Hydrological summary
for the United Kingdom

April 2002

General

April was an exceptionally mild and sunny month in most regions. Rainfall for the UK as a whole was close to the April average, but spatial variations were large - much of eastern and southern Britain experienced an extremely dry spell until late in the month. The subsequent return of rain-bearing frontal systems was especially welcome to farmers but the late-April rainfall was too late to be hydrologically effective in the eastern lowlands – seasonally high evaporative demands produced very dry soil conditions by the third week, almost certainly signalling the end of the aquifer recharge season. Despite spate conditions late in the month April runoff totals were generally well below average. However, most pumped storage reservoirs modestly increased their stocks (as usual in April) whilst appreciable reductions over the month were reported from most gravity-fed impoundments. Early May stocks were relatively low in some small reservoirs (e.g. in Yorkshire, Cornwall and Northern Ireland), and generally, reservoirs were at their lowest, for the time of year, since 1996 or 1997. Nonetheless, overall stocks for England and Wales are only marginally below average whilst groundwaters levels remain close to, or above, average throughout almost all major aquifer outcrops.

Rainfall

High pressure dominated synoptic patterns over much of the country for most of April; most low pressure systems followed tracks well to the north of the English Lowlands. In western regions significant rainfall was associated with a slow-moving Atlantic frontal system in mid-month; 24-hour rainfall totals reached 60 mm at Nantmor (North Wales) and Belfast registered > 20 mm on both the 17th and 18th; some locally intense thunderstorms were reported in eastern England also. Boisterous weather conditions over the final week were associated with successive pulses of rain across much of the country - Loch Glascarnoch (NW Scotland) reported 52 mm on the 29th whilst, in the South, rainfall on the 26th terminated a short but intense drought stretching back 35 days. In some central areas, rainfall during this episode was < 5 mm (normally totals would be in the 40-60 mm range). April rainfall totals reflected the general synoptic pattern - the 100% isopleth broadly partitioning Britain between the wetter west where a few catchments registered > 150% and the much drier east where many sheltered catchments recorded less than 60%, a few localities on the north-east coast of England registered <35% . Provisional rainfall totals for January-April suggest that Scotland and Northern Ireland have both had their fourth wettest start to the year on record. Regional accumulations over longer timespans are mostly well within the normal range.

River Flows

April began with river flows in brisk recession across much of the UK. Locally, these recessions were interrupted in mid-month (e.g. in Northern Ireland) but generally continued well into the third week when particularly depressed flows characterised most western and northern catchments. On the 20th, the Tay registered its lowest April flow since 1974 and the Luss established a new April daily flow minima (on the 22nd). Long term April minima were approached over wide areas as flow patterns showed similarities to the sustained recessions experienced in the spring of 1997. The wet spell over the final week of the month generated a dramatic increase in flows rates, in the west especially. In South Wales, the rivers Tawe and Cynon reported their highest April flow on record and modest floodplain inundations were common. However, these spates were generally insufficient to counterbalance the preceding low flows; only a few April runoff totals (e.g. in western Scotland and spring-fed streams in southern England) exceeded the average - most were in the lowest quartile, the Spey registered its lowest April runoff since 1981. Runoff totals for the last three months are generally above average, notably so in northern and western catchments.

Groundwater

High temperatures combined with record sunshine totals (in some areas) produced exceptional evaporative demands during April (> 25% above average for the month over wide areas). These, together with the limited rainfall over most aquifer outcrop areas, resulted in a steep increase in soil moisture deficits. Entering the final week of April lowland smds were more typical of early June. Some significant April infiltration occurred in the west but, in the absence of exceptional May rainfall, the recharge season has terminated in the east. Groundwater levels in all but the slowest responding Chalk wells and boreholes are in decline. April levels were close to, or a little above, the April average in almost all outcrop areas. Levels in most limestone aquifers are also very close to the seasonal average and generally a little above average in most minor eastern aquifers (e.g. the Norfolk Drift and Essex Gravels). However in most of the much slower responding Permo-Triassic sandstones outcrops levels remain exceptionally high – still above pre-2000 maxima in many areas (e.g. in North Wales and the North West). The importance of groundwater – both in relation to resources and its contribution to river flow, in the lowlands especially – will be underlined in the event of a dry summer.

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 2002	Mar02-Apr02	RP	Jan02-Apr02	RP	Oct01-Apr02	RP	May01-Apr02	RP
England & Wales	**mm**	**45**	**98**		**297**		**542**		**866**	
	%	**74**	**73**	**5-10**	**102**	**2-5**	**96**	**2-5**	**95**	**2-5**
North West	mm	83	144		496		824		1222	
	%	116	86	2-5	136	10-20	111	2-5	102	2-5
Northumbrian	mm	39	93		311		540		838	
	%	70	74	2-5	116	2-5	106	2-5	98	2-5
Severn Trent	mm	45	80		252		445		740	
	%	82	69	5-10	105	2-5	98	2-5	98	2-5
Yorkshire	mm	39	81		259		463		764	
	%	65	64	5-10	98	2-5	93	2-5	93	2-5
Anglian	mm	32	67		166		322		624	
	%	70	72	2-5	92	2-5	94	2-5	105	2-5
Thames	mm	44	87		242		428		690	
	%	88	82	2-5	113	2-5	104	2-5	100	<2
Southern	mm	38	84		262		466		724	
	%	71	72	2-5	105	2-5	94	2-5	93	2-5
Wessex	mm	53	106		310		530		767	
	%	100	86	2-5	113	2-5	100	<2	92	2-5
South West	mm	64	141		456		756		1011	
	%	93	84	2-5	112	2-5	96	2-5	86	5-10
Welsh	mm	94	158		536		933		1333	
	%	117	84	2-5	126	5-10	109	2-5	101	2-5
Scotland	**mm**	**89**	**214**		**655**		**1101**		**1520**	
	%	**117**	**106**	**2-5**	**144**	**70-100**	**121**	**10-20**	**106**	**2-5**
Highland	mm	106	272		817		1405		1907	
	%	117	107	2-5	144	40-60	121	5-15	108	5-10
North East	mm	45	106		331		638		982	
	%	75	77	2-5	109	2-5	108	2-5	101	2-5
Tay	mm	67	181		602		964		1328	
	%	108	106	2-5	147	30-45	122	5-15	108	2-5
Forth	mm	73	171		513		806		1144	
	%	124	112	2-5	146	30-50	117	5-10	103	2-5
Tweed	mm	61	126		424		678		997	
	%	107	93	2-5	140	20-30	116	5-10	103	2-5
Solway	mm	108	199		652		1041		1444	
	%	140	102	2-5	145	30-45	116	5-10	102	2-5
Clyde	mm	115	272		812		1313		1819	
	%	137	118	2-5	151	80-120	120	5-15	107	2-5
Northern Ireland	**mm**	**101**	**167**		**453**		**705**		**1027**	
	%	**158**	**110**	**2-5**	**133**	**5-15**	**107**	**2-5**	**97**	**2-5**

RP = Return period

The monthly rainfall figures[*] are copyright of The Met Office and may not be passed on to, or published by, any unauthorised person or organisation. **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

