorised person or organisation. **All monthly totals since July 2004 are provisional (see page 12).** Revised Met Office totals for 1961-2003 have been recently incorporated. The figures for England & Wales are derived by the Hadley Centre and are updates of the homogenised series developed by the Climate Research Unit; the other national figures are derived from different raingauge networks to those used to derive the CRU data series. The return period estimates are based on tables provided by the Met 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); RP estimates for Northern Ireland are based on the tables for north-west England. The tables reflect rainfall over the period 1911-70 and assume a stable climate. Artifacts, in the Scottish rainfall series in particular, can exaggerate the relative wetness of the recent past. *See page 12.

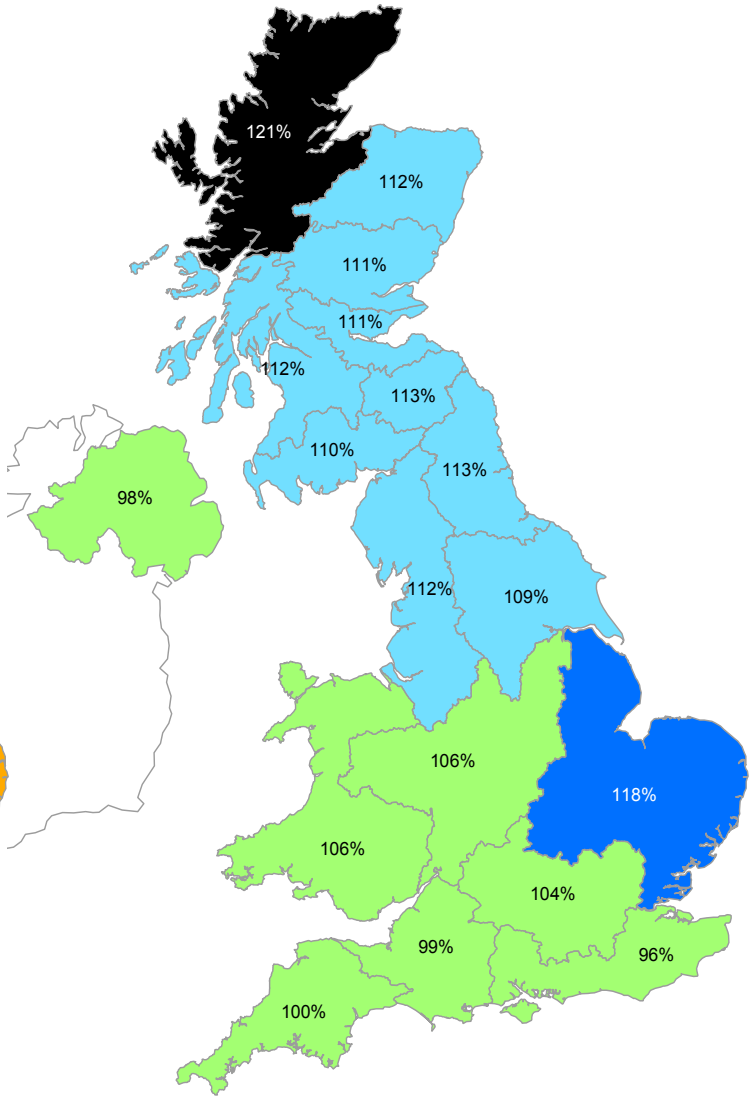
Rainfall . . . Rainfall . .

