Hydrological Summary
for the United Kingdom

April 2003

General

Apart from a wet and blustery start, the first three weeks of April were mainly dry, extending a dry spell which started in mid-February. Rainfall deficiencies in the 3 month period are nationwide and have caused a sharp spring drought with notably low river flows outside of the south east of England. Persistent high pressure developed early in the month; subtle shifts in its position wrought significant changes in temperature; the highest Scottish April temperature was recorded and temperatures not seen for 50 years or more featured in E&W and NI – this contrasted with a cold interludes and a little snow. The generally sunny conditions, lack of rain and some brisk winds generated high evaporative demands; record totals were estimated for extensive areas along the western seaboard, South Wales, East Anglia, and southern England. From southern Scotland into E&W, evaporation was between 20 and 50% above average and SMDs were more than twice the average over much of England. The water resources position has deteriorated through April; reservoir contents have been below average for 3 successive months and are now about 4% below 1988-2002 figures. The month-end rainfall provided a welcome boost to overall contents and stimulated some rapid recoveries in river flows. The likely end to the recharge season has overall groundwater stocks in a healthy state.

Rainfall

A short spell of rainfall at the beginning of April heralded a return to widespread dry conditions for the following three weeks. Frontal rain from slow moving weather systems arrived in Cumbria, central Scotland and Wales on the 21st -22nd, reducing the risk of forest and heath fires. Cyclonic conditions from the 25th brought significant rainfall to most areas with heavy rainfall in the north and west, resulting in monthly averages closer to the mean. Throughout the UK, rainfall totals were below average, with less than 50% in the Western Isles (particularly), the north east England seaboard, the East Midlands, central London, eastern Kent and south Dorset.

The 3-month accumulated rainfall totals (Feb-Apr) are below 75% of normal over the UK; the driest since 1956, with less than 50% in the Northumbrian and Anglian regions. From March 8-April 24, some places had less than 5mm of rainfall, the northeast of England especially. In Wallingford, the 45 days from 8 March recorded 4 rain-days totalling 2.6 mm. The exceptionally low 9-month accumulation in western and northern Scotland is in strong contrast with E&W, the latter reflecting the heavy autumn rainfall. Over the 12 months from May 2002 however, only western and northern Scotland are below average.

River Flows

Country-wide recessions have persisted since early February through to the last week of April, punctuated by short-lived spates. The severity of the decline in flows was principally linked to whether the rivers had significant baseflow support from the Chalk and Lincolnshire Limestone aquifers; in these cases, April mean flows were close to average - only the Mimram and Itchen of the index rivers were above. For the mixed and less permeable catchments elsewhere, all monthly flows were depressed, many notably so. Worst affected were from Cumbria and Northumberland north into Scotland, where a wide spread of stations recorded new April monthly minima, including the rivers Ness, Spey, Dee, Don, Tay, Tweed, Nevis, and Carron. Many other index rivers were exhibiting their 2nd or 3rd lowest monthly April flows. The rivers Ness, Tweed (at Norham), Tawe, Luss Water, Nevis and Naver all recorded their lowest daily April flows.

Low 3-monthly accumulations (Feb-Apr) in northern Scotland and Northumbria are similarly notable, with the Luss Water, Nevis, Naver and South Tyne registering new minima.

The final week of April saw significant rainfall generating some very rapid hydrograph responses, such as in the Tawe and Cynon; unsettled conditions early in May should generate widespread flow recovery, particularly in impermeable catchments.

Groundwater

The combination of low rainfall, high evaporative demand and consequent high SMDs has probably terminated the recharge season. For the majority of index wells the dry late winter and early spring have seen recessions of varying severity. The slowest responding wells in central area of the Chilterns were still exhibiting water levels close to the 2002-3 maximum, but these moderated eastwards though East Anglian and eastern Kent levels are still above or well above average. The northern and southern Chalk is characterised by levels close to or slightly below average, whilst in the far west of the Chalk outcrop some wells show more depressed levels. The Chalk in Northern Ireland has shown the greatest diminution in storage, although the record is short. The Permo-Triassic sandstones do not present a coherent picture; those wells in the West Midlands and Lancashire have levels well above average or close to the maximum recorded. In the Eden valley (Cumbria), Devon, the Welsh Dee valley and Nottinghamshire levels are close to average.

The resources picture for groundwater is generally satisfactory; May is typically the last month where stocks may be replenished but this looks unlikely in the lowlands and attention will focus on the development of SMDs throughout the summer and their persistence into the autumn.

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

British Geological Survey
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Rainfall . . . Rainfall . . .

Rainfall accumulations and return period estimates

Area	Rainfall	Apr 2003	Feb 03-Apr 03	RP	Dec 02-Apr 03	RP	Aug 02-Apr 03	RP	May 02-Apr 03	RP
England & Wales	**mm**	**45**	**122**		**361**		**798**		**1028**	
	%	**74**	**61**	**10-20**	**93**	**2-5**	**111**	**2-5**	**113**	**5-10**
North West	mm	63	180		416		886		1210	
	%	88	74	5-10	85	2-5	92	2-5	101	2-5
Northumbrian	mm	33	89		283		640		865	
	%	58	48	40-60	81	5-10	96	2-5	101	2-5
Severn Trent	mm	41	101		269		588		787	
	%	74	59	10-20	85	2-5	101	2-5	104	2-5
Yorkshire	mm	41	107		304		692		901	
	%	69	58	15-25	87	2-5	108	2-5	110	2-5
Anglian	mm	26	65		235		516		694	
	%	56	50	30-45	100	<2	115	5-10	116	5-10
Thames	mm	35	84		286		597		805	
	%	70	56	10-20	100	<2	113	2-5	117	5-10
Southern	mm	31	90		329		683		894	
	%	59	53	15-25	99	2-5	110	2-5	115	5-10
Wessex	mm	39	116		326		746		959	
	%	73	62	5-15	89	2-5	112	2-5	114	5-10
South West	mm	58	185		458		927		1193	
	%	84	69	5-10	84	2-5	96	2-5	102	2-5
Welsh	mm	67	202		488		1037		1309	
	%	84	71	5-10	84	2-5	96	2-5	100	<2
Scotland	**mm**	**57**	**198**		**434**		**898**		**1260**	
	%	**74**	**65**	**20-30**	**72**	**20-35**	**77**	**30-45**	**88**	**5-10**
Highland	mm	63	246		515		913		1283	
	%	69	65	15-25	67	30-45	62	>>200	73	110-150
North East	mm	53	121		317		820		1106	
	%	89	60	20-35	80	5-10	107	2-5	114	5-10
Tay	mm	61	179		398		906		1294	
	%	99	67	5-15	74	5-15	91	2-5	105	2-5
Forth	mm	53	144		327		789		1128	
	%	90	62	15-25	71	10-20	89	2-5	102	2-5
Tweed	mm	40	114		308		724		997	
	%	69	56	20-35	78	5-10	95	2-5	103	2-5
Solway	mm	66	214		460		1071		1479	
	%	85	73	5-10	77	5-10	92	2-5	104	2-5
Clyde	mm	57	227		465		1009		1447	
	%	68	65	10-20	65	30-50	72	35-50	85	5-15
Northern Ireland	**mm**	**52**	**163**		**340**		**803**		**1152**	
	%	**82**	**71**	**5-10**	**76**	**5-10**	**94**	**2-5**	**109**	**2-5**