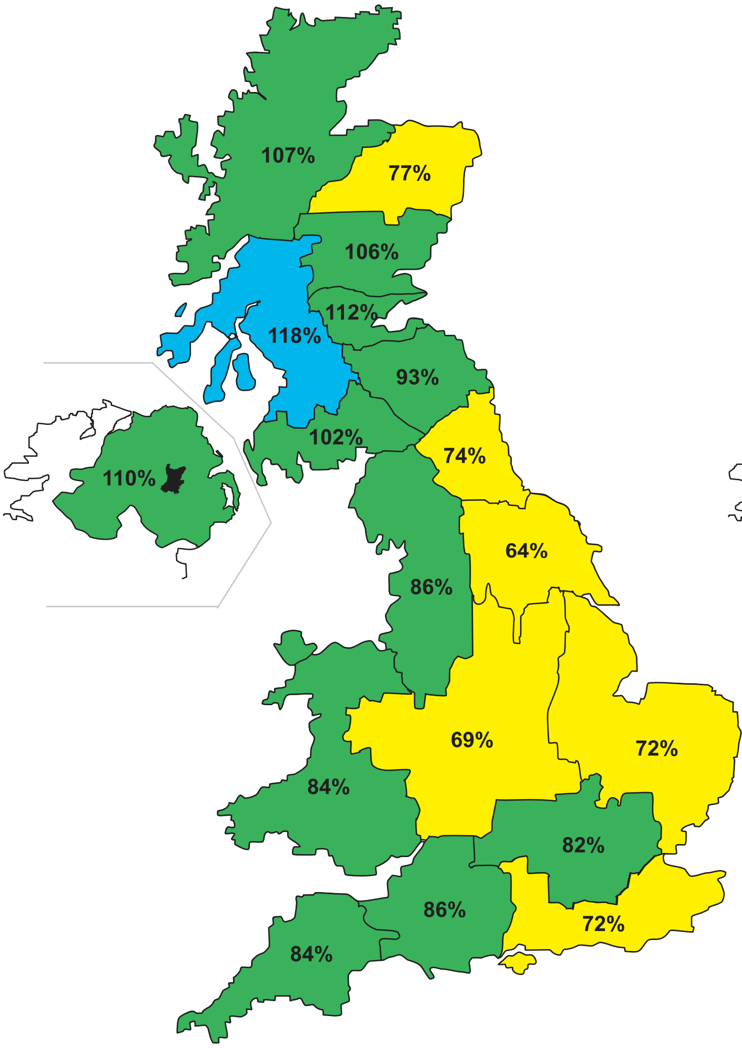
Above average

Normal range

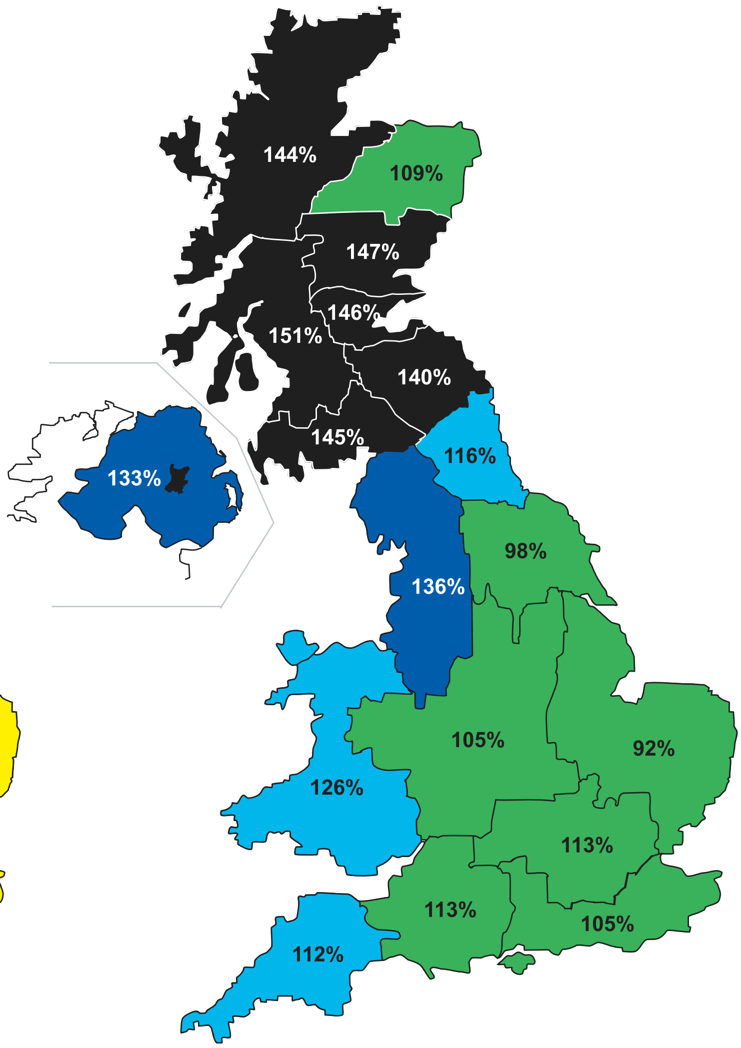
Below average

Substantially below average

Exceptionally low rainfall



March 2002 - April 2002

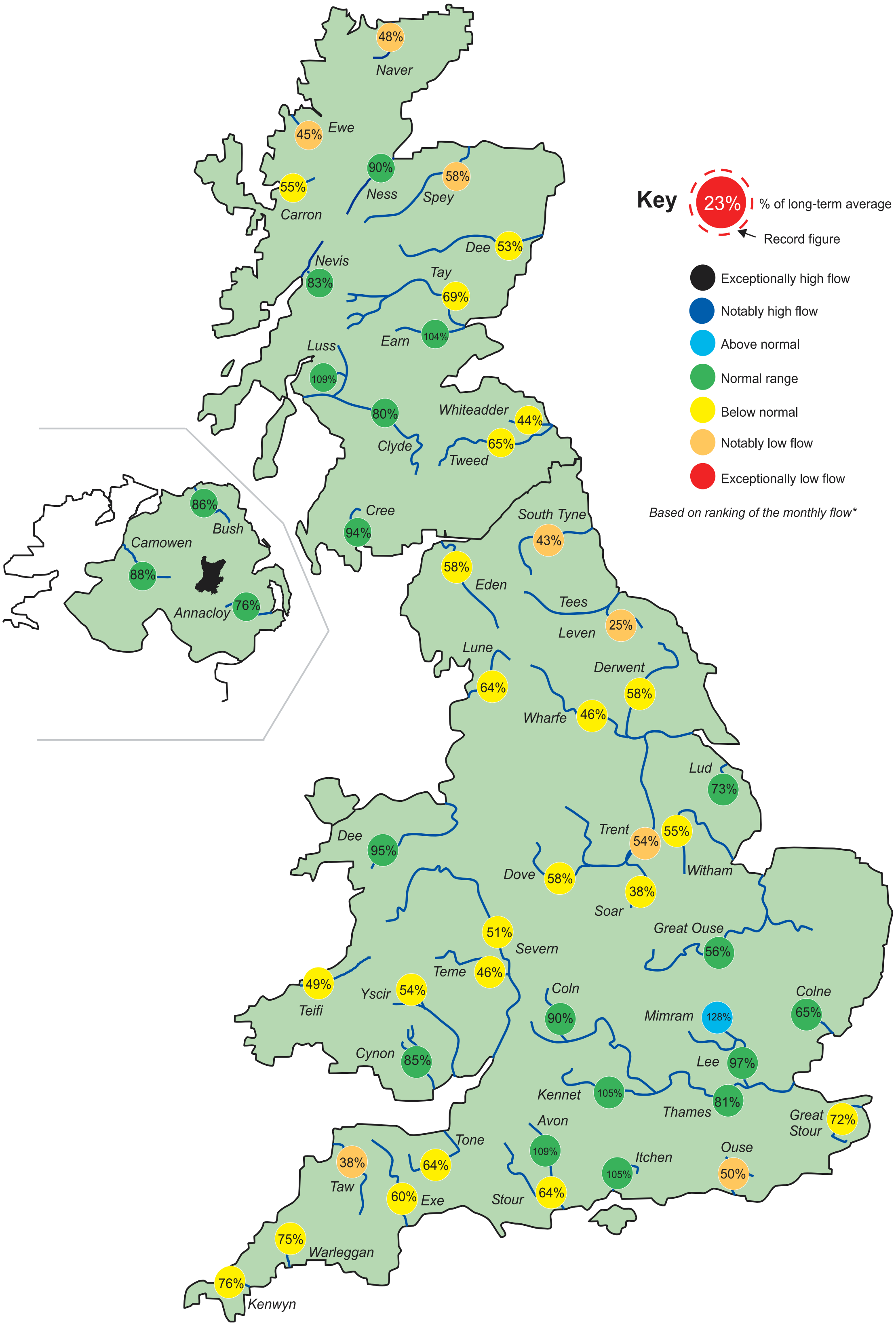


January 2002 - April 2002

Rainfall accumulation maps

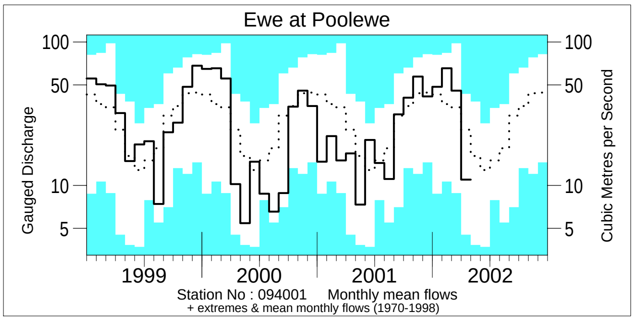
Thanks in large parts to a notably wet February, rainfall totals for the year thus far for the UK as a whole are considerably above average – parts