Hydrological Summary
for the United Kingdom

July 2005

General
July was a generally warm month, and dry across much of Scotland and Northern Ireland, but England and Wales reported only its second month with above average rainfall since last October. Drought conditions eased moderately in some areas (e.g. the South) but intensified in parts of central England. Reservoir stocks declined and, by early August, were well below average in many southern impoundments; hosepipe bans were extended in the South-East. Nonetheless, overall reservoir stocks for E&W are only around 2% below average and well above corresponding stocks in 1989, 1990 and 1995. July river flows were notably low in Scotland and in many southern catchments where they are, mostly a legacy of the dry winter and spring. This effect is more pronounced in relation to groundwater resources; levels are depressed in the southern Chalk, and below average in most major aquifers but generally well above drought minima. In the drought affected regions stress on resources and the aquatic environment is likely to extend well into the autumn: the current dry soil conditions suggest that, given average rainfall, the seasonal recovery in runoff and recharge rates will not begin for around 10-14 weeks.

Rainfall
Synoptic patterns were mostly anticyclonic during July but with unsettled interludes early and, particularly, late in the month. Some notable storms were reported e.g. 65mm in 24 hrs at Milford Haven on the 27/28th. Extended dry episodes were common also e.g. in the Scottish Highlands (mid-month) and at Oxford where rainfall totalled <6mm over the first three weeks. Monthly rainfall totals were below 50% of average across much of Scotland which recorded its second (provisionally) driest July for 50 years. Northern Ireland, north-western England and North Wales were also relatively dry. Above average rainfall characterised much of the rest of E&W as large parts of the English Lowlands reported their wettest month since last October. The above average rainfall across the Southern Region was especially welcome. Accumulated rainfall deficiencies were moderated in much of the most severely drought affected regions. However, some central catchments (e.g. in Berks/Oxon and Cambs) registered their 9th successive month with below average rainfall and the Nov-July rainfall total for E&W is very similar to those during the droughts of 1988/89 and 1995/96; only 1975/76 has been drier since 1948/49. One consequence of the spatially very variable convective rainfall of the early summer is significant local variations in rainfall deficiency and pockets of exceptional drought severity have recorded <60% rainfall in this timeframe e.g. in London and parts of the South Downs. For many catchments in the South-East only 1975/76 (notably so) and 1988/89 have been drier since the 1940s.

River Flow
As usual in July high evaporative demand meant that last month's rainfall had only a limited impact on the hydrological drought. Recessions continued in almost all index rivers – triggering the operation of flow augmentation schemes in some areas (e.g. the Gt. Ouse Groundwater Scheme) - but with a useful recovery in the final week in many drought-affected rivers. The recessions have been particularly steep in Scotland and late July flows were depressed over wide areas. The Luss and Clyde (in a 42-yr record) were among a number of rivers registering new July runoff minima. Flows were also modest in Northern Ireland where the Lower Bann reported its second lowest July runoff. In southern England, flows approached those recorded during the benchmark drought of 1976 in the Itchen, which, like the Test (Hants) and Piddle (Dorset) registered its 2nd lowest July runoff on record. For the Thames the July runoff was the 2nd lowest since 1976 (but similarly modest July flows were substantially more common prior to 1950). Elsewhere, most July runoff totals were in the normal range. However, the exceptional winter/spring rainfall is better reflected in the Nov-July accumulations which testify to a greatly enhanced NW/SE runoff gradient across the UK. Most 9-month accumulations are very low across southern Britain, 40% or less in some catchments (e.g. the Medway and Sussex Ouse) and, commonly, the 2nd or 3rd lowest on record across southern England.

Groundwater
July rainfall was above average across the majority of aquifer outcrop areas but, generally, soil moisture deficits also increased appreciably over the month. Correspondingly, infiltration was minimal and the sustained recessions in groundwater levels continue. Levels remain most depressed in the Chalk of the South Downs where the Chilgrove and Compton boreholes are broadly tracking the 1944 drought recession; current levels are above those of 1934 and 1976 only (in the last 110 years) – levels are low in parts of the Essex Chalk also. Resources are healthier elsewhere in the Chalk, with levels often in the normal range. In the deep, and slow responding, Chalk at Therfield levels are at their lowest for seven years but remain significantly above the minima of recent droughts (and very substantially above the sustained minima of the 1940s and 1900s). July levels in the Middle Jurassic and Carboniferous Limestones were close to the late summer average (as they were in most minor aquifers, e.g. the Norfolk Drift) but relatively depressed in the Magnesian Limestone at Brick House Farm. With the exception of the still elevated levels at Llanfair DC and Yew Tree Farm, groundwater levels in the Permo-Triassic sandstones outcrops are appreciably below average but well above drought minima. Rainfall over the next two months will be very influential in determining the likely onset of the seasonal recovery in recharge rates.

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

British Geological Survey
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Rainfall . . . Rainfall . . .

Rainfall accumulations and return period estimates

Area	Rainfall	Jul 2005	May 05-Jul 05	RP	Feb 05-Jul 05	RP	Nov 04-Jul 05	RP	Aug 04-Jul 05	RP
England & Wales	**mm**	**75**	**176**		**354**		**539**		**900**	
	%	**121**	**91**	**2-5**	**90**	**2-5**	**80**	**5-15**	**98**	**2-5**
North West	mm	**66**	199		430		780		1311	
	%	**76**	81	2-5	87	2-5	91	2-5	108	2-5
Northumbrian	mm	**82**	184		424		615		1011	
	%	**123**	96	2-5	112	2-5	97	2-5	117	5-10
Severn Trent	mm	**63**	160		317		443		774	
	%	**115**	92	2-5	91	2-5	78	5-15	101	2-5
Yorkshire	mm	**80**	164		369		524		872	
	%	**129**	89	2-5	100	<2	85	5-10	104	2-5
Anglian	mm	**62**	150		265		362		608	
	%	**123**	99	2-5	94	2-5	81	5-10	101	2-5
Thames	mm	**53**	126		247		362		626	
	%	**107**	78	2-5	78	5-10	70	20-30	89	2-5
Southern	mm	**61**	118		249		386		654	
	%	**125**	75	2-5	76	5-10	67	30-40	83	5-10
Wessex	mm	**67**	166		327		492		788	
	%	**125**	96	2-5	90	2-5	78	5-15	92	2-5
South West	mm	**84**	213		419		684		1104	
	%	**119**	99	2-5	86	2-5	76	10-20	93	2-5
Welsh	mm	**86**	217		480		809		1347	
	%	**107**	88	2-5	89	2-5	82	5-10	100	<2
Scotland	**mm**	**45**	**267**		**605**		**1159**		**1726**	
	%	**47**	**100**	**<2**	**104**	**2-5**	**110**	**2-5**	**117**	**10-20**
Highland	mm	**53**	314		746		1545		2167	
	%	**49**	105	*2-5*	110	*2-5*	124	*10-20*	125	*30-40*
North East	mm	**42**	215		461		745		1159	
	%	**54**	98	2-5	105	2-5	100	<2	113	5-10
Tay	mm	**30**	241		546		946		1534	
	%	**36**	99	2-5	104	2-5	101	2-5	119	10-20
Forth	mm	**29**	217		483		853		1344	
	%	**38**	96	2-5	103	2-5	105	2-5	117	10-20
Tweed	mm	**53**	194		438		682		1153	
	%	**70**	90	2-5	102	2-5	94	2-5	115	5-10
Solway	mm	**36**	236		522		966		1554	
	%	**39**	89	2-5	92	2-5	95	2-5	108	2-5
Clyde	mm	**40**	299		659		1323		2001	
	%	**35**	98	2-5	98	2-5	108	2-5	114	5-15
Northern Ireland	**mm**	**43**	**201**		**414**		**718**		**1071**	
	%	**60**	**93**	**2-5**	**91**	**2-5**	**91**	**2-5**	**97**	**2-5**

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

 All monthly totals since February 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 . . .