Key

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



November 2004 - December 2004

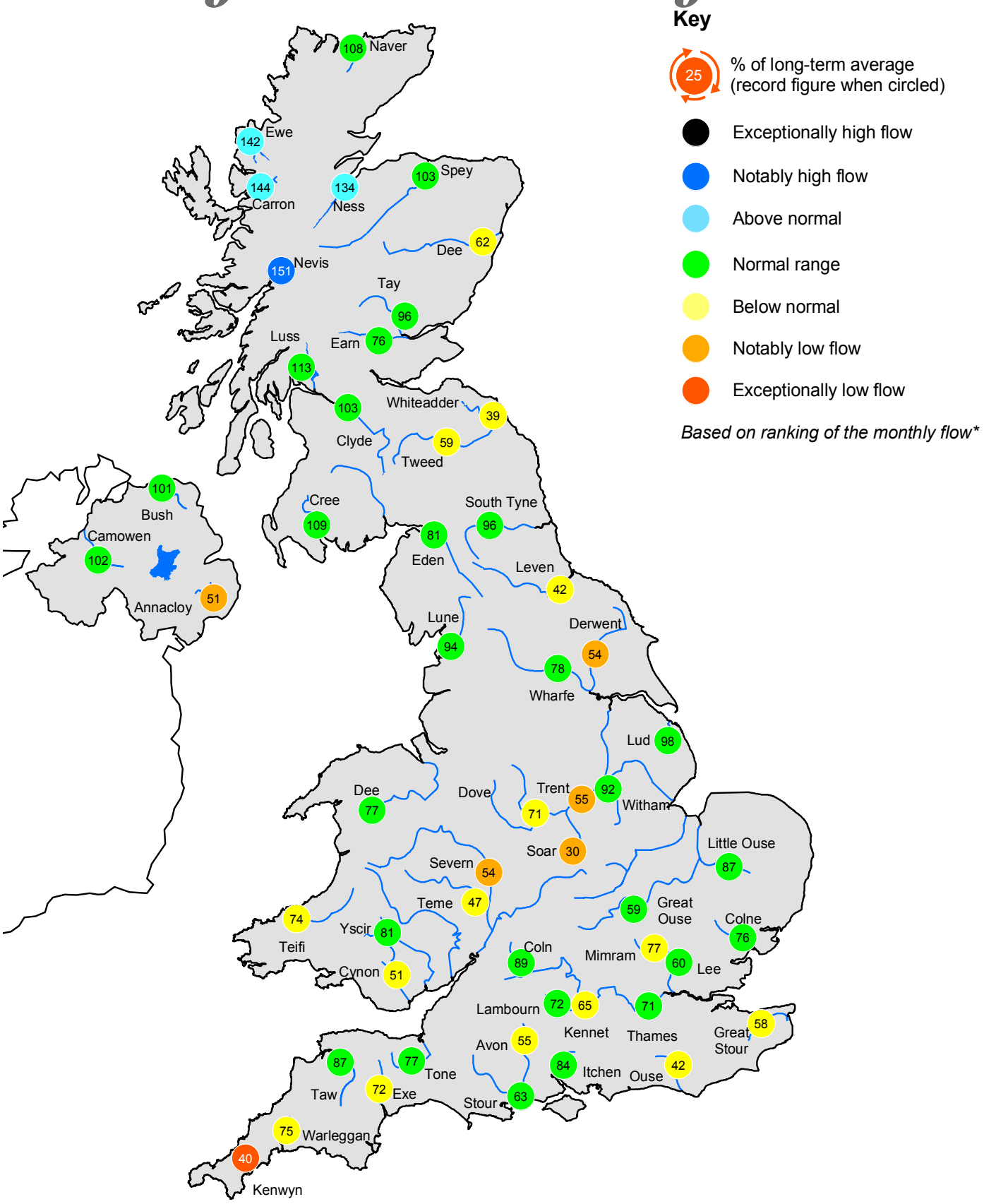


January 2004 - December 2004

Rainfall accumulation maps

Over a large part of the UK, the late autumn and early winter is, on average, the wettest part of the year. Rainfall deficiencies over this period can therefore be of particular water resources significance. In 2004, the Nov/Dec rainfall totals were <65% of average in most regions of England - for the Yorkshire region it was the lowest total in a series from 1961. In contrast to these important shorter term deficiencies, rainfall totals for 2004 were healthy in all regions, and for Scotland as a whole added another notably wet year to the large cluster over the post-1980 period.

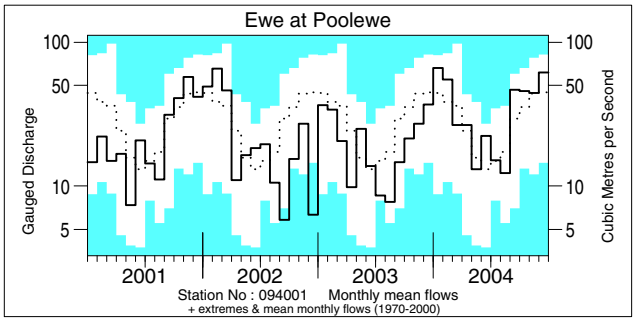
River flow . . . River flow . . .

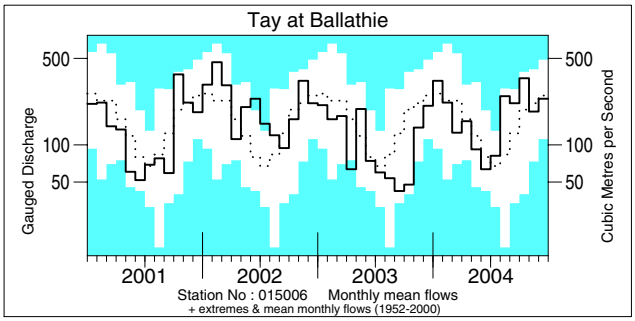


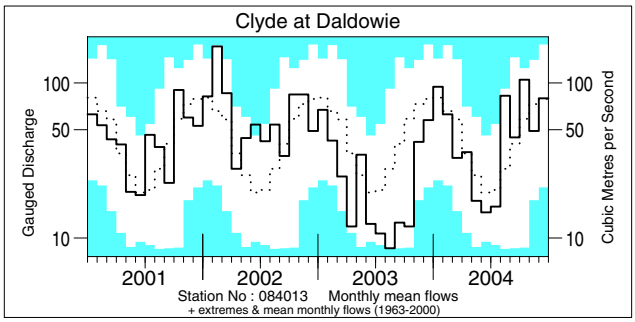
River flows - December 2004

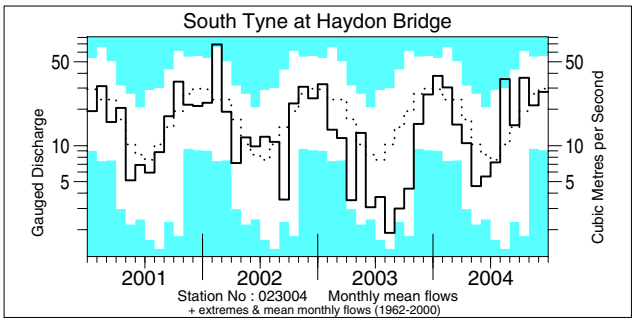
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much greater. Note: the period of record on which these percentages are based varies from station to station. Percentages may be omitted where flows are under review.

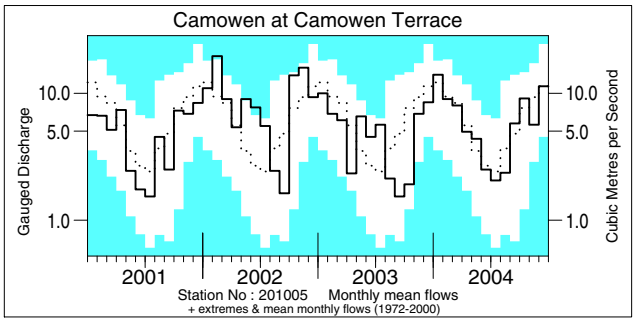
River flow . . . River flow . . .