of Scotland and Northern Ireland have been especially wet. However, the combined March and April rainfall was modest in much of eastern England – much of Yorkshire registered its 4th driest late spring since 1976.

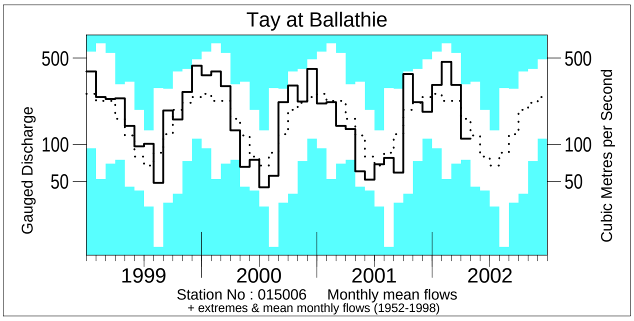
River flow . . . River flow . . .

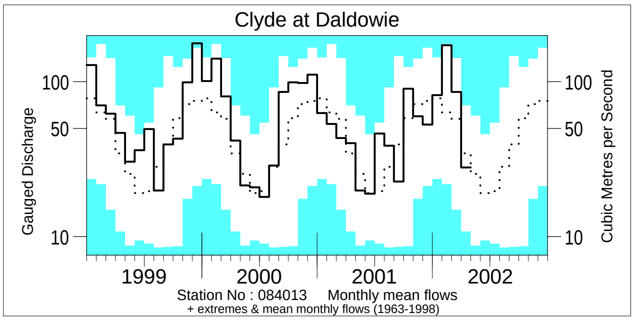


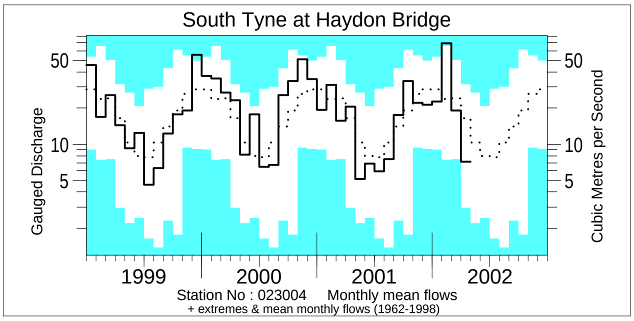
River flows - April 2002

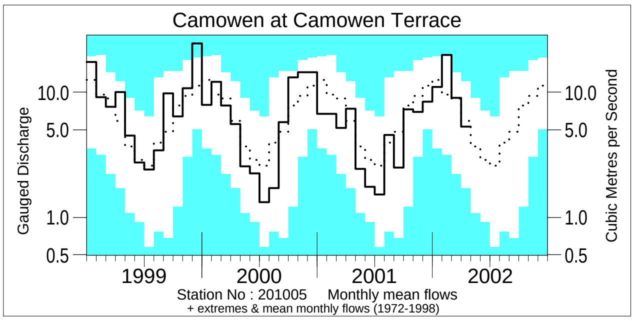
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

