Hydrological Summary
for the United Kingdom

April 2007

General
An exceptionally arid episode, beginning in the 2nd week of March, continued through the warmest April in the 348-year Central England Temperature series. Some parts of southern and eastern England recorded barely a trace of rainfall over the month as England and Wales registered its 2nd driest April in the last 50 years. Correspondingly, stocks in many gravity-fed reservoirs declined very briskly – the Derwent Valley Group reporting a 14% fall in April. Nonetheless, overall stocks for England and Wales remain very close to the average for early May with stocks exceeding 90% of capacity in many impoundments in the English Lowlands. River flows in impermeable catchments fell steeply through April and many rivers reported notably low flows around month-end. Rapidly increasing soil moisture deficits caused problems for gardeners and growers and signalled an early termination to the recharge season in most aquifer outcrop areas. However, healthy recharge over the winter of 2006/07 ensured that groundwater levels remain generally in the normal range (albeit below average), and mostly well above those of the late spring in 2006. Above average May rainfall would be particularly welcome in parts of northern England where reservoir stocks normally decline quickly through the late spring.

Rainfall
Synoptic patterns in April were dominated by persistent anticyclonic conditions – causing almost all Atlantic frontal systems to follow tracks skirting the British Isles. Rain-bearing low pressure systems did penetrate during the fourth week bringing significant rainfall to the western uplands (Capel Curig registered 59mm on the 23rd) but lengthy sequences of rainless days (>20 days over wide areas) were more typical. At Wallingford only 10mm of rain was recorded in the 60 days from March 5th, the longest sequence below this threshold in a 45-year record. A few scattered localities in western Scotland reported above average April rainfall but totals across most of the English Lowlands were less than 5mm. Provisional data suggest that the UK recorded its 3rd driest April in the last 70 years and, in England, the Anglian and Southern regions registered their lowest April rainfall on record (in series from 1914). The very meagre rainfall over the eight weeks to the end of April contrasts with the notable wetness of the preceding winter half-year. Despite the dry early spring, the Nov-April period was the 4th wettest since 1930 for the UK as a whole with outstanding rainfall accumulations for parts of northern and western Scotland.

River Flows
Following widespread flood alerts in early March, river flow patterns changed dramatically across the UK. Steep and sustained recessions characterised April flows in almost all areas but the influence of catchment geology was also very evident; flows holding up well in rivers reliant primarily on groundwater. Many daily river flow hydrographs for southern Britain showed no significant events throughout April. To the north some isolated spates were reported in the final week – arresting recessions which had seen flows fall below previous early-April minima (e.g. on the Forth and Ribble); notably low flows were reported from Northern Ireland also (e.g. on the Mourne). Flows in rivers draining clay catchments in southern Britain were also depressed but flows continued to increase in a few slow-responding spring-fed Chalk streams (e.g. in the Berkshire Downs). Such streams reported well above average April flows but elsewhere April runoff totals were commonly among the lowest on record. In Scotland, the Spey and Earn registered new April minima in records of >50 years; in Wales runoff for the Yscir was also without recorded precedent. Importantly in a water resources context, the April runoff deficiencies need to be considered alongside the runoff accumulations over the last 6 months (see maps on page 4). November-April runoff totals were above average throughout most of the UK – exceptionally so across much of the Scottish Highlands – and generally much healthier than in 2004/05 and 2005/06. May rainfall patterns will be particularly important in many impermeable catchments – an unsettled period is needed to lift flows above late spring minima before the summer recessions become firmly established.

Groundwater
The exceptionally low rainfall and very high evaporative demands (typically 30% above average) throughout April produced very steep increases in soil moisture deficits. Considering E&W as a whole, soils were the driest on record (in a series from 1961) for late April, and more typical of those expected in late summer. In the absence of exceptional May rainfall this is very likely to provide a decisive (and early) end to the 2006/07 recharge season in most major aquifer outcrop areas. Groundwater levels in most index wells and boreholes were mostly within the normal range for April but reflected contrasting storage characteristics – both between and within aquifer units. In many limestone aquifers, including the more responsive western and northern Chalk outcrops, levels fell steeply through April, but generally from very healthy early spring maxima. This was true of a few Permo-Triassic sandstone outcrops (e.g. Bussels) but, more typically (across the Midlands especially), levels are still rising – a lagged response to the substantial 2006/07 winter recharge. In the South East, where the 2004-06 drought was at its most severe, April levels were generally well above those registered in the last two years. By early May seasonal groundwater level recessions were generally well established and likely to follow a normal pattern; tracking below average but above the 2005 and 2006 recessions in the drought-affected regions.

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	Apr 2007	Mar 07-Apr 07	RP	Nov 06-Apr 07	RP	Aug 06-Apr07	RP	May 06-Apr07	RP
England & Wales	**mm**	**12**	**77**		**524**		**807**		**985**	
	%	**20**	**58**	**10-20**	**110**	**2-5**	**113**	**5-10**	**109**	**2-5**
North West	mm	**29**	109		732		1122		1333	
	%	**40**	65	5-10	119	5-10	115	5-10	110	2-5
Northumbrian	mm	**20**	69		476		753		895	
	%	**35**	53	10-20	108	2-5	112	2-5	103	2-5
Severn Trent	mm	**10**	67		421		674		844	
	%	**18**	57	5-15	107	2-5	114	2-5	110	2-5
Yorkshire	mm	**9**	51		439		733		898	
	%	**16**	40	15-25	102	2-5	113	2-5	108	2-5
Anglian	mm	**3**	46		290		518		656	
	%	**7**	50	10-20	98	2-5	114	5-10	109	2-5
Thames	mm	**3**	56		415		655		814	
	%	**6**	52	5-15	116	2-5	121	5-10	116	5-10
Southern	mm	**3**	61		464		722		867	
	%	**5**	53	5-15	111	2-5	115	5-10	111	2-5
Wessex	mm	**7**	73		521		763		961	
	%	**13**	59	5-10	113	2-5	112	2-5	113	2-5
South West	mm	**19**	110		694		978		1190	
	%	**27**	65	5-10	102	2-5	100	<2	100	<2
Welsh	mm	**23**	130		873		1234		1476	
	%	**28**	68	5-10	118	5-10	112	2-5	110	2-5
Scotland	**mm**	**51**	**188**		**1062**		**1504**		**1767**	
	%	**63**	**90**	**2-5**	**136**	**60-90**	**125**	**70-100**	**120**	**60-90**
Highland	mm	**74**	268		1390		1908		2213	
	%	**79**	106	2-5	146	70-100	133	60-90	127	70-100
North East	mm	**26**	103		537		880		1054	
	%	**39**	68	5-10	102	2-5	109	2-5	102	2-5
Tay	mm	**33**	139		936		1321		1557	
	%	**48**	77	2-5	136	30-50	127	15-25	121	10-20
Forth	mm	**25**	111		721		1076		1283	
	%	**40**	69	5-10	122	5-15	117	5-10	112	5-10
Tweed	mm	**14**	90		588		917		1083	
	%	**23**	63	5-15	116	5-10	116	5-10	108	2-5
Solway	mm	**37**	155		978		1410		1662	
	%	**47**	78	2-5	131	15-25	120	5-15	116	5-15
Clyde	mm	**67**	223		1316		1834		2165	
	%	**76**	92	2-5	143	60-90	127	30-45	124	30-45
Northern Ireland	**mm**	**28**	**107**		**604**		**957**		**1175**	
	%	**42**	**68**	**5-10**	**106**	**2-5**	**109**	**2-5**	**107**	**2-5**

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

Important note: Figures in the above table may be quoted provided that their source is acknowledged. See page 12. Where appropriate, specific reference must be made to the uncertainties associated with the return period estimates. Generally, the return period estimates are based on tables provided by the Met Office* but those for Northern Ireland are based on the estimates for north-west England. The estimates relate to the specified region and span of months only (RPs may be an order of magnitude less if n-month periods beginning in any month are considered), they reflect rainfall variability over the period 1911-70 only, and assume a stable climate. (For further details see Tabony, R. C., 1977, *The variability of long duration rainfall over Great Britain*, Scientific Paper No. 37). The timespans featured do not purport to represent the critical periods for any particular water resource management zone and, normally, for hydrological or water resources assessments of drought severity, river flows and groundwater levels provide a better guide than return periods based on rainfall totals. *In some cases ranking positions of accumulated rainfalls are also considered.

