Hydrological Summary
for the United Kingdom

December 2007

General
The December rainfall total for the UK equalled the 1961-90 monthly average – an unremarkable end to a year characterised by very exceptional hydrological conditions. One manifestation is that, after five successive months with below average rainfall, overall reservoir stocks for England & Wales remain a little above the early January average. Stocks are seasonally low in a few impoundments (e.g. Stithians and, in Scotland, Loch Thom) but levels in most reservoirs are well within the normal seasonal range. With soil moisture deficits largely eliminated, seasonal recoveries in river flow and recharge rates were well established in almost all areas by year-end. River flows were relatively depressed in mid-December but notable spates were common in the final week of the year; entering 2008 many catchments were vulnerable to further significant rainfall. Recharge to all but the most easterly aquifer units is underway and December groundwater levels were above average in most index wells and boreholes in England & Wales. Despite the dry autumn, the water resources outlook is generally good but a forecast continuation of the late-December sequence of vigorous low pressure systems signalled an enhanced risk of flooding in January.

Rainfall
The westward extension of a large high pressure cell over northern Europe produced cold and dry conditions in mid-December – when precipitation was largely restricted to fog-drip. This settled interlude was, however, bracketed by cyclonic episodes with severe gales and substantial rainfall (with snow on higher ground) affecting much of the country. Orographic enhancement contributed to notable precipitation totals in many western catchments (e.g. in the Lake District and north Wales); at Capel Curig a rainfall total of 51 mm on the 2nd was followed by 102mm on the 28th – a notably wet day across much of the country (with significant snowfall in northern Britain). The predominant synoptic conditions are generally well reflected in the December rainfall anomalies. Most upland areas from Exmoor to the northern Pennines reported above average rainfall – western catchments in Northern Ireland were wet also – but totals for some sheltered eastern areas fell below 75% (e.g. in central southern England and parts of eastern Scotland). Notwithstanding the recent high frequency of frontal systems, accumulated rainfall totals since last July are well below average in most regions. In parts of southern England it was the driest Aug-Dec since 1991 and in eastern Scotland, the Tay basin reported its lowest Sept-Dec rainfall since 1973. By contrast, provisional rainfall totals for 2007, boosted by the remarkable summer storms, exceed the average for almost all regions and were notably high in parts of central England – the Environment Agency's Midland region registered its 5th wettest year in a series from 1914.

River flow
Flow patterns in all but the most groundwater-dominated rivers displayed considerable spatial congruency in December. Generally, high flows characterised the first 10 days with modest flooding around the 8th (e.g. in Wales, Derbyshire and Antrim). Steep recessions ensued, resulting in some notably low winter flows in the third week of December, particularly in western Britain where frozen headwaters restricted runoff rates; the Luss, Bush (NI) and Welsh Dee were among those index rivers where flows approached December minima. Thereafter, flows increased briskly and flood alerts were common approaching year-end (e.g. in Cumbria); many rivers entered 2008 close to bankfull, and vulnerable to further rainfall. Most December runoff totals were within the normal range but seasonally low in some responsive catchments (e.g. the Kenwyn and Carron). Accumulated runoff totals in the 3-5-month timeframe are notably low in parts of Northern Ireland and Scotland rivers – where the Luss and Earn registered their lowest Oct-Dec runoff totals in records of 29- and 60-yrs respectively. However, as a result of the exceptional runoff rates through the summer, longer term accumulations in England & Wales are generally very healthy. Exceptionally high 2007 runoff totals were reported for some groundwater-fed streams (e.g. the Lambourn and Coln) and some responsive rivers (e.g. Teme and Gt Ouse). These contrast with very modest annual totals in parts of Scotland and Northern Ireland.

Groundwater
December precipitation totals were moderately below average across most major aquifer outcrop areas. Nonetheless, soil moisture deficits declined over the month and, at year-end, significant deficits were generally restricted to a zone from the Vale of York to northern Kent. Pulses of infiltration early and late in the month – the latter generally not captured in the groundwater level hydrographs featured on pages 7 & 8 – generated considerable groundwater levels rises in many areas, for example in the Chalk of the South-West (see the West Woodyates hydrograph) but recessions continued, generally from seasonally high autumn levels, in the most northerly Chalk outcrops (see Dalton Holme). December groundwater levels were generally within the normal range but with substantial spatial variations. Well below average autumn and early winter recharge is reflected in relatively depressed groundwater levels for index wells in Northern Ireland and southern Scotland. To the south however the remarkable summer recharge (in some areas) provides a counterbalance to the subsequent modest replenishment and groundwater levels are mostly above average; notably so in parts of the eastern Chalk (e.g. Norfolk – see Washpit Farm). With soils in most outcrop areas close to saturation and a continuing cyclonic synoptic pattern, there is potential for substantial further recharge in January.

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Rainfall . . . Rainfall . . .

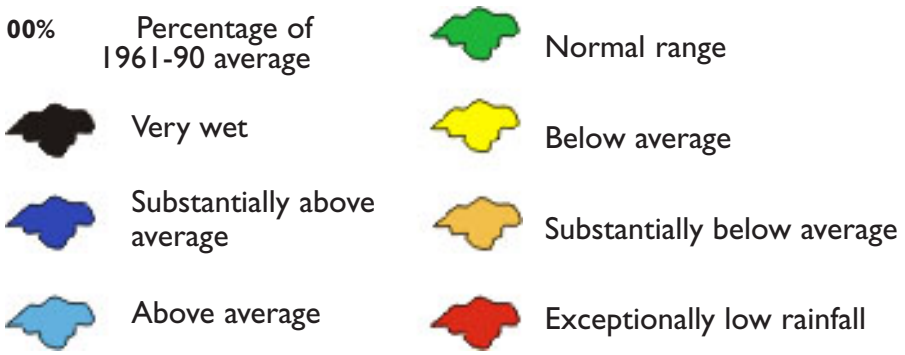
Rainfall accumulations and return period estimates