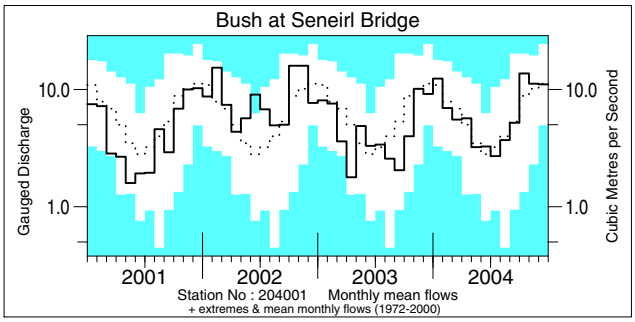


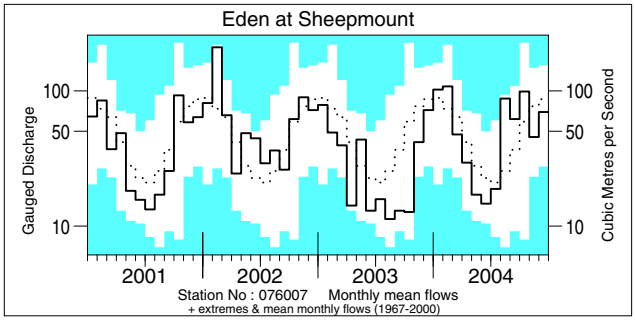


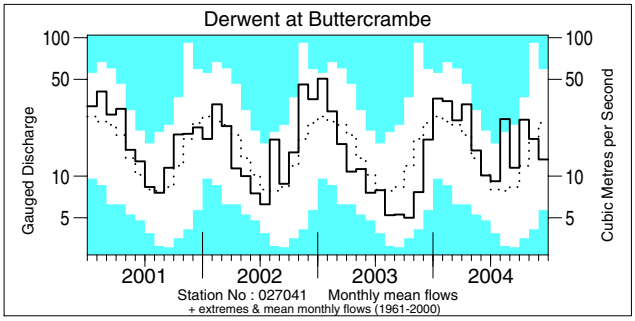


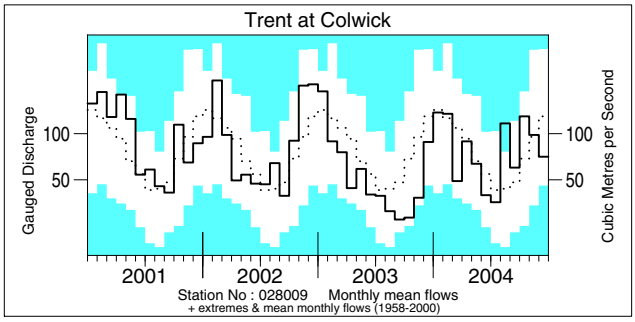


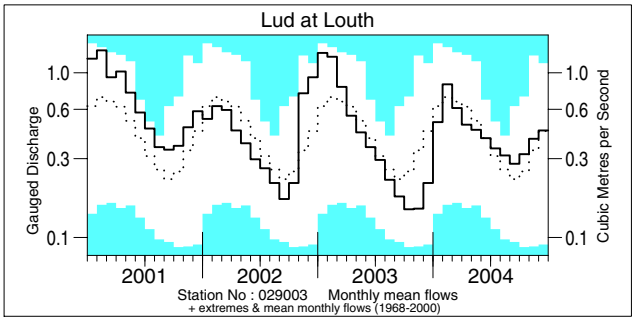








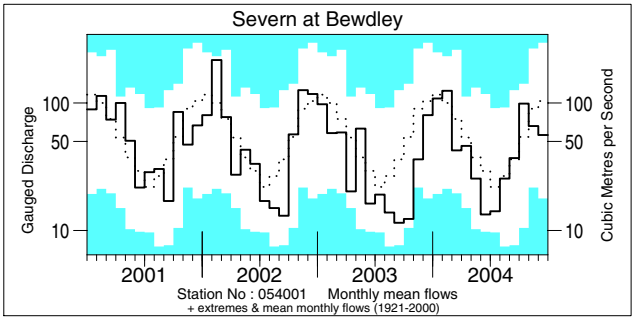


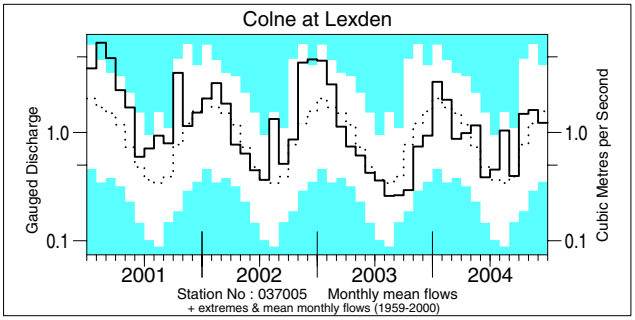


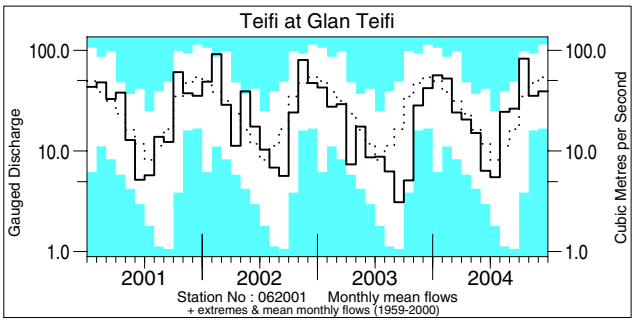
Monthly river flow hydrographs

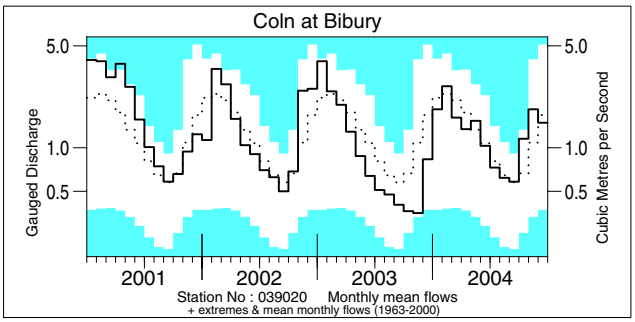
The river flow hydrographs show the monthly mean flow (bold trace), the long term average monthly flow (dotted trace) and the maximum and minimum flow prior to 2001 (shown by the shaded areas). Monthly flows falling outside the maximum/ minimum range are indicated where the bold trace enters the shaded areas.

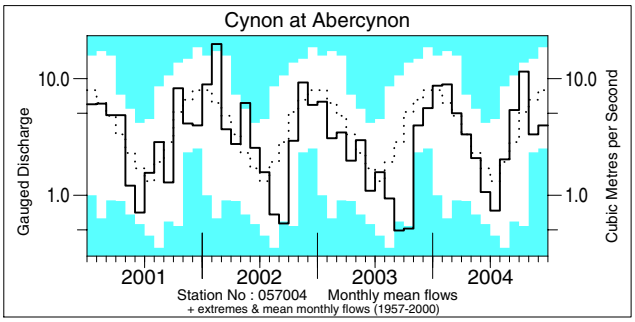
River flow . . . River flow . . .

