Hydrological Summary
for the United Kingdom

May 2006

General

May began dry and warm in most areas but a very moist westerly airflow predominated thereafter. Correspondingly, England and Wales registered its wettest May for 27 years with most regional totals exceeding 150% of the monthly average. Despite increasing evaporation losses, reservoir stocks generally increased, reaching around 4% above average for E&W as a whole by early June, with typical early summer stocks characterising most of the drought-affected region. The wet May was agriculturally welcome but notable storm events triggered a number of flood alerts and reversed, albeit briefly, the seasonal decline in river flows. May runoff totals were spatially very variable but mostly within the normal range. Exceptions included some groundwater-fed streams where the May runoff was close to period of record minima. Modest, but very useful, late spring aquifer recharge has reduced the spatial extent of the groundwater drought – now largely confined to a broad zone from the Midlands to the South East with especially depressed groundwater levels in the Chilterns and parts of the North Downs. A particularly arid episode, extending well into June, with an associated increase in water demand, has underlined the fragility of water resources in such areas. In a groundwater context particularly, the possibility of a third successive dry winter – a rare occurrence in the last 100 years but more frequent in the 19th century – has become an influential factor in the implementation of drought mitigation measures.

Rainfall

Apart from the beginning and end of the month, cyclonic conditions dominated synoptic patterns in May. Damaging thunderstorms in north-western Britain (e.g. Glasgow) on the 4th and sustained frontal rainfall across southern Britain on the 6/7th heralded a notably wet three-week period with measurable rainfall recorded on all but a few days. The resulting media refrain of 'the wettest drought on record' failed to acknowledge that such circumstances are not rare in the English Lowlands where groundwater resources status is a crucial factor; there are many more spring/summer episodes more deserving of such an accolade. Dry conditions at month end extended beyond a fortnight - with some localities in central southern England reporting <1mm of rain. May rainfall totals were below average in some catchments in eastern Scotland but most of the drought-affected region registered > 150%; some areas were especially wet (e.g. the Cotswolds, south London and coastal areas of eastern England; the Isle of Man also). The wet May contributed to the third wettest spring for E&W in the last 20 years but for parts of the drought-affected region (including the Thames basin), May was the only the second month with above average rainfall since October 2004. Correspondingly long term rainfall deficiencies remain high in much of eastern and southern England. Rainfall over the Nov. 2004 - May 2006 period is >25% below average for some (restricted) areas of southern England and for the Thames basin the 19-month total is the 2nd lowest (after 1995-97) since 1944.

River Flow

In most responsive catchments river flows exhibited an exceptional range in May. Flows in the Ribble (Lancashire) closely approached early May minima but recovered dramatically with high spate conditions in the third week. In York, the Ouse exceeded bankfull on the 23rd and Flood Watches were common in the latter half of the month – by which time flows in many field drains had recommenced (e.g. in Essex). Flow recoveries were particularly valuable in the English Lowlands, allowing continuing abstractions to supplement pumped-storage reservoir stocks. The Yorkshire Derwent, Exe, Dart and Nevis were among a significant proportion of index rivers registering new maximum daily flows for May and notably high monthly runoff totals were common – in Wales and northern England especially. In Northern Ireland the River Camowen registered its highest May runoff in a 35-yr record. Flows in rivers draining permeable catchments (in the Chalk particularly) showed a much more muted response to the May rainfall but the modest recoveries were often sufficient to register the highest daily flows of 2006 thus far (e.g. on the Lambourn and Itchen). Nonetheless, May runoff totals were notably low in a number of spring-fed rivers and accumulated runoff totals (for the duration of the drought) remain very low across much of central and southern England.

Groundwater

Across most major aquifer outcrop areas, May rainfall totals exceeded the average by 50-80% but spatial variations in soil moisture conditions, land use and evaporative demands produced a very spatially heterogeneous response in terms of recharge. Not all of the May infiltration will yet have reached the more depressed water-tables but it triggered appreciable groundwater level increases in some responsive limestone aquifers – particularly in the Oolitic Limestone of the Cotswolds (see Ampney Crucis), and useful seasonally late upturns some minor aquifers (e.g. the Upper Greensand on the Isle of Wight and the Essex Gravels). The wet spring has been beneficial across much of the Chalk also – particularly the more southerly and westerly outcrops – where levels are currently well above early summer drought minima (e.g. those of 1997, 1992 and 1976). Accordingly, there has been an appreciable reduction in the area afflicted by severe groundwater drought conditions – this now embraces some Permo-Triassic outcrops in the Midlands (see Morris Dancers) and, especially, the Chalk of the Chilterns and parts of the North Downs (extending into Kent). At Stonor (in the Chilterns), the May groundwater level was the 2nd lowest (after 1997) in a 46-year record whilst Well House Inn (North Downs) reported its 2nd lowest (after 1944) in a 65-yr record. In such areas summer recessions are expected to approach natural base levels with a continuing failure of lower level springs and an associated further contraction in the stream network.

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Rainfall . . . Rainfall . . .

Rainfall accumulations and return period estimates

Area	Rainfall	May 2006	Mar 06- May 06	RP	Nov 05- May 06	RP	Jun 05- May 06	RP	Nov 04- May 06	RP
England & Wales	**mm**	**111**	**245**		**491**		**864**		**1278**	
	%	**176**	**125**	**5-10**	**91**	**2-5**	**95**	**2-5**	**88**	**5-10**
North West	mm	**119**	317		655		1127		1787	
	%	**157**	130	5-10	95	2-5	93	2-5	94	2-5
Northumbrian	mm	**90**	235		478		862		1347	
	%	**144**	123	5-10	95	2-5	99	2-5	98	2-5
Severn Trent	mm	**102**	213		400		745		1062	
	%	**171**	120	2-5	88	2-5	97	2-5	87	5-10
Yorkshire	mm	**113**	264		478		825		1213	
	%	**187**	140	10-20	97	2-5	99	2-5	92	2-5
Anglian	mm	**94**	173		299		587		835	
	%	**193**	122	2-5	87	2-5	97	2-5	88	5-10
Thames	mm	**98**	193		361		627		892	
	%	**174**	118	2-5	87	2-5	89	2-5	80	15-25
Southern	mm	**92**	190		402		701		998	
	%	**169**	112	2-5	85	2-5	89	2-5	79	20-30
Wessex	mm	**109**	202		454		789		1156	
	%	**177**	109	2-5	87	2-5	92	2-5	84	5-15
South West	mm	**109**	253		629		1082		1623	
	%	**148**	104	2-5	83	5-10	91	2-5	83	10-20
Welsh	mm	**167**	387		802		1337		1985	
	%	**198**	140	10-20	98	2-5	99	2-5	92	2-5
Scotland	**mm**	**117**	**358**		**815**		**1425**		**2439**	
	%	**136**	**121**	**5-10**	**94**	**2-5**	**97**	**2-5**	**104**	**2-5**
Highland	mm	**137**	434		1028		1764		3124	
	%	**146**	125	5-10	98	2-5	101	2-5	112	5-15
North East	mm	**80**	230		565		964		1584	
	%	**109**	103	2-5	95	2-5	94	2-5	97	2-5
Tay	mm	**113**	319		699		1196		2021	
	%	**131**	119	2-5	90	2-5	93	2-5	98	2-5
Forth	mm	**101**	274		571		1049		1807	
	%	**132**	116	2-5	86	5-10	92	2-5	100	<2
Tweed	mm	**82**	234		505		944		1506	
	%	**112**	108	2-5	87	2-5	94	2-5	95	2-5
Solway	mm	**116**	381		778		1334		2202	
	%	**132**	133	5-15	93	2-5	93	2-5	97	2-5
Clyde	mm	**145**	414		916		1638		2814	
	%	**152**	123	5-10	90	2-5	94	2-5	102	2-5
Northern Ireland	**mm**	**117**	**324**		**608**		**1019**		**1653**	
	%	**160**	**140**	**10-20**	**94**	**2-5**	**93**	**2-5**	**95**	**2-5**