All monthly rainfall totals since October 2006 are provisional.

Rainfall . . . Rainfall . . .

Key

00% Percentage of 1961-90 average

Very wet

Substantially above average

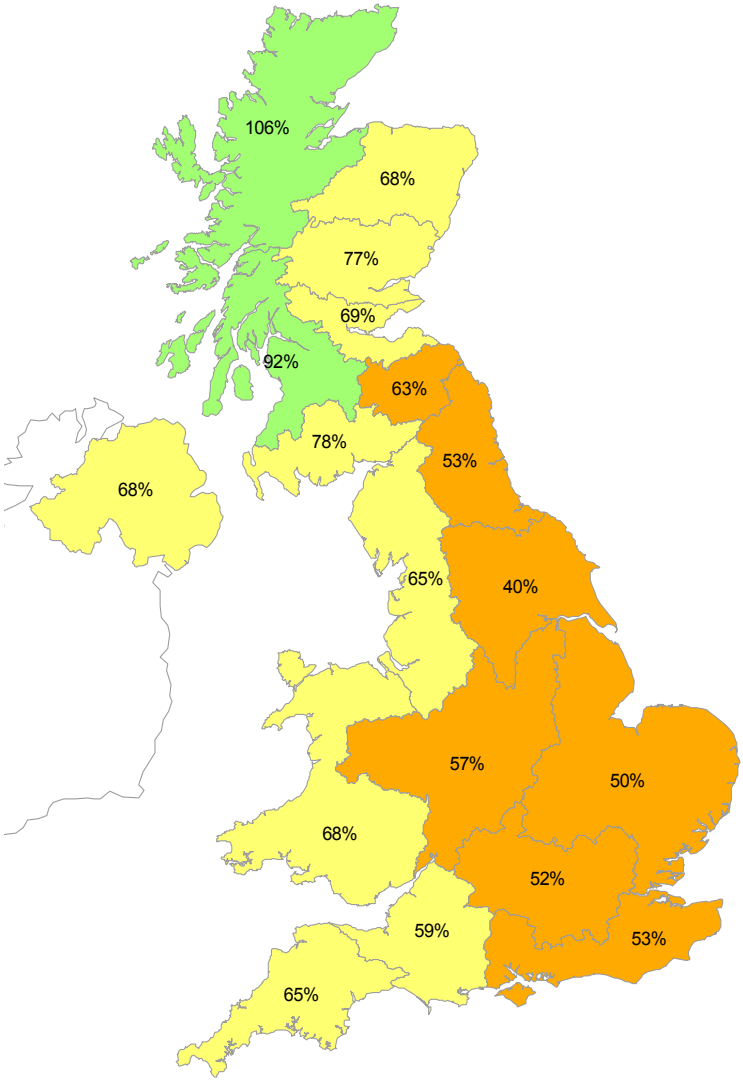
Above average

Normal range

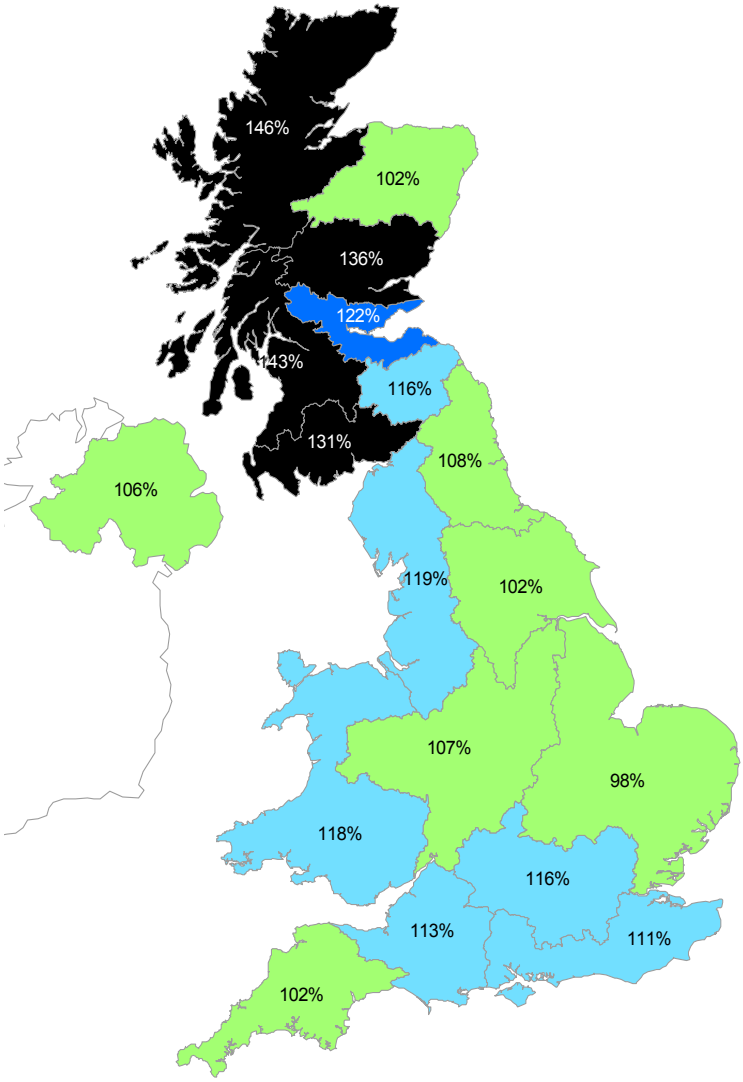
Below average

Substantially below average

Exceptionally low rainfall



March 2007 - April 2007

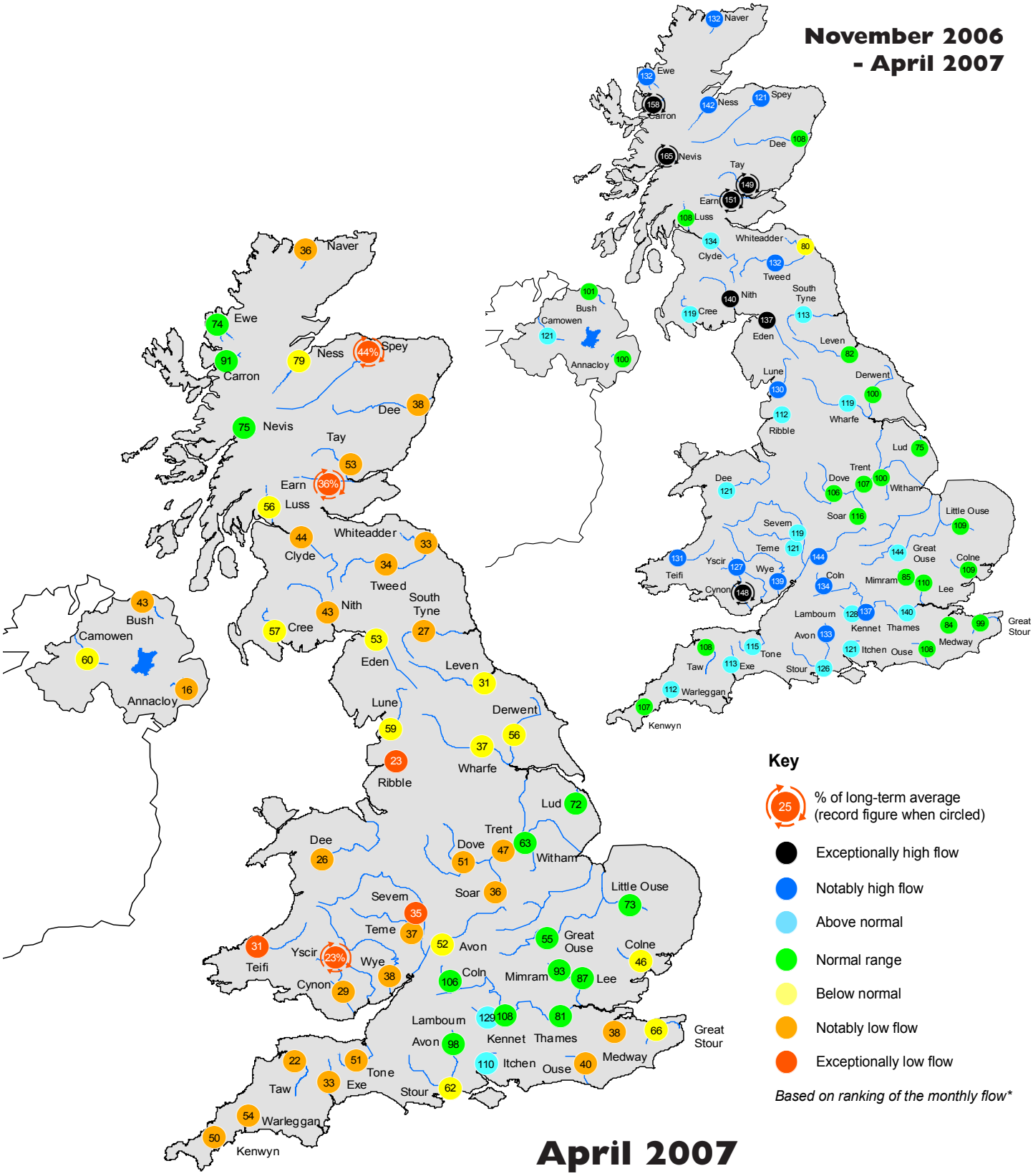


November 2006 - April 2007

Rainfall accumulation map

Apart from northern Scotland the March-April regional rainfall totals were well below average. In this timeframe England & Wales was the 4th