Hydrological summary

for the United Kingdom

January 2000

General

Most of the UK enjoyed a mild and generally sunny January but rainfall patterns displayed marked regional contrasts. Precipitation totals were well above average throughout much of Scotland but parts of the English lowlands were exceptionally dry. Despite the limited rainfall, overall reservoir contents remain very healthy; significant recoveries were reported for a few lowland pumped storage reservoirs where high pesticide concentrations in the rivers greatly restricted infill during December. The limited lowland rainfall resulted in only modest infiltration in almost all aquifer outcrop areas. Nonetheless, most groundwater levels are currently around the seasonal average; the lowest levels are in the east where late winter/early spring rainfall would be especially beneficial.

Rainfall

Vigorous frontal systems – particularly during the first fortnight and at the end of the month – brought gales and abundant rainfall to large parts of Northern Britain, the Scottish Highlands especially. Notable storm rainfall totals were associated with a very slow-moving depression on the 10-12th (e.g. 155 mm in 48 hrs at Capel Curig in north Wales and 54.6 mm in 24 hrs at Brampton, Cumbria). Anticyclonic conditions dominated southern and eastern Britain during January and the contrasting regional synoptic patterns are closely reflected in the precipitation totals. Above average totals were largely restricted to the mountains of north Wales, the Lake District and, particularly, the Scottish Highlands where a few raingauges recorded more than twice the January average. In central and southern England a few notably dry localities (e.g. in the Midlands and along the south coast) registered less than 20%. Northern Ireland was dry also, reporting its second lowest January rainfall since 1987. A broad accentuation in the north-west/south-east rainfall gradient across the UK (a familiar feature of the recent past) is again evident over the last three months. The Nov-Jan period was (provisionally) the fourth wettest for Scotland in a series from 1869 whilst large parts of the Anglian, Thames and Southern regions have recorded <80% of average rainfall. Considerably more regional coherence typifies rainfall accumulations in the 12-month (Feb-Jan) timespan, most regions - western Scotland aside - have recorded rainfall well within the normal range, with relatively low rainfall totals being confined to southern England.

River flows

Entering 2000, catchments throughout the UK were saturated and vulnerable to further significant rainfall. Following widespread late-December flooding further floodplain inundations occurred in Scotland, particularly around the 6/7th January – snowmelt was a contributory factor in many catchments. In northern England notable spates were triggered by the protracted rainfall over the 10-12th; flooding was significant in north Wales and in northern England – the Eden exceeded bankfull at Carlisle and the South Tyne inundated parts of Haltwhistle. By mid-month, steep recessions characterised most rivers. These were reversed over the final week in northern Britain but continued in the south where, entering February, flows were seasonally depressed in some impermeable catchments. Monthly runoff totals displayed very wide regional and local variations. Near average totals characterised many spring-fed rivers in the English lowlands (reflecting a high groundwater component following heavy December recharge) whilst flows in impermeable catchments were generally low, below half the monthly averages in some rivers (e.g. the Wallington and Medway). By contrast, runoff totals for many Scottish catchments ranked amongst the highest quartile. Over the Nov-Jan period, runoff totals are outstanding for some Scottish catchments (e.g. the Clyde). In a few low-lying eastern catchments (e.g. the Whiteadder) corresponding totals are below average – a pattern widely repeated in the English lowlands.

Groundwater

Soils remained wet throughout January – at month-end appreciable soil moisture deficits were confined to a small area inland from the Wash. But the rainfall distribution in January was very unfavourable in groundwater terms - rainfall to the Chalk outcrops being typically in the 30-40% range. Consequently, infiltration was very modest and the exceptionally brisk rises reported for many index wells and boreholes in December were reversed or greatly moderated in January. Notwithstanding this erratic behaviour, levels in the Chalk are generally close to the late-winter average across most of the outcrop. An exception is in Northern Ireland where low rainfall together with the unusual responsiveness of the Killyglen well (to which the overlying gravels is a contributory factor), resulted in a very steep decline from the December peak. Levels in the limestone aquifers declined briskly over the latter half of January but remain close to the January average. Moderate declines also characterised the more responsive Permo-Triassic sandstones outcrops – with sluggish recoveries continuing in the slowest responding units. Generally, levels remain healthy in the more westerly outcrops but low in the east.

Institute of Hydrology

British Geological Survey

Rainfall accumulations and return period estimates

Area	Rainfall	Jan 2000	Nov 99-Jan 00	RP	Aug 99-Jan 00	RP	May 99-Jan 00	RP	Feb 99-Jan 00	RP
England	**mm**	**50**	**258**		**552**		**706**		**888**	
& Wales	**%**	**56**	**95**	**2-5**	**108**	**2-5**	**101**	**2-5**	**99**	**2-5**
North West	mm	113	422		757		979		1226	
	%	93	115	2-5	105	2-5	102	2-5	102	2-5
Northumbrian	mm	73	274		500		699		891	
	%	87	109	2-5	104	2-5	105	2-5	104	2-5
Severn Trent	mm	31	197		481		630		815	
	%	44	91	2-5	116	2-5	108	2-5	108	2-5
Yorkshire	mm	53	215		448		617		832	
	%	67	89	2-5	98	2-5	97	2-5	101	2-5
Anglian	mm	20	125		352		489		621	
	%	39	77	2-5	111	2-5	105	2-5	104	2-5
Thames	mm	22	160		424		567		689	
	%	35	81	2-5	112	2-5	105	2-5	100	>2
Southern	mm	28	205		488		603		739	
	%	35	83	2-5	108	2-5	99	2-5	95	2-5
Wessex	mm	30	244		550		685		863	
	%	35	93	2-5	115	2-5	105	2-5	103	2-5
South West	mm	50	378		690		852		1124	
	%	36	94	2-5	99	2-5	94	2-5	96	2-5
Welsh	mm	91	443		903		1094		1398	
	%	64	101	2-5	114	2-5	106	2-5	106	2-5
Scotland	**mm**	**191**	**642**		**975**		**1284**		**1648**	
	%	**126**	**142**	**30-40**	**112**	**2-5**	**113**	**5-10**	**115**	**10-15**
Highland	mm	279	877		1280		1638		2149	
	%	148	149	30-50	118	5-10	119	10-15	122	30-40
North East	mm	102	384		627		839		1062	
	%	103	132	10-15	112	2-5	109	2-5	109	2-5
Tay	mm	173	549		872		1144		1410	
	%	120	140	10-20	119	5-10	119	5-10	115	5-10
Forth	mm	127	474		711		990		1219	
	%	108	139	10-20	108	2-5	113	5-10	110	2-5
Tweed	mm	89	348		566		796		983	
	%	89	122	5-10	101	2-5	104	2-5	101	2-5
Solway	mm	154	578		899		1229		1555	
	%	99	129	5-10	104	2-5	109	2-5	109	2-5
Clyde	mm	222	797		1174		1523		1932	
	%	117	145	30-40	111	2-5	113	5-10	114	5-10
Northern	**mm**	**59**	**397**		**718**		**896**		**1122**	
Ireland	**%**	**53**	**125**	**5-10**	**116**	**2-5**	**108**	**2-5**	**106**	**2-5**