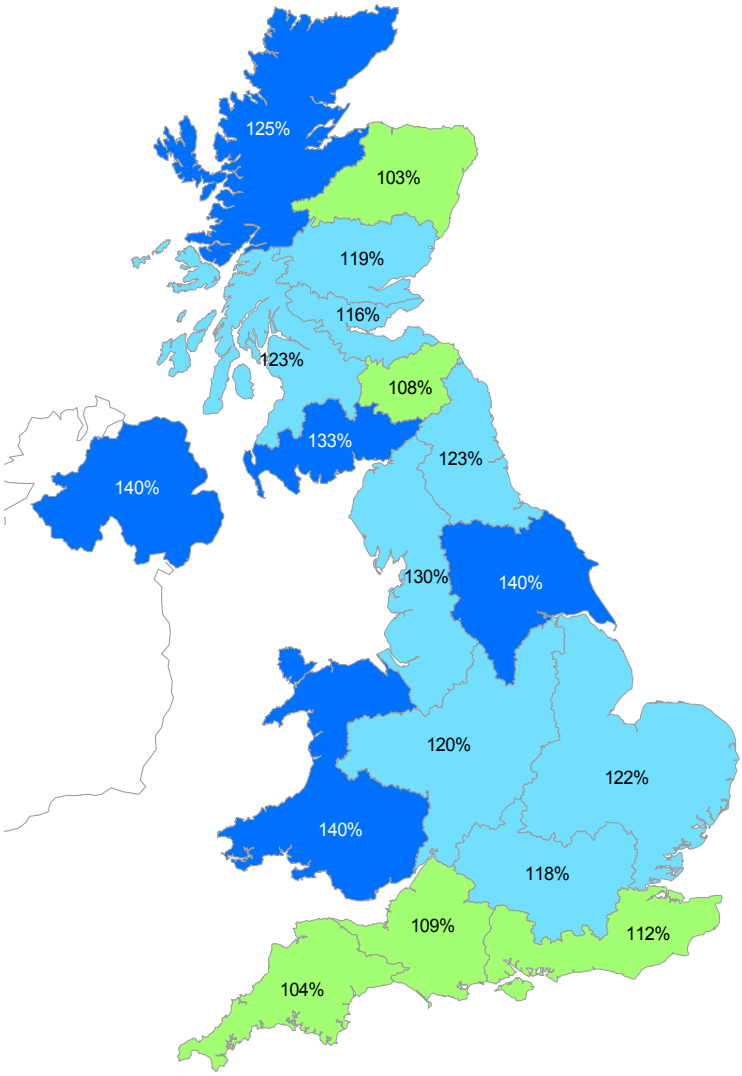
% = percentage of 1961-90 average *RP = Return period*

 All monthly totals since December 2005 are provisional (see page 12). 1961-2003 regional monthly totals were revised by the Met Office in 2004. Most of the return period estimates are based on tables provided by the Met 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	Normal range
Very wet	Below average
Substantially above average	Substantially below average
Above average	Exceptionally low rainfall



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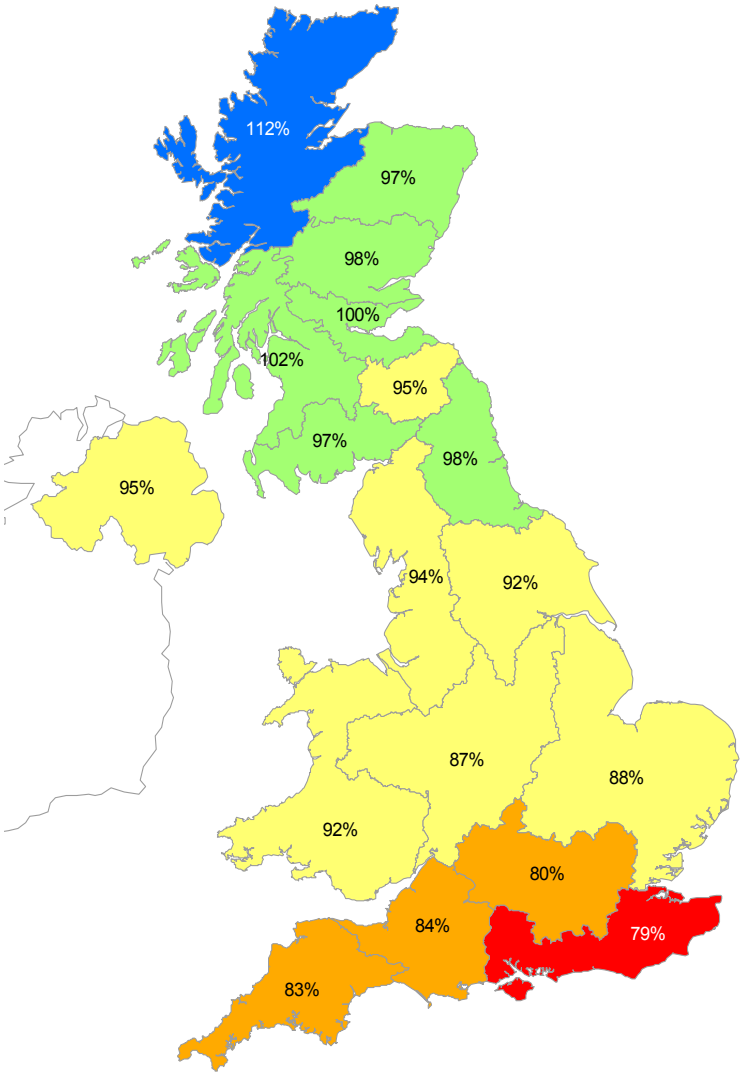
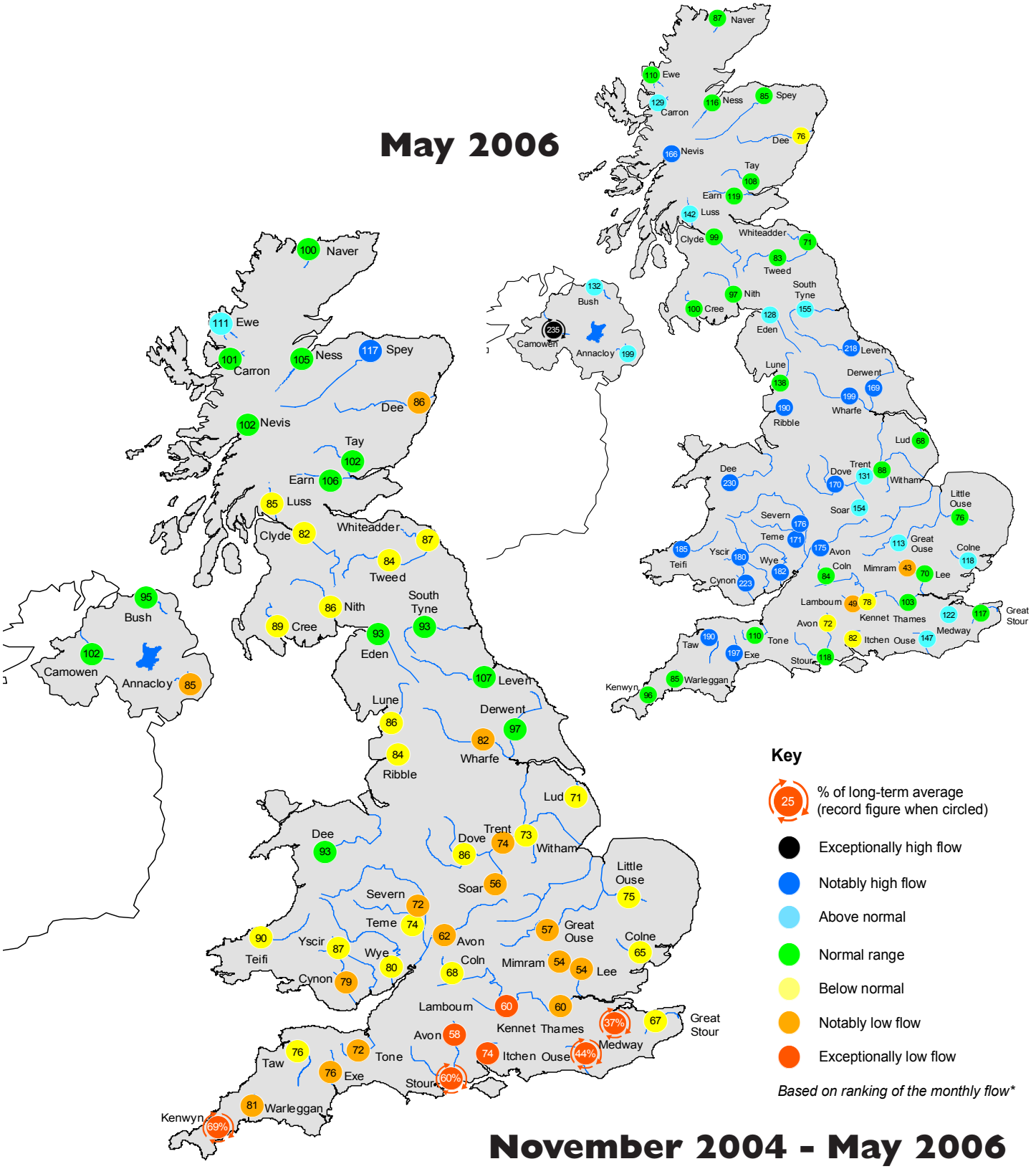


