Hydrological Summary
for the United Kingdom

August 2005

General
Rainfall patterns in August were characterised by unusually large spatial and temporal variability. As a consequence, long term rainfall deficiencies were moderated in some of the most drought-stricken areas but increased in others. Very unsettled conditions over the 2nd half of the month moderated water demand and overall reservoir stocks for England and Wales were only around 2% below average entering September, but with stocks relatively low in a number of southern reservoirs. In a few areas, algal blooms have created water treatment problems; in parts of South Armagh tankers were needed to maintain water supplies. Summer (June-August) rainfall was well within the normal range in most regions – benefiting agriculture and tending to reduce the drought's perceived intensity. But it has had very limited impact on the drought's hydrological severity which is primarily a legacy of the dry winter and spring. Local flash flood events were common but August runoff totals were mostly well below average. More significantly, accumulated runoff totals (over 10 months) are among the lowest on record in parts of southern Britain. Groundwater levels are correspondingly depressed in parts of the southern Chalk but mostly well above drought minima elsewhere. The short term resources outlook remains fragile in parts of the South and the continuing need to moderate demand is underpinned by concern about the resources prospects for 2006 in the event of another dry winter.

Rainfall
August was a month of two halves with mainly dry conditions over the initial fortnight followed by regular frontal incursions and thundery episodes. Locally intense storms caused appreciable damage (e.g. power loss in North Tyneside and in parts of Northern Ireland) and urban drainage capacities were overwhelmed. Storm totals were especially notable during the final fortnight; World's End (Hants) registered 22mm in an hour on the 19th. In the west, frontal rainfall also generated impressive daily totals including 49mm at Shap Fell (24th) and 52mm at Lusa, Skye (28th). These contributed to above average August rainfall totals in much of north-western Britain; large parts of the English Lowlands also exceeded the average. By contrast, parts of the South-West, Wales, Midlands and the North-East were notably dry. The above average rainfall in Southern Region was especially welcome but some parts of central southern England added a further month – 10 in total – to a sequence of below average totals. Summer (Jun-Aug) totals were very low in south-west Scotland and Northern Ireland which, provisionally, reported its 2nd driest summer since 1983. In England most regional totals were in the normal range with a few of the worst affected drought areas (e.g. Havant) reporting above average rainfall in June, July and August. Nonetheless, longer term regional deficiencies remain very substantial. The Nov-Aug total for E&W is the 3rd lowest in this timeframe since 1949 (1975/76 and 1988/89 were drier); for many gauged catchments in the South East, it is the lowest on record. Overall deficiencies are >40% in a few southern districts (e.g. in London and the Lizard), mirrored by similar, but positive, anomalies in north-west Scotland.

River Flow
Summer rainfall, which is often convective, can generate severe localized flooding but normally has only a limited impact on the generality of rivers. In August, flash floods were widely reported (e.g. at Gosport on the 19th, Braunstone on the 24st and North Tyneside at month end) but generally did little to counterbalance the sustained early summer flow recessions. In Scotland, mid-month flows in the Forth and Clyde closely approached their minimum recorded flows, the latter in a 42-yr series. In England modest, but very useful, recoveries were registered in a number of drought-affected rivers. As a result August runoff totals, although generally well below average, were appreciably above drought minima; exceptions included the Test and Itchen which reported their 2nd and 3rd lowest totals in series of around 50 yrs. The drought's impact is more effectively indexed by runoff accumulations since last October. The Nov-Aug totals are among the lowest four of five on record across much of southern Britain. The Mole, Medway, Wallington and Sussex Ouse are among those index rivers ranking 2nd only to 1975/76. In Northern Ireland, the Lower Bann established a new minimum in this timeframe. In permeable catchments spring outflows have been declining for lengthy periods and flows in some groundwater-fed rivers (e.g. the Lambourn) have remained below average for >24 months. There are historical precedents for longer sequences of low flow but many southern permeable catchments are especially vulnerable to below average rainfall over the coming autumn and winter.

Groundwater
Soils continued to dry out in most regions through early August and, despite the subsequent wet spell, soil moisture deficits remained considerably above average across most major aquifer outcrop areas entering the autumn. Infiltration was therefore minimal and groundwater levels continued their summer recessions. In parts of the southern Chalk (e.g. at Chilgrove where records begin in 1836), they remained below any corresponding levels except during the droughts of 1976, 1934 and 1855. August levels were also low in some limestone and Permo-Triassic sandstone outcrops (e.g. in the South West and Midlands). Such outcrops apart, groundwater levels were mostly at the lower end of the normal range – but appreciably above those recorded during the droughts of the early and mid-1990s. The recent Indian Summer conditions are likely to delay the seasonal recovery of recharge rates in the most drought-affected regions; emphasizing the need for above average winter rainfall to replenish groundwater resources.

Centre for Ecology & Hydrology
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British Geological Survey
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Rainfall . . . Rainfall . . .

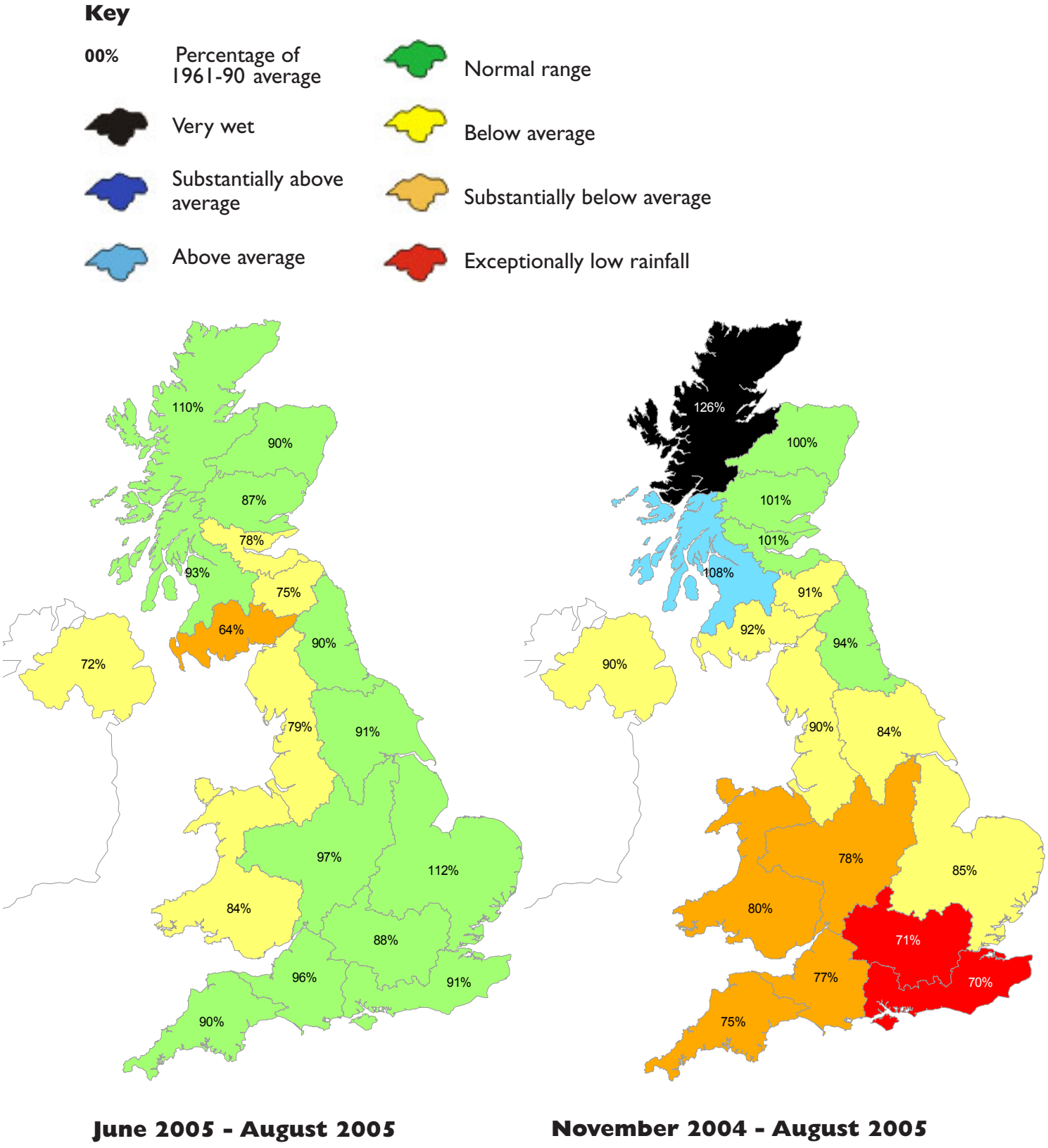
Rainfall accumulations and return period estimates

