Note : much of the hydrometric data featured in this report is provisional

Hydrological summary for the United Kingdom

January 2001

General

The autumn and early of winter of 2000/2001 is set to join March 1947 and the 1976 drought as major UK hydrological benchmarks - the impact of which have imprinted themselves on a generation. January rainfall totals were generally low in northern regions but again above average in the South-East. With most catchments remaining close to saturation, the flood risk was high throughout the month – in the English Lowlands especially. Exceptional January flows in southern rivers contributed to new maximum three and four-month runoff totals in many areas. Floodplain inundations were less extensive than in late-2000 but the groundwater dimension to the flood threat assumed a rare prominence. Rising water-tables intersected the surface – in the chalk downlands especially – producing 'clear-water' flooding in many localities. Road and basement flooding (and sewer surcharging) were common even in areas with no recent history of such occurrences. Waterlogged land continued to create problems for the farming community and erosion rates remained high. Reservoirs stocks are mostly very close to capacity but freezing conditions in western Scotland, and subsequent pipe-bursts, led to local water supply difficulties.

Rainfall

The westward extension of a European high pressure cell produced a sunny, cold and more settled month over much of the UK. Dry spells were especially prolonged in the north despite significant snowfall. Outside of the extreme South West and the South East of England, rainfall totals were below the 1961-90 average. North of Loch Ness, totals fell well below 50%; on the eastern seaboard some single figures were recorded. East of Lough Neagh in Northern Ireland, the Midland Valley of Scotland, the Solway Firth and the eastern Peak District experienced percentage totals in the low 40s and below. By contrast, parts of Kent and Hampshire reported their fifth successive month with significantly above average rainfall. A legacy of the remarkably wet autumn and early winter is that long term rainfall accumulations are outstanding.The provisional Sept-Jan rainfall total for the Thames basin is the highest for any five-month sequence in a series from 1883. For England and Wales, rainfall over the same period has been around 50% above average; only in 1960/61 have higher 5-month accumulations (for any start month) been recorded since 1877. For most lowland catchments, and many others in England and Wales, the 5-month rainfall totals, are unprecedented over the period for which the great majority of gauging stations (and observation boreholes) have been in operation. By early February, the area of the South-East which has received around its average annual rainfall (or more) since the beginning of September 2000 had increased appreciably – the Southern region as a whole is just 40mm short of its annual figure.

River Flow

Protracted recessions characterised many rivers in western and northern regions of the UK during January. Frozen catchments in northern Scotland yielded particularly modest runoff – the provisional January mean flows for the Rivers Naver and Carron were the second lowest in 20 years. In the English Lowlands, however, a combination of heavy frontal rainfall, saturated soils and continuing high baseflow contribution made for another month of sustained spates. Many rivers exceeded bankfull early in the month (a response to notable rainfall over the four days from Dec 30th) and many further flood alerts were triggered in the last week of the month. Whilst flows declined in northern Britain, runoff continued to increase in the upper reaches of many spring-fed southern streams as water-tables rose in lagged response to the exceptional recharge of the last four months. In lowland England, new January maximum mean flows were common and the very singular nature of the recent runoff episode is underlined by the 3- and 4-month totals. November-January runoff totals have eclipsed previous maxima by wide margins and exceed 250% of average in many southern catchments (e.g. the Coln, Mole and Lee). For some, including the Trent, Leven and Dorset Stour and Piddle, the 3-month totals are unsurpassed for any start month. More remarkably, there is no precedent for runoff of this magnitude in the Thames and only one on the Lee (in 1919) in their long flow records from 1883.

Groundwater

Whilst much of the country has been wet since the early autumn, the greatest rainfall anomalies broadly coincide with the aquifer outcrop areas, the Chalk especially. The relation between rainfall and recharge is non-linear and an increase of 50%-80% in rainfall over the winter half-year can treble the recharge to eastern aquifer units. Unsurprisingly therefore, recharge since September has been without recorded precedent in many areas. Some modest falls in groundwater levels from the remarkable December peaks were reported (e.g. at Alstonfield and West Woodyates) but, generally, levels continued to rise. Many new absolute maxima were established during January, for example in the Permo-Triassic sandstones (e.g. Heathlanes and Nuttalls Farm), the Magnesian Limestone (Peggy Ellerton), the Upper Greensand (Lime Kiln Way) and the Chalk (Stonor). Overflowing wells and boreholes were commonplace (e.g. on the South Downs and Salisbury Plain) and outflows from high level springs have been truly exceptional. Whilst 'clear-water' flooding was a feature of established channels, the extension of the drainage network high into 'dry' chalk valleys has often yielded turbid waters accompanying erosion.

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Rainfall accumulations and return period estimates

Area	Rainfall	Jan 2001	Dec 00-Jan 01	RP	Sep 00-Jan 01	RP	May 00-Jan 01	RP	Feb 00-Jan 01	RP
England & Wales	**mm**	**70**	**194**		**658**		**911**		**1164**	
	%	**80**	**107**	**2-5**	**152**	**110-150**	**130**	**30-50**	**130**	**50-80**
North West	mm	72	220		885		1240		1535	
	%	59	90	2-5	145	35-50	129	25-40	128	30-50
Northumbrian	mm	47	143		546		804		1045	
	%	56	87	2-5	137	20-30	120	5-15	122	10-20
Severn Trent	mm	46	158		542		767		997	
	%	66	108	2-5	157	80-120	131	25-40	132	40-60
Yorkshire	mm	44	147		591		837		1070	
	%	56	91	2-5	154	70-100	132	30-40	130	35-50
Anglian	mm	48	112		419		624		793	
	%	97	107	2-5	159	120-170	134	35-50	133	50-80
Thames	mm	72	176		557		764		985	
	%	113	131	5-10	174	>200	142	50-80	143	150-250
Southern	mm	104	226		738		953		1190	
	%	130	140	5-10	186	>>200	156	>>200	153	>>200
Wessex	mm	94	244		682		905		1187	
	%	108	136	5-10	165	120-170	139	40-60	142	120-170
South West	mm	125	309		880		1153		1468	
	%	91	112	2-5	144	30-40	127	10-20	125	15-25
Welsh	mm	90	294		952		1304		1682	
	%	63	99	2-5	138	20-30	127	15-25	128	30-50
Scotland	**mm**	**91**	**270**		**814**		**1110**		**1516**	
	%	**60**	**90**	**2-5**	**108**	**2-5**	**98**	**2-5**	**105**	**2-5**
Highland	mm	93	288		880		1186		1741	
	%	49	75	5-10	92	2-5	86	5-10	99	2-5
North East	mm	70	193		625		876		1158	
	%	70	100	2-5	131	15-25	114	5-10	119	10-20
Tay	mm	104	286		797		1086		1424	
	%	72	106	2-5	125	5-15	113	2-5	116	5-10
Forth	mm	79	220		661		951		1282	
	%	67	97	2-5	117	5-10	108	2-5	116	5-15
Tweed	mm	60	183		591		886		1156	
	%	60	95	2-5	126	5-15	115	5-10	119	10-20
Solway	mm	97	330		1022		1384		1747	
	%	62	109	2-5	137	20-35	123	10-20	123	20-35
Clyde	mm	124	354		1033		1373		1824	
	%	66	96	2-5	112	2-5	102	2-5	108	2-5
Northern Ireland	**mm**	**59**	**200**		**644**		**896**		**1160**	
	%	**53**	**93**	**2-5**	**122**	**5-10**	**108**	**2-5**	**109**	**2-5**

RP = Return period

 All monthly totals since December 1998 are provisional (see page 12). 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 England & Wales and Scotland rainfall series can exaggerate the relative wetness of the recent past. *See page 12.