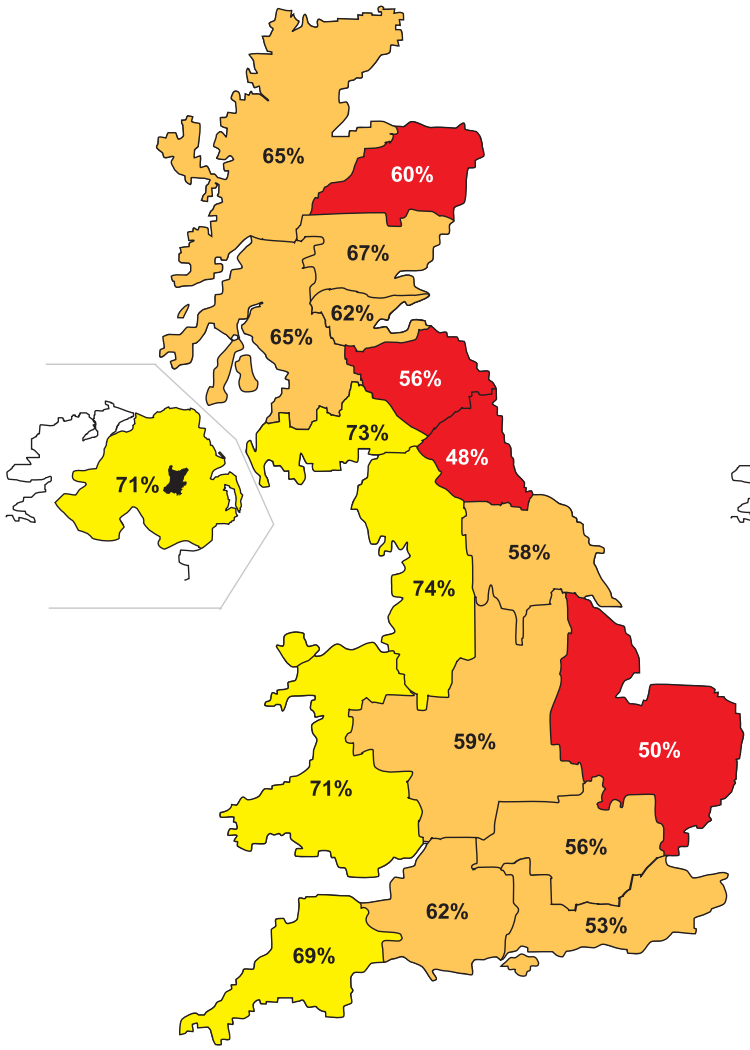
RP = Return period

 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.

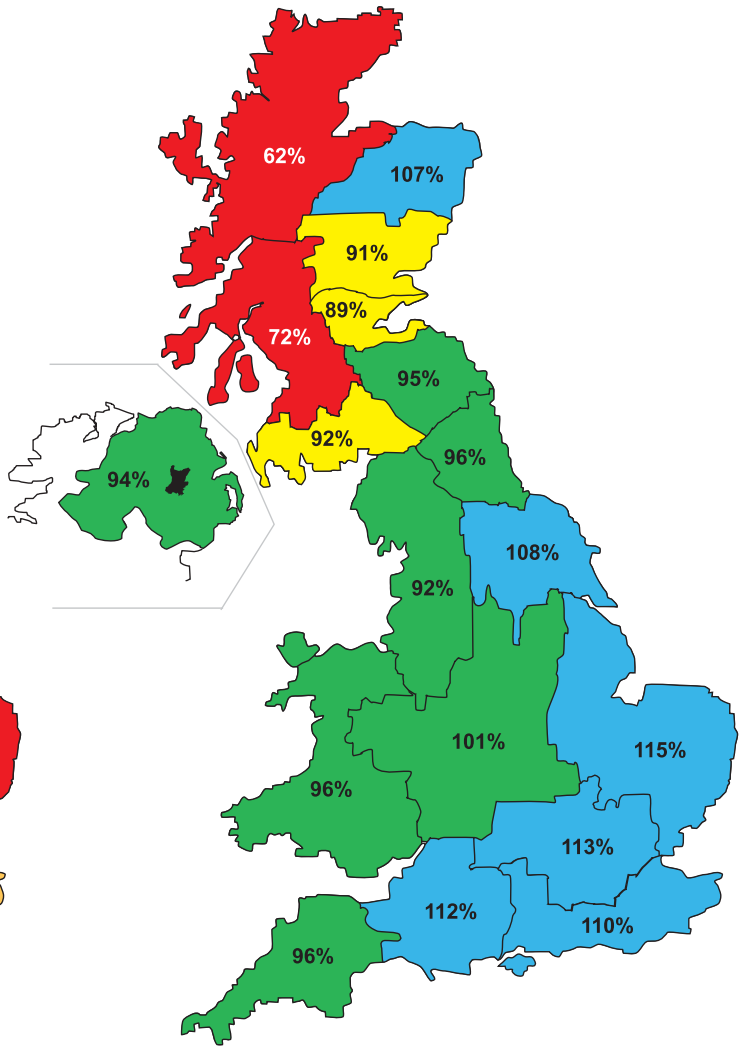
Rainfall . . . Rainfall . .