Area	Rainfall	Aug 2005	Jun 05-Aug 05	RP	Jan 05-Aug 05	RP	Nov 04-Aug 05	RP	Feb 04-Aug 05	RP
England & Wales	**mm**	**62**	**192**		**480**		**600**		**1335**	
	%	**80**	**94**	**2-5**	**86**	**5-10**	**80**	**5-15**	**96**	**2-5**
North West	mm	**89**	221		659		873		1851	
	%	**81**	79	2-5	91	2-5	90	2-5	102	2-5
Northumbrian	mm	**54**	191		576		670		1451	
	%	**65**	90	2-5	105	2-5	94	2-5	109	2-5
Severn Trent	mm	**53**	178		408		495		1153	
	%	**77**	97	2-5	84	5-10	78	10-20	97	2-5
Yorkshire	mm	**57**	181		493		580		1302	
	%	**75**	91	2-5	94	2-5	84	5-10	102	2-5
Anglian	mm	**66**	176		358		427		971	
	%	**120**	112	2-5	92	2-5	85	5-10	103	2-5
Thames	mm	**50**	144		325		412		955	
	%	**84**	88	2-5	74	5-15	71	20-30	89	5-10
Southern	mm	**60**	147		347		443		999	
	%	**103**	91	2-5	74	5-15	70	20-35	85	5-10
Wessex	mm	**44**	171		428		537		1161	
	%	**66**	96	2-5	82	5-10	77	5-15	90	2-5
South West	mm	**47**	206		567		734		1572	
	%	**54**	90	2-5	80	5-10	75	10-20	89	5-10
Welsh	mm	**65**	226		654		867		1901	
	%	**61**	84	2-5	83	5-10	80	5-15	96	2-5
Scotland	**mm**	**136**	**285**		**983**		**1296**		**2460**	
	%	**117**	**96**	**2-5**	**115**	**5-10**	**111**	**5-10**	**113**	**10-20**
Highland	mm	**196**	370		1281		1743		3099	
	%	**151**	110	*2-5*	130	*10-20*	126	*35-50*	122	*35-50*
North East	mm	**92**	214		680		836		1723	
	%	**101**	90	2-5	108	2-5	100	<2	110	5-10
Tay	mm	**97**	225		855		1039		2138	
	%	**97**	87	2-5	111	2-5	101	2-5	112	5-10
Forth	mm	**71**	193		748		925		1895	
	%	**73**	78	5-10	109	2-5	101	2-5	111	5-10
Tweed	mm	**59**	173		628		740		1641	
	%	**66**	75	5-10	101	2-5	91	2-5	108	2-5
Solway	mm	**82**	191		801		1048		2181	
	%	**67**	64	10-20	95	2-5	92	2-5	103	2-5
Clyde	mm	**161**	327		1091		1486		2833	
	%	**114**	93	2-5	109	2-5	108	2-5	110	5-10
Northern Ireland	**mm**	**73**	**172**		**631**		**799**		**1589**	
	%	**77**	**72**	**5-10**	**95**	**2-5**	**90**	**2-5**	**96**	**2-5**

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

 All monthly totals since March 2005 are provisional (see page 12). 1961-2003 regional monthly totals were revised by the Met Office in 2004. The figures for England & Wales are derived by the Hadley Centre and are updates of the homogenised series developed by the Climate Research Unit; the other national figures are derived from different raingauge networks to those used to derive the CRU data series. 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 and those for the Highland region take account of ranking positions. 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 . . .