Rainfall . . . Rainfall . . . Rainfall

Key

00% Percentage of 1961-90 average

Very wet

Substantially above average

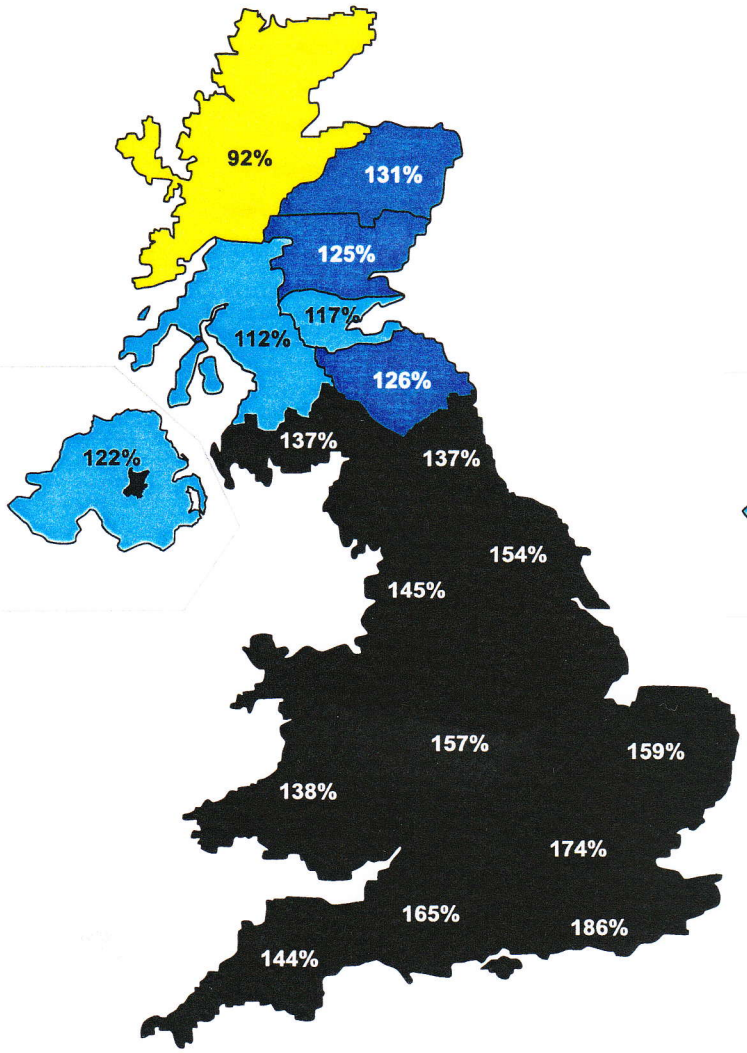
Above average

Normal range

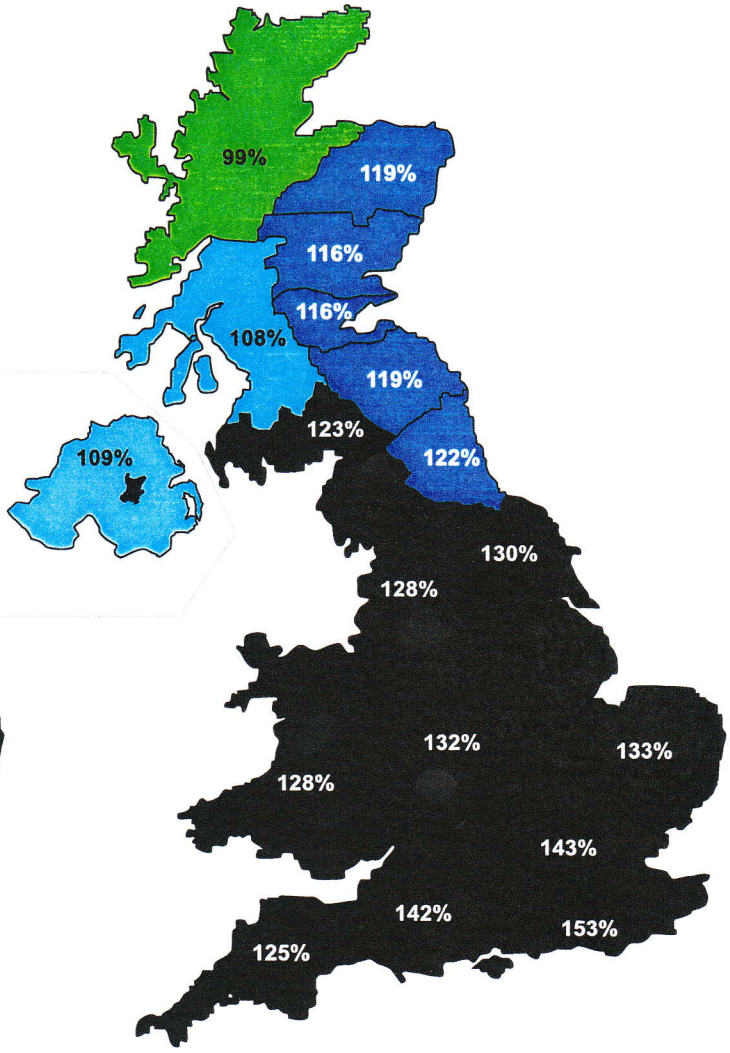
Below average

Substantially below average

Exceptionally low rainfall



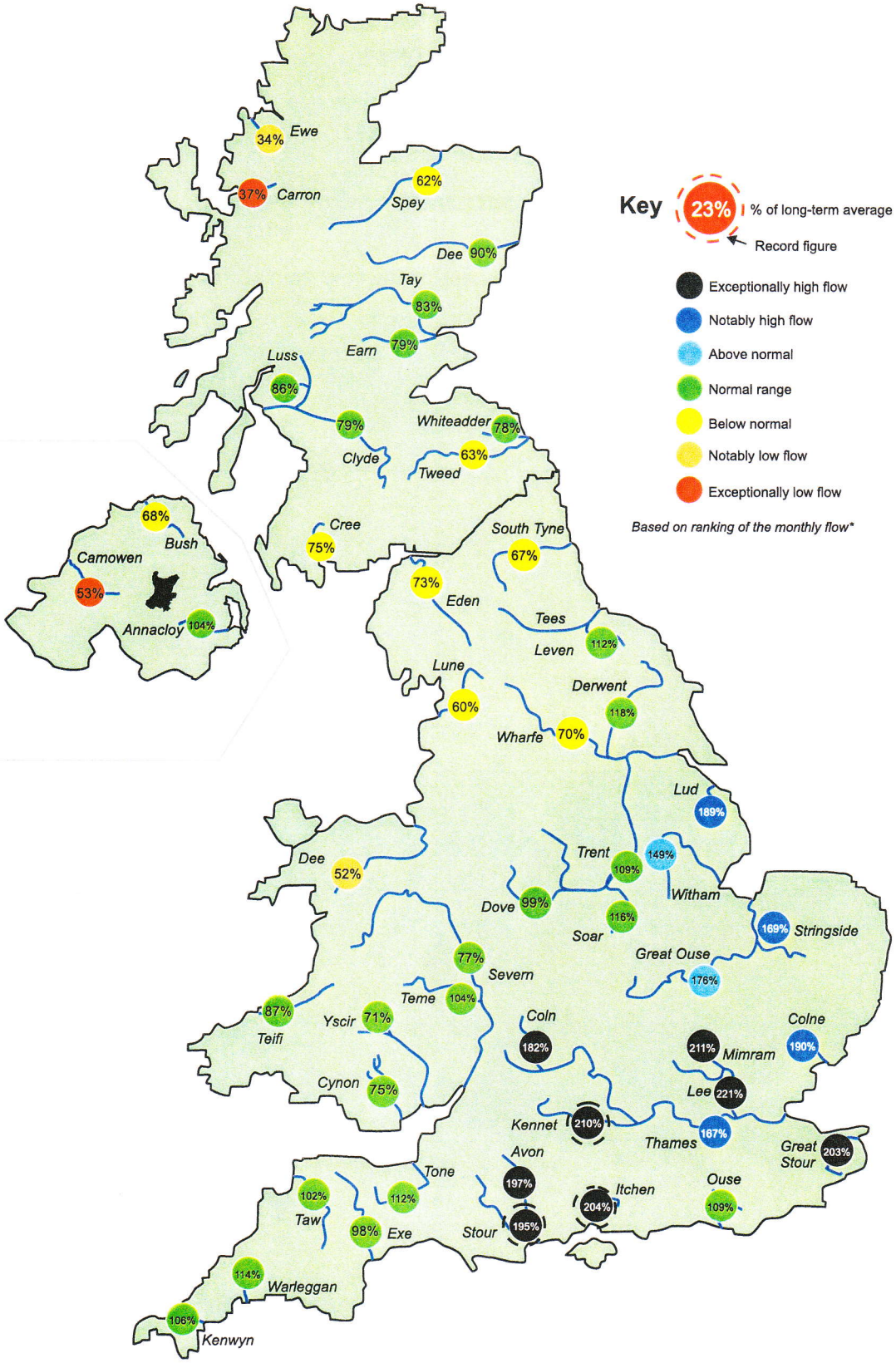
September 2000 - January 2001



February 2000 - January 2001

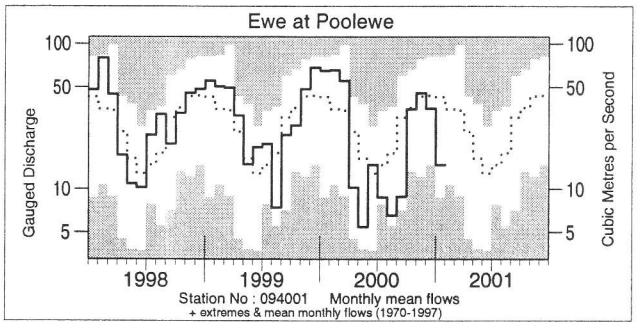
Rainfall accumulation maps

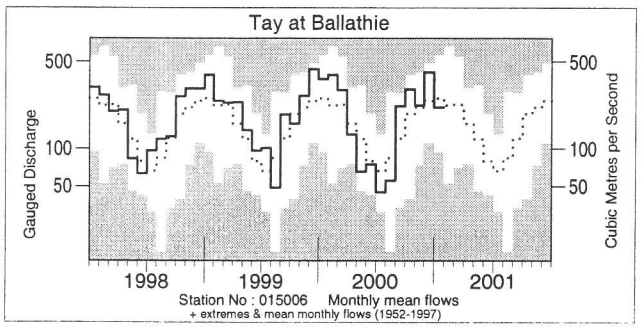