driest in the last 30 years – with substantial rainfall deficiencies in eastern England, the Yorkshire region especially. The 6-month timeframe presents a contrasting picture: only the Anglian region (marginally) registered below average rainfall for the November-April period.

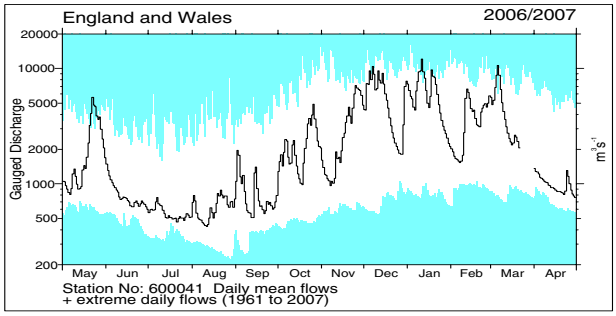
River flow . . . River flow . . .

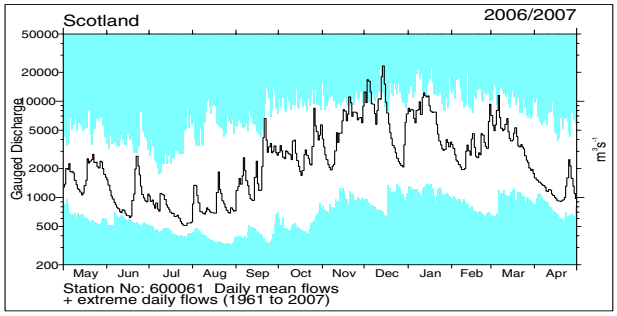


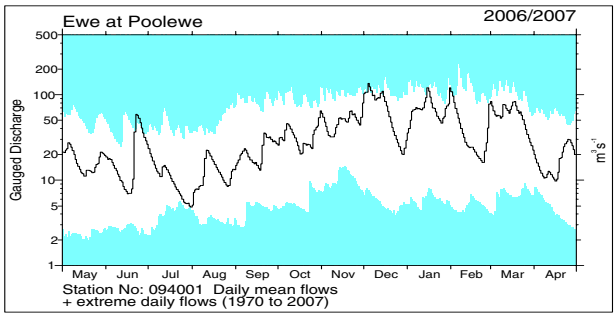
River flows

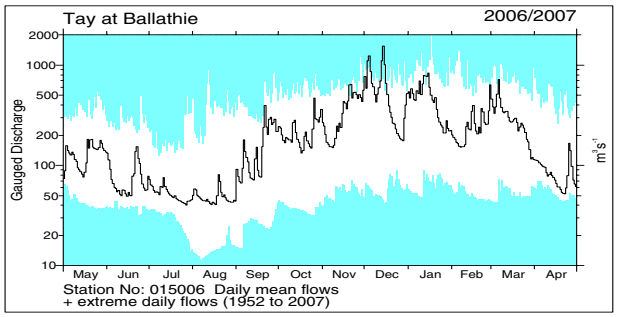
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

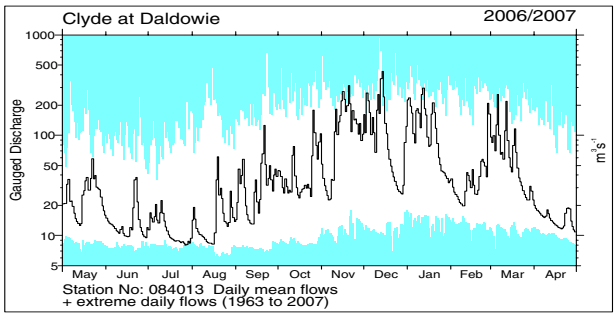
River flow . . . River flow . . .