November 2004 - May 2006

Rainfall accumulation maps

Provisional data suggest that spring (March-May) was the equal 6th wettest for the UK in a series from 1914 – with above average rainfall in all regions. By contrast, only northern Scotland registered above average rainfall in the 19-month timeframe and notable long term deficiencies extend across most of southern England.

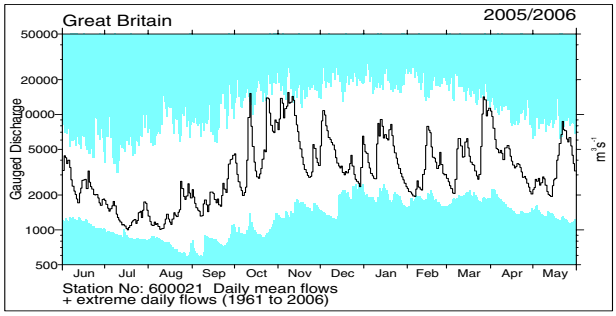
River flow . . . River flow . . .

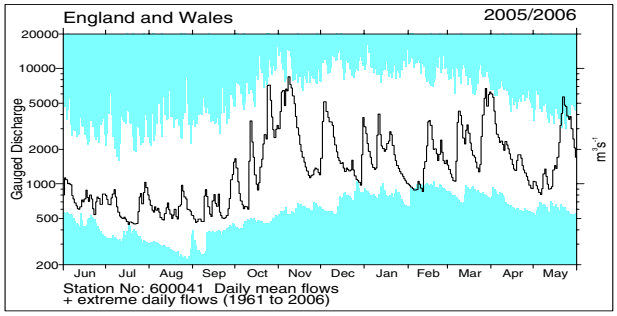


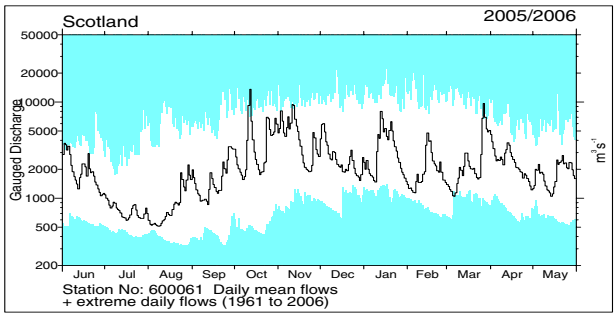
River flows

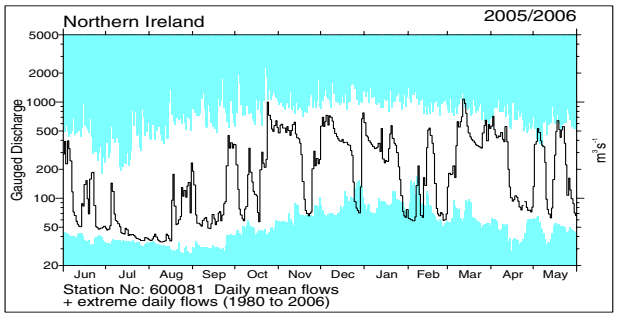
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

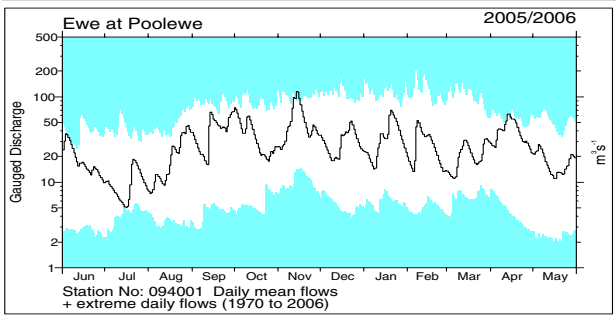
River flow . . . River flow . . .