Key

00% Percentage of 1961-90 average

Very wet

Substantially above average

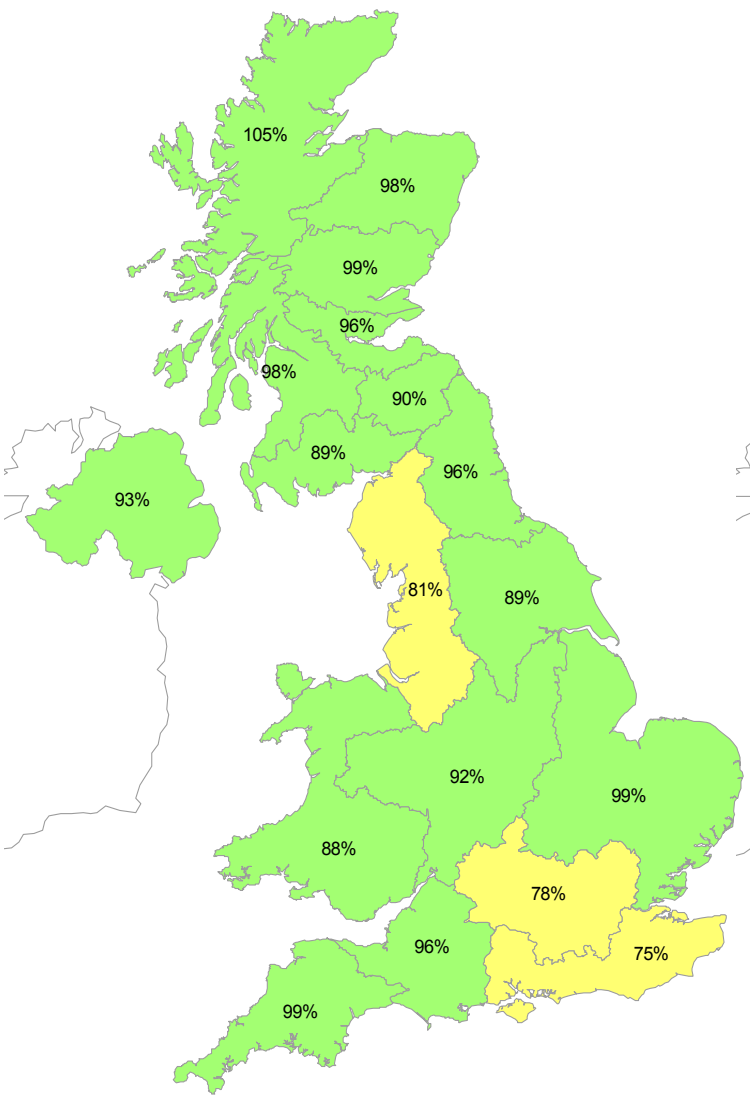
Above average

Normal range

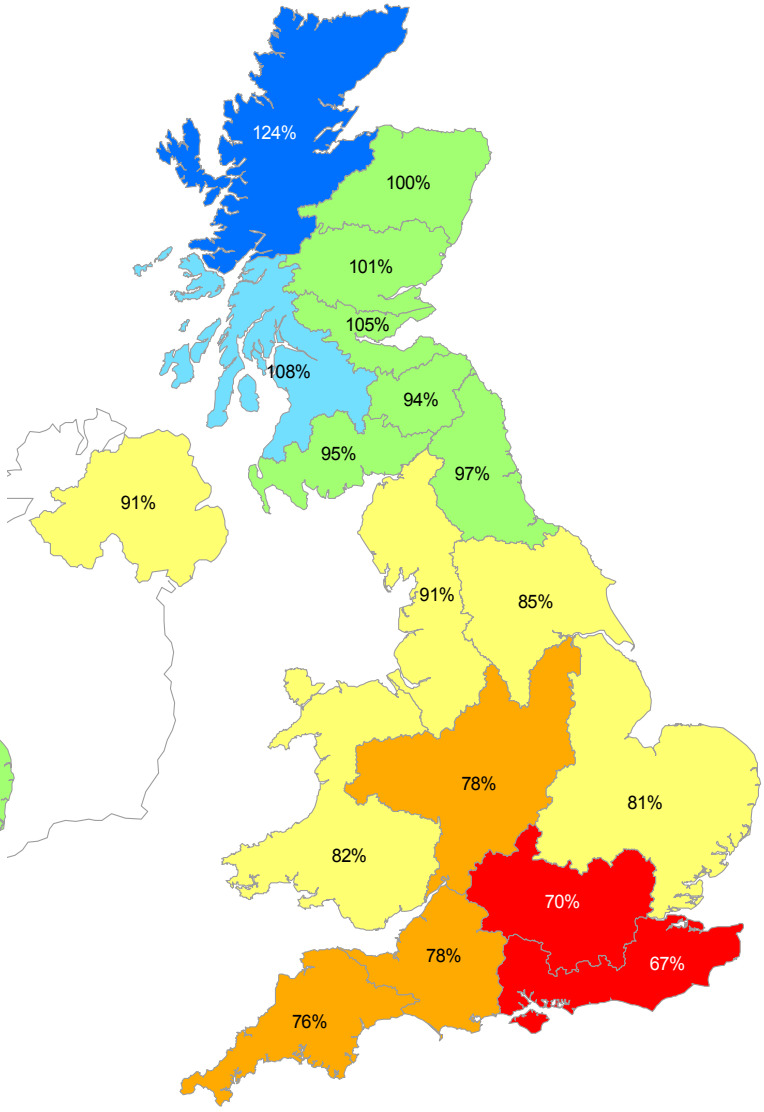
Below average

Substantially below average

Exceptionally low rainfall



May 2005 - July 2005

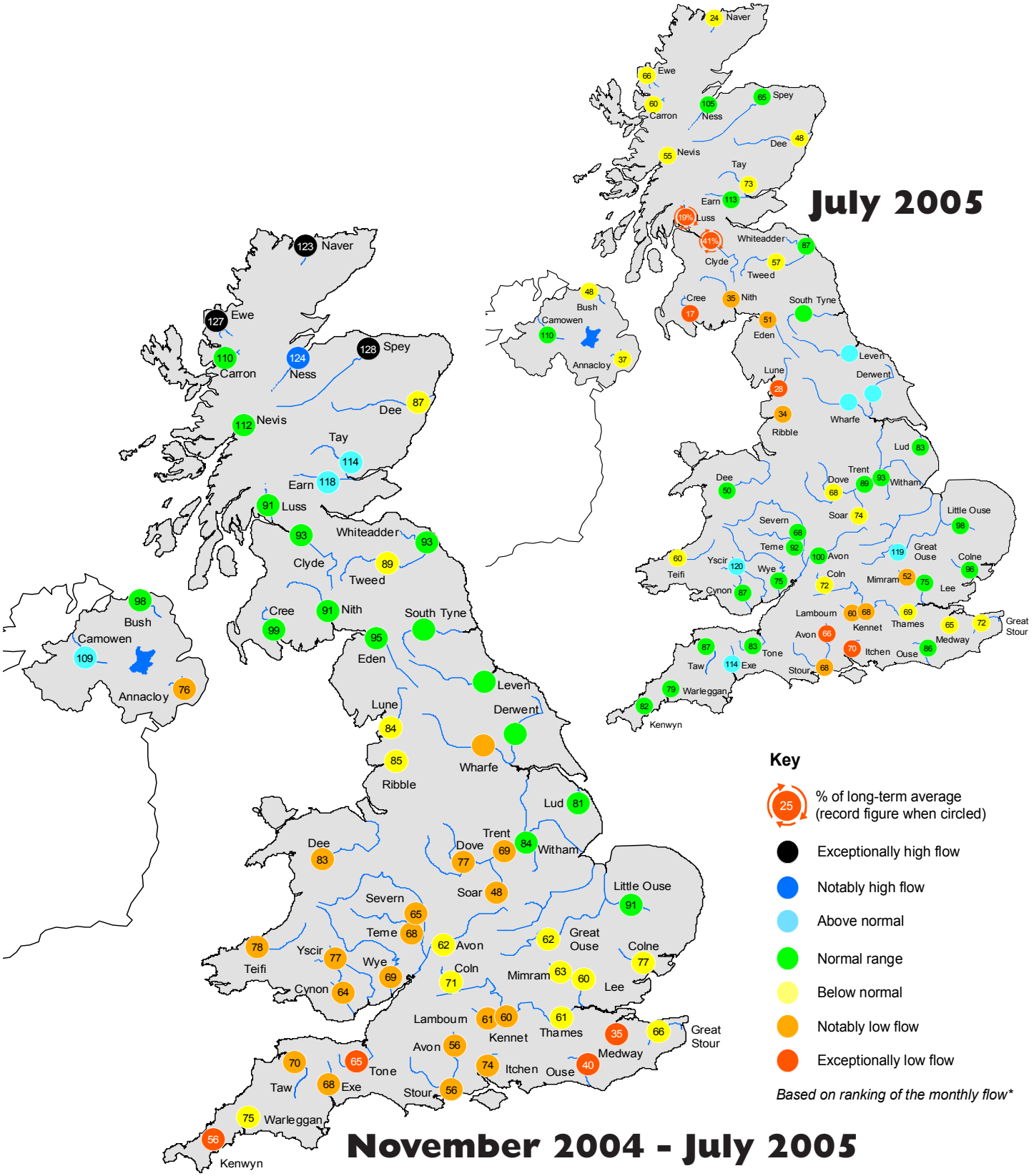


November 2004 - July 2005

Rainfall accumulation maps

Regional rainfall totals for the May-Jul period are unremarkable – the third driest such period for the UK since 1996, with moderate deficiencies in the Southern, Thames and North-West regions. However, when