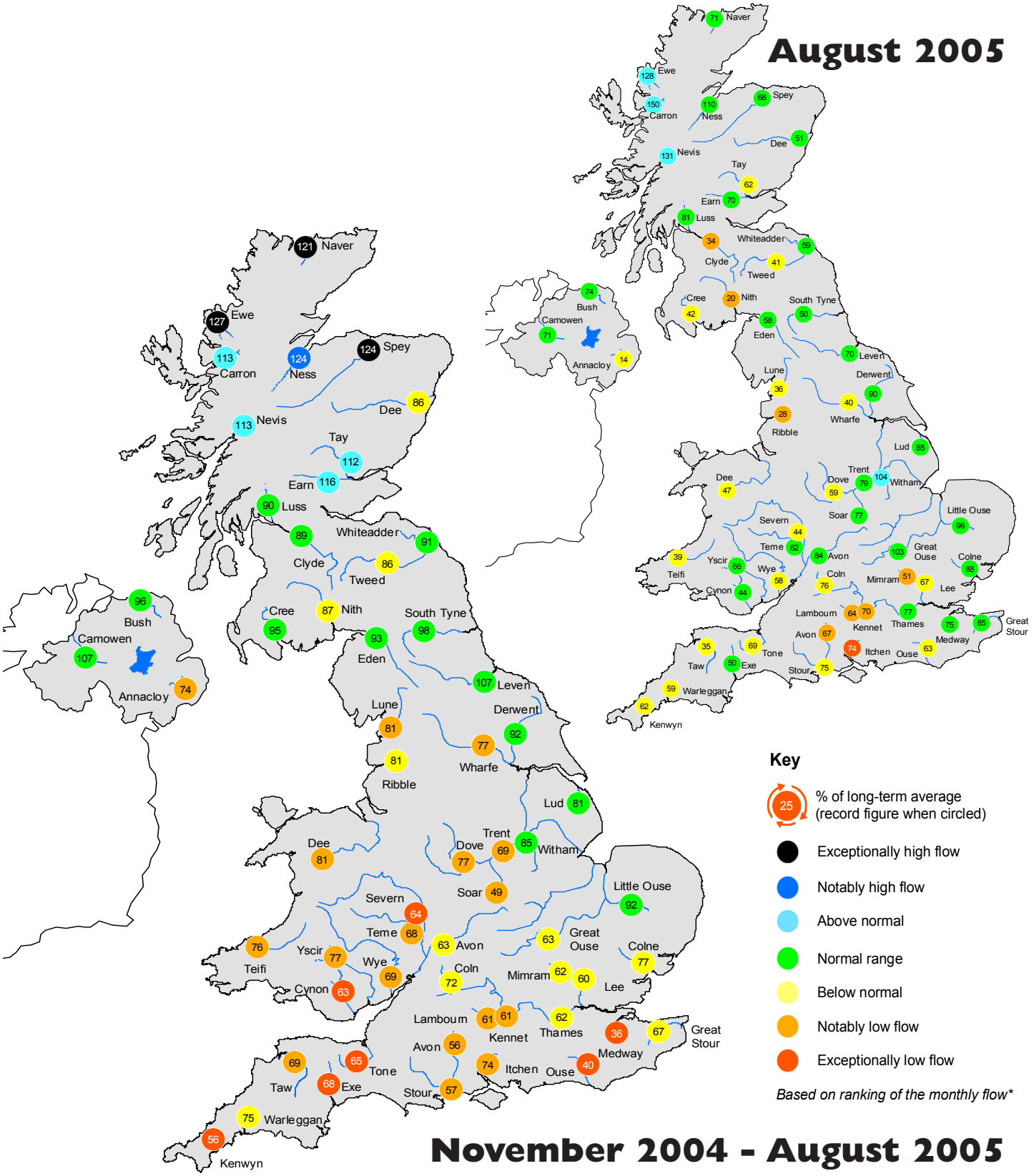
June 2005 - August 2005

November 2004 - August 2005

Rainfall accumulation maps

Regional rainfall totals for the summer of 2005 were well within the normal range across most of the UK. Anglian region registered its 7th wetter-than-average summer in the last nine years. By contrast, the Solway region reported its second lowest Jun-Aug rainfall since 1984. Over the last ten months the preferred tracks of most frontal systems is reflected in the exceptional rainfall contrast between north-west Scotland and south-east England. Provisional data suggest that in the Thames Region only 1975/76 has been drier (albeit substantially so) in the Nov-Aug timeframe since 1943/44.

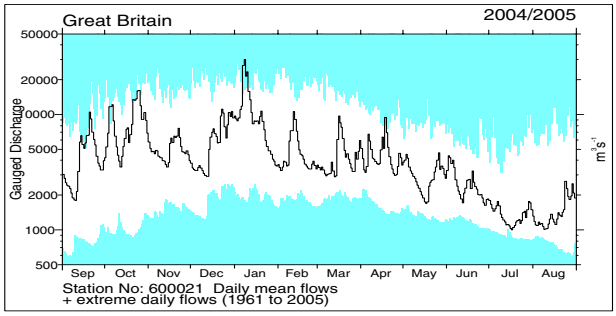
River flow . . . River flow . . .

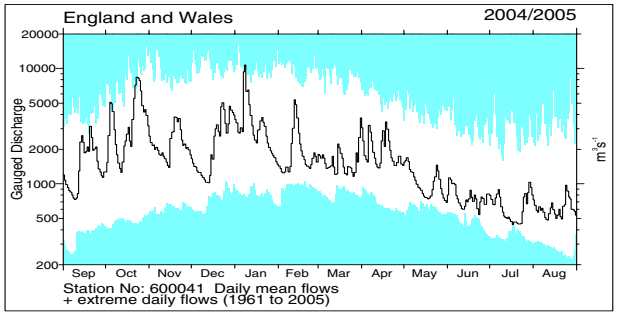


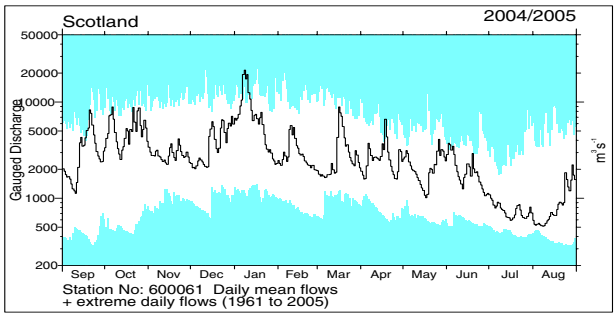
River flows

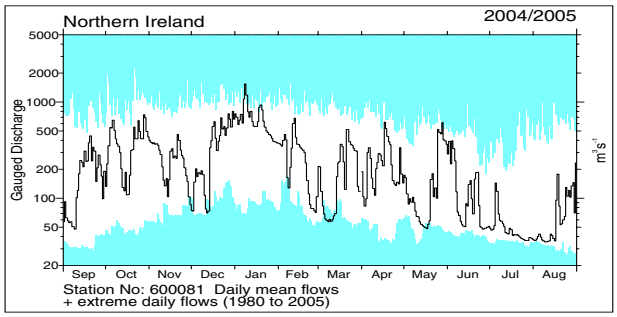
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

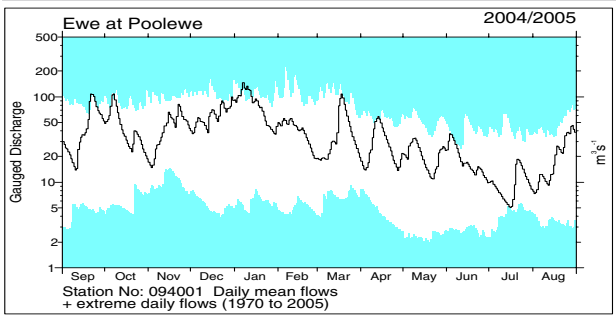
River flow . . . River flow . . .

