Hydrological Summary
for the United Kingdom

January 2004

General
January was a very unsettled month with few dry days and most regions registered appreciably above average rainfall; as importantly, three-month rainfall totals are also above average. Consequently reservoir stocks continued their brisk December improvement and, despite drawdowns in some impoundments to provide additional flood alleviation capacity, overall stocks for England and Wales are now around 4% above average for the late winter. Over wide areas, river flows approached, or exceeded bankfull, during January and moderate floodplain inundation was a common occurrence; at month-end many catchments were very vulnerable to further rainfall. Below average January runoff totals were largely confined to spring-fed rivers in the English Lowlands. In most major aquifers groundwater levels increased substantially over the month and the near-saturated soil conditions provide the opportunity for further significant late-winter recharge. 1990 and 1995 serve as recent reminders that a wet winter cannot completely eliminate the possibility of drought stress in the following summer. Nonetheless, it is a measure of the UK's resilience to within-year drought episodes that the elimination of less than half of the rainfall deficiencies (built-up by late October) has secured a healthy water resources outlook.

Rainfall
January was a generally mild month punctuated by a freezing interlude as an Arctic airflow brought widespread snowfall across much of the UK late in the month - substantial accumulations were reported on the 28th (e.g. around 30 cm at Fylingdales and Glenlivit). Gales and blizzards were common in northern Scotland but, to the south, mild and damp conditions predominated. Many areas reported only 3 or 4 dry days in the month and vigorous frontal systems produced significant precipitation totals on a number of occasions. The last few days of the month were especially wet (Eskdalemuir reported 62 mm on the 28th and parts of Northern Ireland received almost half their January total in the last couple of days) - initiating an exceptionally wet spell that continued into February. A few areas, mostly in eastern Scotland, reported slightly below average January rainfall totals but much of Britain exceeded 120% with a few areas (e.g. the North York Moors approaching 200%). For the UK as a whole, January was the wettest month since Oct 2002 and all regions have had above average rainfall since last October (only marginally so in the South-West). Nov-Jan is, on average, the wettest period of the year (and evaporative losses are modest). Thus the positive rainfall anomalies in this timespan resulted in substantial improvements in water resources – despite appreciable long term rainfall deficiencies (beginning Feb 2003) remaining, in parts of north-east Britain especially.

River Flow
Most rivers experienced a wide range of flows in January but the overall runoff pattern was in marked contrast to the depressed flows characterising most catchments in October. In the interim, the focus of hydrological concern has switched decisively to the risk of flooding. Flood Alerts and Warnings were common in January and snowmelt at month end, together with heavy rainfall, triggered notable spates in many catchments. The River Ewe registered its second highest flow in the last 10 years and the Dee (north Wales) closely approached its highest January flow on record - heralding severe flooding in early February, in the Conwy Valley particularly. The late-January spates boosted runoff totals to well above average in the great majority of index catchments. Flows in some, mostly eastern, spring-fed rivers remained below average but the belated seasonal recovery has gathered momentum over the last 6-8 weeks. In many areas the January runoff terminated lengthy sequences of below average monthly flows – extending back to last February on the Thames, and longer in many Scottish catchments. A measure of the contrast with flow patterns in 2003 is provided by the Aberdeenshire Dee – above average January flows followed its lowest annual runoff total in a series from 1929.

Groundwater
Soils remained at, or very close to, saturation throughout January and with modest evaporative demands, infiltration rates were well above average throughout most aquifer units – exceeding 150% of the Jan average in parts of the Chalk. The lag between infiltration and water-table response can be considerable (especially following a period of depressed groundwater levels) but January levels confirmed that a strong recovery is underway in almost all areas. In the southern Chalk (e.g. at Chilgrove and West Woodyates) levels have risen by 30 metres or more since the 2003 minima. Levels remain below average in the slower responding eastern outcrops where the recovery has only recently been initiated; nonetheless late-January levels were generally within the normal range. Steep recent recoveries characterise most limestone aquifers - in the Jurassic Limestone of the Cotswolds levels at Ampney Crucis, levels exceed the average having been at their lowest since 1996 in November. In contrast to the limestone and Chalk aquifers the recovery in most of the Permo-Triassic sandstones outcrops (Bussels is an exception) is being generated from relatively healthy levels – a reflection of recharge patterns over several years. The recovery is now gathering momentum and most index boreholes are appreciably above average. Heavy late-January infiltration implies that further groundwater level rises may be anticipated in February.

Centre for Ecology & Hydrology
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Rainfall . . . Rainfall . . .

Rainfall accumulations and return period estimates

Area	Rainfall	Jan 2004	Nov 03-Jan 04	RP	Aug 03-Jan 04	RP	May 03-Jan 04	RP	Feb 03-Jan 04	RP
England & Wales	**mm**	**125**	**342**		**465**		**677**		**795**	
	%	**137**	**122**	**5-10**	**89**	**2-5**	**95**	**2-5**	**87**	**5-10**
North West	mm	169	417		573		847		1027	
	%	140	113	2-5	80	5-10	88	2-5	85	5-10
Northumbrian	mm	123	277		395		589		679	
	%	147	110	2-5	82	5-10	88	2-5	80	10-20
Severn Trent	mm	93	233		329		522		622	
	%	133	107	2-5	80	5-10	89	2-5	83	5-15
Yorkshire	mm	115	259		383		603		710	
	%	145	107	2-5	84	2-5	95	2-5	86	5-10
Anglian	mm	76	211		283		467		532	
	%	151	130	5-10	89	2-5	100	<2	89	2-5
Thames	mm	88	268		336		483		567	
	%	137	135	5-10	89	2-5	90	2-5	82	5-10
Southern	mm	102	329		418		557		648	
	%	128	133	5-10	92	2-5	92	2-5	83	5-10
Wessex	mm	116	327		410		589		705	
	%	133	124	2-5	85	2-5	91	2-5	84	5-10
South West	mm	161	408		553		814		999	
	%	116	101	2-5	80	5-10	90	2-5	85	5-10
Welsh	mm	194	477		651		944		1146	
	%	136	109	2-5	82	5-10	92	2-5	87	5-10
Scotland	**mm**	**200**	**524**		**728**		**1024**		**1222**	
	%	**132**	**116**	**2-5**	**84**	**5-10**	**90**	**2-5**	**85**	**10-20**
Highland	mm	261	656		929		1268		1515	
	%	139	111	2-5	86	5-10	92	2-5	86	5-15
North East	mm	127	319		473		647		768	
	%	128	110	2-5	84	5-10	84	5-10	79	20-35
Tay	mm	153	428		541		798		977	
	%	106	109	2-5	74	10-20	83	5-10	80	10-20
Forth	mm	142	367		501		743		887	
	%	120	108	2-5	76	10-20	85	5-10	80	15-25
Tweed	mm	124	305		425		647		761	
	%	124	107	2-5	76	5-15	84	5-10	78	20-30
Solway	mm	182	533		692		1003		1217	
	%	117	119	2-5	80	5-10	89	2-5	86	5-10
Clyde	mm	233	636		865		1245		1472	
	%	123	116	2-5	82	5-10	92	2-5	87	5-10
Northern Ireland	**mm**	**128**	**337**		**479**		**774**		**937**	
	%	**115**	**106**	**2-5**	**77**	**5-15**	**93**	**2-5**	**88**	**2-5**