Provisionally, September 2000 to January 2001 was the fifth wettest 5 month period (any start month) in the England and Wales rainfall series from 1766. Both the GB and UK series reveal that the last 5 months were the wettest Sep-Jan periods in records since 1877 and from 1900 respectively.

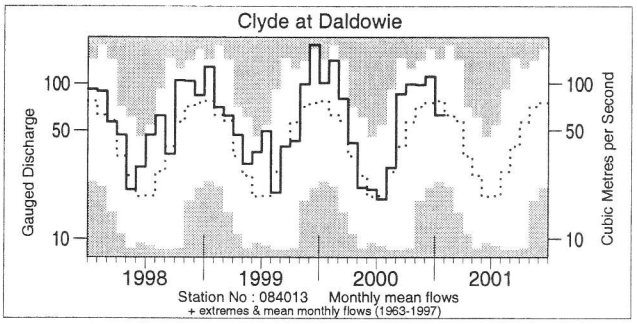


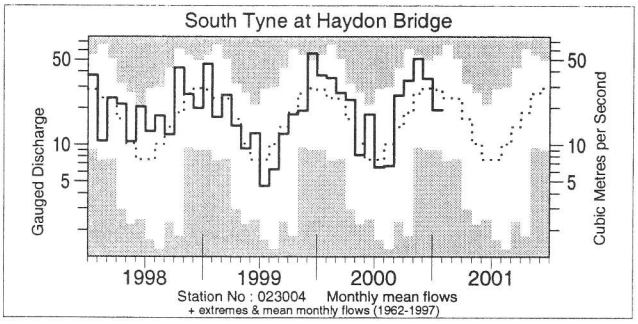
River flows - January 2001

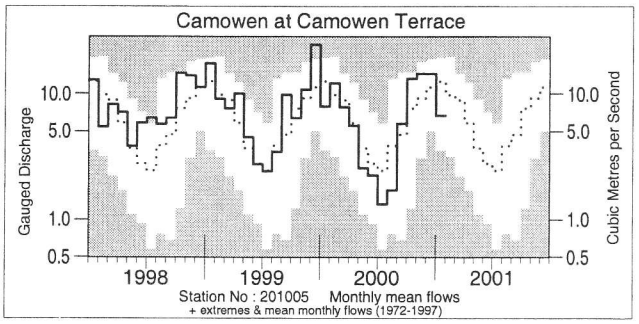
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