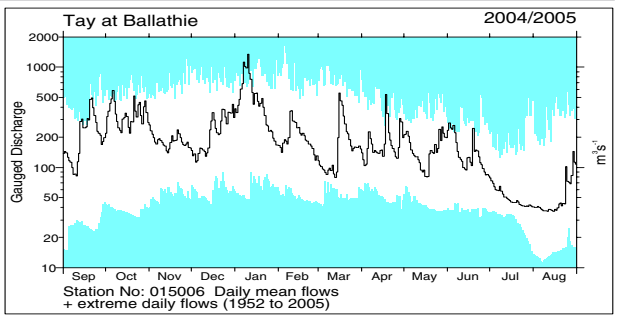


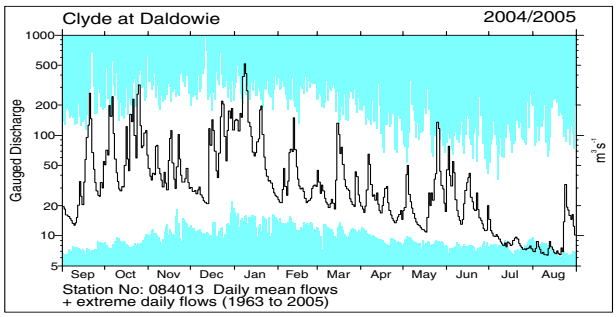


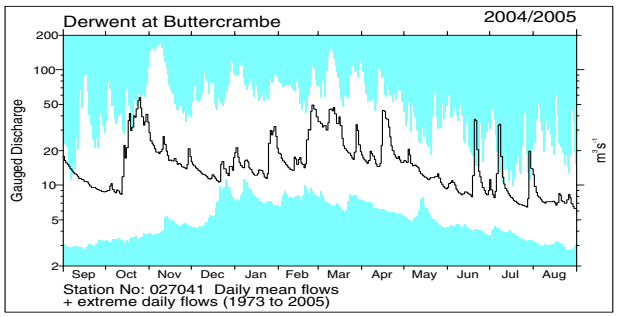


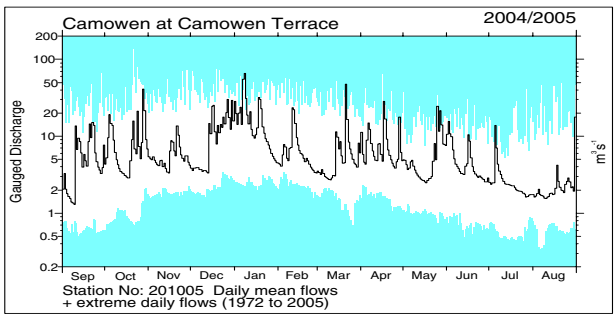


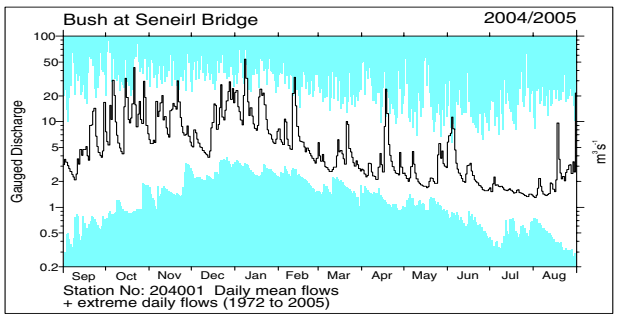








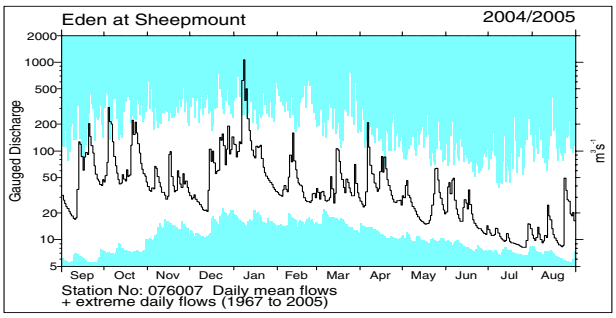


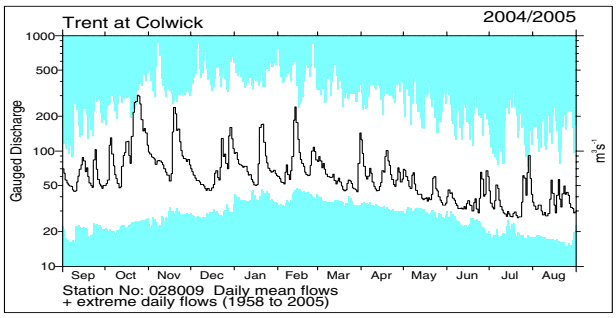


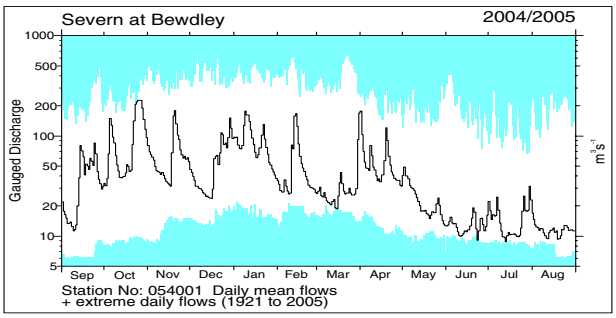
River flow hydrographs

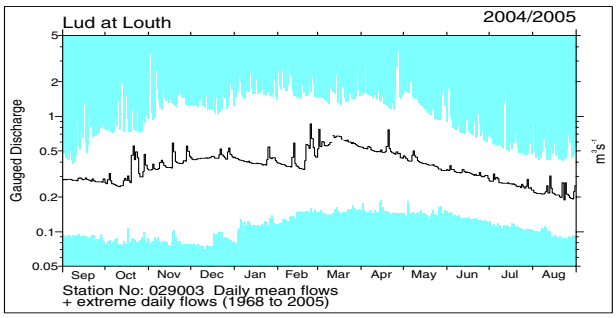
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to September 2004 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas.

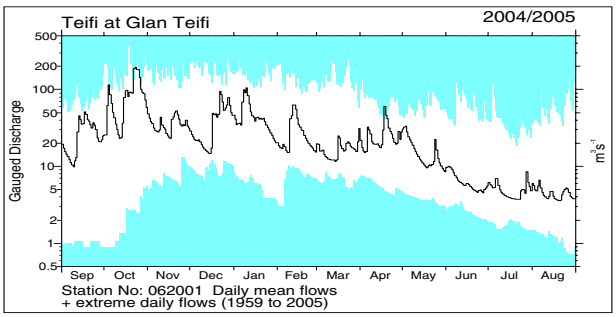
River flow . . . River flow . . .