Key

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



February 2003 - April 2003

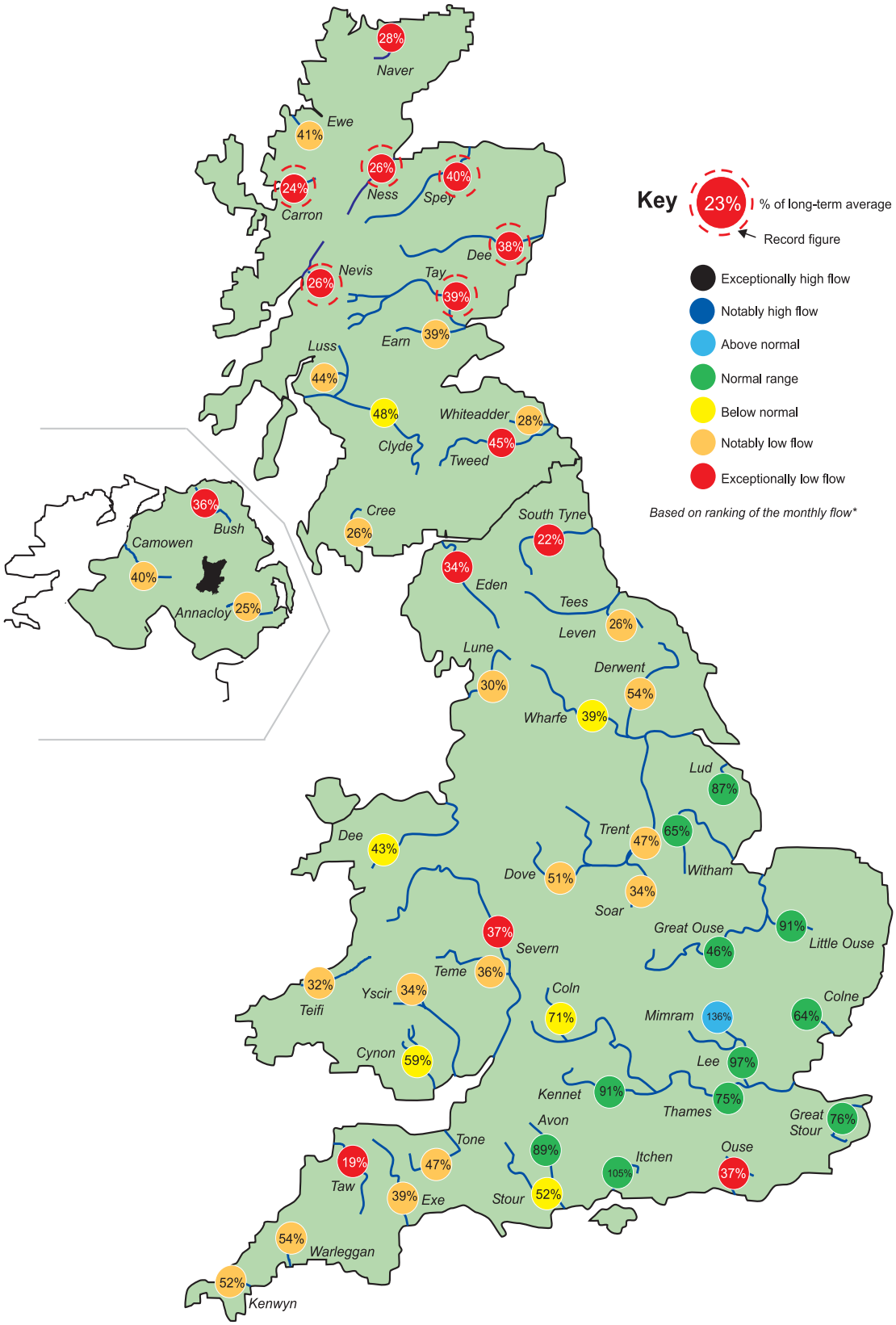


August 2002 - April 2003

Rainfall accumulation maps

Provisionally, comparing February - April accumulations, 2003 was the driest since 1976 in E&W and since 1969 in Scotland. Precipitation in the North East, Tweed and Northumbrian regions for those 3 months has been the lowest in at least 40 years, and in Anglian, the driest since 1976. For Scotland as a whole, in the 9 month timeframe August-April has been the driest for 30 years, with the Highland and Clyde areas experiencing their driest August-April since 1968/1969.

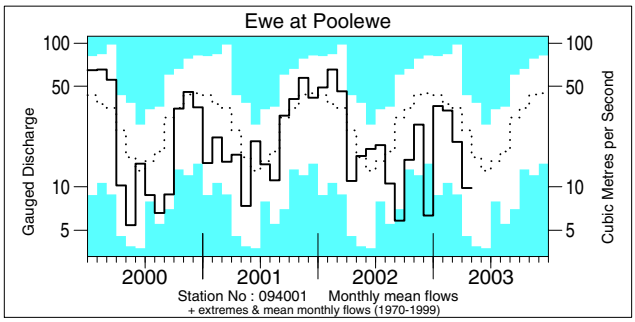
River flow . . . River flow . . .

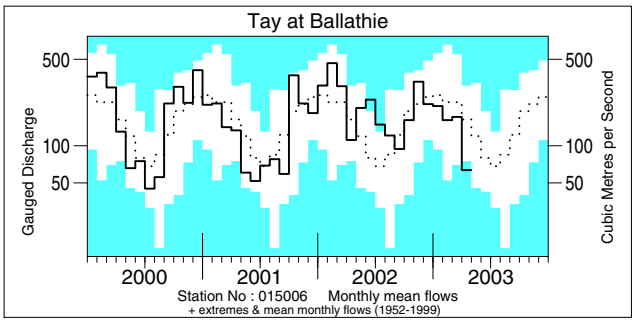


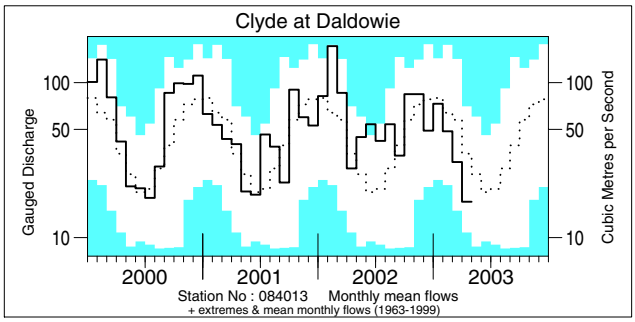
River flows - April 2003

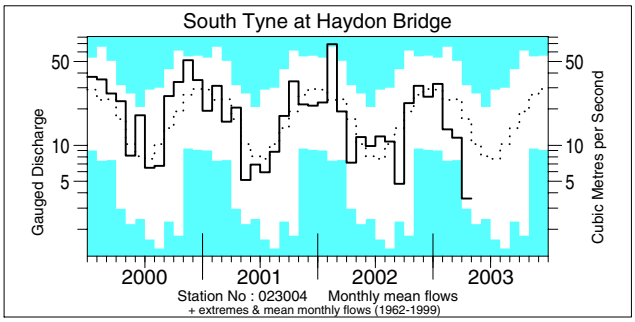
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

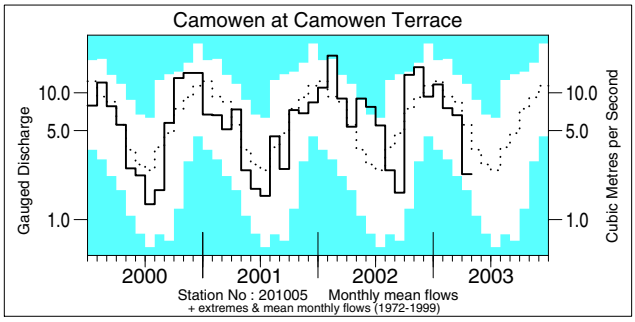
River flow . . . River flow . . .