considered together with the rainfall deficiencies over the preceding six months, the drought is of a notable magnitude across much of the South-East where many catchments (rather than regions) have reported <65% of average rainfall.

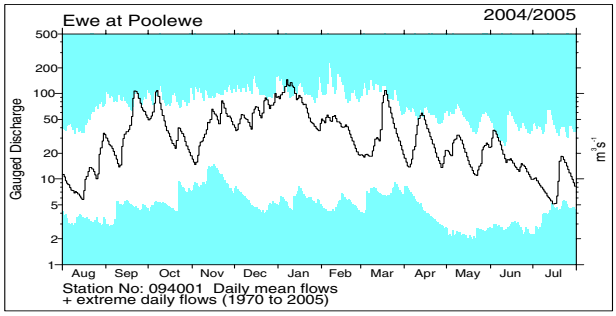
River flow . . . River flow . . .

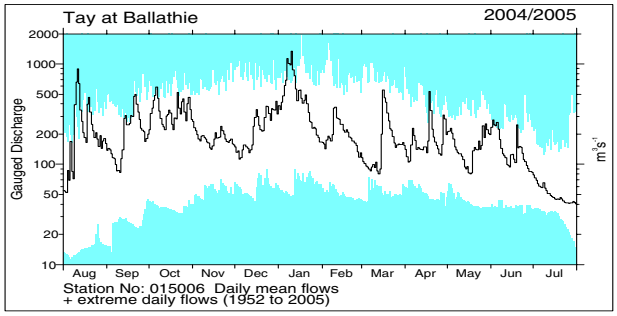


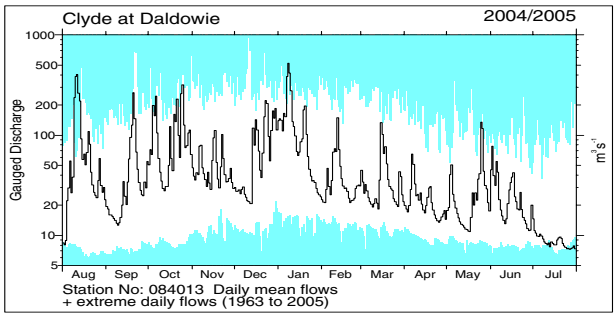
River flows

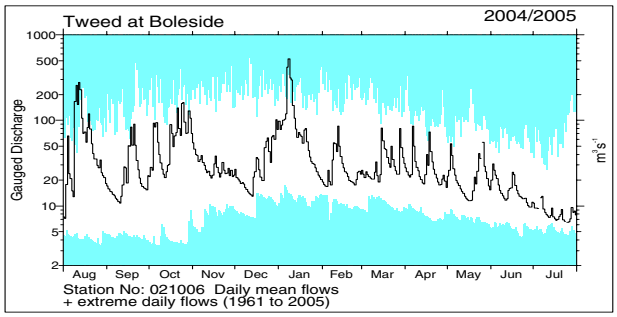
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

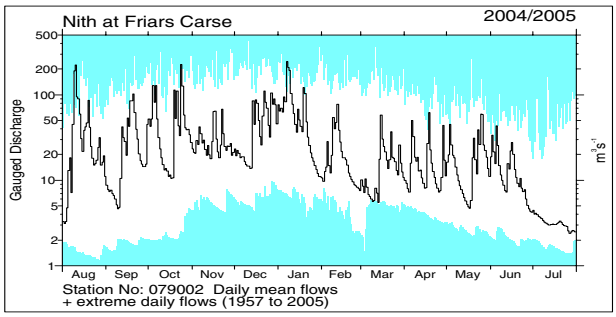
River flow . . . River flow . . .

