Hydrological summary

for Great Britain

April 1998

General

April is often a pivotal month in relation to the water resources outlook. An exceptionally dry April in 1995 signalled the start of a drought which, in parts of England, was not terminated until last month - the wettest April on record for Britain as a whole, in a series from 1869. Overall reservoir stocks in early May were the highest since national monitoring began a decade ago. The remarkable April rainfall patterns culminated in exceptionally severe flooding in the south Midlands over Easter - the most damaging floods in the UK since the summer floods of 1968. From a groundwater perspective however, the April rainfall was decidedly beneficial - producing a very late surge of aquifer replenishment - leaving water-tables within the normal range in almost all areas.

Rainfall

April was generally a dull, cool and remarkably wet month. Some central and southern districts reported only two dry days in the entire month as a sequence of frontal systems assailed Britain from various quarters. Notwithstanding below average rainfall in a few north-western areas, Scotland registered around twice the 1961-90 mean. In England some districts - mostly in the Midlands and the south - exceeded 300% of the April average. The provisional England and Wales total for April is the highest since 1818. On the 9th, a frontal system aligned along a broad swathe from Gloucestershire to the Wash became very slow moving - many catchments received the equivalent of more than a months rainfall in under 10 hours. In many localities storm totals were in the 40-65 mm band and rain-day totals reached 70-80 mm at Pershore (Hereford and Worcester) and Althorpe Park (Northants). The last three months have been exceptionally wet in parts of western Scotland and the spring thus far has been the second wettest for over 50 years in E&W. Regional rainfall totals in the 6 and 12 month timeframes are also well above average. Deficiencies can still be recognised over timespans of around three years - e.g. in the eastern Thames basin where they continue to be reflected in the groundwater levels (see opposite).

River Flow

The recovery in flow rates during March (following notably low February flows) gathered momentum in April. Widespread minor spates occurred on the 3rd and, with catchments saturated, rivers were very susceptible to further significant rainfall. The storm on the 9th principally affected the mostly flat, impermeable and saturated clay vales of the Avon (Warwickshire) and Nene basins (and extending north towards the Soar basin). Rainfall intensities of 5-10 mm an hour for 6-10 hours were typical. A number of catchments in the region are particularly vulnerable to storms of this duration and substantial flooding was inevitable. In the event; flows exceeded previous maxima in most of the affected region. Oustanding flows were reported for the Avon and a number of tributaries (the Leam particularly); flood peaks were remarkable on the Cherwell also. Initial estimates of return periods for the peaks exceed 50 years. Most gauging station records extend back only 30-40 years but a longer, albeit less reliable, perspective is provided by flood marks on bridges and buildings. These confirmed the exceptional magnitude of the Easter floods; at Evesham (on the Avon) levels exceeded the 1900 and 1848 peaks. Catchments establishing new maximum runoff totals showed a wide distribution - from the Scottish Dee (at Park) to the Yscir in South Wales. The seasonally delayed recoveries were especially welcome in many eastern spring-fed streams; runoff in the Mimram was the the highest for two years, albeit still significantly below average.

Groundwater

For much of April, soils were close to saturation - a rare circumstance in the English lowlands which created difficulties for farmers and growers but allowed much needed replenishment to eastern aquifers - at a time when groundwater level recessions are normally well established. In much of the Thames region, estimated percolation during April was 5-10 times the average; for some aquifer units it was the highest, for April, in records extending back over 75 years. In the Chalk, the March recessions in the west and south of the outcrop were reversed and, in parts of the east, very belated recoveries were triggered from an exceptionally low base. Overall groundwater resources in the Chalk are now close to the seasonal average. In the zone where water-tables were most depressed earlier in the year, recoveries have, as yet, been modest but levels at the Holt and Redlands boreholes have risen above those of last year and 1992 also. The Therfield well remains dry but the spring infiltration has yet to reach the deep water-table. A similar situation may be found in some of the very slow responding Permo-Triassic sandstones boreholes (e.g. Morris Dancers) but levels in most are well above 1996 and 1997 minima. Late April average levels in most of the more responses limestone outcrops were appreciably above average - notably so at Ampney Crucis.

Institute of Hydrology

British Geological Survey

Rainfall . . . Rainfall . . . Rainfall. .

