Hydrological summary

for Great Britain

August 1998

General

The August rainfall total for Britain was significantly below average and many lowland reservoir stocks declined considerably over the month. Nonetheless, overall stocks for England and Wales remain very healthy - at their highest level for the late summer since the national monitoring programme began (in 1988). August river flows in western and northern Britain were mostly well above average but runoff rates, and groundwater levels, are low in some regions - mostly in eastern England.

Rainfall

Westerly airflows dominated northern Britain which was cooler and cloudier than average whilst in the south, anticyclonic conditions resulted in warmer, sunnier conditions. This synoptic contrast was reflected in the monthly rainfall totals: a few localities in western Scotland registered > 200% of the average whereas large parts of eastern, central and southern England recorded <70%. In some southern districts which escaped the thunderstorms, August rainfall totals fell below 10 mm. However, some notable downpours occurred particularly where convective storms were slow-moving, e.g. 54 mm in one hour - including 48 mm in 30 minutes - at Beckenham in south London on the 1st (return period > 100 years). Berkshire and Oxfordshire also experienced some intense downpours - a lightning strike caused a fatality at Chalgrove. Subsequently, very little rain fell - some central southern districts reported rain on only two days from the 4th-31st. The provisional E&W rainfall total for August ranks as the tenth driest in the last 50 years; some southern districts registered an exceptionally dry late summer - the July/August rainfall total was amongst the driest ten on record for the Thames Valley (in a 115-year series). However, summer (June-August) rainfall exceeded the average in most regions. For the year thus far, rainfall totals exceed the average in almost all regions - notably so in Scotland which registered its fifth wettest January-August period in the last 120 years (but 1990, 1992 and 1989 were wetter). Very long term rainfall deficiences (>30 months) remain significant in some, mostly lowland, regions and continue to exert a hydrological influence, especially in groundwater terms.

River Flows

In northern, and parts of western, Britain the summer recessions were interrupted by a series of minor spates whereas in most permeable, lowland catchments flows continued a gentle recession. In many northern catchments August runoff totals were well above average and notably high for some index rivers in Scotland - this is true of the 3-month summer period also. Less spatial coherence was evident in the English lowlands where catchment geology and land use was very influential. The Beckenham storm on the 1st triggered Amber flood warnings on the Wandle and Ravensbourne - the latter recording its highest flow for seven years. In Hampshire runoff totals for the Test and Itchen - benefitting from heavy recharge to the Chalk earlier in the year - were around 90% of average. Whilst flows in neighbouring impermeable catchments responded rapidly to the lack of rainfall, and were notably depressed by month-end. Low flows characterised rivers draining low-lying parts of the East Midlands also (e.g. the Soar). The Mimram exemplifies those eastern spring-fed streams where flows remain very modest; seven of the lowest dozen summer runoff totals (in a 46-year series) now cluster in the 1990s, and runoff over the September-August period was the second lowest on record.

Groundwater

Soils moisture deficits remained close to zero in the more maritime regions but, after the 1st, they built rapidly in the English lowlands. The very unsettled start to September is encouraging but the dry soils could, again, delay the seasonal recovery in eastern England. Groundwater levels in the Chalk are very close to the seasonal average throughout most of the outcrop zones. By contrast, levels in outcrops nearer to London - to the north especially - remain depressed. Downturns in the deeper wells (e.g. The Holt) signal the end of the recovery resulting from infiltration through last winter and spring. At Therfield, the very modest rise over the last few months suggests that a further extended dry period may be anticipated. In such areas, where levels have been substantially below average for around three years, well above average winter rainfall will be required to return levels to the normal range. Levels in most of the limestone aquifers are very close to the seasonal average. In the Permo-Triassic sandstones levels are mostly well below average but above corresponding levels in the last two years. Levels have begun to increase in the very slow-responding Morris Dancers borehole - but from a base below any recorded in a 30-year series.

Institute of Hydrology

British Geological Survey

Rainfall . . . Rainfall . . . Rainfall. .

Rainfall accumulations and return period estimates

Area	Rainfall	Aug 1998	Jun 98- Aug 98	RP	Jan 98-Aug 98	RP	Sep 97- Aug 98	RP	Sep 96- Aug 98	RP
England & Wales	**mm**	**47**	**230**		**627**		**955**		**1798**	
	%	**62**	**113**	**2-5**	**114**	**5-10**	**107**	**2-5**	**100**	**<2**
North West	mm	93	338		829		1251		2359	
	%	86	124	5-10	116	5-10	104	2-5	98	2-5
Northumbrian	mm	78	294		734		1013		1866	
	%	96	143	10-20	137	40-60	119	10-15	109	5-10
Severn Trent	mm	47	205		539		786		1517	
	%	70	114	2-5	113	2-5	104	2-5	101	2-5
Yorkshire	mm	43	223		610		873		1680	
	%	58	116	2-5	118	5-10	106	2-5	102	2-5
Anglian	mm	35	167		427		633		1201	
	%	64	108	2-5	112	2-5	106	2-5	101	2-5
Thames	mm	24	158		459		692		1283	
	%	41	97	2-5	106	2-5	100	<2	93	2-5
Southern	mm	17	156		463		819		1513	
	%	29	98	2-5	100	<2	105	2-5	97	2-5
Wessex	mm	32	203		588		931		1761	
	%	48	116	2-5	115	2-5	111	2-5	105	2-5
South West	mm	39	275		798		1308		2435	
	%	46	124	5-10	114	2-5	111	2-5	104	2-5
Welsh	mm	86	334		926		1438		2660	
	%	85	130	5-10	121	5-10	110	2-5	101	2-5
Scotland	**mm**	**121**	**382**		**1050**		**1565**		**3054**	
	%	**103**	**129**	**10-15**	**125**	**30-45**	**109**	**2-5**	**106**	**2-5**
Highland	mm	131	403		1295		1847		3706	
	%	103	122	5-10	131	40-60	105	2-5	105	2-5
North East	mm	67	296		727		1085		2131	
	%	77	131	5-15	122	10-20	112	5-10	110	5-10
Tay	mm	84	329		872		1362		2603	
	%	89	135	5-15	118	5-10	111	2-5	106	2-5
Forth	mm	121	347		865		1264		2433	
	%	129	146	25-40	131	30-50	114	5-10	110	5-10
Tweed	mm	76	273		719		1072		2148	
	%	86	121	2-5	120	5-10	111	2-5	111	5-10
Solway	mm	137	446		1011		1608		3001	
	%	115	152	30-50	122	10-15	113	5-10	106	2-5
Clyde	mm	175	464		1179		1819		3449	
	%	131	138	10-20	122	10-20	107	2-5	102	2-5