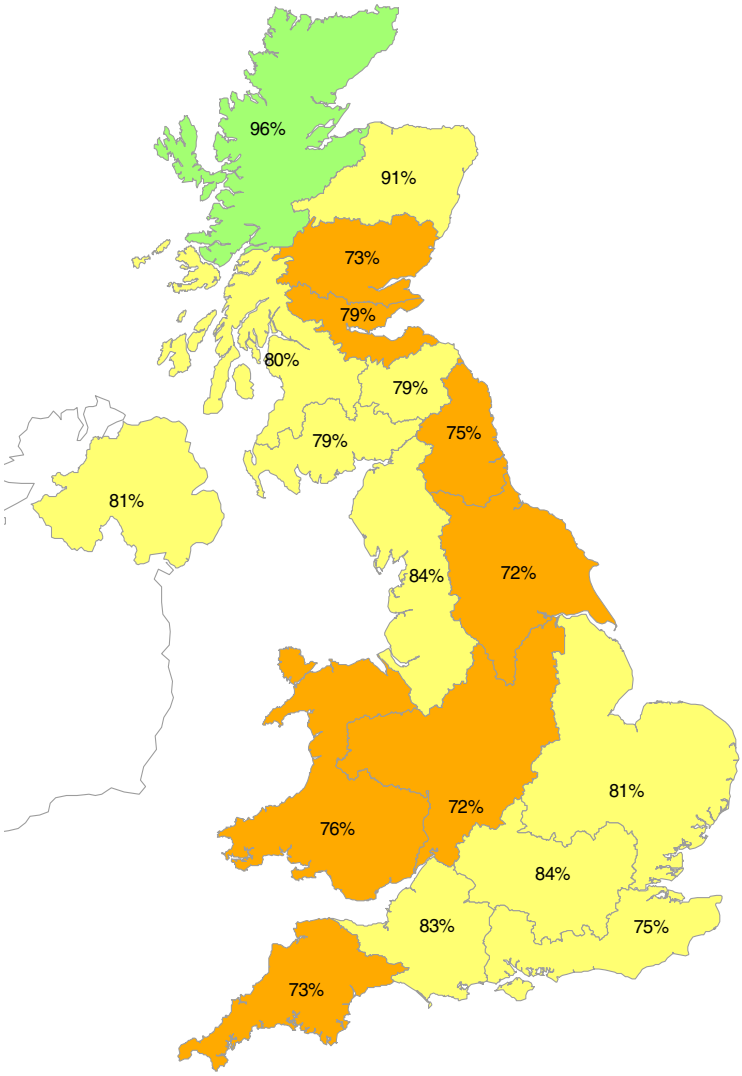
Area	Rainfall	Dec 2007	Oct 07- Dec 07	RP	Aug 07- Dec 07	RP	May 07- Dec 07	RP	Jan 07-Dec 07	RP
England & Wales	**mm**	**101**	**223**		**333**		**728**		**1014**	
	%	**106**	**82**	**5-10**	**78**	**5-10**	**118**	**5-10**	**112**	**5-10**
North West	mm	**169**	328		511		933		1304	
	%	**135**	87	2-5	84	2-5	110	2-5	107	2-5
Northumbrian	mm	**93**	199		303		644		883	
	%	**113**	81	5-10	75	5-15	108	2-5	102	2-5
Severn Trent	mm	**78**	177		253		696		938	
	%	**100**	82	5-10	72	5-15	133	20-30	122	15-25
Yorkshire	mm	**87**	190		278		689		934	
	%	**105**	80	5-10	72	5-15	121	5-10	112	5-10
Anglian	mm	**46**	137		220		549		715	
	%	**83**	83	2-5	81	5-10	130	10-20	118	5-10
Thames	mm	**62**	191		270		608		830	
	%	**87**	95	2-5	84	2-5	126	5-10	118	5-10
Southern	mm	**62**	192		282		593		834	
	%	**75**	77	5-10	75	5-10	111	2-5	106	2-5
Wessex	mm	**95**	235		332		694		975	
	%	**100**	90	2-5	83	2-5	121	2-5	114	2-5
South West	mm	**141**	280		416		862		1313	
	%	**100**	73	5-15	73	5-10	110	2-5	110	2-5
Welsh	mm	**185**	340		504		999		1455	
	%	**119**	77	5-10	76	5-10	110	2-5	108	2-5
Scotland	**mm**	**144**	**398**		**635**		**1007**		**1573**	
	%	**92**	**84**	**2-5**	**87**	**2-5**	**101**	**2-5**	**107**	**5-10**
Highland	mm	**188**	553		843		1247		1988	
	%	**97**	92	2-5	96	2-5	106	5-10	114	10-20
North East	mm	**88**	275		446		813		1130	
	%	**89**	90	2-5	91	2-5	115	5-10	110	5-10
Tay	mm	**103**	296		452		834		1337	
	%	**77**	75	5-15	73	5-15	97	2-5	104	2-5
Forth	mm	**94**	270		441		779		1215	
	%	**83**	77	5-10	79	5-10	99	2-5	106	2-5
Tweed	mm	**106**	235		376		753		1064	
	%	**109**	80	5-10	79	5-10	109	2-5	106	2-5
Solway	mm	**155**	354		570		942		1418	
	%	**103**	78	2-5	79	5-10	96	2-5	99	2-5
Clyde	mm	**169**	451		714		1087		1762	
	%	**91**	80	2-5	80	5-10	91	2-5	101	2-5
Northern Ireland	**mm**	**117**	**266**		**429**		**779**		**1105**	
	%	**107**	**80**	**5-10**	**81**	**5-10**	**105**	**2-5**	**101**	**2-5**

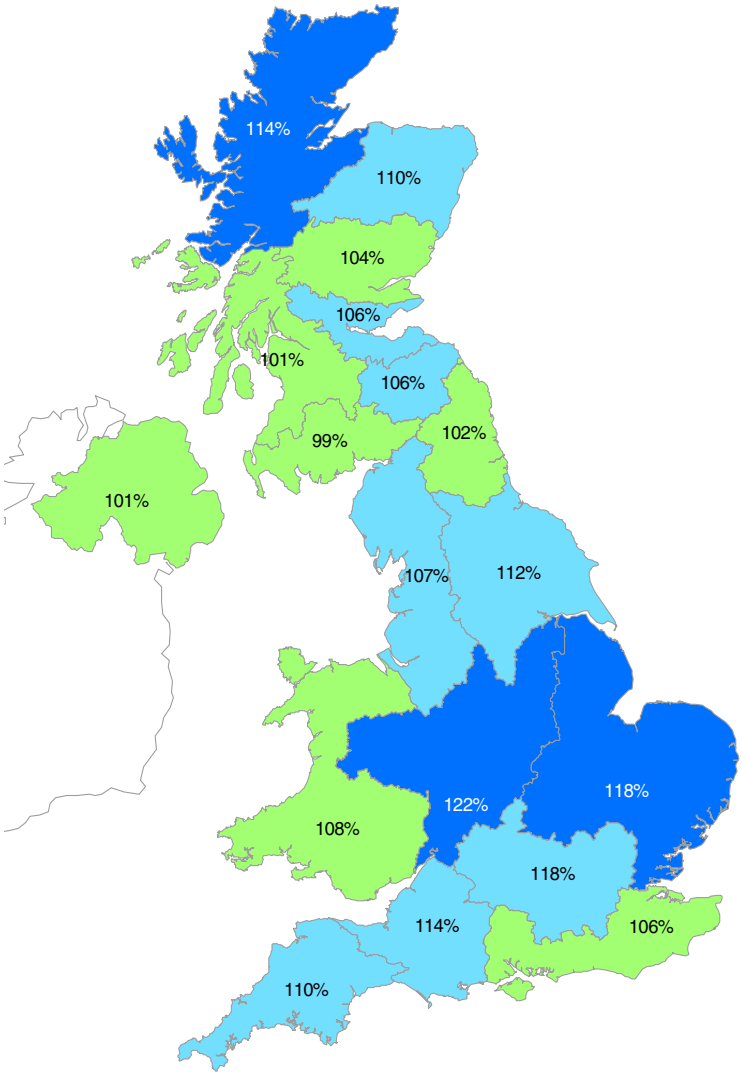
% = percentage of 1961-90 average *RP = Return period*

Important note: Figures in the above table may be quoted provided their source is acknowledged (see page 12). Where appropriate, specific mention must be made of the uncertainties associated with the return period estimates. The RP estimates are based on data provided by the Met Office and derived following the method described in: Tabony, R. C. 1977, *The variability of long duration rainfall over Great Britain*. Met Office Scientific Paper no. 37. The estimates reflect climatic variability since 1913 and assume a stable climate. The timespans featured do not purport to represent the critical periods for any particular water resource management zone. For hydrological or water resources assessments of drought severity, river flows and/or groundwater levels normally provide a better guide than return periods based on regional rainfall totals.
All monthly rainfall totals since August 2007 are provisional.

Rainfall . . . Rainfall . . .