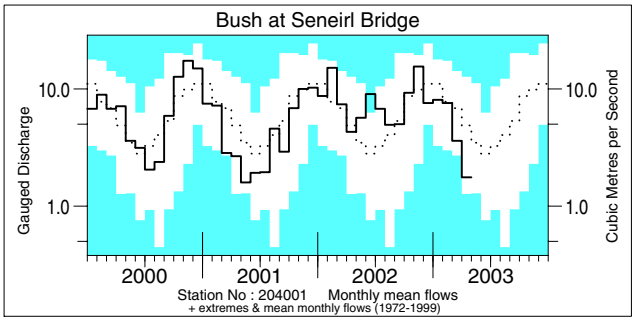


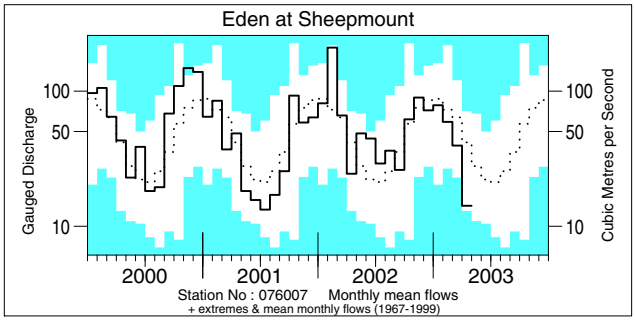


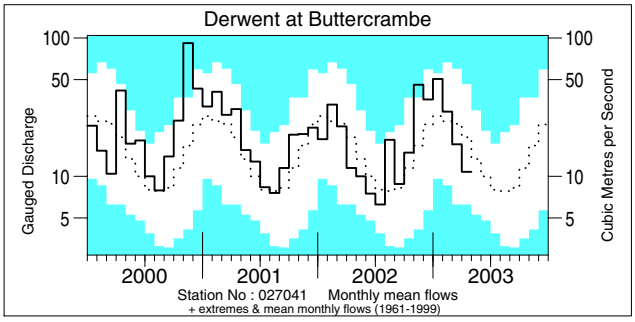


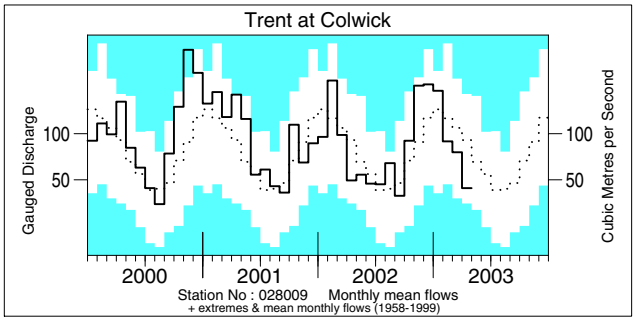


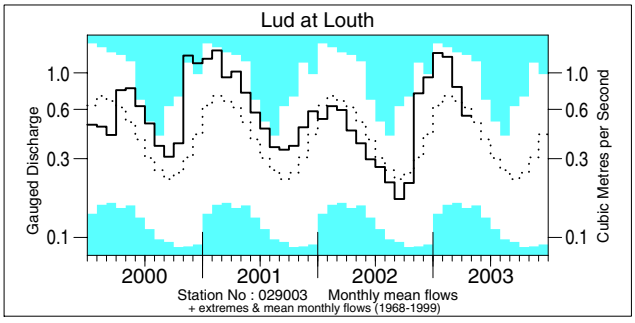








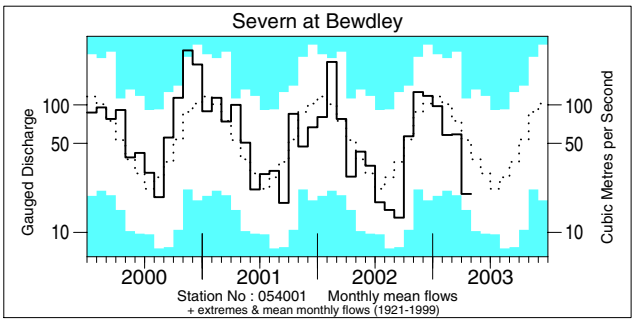


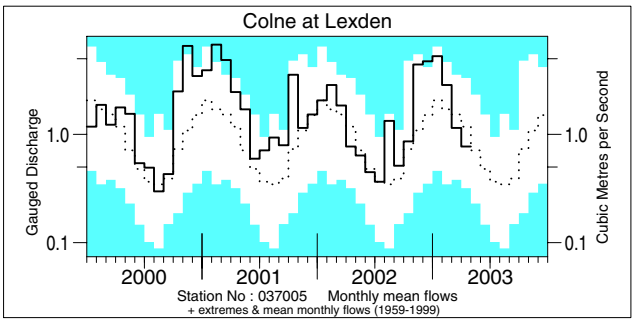


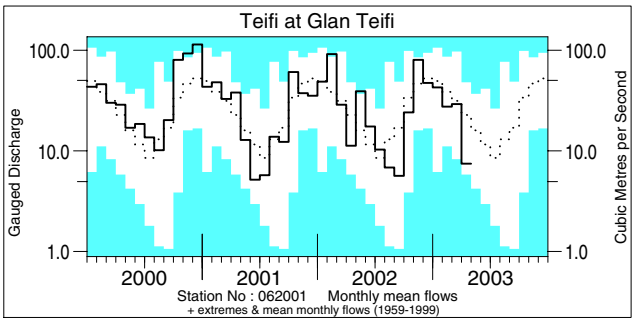
Monthly river flow hydrographs

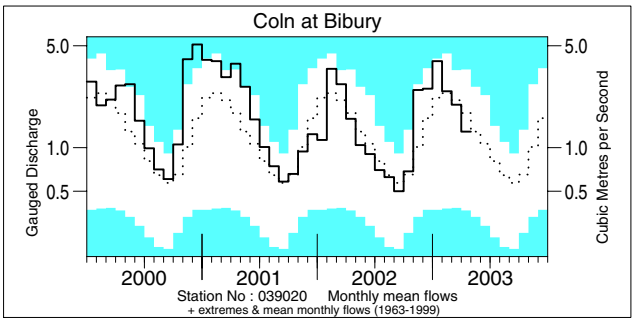
The river flow hydrographs show the monthly mean flow (bold trace), the long term average monthly flow (dotted trace) and the maximum and minimum flow prior to 2000 (shown by the shaded areas). Monthly flows falling outside the maximum/ minimum range are indicated where the bold trace enters the shaded areas.

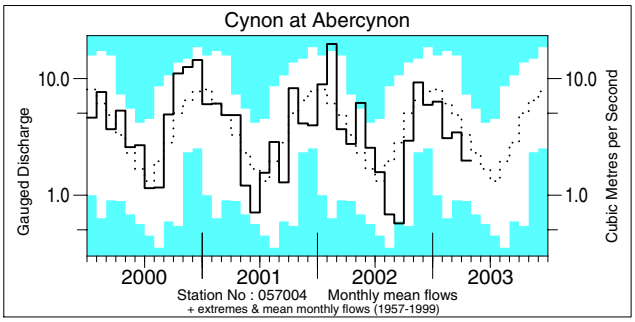
River flow . . . River flow . . .