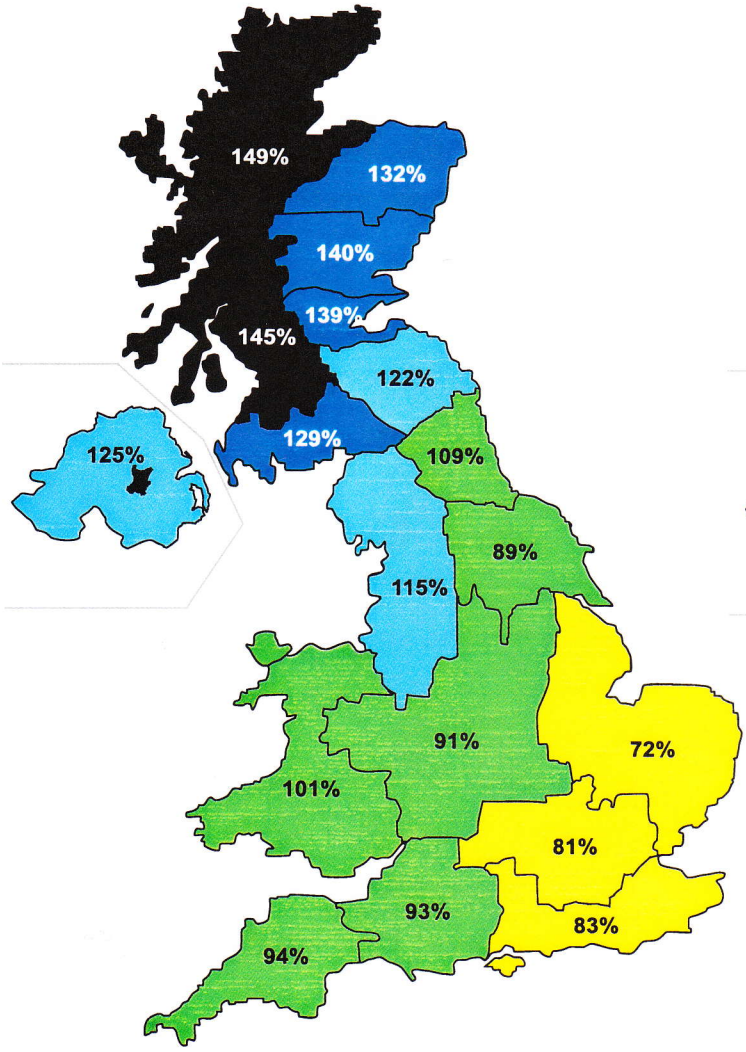
RP = Return period

The monthly rainfall figures* are copyright of The Met. Office and may not be passed on to any unauthorised person or organisation. **All monthly totals since July 1998 are provisional (see page 12).** Recent monthly rainfall figures for the Scottish regions have been compiled using data provided by the Scottish Environment Protection Agency. 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.