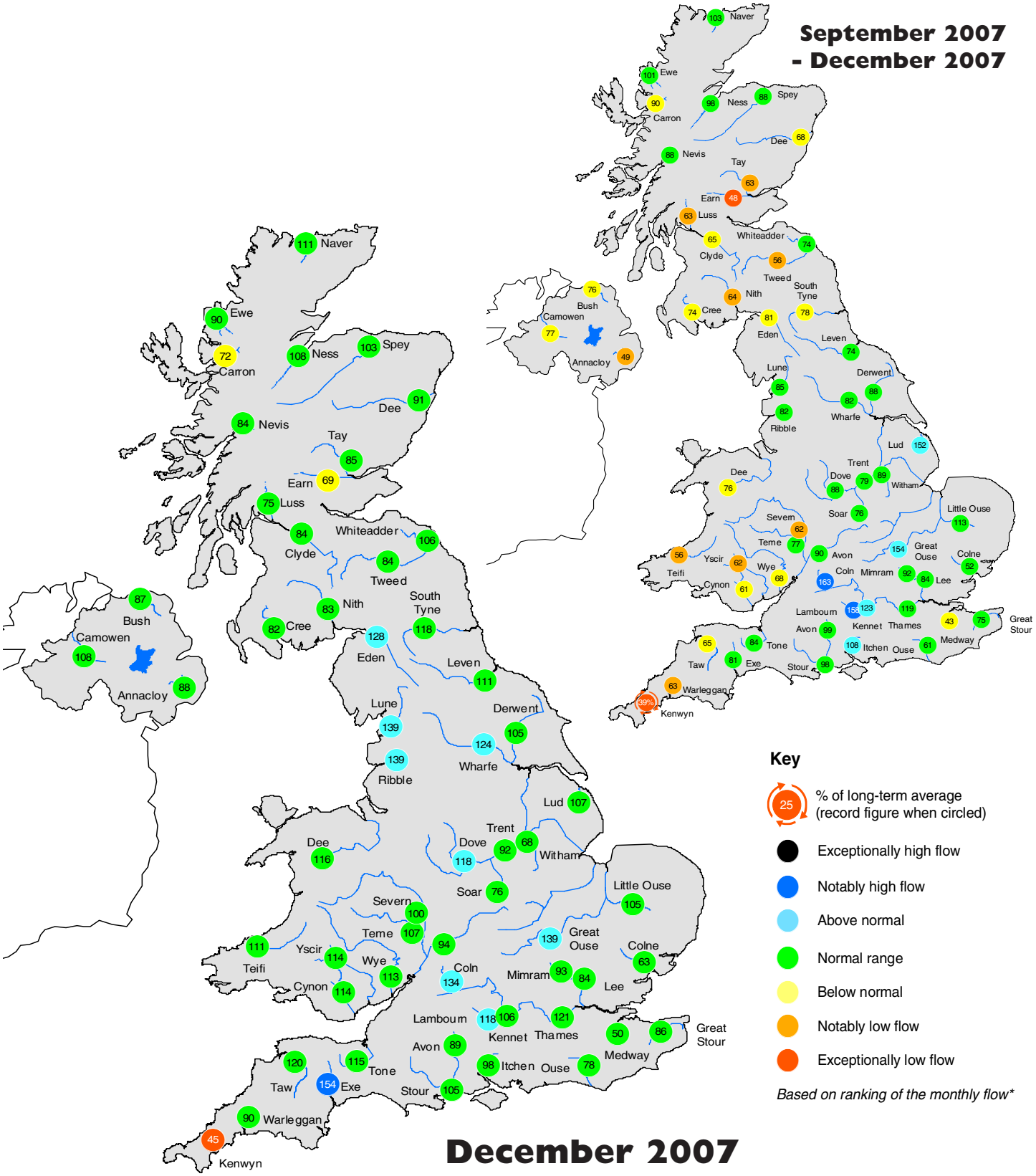


August 2007 - December 2007 **January 2007 - December 2007**

Rainfall accumulation map

The UK rainfall over the Aug-Dec period in 2007 was the 3rd lowest since 1975. Nonetheless, the annual rainfall total was well above average, and reinforces a tendency for increased rainfall in the recent past. 2007 ranks as the 6th wettest year for the UK since 1954; in this timeframe, all of the wetter years cluster in the post-1997 period.

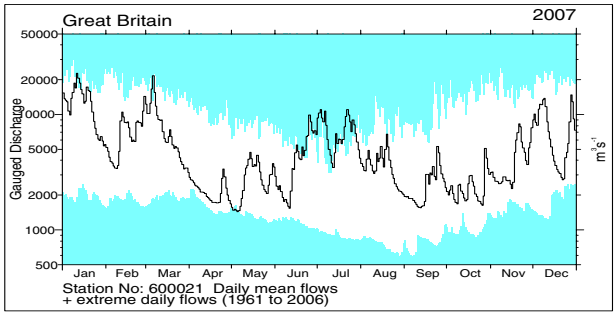
River flow . . . River flow . . .

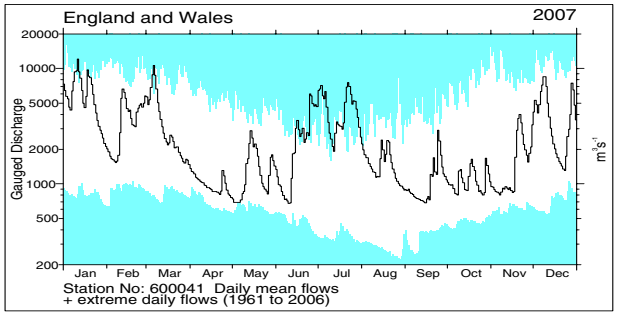


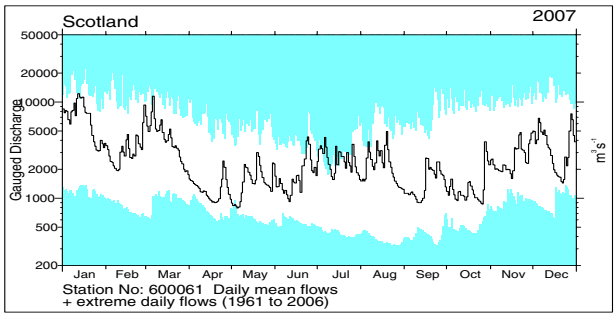
River flows

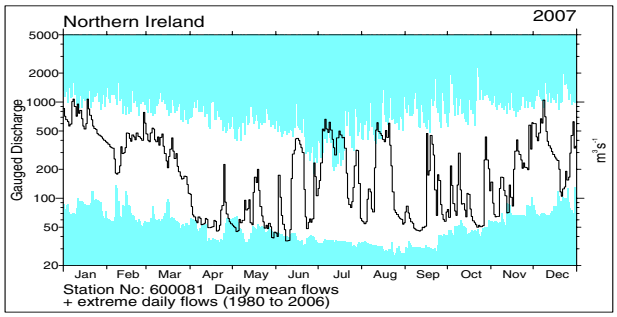
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

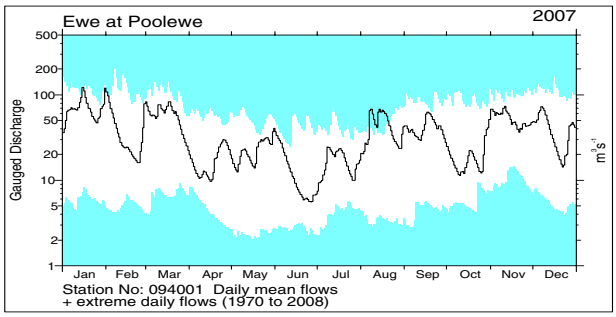
River flow . . . River flow . . .