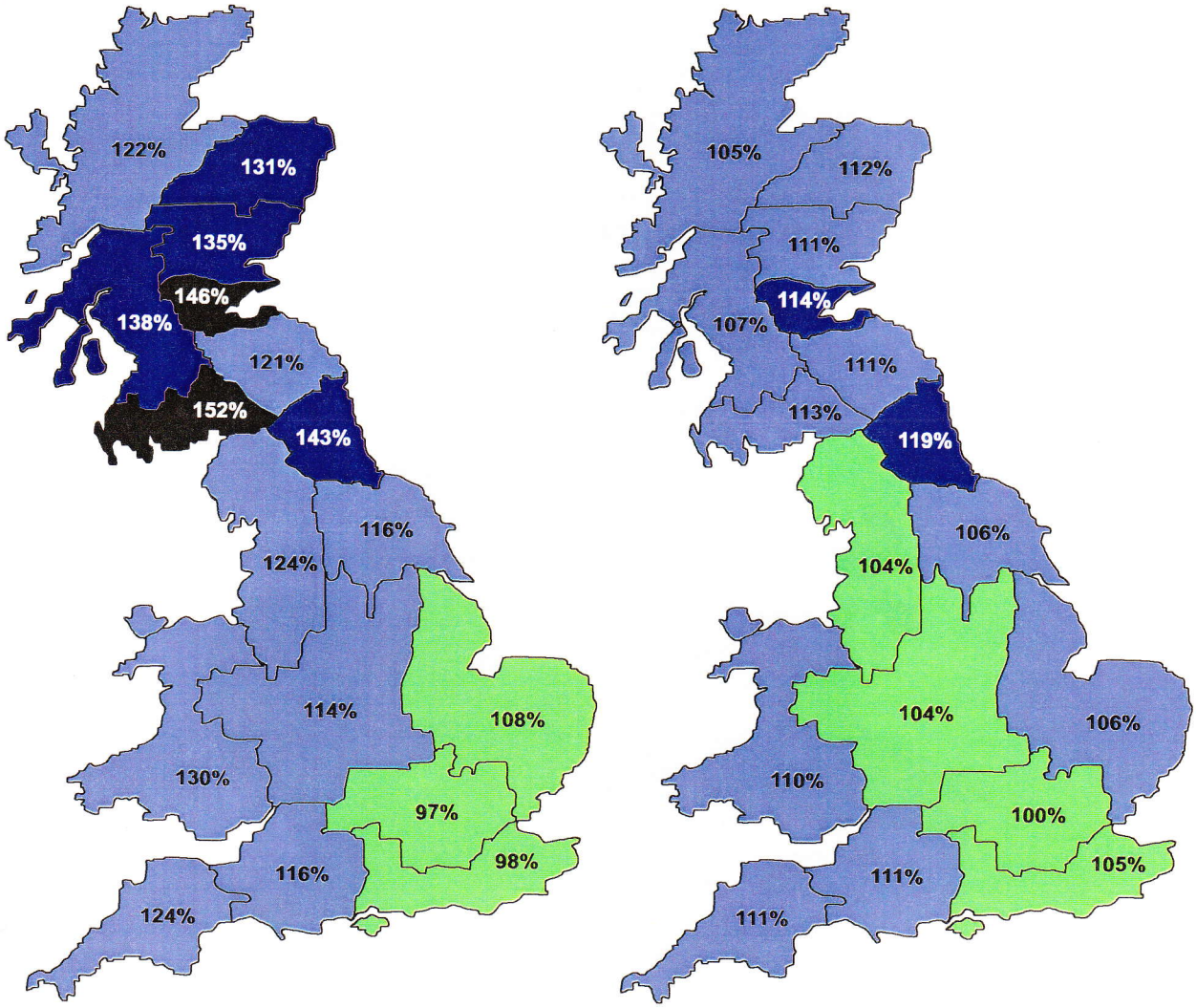
RP = Return period

 Recent monthly rainfall figures for the Scottish regions have ben compiled using data provided by the Scottish Environment Protection Agency. The return period estimates are based on tables provided by the Meteorological 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). The tables reflect rainfall over the period 1911-70 and assume a stable climate. Artifacts in the England & Wales and Scotland rainfall series can exaggerate the relative wetness of the recent past.

Rainfall . . . Rainfall . . . Rainfall

Key

00%	Percentage of 1961-90 average		Normal range
	Very wet		Below average
	Substantially above average		Substantially below average
	Above average		Exceptionally low rainfall



June 1998 - August 1998

September 1997 - August 1998

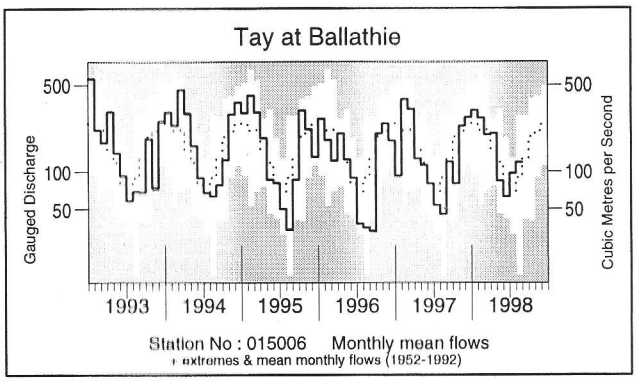
Rainfall accumulation maps

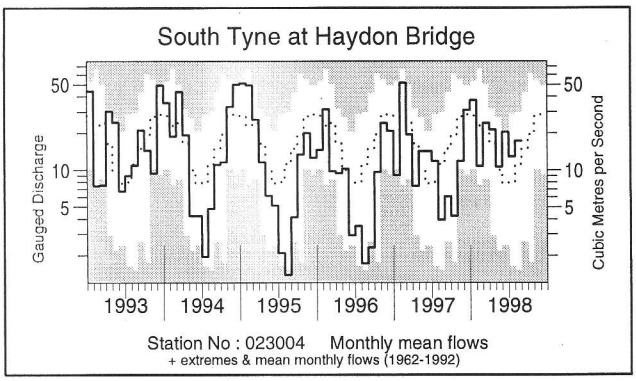
For Britain as a whole the summer (June - August) of 1998 was the fifth wettest in the last 30 years. Over the last 12 months rainfall totals exceed the average in all regions. This is true of most regions in the 24-month timeframe also. Longer term rainfall deficiencies remain significant in some areas - particularly in relation to groundwater resources.