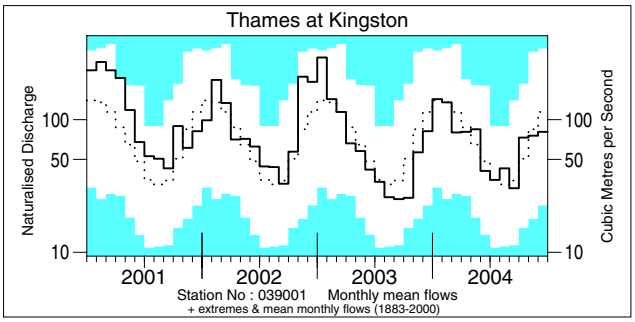


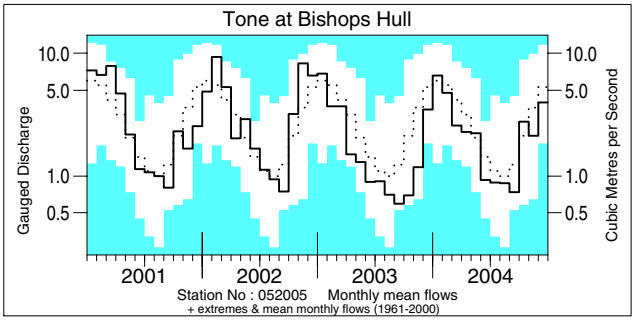


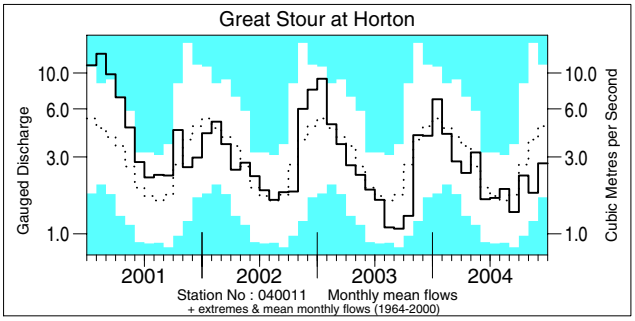


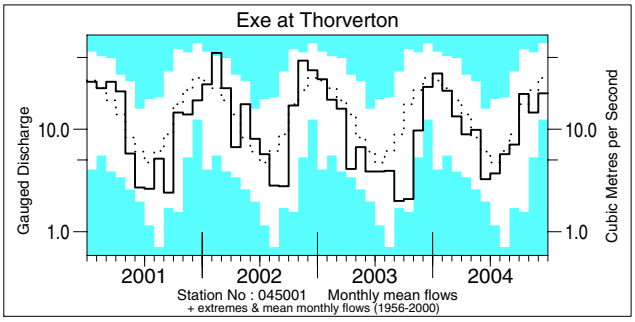


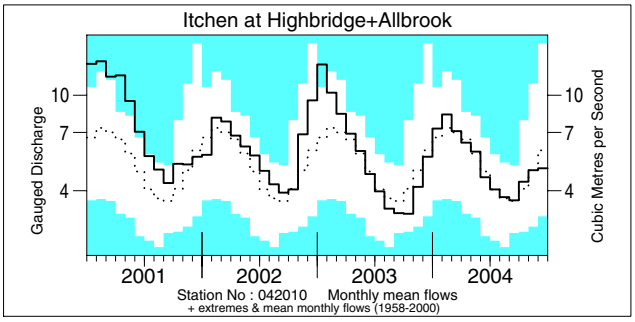












Notable runoff accumulations (a) November 2004 - December 2004, (b) January 2004 - December 2004

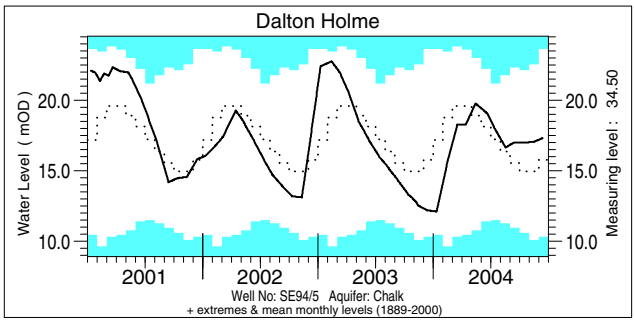
	River	%lta	Rank
a)	Mole	49	7/30
	Medway	33	5/47
	Ouse (Sussex)	36	7/44
	Otter	51	5/43
	Dart	59	7/47
	Kenwyn	51	3/37
	Cynon	51	6/47
	Dee (New Inn)	69	5/36
	Annacloy	53	3/25

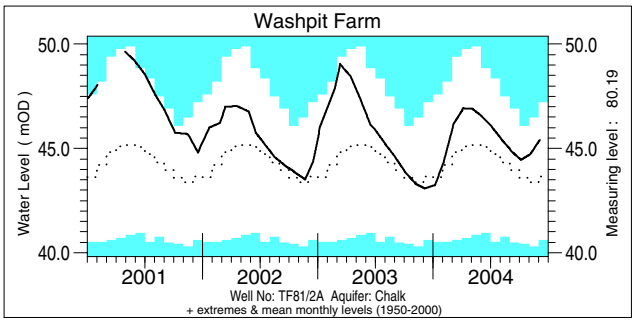
	River	%lta	Rank
b)	Spey (Boat o'Brig)	119	47/52
	Deveron	136	39/44
	Leven (Leven Br)	131	38/44
	Soar	82	8/33
	Witham	142	40/45
	Stringside	133	30/36

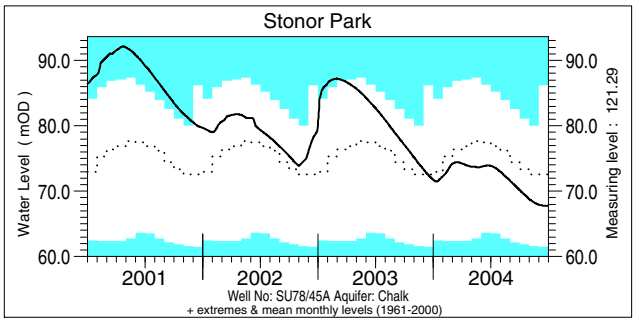
River	%lta	Rank
Lambourn	79	8/42
Medway	57	1/41
Ouse (Sussex)	68	4/39
Avon (Wilts)	77	7/39
Ewe	123	32/34
Naver	121	24/27
Faughan	85	5/28

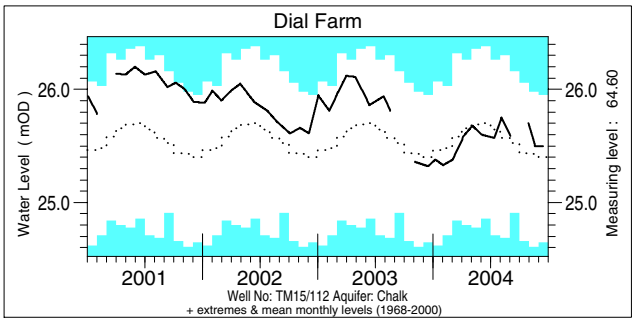
lta = long term average
Rank 1 = lowest on record