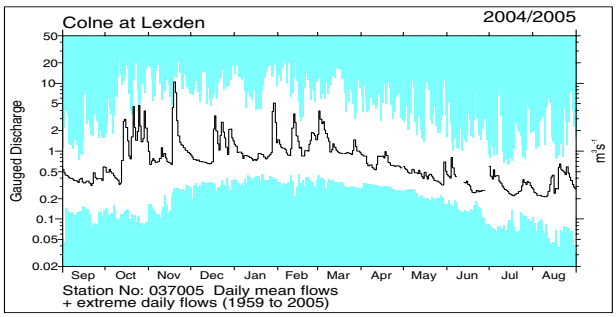


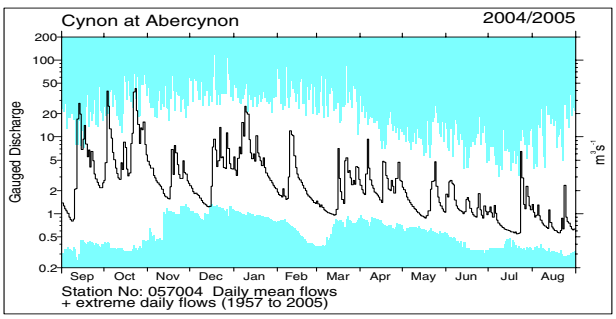


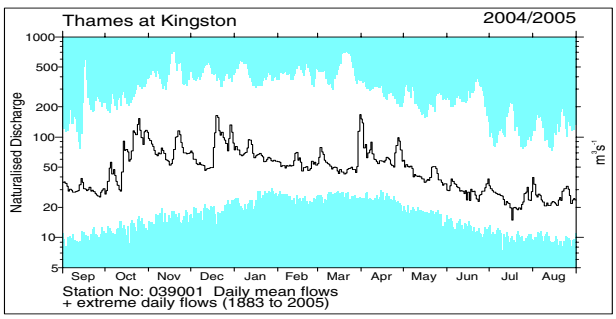


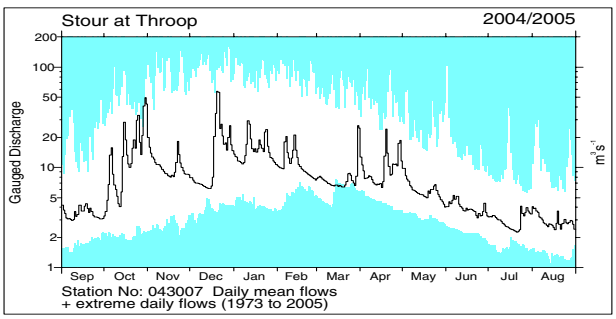


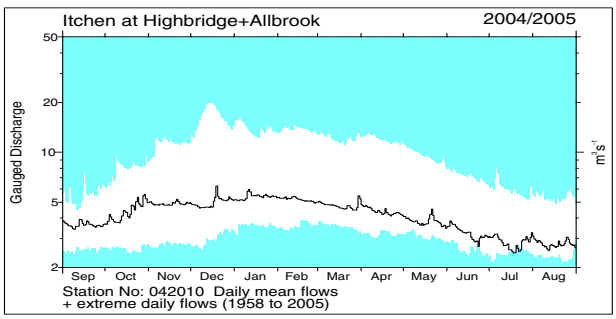












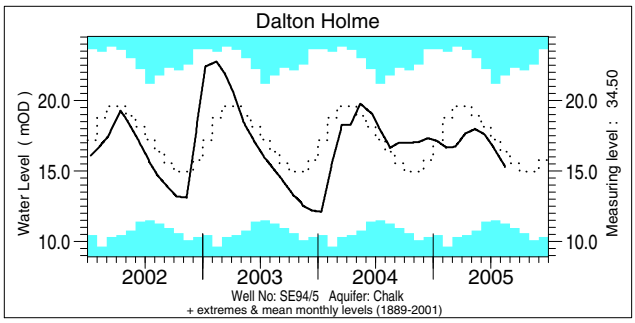
Notable runoff accumulations **(a) June 2005 - August 2005, (b) November 2004 - August 2005**

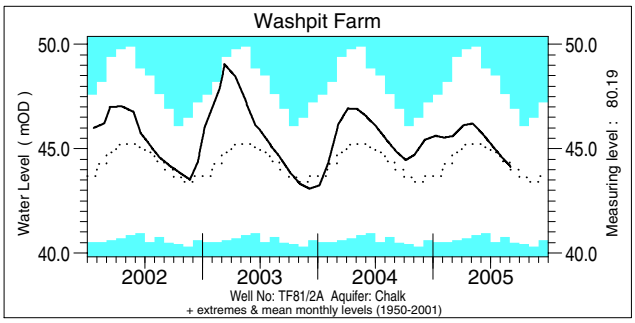
	River	%lta	Rank
a)	Ness	132	30/33
	Mimram	52	7/53
	Test	65	2/47
	Itchen	71	3/47
	Avon (Amesbury)	66	3/41
	Piddle	69	3/42
	Severn	51	8/85
	Ribble	46	5/46

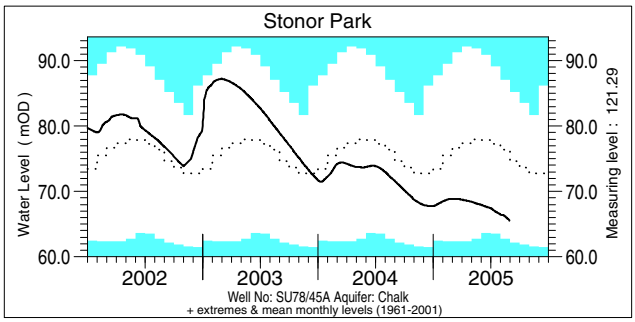
	River	%lta	Rank
b)	Spey (Boat o'Brig)	124	51/53
	Soar	49	3/34
	Mole	55	1/30
	Medway	36	2/44
	Ouse (Gold Bridge)	40	2/41
	Wallington	39	2/50
	Exe	68	3/49
	Kenwyn	56	2/37
	Tone	65	3/44
	Cynon	63	3/47
	Tawe	70	3/44
	Ewe	127	34/35
	Naver	121	27/28
	L Bann	74	1/25

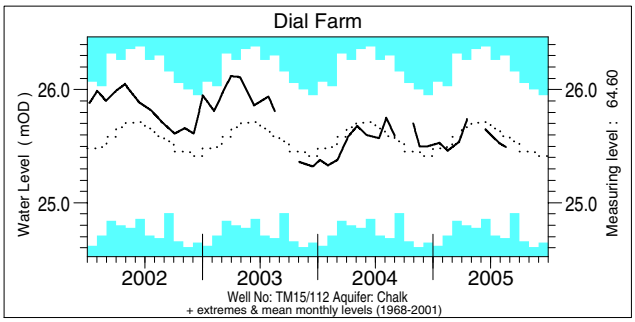
lta = long term average
Rank 1 = lowest on record