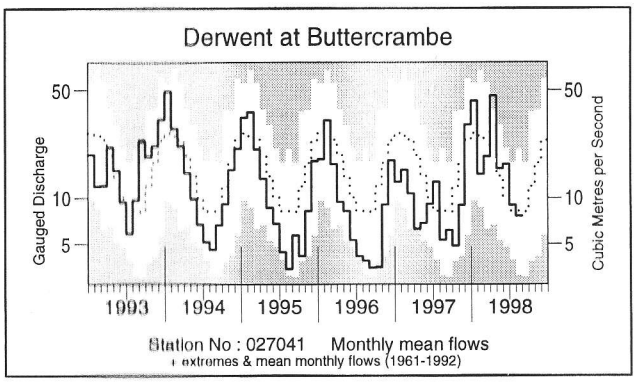
River flow . . . River flow . . .

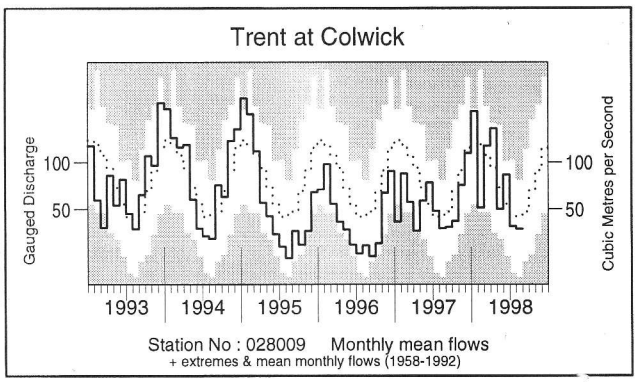
River flows - August 1998

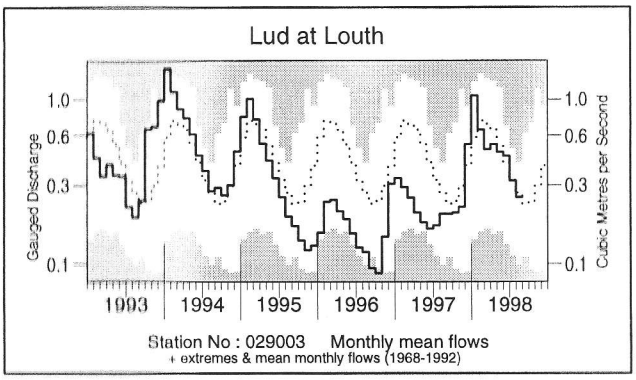
Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