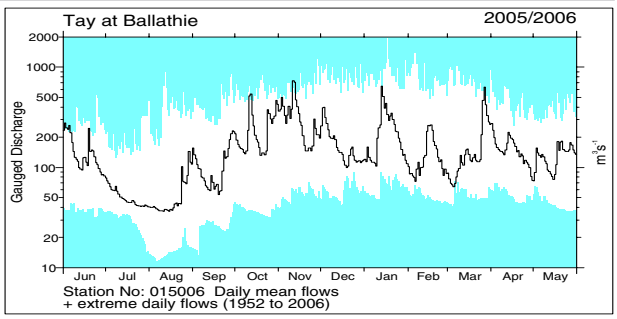


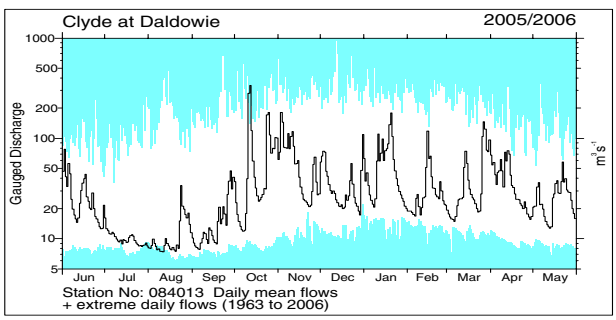


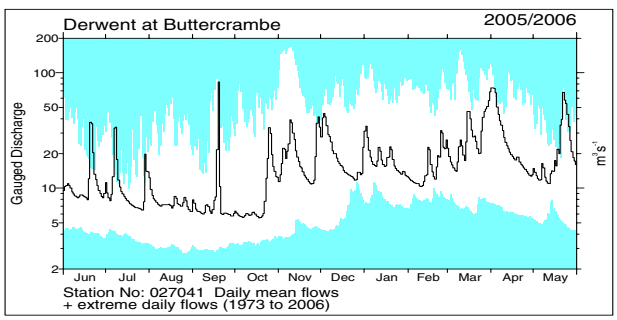


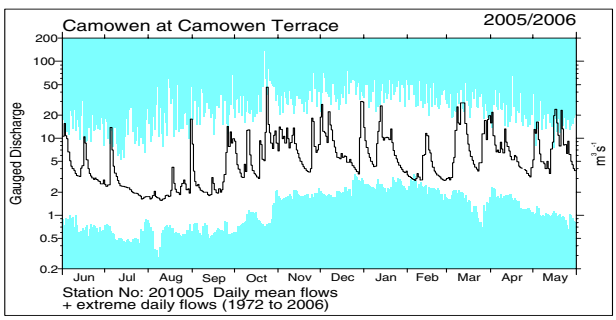


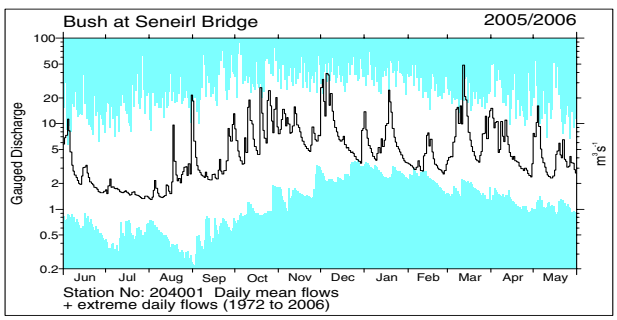








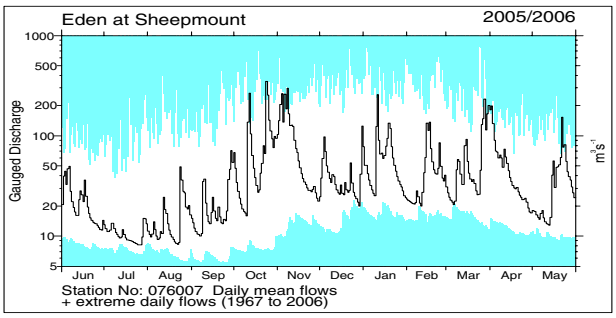


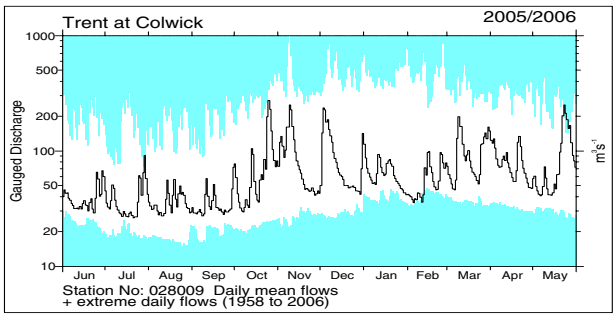


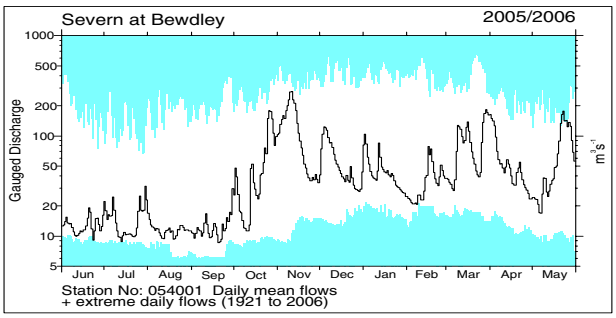
River flow hydrographs

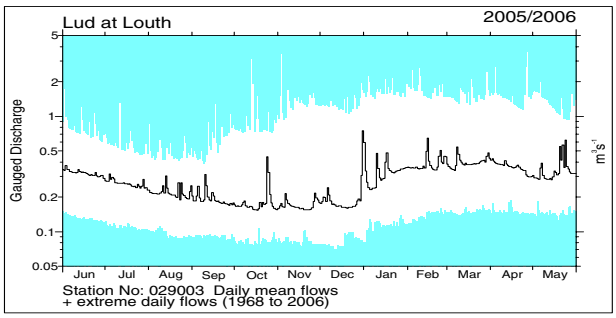
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to June 2005 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas.

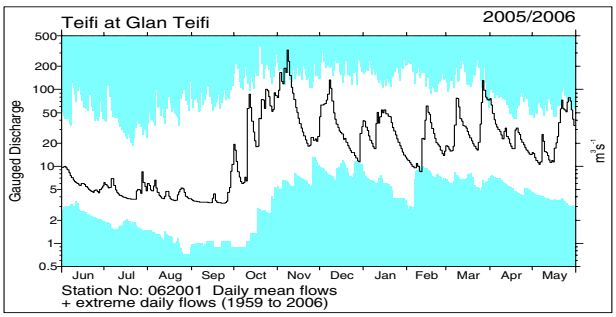
River flow . . . River flow . . .