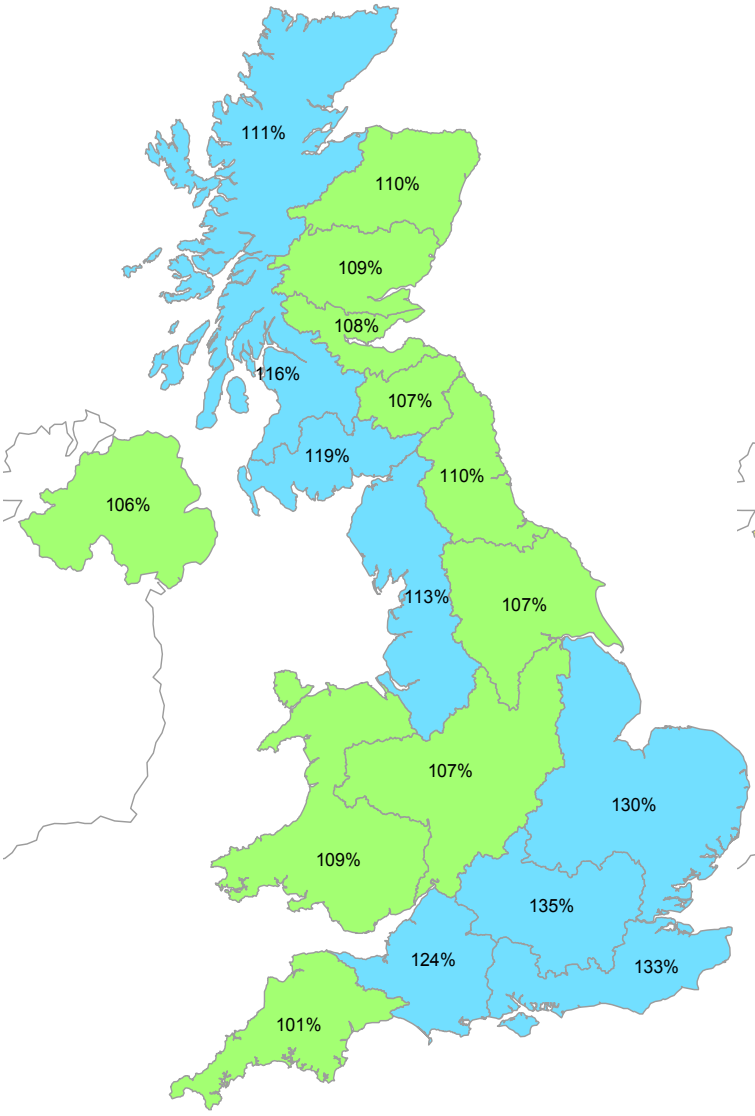
RP = Return period

 All monthly totals since December 1998 are provisional (see page 12). 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 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); 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.

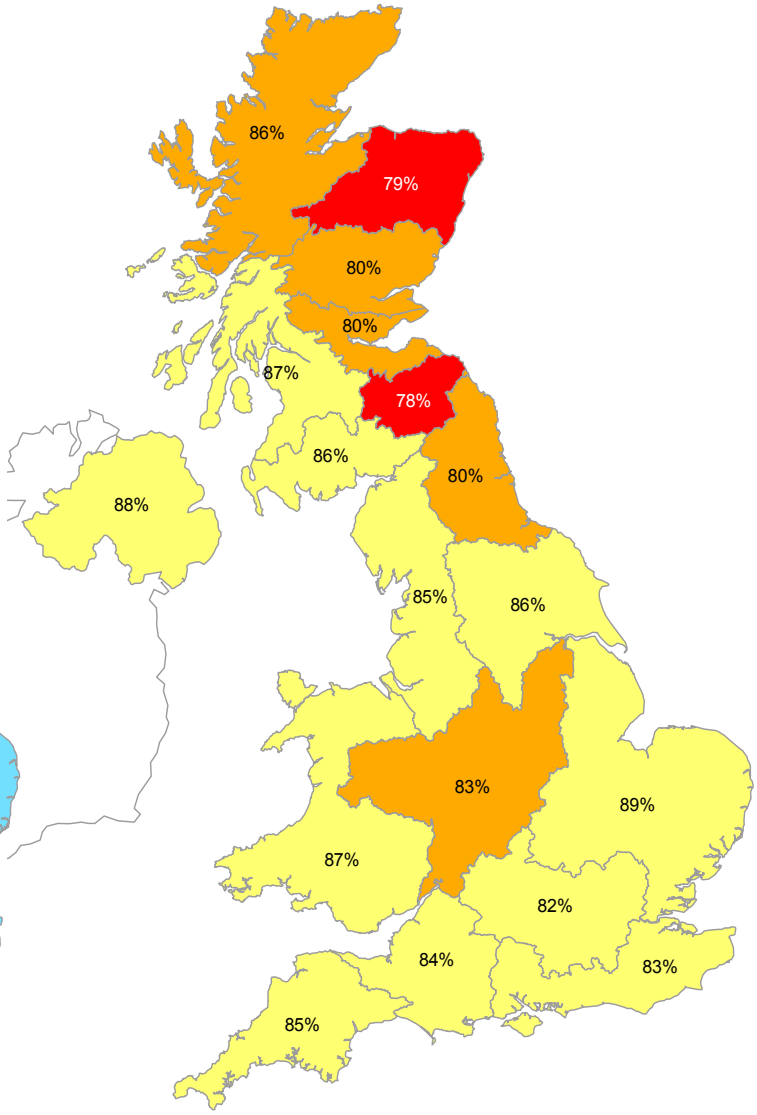
Rainfall . . . Rainfall . .