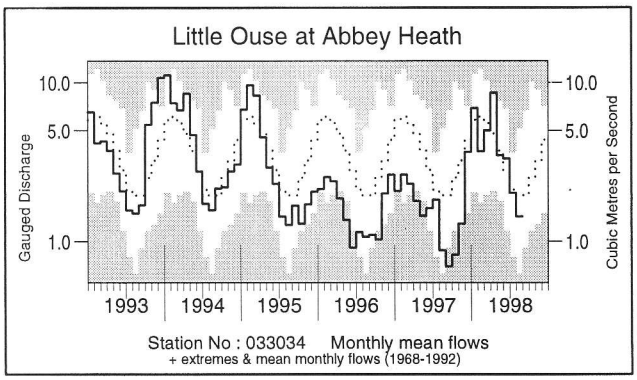


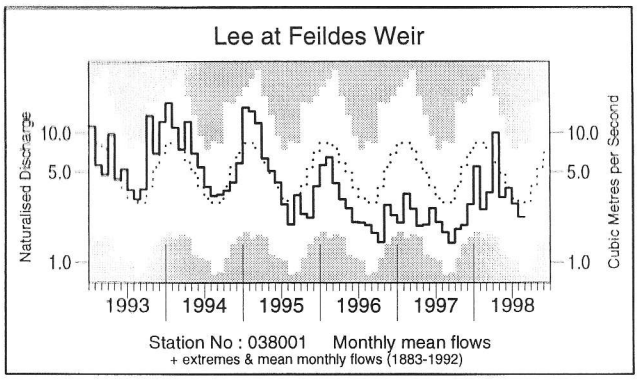


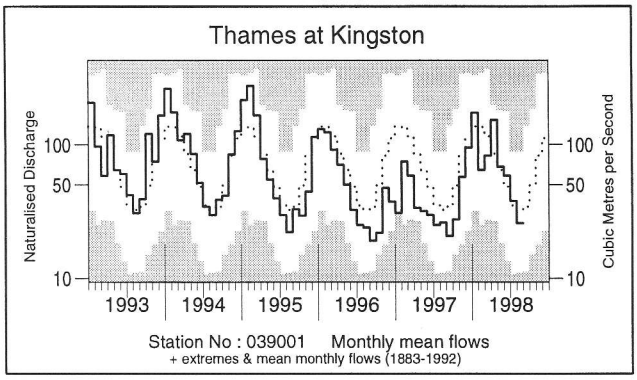








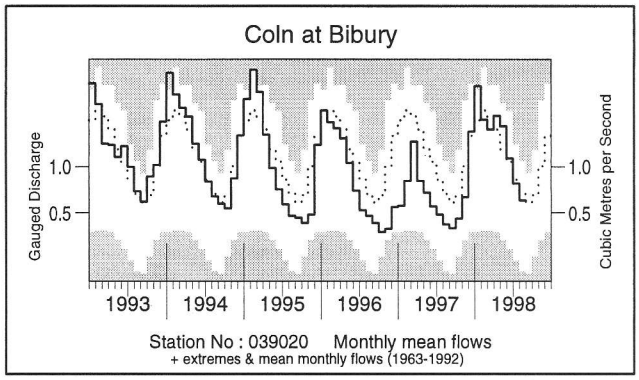


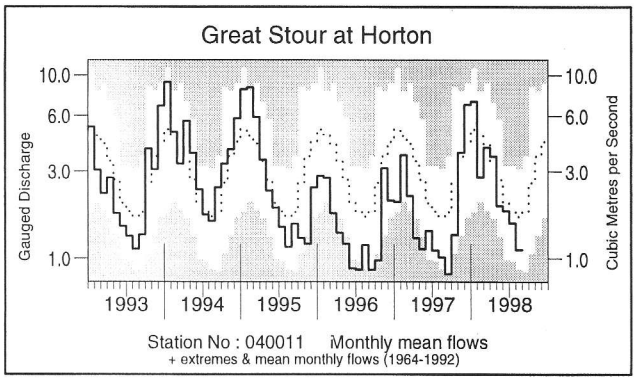


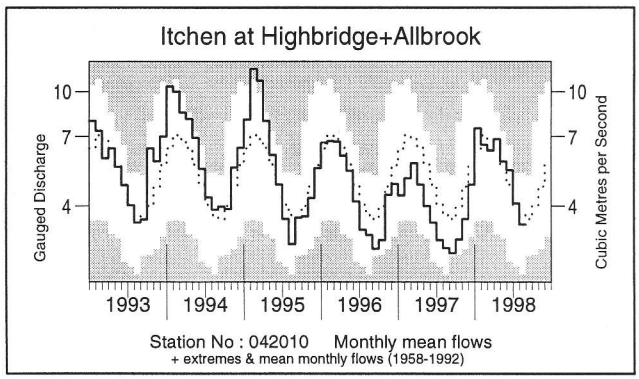
Monthly river flow hydrographs

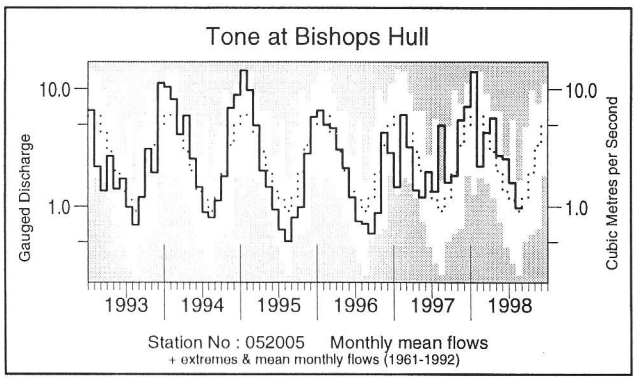
The river flow hydrographs show the monthly mean flow (bold trace), the long term average monthly flow (dotted trace) and the maximum and minimum flow prior to 1992 (shown by the shaded areas). Monthly flows falling outside the maximum/ minimum range are indicated where the bold trace enters the shaded areas.

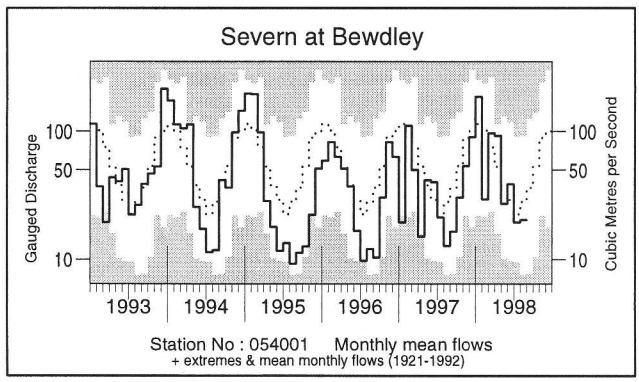
River flow . . . River flow . . .

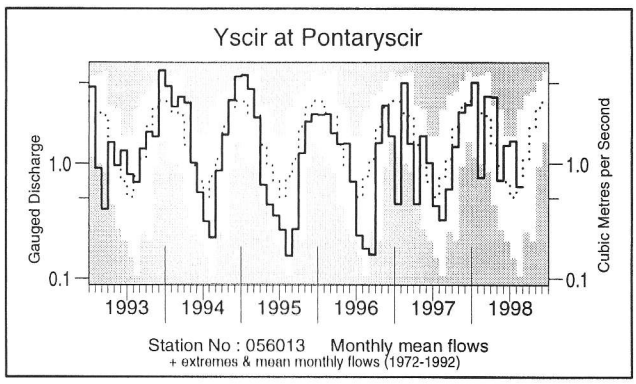


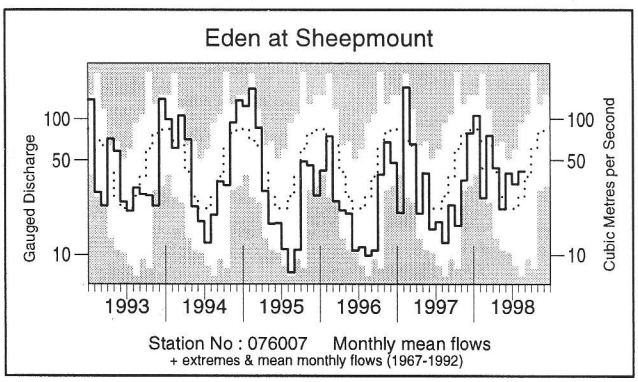


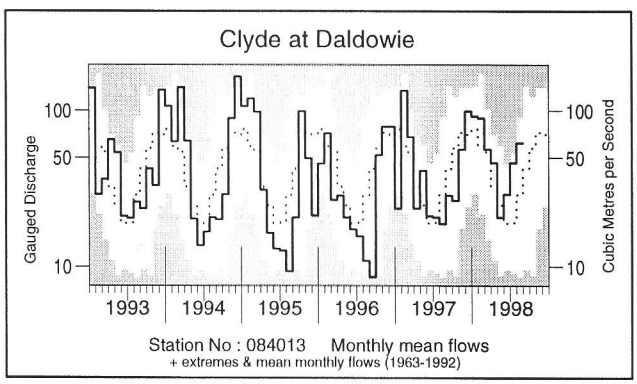












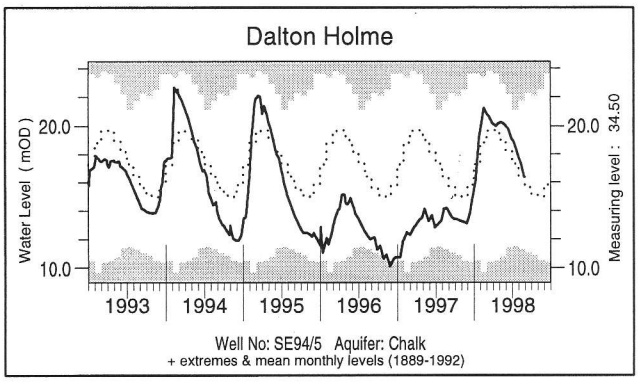
Notable runoff accumulations June 1998 - August 1998 (a); January 1998 - August 1998 (b)