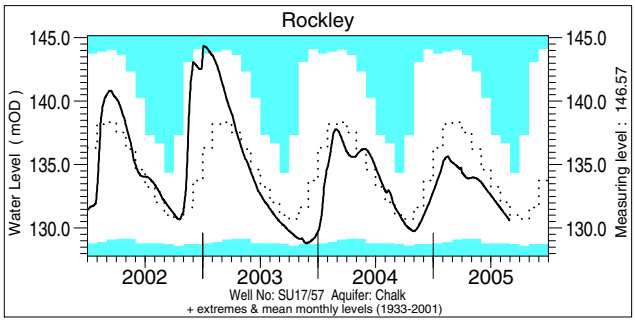
Groundwater . . . Groundwater

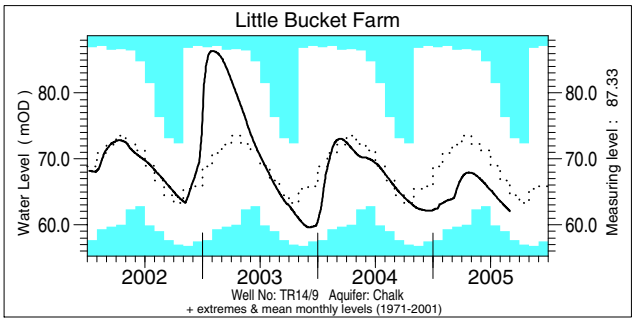


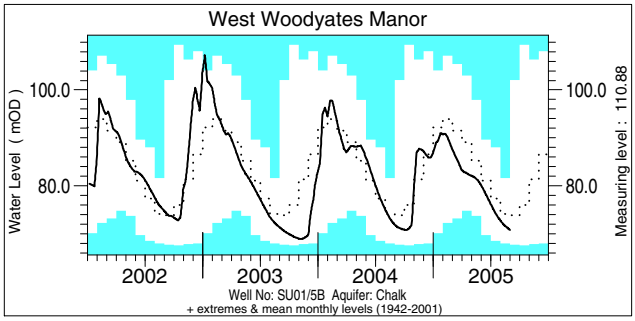


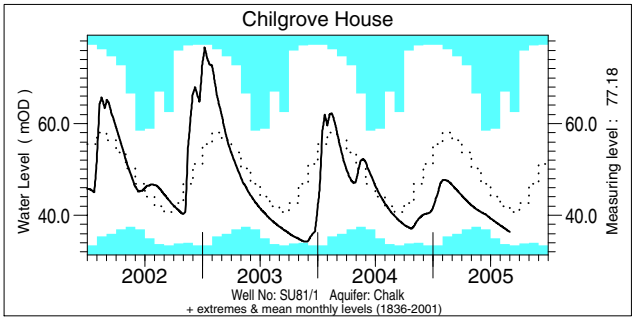


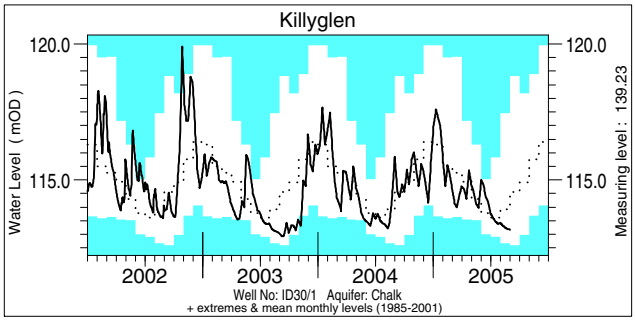


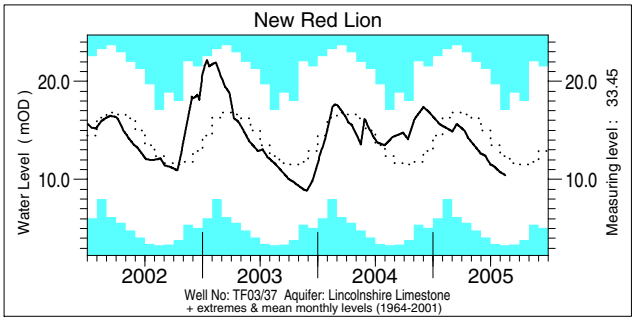






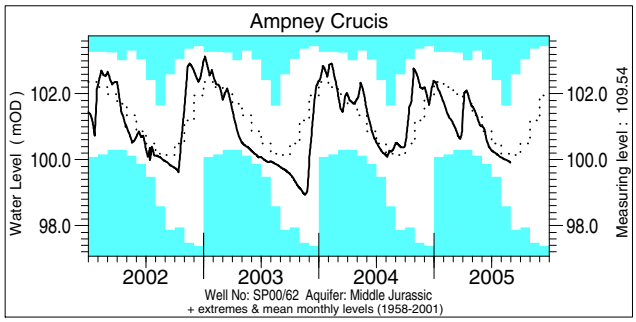


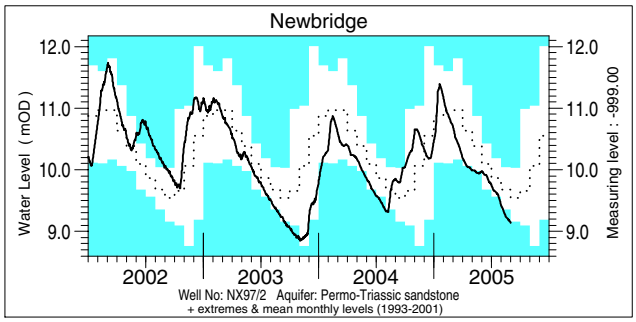


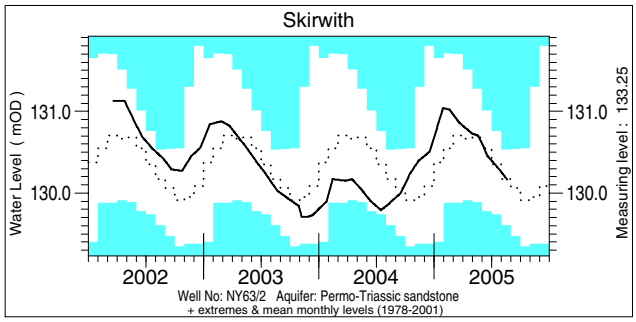


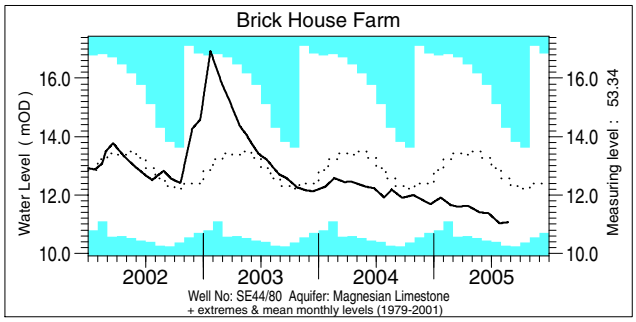
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined below overlying impermeable strata. The monthly max., min. and mean levels are displayed in a similar style to the river flow hydrographs. Note that most groundwater levels are not measured continuously – the latest recorded levels are listed overleaf.