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 2003 - January 2004

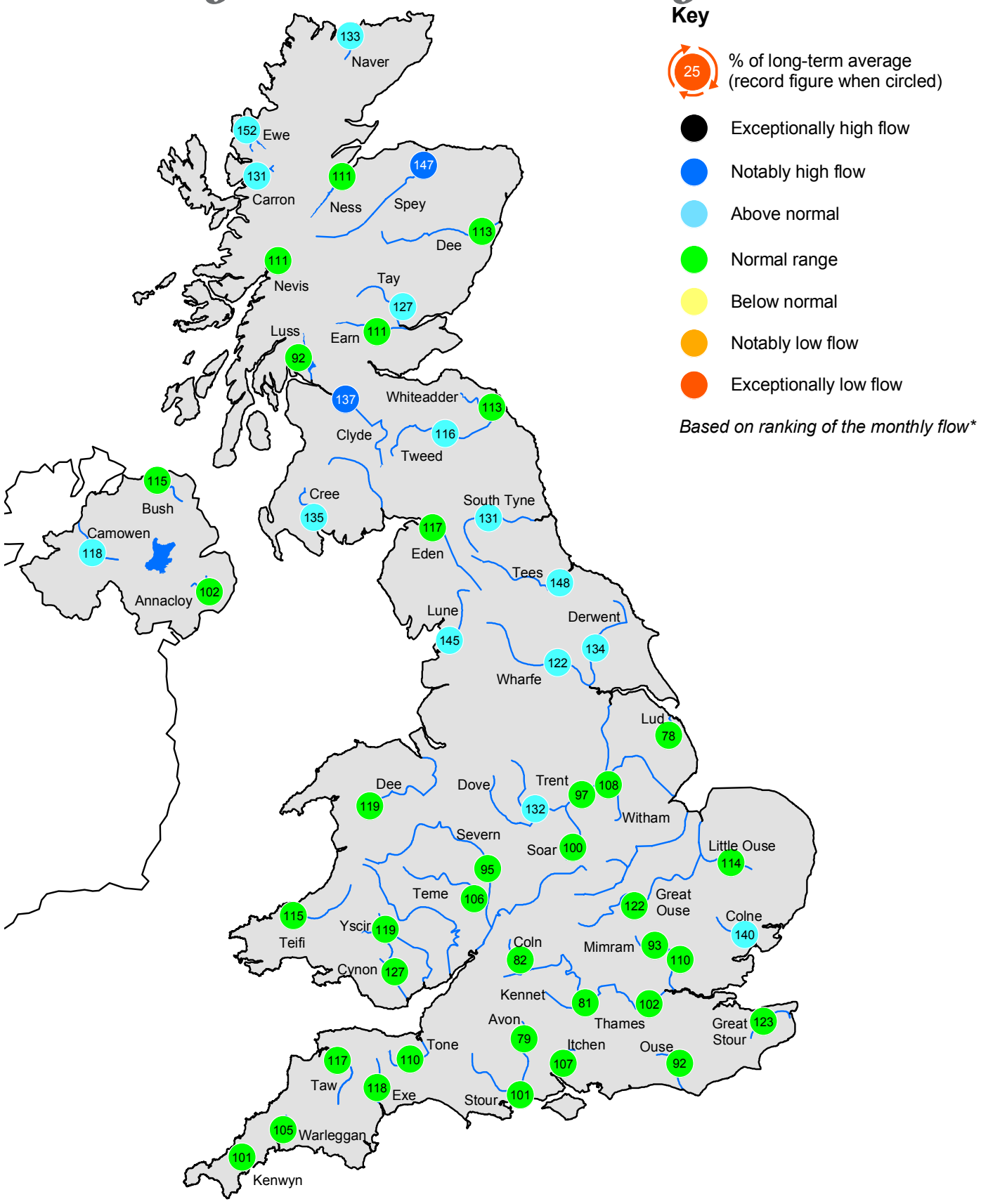


February 2003 - January 2004

Rainfall accumulation maps

The last three months added to a cluster of notably wet Nov-Jan periods; for the UK as a whole 9 out of the last 12 have registered well above average rainfall. Notwithstanding the recent sequence of wet months, provisional rainfall figures indicate that the Feb 2003 - Jan 2004 rainfall was the second lowest (in that timeframe) since 1976; parts of eastern Scotland being especially dry.

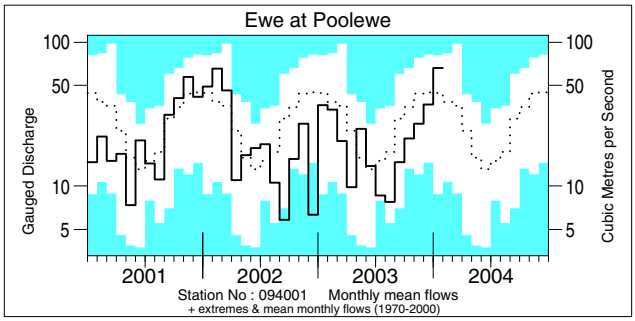
River flow . . . River flow . . .

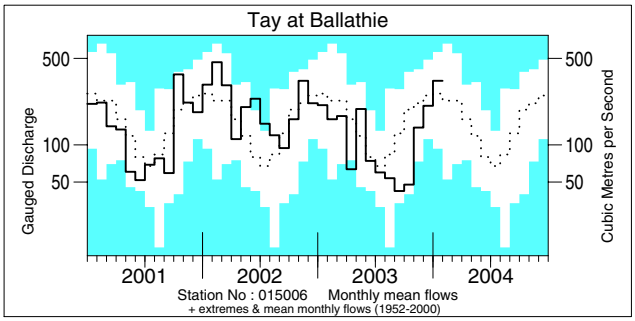


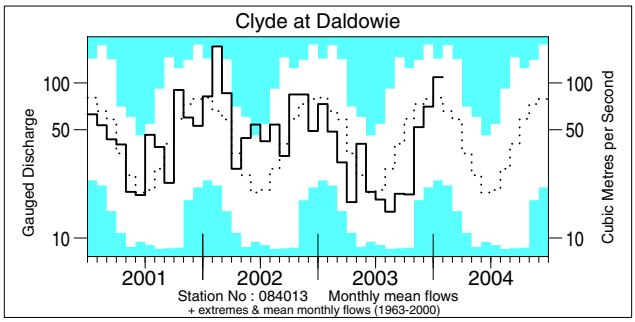
River flows - January 2004

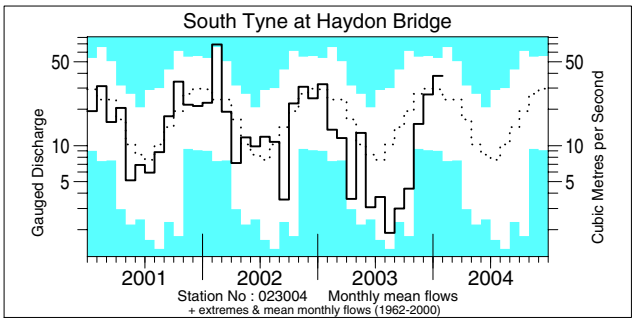
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

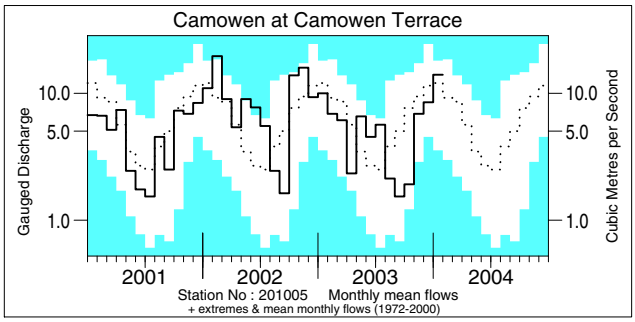
River flow . . . River flow . . .