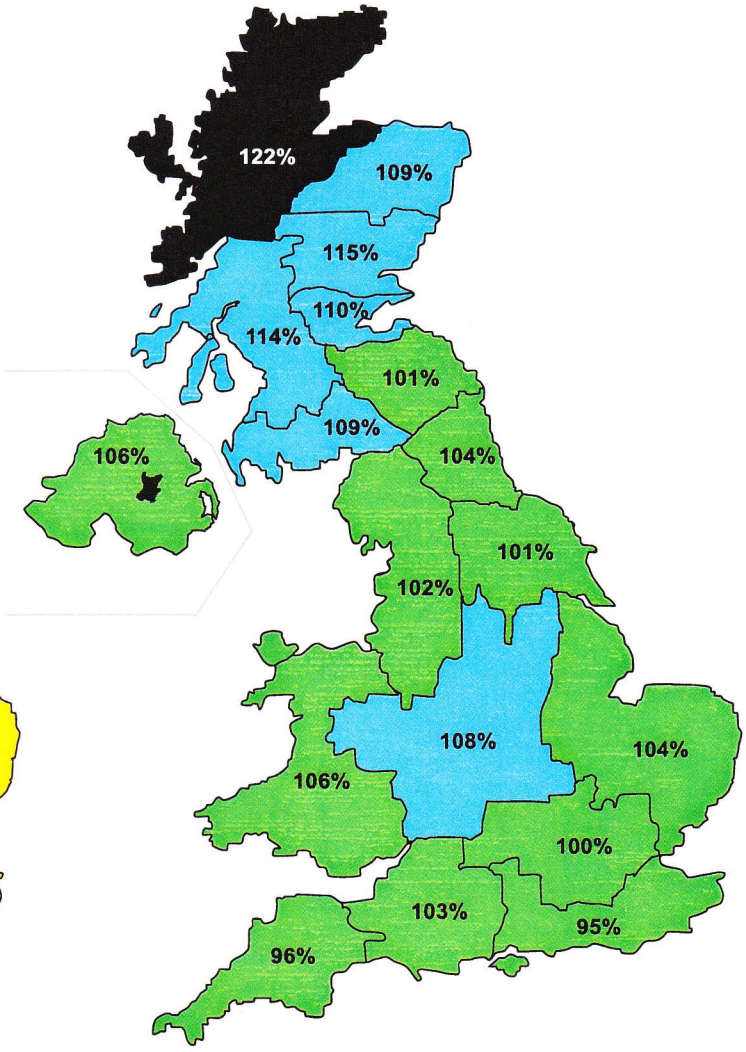
Rainfall . . . Rainfall . . . Rainfall

Key

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



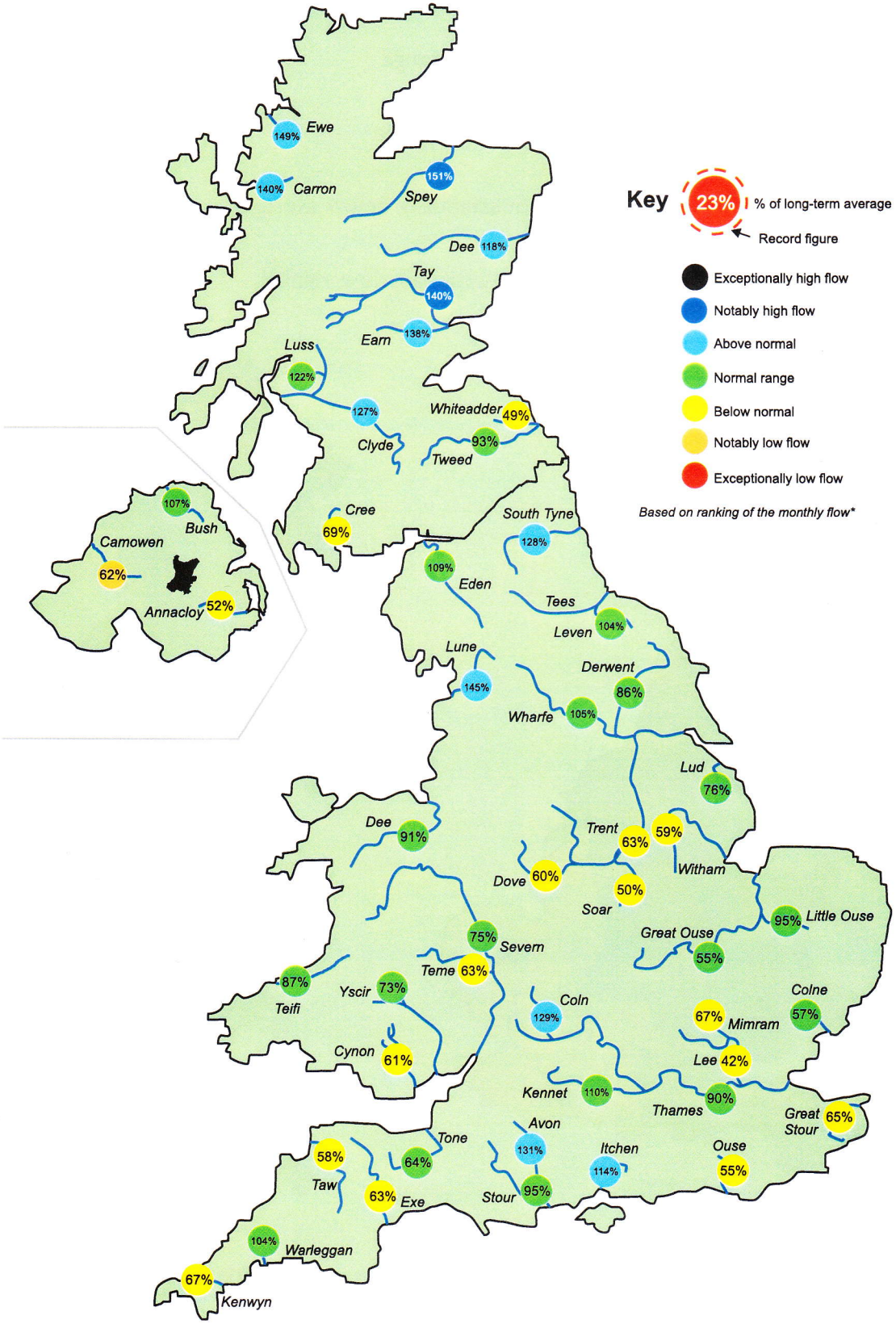
November 1999 - January 2000



February 1999 - January 2000

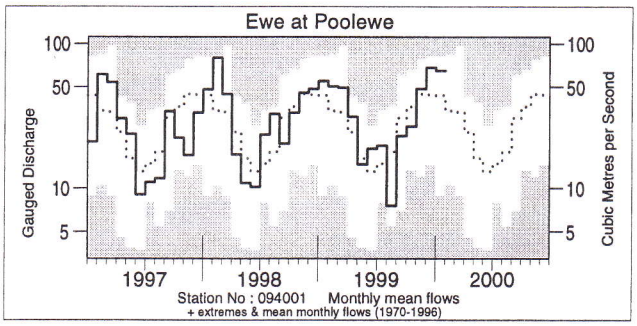
Rainfall accumulation maps

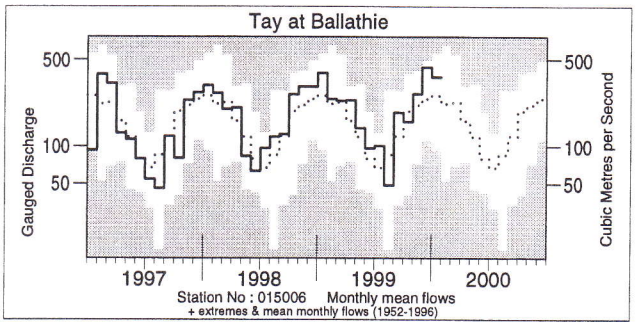
The preferred paths of most rain-bearing frontal systems is reflected in the November - January rainfall figures. In this timeframe, Scotland was again notably wet - concluding a ten-year sequence when the November - January precipitation has been more than 15% greater than average for the preceding record. Over the 12-month timespan, the February - January rainfall total for the UK is the third in succession to be well above the 1961-90 average.

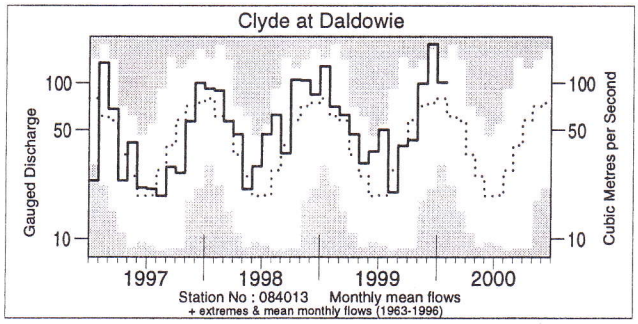


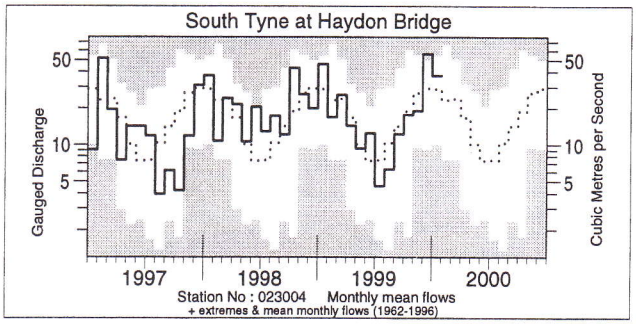
River flows - January 2000

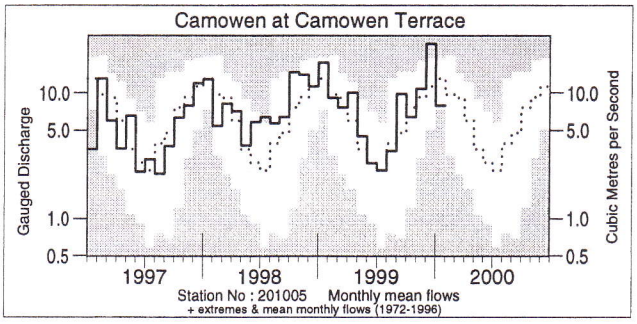
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