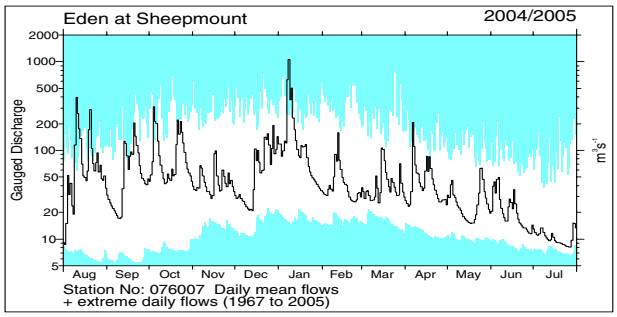


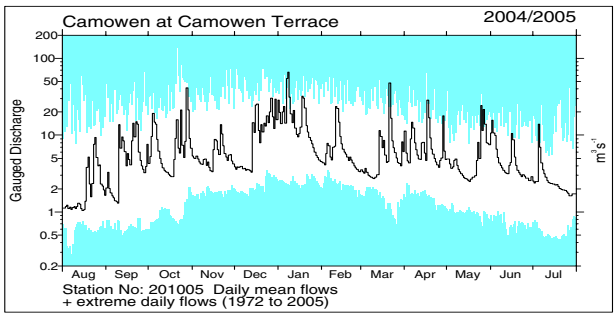


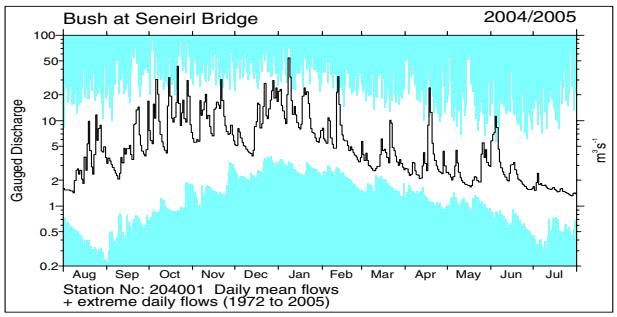


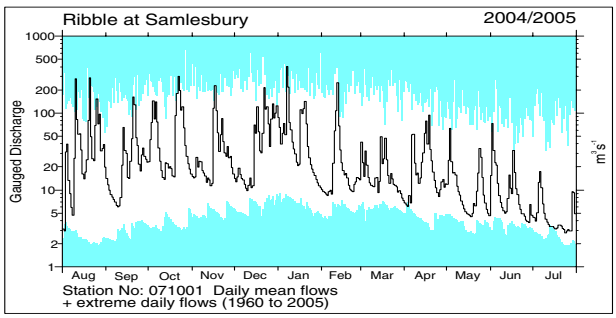


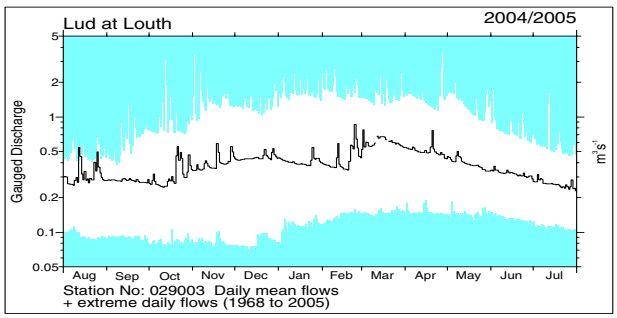










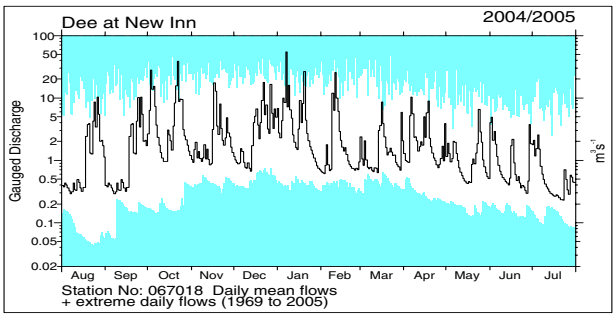


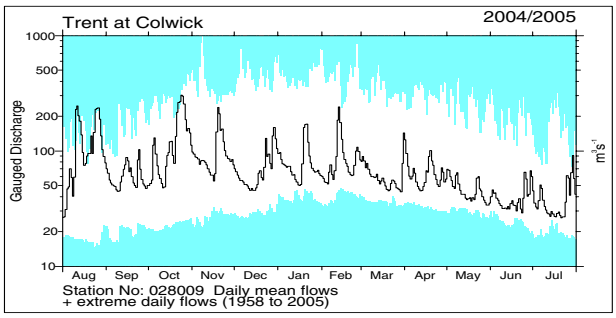
River flow hydrographs

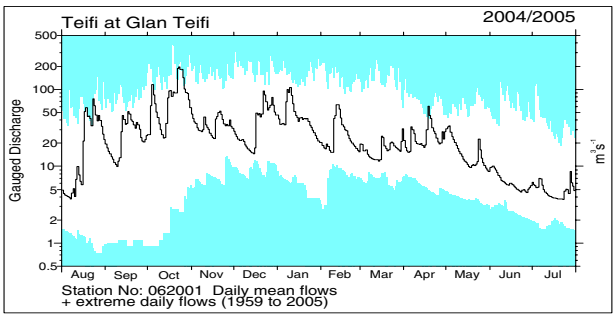
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to August 2004 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas.

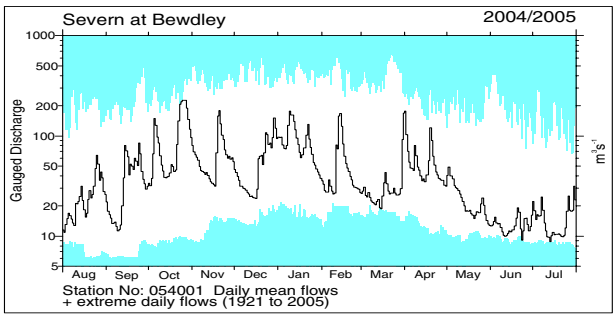
Note: The unavailability of flows for some index stations has prevented the updating of the national runoff series.

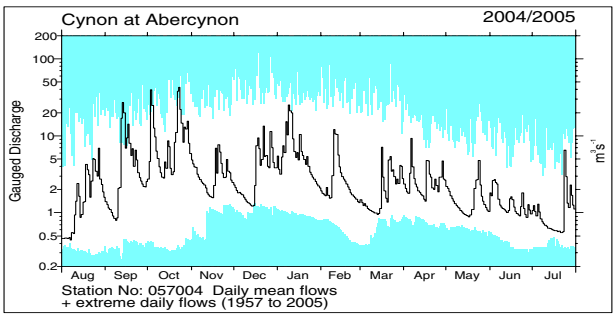
River flow . . . River flow . . .