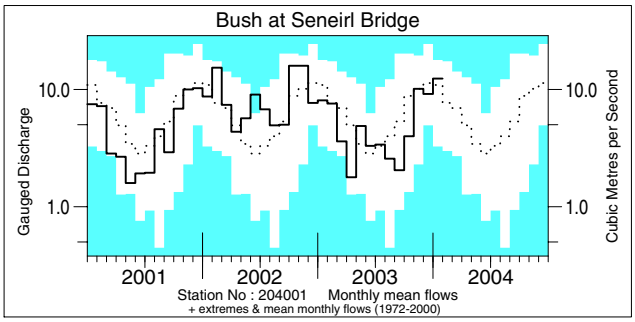


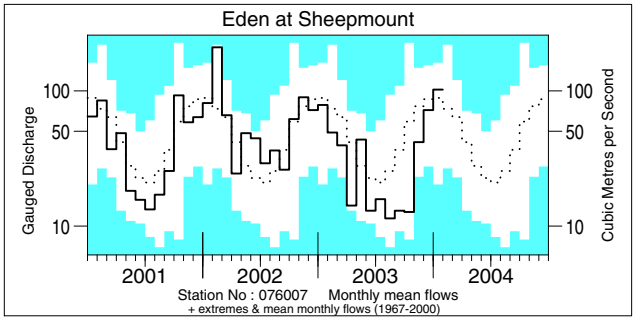


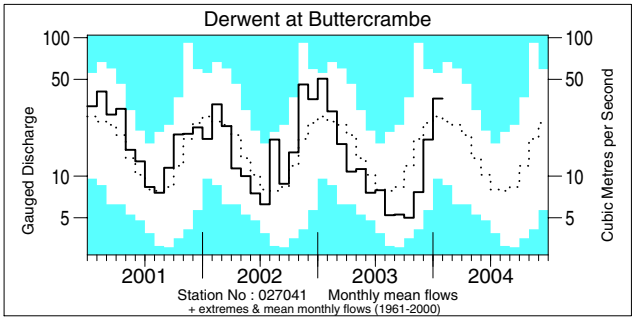


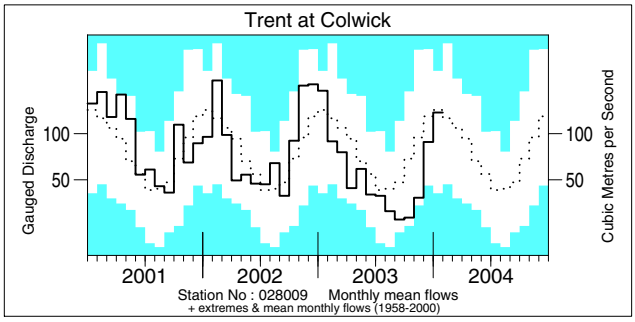


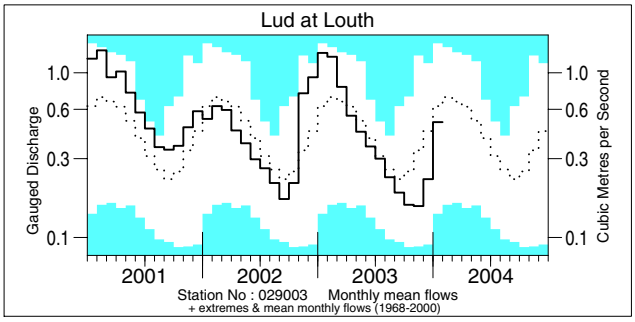








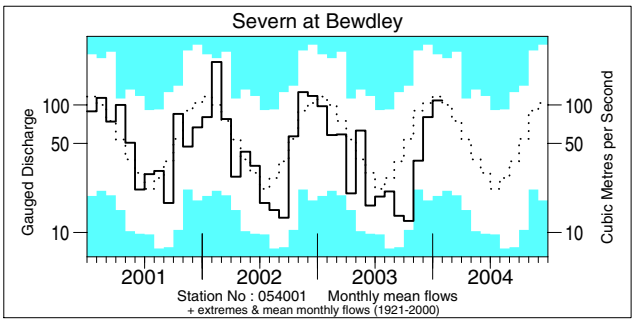


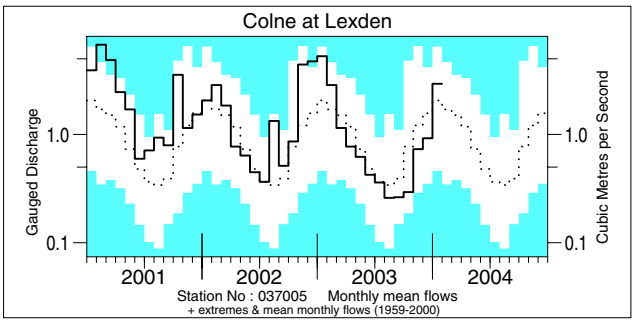


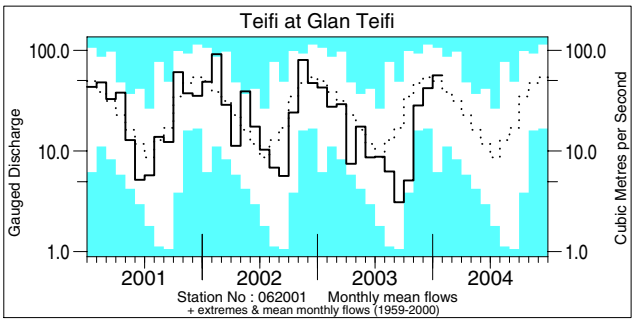
Monthly river flow hydrographs

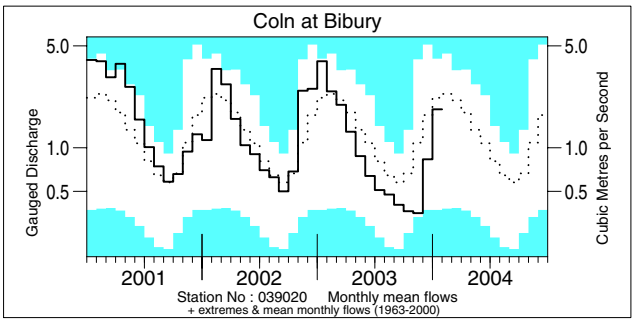
The river flow hydrographs show the monthly mean flow (bold trace), the long term average monthly flow (dotted trace) and the maximum and minimum flow prior to 2001 (shown by the shaded areas). Monthly flows falling outside the maximum/ minimum range are indicated where the bold trace enters the shaded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

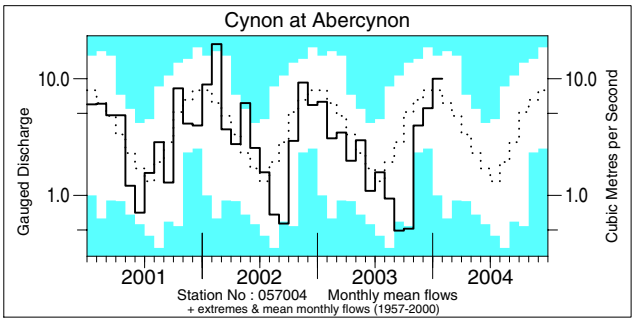
River flow . . . River flow . . .