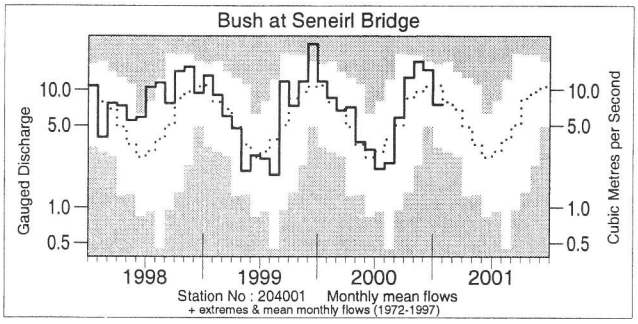


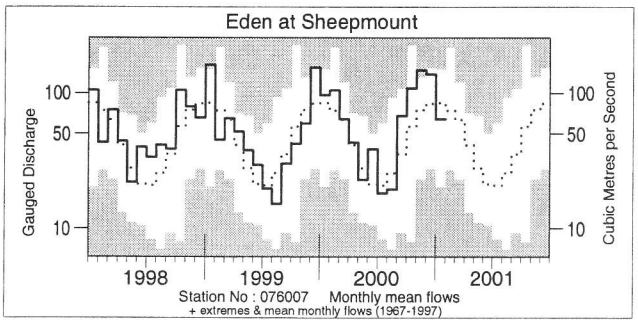


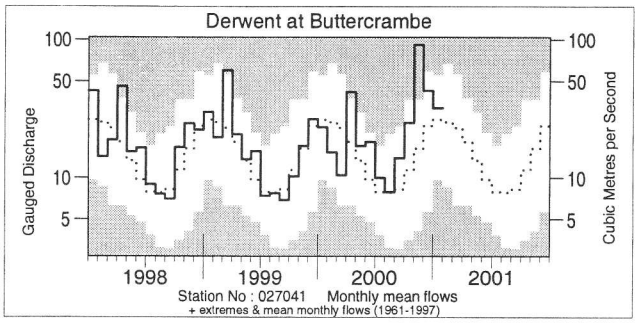


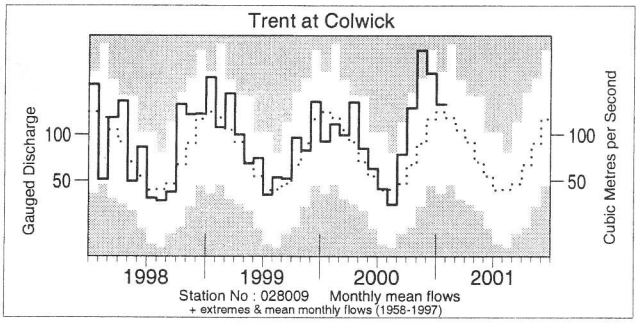


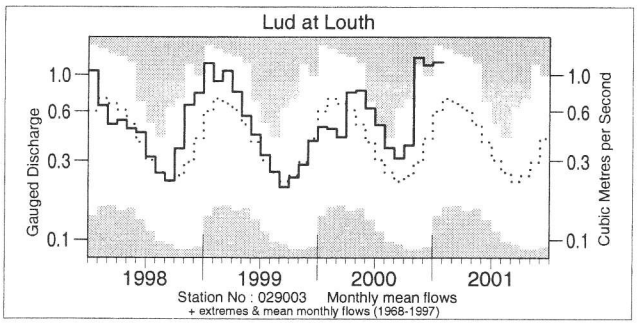








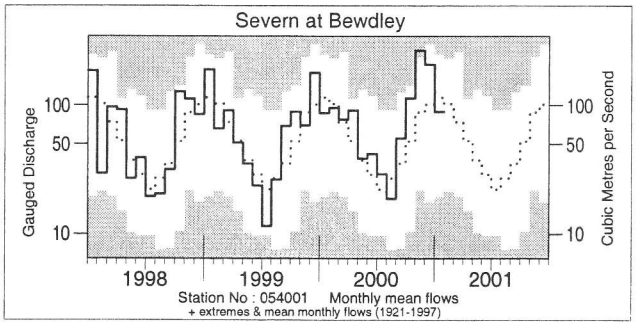


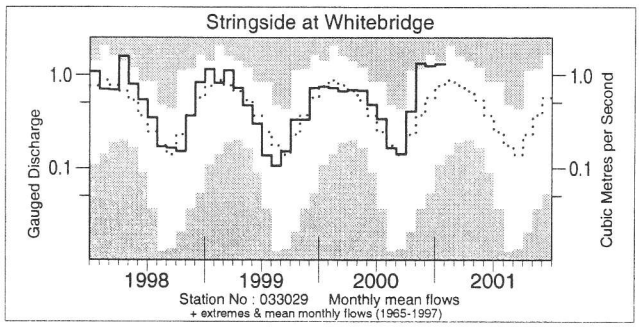


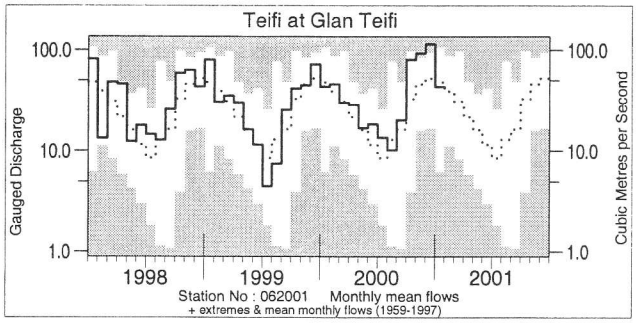
Monthly river flow hydrographs

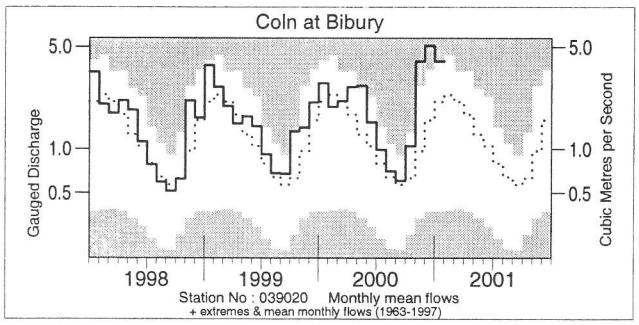
The river flow hydrographs show the monthly mean flow (bold trace), the long term average monthly flow (dotted trace) and the maximum and minimum flow prior to 1998 (shown by the shaded areas). Monthly flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas.

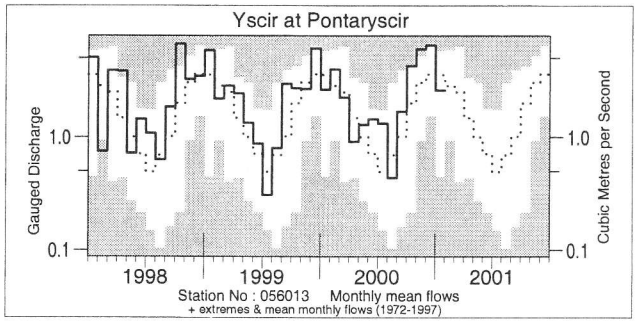
River flow . . . River flow . . .