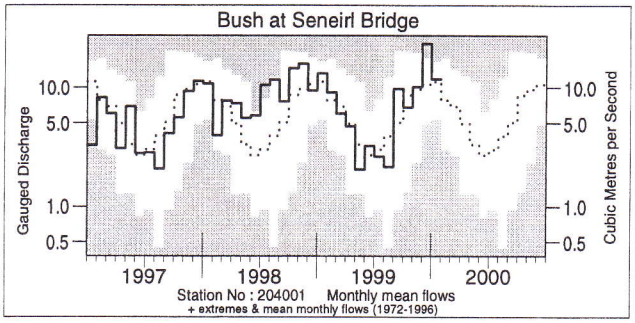


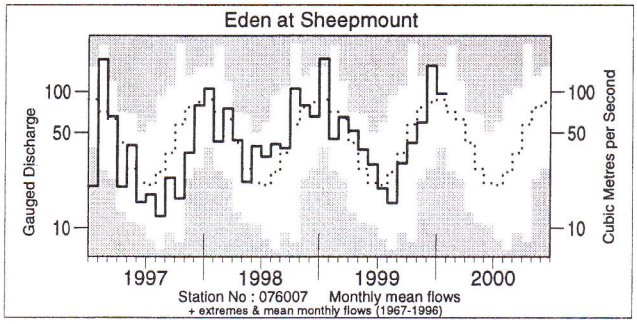


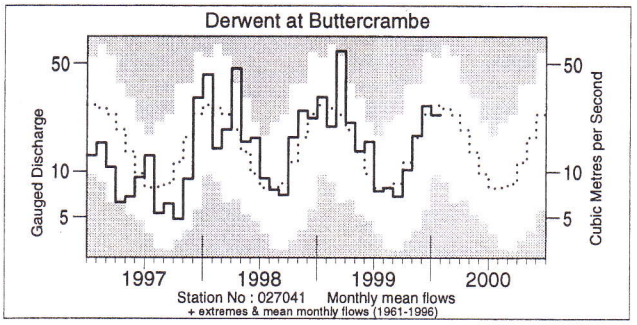


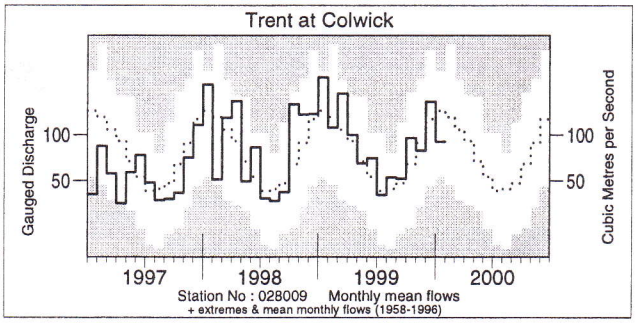


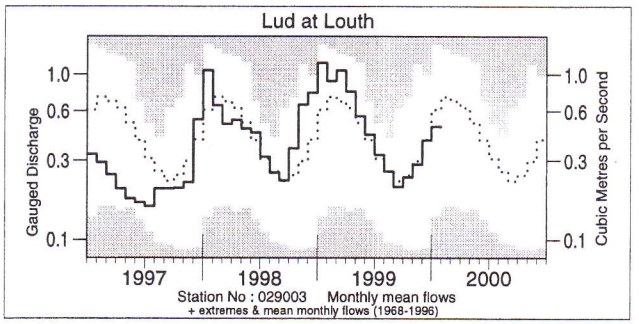








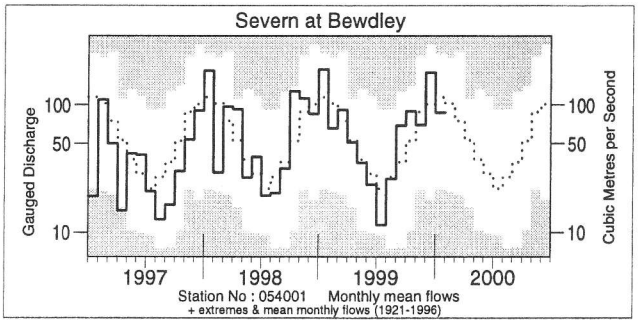


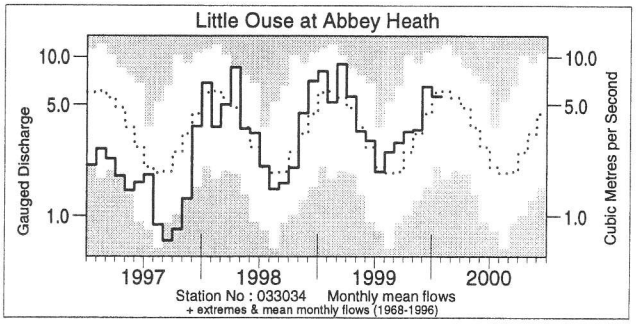


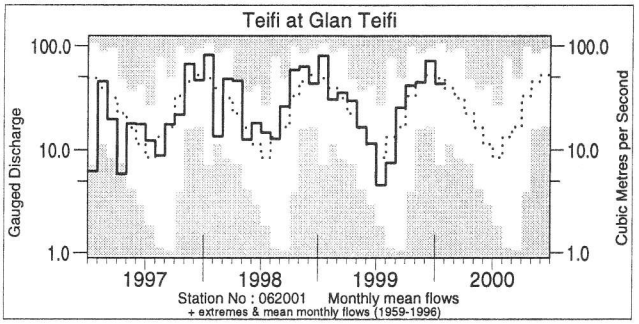
Monthly river flow hydrographs

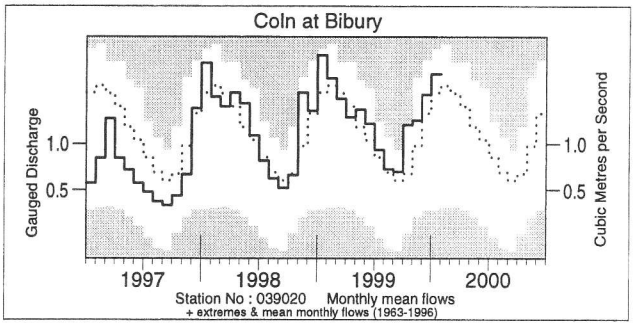
The river flow hydrographs show the monthly mean flow (bold trace), the long term average monthly flow (dotted trace) and the maximum and minimum flow prior to 1997 (shown by the shaded areas). Monthly flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas.

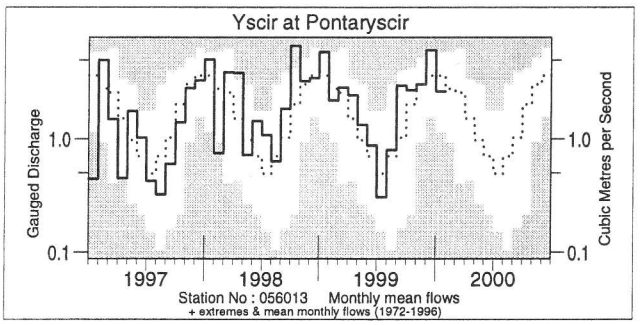
River flow . . . River flow . . .