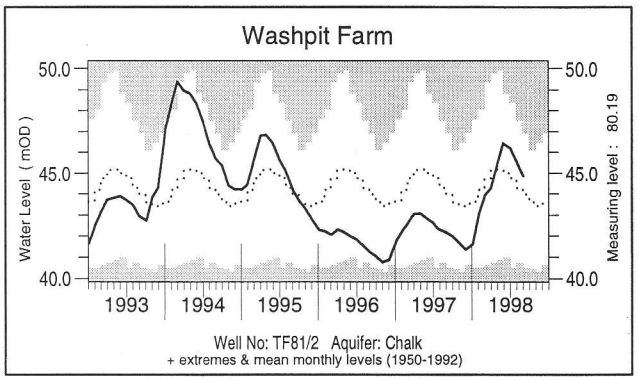
(a) River	%lta	Rank	River	%lta	Rank
Dee (Scot)	148	24/26	Yscir	186	24/27
Tweed	219	37/38	Dee (Wales)	178	28/29
Whiteadder	263	29/29	Lune	180	36/38
Exe	187	40/43	Clyde	206	34/35
Kenwyn	185	29/30	Luss Water	180	20/20
Tone	146	36/38	Ewe	146	27/28

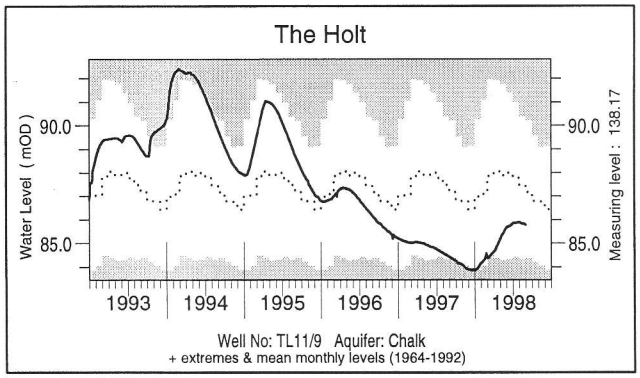
(b) River	%lta	Rank
Tweed	124	37/38
Mole	125	21/24
Tone	137	36/37
Yscir	135	26/26
Dee (Wales)	131	28/29
Ewe	133	25/28

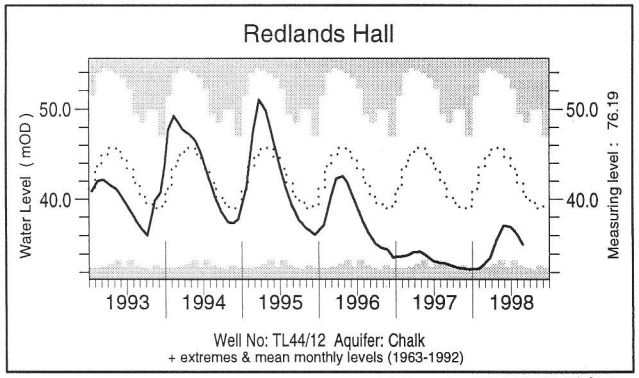
lta = long term average
Rank 1 = lowest on record