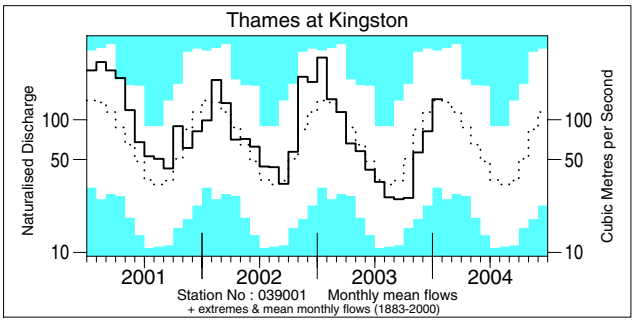


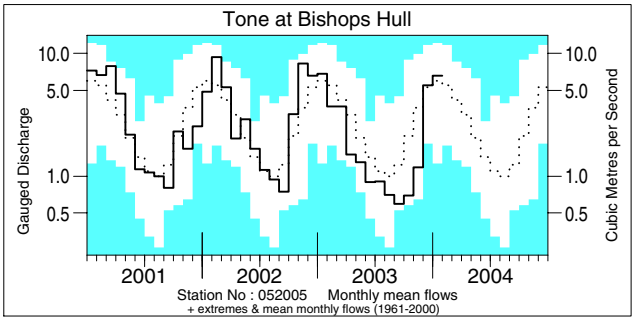


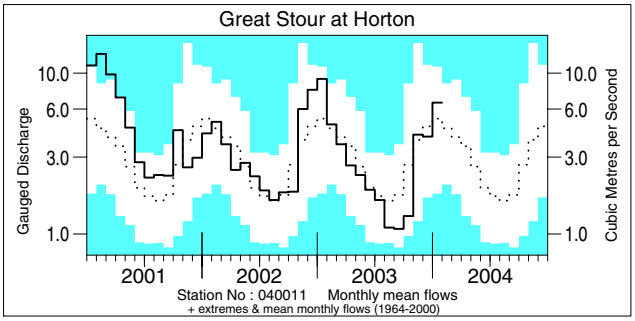


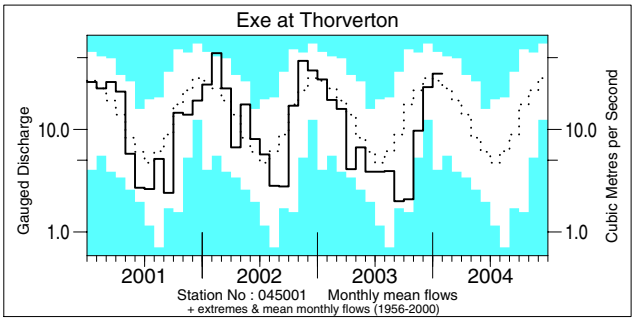


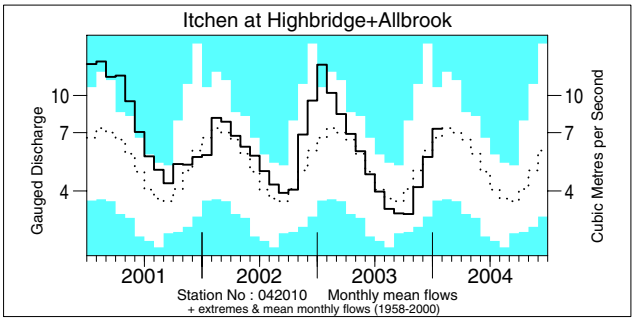












Notable runoff accumulations **(a) December 2003 - January 2004, (b) February 2003 - January 2004**

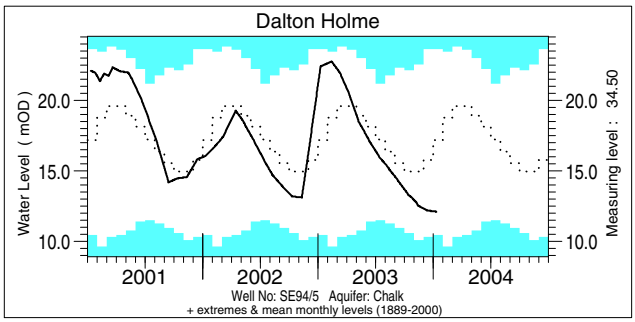
	River	%lta	Rank
a)	Tyne	116	30/39
	Soar	76	9/33
	Lymington	157	40/44
	Warleggan	83	8/35
	Kenwyn	76	9/36
	Teme	80	9/34
	Annacloy	80	8/25

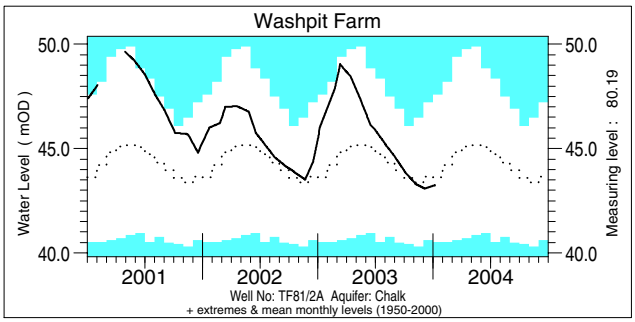
	River	%lta	Rank
b)	Spey (Boat o'Garten)	64	2/52
	Dee (Woodend)	65	1/74
	Tyne	62	1/44
	S.Tyne	62	2/40
	Soar	56	2/32
	Warleggan	74	2/34
	Kenwyn	70	1/35

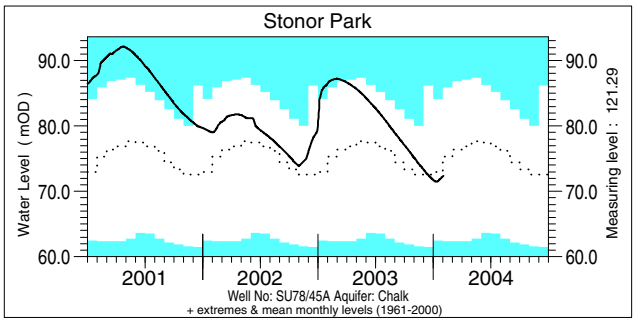
River	%lta	Rank
Teme	61	2/33
Wye	61	2/67
Clyde (Blairston)	70	1/42
Luss	70	1/25
Carron	68	1/25
Naver	75	2/26
Annacloy	66	1/24

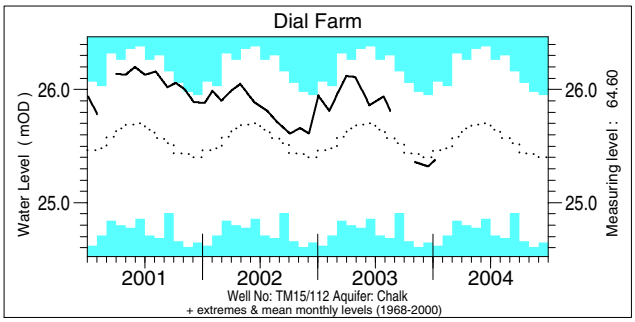
lta = long term average
Rank 1 = lowest on record