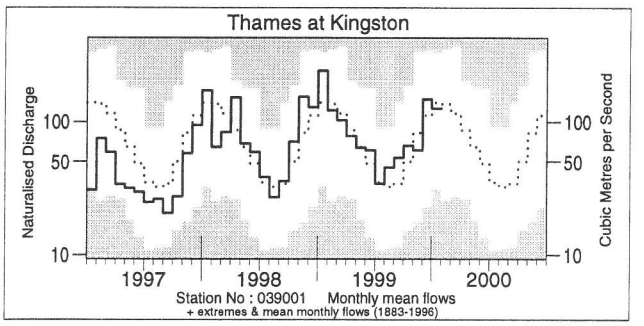


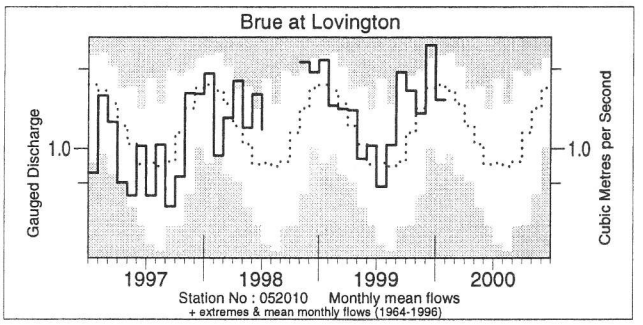


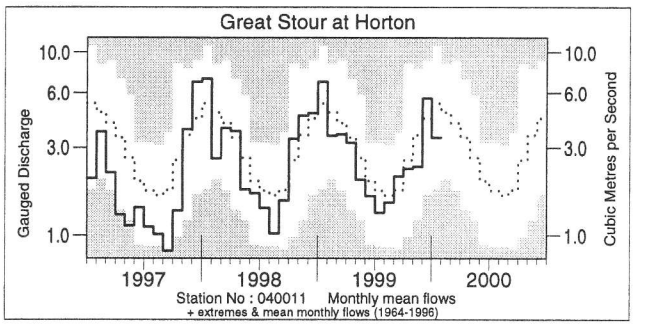


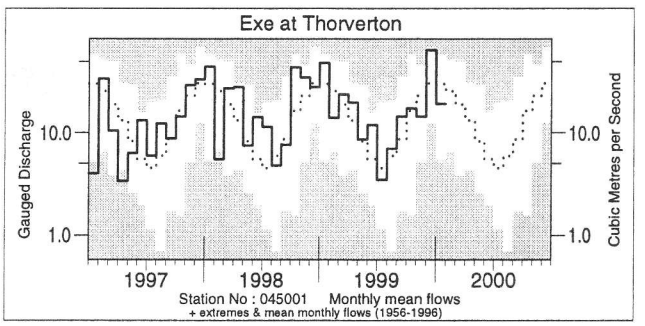


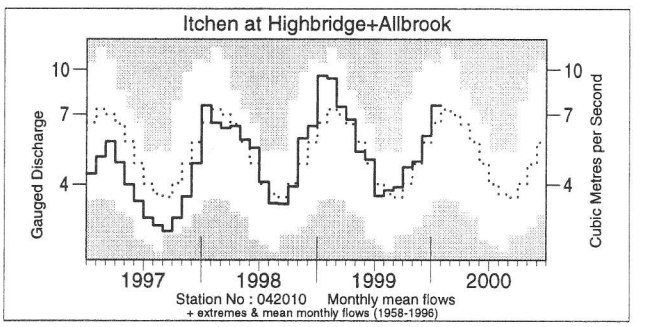












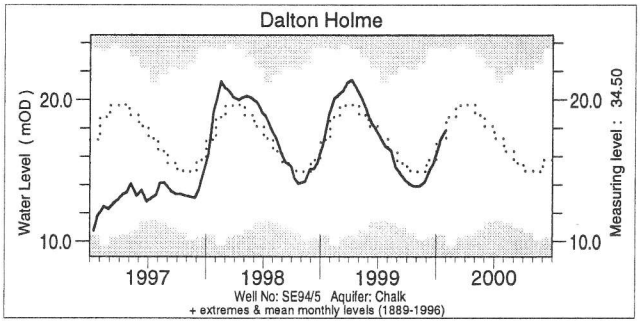
Notable runoff accumulations November 1999 - January 2000 (a); February 1999 - January 2000 (b)

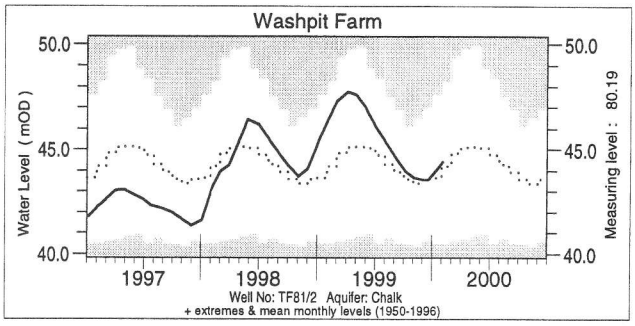
(a) River	%lta	Rank	River	%lta	Rank
Mimram	72	8/46	Clyde	164	37/37
Spey	151	46/48	Camowen	130	27/27
Earn	148	50/52	Bush	143	25/26
Whiteadder	85	10/31	Annacloy	72	3/20

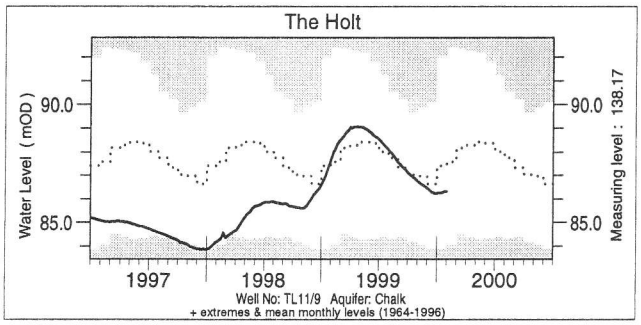
(b) River	%lta	Rank
Ouse	60	4/34
Brue	139	34/34
Yscir	165	27/27
Annacloy	82	2/20

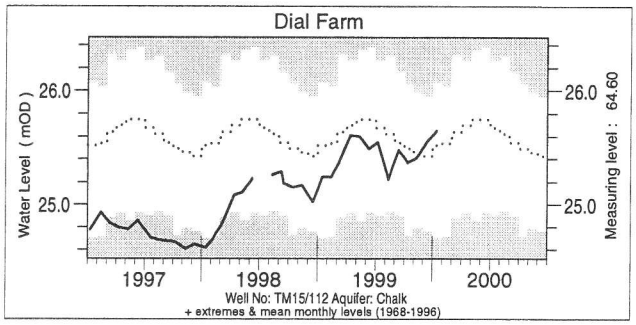
lta = long term average
Rank 1 = lowest on record