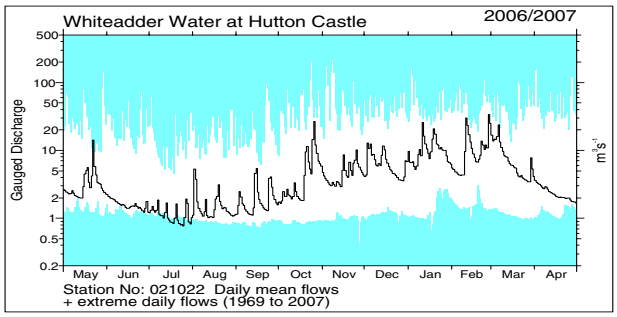


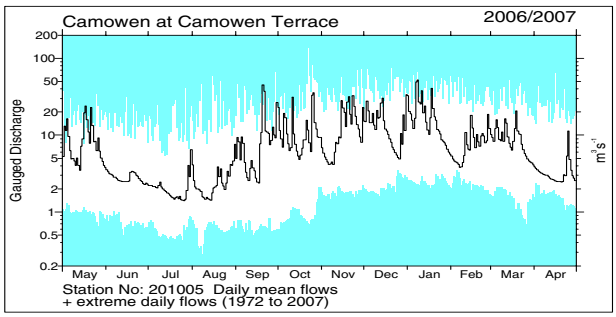


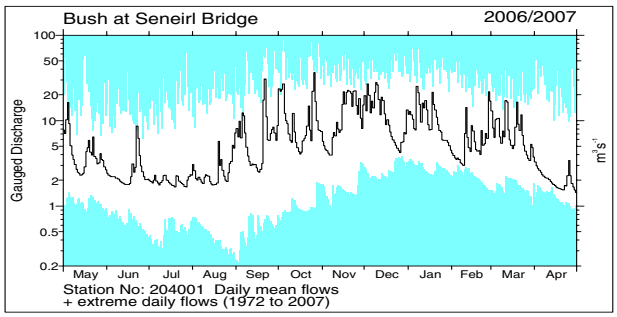


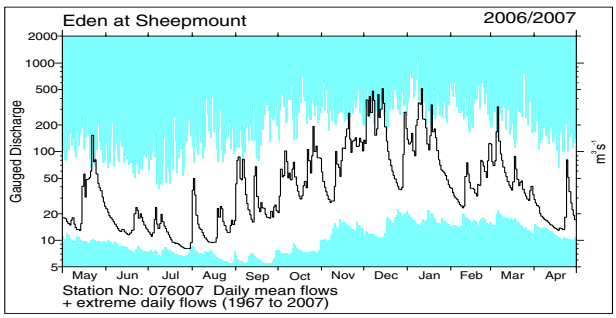


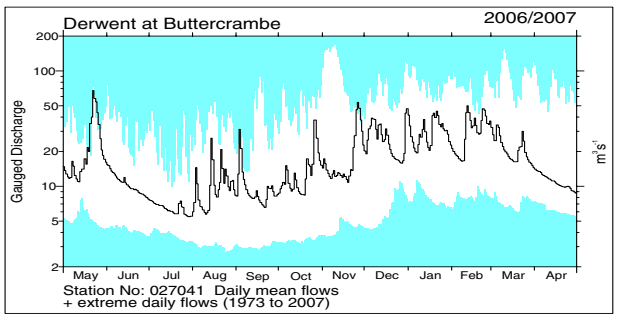








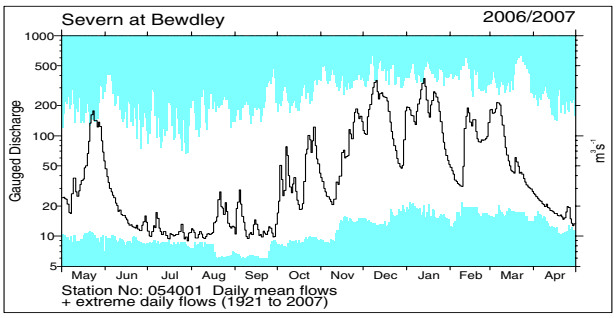


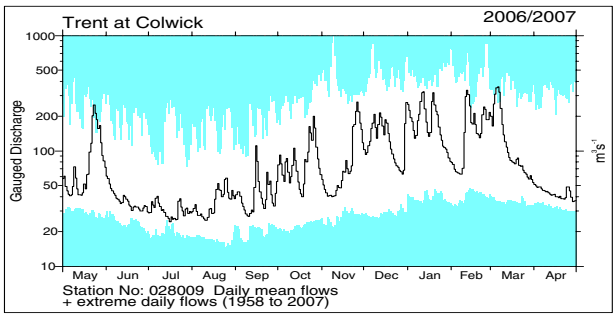


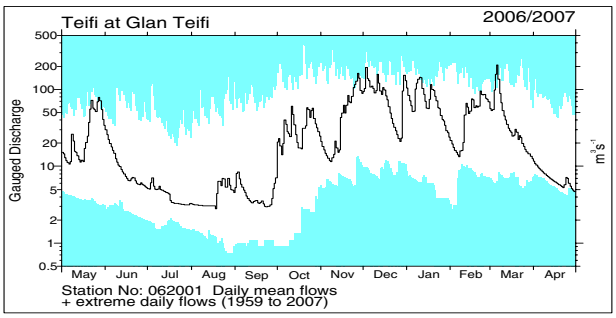
River flow hydrographs

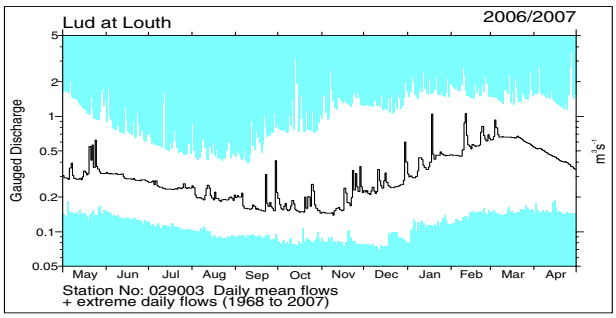
The river flow hydrographs show the daily mean flows together with the maximum and minimum daily flows prior to May 2006 (shown by the shaded areas). Daily flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas.

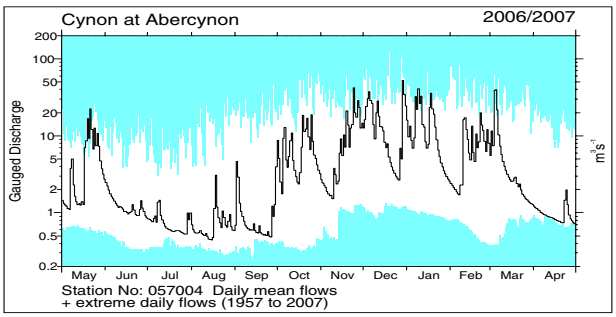
River flow . . . River flow . . .