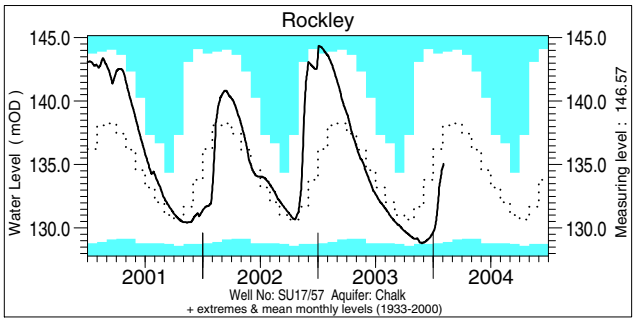
Groundwater . . . Groundwater

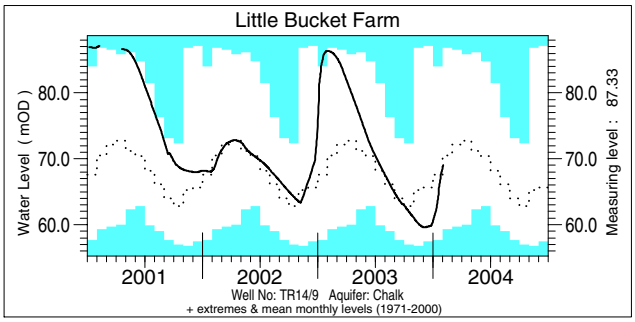


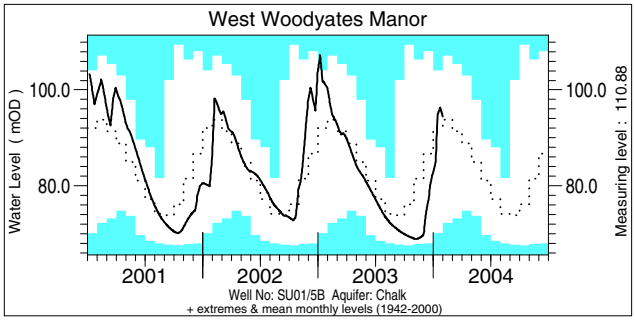


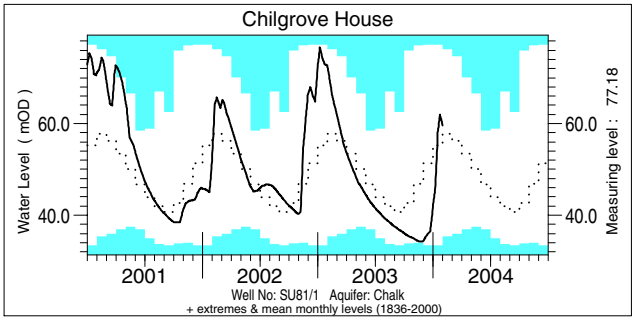


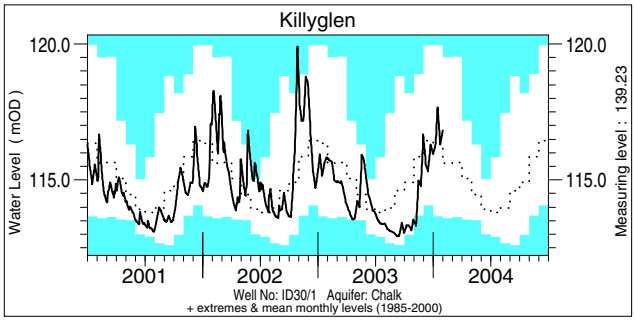


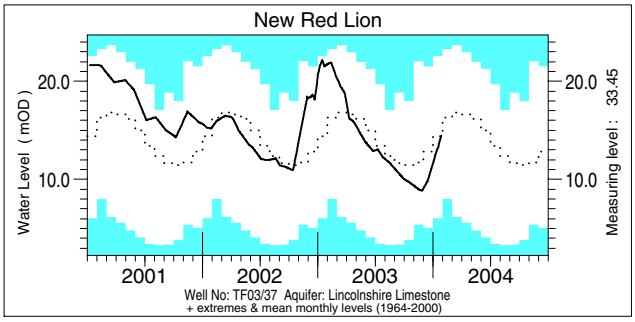






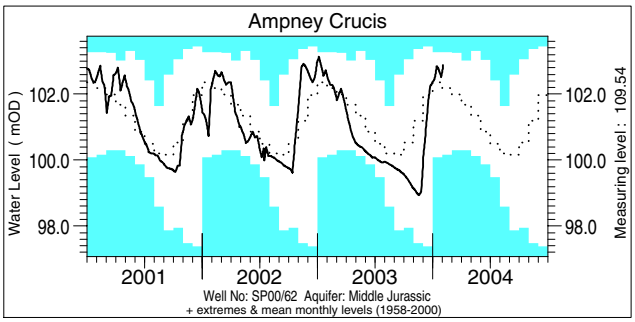


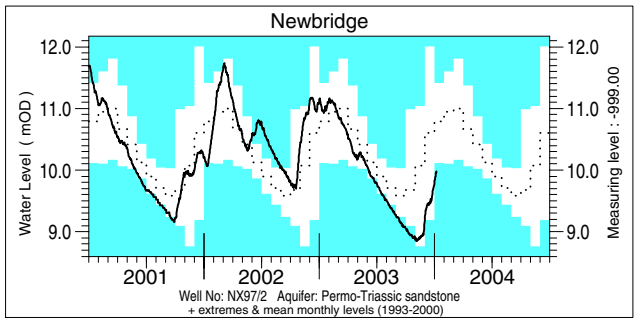


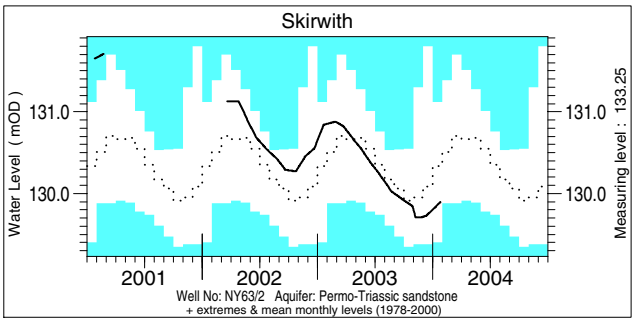


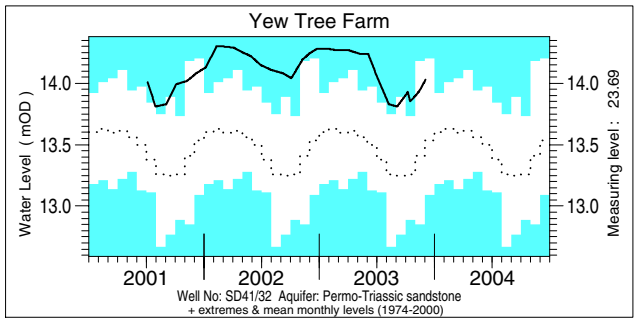
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