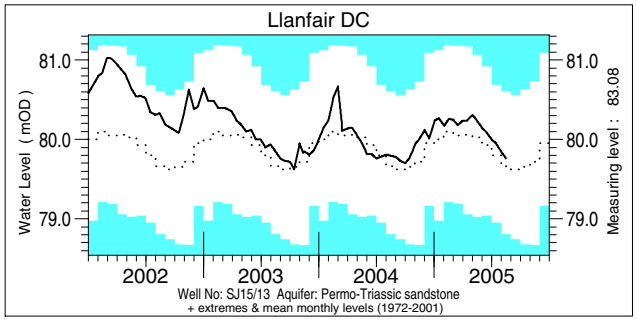
Groundwater . . . Groundwater

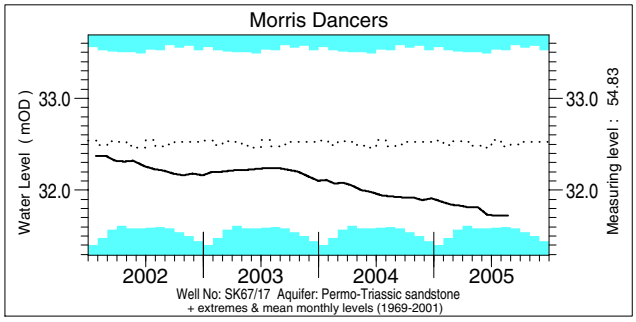


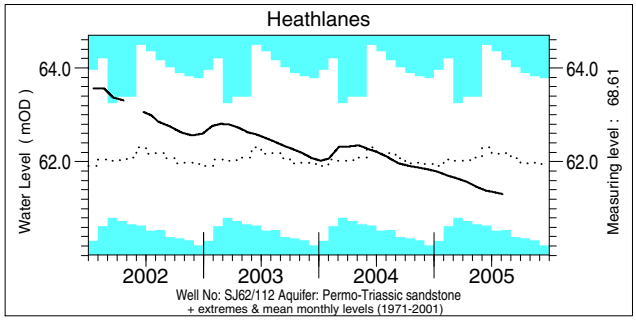


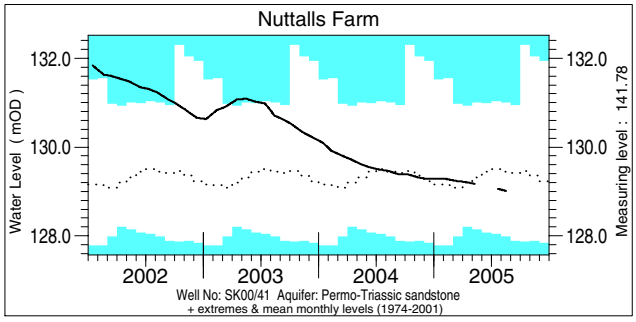


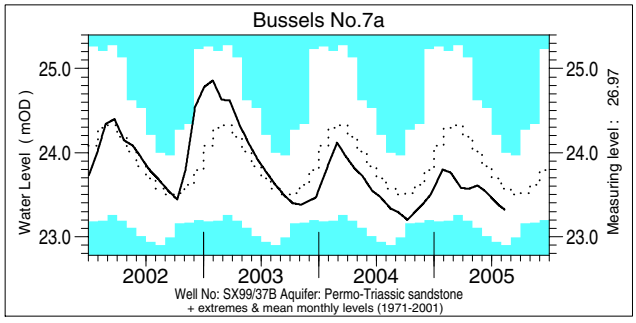


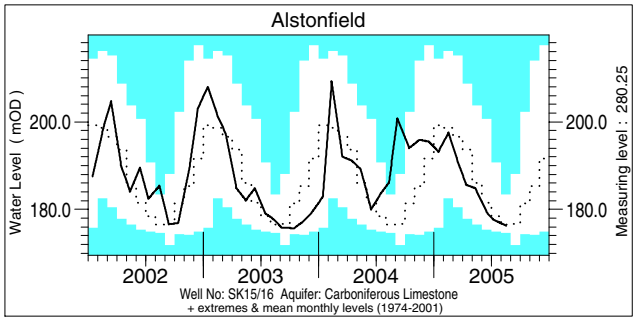












Groundwater levels August / September 2005

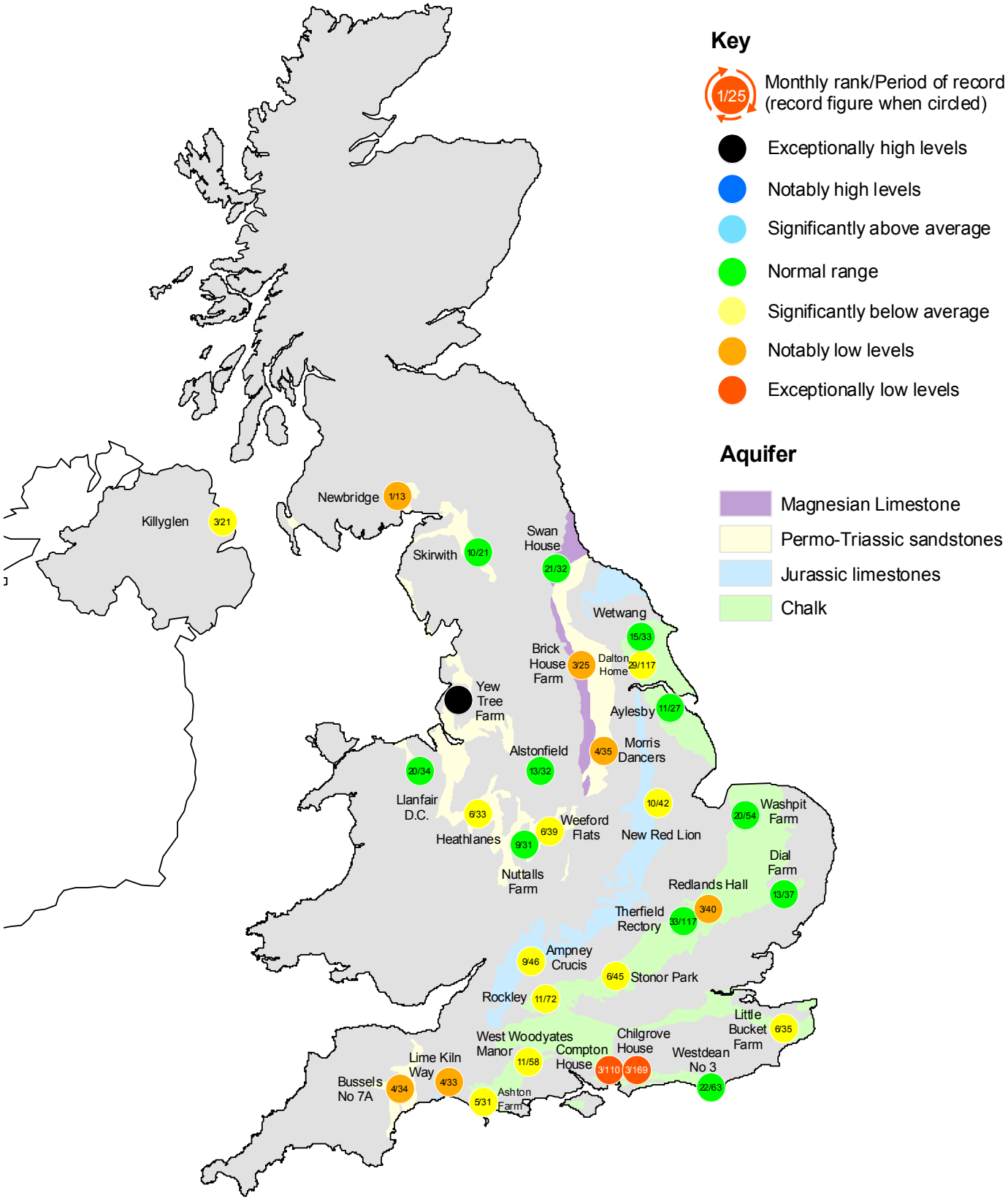
Borehole	Level	Date	Aug. av.
Dalton Holme	15.29	15/08	16.25
Washpit Farm	44.13	02/09	44.49
Stonor Park	65.56	30/08	76.23
Dial Farm	25.49	19/08	25.60
Rockley	130.62	30/08	132.03
Little Bucket Farm	62.03	31/08	67.08
West Woodyates	70.81	31/08	73.94

Borehole	Level	Date	Aug. av.
Chilgrove House	36.32	31/08	41.73
Killyglen	113.18	31/08	113.85
New Red Lion	10.43	16/08	12.42
Ampney Crucis	99.91	30/08	100.16
Newbridge	9.14	31/08	9.69
Skirwith	130.16	19/08	130.16
Brick House Farm	11.07	23/08	12.56

Borehole	Level	Date	Aug. av.
Llanfair DC	79.76	15/08	79.62
Morris Dancers	31.72	23/08	32.36
Heathlanes	61.31	04/08	62.16
Nuttalls Farm	129.01	16/08	129.63
Bussels No.7a	23.32	11/08	23.59
Alstonfield	176.29	16/08	177.46

Levels in metres above Ordnance Datum

Groundwater . . .Groundwater



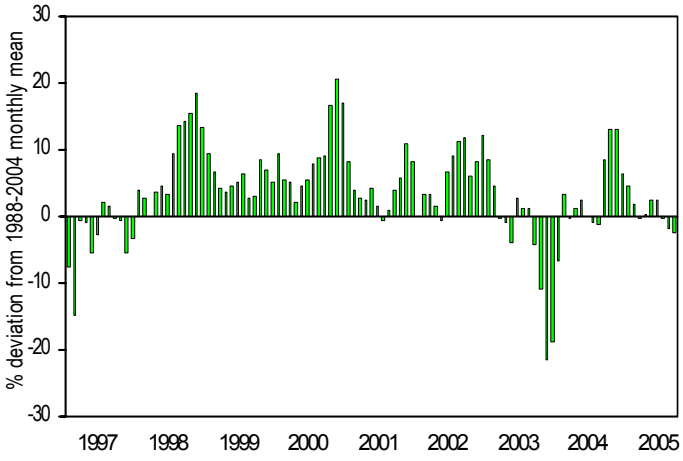
Groundwater levels - August 2005

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.

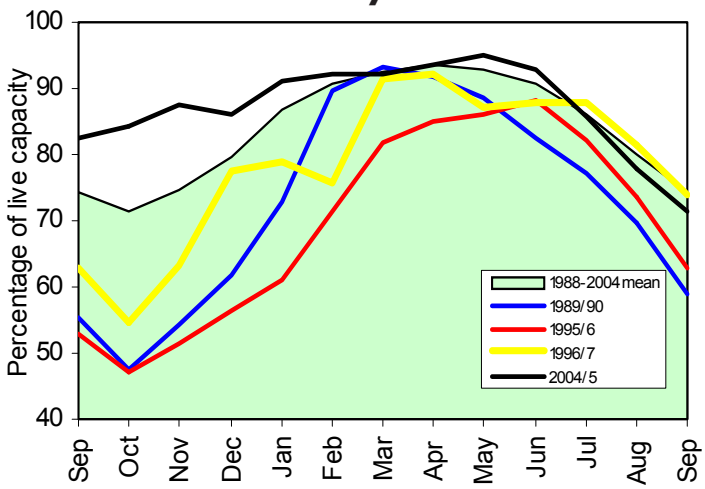
Notes: i. The outcrop areas are coloured according to British Geological Survey conventions.
ii. Yew Tree Farm levels are now received quarterly.