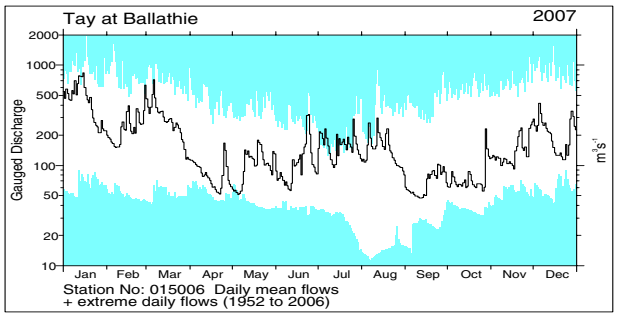


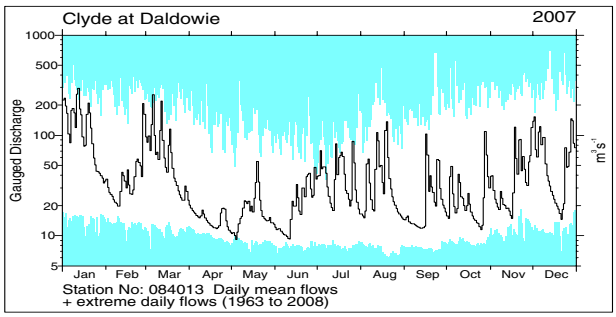


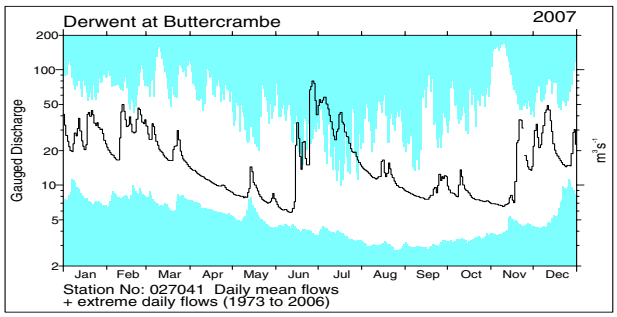


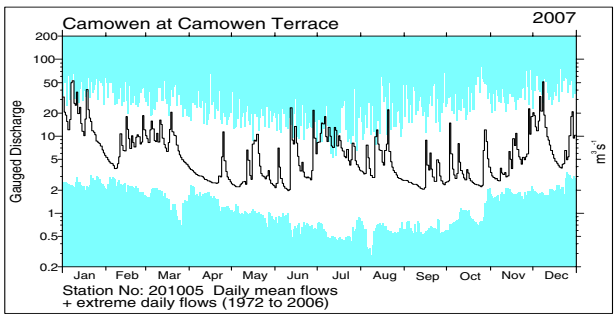


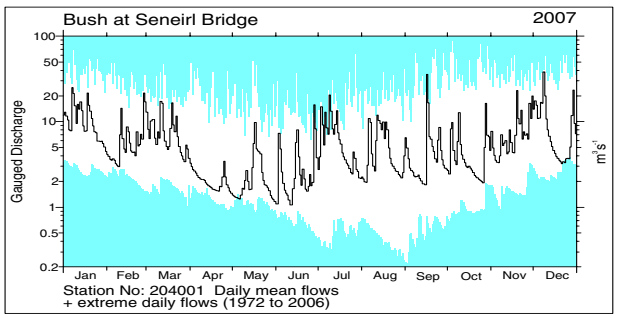








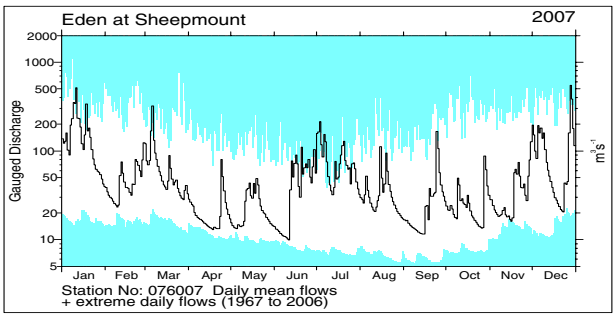


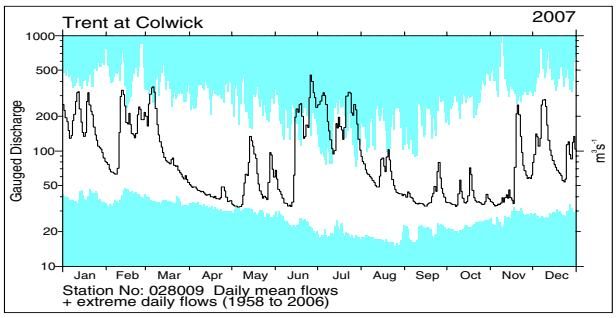


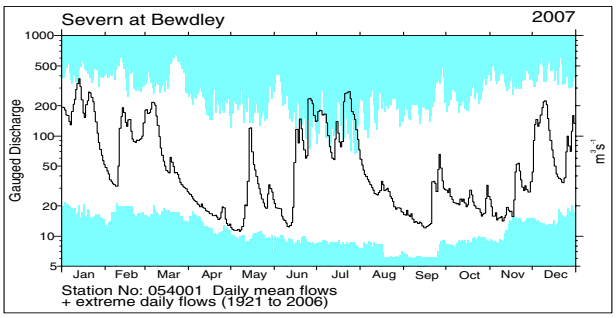
River flow hydrographs

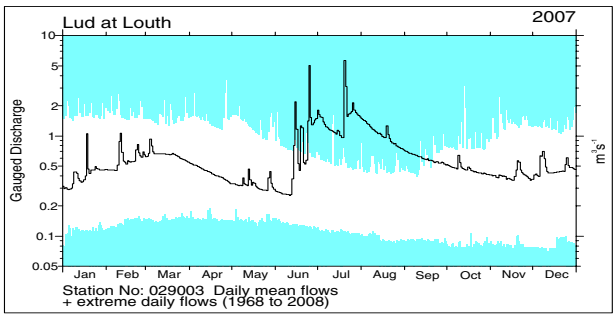
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to January 2007 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas.

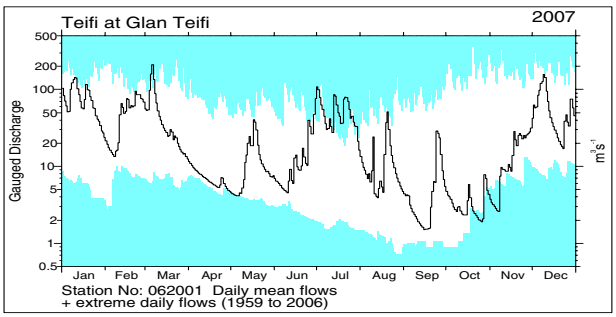
River flow . . . River flow . . .