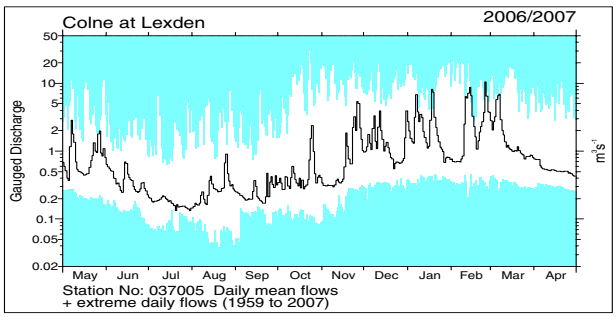


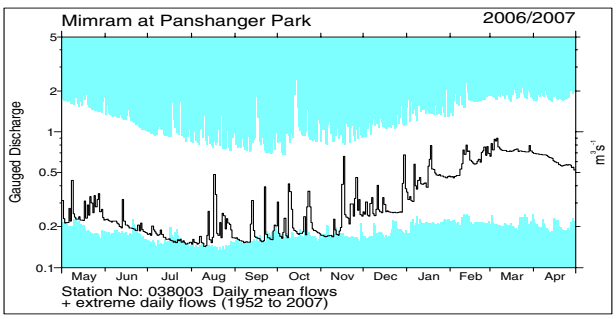


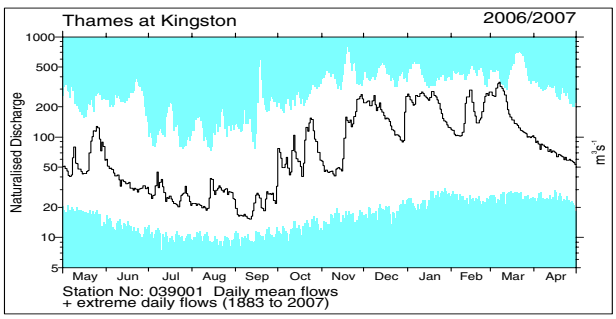


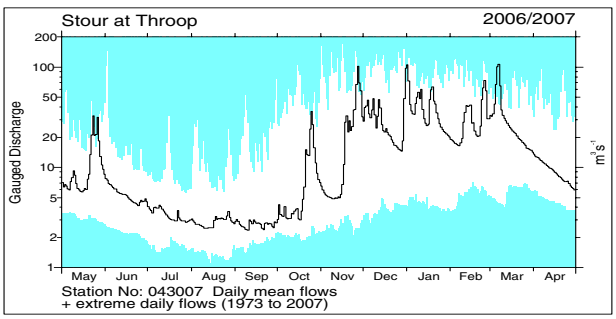


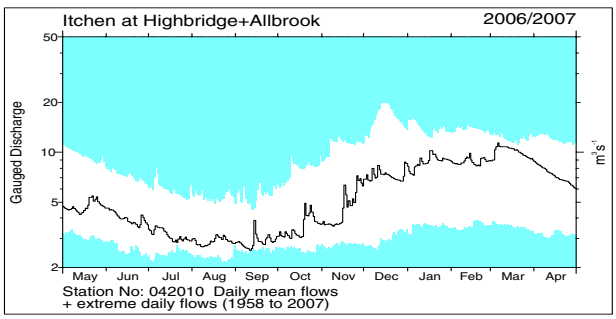












Notable runoff accumulations (a) March 2007 - April 2007, (b) November 2006 - April 2007

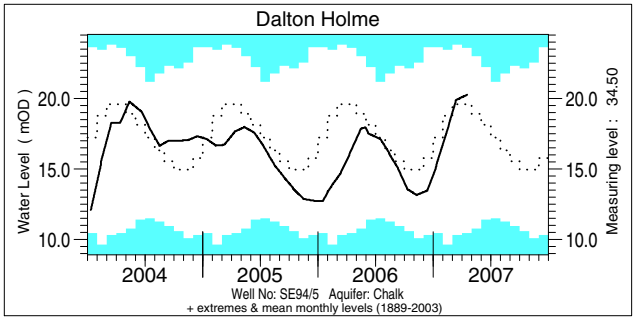
	River	%lta	Rank
a)	S Tyne	59	5/45
	Kennet	134	41/46
	Lambourn	142	43/45
	Coln	140	41/44
	Itchen	127	45/49
	Ribble	52	4/47
	Luss	67	4/31
	Mourne	67	3/25
	Faughan	60	3/31
	Annacloy	65	4/28

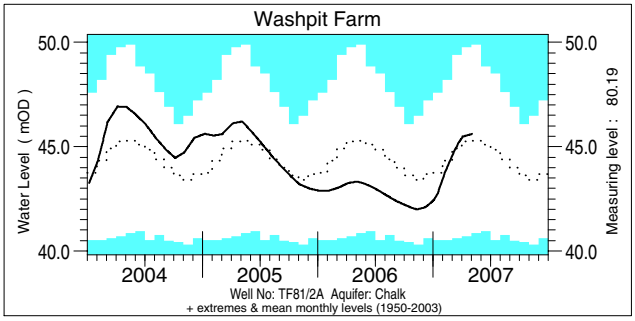
	River	%lta	Rank
b)	Ness	142	32/34
	Tay	149	55/55
	Earn	151	59/59
	Tweed (Boleside)	132	44/46
	Cynon	148	49/49
	Teifi	131	45/47
	Eden	137	39/40

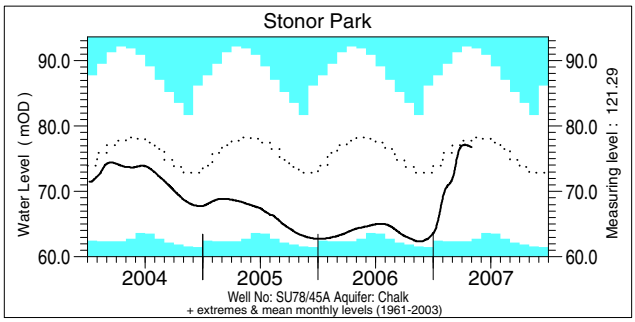
River	%lta	Rank
Nith	140	49/50
Clyde(Blairston)	143	44/46
Nevis	165	25/25
Carron	158	28/28
Ewe	132	36/37
Naver	132	29/30
Camowen	121	30/34

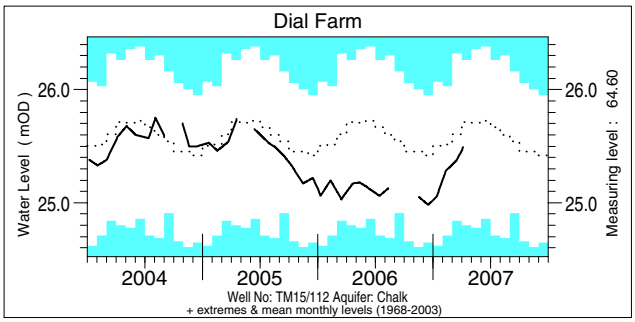
lta = long term average
Rank 1 = lowest on record