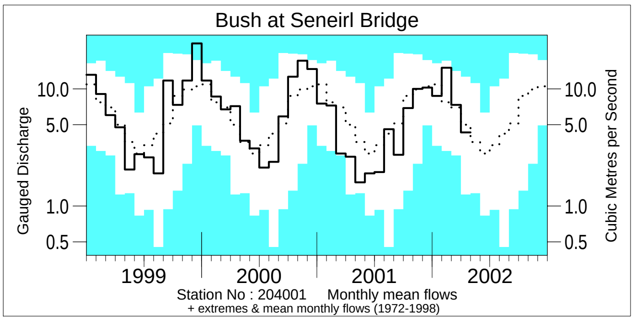


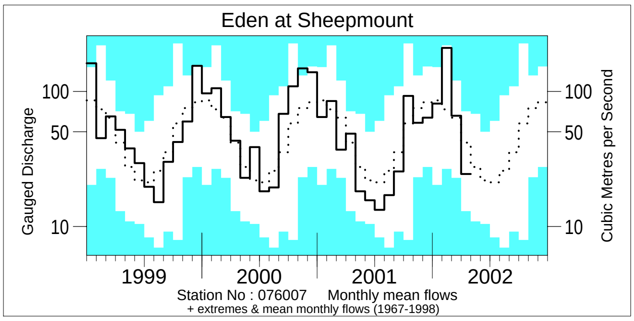


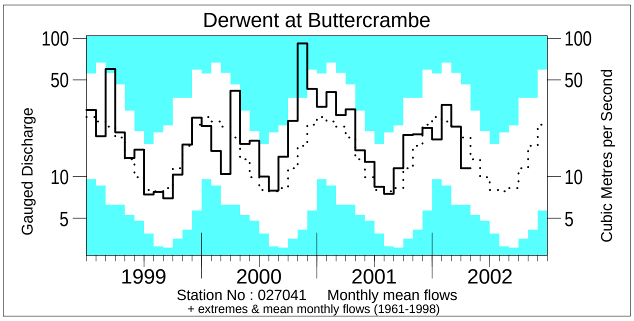


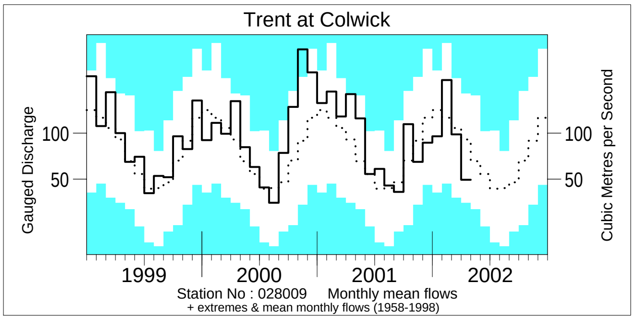


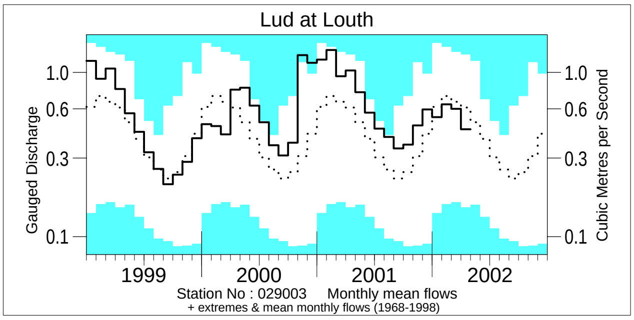








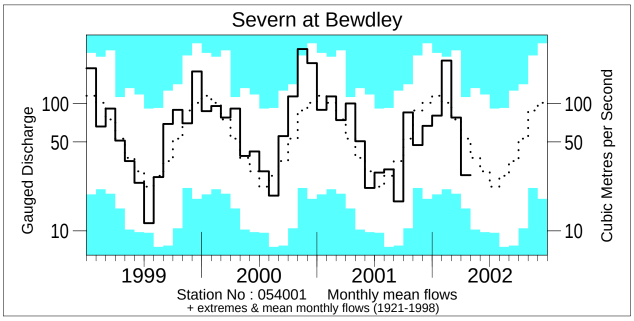


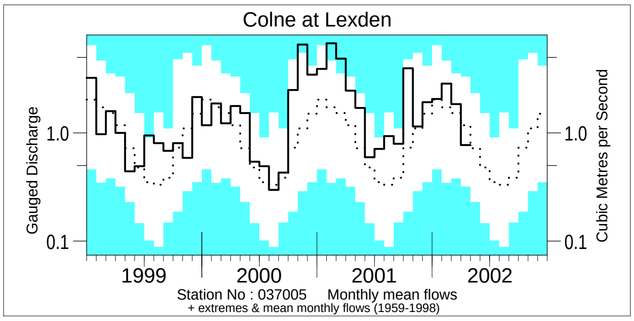


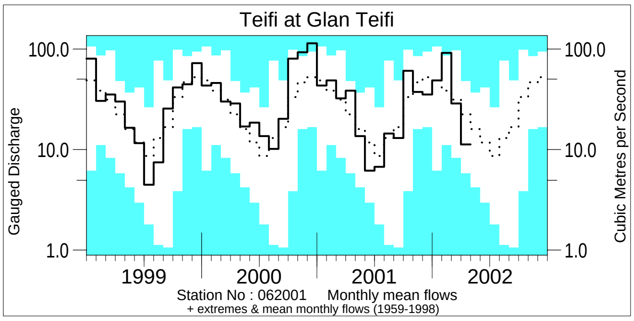
Monthly river flow hydrographs

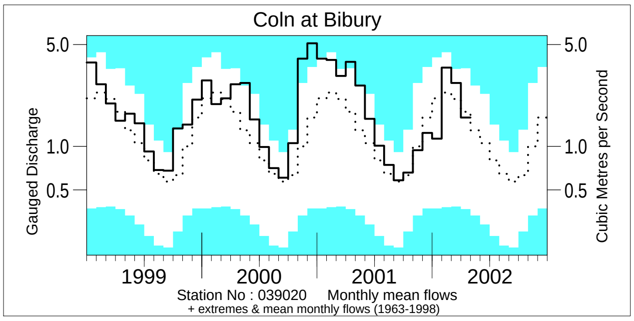
The river flow hydrographs show the monthly mean flow (bold trace), the long term average monthly flow (dotted trace) and the maximum and minimum flow prior to 1999 (shown by the shaded areas). Monthly flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas.

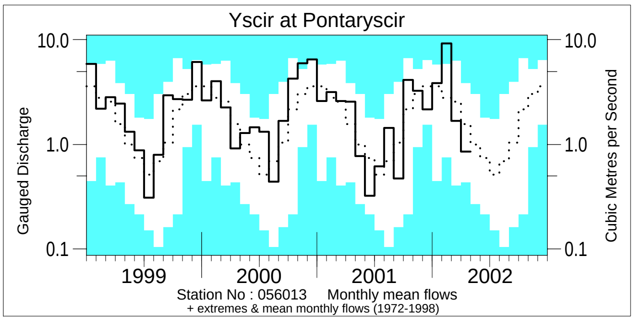
River flow . . . River flow . . .