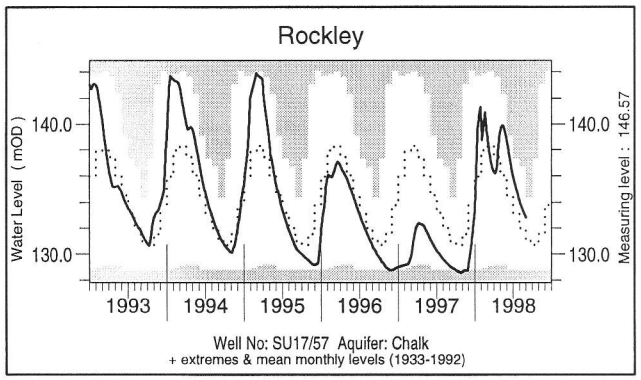
Groundwater . . . Groundwater

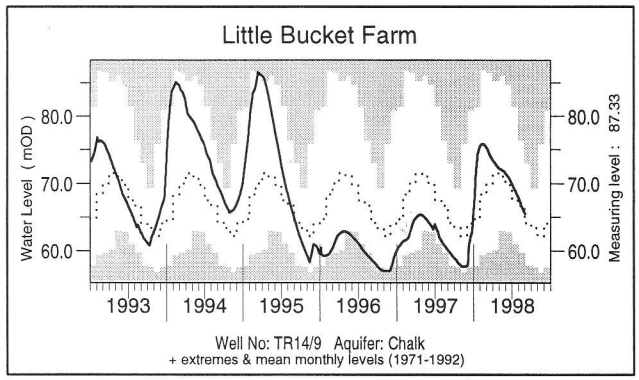


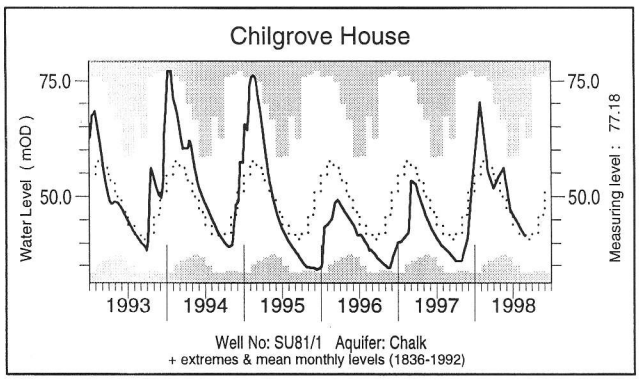


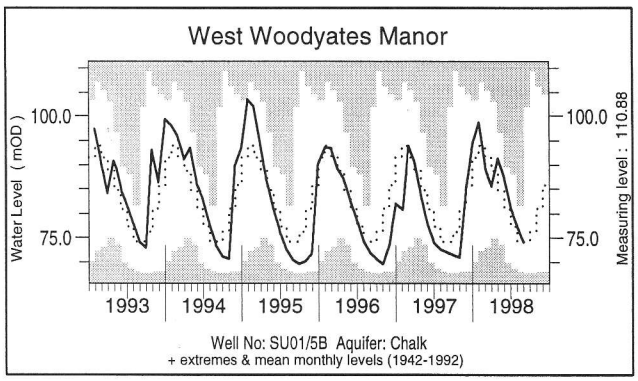








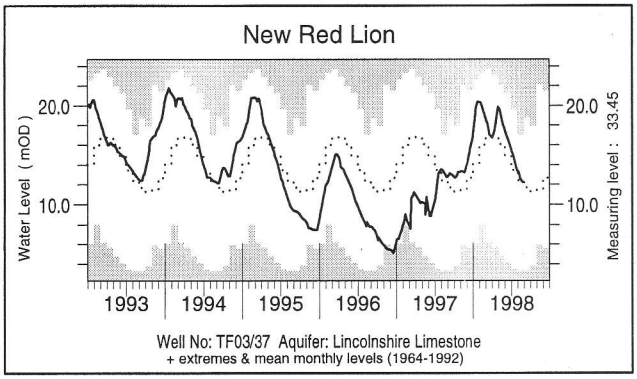


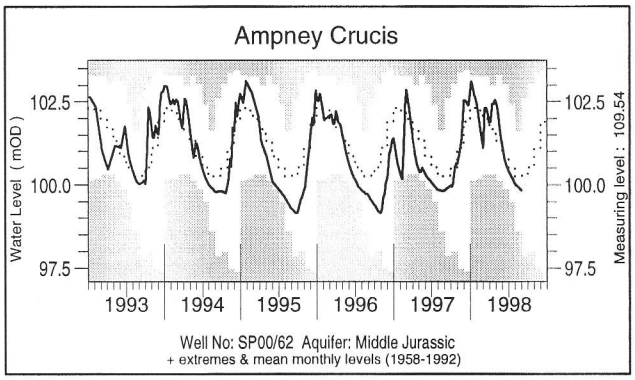


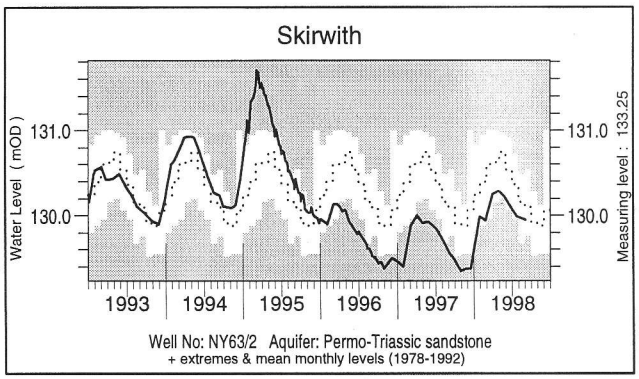
What is groundwater?

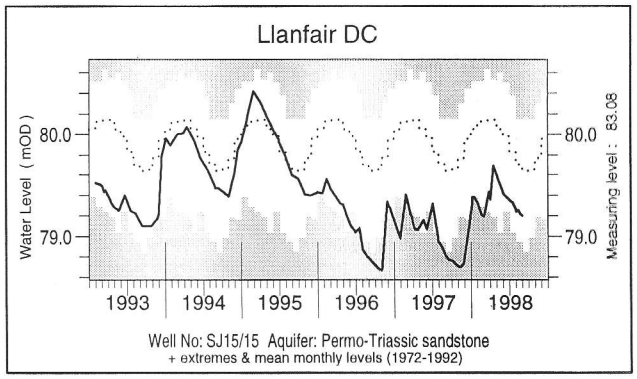
Groundwater is stored in the natural water bearing rock strata (or aquifers) which are found mostly in southern and eastern England (see page 11) where groundwater is the major water supply source. Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment 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.