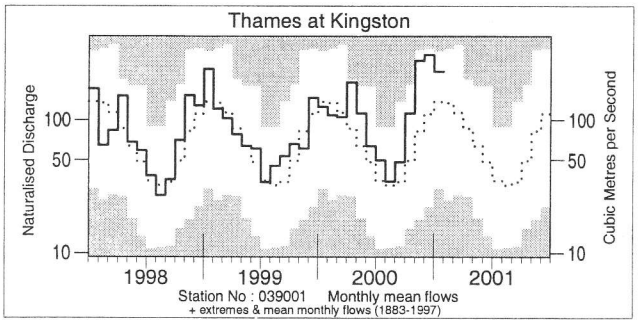


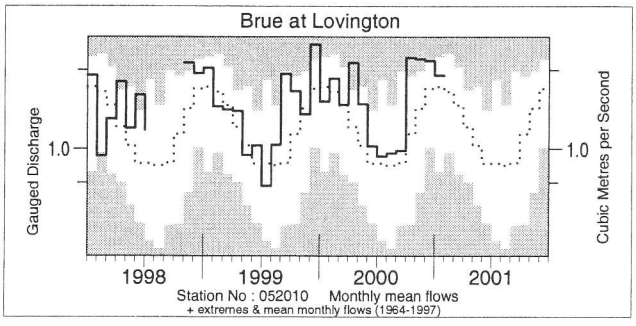


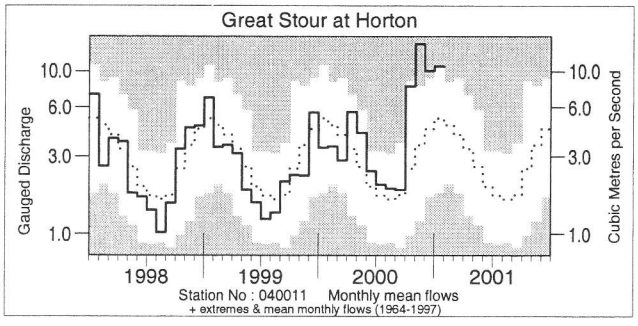


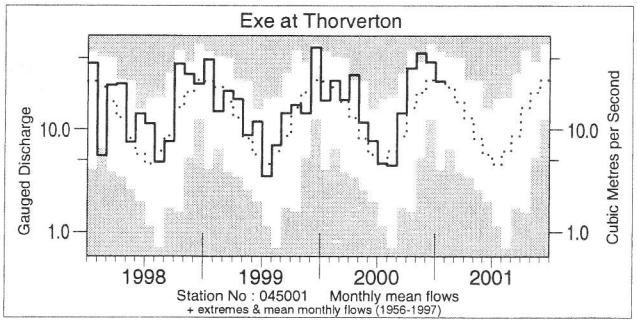


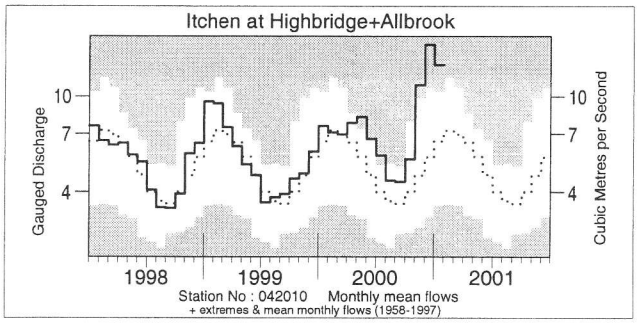










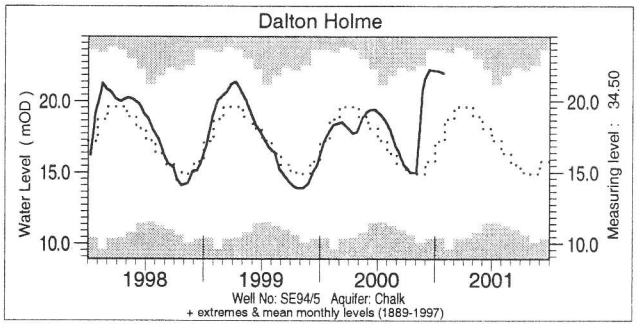


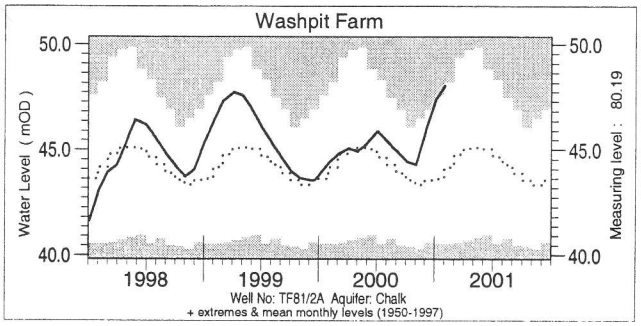
Notable runoff accumulations November 2000 - January 2001

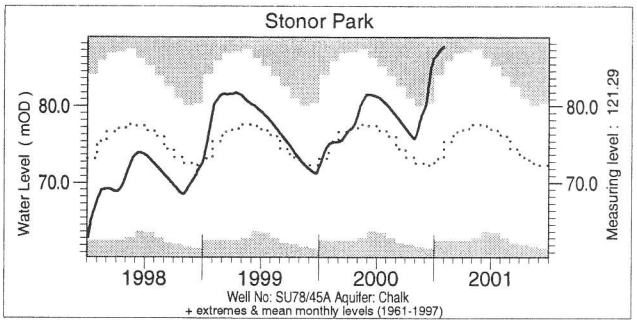
River	%lta	Rank	River	%lta	Rank	River	%lta	Rank
Lud	253	33/33	Kennet	251	40/40	Wallington	297	48/48
Colne	288	41/41	Coln	260	38/38	Lymington	257	41/41
Lee	276	116/116	Mole	251	26/26	Avon	299	36/36
Thames	244	118/118	Great Stour	254	36/36	Carron	63	2/22

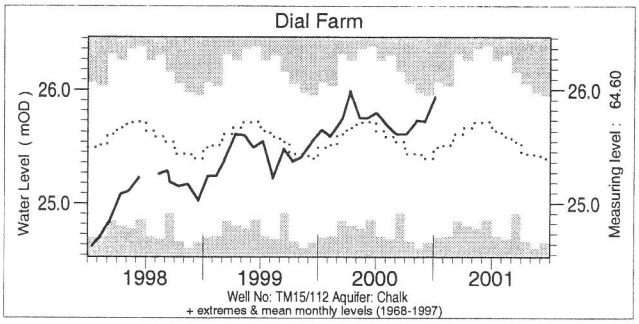
lta = long term average
Rank 1 = lowest on record