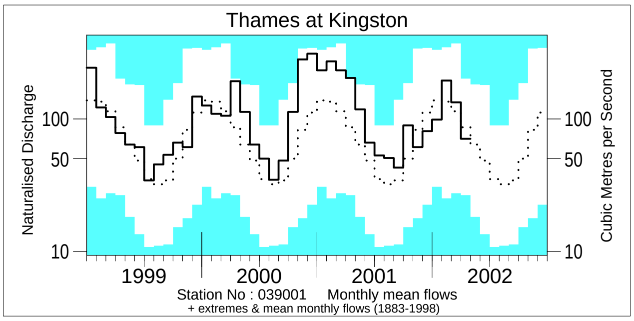


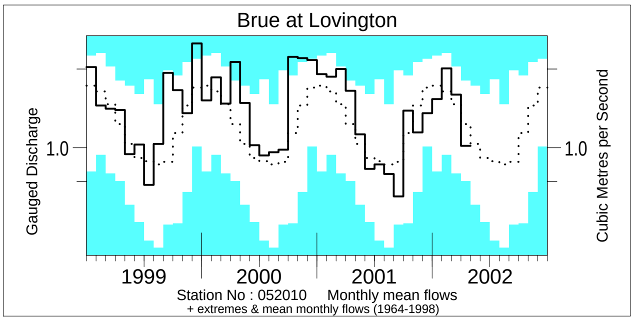


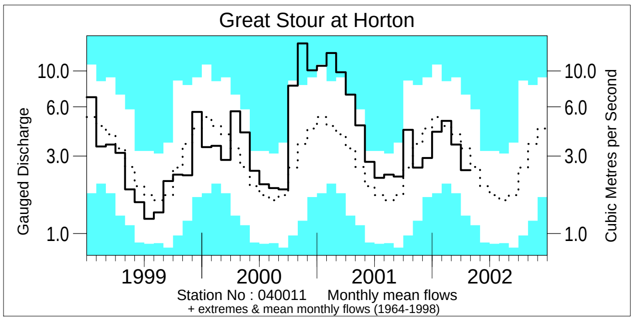


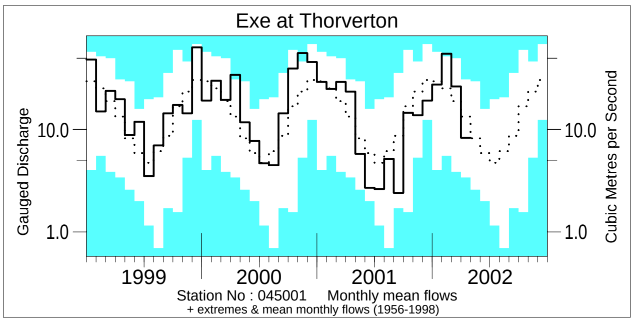


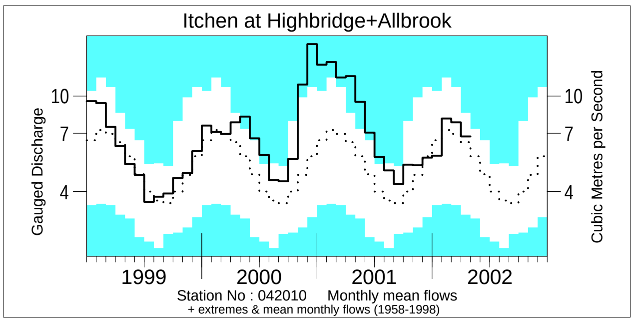












Notable runoff accumulations (a) February 2002 – April 2002, (b) August 2001 – April 2002

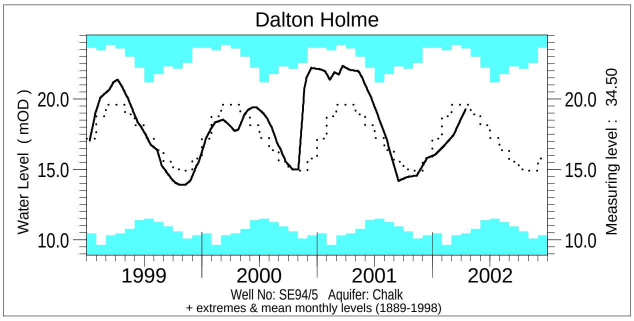
	River	%lta	Rank
a)	Tweed	151	41/42
	S Tyne	141	38/40
	Wharfe	149	45/47
	Exe	150	45/46
	Yscir	159	30/30
	Cynon	176	44/44
	Tawe	140	40/43

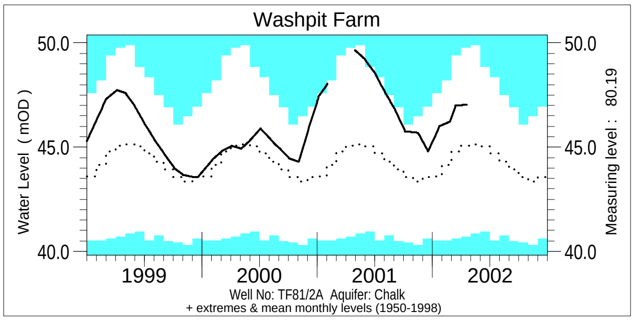
River	%lta	Rank
Dee	158	64/65
Lune	158	42/42
Eden	159	34/35
Clyde	174	38/39
Leven (Glasgow)	161	38/39
Camowen	135	28/29

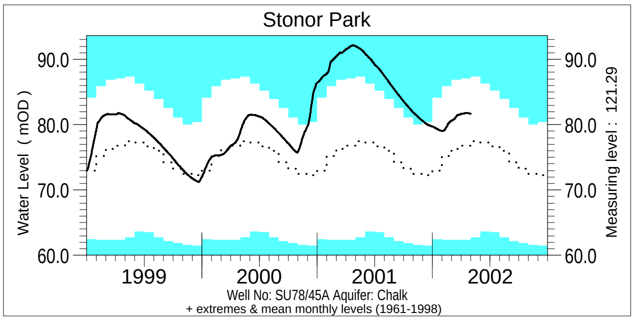
	River	%lta	Rank
(b)	Mimram	150	45/48
	Kenwyn	72	3/33
	Yscir	121	26/29
	Naver	116	22/25
	Annacloy	77	3/22

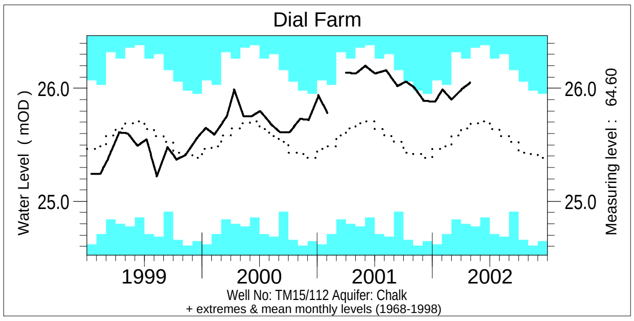
lta = long term average
Rank 1 = lowest on record