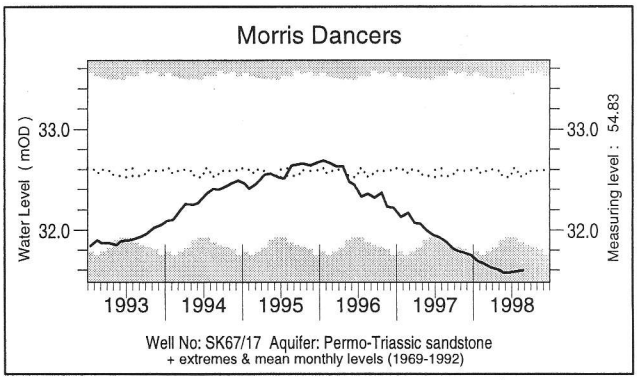
Groundwater . . . Groundwater

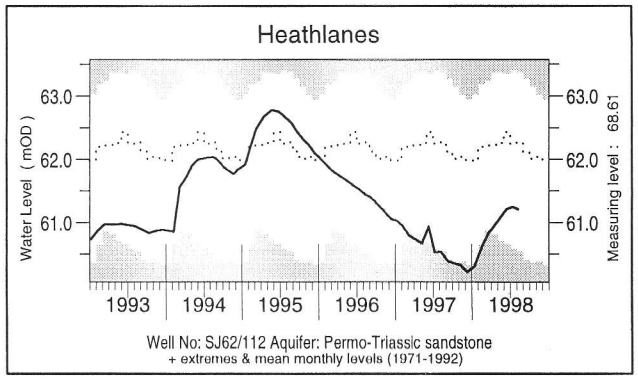


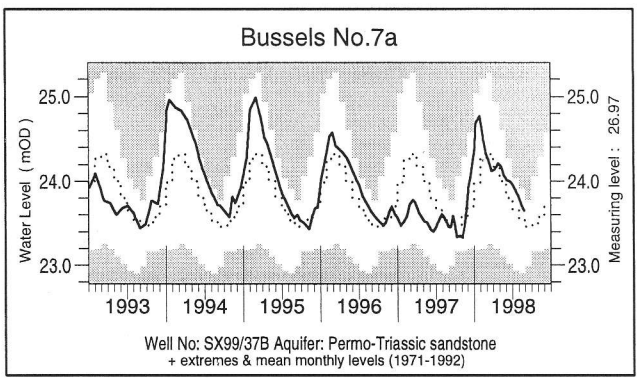


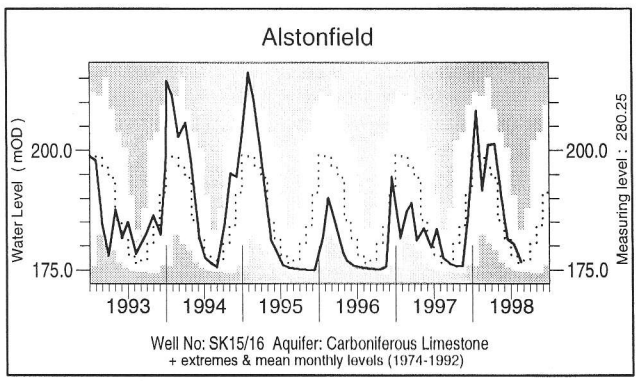












Groundwater levels August/September 1998

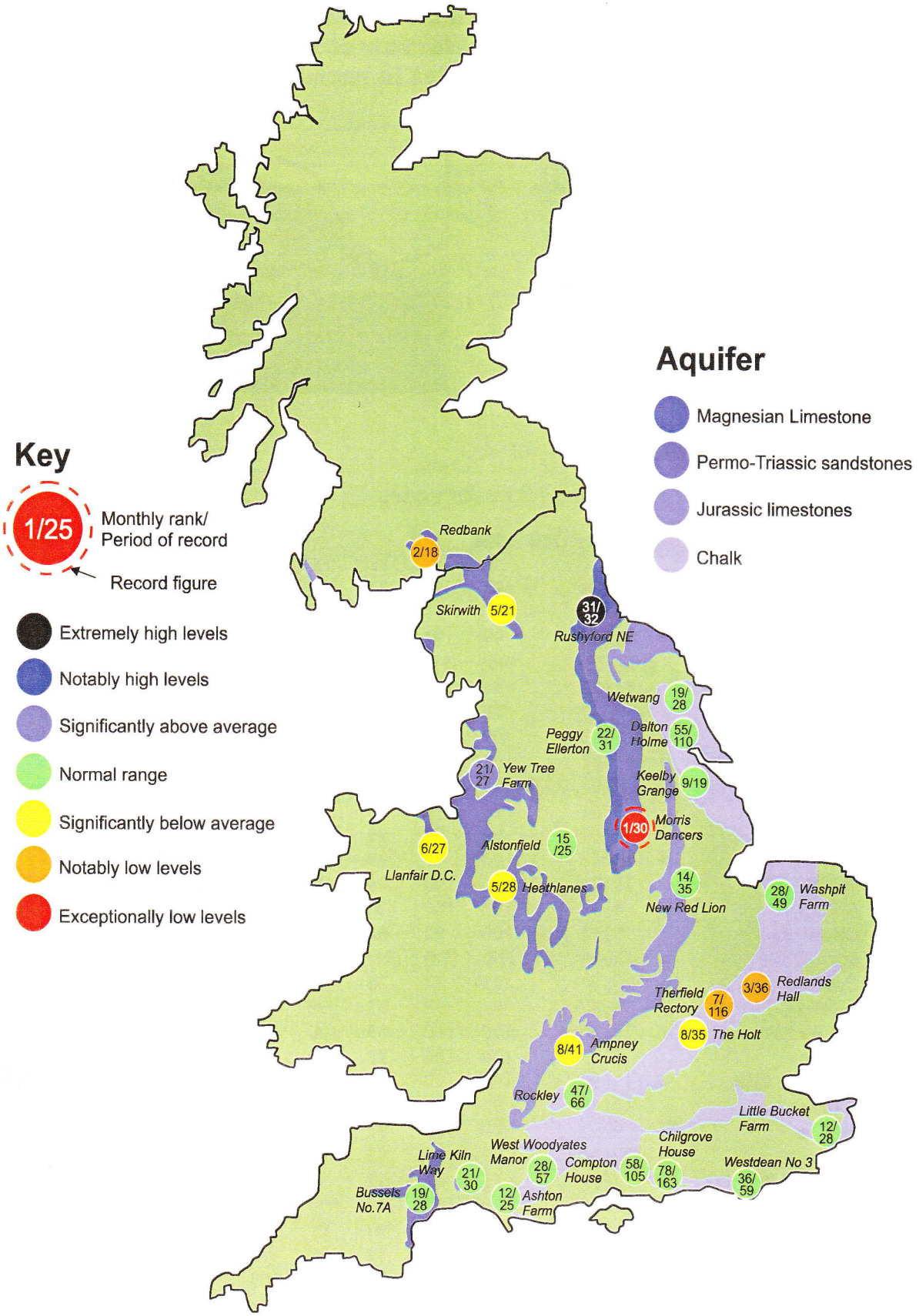
Borehole	Level	Date	Aug av.
Dalton Holme	16.33	27/08	16.25
Washpit Farm	44.84	02/09	44.33
The Holt	85.78	01/09	87.55
Redlands Hall	35.04	27/08	40.90
Ashton Farm	65.60	31/08	65.70
Little Bucket	65.47	02/09	66.69

Borehole	Level	Date	Aug av.
Chilgrove	41.43	27/08	41.74
W Woodyates	74.03	31/08	73.90
New Red Lion	12.24	25/08	12.23
Ampney Crucis	99.83	01/09	100.18
Skirwith	129.95	02/09	129.61

Borehole	Level	Date	Aug av.
Llanfair DC	79.20	31.08	79.54
Morris Dancers	31.60	26/08	32.46
Heathlanes	61.21	07/08	62.09
Bussels	23.65	25/08	23.56
Alstonfield	176.51	19/08	176.84