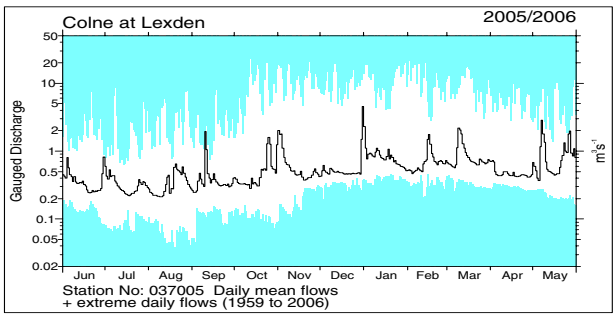


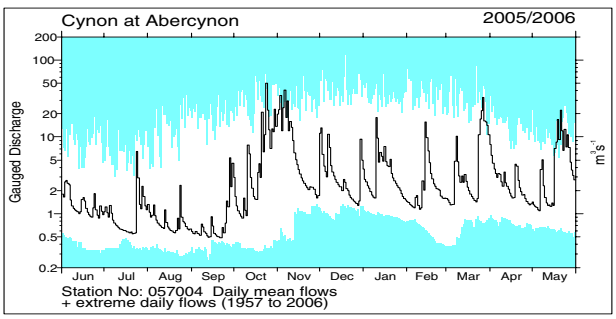


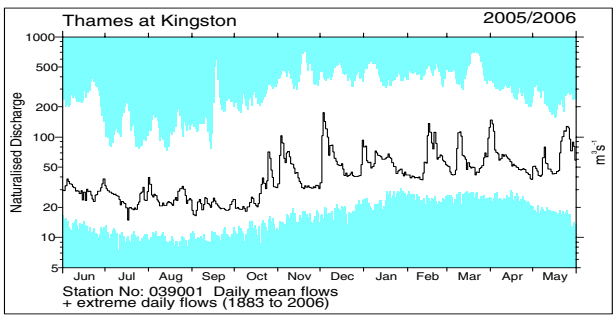


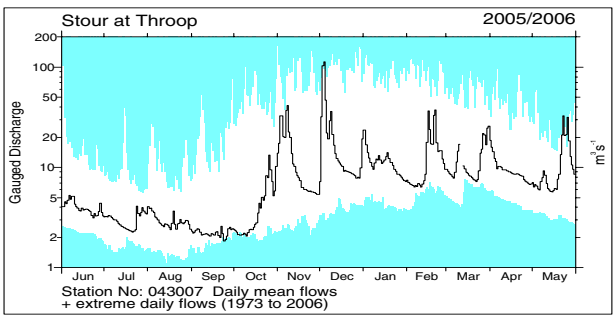


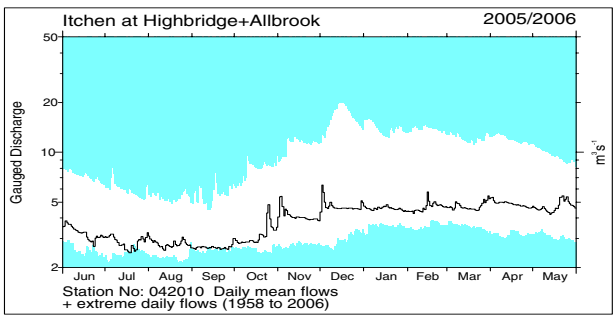












Notable runoff accumulations (a) May 2006, (b) November 2004 - May 2006

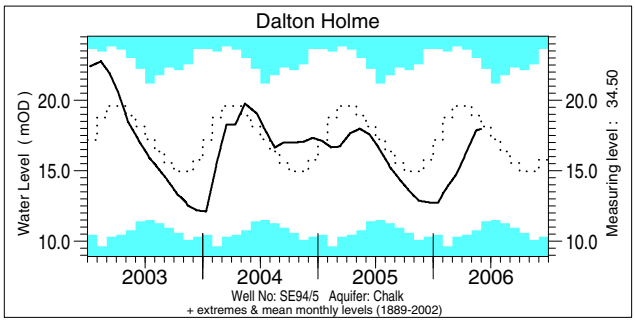
	River	%lta	Rank
a)	Mimram	43	4/54
	Lamborn	49	5/44
	Mole	236	31/33
	Cynon	223	46/48
	Tawe	216	46/49
	Dee (New Inn)	230	35/37
	Nevis	166	22/24
	Camowen	235	35/35

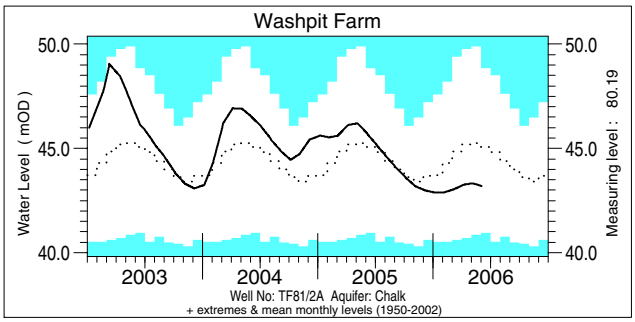
	River	%lta	Rank
b)	Soar	56	2/34
	Blackwater	71	3/53
	Kennet	60	2/44
	Lambourn	56	2/43
	Mole	64	1/29
	Medway	37	1/41
	Ouse (Gold Bridge)	44	1/38

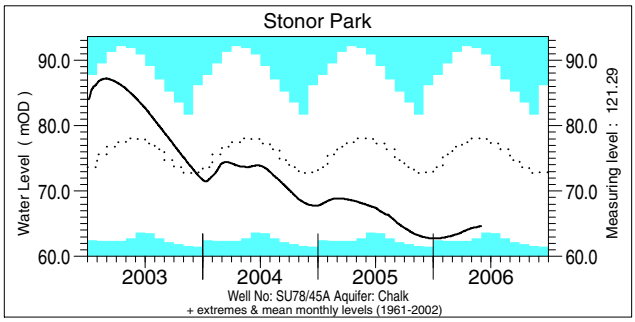
River	%lta	Rank
Wallington	46	1/47
Test	63	1/46
Itchen	74	2/47
Stour (Throop)	60	1/32
Piddle	62	1/40
Kenwyn	69	1/37
Faughan	75	2/29

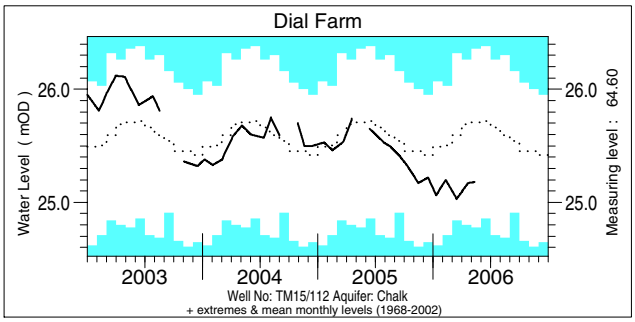
lta = long term average
Rank 1 = lowest on record