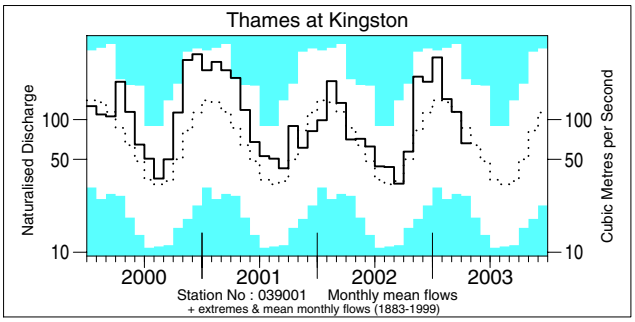


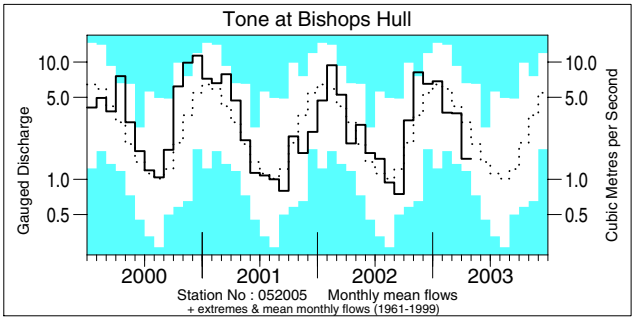


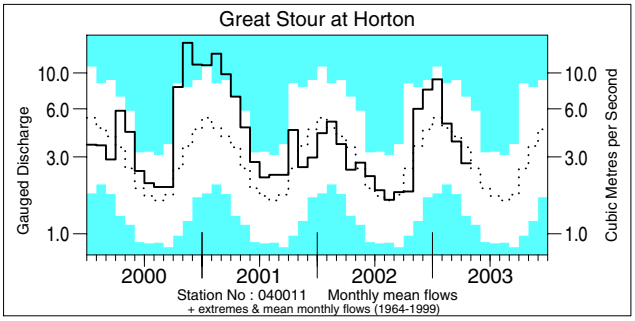


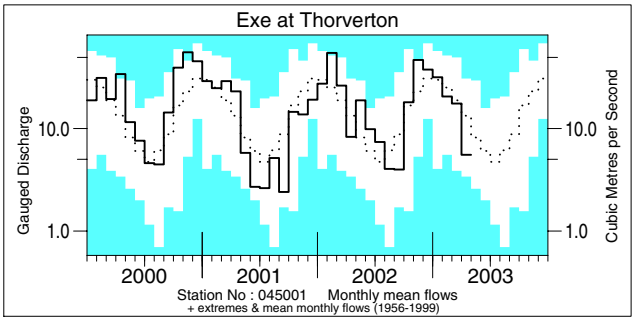


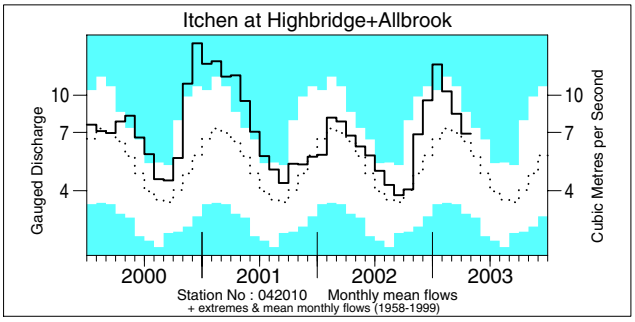












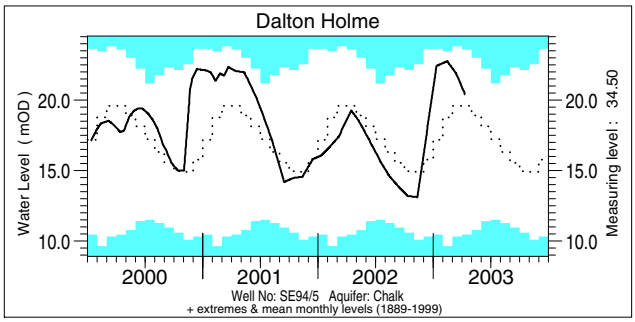
Notable runoff accumulations (a) February 2003- April 2003, (b) August 2002 -April 2003

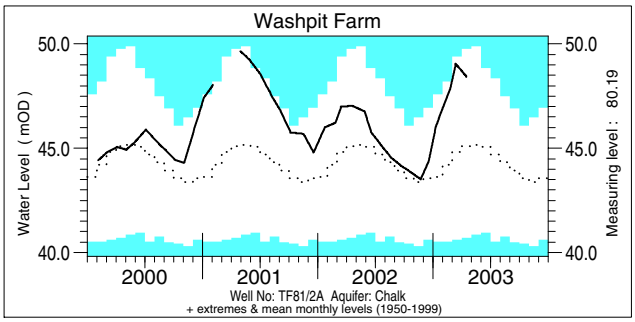
	River	%lta	Rank	River	%lta	Rank
a)	Spey	66	3/51	Yscir	58	3/31
	Dee	60	2/31	Eden	62	3/36
	Tay	64	5/51	Cree	61	3/40
	Tyne	57	3/39	Luss	47	1/26
	Whiteadder	40	2/34	Nevis	45	1/21
	Tweed	62	3/43	Naver	50	1/26
	South Tyne	44	1/41	Annacloy	69	2/24
	Soar	49	3/32			

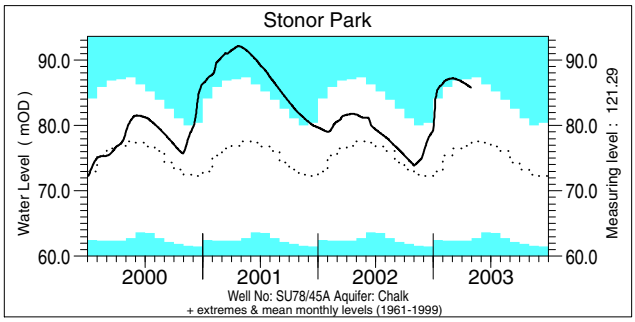
	River	%lta	Rank
b)	Ness	53	1/30
	Deveron	134	38/40
	Stringside	192	35/36
	Blackwater	149	49/50
	Wilts. Avon	164	37/38
	Carron	43	1/24
	Ewe	53	1/32
	Annacloy	140	22/23

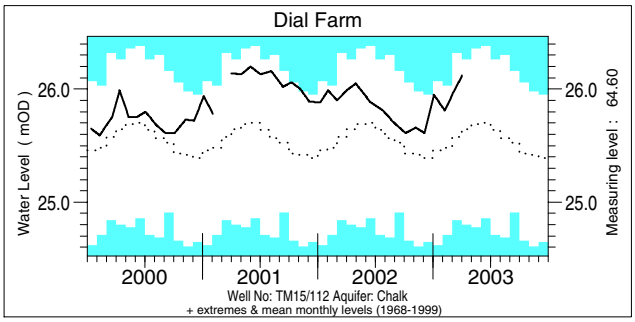
lta = long term average
Rank 1 = lowest on record