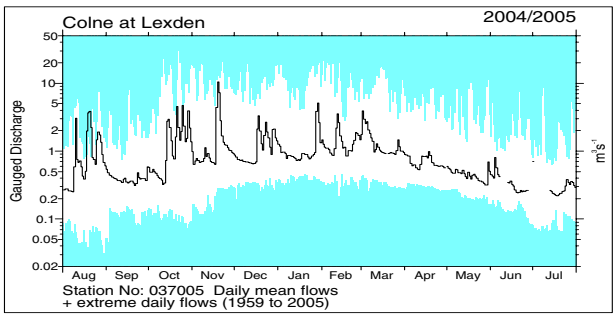


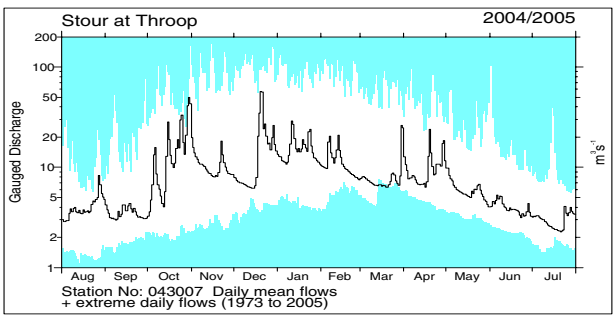


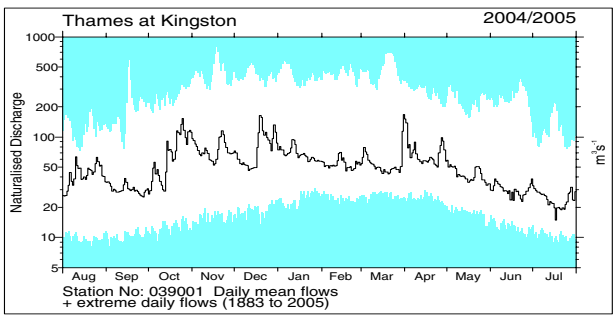


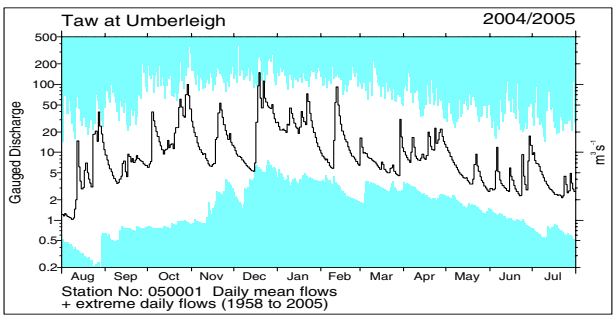


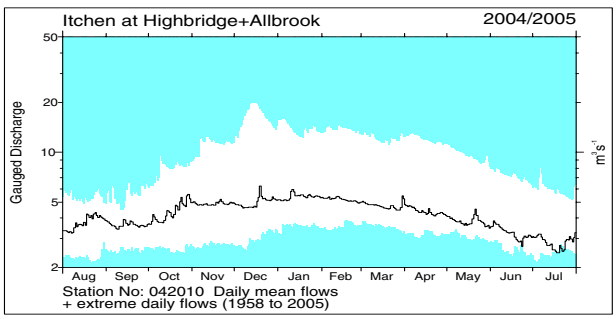












Notable runoff accumulations (a) May 2005 - July 2005, (b) November 2004 - July 2005

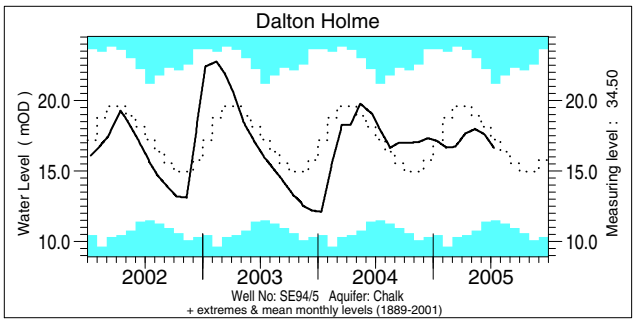
	River	%lta	Rank
a)	Ness	133	30/33
	Earn	182	57/58
	Forth	141	20/24
	Dover Beck	62	4/31
	Kennet	64	5/44
	Test	62	4/47
	Itchen	68	3/47
	Piddle	67	2/42

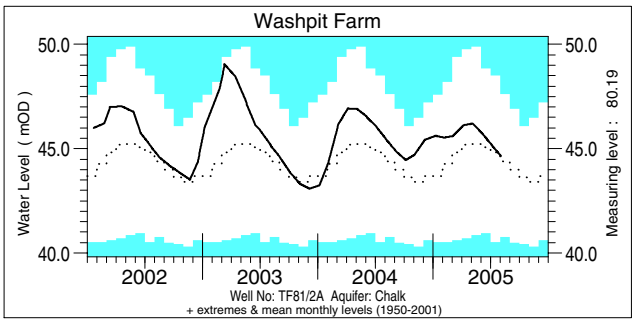
	River	%lta	Rank
b)	Spey (Boat o'Brig)	128	51/53
	Soar	48	3/34
	Mole	53	1/30
	Medway	35	2/44
	Ouse (Gold Bridge)	40	2/41
	Wallington	38	2/50
	Stour (Throop)	56	3/32

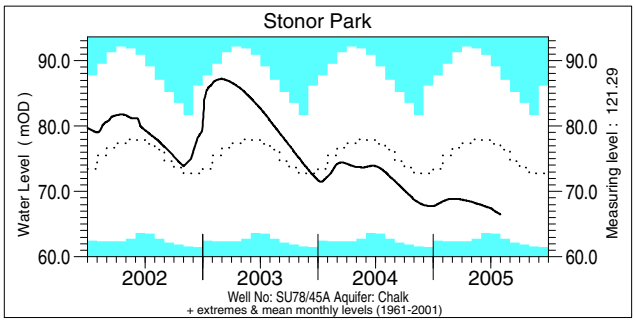
River	%lta	Rank
Otter	59	3/43
Kenwyn	56	2/37
Tone	65	3/44
Tawe	71	3/44
Ewe	127	34/35
Naver	123	27/28
L Bann	76	1/25

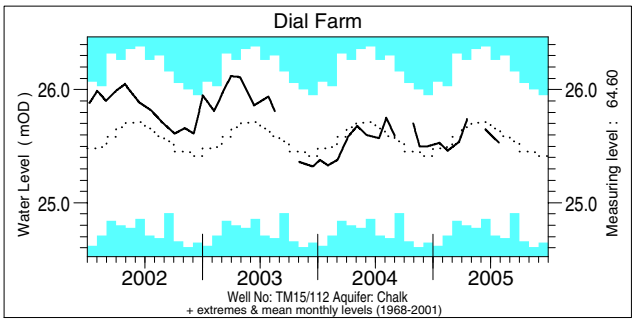
lta = long term average
Rank 1 = lowest on record