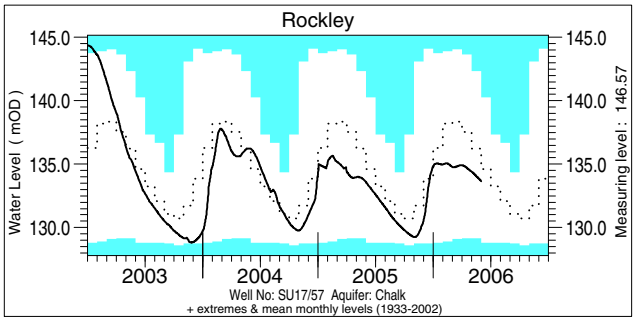
Groundwater . . . Groundwater

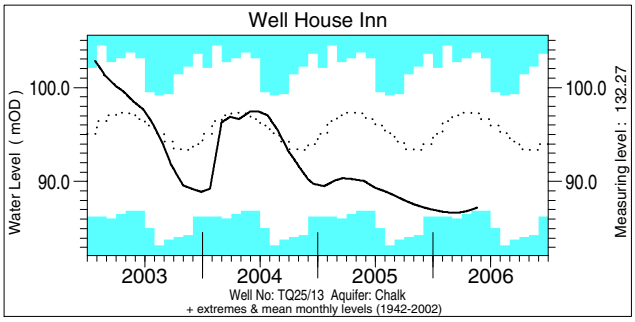


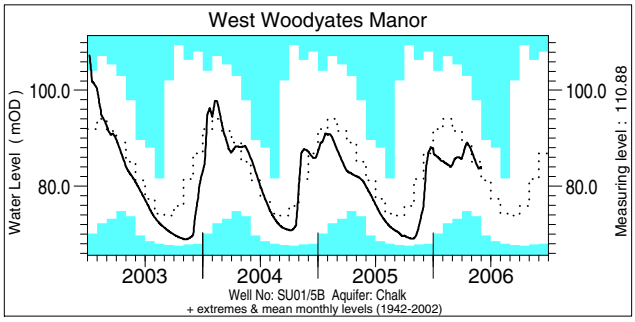


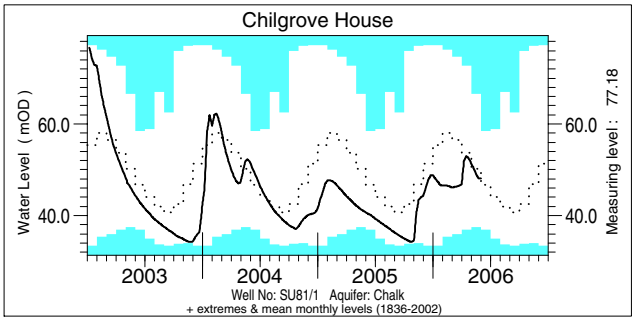


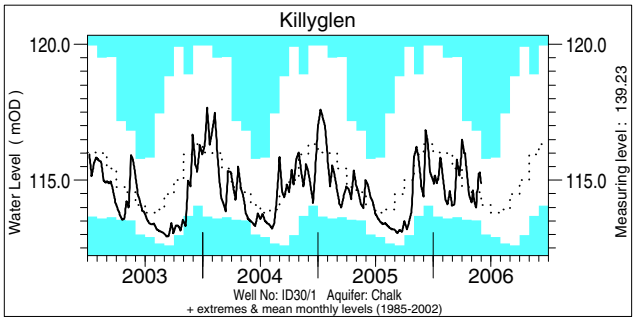


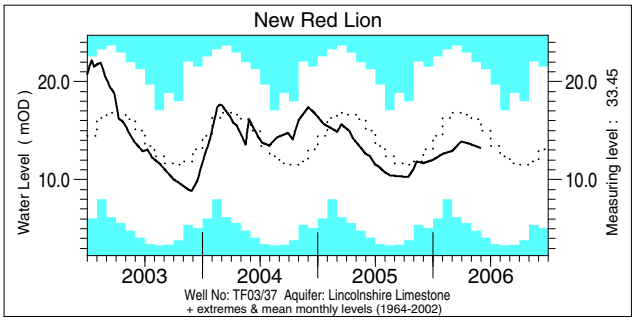






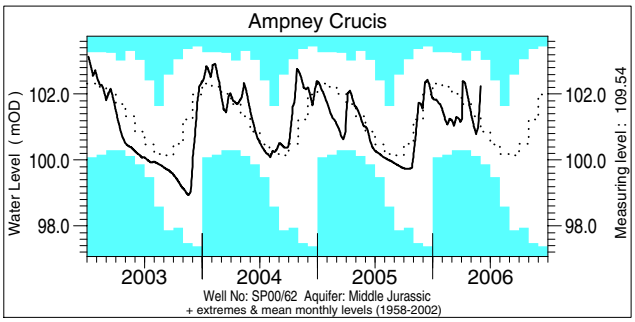


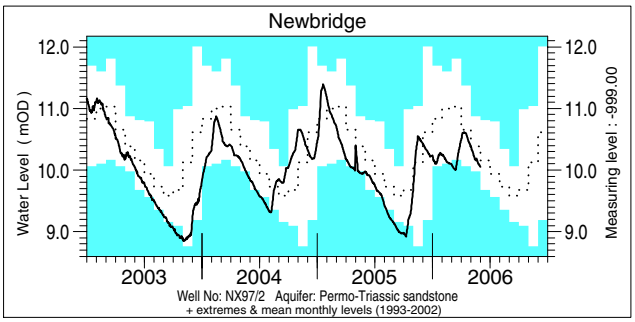


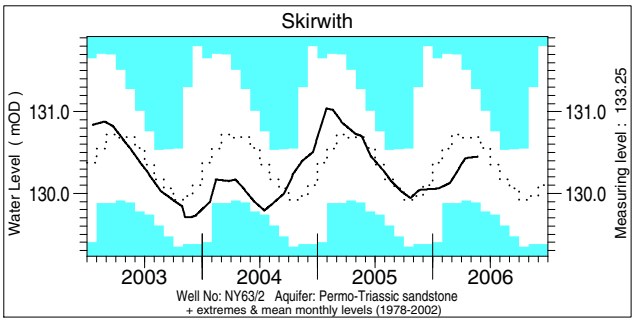


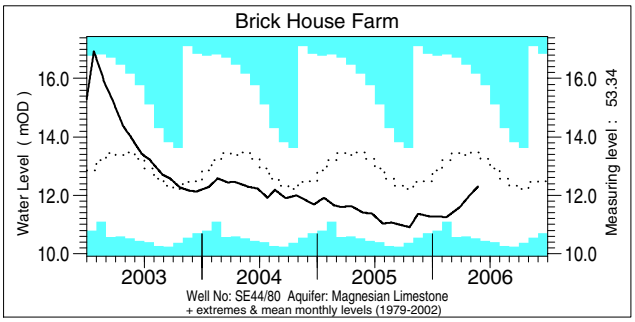
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