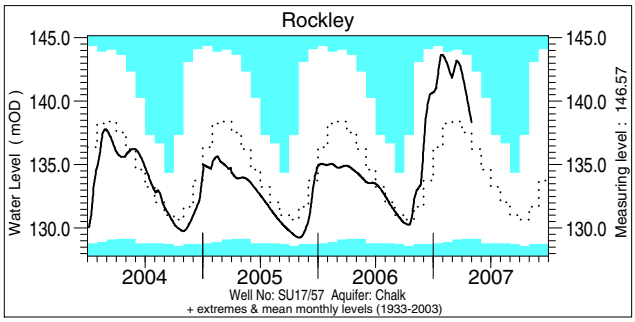
Groundwater . . . Groundwater

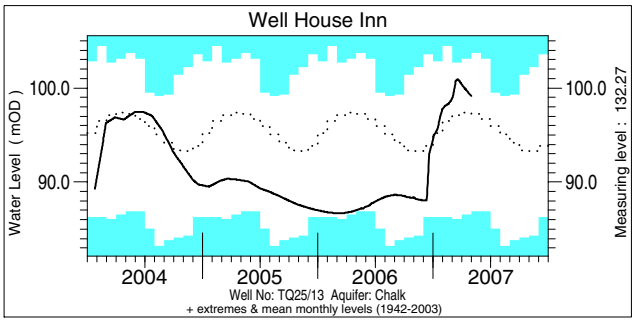


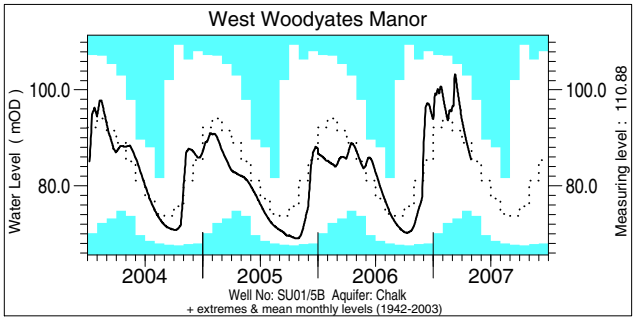


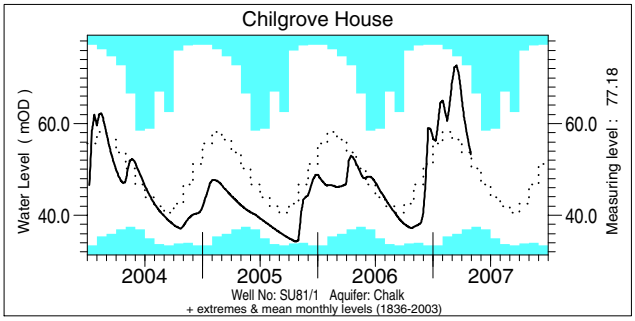


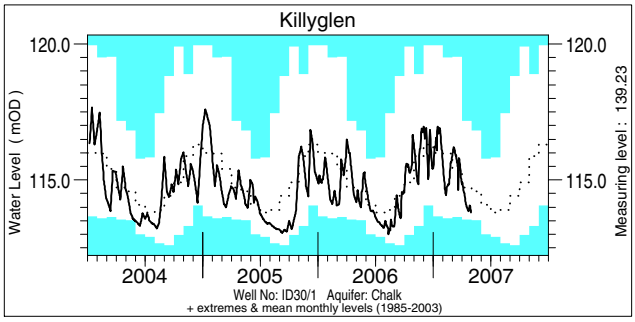


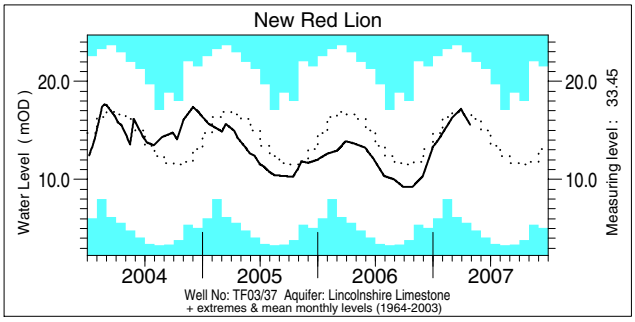






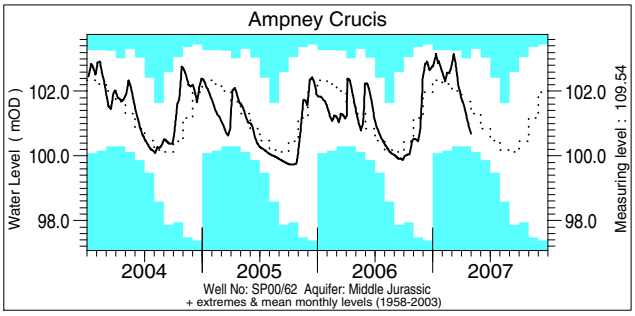


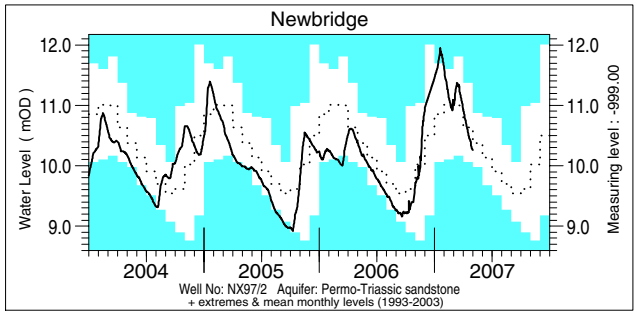


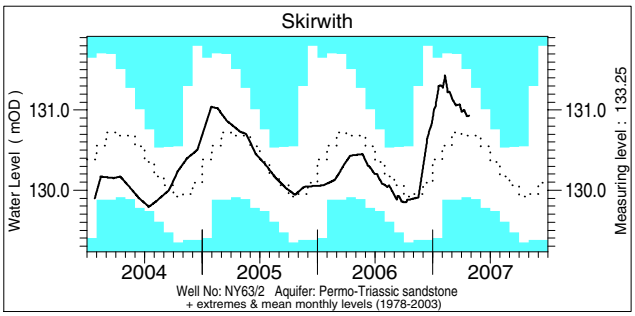


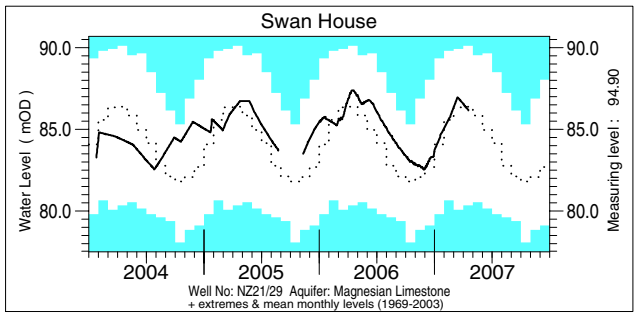
Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined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