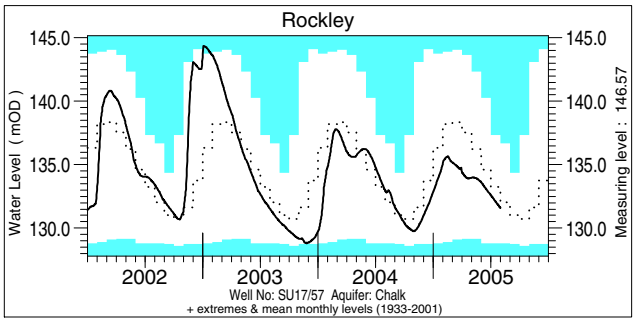
Groundwater . . . Groundwater

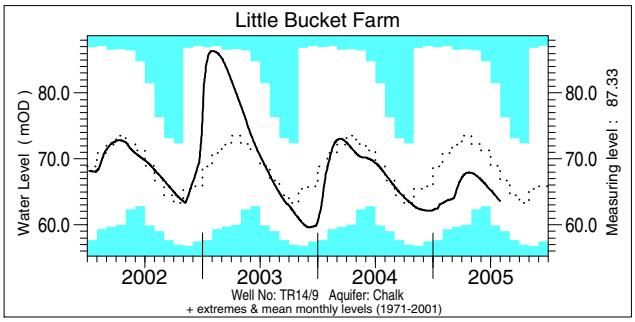


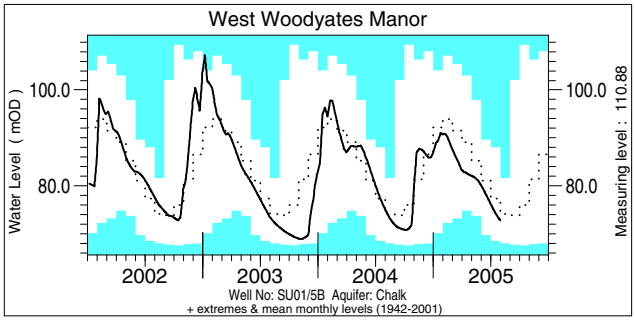


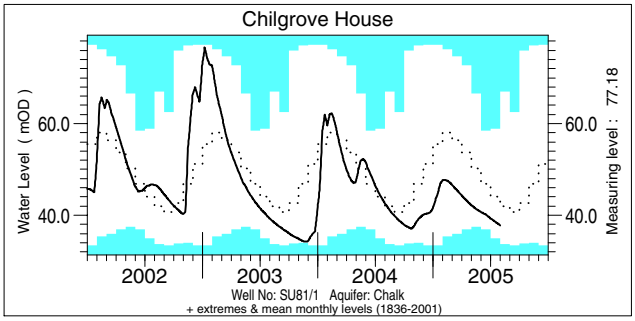


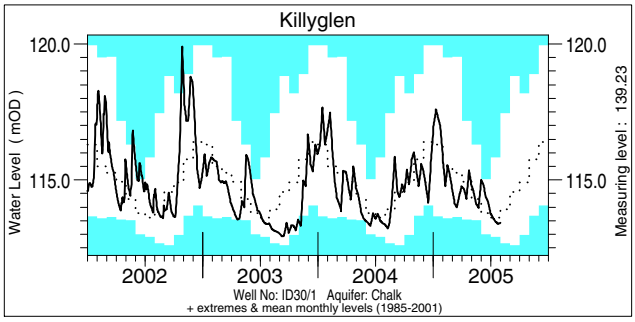


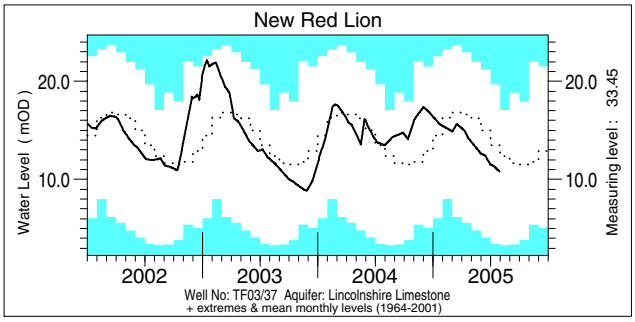






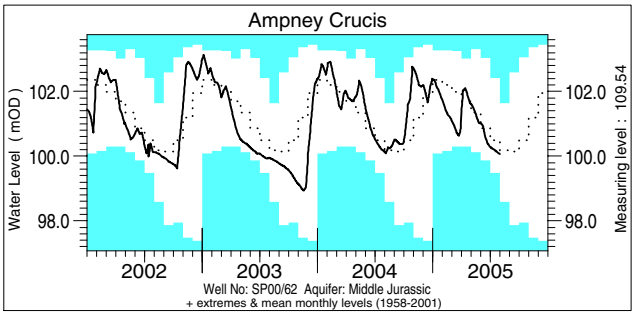


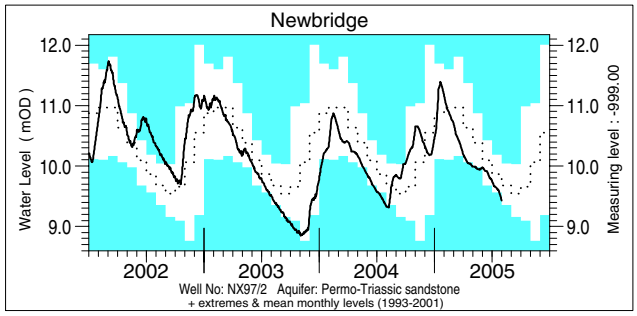


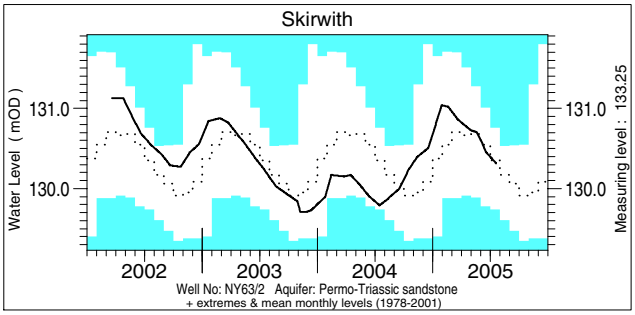


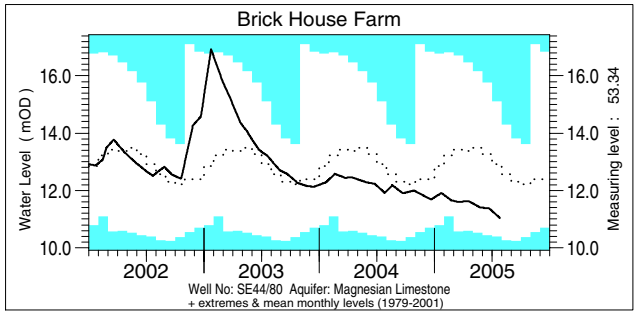
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