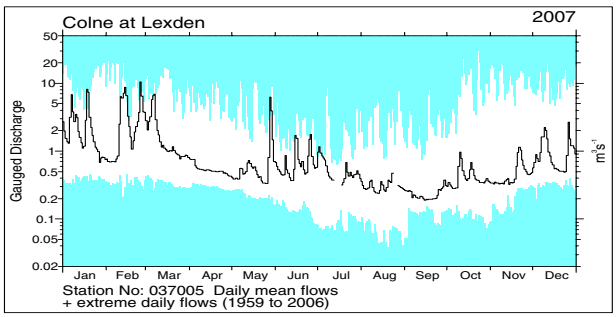


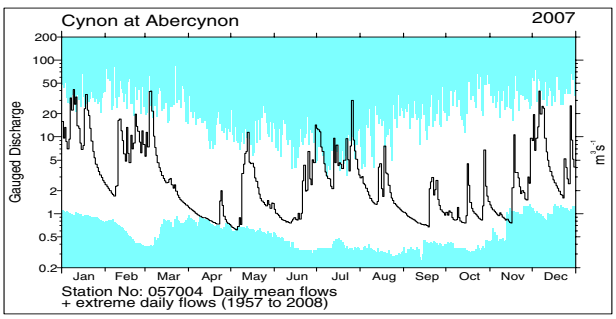


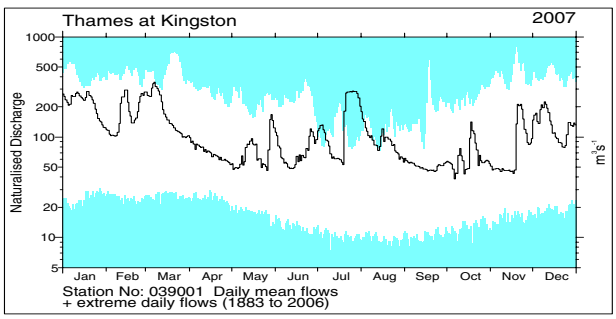


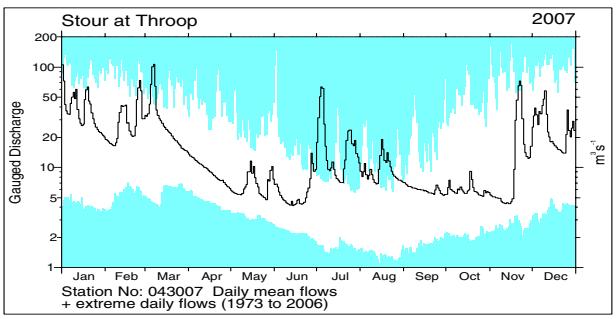


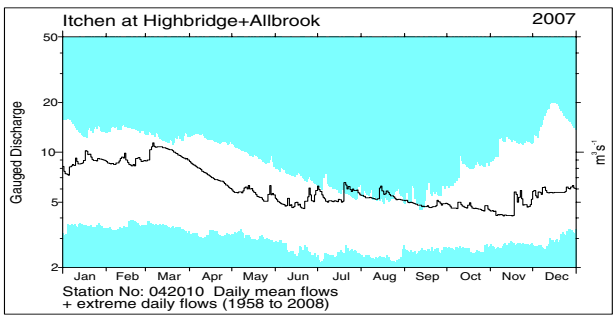












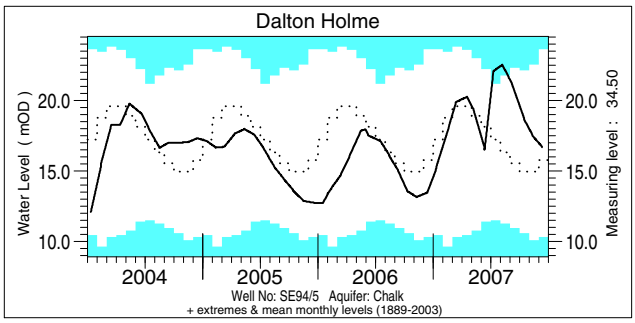
Notable runoff accumulations (a) September 2007 - December 2007, (b) January 2007 - December 2007

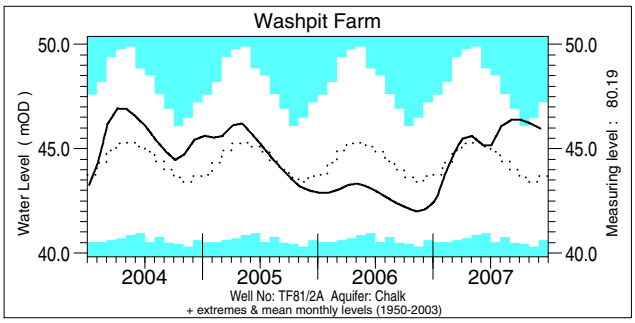
	River	%lta	Rank
a)	Tay	63	3/55
	Earn	48	3/60
	Forth	54	2/27
	Kenwyn	39	1/39
	Teifi	56	3/48
	Luss	63	2/29
	L Bann	43	1/28
	Annacloy	49	3/28

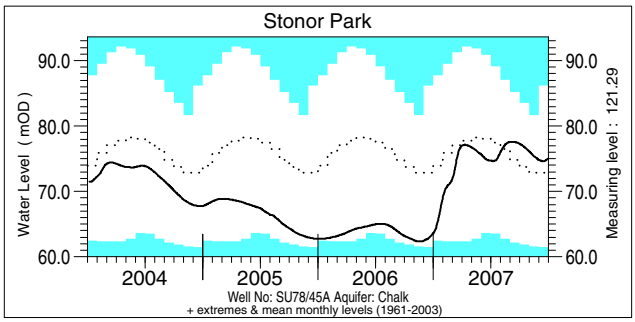
	River	%lta	Rank
b)	Trent	124	46/49
	Dover Beck	184	30/30
	Witham	156	46/48
	Ouse (Bedford)	174	73/75
	Stringside	144	36/39
	Little Ouse	126	32/36
	Blackwater	129	52/55
	Kennet	139	44/46
	Lambourn	148	44/45
	Coln	165	44/44
	Avon (Evesham)	168	70/71
	Teme	154	36/37
	Ewe	121	34/37
	Naver	124	29/30

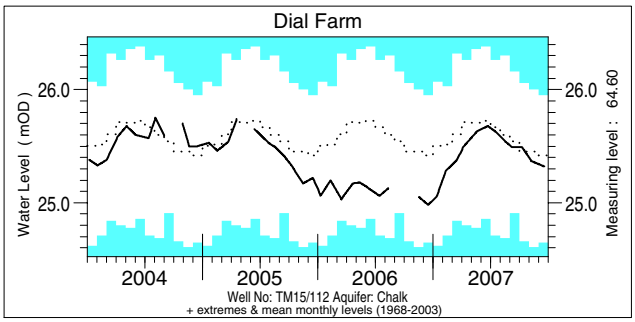
lta = long term average
Rank 1 = lowest on record