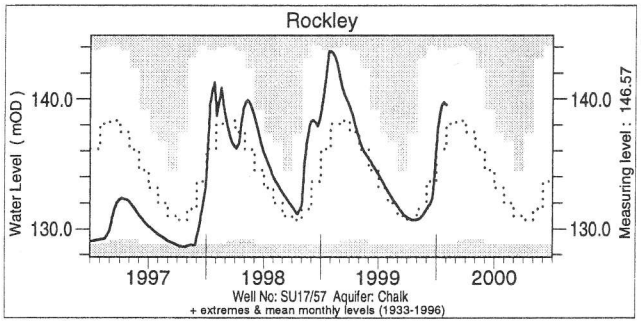
Groundwater . . . Groundwater

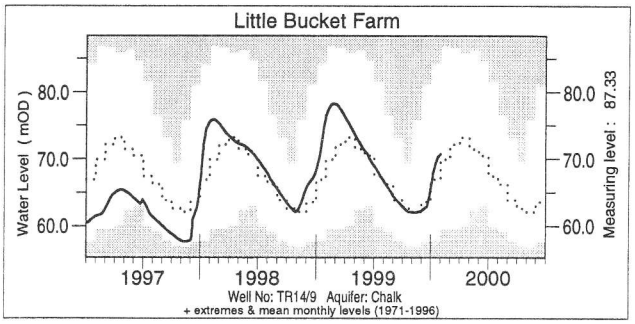


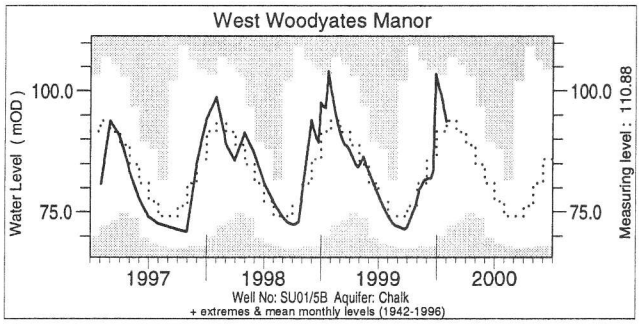


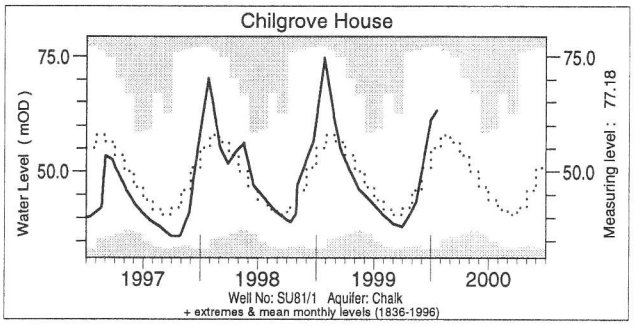


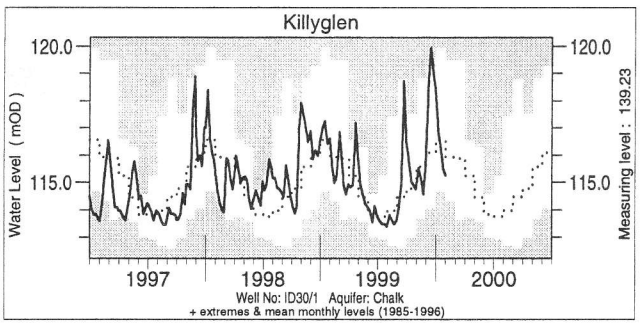


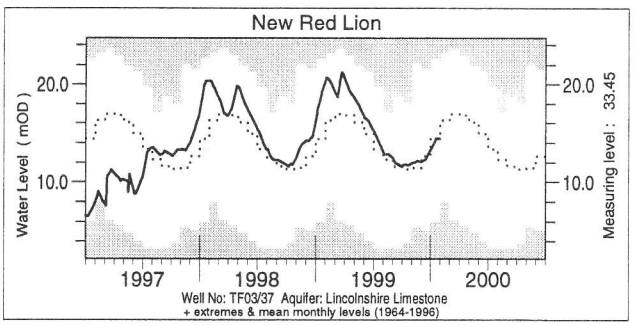








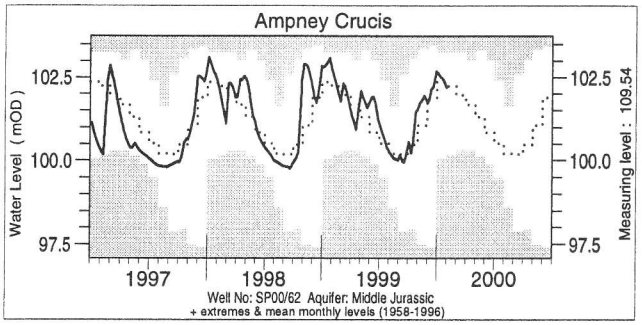


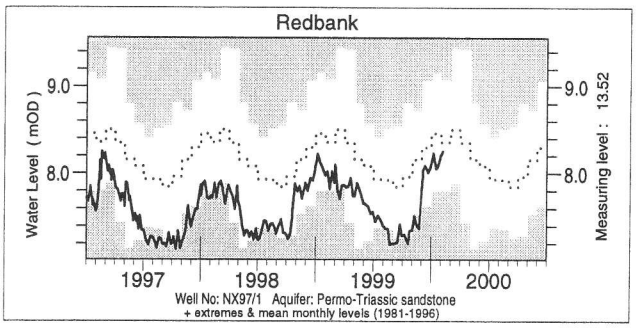


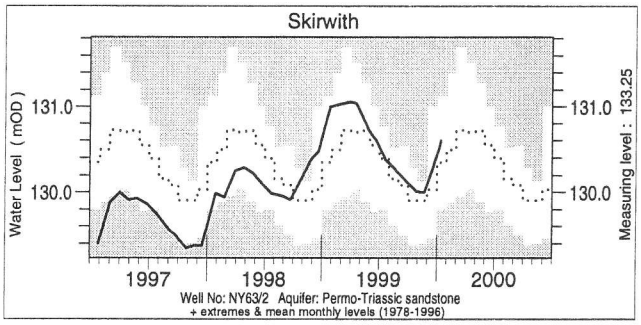
What is groundwater?

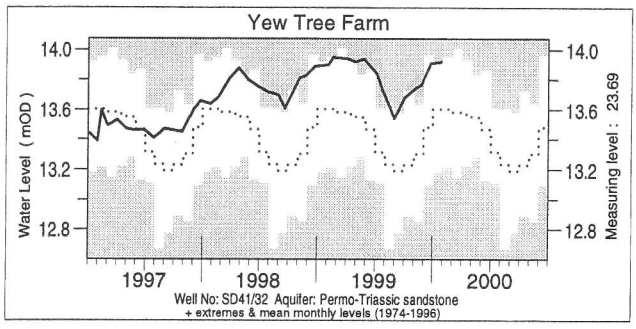
Groundwater is stored in the natural water bearing rock strata (or aquifers) which are found mostly in southern and eastern England (see page 11) where groundwater is the major water supply source. Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment 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.