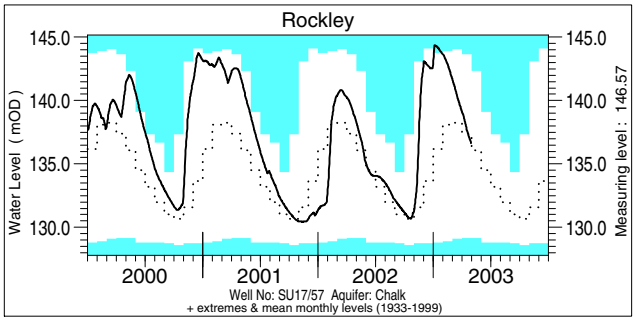
Groundwater . . . Groundwater

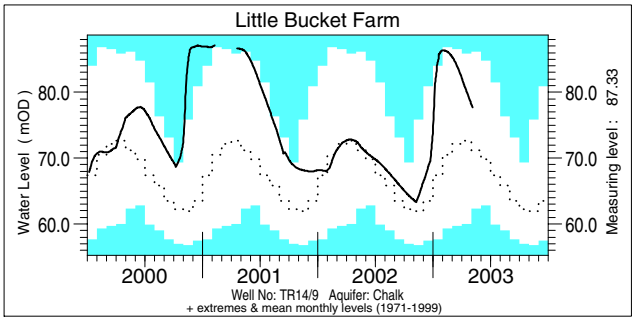


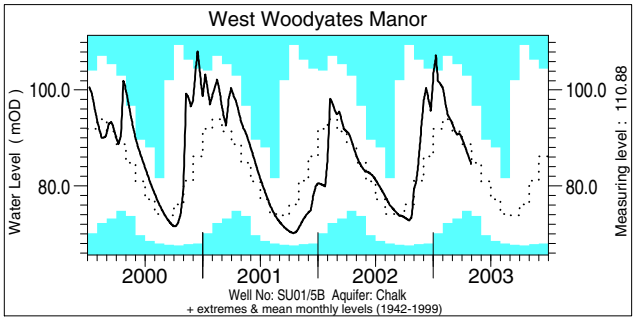


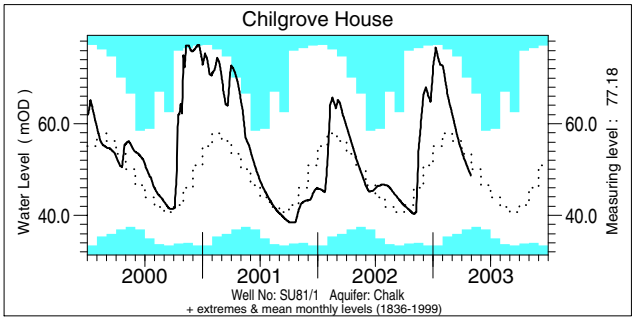


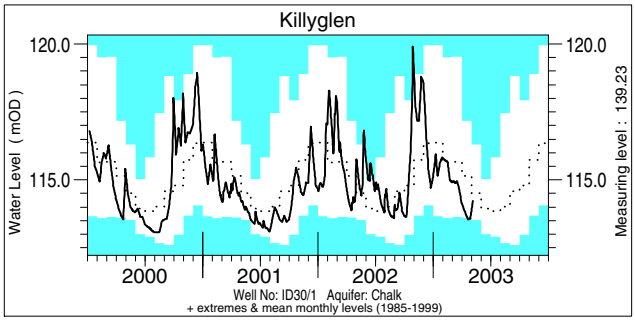


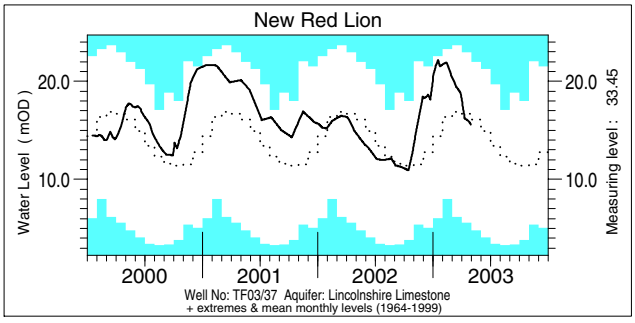






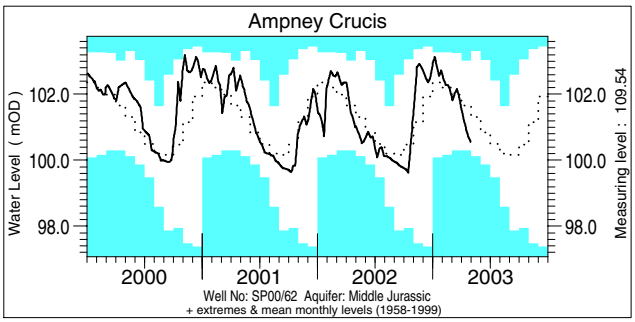


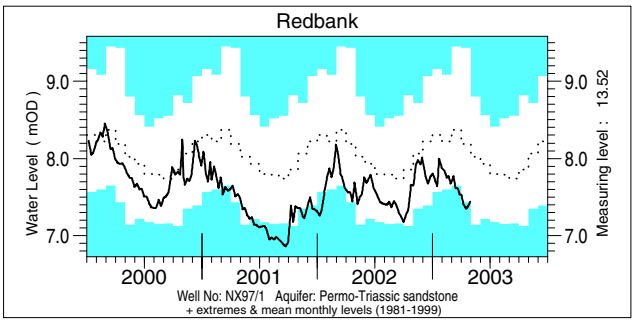


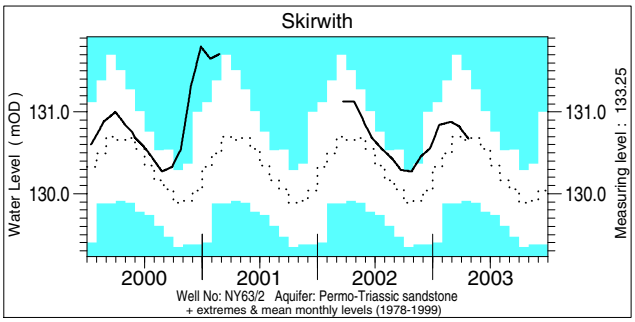


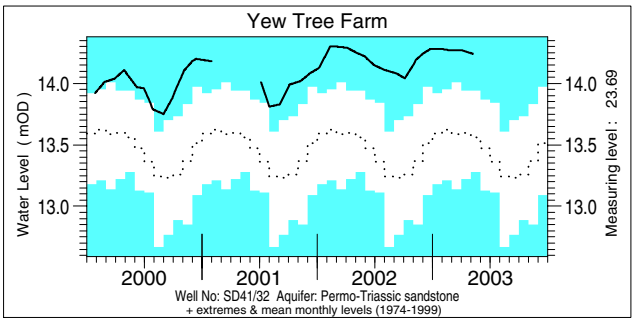
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