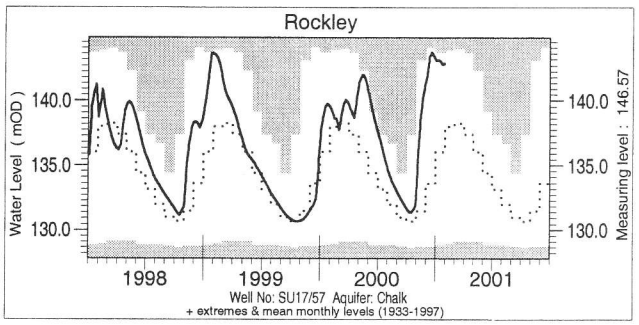
Groundwater . . . Groundwater

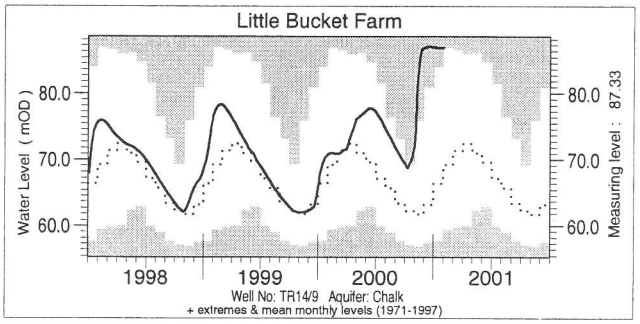


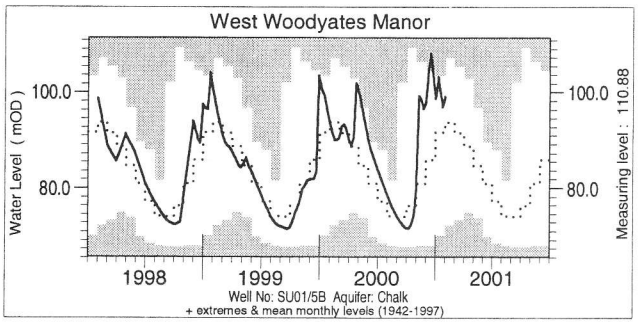


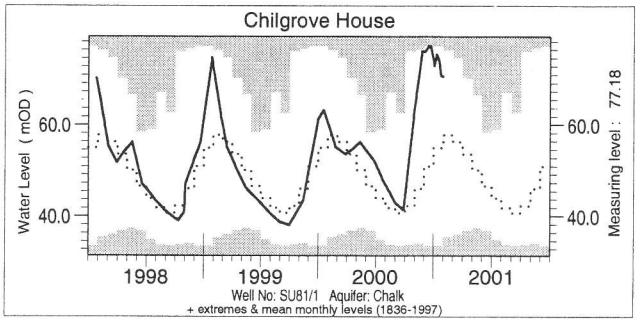


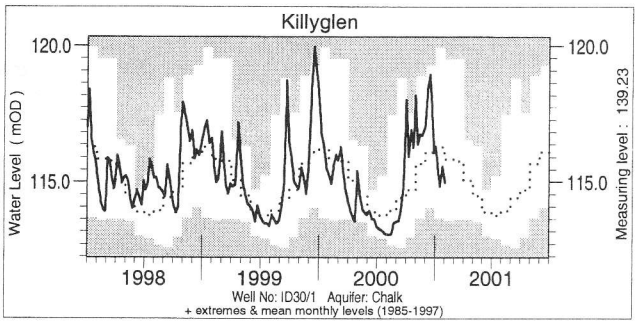


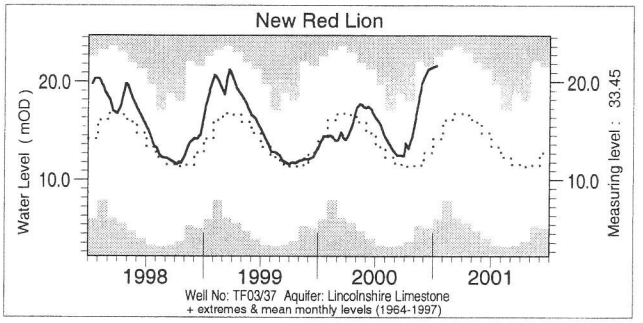








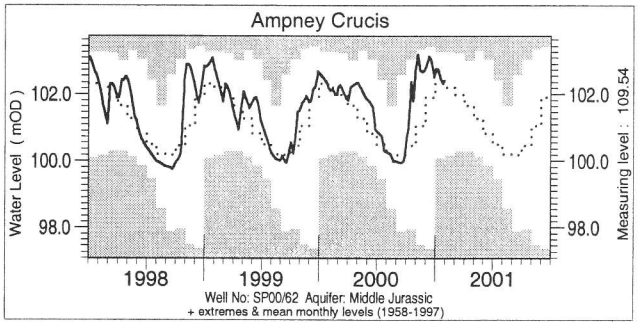


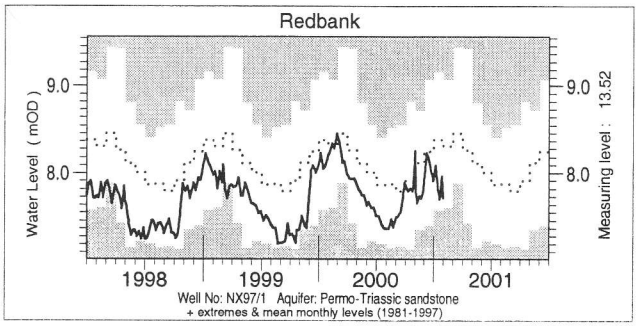


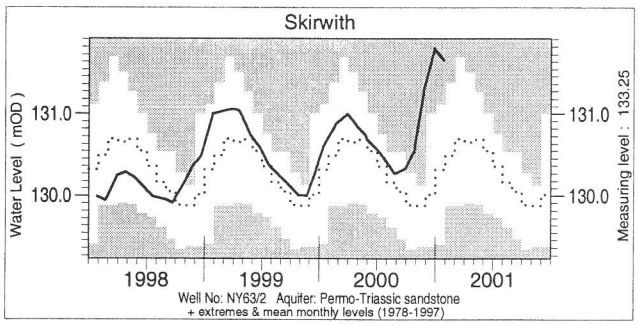
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

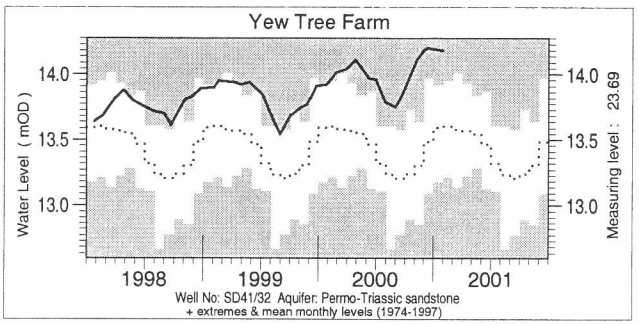
Note. Due to the impact of abstraction on groundwater levels at The Holt borehole, it has been replaced as an index site by the Stonor Park well.