Levels in metres above Ordnance Datum

Groundwater . . . Groundwater

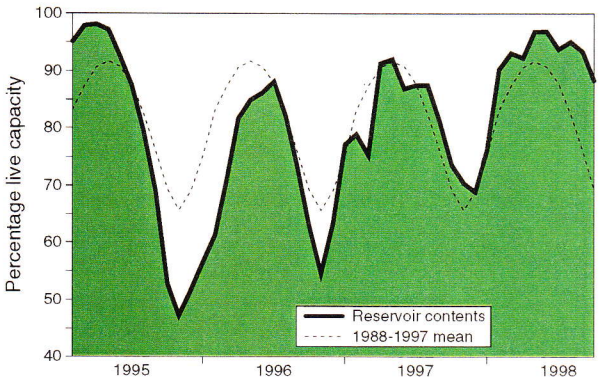


Groundwater levels - August 1998

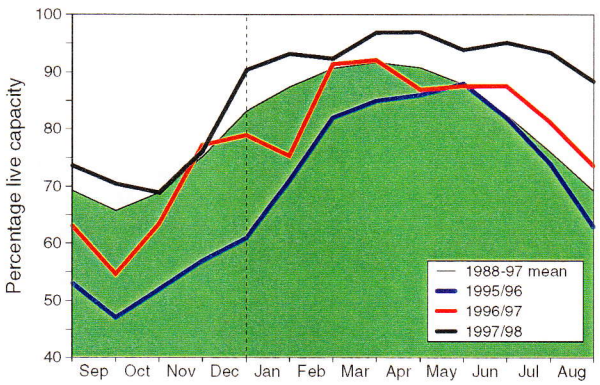
The rankings are based on a comparison of current levels (usually a single reading in a month) with the average level in each corresponding month on record. Caution needs to be exercised when interpreting the ranking, especially during periods of rapid changes in groundwater level. Rankings may be omitted where they are considered misleading.

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

Area	Reservoir	Capacity (Ml)	1998 Apr	May	Jun	Jul	Aug	**Sep**	Min. Sep	Year* of min
NorthWest	N Command Zone	• 133375	94	93	87	85	84	80	24	1995
	Vyrnwy	55146	100	97	95	93	90	81	36	1995
Northumbrian	Teesdale	• 87936	99	97	90	90	90	92	39	1991
	Kielder	(199175)	(96)	(95)	(92)	(93)	(92)	(94)	(66)	1989
SevernTrent	Clywedog	44922	96	99	98	98	97	93	38	1989
	DerwentValley	• 39525	98	99	90	100	93	96	34	1995
Yorkshire	Washburn	• 22035	99	95	91	98	89	85	34	1995
	Bradford supply	• 41407	100	99	93	96	93	92	21	1995
Anglian	Grafham	58707	86	92	99	96	95	87	59	1997
	Rutland	130061	98	98	96	96	93	88	66	1995
Thames	London	• 206399	99	98	99	99	96	85	62	1995
	Farmoor	• 13843	100	97	99	98	96	97	64	1995
Southern	Bewl	28170	100	100	96	92	86	76	38	1990
	Ardingly	4685	100	100	100	100	96	74	47	1996
Wessex	Clatworthy	5364	100	92	88	92	87	77	31	1995
	BristolWW	• (38666)	(98)	(98)	(91)	(92)	(88)	(79)	(43)	1990
SouthWest	Colliford	28540	73	77	76	77	78	76	43	1997
	Roadford	34500	91	98	97	98	99	98	40	1995
	Wimbleball	21320	100	100	99	100	99	92	40	1995
	Stithians	5205	100	100	98	92	88	80	30	1990
Welsh	Celyn and Brenig	• 131155	100	100	98	100	100	84	49	1989
	Brianne	62140	97	100	94	99	100	100	55	1995
	Big Five	• 69762	98	99	91	98	97	88	29	1995
	Elan Valley	• 99106	99	100	93	98	98	96	46	1995
East of	Edinburgh/Mid Lothian	• 97639	71	62	52	54	51	45**	65	1989
Scotland	East Lothian	• 10206	100	100	99	100	100	99	63	1989
West of	Loch Katrine	• 111363	97	99	90	81	85	89	50	1995
Scotland	Daer	22412	100	100	90	95	98	87	41	1995
	LochThom	• 11840	100	100	92	90	100	98	58	1997

( ) figures in parentheses relate to gross storage
** Megget drawdown for maintainence
• denotes reservoir groups
* last occurrence

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 area; this can be particularly important during droughts.
The minimum storage figures relate to the 1988-1998 period only. In some gravity-fed reservoirs (eg. Clywedog) stocks are kept below capacity during the winter to provide scope for flood

Location map . . . Location map

Where the information comes from

The National Hydrological Monitoring Programme was instigated in 1988 and is undertaken jointly by 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 of the Environment, Transport and the Regions, the Environment Agency (EA), the Scottish Environment Protection Agency (SEPA) and the Office of Water Services (OFWAT).

River flow and groundwater levels

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

River flow and groundwater level data are provided by the regional divisions of the EA (England and Wales) and SEPA (Scotland). In all cases the data are subject to revision following validation (flood and drought data in particular may be subject to significant revision).

Reservoirs

Reservoir level information is provided by the Water Service Companies, the EA and, in Scotland, the West of Scotland and East of Scotland Water Authorities.

Rainfall

Most rainfall data are provided by the Met Office. To allow better spatial differentiation the rainfall data are presented for the regional divisions of the precursor organisations of the EA and SEPA. The recent rainfall estimates for the Scottish regions are derived by IH in collaboration with the SEPA regions. In England and Wales the recent rainfall figures derive from MORECS. MORECS is the generic name for the Meteorological Office services involving the routine calculation of evaporation and soil moisture throughout Great Britain. The provisional regional rainfall figures are regularly updated using figures derived from a much denser rainguage network. Further details of Met. Office services can be obtained from:

The Meteorological Office
Sutton House
London Road
Bracknell
RG12 2SY.
Tel. 01344 856858; 01344 854024.

The cooperation of all data suppliers 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.nwl.ac.uk/ih

Hydrological Summary for Great Britain - August 1998

An error has been discovered on page 2 of the August report which was circulated yesterday. The 'LTA %' figures given for the national and regional rainfall accumulations are incorrect. The correct percentages are featured on the enclosed sheet which I would be most grateful if you would interleave with the rest of the August report.

Please accept my apologies for any inconvenience caused by this computation error.

Terry Marsh

Editor, Hydrological Summaries for Great Britain

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