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.

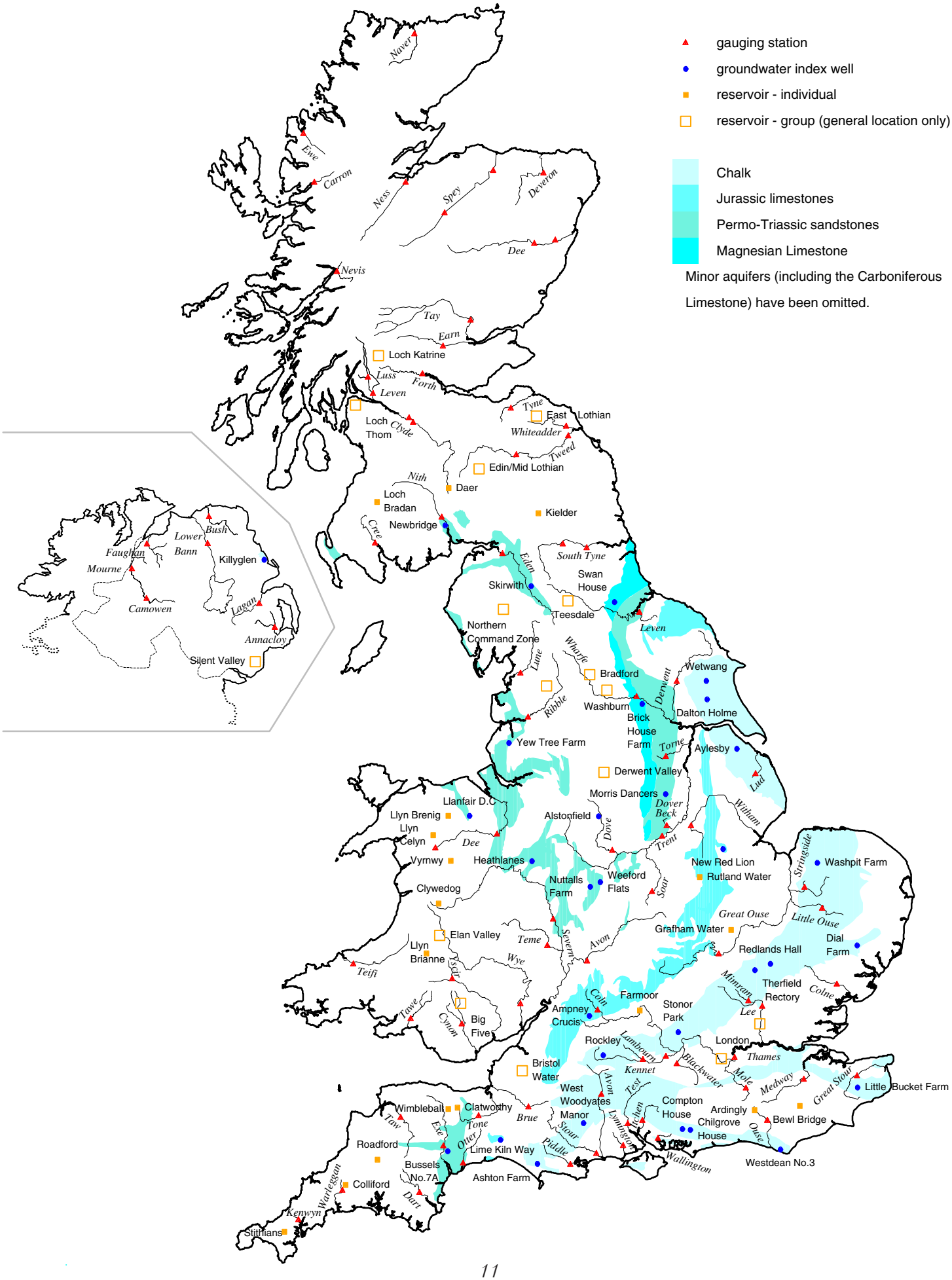
Percentage live capacity of selected reservoirs at start of month

Area	Reservoir	Capacity (Ml)	2005 May	Jun	Jul	Aug	Sep	Avg. Sep	Min. Sep	Year* of min.
North West	N Command Zone	• 124929	90	86	72	57	**49**	54	24	1995
	Vyrnwy	55146	98	94	84	75	**63**	69	36	1995
Northumbrian	Teesdale	• 87936	98	95	87	77	**69**	63	38	1995
	Kielder	(199175)	(93)	(94)	(90)	(87)	**(89)**	(86)	(66)	1989
Severn Trent	Clywedog	44922	100	100	97	87	**76**	75	38	1989
	Derwent Valley	• 39525	100	92	83	72	**60**	65	34	1995
Yorkshire	Washburn	• 22035	85	77	69	62	**57**	66	34	1995
	Bradford supply	• 41407	100	93	80	70	**57**	63	21	1995
Anglian	Grafham	(55490)	(96)	(93)	(89)	(86)	**(82)**	(84)	(59)	1997
	Rutland	(116580)	(94)	(95)	(89)	(85)	**(82)**	(81)	(66)	1995
Thames	London	• 202340	99	98	89	80	**74**	79	62	1995
	Farmoor	• 13830	98	99	99	99	**98**	91	64	1995
Southern	Bewl	28170	85	78	69	61	**54**	69	38	1990
	Ardingly	4685	98	98	82	65	**56**	72	47	1996
Wessex	Clatworthy	5364	100	94	87	80	**66**	60	31	1995
	Bristol WW	• (38666)	(85)	(82)	(75)	(65)	**(55)**	(65)	(43)	1990
South West	Colliford	28540	71	71	67	62	**54**	71	43	1997
	Roadford	34500	75	73	71	66	**58**	72	40	1995
	Wimbleball	21320	96	93	88	83	**74**	67	40	1995
	Stithians	5205	84	87	79	67	**54**	59	30	1990
Welsh	Celyn and Brenig	• 131155	100	100	96	86	**78**	79	49	1989
	Brianne	62140	100	100	94	93	**88**	84	55	1995
	Big Five	• 69762	96	91	82	73	**62**	67	29	1995
	Elan Valley	• 99106	99	94	83	75	**67**	75	46	1995
Scotland(E)	Edinburgh/Mid Lothian	• 97639	99	99	96	85	**74**	75	45	1998
	East Lothian	• 10206	100	100	96	90	**78**	81	63	1989
Scotland(W)	Loch Katrine	• 111363	97	100	94	73	**67**	68	50	2000
	Daer	22412	100	100	94	80	**69**	69	41	1995
	Loch Thom	• 11840	100	100	100	100	**100**	76	58	1997
Northern Ireland	Total+	• 67270	89	89	86	75	**71**	72	40	1995
	Silent Valley	• 20634	89	93	86	74	**65**	62	33	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 1988-2005 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.

The Met Office
FitzRoy Road
Exeter
Devon
EX1 3PB

Tel.: 0870 900 0100
Fax: 0870 900 5050
E-mail: enquiries@metoffice.com

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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