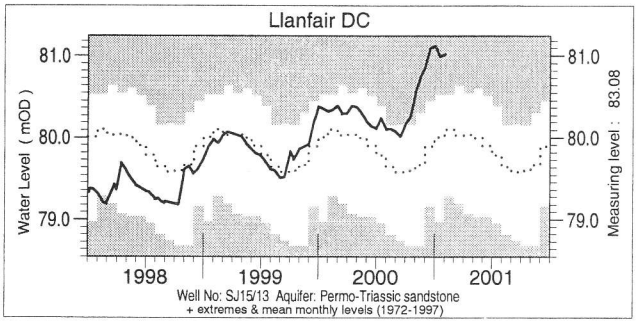
Groundwater . . . Groundwater

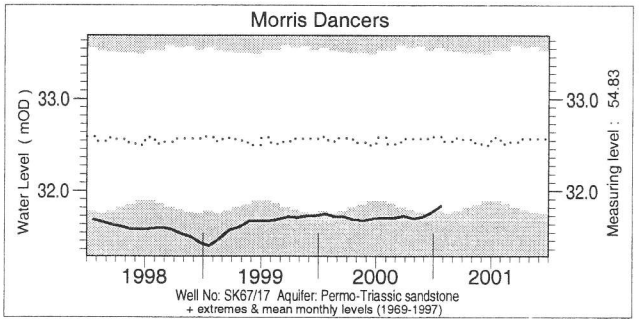


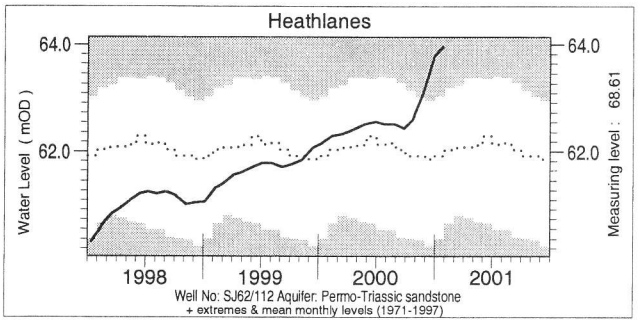


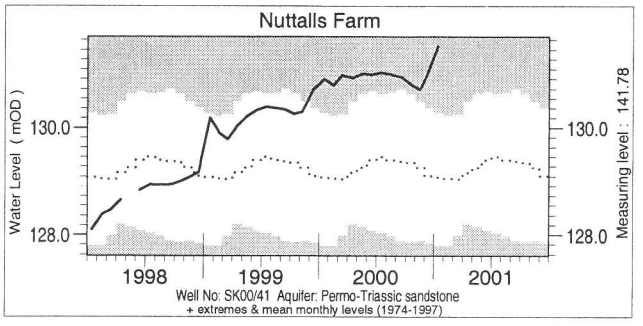


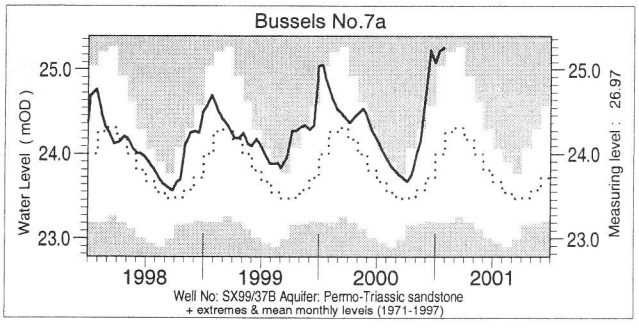


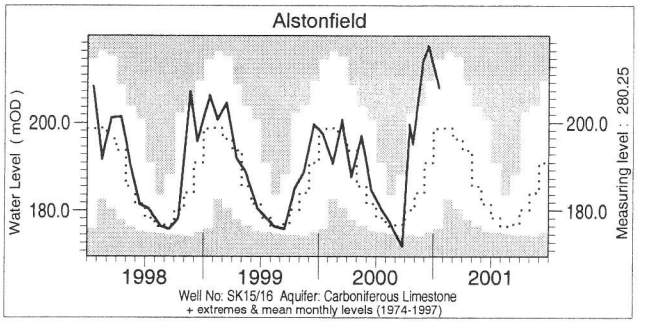












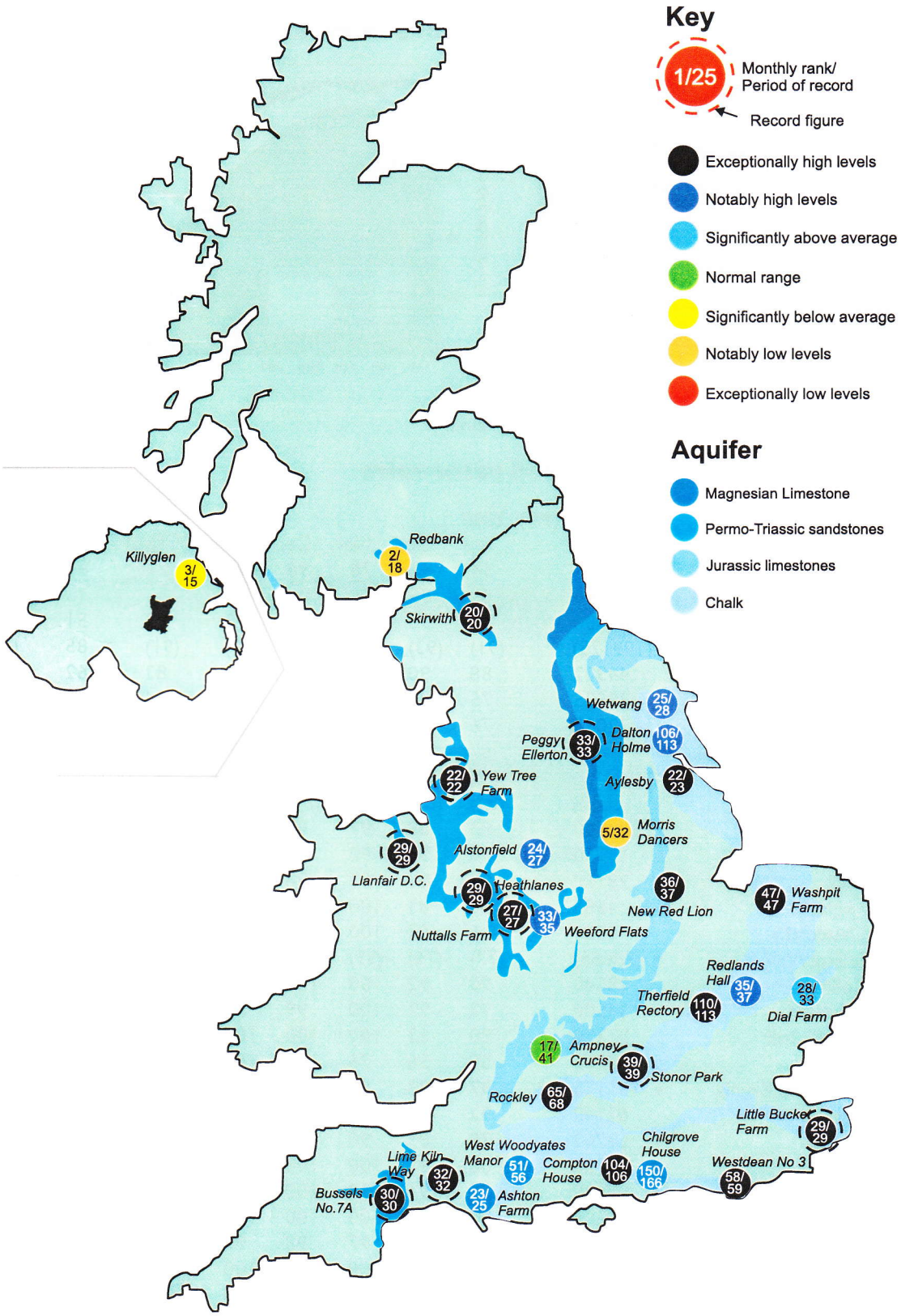
Groundwater levels January /February 2001