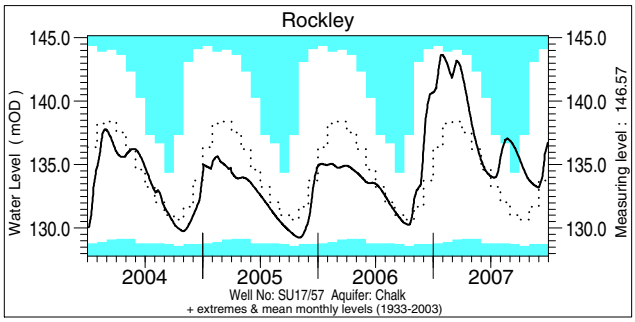
Groundwater . . . Groundwater

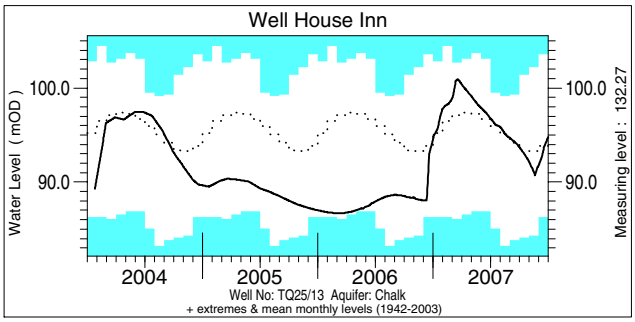


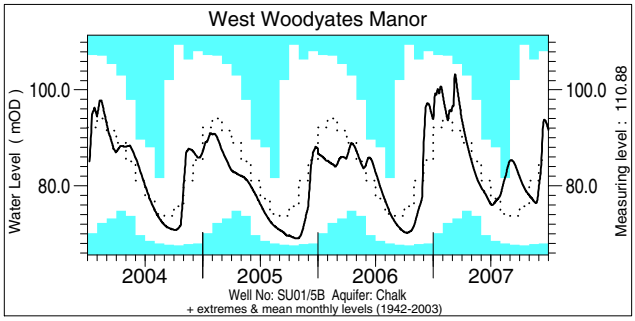


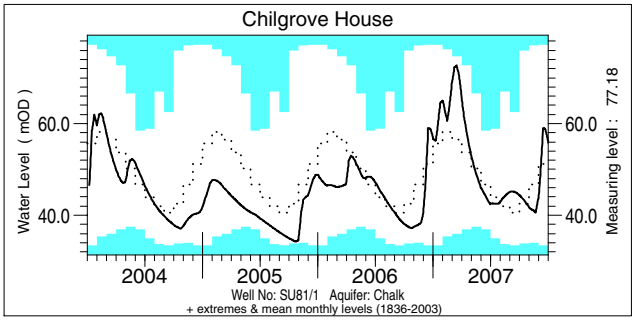


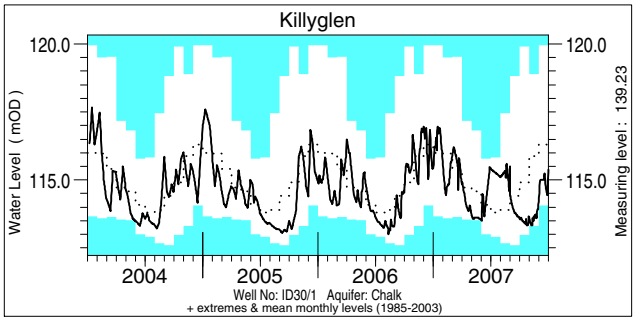


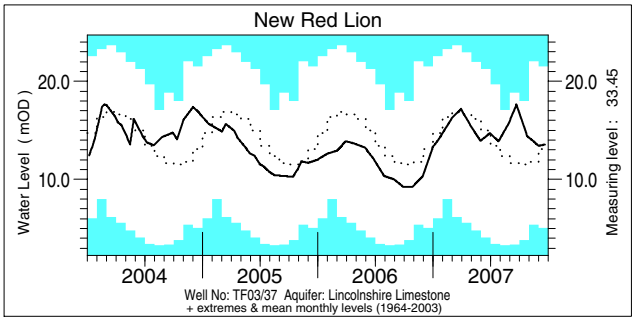






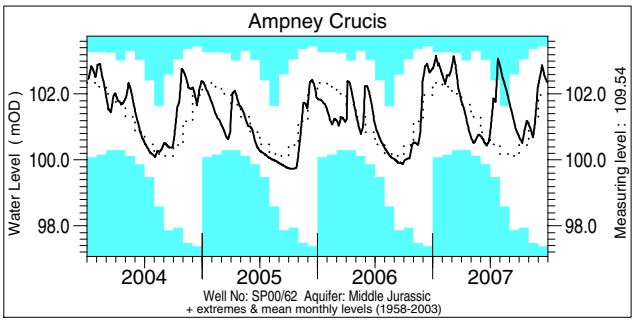


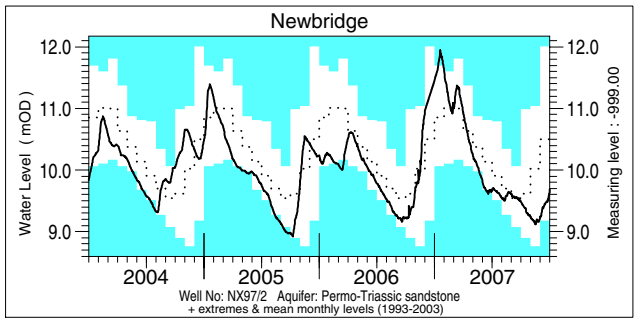


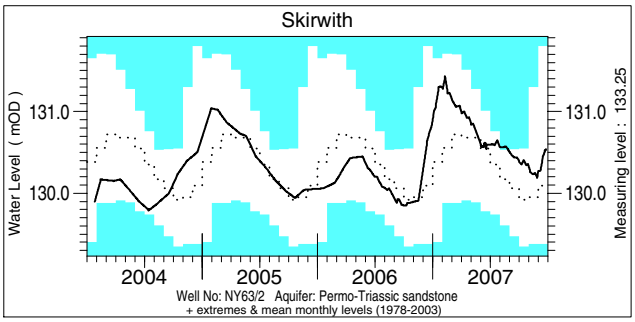


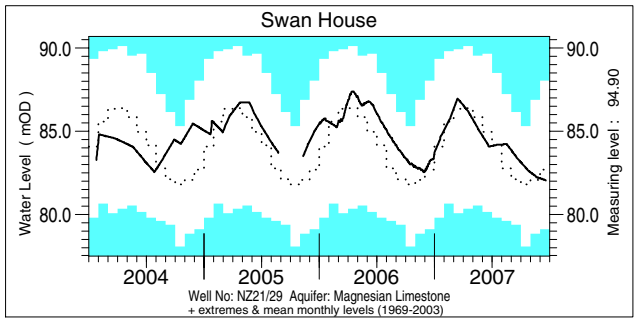
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined below overlying impermeable strata. The monthly mean and the highest and lowest levels recorded for each month 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.