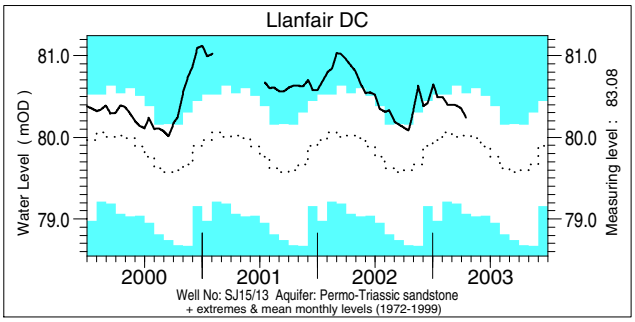
Groundwater . . . Groundwater

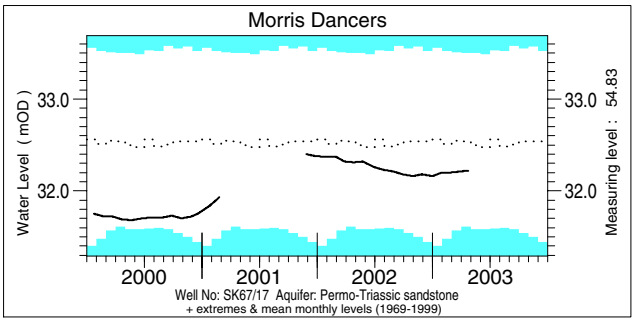


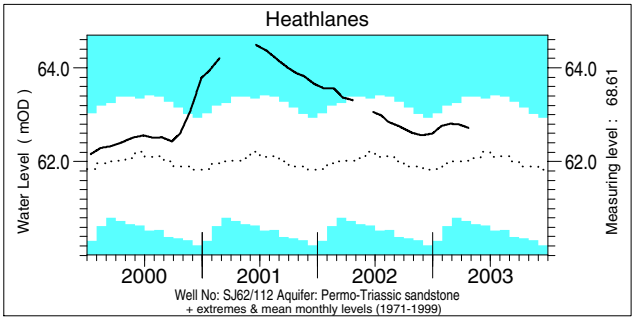


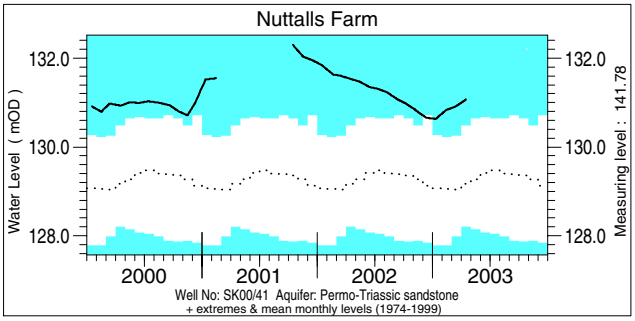


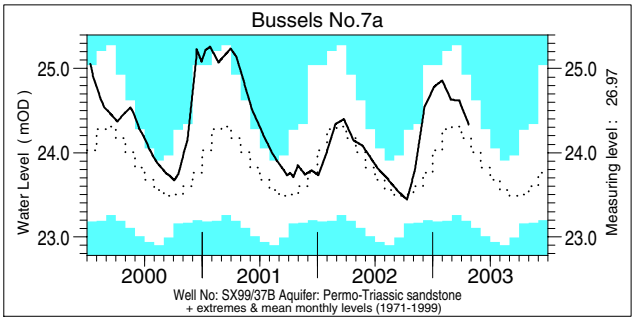


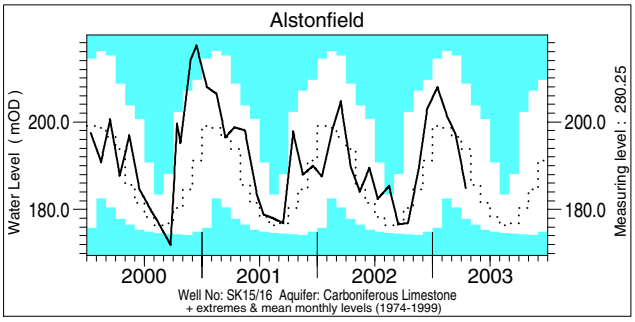










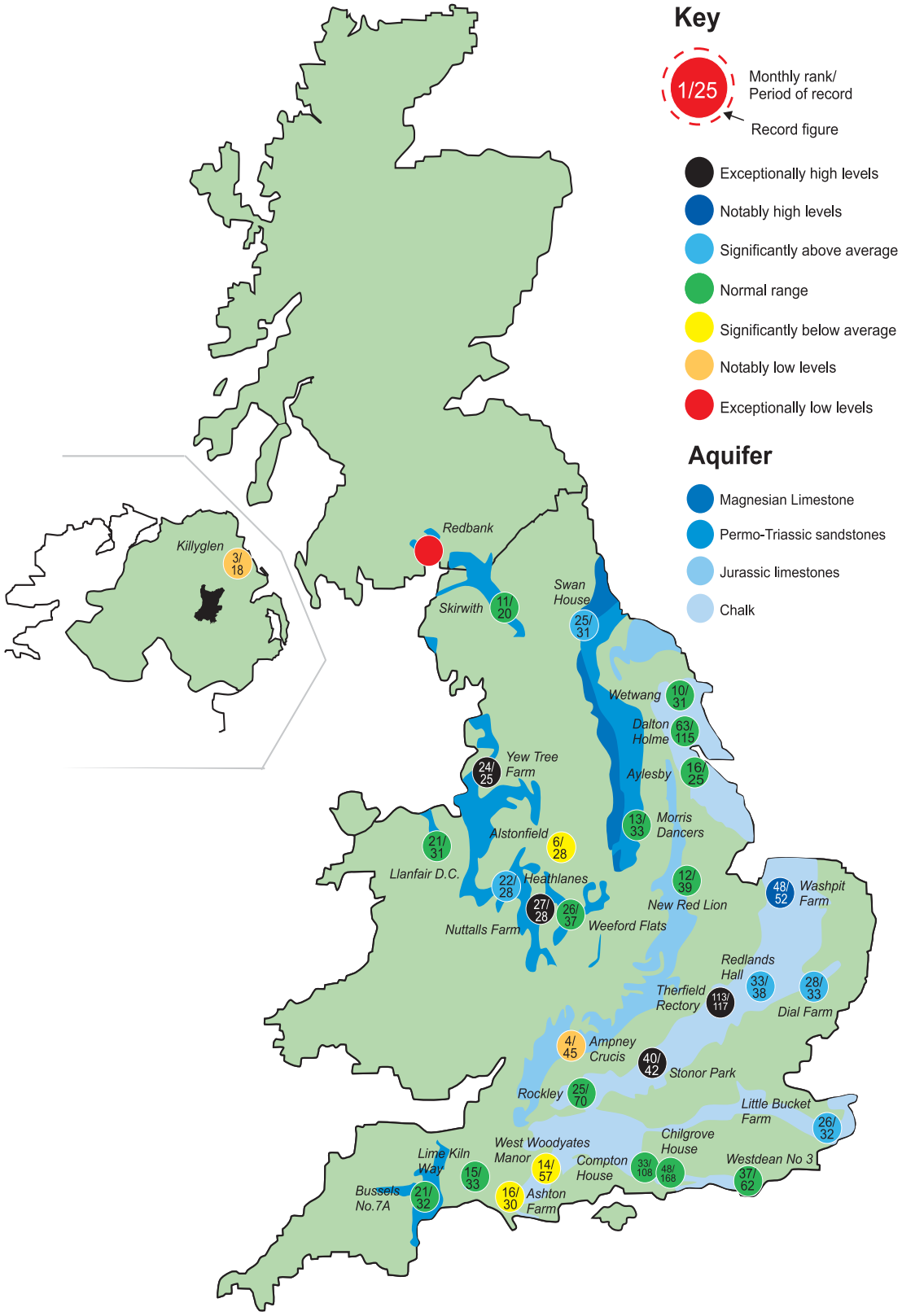


Groundwater levels April 2003 / May 2003

Borehole	Level	Date	Apr. av.	Borehole	Level	Date	Apr. av.	Borehole	Level	Date	Apr. av.
Dalton Holme	20.42	10/04	19.52	Chilgrove House	48.64	30/04	52.32	Llanfair DC	80.24	15/04	80.00
Washpit Farm	48.43	16/04	45.33	Killyglen	114.23	05/05	115.03	Morris Dancers	32.22	24/04	32.39
Stonor Park	85.78	30/04	77.83	New Red Lion	15.57	30/04	16.52	Heathlanes	62.72	23/04	62.08
Dial Farm	26.12	01/04	25.68	Ampney Crucis	100.55	30/04	101.74	Nuttalls Farm	131.07	16/04	129.45
Rockley	136.61	30/04	137.59	Redbank	7.44	29/04	8.17	Bussels No.7a	24.33	24/04	24.19
Little Bucket Farm	77.66	05/05	72.41	Skirwith	130.67	23/04	130.65	Alstonfield	184.91	15/04	193.56
West Woodyates	84.57	30/04	88.51	Yew Tree Farm	14.24	08/05	13.64				

Levels in metres above Ordnance Datum

Groundwater . . . Groundwater

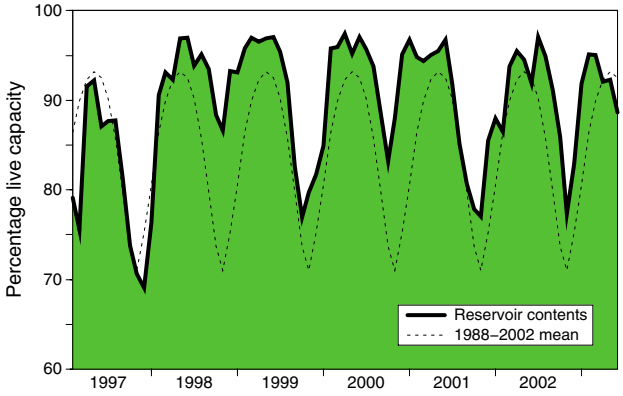


Groundwater levels - April 2003

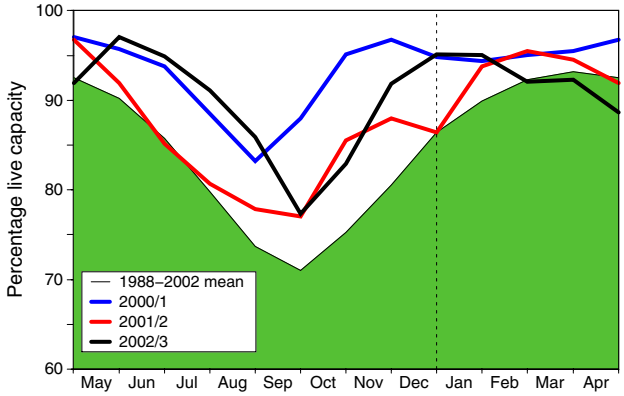
The rankings are based on a comparison between the average level in the featured month (but often only single readings are available) and the average level in each corresponding month on record. They need to be interpreted with caution especially when groundwater levels are changing rapidly or when comparing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

(Note: Redbank is affected by groundwater abstraction.)