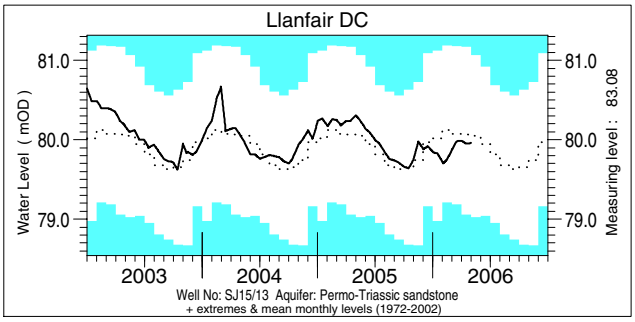
Groundwater . . . Groundwater

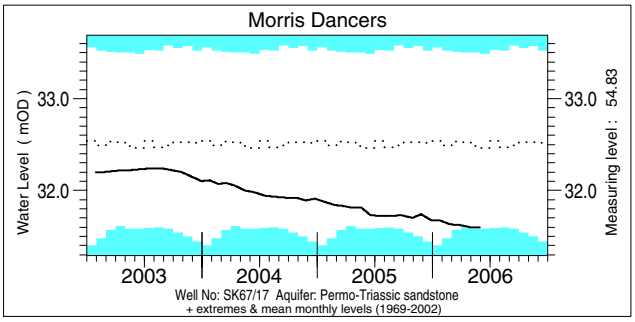


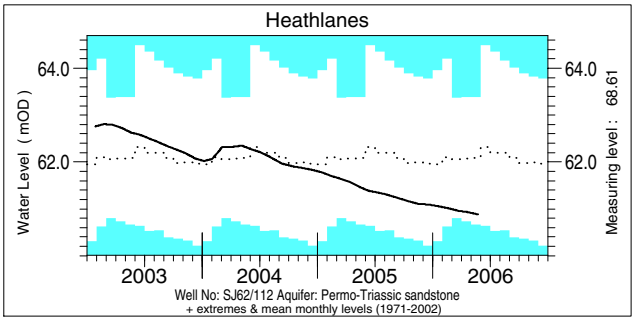


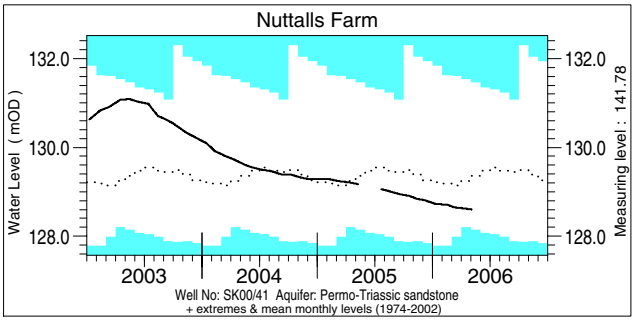


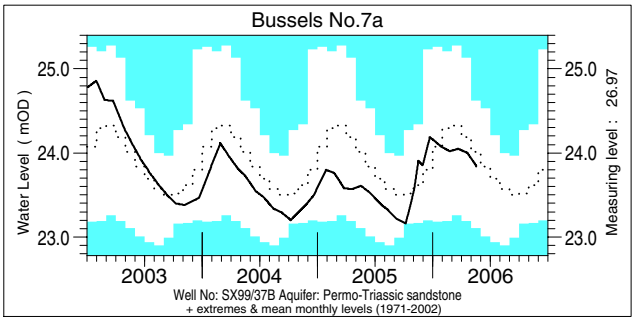


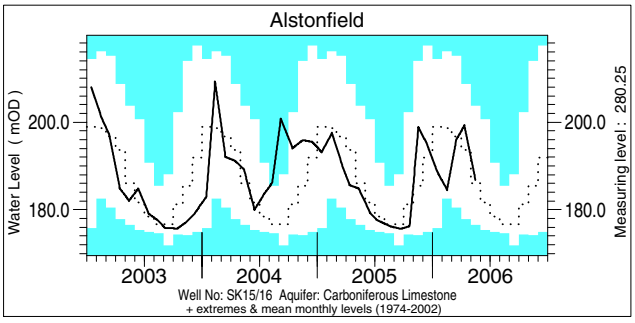










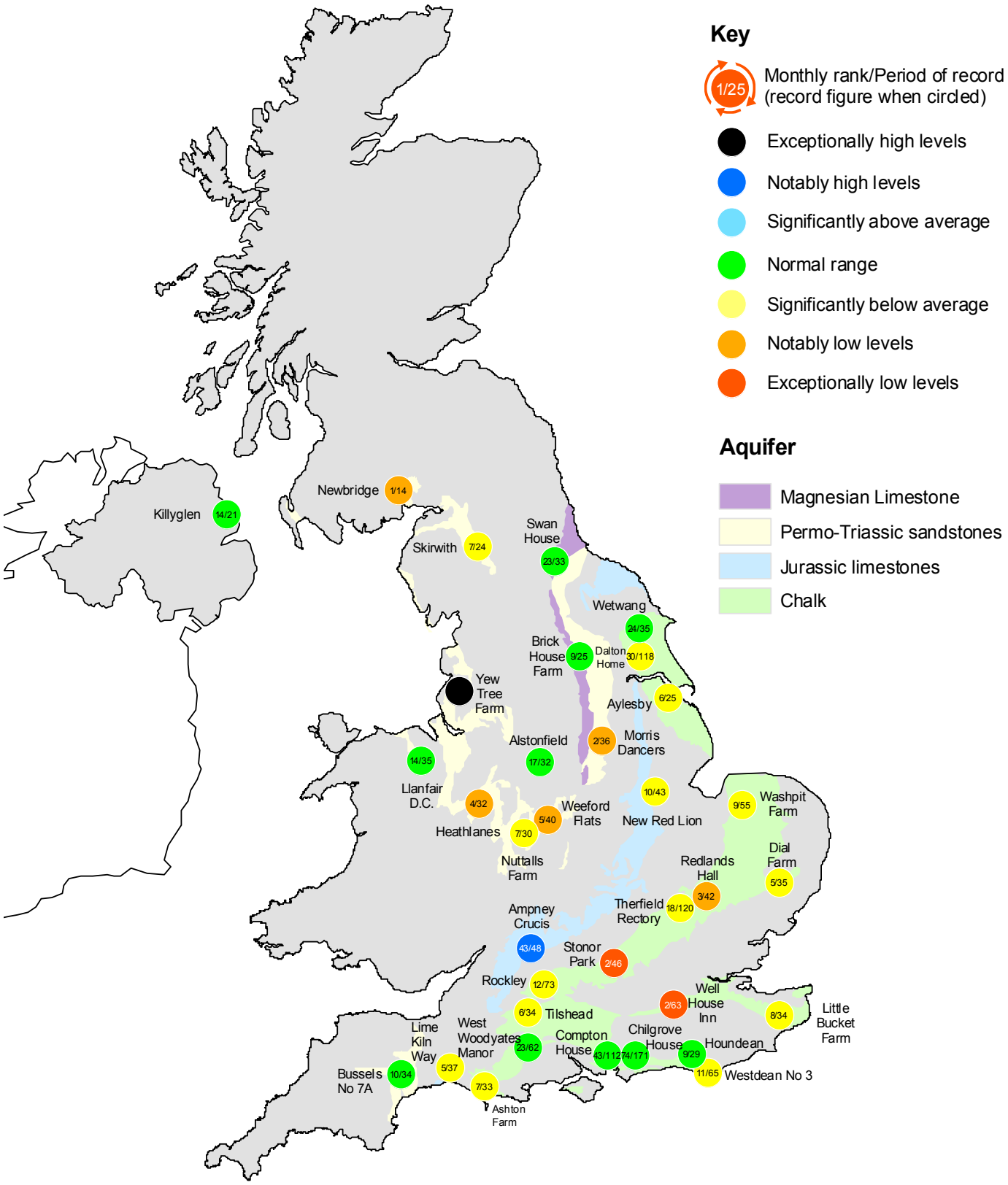


Groundwater levels May / June 2006

Borehole	Level	Date	May. av.	Borehole	Level	Date	May. av.	Borehole	Level	Date	May. av.
Dalton Holme	17.97	31/05	18.95	Chilgrove House	48.16	31/05	48.96	Llanfair DC	79.96	01/05	79.97
Washpit Farm	43.19	02/06	45.50	Killyglen	114.89	31/05	114.51	Morris Dancers	31.60	29/05	32.35
Stonor Park	64.61	31/05	78.23	New Red Lion	13.22	30/05	15.89	Heathlanes	60.88	24/05	62.09
Dial Farm	25.18	12/05	25.71	Ampney Crucis	102.24	31/05	101.28	Nuttalls Farm	128.60	04/05	129.61
Rockley	133.67	31/05	136.19	Newbridge	10.05	31/05	10.32	Bussels No.7a	23.84	18/05	24.00
Well House Inn	87.23	19/05	97.15	Skirwith	130.45	22/05	130.58	Alstonfield	186.82	15/05	186.77
West Woodyates	84.06	31/05	84.62	Brick House Farm	12.31	24/05	13.37				

Levels in metres above Ordnance Datum

Groundwater . . .Groundwater



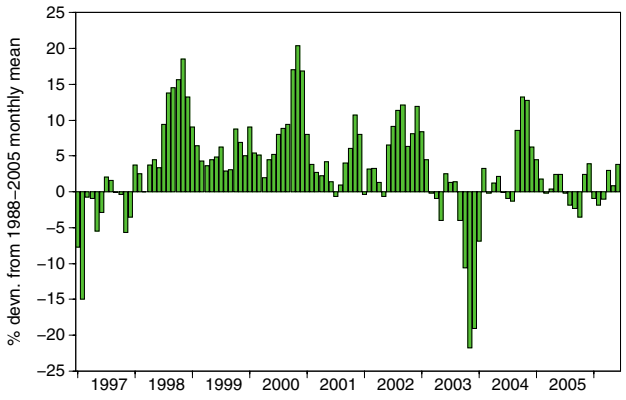
Groundwater levels - May 2006

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.

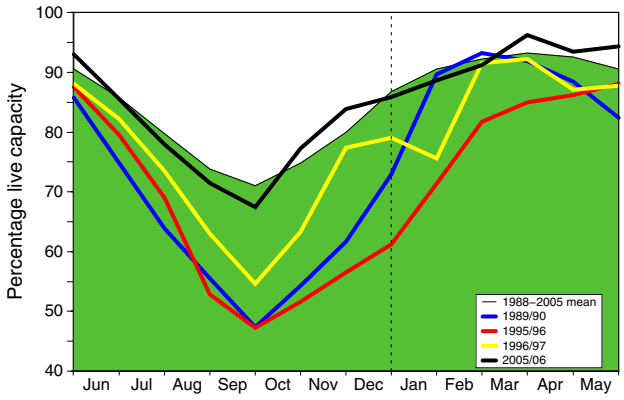
Notes: i. The outcrop areas are coloured according to British Geological Survey conventions.
ii. Yew Tree Farm levels are now received quarterly.