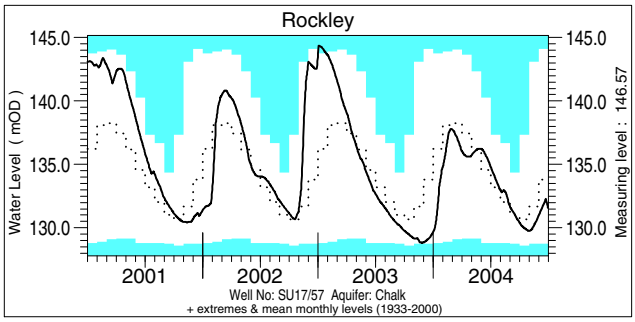
Groundwater . . . Groundwater

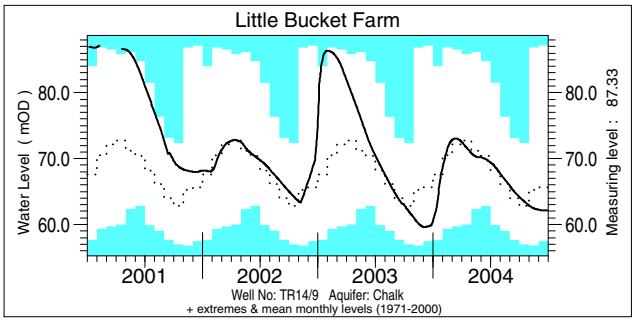


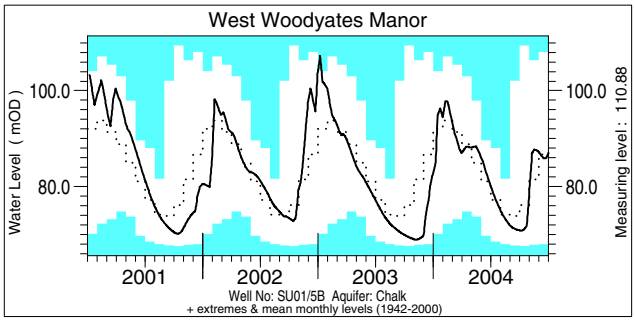


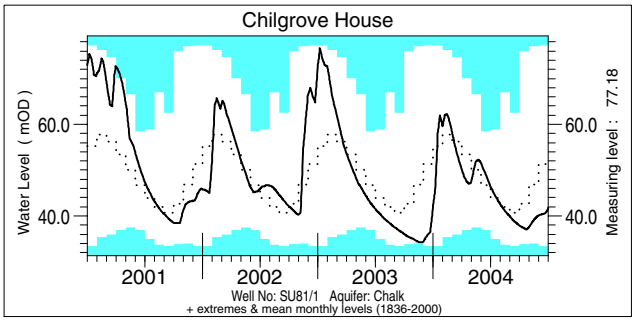


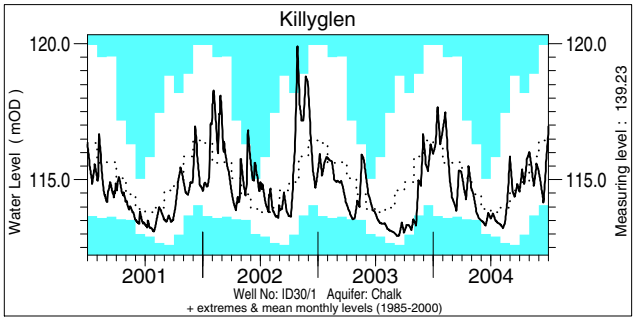


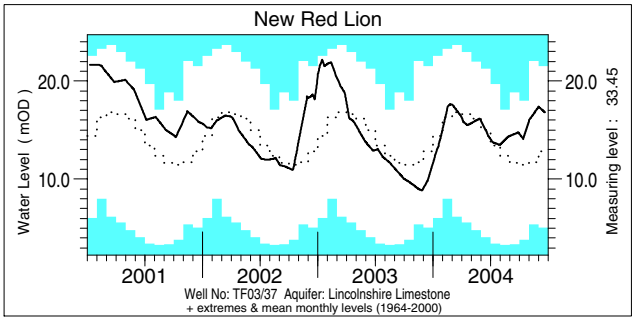






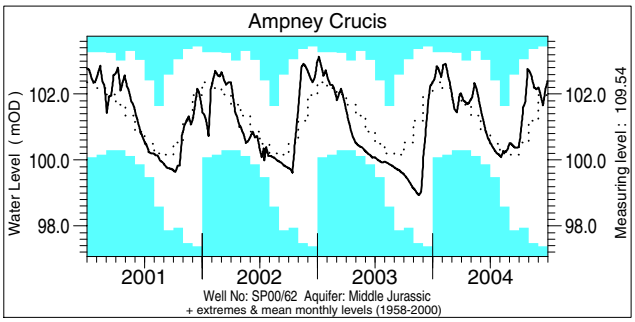


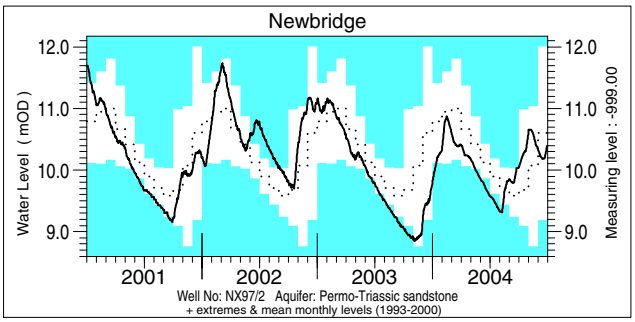


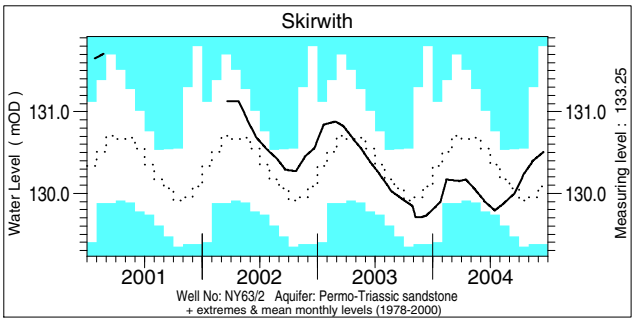


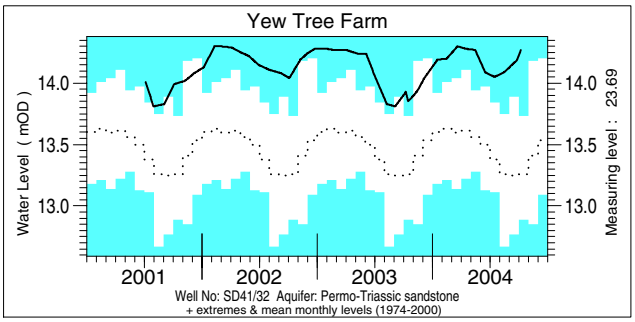
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined 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.