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.

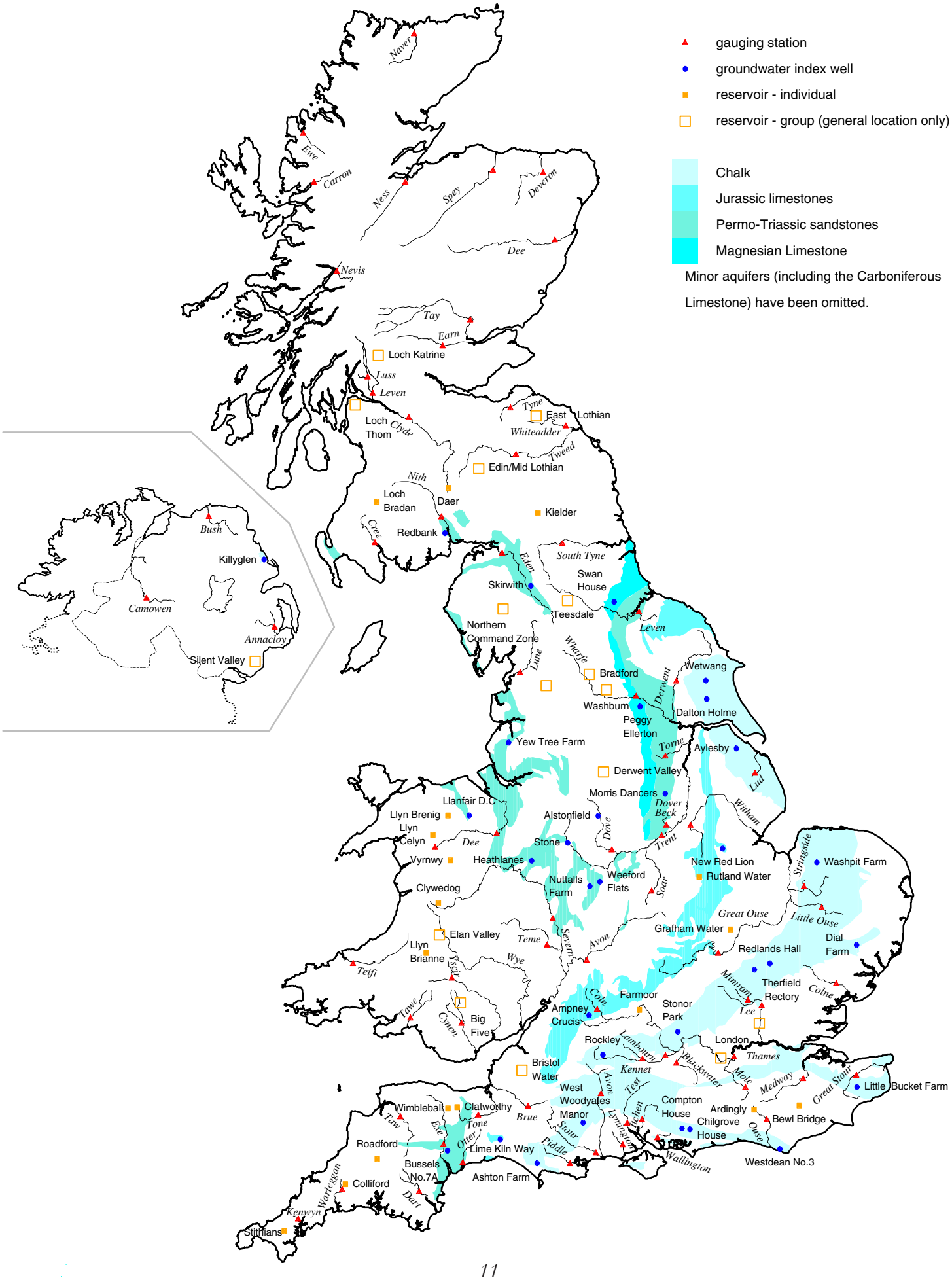
Percentage live capacity of selected reservoirs at start of month

Area	Reservoir	Capacity (Ml)	2002 Dec	2003 Jan	Feb	Mar	Apr	May	Min. May	Year* of min.
North West	N Command Zone	• 124929	79	86	93	89	88	**74**	74	2003
	Vyrnwy	55146	99	99	94	92	94	**90**	70	1996
Northumbrian	Teesdale	• 87936	92	93	93	79	77	**74**	74	2003
	Kielder	(199175)	(90)	(99)	(99)	(91)	(90)	**(92)**	(85)	1990
Severn Trent	Clywedog	44922	78	88	81	85	96	**97**	85	1988
	Derwent Valley	• 39525	99	100	98	98	96	**86**	54	1996
Yorkshire	Washburn	• 22035	90	99	97	97	90	**78**	76	1996
	Bradford supply	• 41407	100	100	100	96	94	**85**	60	1996
Anglian	Grafham	(55490)	(90)	(89)	(84)	(86)	(91)	**(94)**	(73)	1997
	Rutland	(116580)	(94)	(93)	(90)	(87)	(93)	**(95)**	(72)	1997
Thames	London	• 202340	96	97	97	92	94	**94**	86	1990
	Farmoor	• 13830	94	91	91	93	93	**94**	81	2000
Southern	Bewl	28170	80	86	92	92	92	**90**	63	1990
	Ardingly	4685	100	100	100	100	100	**100**		
Wessex	Clatworthy	5364	100	100	100	100	99	**86**	81	1990
	Bristol WW	• (38666)	(93)	(99)	(98)	(97)	(96)	**(91)**	(85)	1990
South West	Colliford	28540	71	78	81	83	83	**81**	56	1997
	Roadford	34500	91	95	92	92	91	**87**	41	1996
	Wimbleball	21320	98	100	100	100	98	**92**	79	1992
	Stithians	5205	84	100	99	100	96	**89**	65	1992
Welsh	Celyn and Brenig	• 131155	94	96	96	99	98	**94**	75	1996
	Brianne	62140	98	99	99	97	95	**88**	86	1997
	Big Five	• 69762	89	96	99	98	95	**86**	85	1997
	Elan Valley	• 99106	100	100	100	99	96	**87**	87	2003
Scotland(E)	Edinburgh/Mid Lothian	• 97639	94	95	99	96	94	**87**	62	1998
	East Lothian	• 10206	99	99	100	98	96	**95**	89	1992
Scotland(W)	Loch Katrine	• 111363	88	89	97	95	89	**87**	83	2001
	Daer	22412	100	100	99	95	97	**89**	89	2003
	Loch Thom	• 11840	100	100	100	100	94	**88**	88	2003
Northern Ireland	Total+	•	100	99	98	96	94	**80**	80	2003
	Silent Valley	• 20634	100	98	98	92	93	**79**	58	2000

() 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 minimum storage figures relate to the 1988-2003 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 regional divisions of the EA (England and Wales) and SEPA (Scotland), data for Northern Ireland are provided by 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 (address 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; over the coming months further monthly raingauge totals will be included for selected regions. Until the access to these additional data has stabilised the regional figures (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:

Hydrological Summaries
National Water Archive
CEH Wallingford
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Oxfordshire
OX10 8BB
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Fax: 01491 692424
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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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