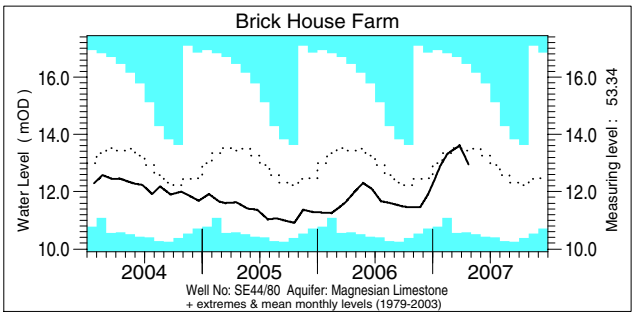
Groundwater . . . Groundwater

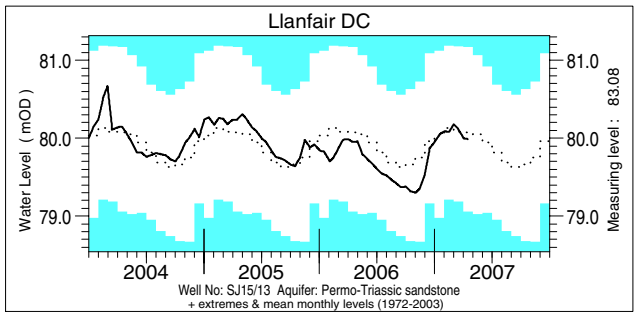


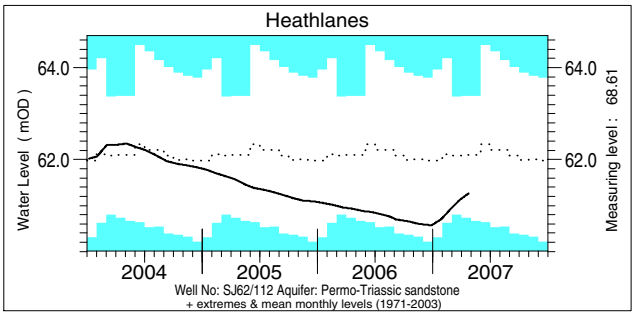


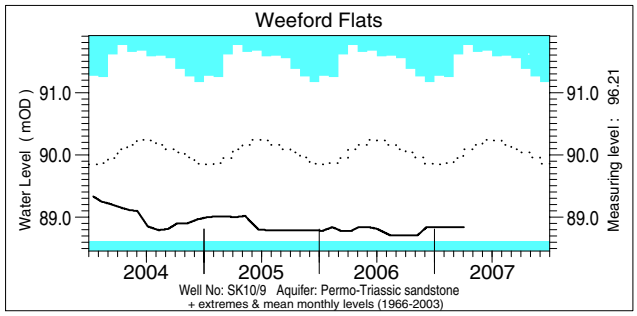


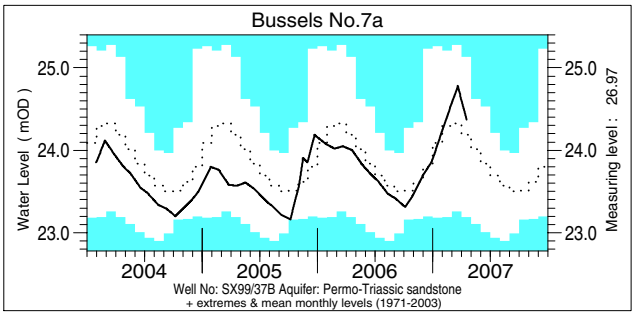


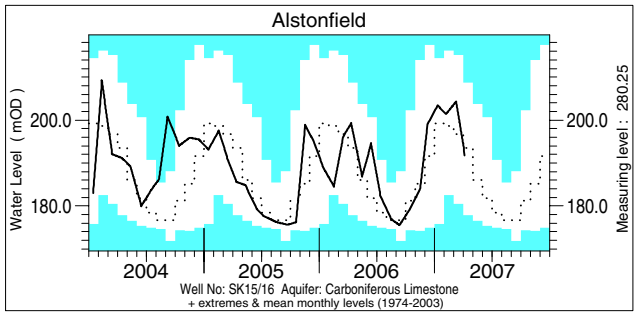










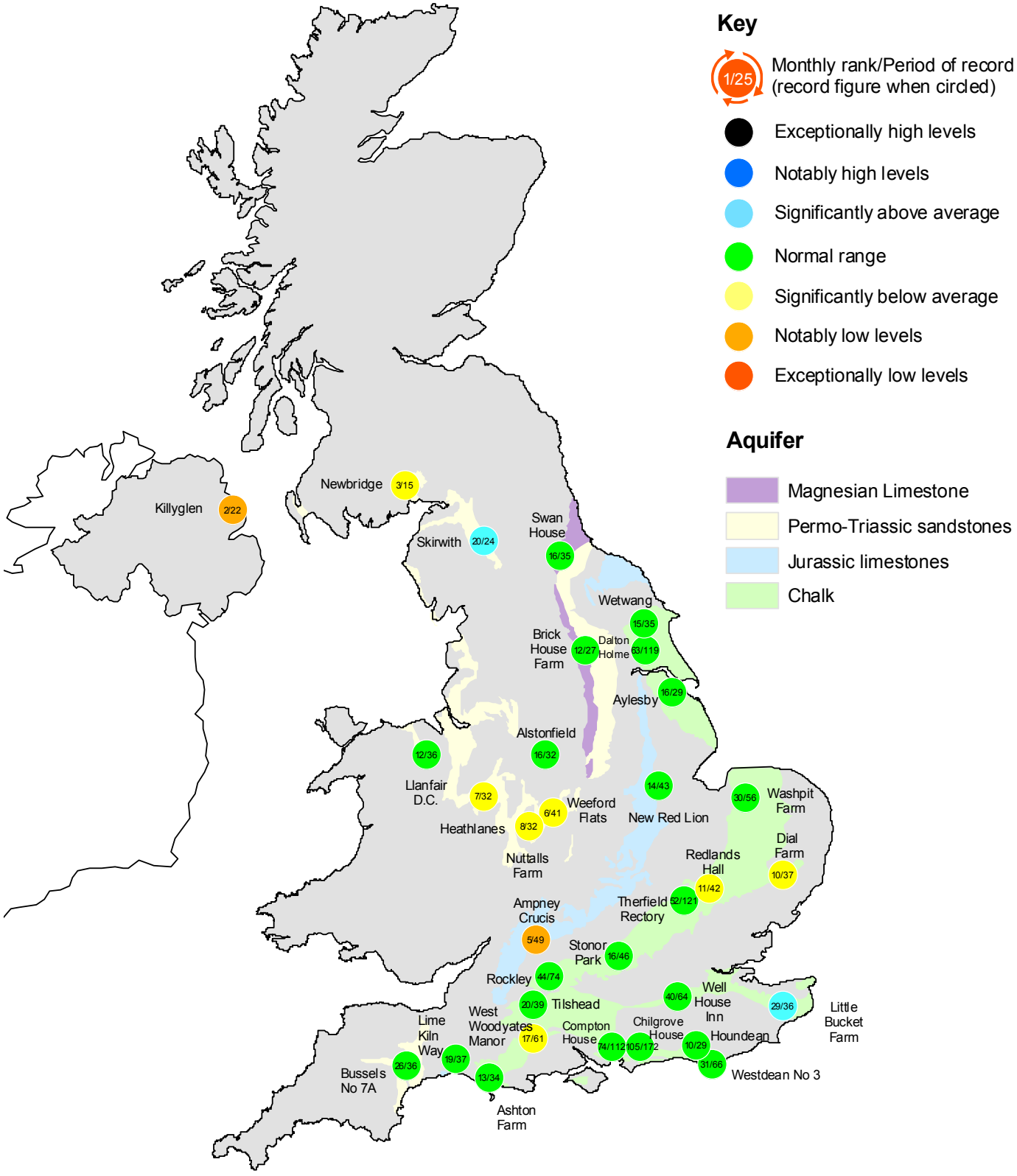


Groundwater levels April / May 2007

Borehole	Level	Date	Apr. av.	Borehole	Level	Date	Apr. av.	Borehole	Level	Date	Apr. av.
Dalton Holme	20.26	17/04	19.47	Chilgrove House	53.22	30/04	52.23	Brick House Farm	12.95	23/04	13.34
Washpit Farm	45.61	03/05	45.39	Killyglen	113.81	30/04	114.97	Llanfair DC	79.99	15/04	80.05
Stonor Park	76.74	01/05	77.42	New Red Lion	15.57	27/04	16.37	Heathlanes	61.27	24/04	62.05
Dial Farm	25.49	05/04	25.68	Ampney Crucis	100.68	01/05	101.72	Weeford Flats	88.84	03/04	89.87
Rockley	138.33	01/05	137.48	Newbridge	10.26	01/05	10.56	Bussels No.7a	24.37	17/04	24.16
Well House Inn	99.14	01/05	97.06	Skirwith	130.93	25/04	130.62	Alstonfield	191.82	05/04	193.13
West Woodyates	85.45	30/04	88.37	Swan House	86.14	18/04	85.69				

Levels in metres above Ordnance Datum

Groundwater . . .Groundwater



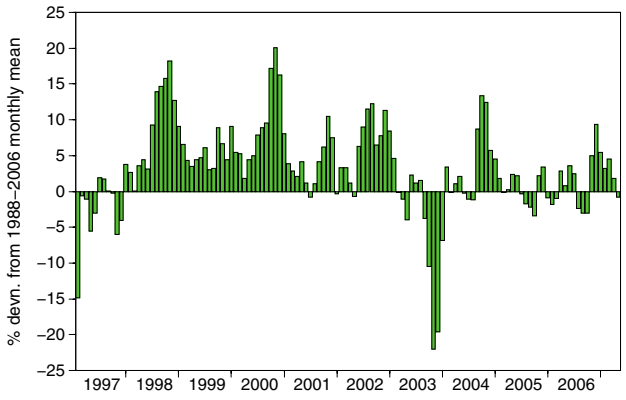
Groundwater levels - April 2007

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

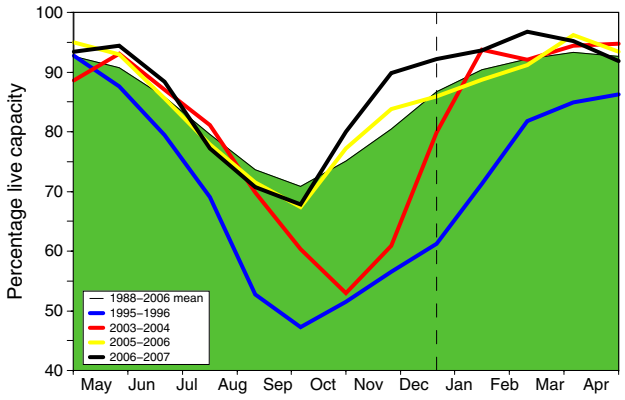
Notes: i. The outcrop areas are coloured according to British Geological Survey conventions.
ii. Yew Tree Farm levels are now received quarterly.
iii. Data for Nuttalls Farm are currently under review.