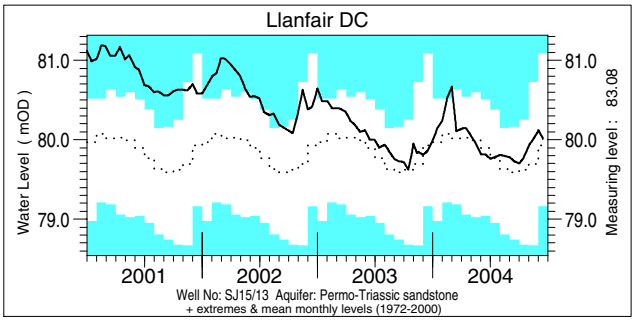
Groundwater . . . Groundwater

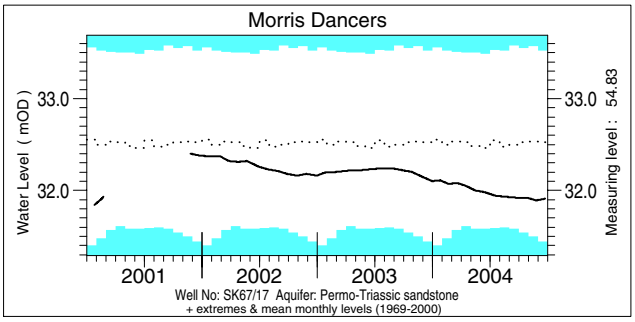


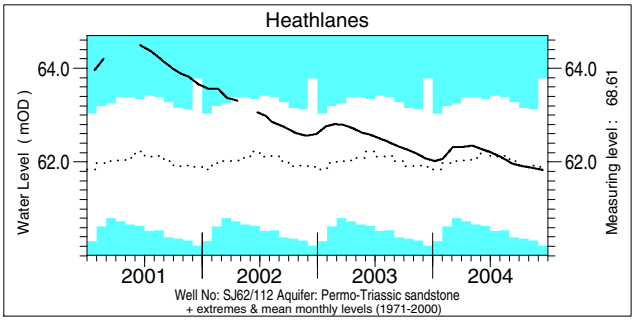


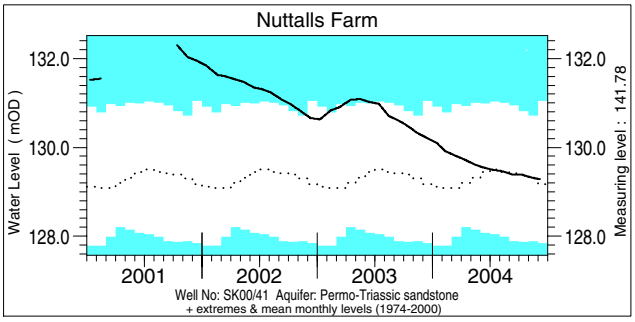


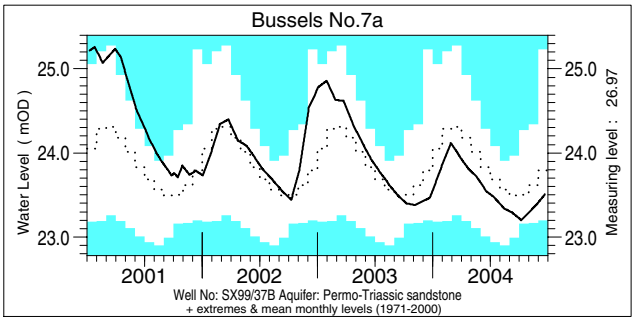


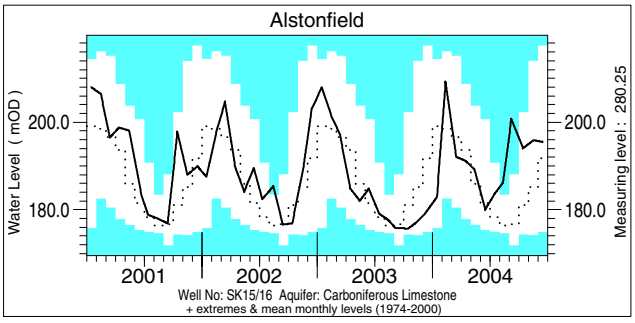










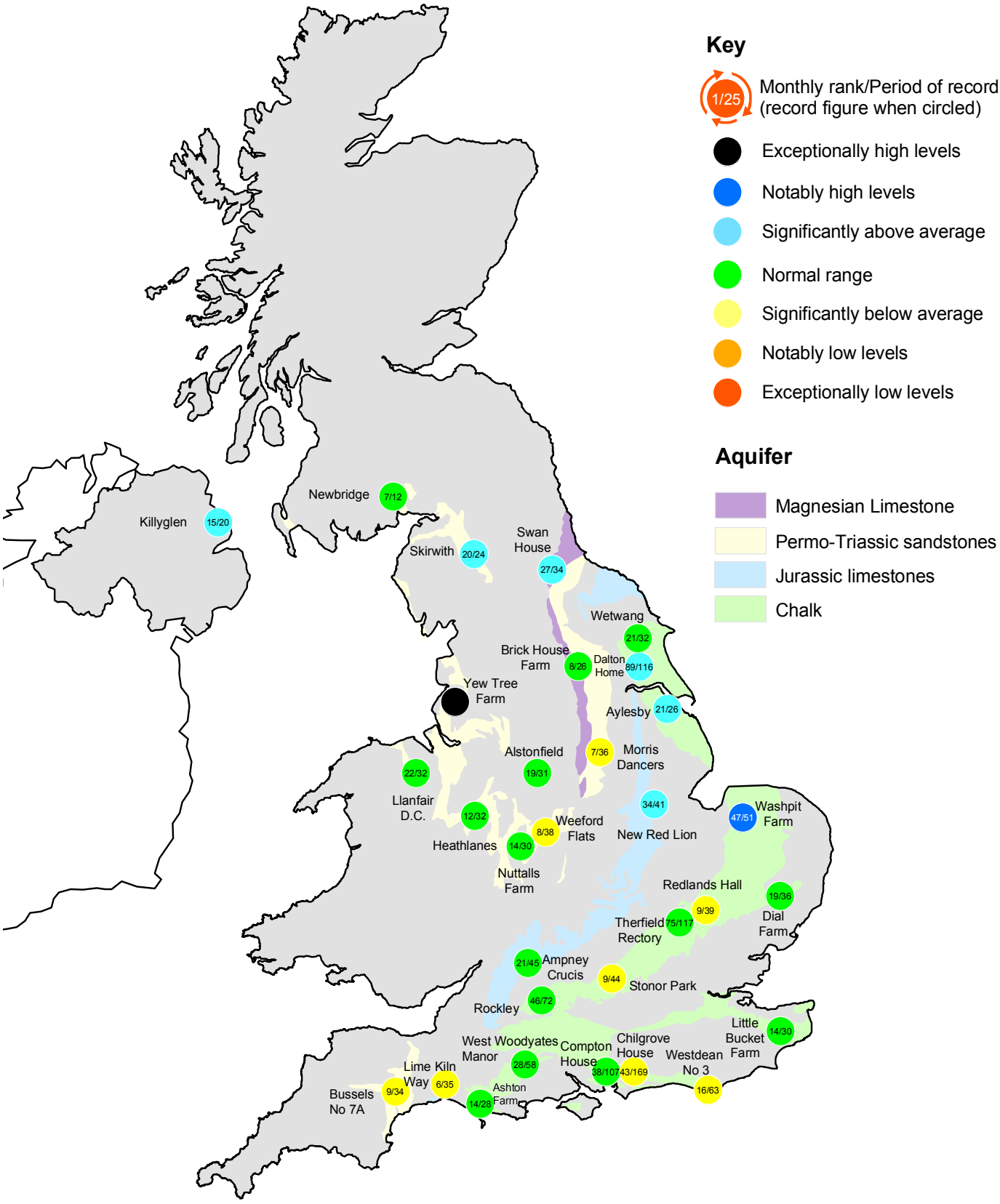


Groundwater levels December 2004 / January 2005

Borehole	Level	Date	Dec. av.	Borehole	Level	Date	Dec. av.	Borehole	Level	Date	Dec. av.
Dalton Holme	17.33	13/12	15.59	Chilgrove House	41.75	31/12	51.94	Llanfair DC	80.01	15/12	79.86
Washpit Farm	45.62	07/01	43.35	Killyglen	116.96	31/12	116.24	Morris Dancers	31.91	23/12	32.39
Stonor Park	68.00	12/01	72.86	New Red Lion	16.79	20/12	12.87	Heathlanes	61.83	15/12	61.95
Dial Farm	25.50	15/12	25.41	Ampney Crucis	102.16	12/01	101.91	Nuttalls Farm	129.28	07/12	129.51
Rockley	134.72	12/01	133.79	Newbridge	10.62	05/01	10.54	Bussels No.7a	23.51	21/12	23.84
Little Bucket Farm	62.46	08/01	64.80	Skirwith	130.51	17/12	130.22	Alstonfield	195.47	15/12	192.44