Borehole	Level	Date	Jan. av.
Dalton Holme	21.95	26/01	17.16
Washpit Farm	48.05	02/02	43.59
Therfield Rectory	86.23	29/01	77.58
Dial Farm	25.94	04/01	25.46
Rockley	142.88	29/01	136.21
Little Bucket	86.90	31/01	67.45
West Woodyates	99.09	31/01	91.48

Borehole	Level	Date	Jan. av.
Chilgrove	70.56	29/01	56.08
Killyglen	114.99	01/02	116.30
New Red Lion	21.63	10/01	14.49
Ampney Crucis	102.42	29/01	102.34
Redbank	7.72	30/01	8.35
Skirwith	131.65	25/01	130.36
Yew Tree Farm	14.18	30/01	13.58

Borehole	Level	Date	Jan. av.
Llanfair D.C.	81.02	01/02	79.87
Morris Dancers	31.84	25/01	32.41
Heathlanes	63.96	25/01	61.81
Nuttalls Farm	131.52	11/01	129.29
Bussels No. 7A	25.26	25/01	24.09
Alstonfield	207.98	15/01	199.34

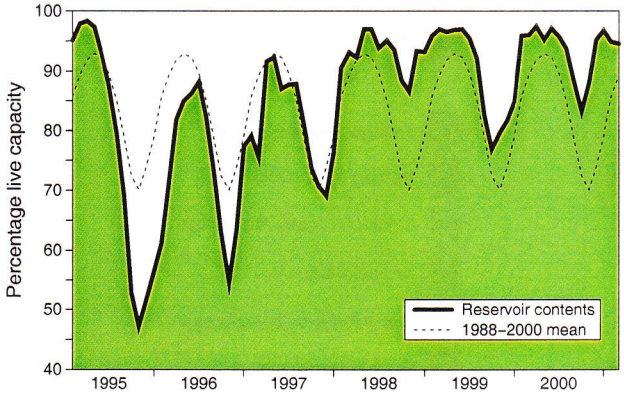
Levels in metres above Ordnance Datum



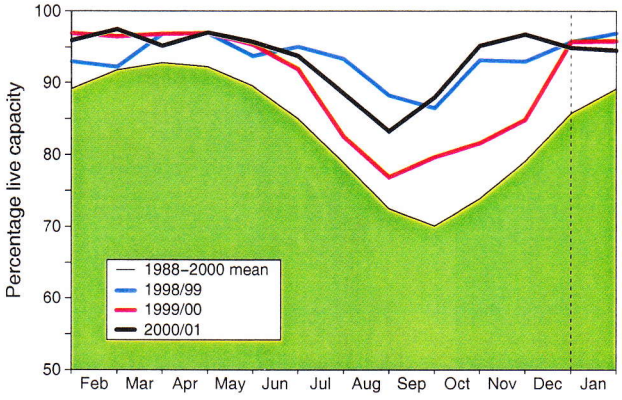
Groundwater levels - January 2001

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.

Guide to the variation in overall reservoir stocks for England and Wales



Comparison between overall reservoir stocks for England and Wales in recent years



These plots are based on the England and Wales figures listed below.

Percentage live capacity of selected reservoirs

Area	Reservoir	Capacity (Ml)	2000 Sep	Oct	Nov	Dec	2001 Jan	Feb	Min. Feb	Year* of min
North West	N Command Zone	• 124929	54	62	78	96	95	94	63	1996
	Vyrnwy	55146	89	99	100	100	93	93	45	1996
Northumbrian	Teesdale	• 87936	78	95	99	100	99	97	51	1996
	Kielder	(199175)	(91)	(93)	(97)	(95)	(93)	(91)	85	1989
Severn Trent	Clywedog	44922	88	90	98	98	82	82	62	1996
	Derwent Valley	• 39525	75	87	100	100	100	94	15	1996
Yorkshire	Washburn	• 22035	76	85	98	97	89	95	34	1996
	Bradford supply	• 41407	67	83	99	100	99	99	33	1996
Anglian	Grafham	** (55490)	(92)	(94)	(94)	(89)	(88)	(88)	67	1998
	Rutland	**(116580)	(84)	(81)	(89)	(89)	(89)	(86)	68	1997
Thames	London	• 202340	83	88	97	98	98	97	70	1997
	Farmoor	• 13830	98	95	90	90	80	72	82	1991
Southern	Bewl	28170	85	80	89	98	100	100	47	1990
	Ardingly	4685	78	83	100	100	100	100	68	1997
Wessex	Clatworthy	5364	66	63	100	100	100	97	62	1989
	Bristol WW	• (38666)	(77)	(76)	(95)	(99)	(95)	(100)	58	1992
South West	Colliford	28540	90	92	100	100	100	100	52	1997
	Roadford	34500	92	97	100	99	98	98	30	1996
	Wimbleball	21320	80	83	100	100	100	100	59	1997
	Stithians	5205	58	56	76	100	100	100	38	1992
Welsh	Celyn and Brenig	• 131155	97	98	99	100	95	97	61	1996
	Brianne	62140	92	97	100	100	94	97	84	1997
	Big Five	• 69762	78	83	90	89	94	100	67	1997
	Elan Valley	• 99106	88	96	100	100	100	99	73	1996
East of Scotland	Edinburgh/Mid Lothian	• 97639	76	91	99	100	99	99	72	1999
	East Lothian	• 10206	93	100	100	100	100	100	68	1990
West of Scotland	Loch Katrine	• 111363	50	75	97	98	90	94	85	2000
	Daer	22412	68	98	100	100	100	100	91	1997
	Loch Thom	• 11840	60	80	100	100	100	100	93	1998
Northern Ireland	Silent Valley	• 20634	33	45	65	85	100	95	62	2000

()figures in parentheses relate to gross storage • denotes reservoir groups *last occurrence **updated gross capacity

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 1988-2000 period only (except for West of Scotland where data commence in 1994). 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 of the Environment, Transport and the Regions, 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; the Hydrological Summaries for the autumn and early winter of 2000/2001, in particular, stand as a testimony to the assistance provided by many hydrometric personnel working in exceptionally challenging circumstances.

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.nwl.ac.uk/ih

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