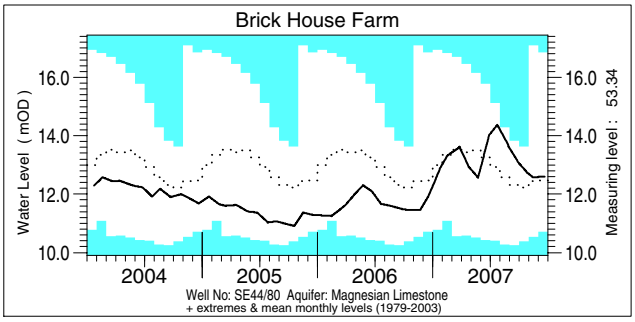
Groundwater . . . Groundwater

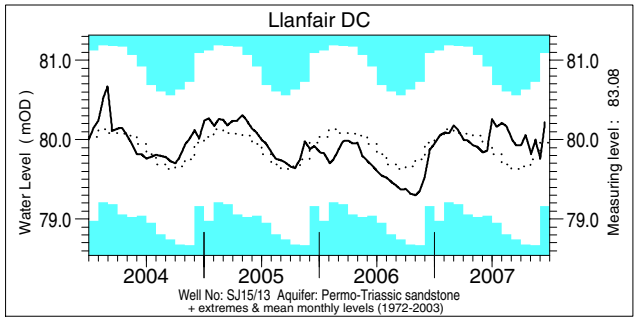


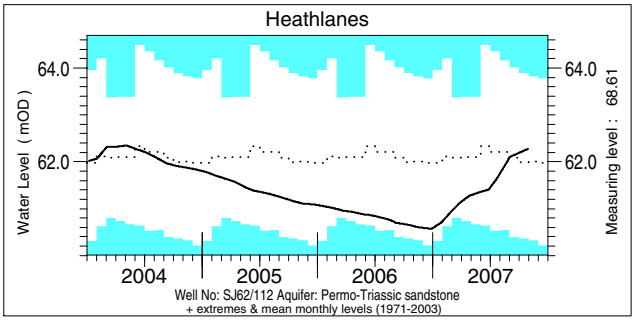


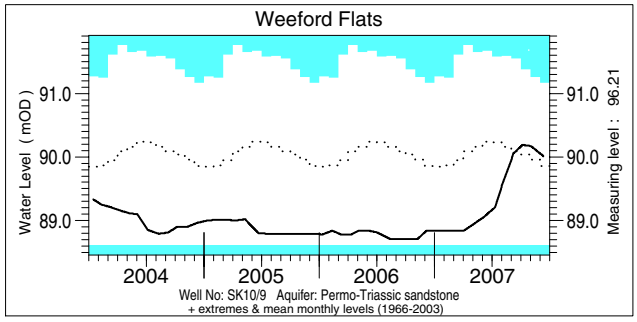


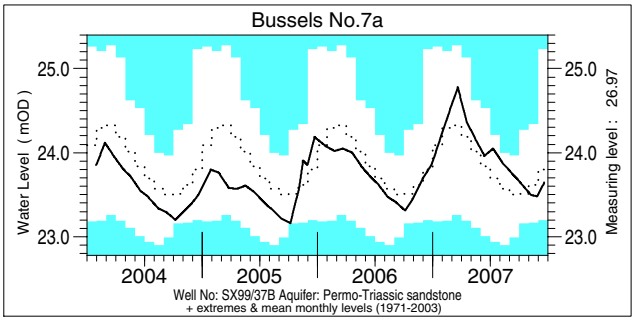


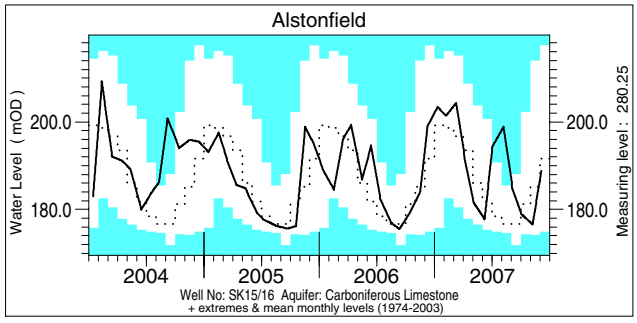










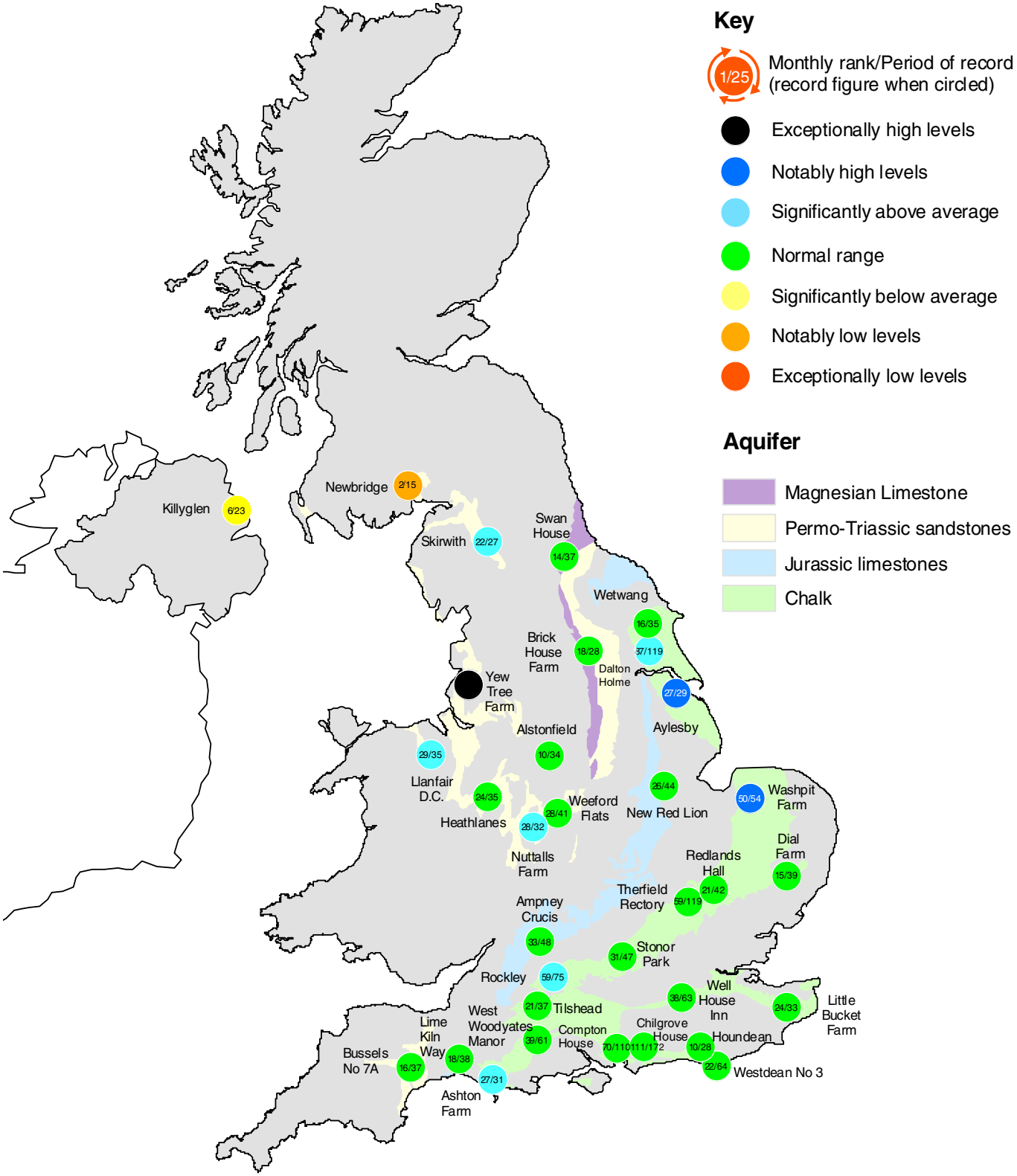


Groundwater levels December 2007 / January 2008

Borehole	Level	Date	Dec. av.	Borehole	Level	Date	Dec. av.	Borehole	Level	Date	Dec. av.
Dalton Holme	16.69	11/12	15.56	Chilgrove House	55.78	31/12	51.87	Brick House Farm	12.61	20/12	12.40
Washpit Farm	45.81	03/01	43.36	Killyglen	115.39	31/12	116.19	Llanfair DC	80.22	15/12	79.87
Stonor Park	75.14	02/01	72.32	New Red Lion	13.56	20/12	12.95	Heathlanes	62.23	31/12	61.88
Dial Farm	25.32	18/12	25.40	Ampney Crucis	102.47	02/01	101.94	Weeford Flats	90.01	11/12	89.64
Rockley	136.91	02/01	133.85	Newbridge	9.74	01/01	10.53	Bussels No.7a	23.65	19/12	23.84
Well House Inn	94.77	31/12	93.62	Skirwith	130.54	25/12	130.24	Alstonfield	188.90	04/12	192.80
West Woodyates	91.62	31/12	86.90	Swan House	82.03	19/12	83.05				