West Woodyates	87.12	31/12	86.77	Yew Tree Farm	14.27	06/10	13.65				

Levels in metres above Ordnance Datum

Groundwater . . . Groundwater

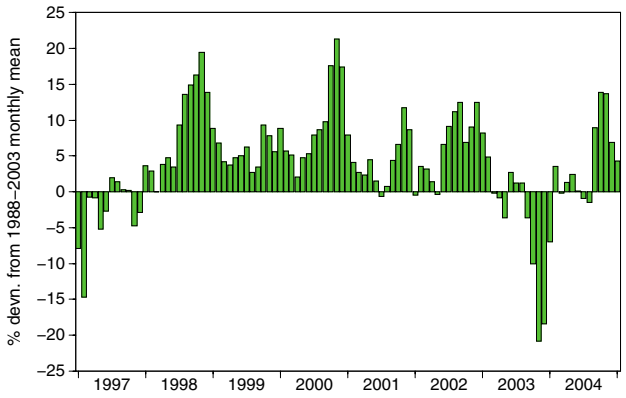


Groundwater levels - December 2004

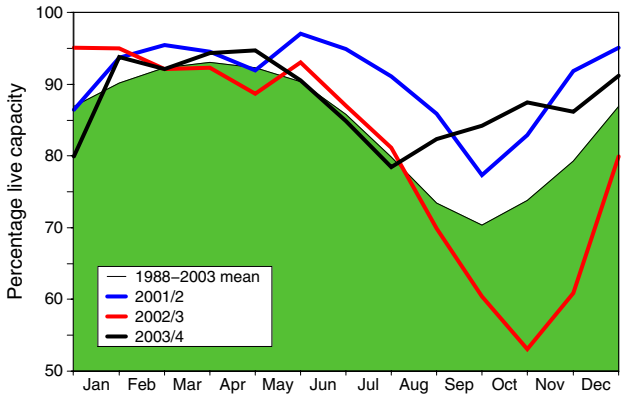
The rankings are based on a comparison between the average level in the featured month (but often only single readings are available) and the average level in each corresponding month on record. They need to be interpreted with caution especially when groundwater levels are changing rapidly or when comparing wells with very different periods of record. Rankings may be omitted where they are considered misleading.

Notes: i. The outcrop areas are coloured according to British Geological Survey conventions.
ii. Yew Tree Farm levels are now received quarterly.

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.

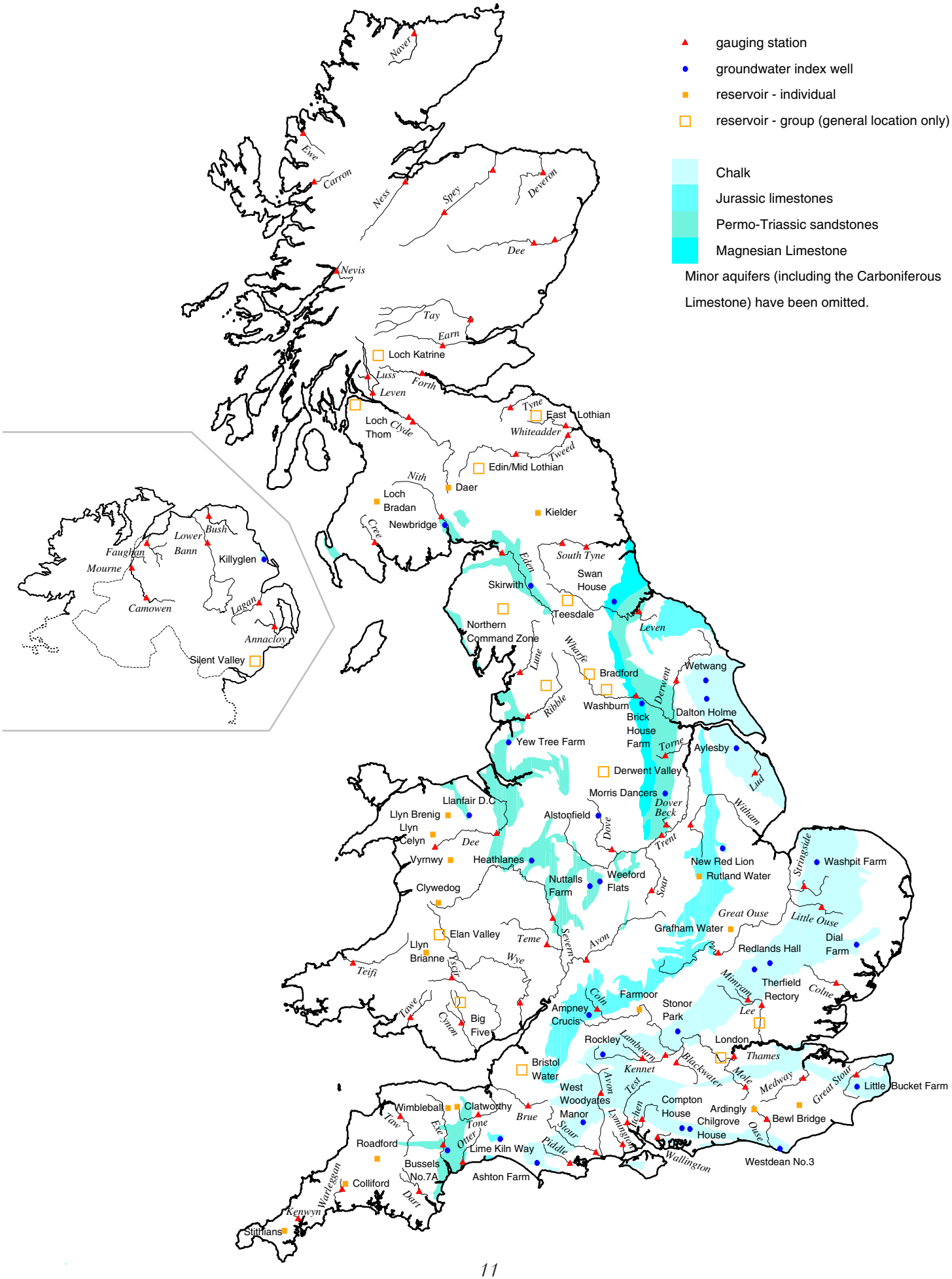
Percentage live capacity of selected reservoirs at start of month