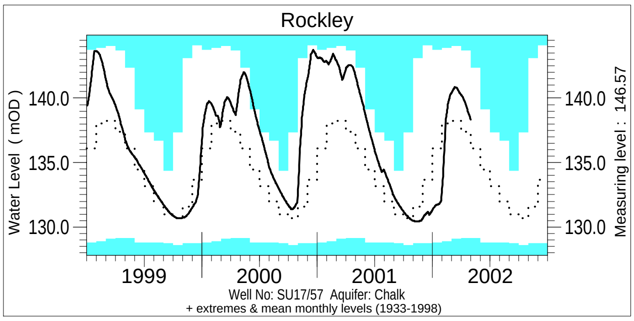
Groundwater . . . Groundwater

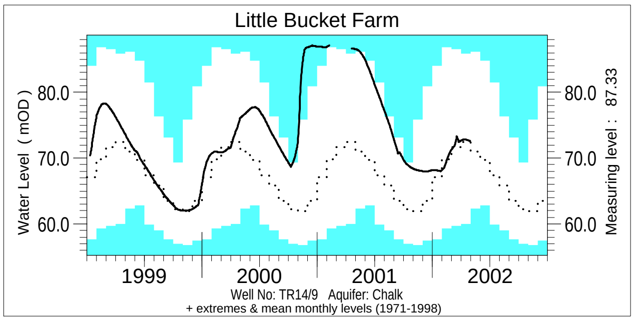


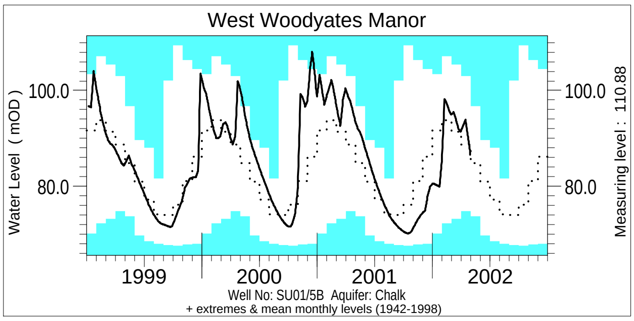


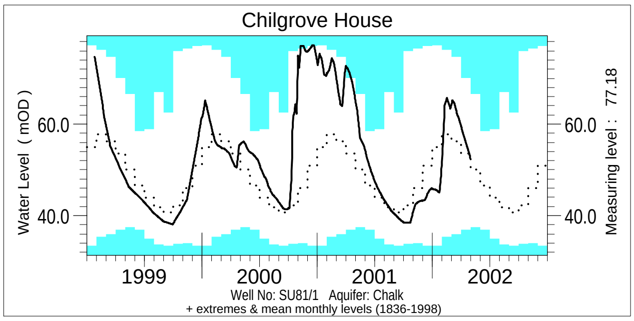


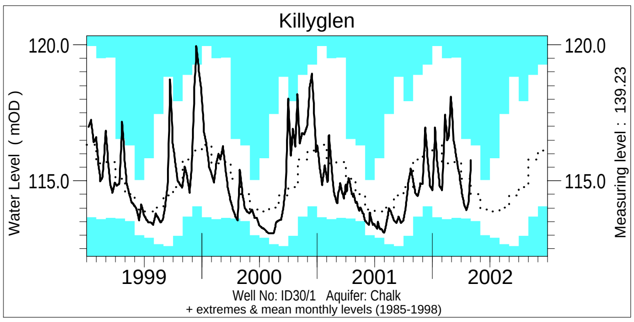


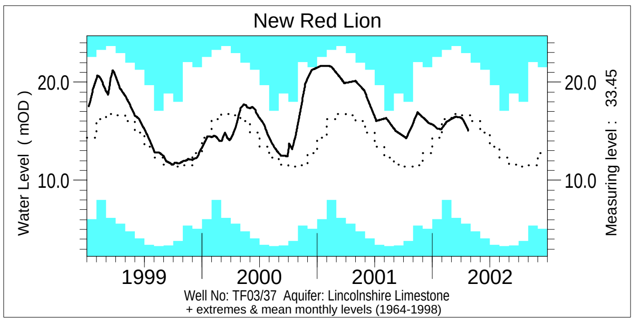






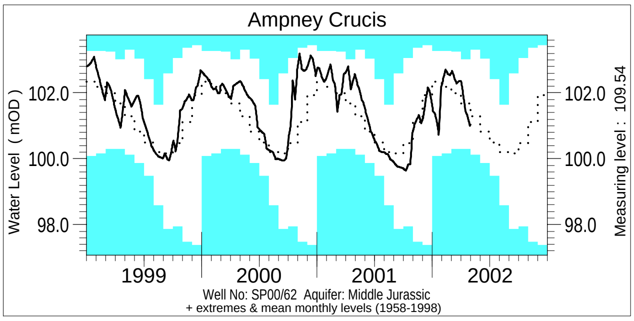


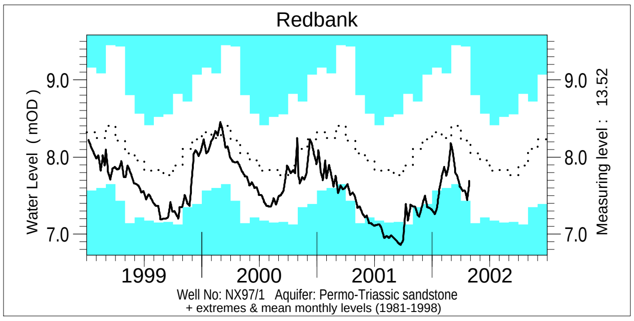


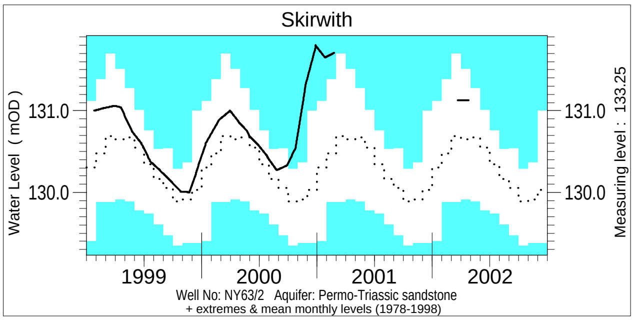


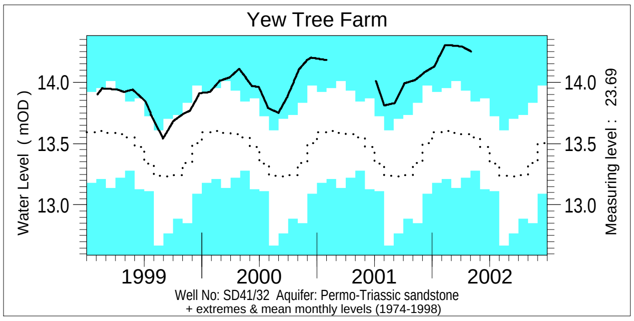
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