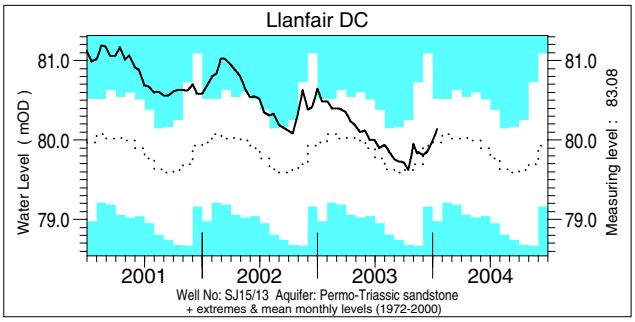
Groundwater . . . Groundwater

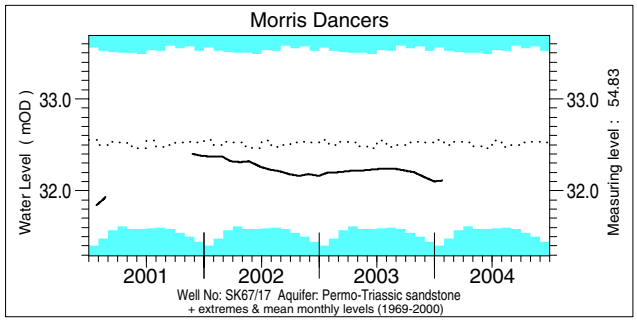


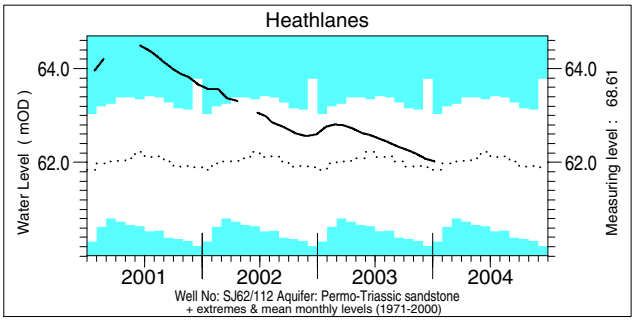


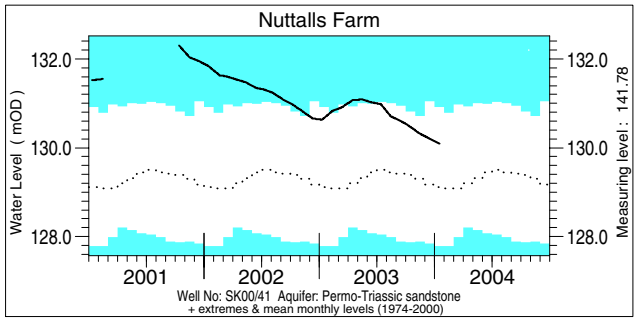


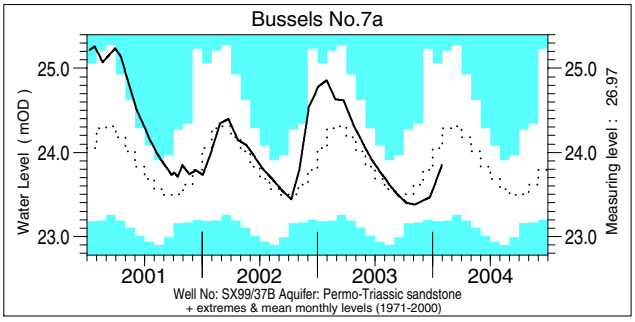


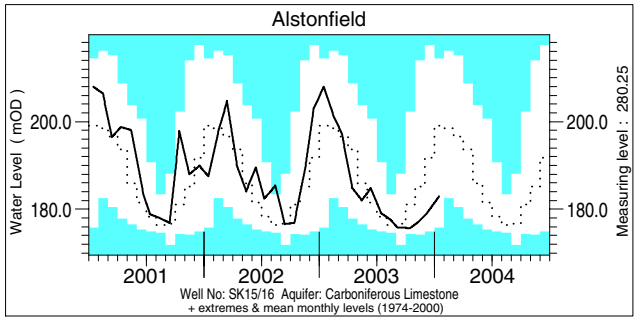








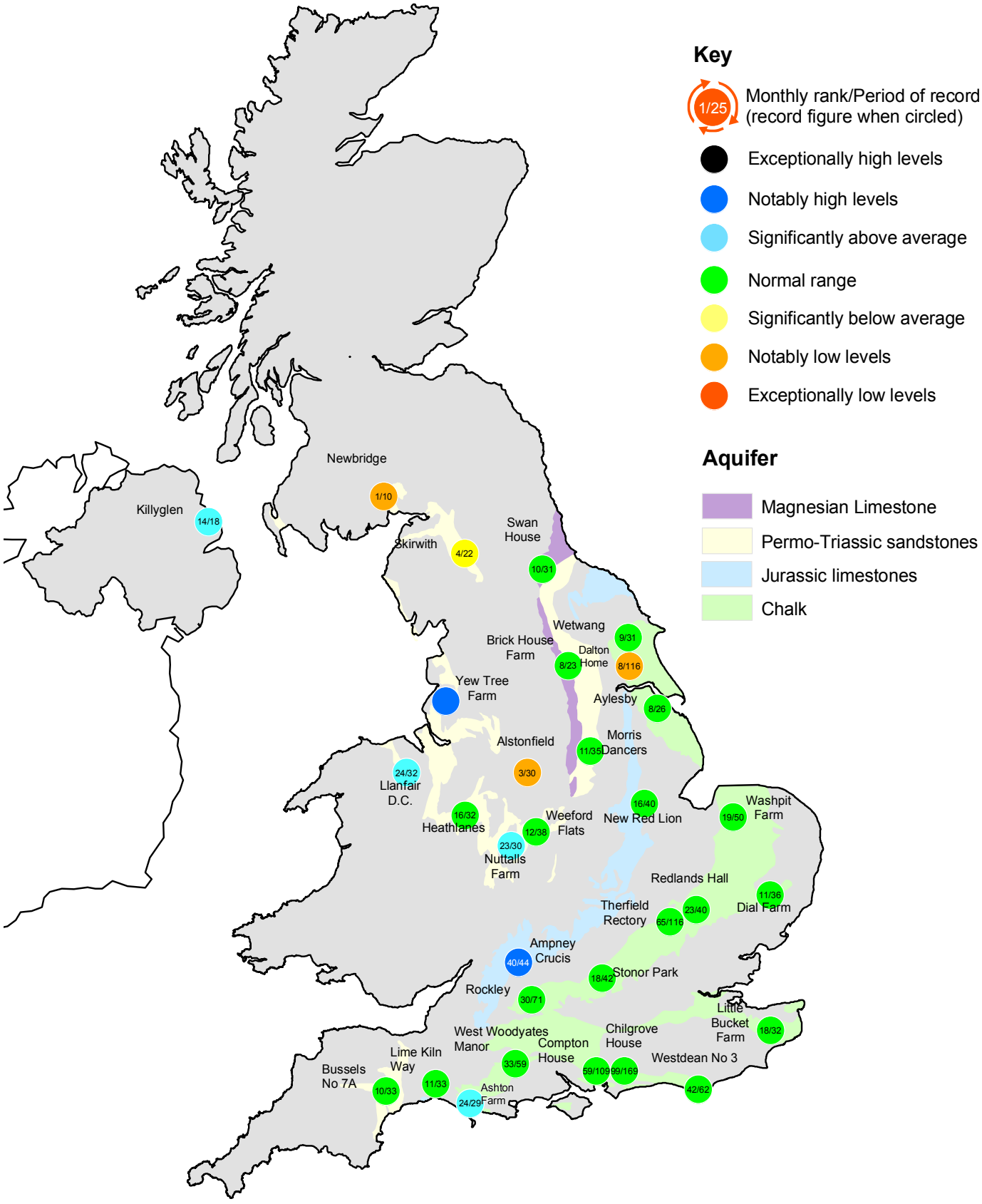




Groundwater levels January / February 2004

Borehole	Level	Date	Jan. av.	Borehole	Level	Date	Jan. av.	Borehole	Level	Date	Jan. av.
Dalton Holme	12.11	12/01	17.23	Chilgrove House	59.62	31/01	56.23	Llanfair DC	80.14	15/01	79.96
Washpit Farm	43.25	07/01	43.77	Killyglen	116.81	31/01	116.14	Morris Dancers	32.11	25/01	32.39
Stonor Park	72.41	03/02	73.85	New Red Lion	14.45	27/01	14.87	Heathlanes	62.02	07/01	61.97
Dial Farm	25.38	07/01	25.50	Ampney Crucis	102.88	03/02	102.33	Nuttalls Farm	130.09	16/01	129.50
Rockley	135.08	03/02	136.35	Newbridge	9.98	07/01	10.81	Bussels No.7a	23.85	30/01	24.14
Little Bucket Farm	69.04	02/02	68.65	Skirwith	129.90	26/01	130.44	Alstonfield	183.03	15/01	199.53
West Woodyates	94.43	31/01	91.66	Yew Tree Farm	14.03	03/12	13.71				

Levels in metres above Ordnance Datum

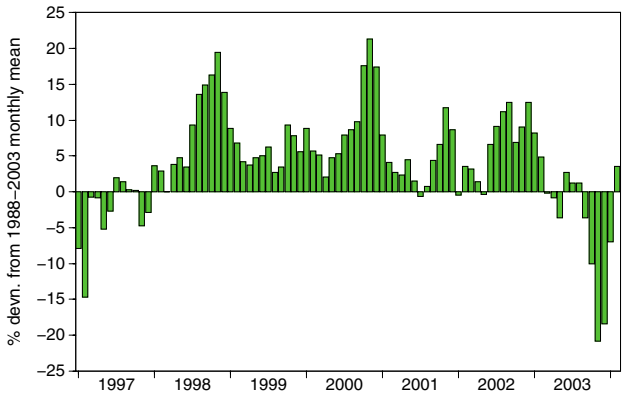


Groundwater levels - January 2004

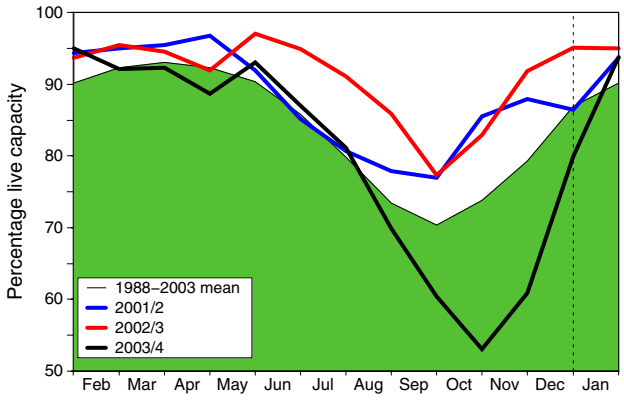
The rankings are based on a comparison between the average level in the featured month (but often only single readings are available) and the average level in each corresponding month on record. They need to be interpreted with caution especially when groundwater levels are changing rapidly or when comparing 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. The Newbridge borehole supercedes Redbank (which was affected by groundwater abstraction). 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.