Reservoirs . . . Reservoirs . . .

Guide to the variation in overall reservoir stocks for England and Wales



Comparison between overall reservoir stocks for England and Wales in recent years



These plots are based on the England and Wales figures listed below.

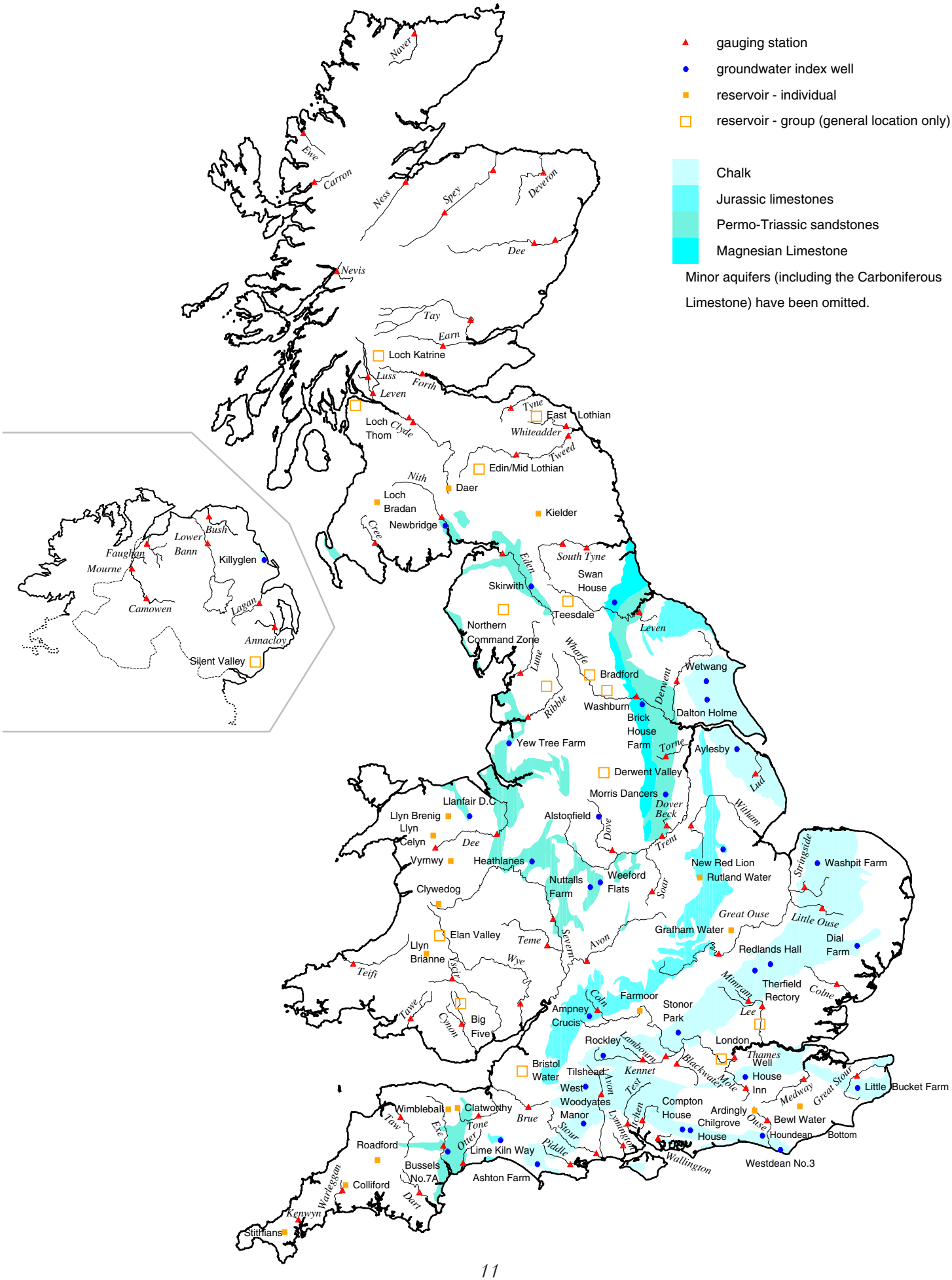
Percentage live capacity of selected reservoirs at start of month

Area	Reservoir		Capacity (Ml)	2007 Mar	2007 Apr	2007 May	May Anom.	Min. May	Year* of min.	2006 **May**	Diff **07-06**
North West	N Command Zone	•	124929	98	94	**88**	-1	74	2003	91	-3
	Vyrnwy		55146	100	97	**88**	-5	70	1996	98	-10
Northumbrian	Teesdale	•	87936	97	94	**85**	-6	74	2003	94	-9
	Kielder		(199175)	(94)	(89)	**(89)**	-2	(85)	1990	(89)	0
Severn Trent	Clywedog		44922	96	98	**98**	2	85	1988	100	-2
	Derwent Valley	•	39525	100	98	**84**	-9	54	1996	99	-15
Yorkshire	Washburn	•	22035	98	91	**84**	-6	76	1996	94	-10
	Bradford supply	•	41407	100	96	**85**	-6	60	1996	95	-10
Anglian	Grafham		(55490)	(95)	(97)	**(97)**	4	(73)	1997	(99)	-2
	Rutland		(116580)	(96)	(95)	**(94)**	2	(72)	1997	(91)	3
Thames	London	•	202406	96	97	**100**	6	86	1990	91	9
	Farmoor	•	13822	97	99	**100**	3	81	2000	99	1
Southern	Bewl		28170	100	100	**91**	2	63	1990	85	6
	Ardingly		4685	100	100	**100**	0	98	2005	100	0
Wessex	Clatworthy		5364	100	100	**85**	-8	81	1990	98	-13
	Bristol WW	•	(38666)	(98)	(95)	**(90)**	-3	(85)	2005	(92)	-2
South West	Colliford		28540	75	79	**77**	-8	56	1997	70	7
	Roadford		34500	88	91	**89**	5	41	1996	75	14
	Wimbleball		21320	100	99	**94**	0	79	1992	99	-5
	Stithians		5205	100	97	**90**	0	65	1992	94	-4
Welsh	Celyn and Brenig	•	131155	100	100	**96**	-1	75	1996	100	-4
	Brianne		62140	97	96	**89**	-8	86	1997	100	-11
	Big Five	•	69762	99	97	**89**	-4	85	1997	97	-8
	Elan Valley	•	99106	100	98	**97**	0	87	2003	99	-2
Scotland(E)	Edinburgh/Mid Lothian	•	97639	100	98	**92**	0	62	1998	92	0
	East Lothian	•	10206	100	100	**97**	-1	89	1992	100	-3
Scotland(W)	Loch Katrine	•	111363	100	83	**84**	-9	83	2001	94	-10
	Daer		22412	98	98	**87**	-9	89	2003	97	-10
	Loch Thom	•	11840	98	98	**90**	-5	88	2003	100	-10
Northern Ireland	Total+	•	67270	90	87	**77**	-11	77	2007	89	-12
	Silent Valley	•	20634	97	93	**79**	-3	58	2000	93	-14

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

Details of the individual reservoirs in each of the groupings listed above are available on request. The percentages given in the Average and Minimum storage columns relate to the 1988-2006 period except for West of Scotland and Northern Ireland where data commence in the mid-1990's. In some gravity-fed reservoirs (e.g. Clywedog) stocks are kept below capacity during the winter to provide scope for flood attenuation purposes.

Location map . . . Location map



National Hydrological Monitoring Programme

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

Data Sources

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

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

Rainfall

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

NATURAL ENVIRONMENT RESEARCH COUNCIL

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

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

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

Subscription

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

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

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05/07