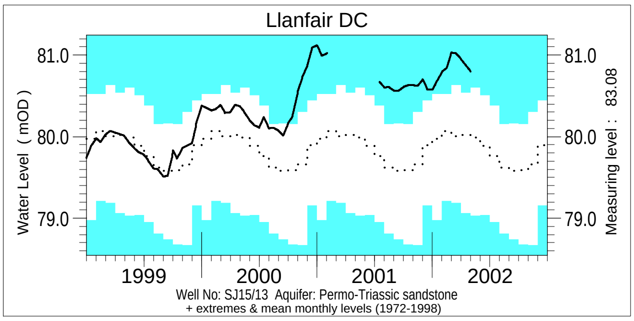
Groundwater . . . Groundwater

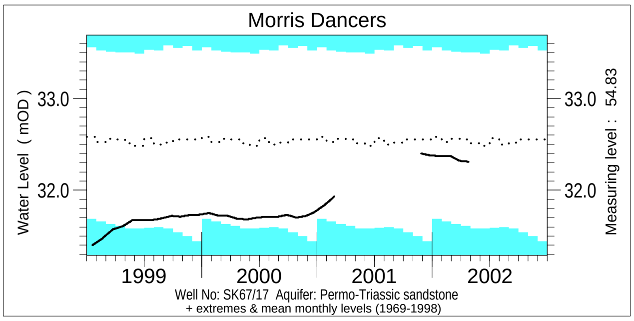


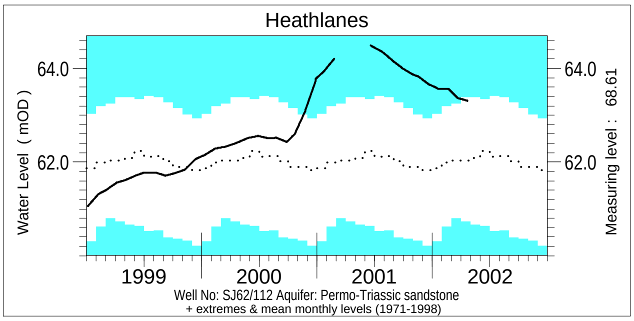


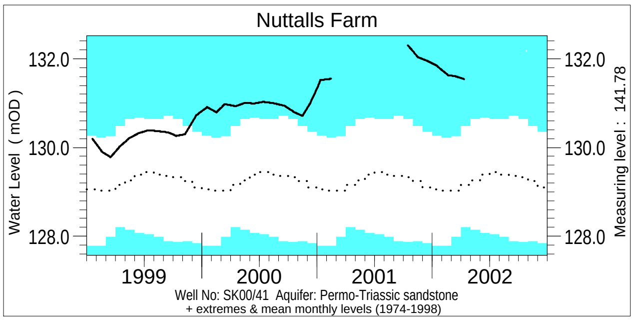


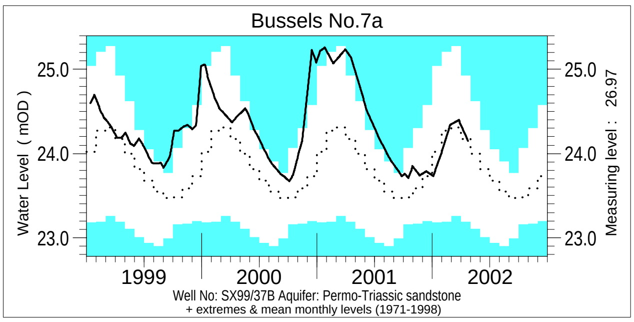


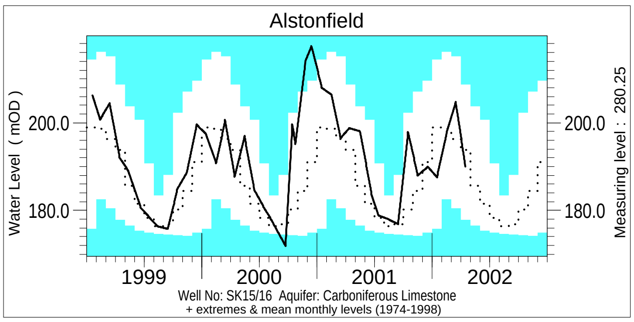










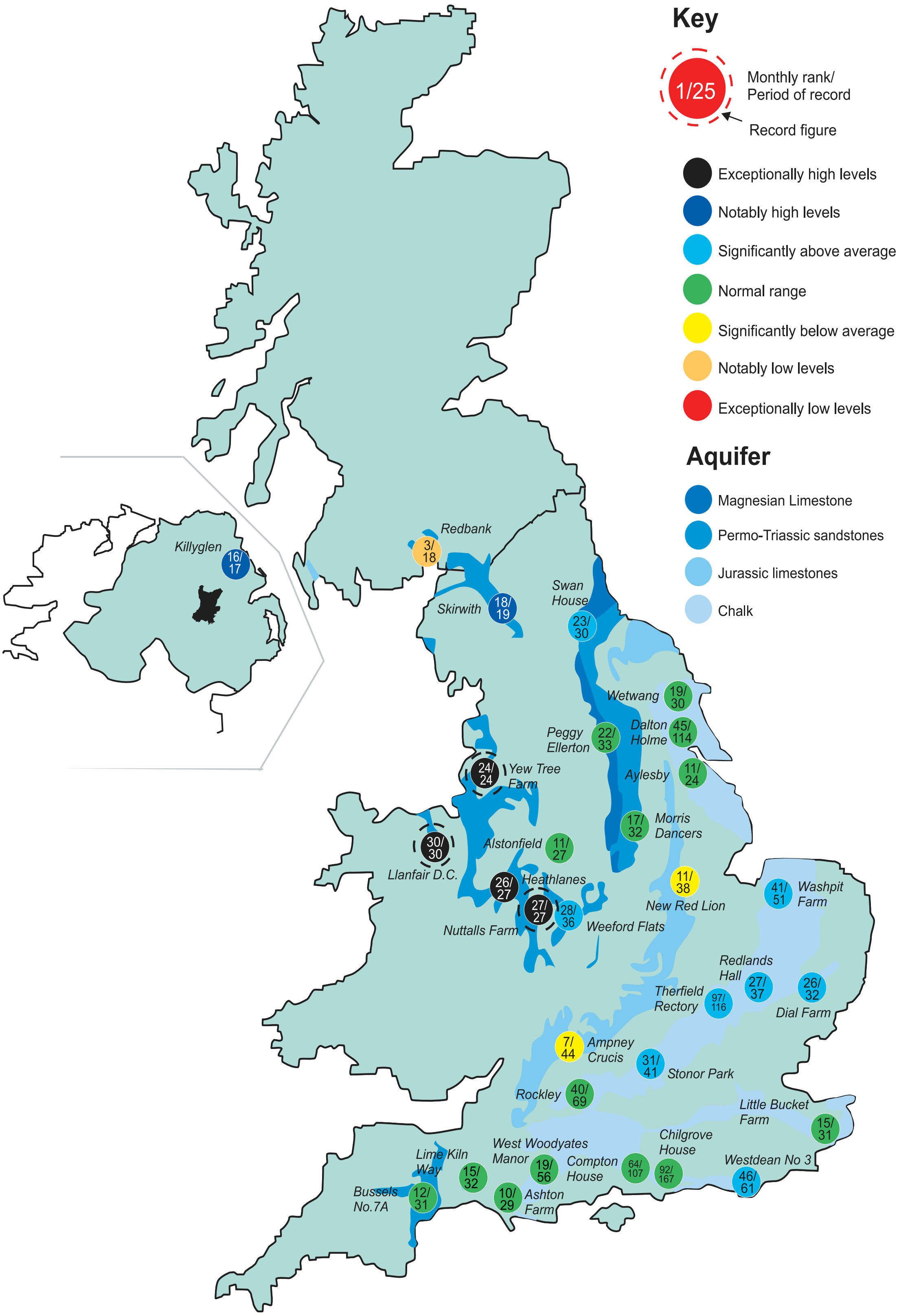


Groundwater levels April 2002 / May 2002

Borehole	Level	Date	Apr. av.	Borehole	Level	Date	Apr. av.	Borehole	Level	Date	Apr. av.
Dalton Holme	19.28	15/04	19.52	Chilgrove House	52.65	30/04	52.32	Llanfair DC	80.80	01/05	79.97
Washpit Farm	47.04	19/04	45.29	Killyglen	115.76	02/05	115.07	Morris Dancers	32.31	25/04	32.40
Stonor Park	81.71	01/05	77.74	New Red Lion	15.02	24/04	16.54	Heathlanes	63.31	22/04	62.03
Dial Farm	26.05	30/04	25.67	Ampney Crucis	101.04	01/05	101.74	Nuttalls Farm	131.54	12/04	129.37
Rockley	138.32	01/05	137.56	Redbank	7.69	28/04	8.21	Bussels No.7a	24.15	23/04	24.19
Little Bucket Farm	72.58	30/04	72.40	Skirwith	131.13	26/04	130.62	Alstonfield	189.98	15/04	193.70
West Woodyates	86.53	30/04	88.50	Yew Tree Farm	14.25	03/05	13.62				

Levels in metres above Ordnance Datum

Groundwater . . . Groundwater



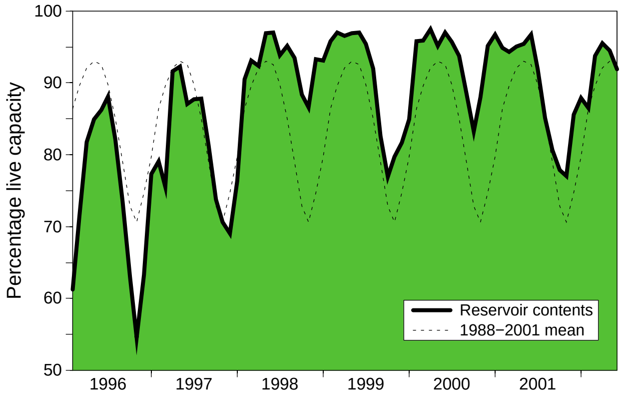
Groundwater levels - April 2002

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.