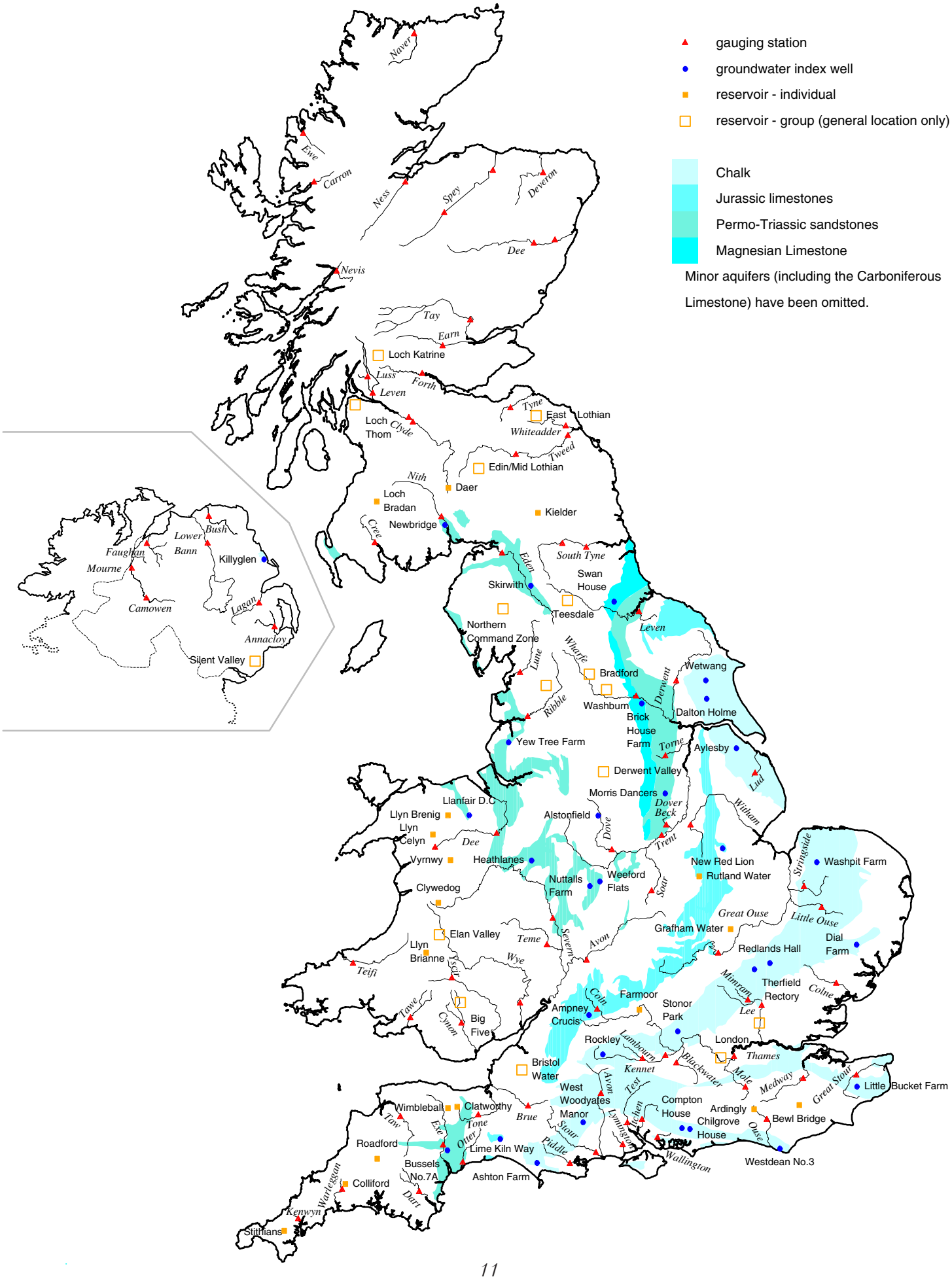
Percentage live capacity of selected reservoirs at start of month

Area	Reservoir	Capacity (Ml)	2003 Sep	Oct	Nov	Dec	2004 Jan	Feb	Min. Jan	Year* of min.
North West	N Command Zone	• 124929	45	37	33	59	83	99	63	1996
	Vyrnwy	55146	70	59	60	64	86	99	45	1996
Northumbrian	Teesdale	• 87936	48	38	39	48	72	92	51	1996
	Kielder	(199175)	(81)	(76)	(66)	(64)	(78)	(96)	(85)	1989
Severn Trent	Clywedog	44922	82	69	61	73	90	96	62	1996
	Derwent Valley	• 39525	62	40	29	37	65	100	15	1996
Yorkshire	Washburn	• 22035	69	58	46	49	69	97	34	1996
	Bradford supply	• 41407	58	51	42	54	72	89	33	1996
Anglian	Grafham	(55490)	(79)	(72)	(64)	(67)	(74)	(82)	(67)	1998
	Rutland	(116580)	(79)	(73)	(66)	(65)	(71)	(81)	(68)	1997
Thames	London	• 202340	71	58	49	62	91	97	70	1997
	Farmoor	• 13830	71	54	43	59	97	96	72	2001
Southern	Bewl	28170	62	55	48	51	63	96	47	1990
	Ardingly	4685	53	32	15	23	41	95	68	1997
Wessex	Clatworthy	5364	43	25	14	16	54	100	62	1989
	Bristol WW	• (38666)	(79)	(79)	(48)	(44)	(64)	(83)	(58)	1992
South West	Colliford	28540	71	64	59	59	54	71	52	1997
	Roadford	34500	71	63	53	51	64	65	30	1996
	Wimbleball	21320	57	46	34	36	72	95	59	1997
	Stithians	5205	68	57	50	46	57	81	38	1992
Welsh	Celyn and Brenig	• 131155	84	77	75	81	91	100	61	1996
	Brianne	62140	85	76	71	81	96	100	84	1997
	Big Five	• 69762	64	48	38	53	76	97	67	1997
	Elan Valley	• 99106	62	48	41	56	88	100	73	1996
Scotland(E)	Edinburgh/Mid Lothian	• 97639	67	56	48	45	65	77	72	1999
	East Lothian	• 10206	67	61	38	38	78	100	68	1990
Scotland(W)	Loch Katrine	• 111363	66	54	40	66	80	98	85	2000
	Daer	22412	66	55	42	73	85	100	91	1997
	Loch Thom	• 11840	77	71	69	72	90	90	90	2004
Northern Ireland	Total+	•	77	64	54	59	62	78	75	2002
	Silent Valley	• 20634	78	62	47	47	54	59	46	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 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. An initiative is underway with The Met Office to provide more accurate areal figures and, since October 1999, to include more raingauges in the analysis. A significant number of additional monthly rainfall totals are currently being provided by the Environment Agencies. 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 Meteorological 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

NATURAL ENVIRONMENT RESEARCH COUNCIL

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