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.

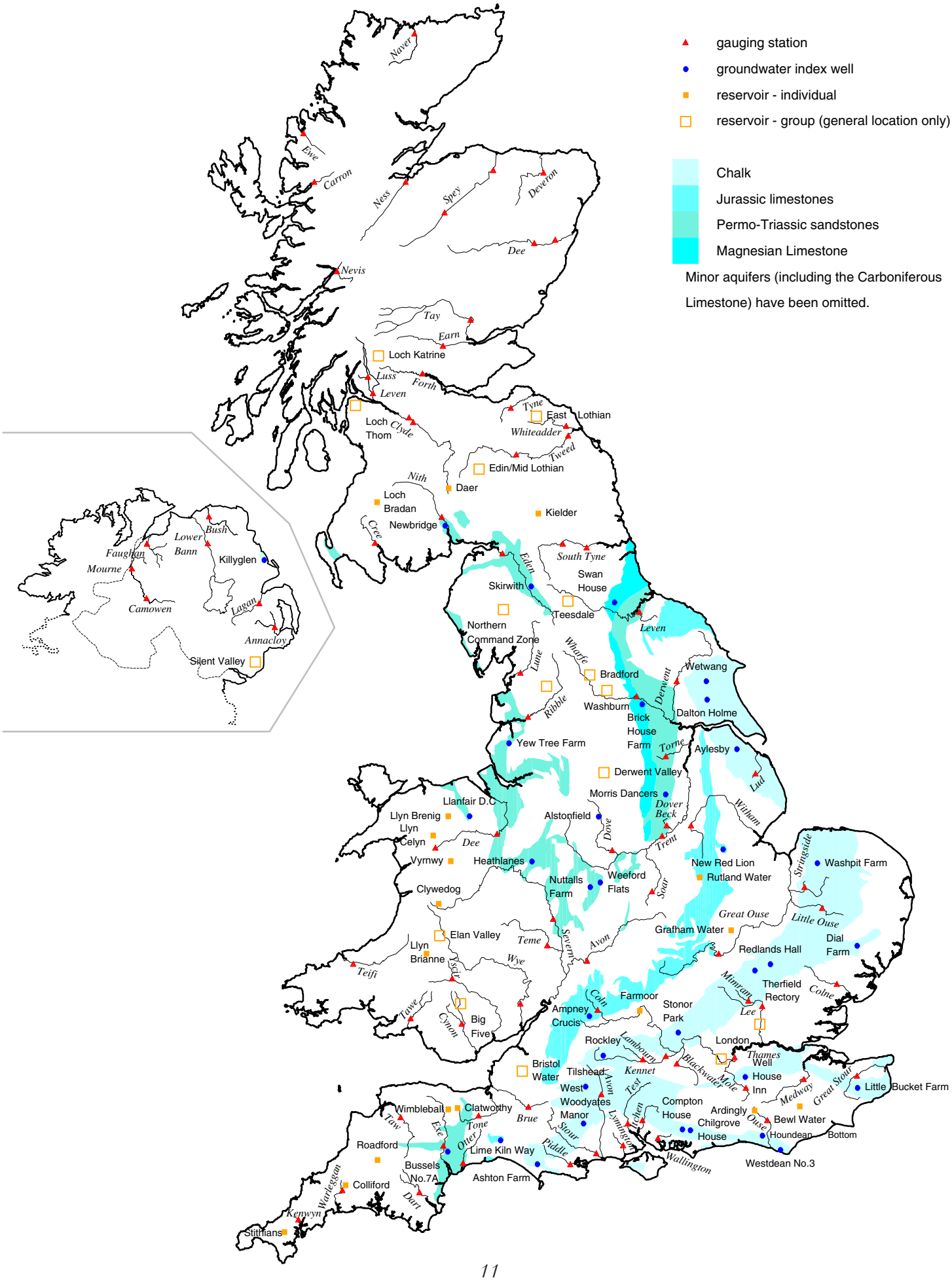
Percentage live capacity of selected reservoirs at start of month

Area	Reservoir	Capacity (Ml)	2006 Feb	Mar	Apr	May	Jun	Avg. Jun	Min. Jun	Year* of min.
North West	N Command Zone	• 124929	89	90	100	91	**85**	83	72	1991
	Vyrnwy	55146	91	90	100	98	**98**	89	72	1990
Northumbrian	Teesdale	• 87936	94	100	100	94	**95**	86	64	1991
	Kielder	(199175)	(93)	(92)	(98)	(89)	**(93)**	(92)	(85)	1989
Severn Trent	Clywedog	44922	87	88	99	100	**100**	96	83	1989
	Derwent Valley	• 39525	93	98	100	99	**100**	88	56	1996
Yorkshire	Washburn	• 22035	85	89	99	94	**98**	87	72	1990
	Bradford supply	• 41407	82	83	97	95	**99**	86	70	1996
Anglian	Grafham	(55490)	(85)	(89)	(96)	(99)	**(100)**	(93)	(72)	1997
	Rutland	(116580)	(80)	(83)	(88)	(91)	**(93)**	(91)	(75)	1997
Thames	London	• 202406	92	98	99	91	**93**	93	83	1990
	Farmoor	• 13822	93	99	97	99	**100**	98	90	2002
Southern	Bewl	28170	37	50	65	85	**91**	87	57	1990
	Ardingly	4685	65	77	88	100	**100**	99	96	1990
Wessex	Clatworthy	5364	100	100	100	98	**86**	87	67	1990
	Bristol WW	• (38666)	(76)	(81)	(87)	(92)	**(96)**	(88)	(70)	1990
South West	Colliford	28540	60	62	68	70	**70**	85	52	1997
	Roadford	34500	69	71	76	75	**77**	83	48	1996
	Wimbleball	21320	84	95	100	99	**100**	91	76	1992
	Stithians	5205	83	88	96	94	**90**	86	66	1990
Welsh	Celyn and Brenig	• 131155	96	98	100	100	**100**	97	82	1996
	Brianne	62140	95	95	100	100	**100**	96	85	1995
	Big Five	• 69762	97	97	99	97	**96**	90	70	1990
	Elan Valley	• 99106	98	98	100	99	**100**	95	85	1990
Scotland(E)	Edinburgh/Mid Lothian	• 97639	95	94	96	92	**92**	89	52	1998
	East Lothian	• 10206	100	99	100	100	**99**	96	84	1990
Scotland(W)	Loch Katrine	• 111363	94	95	99	94	**98**	88	66	2001
	Daer	22412	100	99	100	97	**94**	91	70	1994
	Loch Thom	• 11840	100	100	100	100	**100**	90	74	2001
Northern Ireland	Total+	• 67270	90	88	93	89	**89**	86	74	2004
	Silent Valley	• 20634	94	90	98	93	**94**	80	56	2000

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

Details of the individual reservoirs in each of the groupings listed above are available on request. The featured reservoirs may not be representative of the storage conditions across each region; this can be particularly important during droughts. The storage figures relate to the 1988-2006 period only (except for West of Scotland and Northern Ireland where data commence in the mid-1990's). In some gravity-fed reservoirs (e.g. Clywedog) stocks are kept below capacity during the winter to provide scope for flood attenuation purposes.

Location map . . . Location map



National Hydrological Monitoring Programme

The National Hydrological Monitoring Programme (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.

*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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06/06