Area	Reservoir	Capacity (Ml)	2004 Sep	Oct	Nov	Dec	2005 Jan	Avg. Jan	Min. Jan	Year* of min.
North West	N Command Zone	• 124929	73	86	91	85	**91**	85	51	1996
	Vyrnwy	55146	67	78	94	85	**100**	90	35	1996
Northumbrian	Teesdale	• 87936	97	97	98	94	**90**	87	41	1996
	Kielder	(199175)	(94)	(93)	(96)	(86)	**(98)**	(92)	(70)	1990
Severn Trent	Clywedog	44922	92	80	82	78	**83**	83	54	1996
	Derwent Valley	• 39525	98	93	95	100	**100**	90	10	1996
Yorkshire	Washburn	• 22035	95	85	89	89	**90**	82	23	1996
	Bradford supply	• 41407	90	91	100	98	**99**	88	22	1996
Anglian	Grafham	(55490)	(76)	(74)	(78)	(86)	**(92)**	(83)	(57)	1998
	Rutland	(116580)	(87)	(81)	(78)	(86)	**(93)**	(82)	(60)	1991
Thames	London	• 202340	84	76	81	83	**87**	84	60	1991
	Farmoor	• 13830	98	99	96	92	**98**	90	71	1991
Southern	Bewl	28170	81	74	68	63	**60**	75	38	1991
	Ardingly	4685	71	60	60	60	**69**	88	41	2004
Wessex	Clatworthy	5364	64	56	65	89	**100**	92	54	2004
	Bristol WW	• (38666)	(66)	(57)	(56)	(58)	**(64)**	(77)	(40)	1991
South West	Colliford	28540	55	50	60	62	**66**	81	46	1996
	Roadford	34500	51	55	57	58	**69**	79	23	1996
	Wimbleball	21320	69	63	73	76	**79**	84	46	1996
	Stithians	5205	57	50	60	61	**60**	79	33	2002
Welsh	Celyn and Brenig	• 131155	82	92	97	95	**97**	91	54	1996
	Brianne	62140	85	100	99	93	**98**	97	76	1996
	Big Five	• 69762	71	82	87	92	**97**	88	67	1996
	Elan Valley	• 99106	81	100	100	99	**100**	96	56	1996
Scotland(E)	Edinburgh/Mid Lothian	• 97639	80	94	87	88	**87**	91	60	1999
	East Lothian	• 10206	100	100	100	100	**100**	95	48	1990
Scotland(W)	Loch Katrine	• 111363	74	94	97	94	**100**	90	80	2004
	Daer	22412	90	100	100	100	**100**	98	83	1996
	Loch Thom	• 11840	100	100	100	100	**100**	98	90	2004
Northern Ireland	Total+	•	72	73	85	88		85	61	2002
	Silent Valley	• 20634	58	64	73	72	**69**	82	39	2002

() figures in parentheses relate to gross storage • denotes reservoir groups +excludes Lough Neagh *last occurrence - see footnote

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 region; this can be particularly important during droughts. The storage figures relate to the 1988-2004 period only (except for West of Scotland and Northern Ireland where data commence in the mid-1990's). 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



National Hydrological Monitoring Programme

The National Hydrological Monitoring Programme (NHMP) was instigated in 1988 and is undertaken jointly by the Centre for Ecology and Hydrology Wallingford (formerly 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 for Environment, Food and Rural Affairs (Defra), the Environment Agency (EA), the Scottish Environment Protection Agency (SEPA), the Rivers Agency (RA) in Northern Ireland, and the Office of Water Services (OFWAT).

Data Sources

River flow and groundwater level data are provided by the Environment Agency, the Environment Agency Wales, the Scottish Environment Protection Agency and, for Northern Ireland, the Rivers Agency and the Department of the Environment (NI). In all cases the data are subject to revision following validation (flood and drought data in particular may be subject to significant revision).

Reservoir level information is provided by the Water Service Companies, the EA, Scottish Water and the Northern Ireland Water Service.

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

Rainfall

Most rainfall data are provided by the Met Office (see opposite). To allow better spatial differentiation the rainfall data for Britain are presented for the regional divisions of the precursor organisations of the EA and SEPA. Following the discontinuation of the Met Office's CARP system in July 1998, the areal rainfall figures have been derived using several procedures, including initial estimates based on MORECS*. Recent figures have been produced by the Met Office, National Climate Information Centre (NCIC), using a technique similar to CARP. A significant number of additional monthly raingauge totals are provided by the EA and SEPA to help derive the contemporary regional rainfalls. Revised monthly national ans regional rainfall totals for the post-1960 period (together with revised 1961-90 averages) were made available in 2004; these have been adopted by the NHMP. As with all regional figures based on limited raingauge networks the monthly tables and accumulations (and the return periods associated with them) should be regarded as a guide only.

*MORECS is the generic name for the Met Office services involving the routine calculation of evaporation and soil moisture throughout Great Britain.

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The National Hydrological Monitoring Programme depends on the active cooperation of many data suppliers. This cooperation is gratefully acknowledged.

Subscription

Subscription to the Hydrological Summaries costs £48 per year. Orders should be addressed to:

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Selected text and maps are available on the WWW at
http://www.nerc-wallingford.ac.uk/ih/nrfa/index.htm
Navigate via Water Watch

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