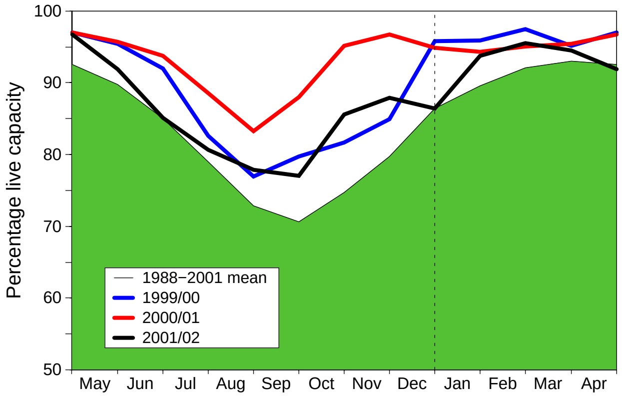
(Note: Redbank is affected by groundwater abstraction)

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.

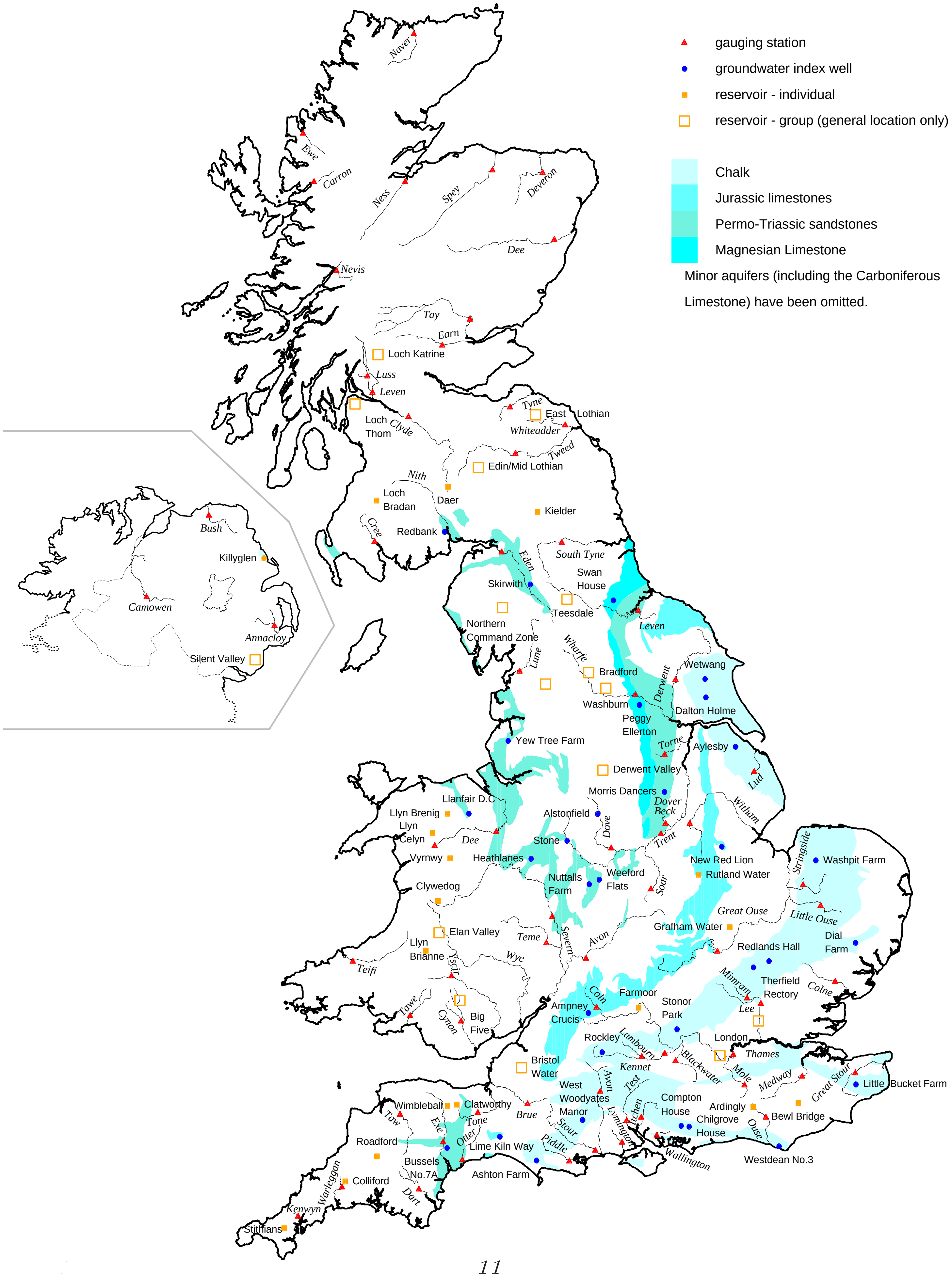
Percentage live capacity of selected reservoirs at start of month

Area	Reservoir	Capacity (Ml)	2001 Dec	2002 Jan	Feb	Mar	Apr	May	Min. May	Year* of min
North West	N Command Zone	• 124929	84	84	100	100	97	89	80	1996
	Vyrnwy	55146	91	88	100	100	100	94	70	1996
Northumbrian	Teesdale	• 87936	83	84	99	100	97	89	81	1996
	Kielder	(199175)	(95)	(89)	(100)	(96)	(92)	(91)	85	1990
Severn Trent	Clywedog	44922	100	87	96	100	94	98	85	1988
	Derwent Valley	• 39525	86	100	100	100	98	88	54	1996
Yorkshire	Washburn	• 22035	92	91	95	97	91	85	76	1996
	Bradford supply	• 41407	90	90	99	100	96	84	60	1996
Anglian	Grafham	(55490)	(88)	(88)	(87)	(87)	(89)	(91)	73	1997
	Rutland	(116580)	(81)	(82)	(84)	(89)	(92)	(94)	72	1997
Thames	London	• 202340	87	86	87	88	92	93	86	1990
	Farmoor	• 13830	91	77	79	88	87	95	81	2000
Southern	Bewl	28170	74	75	90	97	98	95	63	1990
	Ardingly	4685	73	86	100	100	100	100		
Wessex	Clatworthy	5364	72	84	97	100	100	89	81	1990
	Bristol WW	• (38666)	(59)	(61)	(70)	(99)	(98)	(93)	85	1990
South West	Colliford	28540	62	64	72	78	82	81	56	1997
	Roadford	34500	73	72	84	94	94	91	41	1996
	Wimbleball	21320	54	58	76	100	100	97	79	1992
	Stithians	5205	29	33	49	78	88	85	65	1992
Welsh	Celyn and Brenig	• 131155	97	94	100	100	98	99	75	1996
	Brianne	62140	100	94	100	98	97	89	86	1997
	Big Five	• 69762	95	93	99	97	94	90	85	1997
	Elan Valley	• 99106	100	99	100	100	97	93	91	1997
East of Scotland	Edinburgh/Mid Lothian	• 97639	90	89	92	100	98	94	62	1998
	East Lothian	• 10206	100	100	100	100	100	100	89	1992
West of Scotland	Loch Katrine	• 111363	93	88	99	100	99	95	83	2001
	Daer	22412	100	97	100	100	100	99	91	1995
	Loch Thom	• 11840	93	93	100	100	98	95	89	2001
Northern Ireland	Silent Valley	• 20634	43	39	46	57	59	65	58	2000

() figures in parentheses relate to gross storage • denotes reservoir groups * 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 1988-2002 period only (except for West of Scotland and Northern Ireland where data commence in 1994 and 1993 respectively). 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, the West of Scotland and East of Scotland Water Authorities, 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
Maclean Building
Crowmarsh Gifford
Wallingford
Oxfordshire
OX10 8BB
Tel.: 01491 838800
Fax: 01491 692424

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

4/02