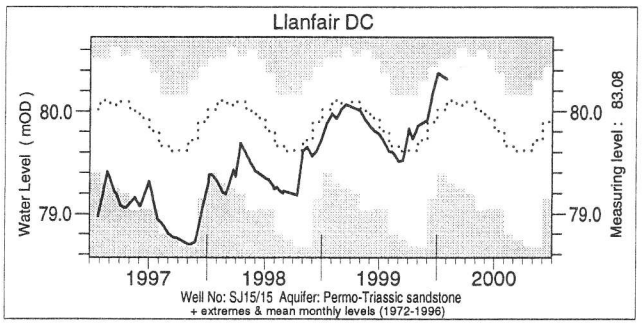
Groundwater . . . Groundwater

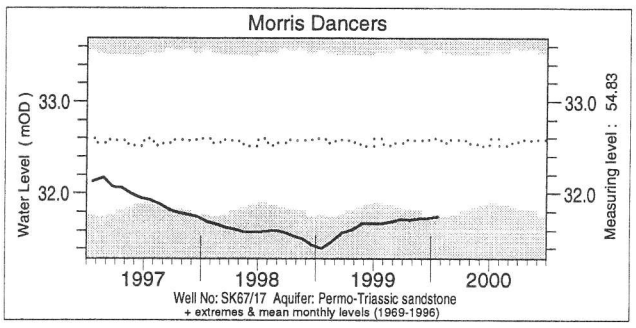


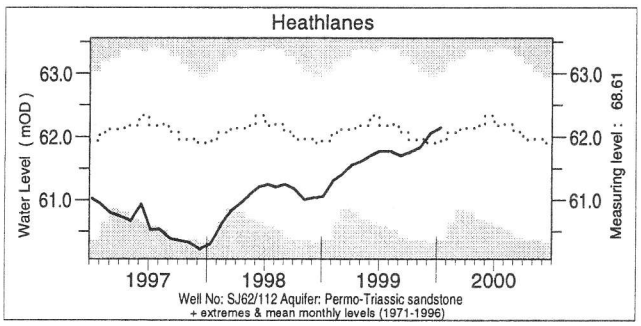


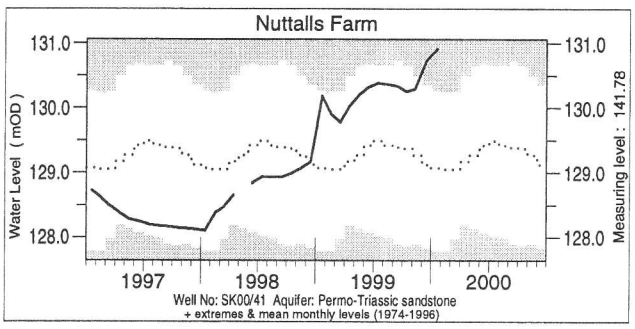


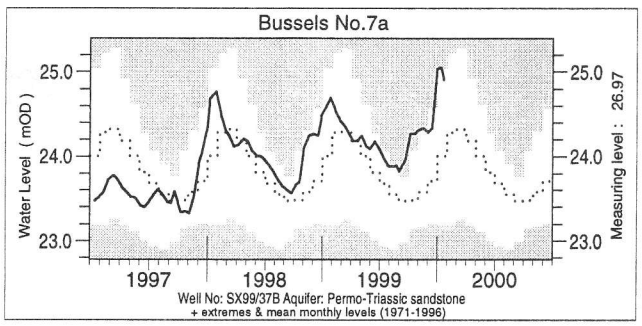


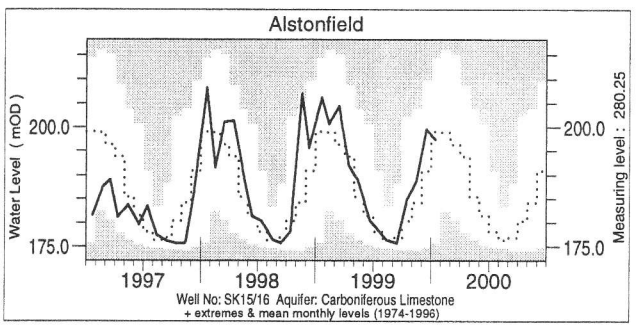












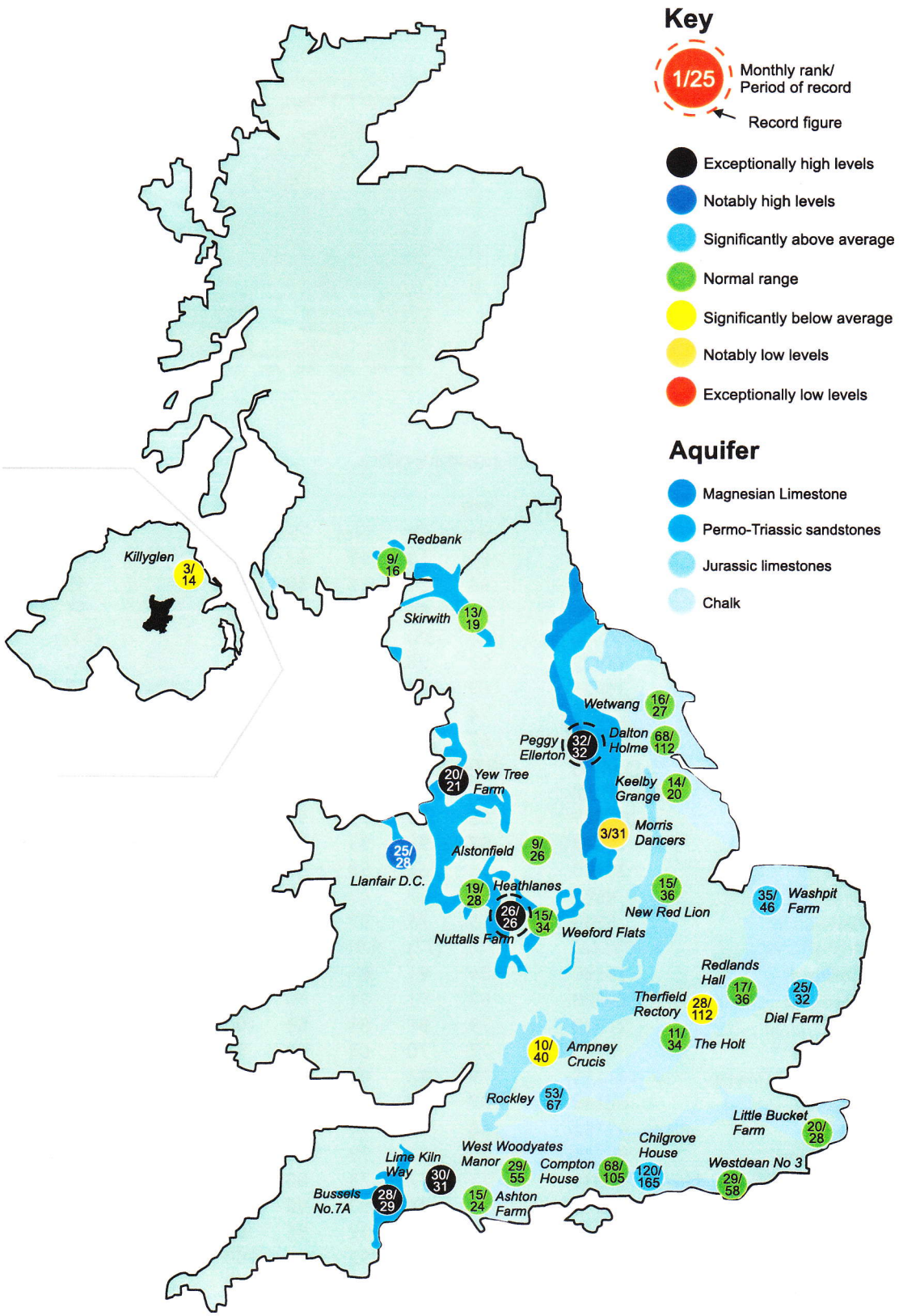
Groundwater levels January/February 2000