Levels in metres above Ordnance Datum

Groundwater . . .Groundwater



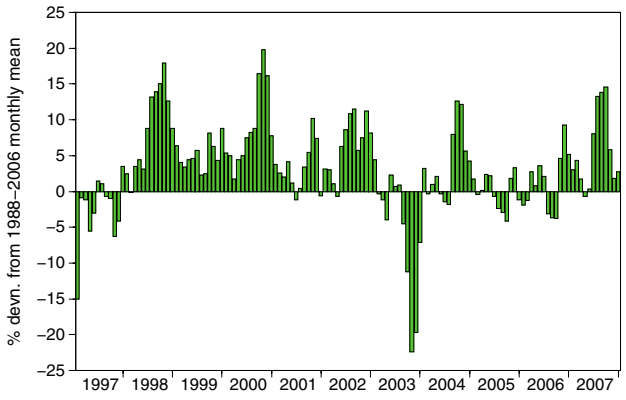
Groundwater levels - December 2007

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

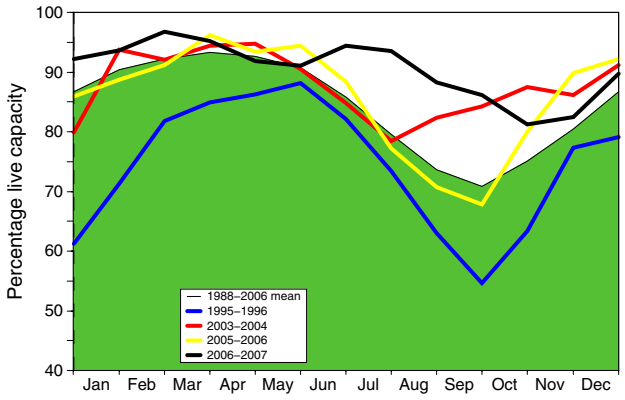
Notes: i. The outcrop areas are coloured according to British Geological Survey conventions.

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)	2007 Nov	Dec	2008 Jan	Jan Anom.	Min. Jan	Year* of min.	2007 Jan	Diff 08-07
North West	N Command Zone	• 124929	69	73	**87**	1	51	1996	99	-12
	Vyrnwy	55146	75	83	**99**	9	35	1996	99	0
Northumbrian	Teesdale	• 87936	87	95	**100**	13	41	1996	89	11
	Kielder*	(199175)	(66)	(55)	**(73)**	-18	(70)	1990	(92)	-19
Severn Trent	Clywedog	44922	83	87	**85**	1	54	1996	83	2
	Derwent Valley*	• 39525	77	86	**94**	5	10	1996	87	7
Yorkshire	Washburn	• 22035	72	76	**89**	6	23	1996	96	-7
	Bradford supply	• 41407	76	89	**99**	11	22	1996	100	-1
Anglian	Grafham	(55490)	(94)	(93)	**(95)**	12	(57)	1998	(93)	2
	Rutland	(116580)	(85)	(84)	**(89)**	7	(60)	1991	(88)	1
Thames	London	• 202406	87	89	**89**	4	60	1991	92	-3
	Farmoor	• 13822	98	87	**81**	-10	71	1991	100	-19
Southern	Bewl	28170	66	66	**74**	2	34	2006	83	-9
	Ardingly	4685	65	75	**92**	8	41	2004	100	-8
Wessex	Clatworthy	5364	77	68	**100**	9	54	2004	100	0
	Bristol WW	• (38666)	(83)	(79)	**(94)**	18	(40)	1991	(87)	7
South West	Colliford	28540	76	73	**78**	2	46	1996	53	25
	Roadford	34500	87	84	**88**	11	23	1996	70	18
	Wimbleball	21320	86	83	**98**	16	46	1996	84	14
	Stithians	5205	62	52	**56**	-20	33	2002	67	-11
Welsh	Celyn and Brenig	• 131155	92	95	**97**	5	54	1996	98	-1
	Brianne	62140	95	96	**100**	3	76	1996	100	0
	Big Five	• 69762	77	79	**92**	3	67	1996	96	4
	Elan Valley	• 99106	89	100	**99**	3	56	1996	100	-1
Scotland(E)	Edinburgh/Mid Lothian	• 97639	77	79	**85**	-5	60	1999	100	-15
	East Lothian	• 10206	93	100	**100**	6	48	1990	93	7
Scotland(W)	Loch Katrine	• 111363	59	65	**75**	-15	75	2008	100	-25
	Daer	22412	77	98	**100**	3	83	1996	98	2
	Loch Thom	• 11840	66	74	**80**	-17	80	2008	97	-17
Northern Ireland	Total+	• 67270	71	76	**82**	15	61	2002	90	-8
	Silent Valley	• 20634	72	76	**83**	2	39	2002	93	-10

() figures in parentheses relate to gross storage • denotes reservoir groups +excludes Lough Neagh *last occurrence

Details of the individual reservoirs in each of the groupings listed above are available on request. The percentages given in the Average and Minimum storage columns relate to the 1988-2006 period 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. * Scheduled drawdown is affecting Kielder and Ladybower (Derwent Valley) levels.

Location map . . . Location map

National Hydrological Monitoring Programme

The National Hydrological Monitoring Programme (NHMP) was instigated in 1988 and is undertaken jointly by the Centre for Ecology and Hydrology Wallingford (formerly the Institute of Hydrology - IH) and the British Geological Survey (BGS). Financial support for the production of the monthly Hydrological Summaries is provided by the Department for Environment, Food and Rural Affairs (Defra), the Environment Agency (EA), the Scottish Environment Protection Agency (SEPA), the Rivers Agency (RA) in Northern Ireland, and the Office of Water Services (OFWAT).

Data Sources

River flow and groundwater level data are provided by the Environment Agency, the Environment Agency Wales, the Scottish Environment Protection Agency and, for Northern Ireland, the Rivers Agency and the Department of the Environment (NI). In all cases the data are subject to revision following validation (flood and drought data in particular may be subject to significant revision).
Reservoir level information is provided by the Water Service Companies, the EA, Scottish Water and the Northern Ireland Water Service.

The National River Flow Archive (maintained by CEH Wallingford) and the National Groundwater Level Archive (maintained by BGS) provide the historical perspective within which to examine contemporary hydrological conditions.

Rainfall

Most rainfall data are provided by the Met Office (see opposite). To allow better spatial differentiation the rainfall data for Britain are presented for the regional divisions of the precursor organisations of the EA and SEPA. Following the discontinuation of the Met Office's CARP system in July 1998, the areal rainfall figures have been derived using several procedures, including initial estimates based on MORECS*. Recent figures have been produced by the Met Office, National Climate Information Centre (NCIC), using a technique similar to CARP. A significant number of additional monthly raingauge totals are provided by the EA and SEPA to help derive the contemporary regional rainfalls. Revised monthly national and regional rainfall totals for the post-1960 period (together with revised 1961-90 averages) were made available by the Met Office in 2004; these have been adopted by the NHMP. As with all regional figures based on limited raingauge networks the monthly tables and accumulations (and the return periods associated with them) should be regarded as a guide only.

NATURAL ENVIRONMENT RESEARCH COUNCIL

The monthly rainfall figures are provided by the Met Office (National Climate Information Centre) and are Crown Copyright and may not be passed on to, or published by, any unauthorised person or organisation.

*MORECS is the generic name for the Met Office services involving the routine calculation of evaporation and soil moisture throughout Great Britain.

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The National Hydrological Monitoring Programme depends on the active cooperation of many data suppliers. This cooperation is gratefully acknowledged.

Subscription

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

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Selected text and maps are available on the WWW at
http://www.nerc-wallingford.ac.uk/ih/nrfa/index.htm
Navigate via Water Watch

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