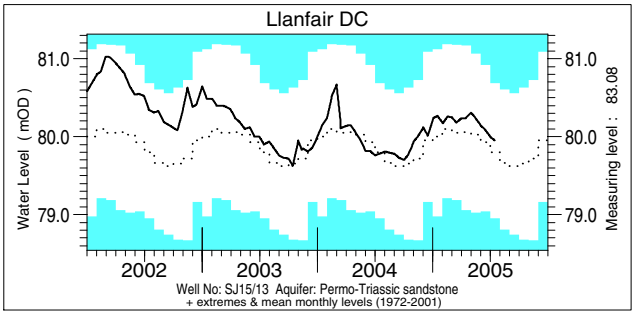
Groundwater . . . Groundwater

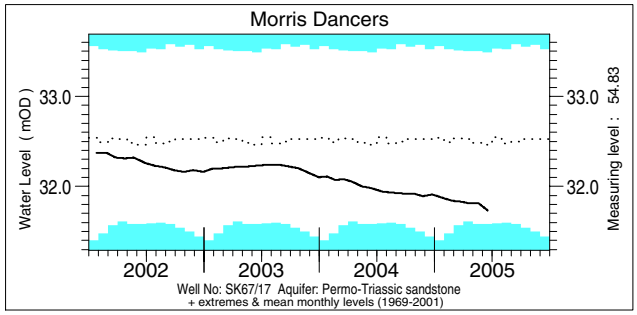


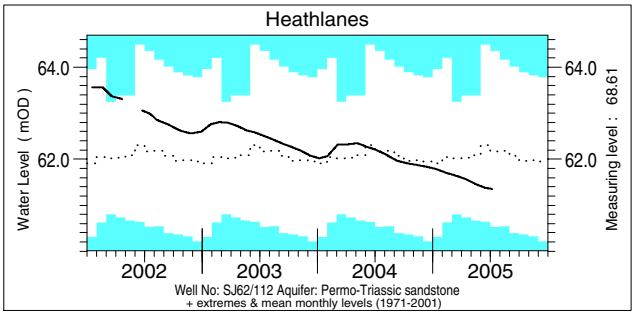


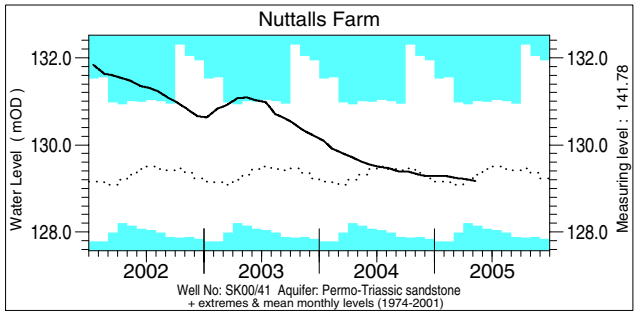


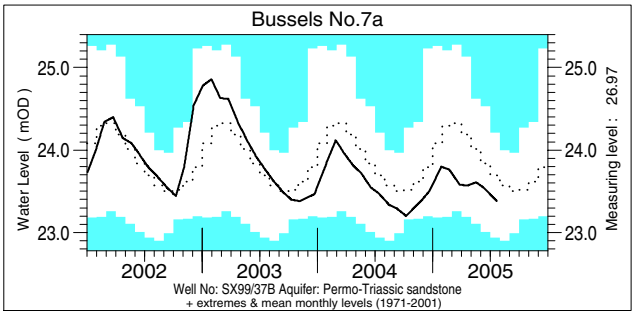


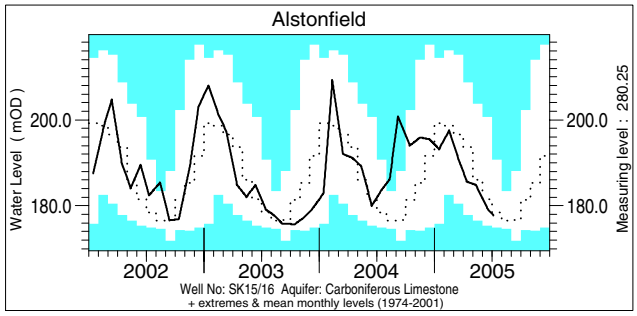










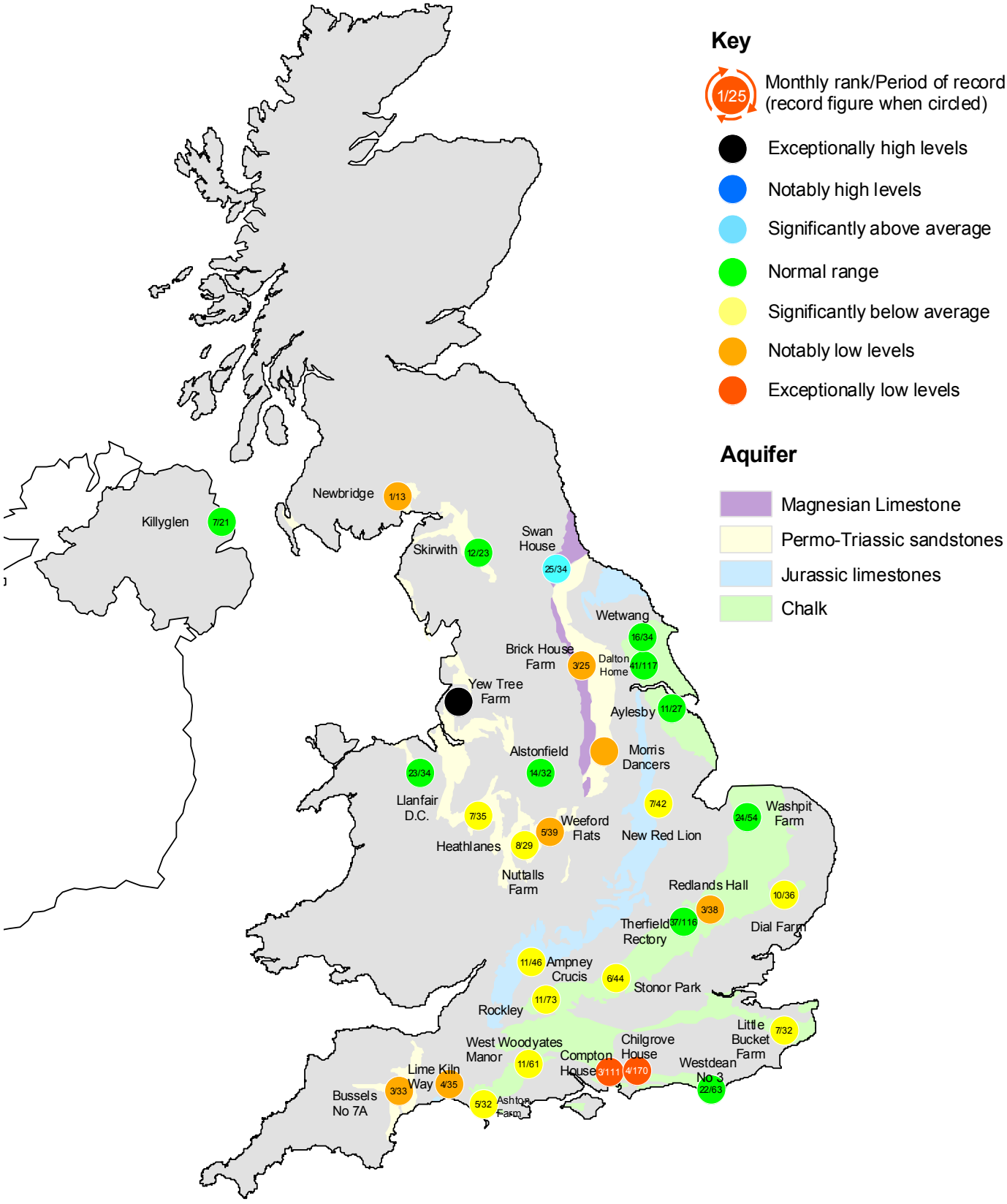


Groundwater levels July/August 2005

Borehole	Level	Date	Jul. av.	Borehole	Level	Date	Jul. av.	Borehole	Level	Date	Jul. av.
Dalton Holme	16.62	11/07	17.19	Chilgrove House	37.79	31/07	43.59	Llanfair DC	79.95	15/07	79.74
Washpit Farm	44.63	03/08	44.90	Killyglen	113.42	31/07	113.75	Morris Dancers	31.73	17/06	32.35
Stonor Park	66.45	01/08	77.66	New Red Lion	10.79	29/07	13.40	Heathlanes	61.35	08/07	62.20
Dial Farm	25.53	27/07	25.68	Ampney Crucis	100.07	01/08	100.44	Nuttalls Farm	129.06	21/07	129.64
Rockley	131.56	01/08	133.22	Newbridge	9.43	31/07	9.87	Bussels No.7a	23.38	22/07	23.73
Little Bucket Farm	63.59	31/07	68.89	Skirwith	130.31	20/07	130.26	Alstonfield	177.72	06/07	179.20
West Woodyates	72.75	31/07	76.97	Brick House Farm	11.03	26/07	12.88				

Levels in metres above Ordnance Datum

Groundwater . . .Groundwater



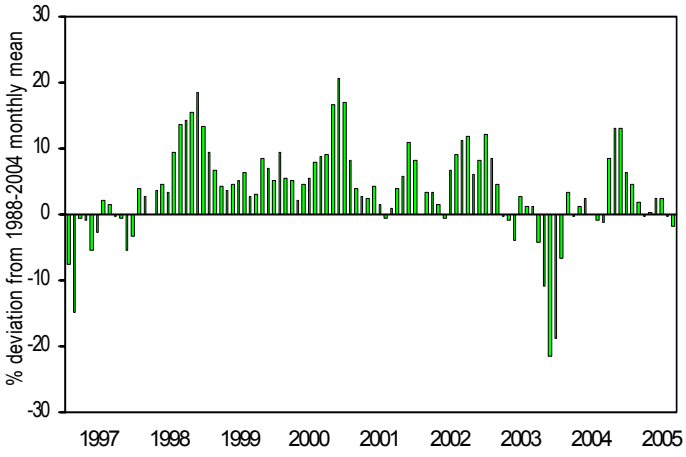
Groundwater levels - July 2005

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.