Borehole	Level	Date	Jan av.
Dalton Holme	17.83	28/01	17.14
Washpit Farm	44.42	04/02	43.60
The Holt	86.33	31/01	87.04
Dial Farm	25.65	13/01	25.49
Rockley	139.56	31/01	136.03
Little Bucket	70.71	31/01	66.96
West Woodyates	93.77	31/01	91.08

Borehole	Level	Date	Jan av.
Chilgrove	63.28	18/01	55.84
Killyglen	115.27	31/01	116.24
New Red Lion	14.39	01/02	14.20
Ampney Crucis	102.20	31/01	102.30
Redbank	8.25	06/02	8.42
Skirwith	130.60	14/01	130.33
Yew Tree Farm	13.92	27/01	13.56

Borehole	Level	Date	Jan av.
Llanfair D.C.	80.32	01/02	79.87
Morris Dancers	31.75	24/01	32.50
Heathlanes	62.16	13/01	61.89
Nuttalls Farm	130.91	18/01	129.23
Bussels No. 7A	24.91	20/01	24.02
Alstonfield	197.45	14/01	198.73

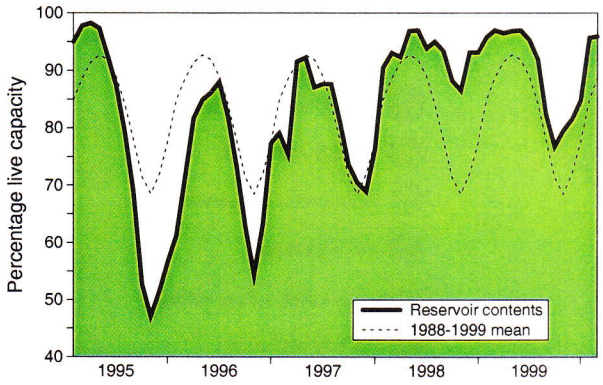
Levels in metres above Ordnance Datum



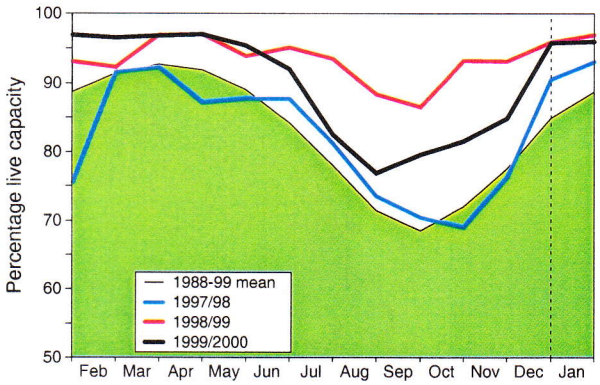
Groundwater levels - January 2000

The rankings are normally based on a comparison of current levels (usually a single reading in a month) with 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)	1999 Sep	Oct	Nov	Dec	2000 Jan	**Feb**	Min. Feb	Year* of min
North West	N Command Zone	• 133375	56	60	57	67	93	98	63	1996
	Vyrnwy	55146	66	81	76	82	99	96	45	1996
Northumbrian	Teesdale	• 87936	61	66	68	69	99	97	51	1996
	Kielder	(199175)	(88)	(88)	(86)	(87)	(100)	(93)	(85)	1989
Severn Trent	Clywedog	44922	83	88	82	84	91	88	62	1996
	Derwent Valley	• 39525	69	64	85	84	100	100	15	1996
Yorkshire	Washburn	• 22035	74	74	72	71	99	98	34	1996
	Bradford supply	• 41407	67	76	77	78	99	99	33	1996
Anglian	Grafham	** (55490)	(89)	(89)	(92)	(96)	(95)	(94)	(67)	1998
	Rutland	**(116580)	(82)	(79)	(81)	(83)	(88)	(91)	(68)	1997
Thames	London	• 206399	85	79	79	90	94	95	70	1997
	Farmoor	• 13843	97	95	93	98	77	95	82	1991
Southern	Bewl	28170	66	61	58	54	74	95	47	1990
	Ardingly	4685	61	57	63	65	100	100	68	1997
Wessex	Clatworthy	5364	75	75	87	91	100	98	62	1989
	Bristol WW	• (38666)	(76)	(77)	(89)	(89)	(93)	(94)	(58)	1992
South West	Colliford	28540	84	81	81	82	96	98	52	1997
	Roadford	34500	87	91	91	90	99	95	30	1996
	Wimbleball	21320	79	81	83	88	100	100	59	1997
	Stithians	5205	77	70	63	60	94	98	38	1992
Welsh	Celyn and Brenig	• 131155	79	86	88	89	99	99	61	1996
	Brianne	62140	87	100	98	96	100	98	84	1997
	Big Five	• 69762	68	87	90	92	94	98	67	1997
	Elan Valley	• 99106	70	77	99	100	100	100	73	1996
East of Scotland	Edinburgh/Mid Lothian	• 97639	71	71	73	80	100	98	72	1999
	East Lothian	• 10206	93	86	90	98	99	97	68	1990
West of Scotland	Loch Katrine	• 111363	74	92	92	95	88	85	85	2000
	Daer	22412	73	80	93	100	100	100	91	1997
	Loch Thom	• 11840	75	82	73	84	100	100	93	1998
Northern Ireland	Silent Valley	• 20634	56	71	69	58	61	62	62	2000

()figures in parentheses relate to gross storage • denotes reservoir groups *last occurence **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 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 IH) 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. Since the discontinuation of The Met. Office's CARP system in July 1998, rainfall figures have been provided by differing methods. Initial rainfall estimates for Scotland and the Scottish regions were derived by IH in collaboration with SEPA. In England and Wales, between July 1998 and May 1999, provisional rainfall figures derive from MORECS*. Beginning with the June 1999 report, provisional rainfall figures for England and Wales, the EA regions and Northern Ireland (from September 1999) 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 SEPA; over the coming months further monthly raingauge totals will be included for selected EA 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 cooperation of all data suppliers is gratefully acknowledged.

Subscription

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

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