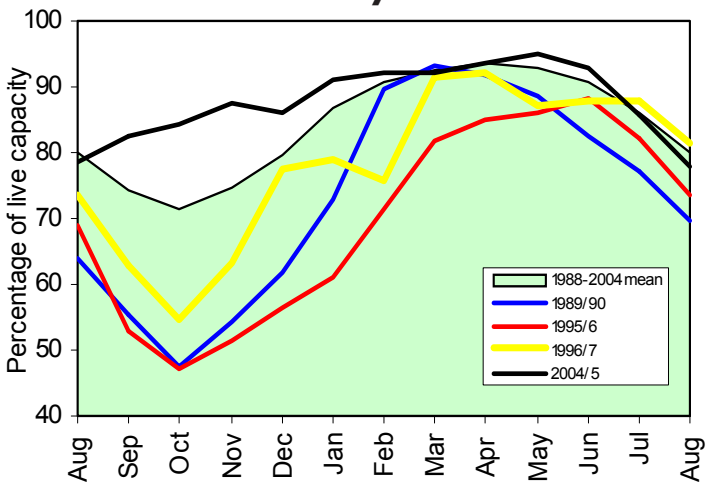
Notes: i. The outcrop areas are coloured according to British Geological Survey conventions.
ii. Yew Tree Farm levels are now received quarterly.

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.

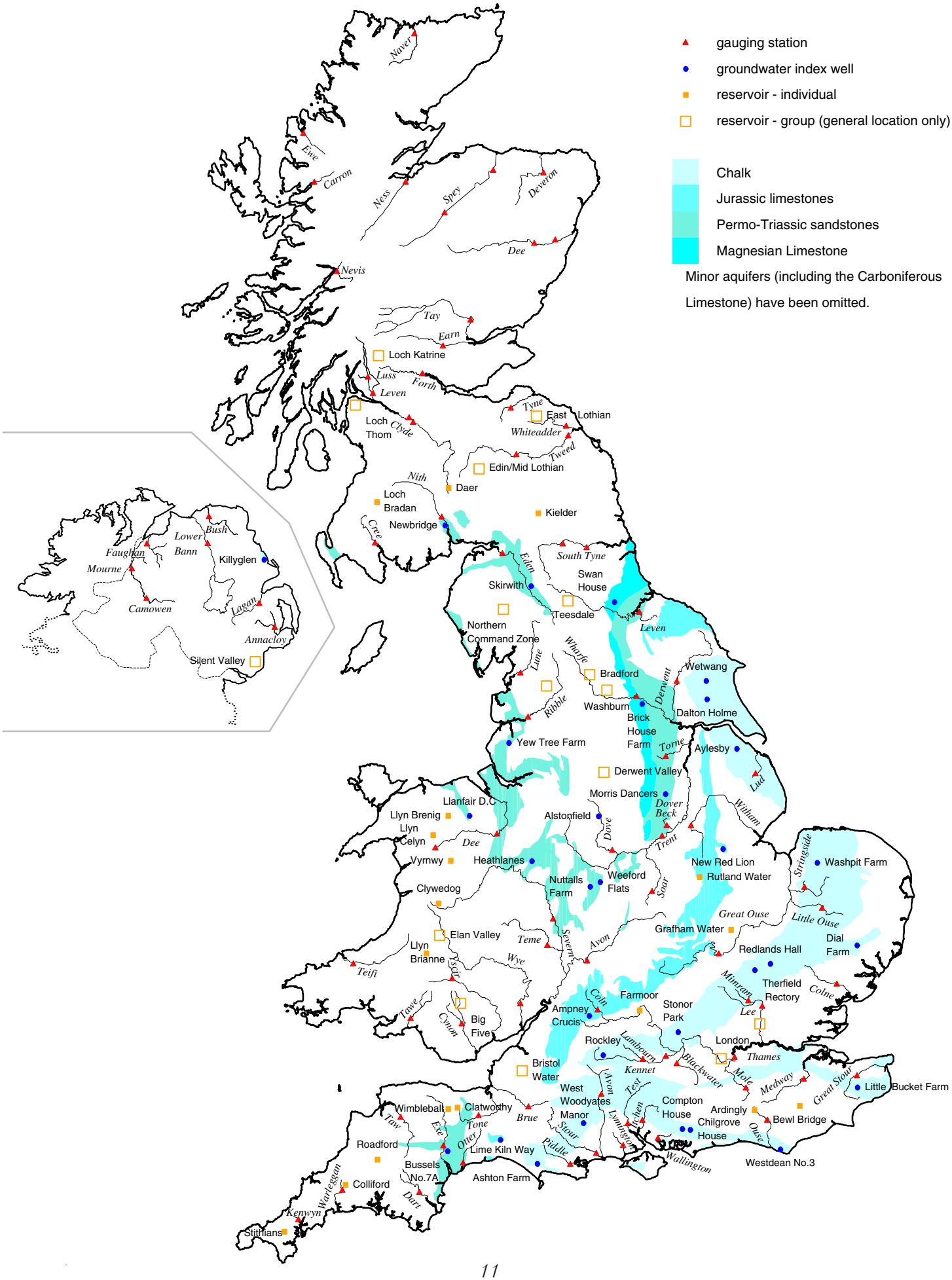
Percentage live capacity of selected reservoirs at start of month

Area	Reservoir	Capacity (Ml)	2005 Apr	May	Jun	Jul	Aug	Avg. Aug	Min. Aug	Year* of min.
North West	N Command Zone	• 124929	91	90	86	72	**57**	61	38	1989
	Vyrnwy	55146	97	98	94	84	**75**	76	56	1996
Northumbrian	Teesdale	• 87936	95	98	95	87	**77**	68	45	1989
	Kielder	(199175)	(91)	(93)	(94)	(90)	**(87)**	(88)	(66)	1989
Severn Trent	Clywedog	44922	94	100	100	97	**87**	84	57	1989
	Derwent Valley	• 39525	99	100	92	83	**72**	72	43	1996
Yorkshire	Washburn	• 22035	80	85	77	69	**62**	72	50	1995
	Bradford supply	• 41407	98	100	93	80	**70**	68	38	1995
Anglian	Grafham	(55490)	(96)	(96)	(93)	(89)	**(86)**	(89)	(66)	1997
	Rutland	(116580)	(94)	(94)	(95)	(89)	**(85)**	(85)	(74)	1995
Thames	London	• 202340	96	99	98	89	**80**	86	73	1990
	Farmoor	• 13830	97	98	99	99	**99**	95	84	1990
Southern	Bewl	28170	86	85	78	69	**61**	76	45	1990
	Ardingly	4685	93	98	98	82	**65**	86	48	1995
Wessex	Clatworthy	5364	94	100	94	87	**80**	70	43	1992
	Bristol WW	• (38666)	(82)	(85)	(82)	(75)	**(65)**	(73)	(53)	1990
South West	Colliford	28540	70	71	71	67	**62**	77	47	1997
	Roadford	34500	72	75	73	71	**66**	78	46	1996
	Wimbleball	21320	96	96	93	88	**83**	75	53	1992
	Stithians	5205	78	84	87	79	**67**	68	39	1990
Welsh	Celyn and Brenig	• 131155	100	100	100	96	**86**	87	65	1989
	Brianne	62140	97	100	100	94	**93**	87	67	1995
	Big Five	• 69762	97	96	91	82	**73**	74	41	1989
	Elan Valley	• 99106	99	99	94	83	**75**	82	63	1989
Scotland(E)	Edinburgh/Mid Lothian	• 97639	99	99	99	96	**85**	80	51	1998
	East Lothian	• 10206	100	100	100	96	**90**	87	72	1992
Scotland(W)	Loch Katrine	• 111363	91	97	100	94	**73**	74	53	2000
	Daer	22412	95	100	100	94	**80**	76	58	1994
	Loch Thom	• 11840	100	100	100	100	**100**	81	59	2000
Northern Ireland	Total+	• 67270	84	89	89	86	**75**	76	54	1995
	Silent Valley	• 20634	73	89	93	86	**74**	67	42	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.

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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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Crowmarsh Gifford
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OX10 8BB

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E-mail: nwamail@ceh.ac.uk

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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