Rainfall accumulations and return period estimates

Area	Rainfall	Apr 1998	Feb 98-Apr 98	RP	Nov 97-Apr 98	RP	May 97-Apr 98	RP	Apr 95-Apr 98	RP
England & Wales	**mm**	**134**	**240**		**576**		**1023**		**2456**	
	%	**223**	**123**	**5-10**	**123**	**5-10**	**114**	**5-10**	**89**	**10-15**
North West	mm	118	324		720		1223		3053	
	%	166	133	5-10	118	5-10	102	2-5	83	50-80
Northumbrian	mm	130	234		554		972		2427	
	%	231	127	5-10	127	10-15	114	5-10	93	5-10
Severn Trent	mm	112	208		467		896		2070	
	%	204	122	2-5	120	5-10	119	5-15	89	5-10
Yorkshire	mm	114	232		519		936		2190	
	%	194	125	5-10	121	5-10	114	5-10	87	15-25
Anglian	mm	117	176		379		729		1619	
	%	255	136	5-10	129	10-20	122	10-20	88	10-15
Thames	mm	108	177		413		764		1833	
	%	216	117	2-5	118	2-5	111	2-5	87	10-20
Southern	mm	103	176		534		919		2134	
	%	195	103	2-5	128	5-10	118	5-10	89	5-10
Wessex	mm	111	203		580		1026		2566	
	%	210	108	2-5	128	5-15	122	10-15	100	<2
South West	mm	137	269		791		1370		3443	
	%	198	100	<2	118	5-10	117	5-10	96	2-5
Welsh	mm	155	365		890		1503		3670	
	%	194	129	5-10	123	5-10	114	5-10	91	5-10
Scotland	**mm**	**109**	**476**		**964**		**1528**		**4252**	
	%	**143**	**157**	**120-170**	**127**	**25-40**	**106**	**2-5**	**97**	**2-5**
Highland	mm	84	648		1171		1805		5049	
	%	92	171	>>200	121	5-15	103	2-5	94	5-10
North East	mm	146	284		663		1155		3169	
	%	243	140	15-25	134	30-50	119	10-20	106	5-10
Tay	mm	113	353		849		1337		3731	
	%	182	133	5-10	129	10-20	109	2-5	100	<2
Forth	mm	105	329		712		1192		3262	
	%	178	142	15-25	124	10-15	107	2-5	96	2-5
Tweed	mm	116	253		617		1090		2906	
	%	204	125	5-10	126	10-15	112	5-10	98	2-5
Solway	mm	102	399		936		1534		4129	
	%	132	135	10-15	126	10-15	108	2-5	95	2-5
Clyde	mm	122	567		1123		1710		4851	
	%	145	162	120-170	125	10-20	101	2-5	94	5-10

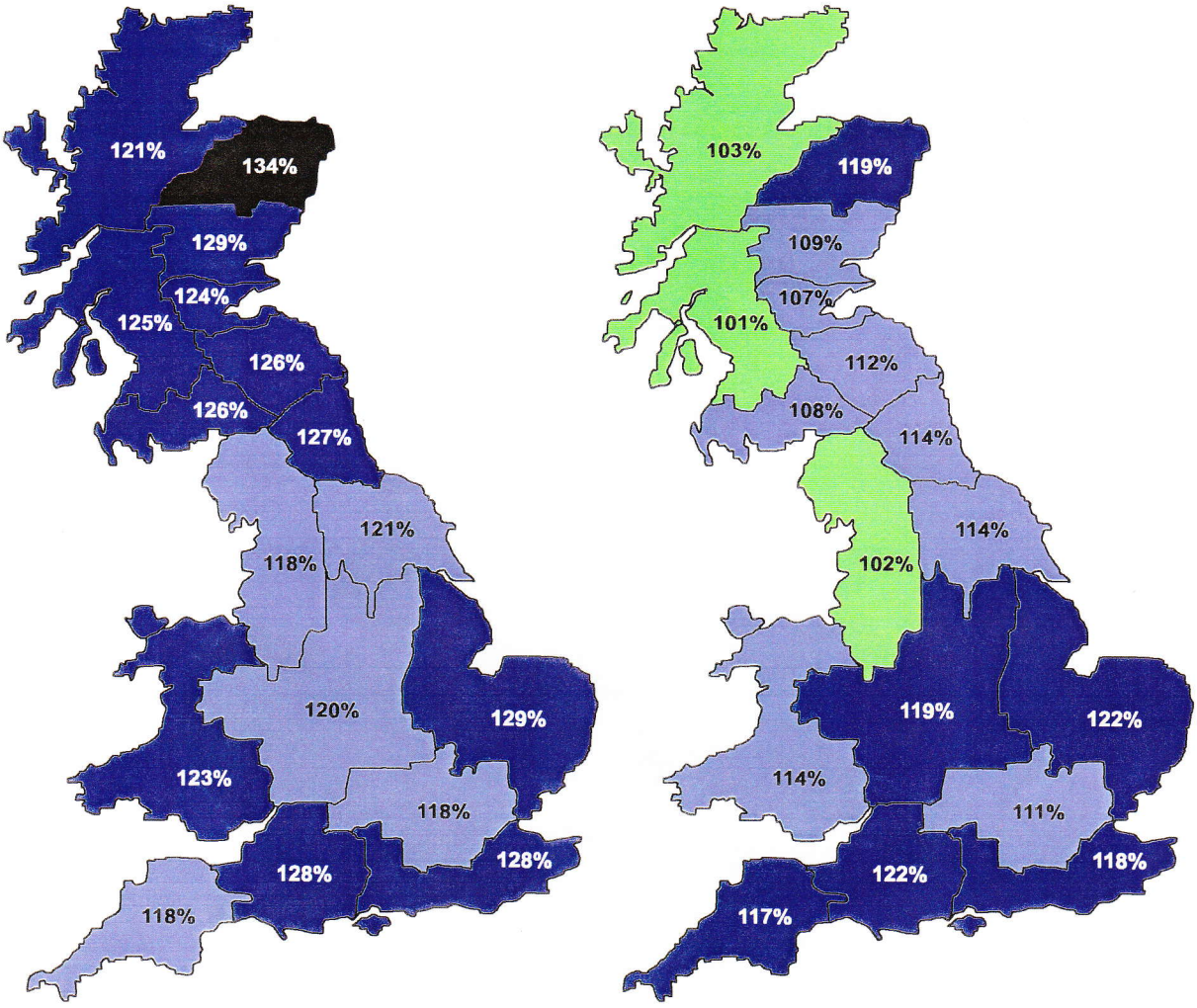
RP = Return period

 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

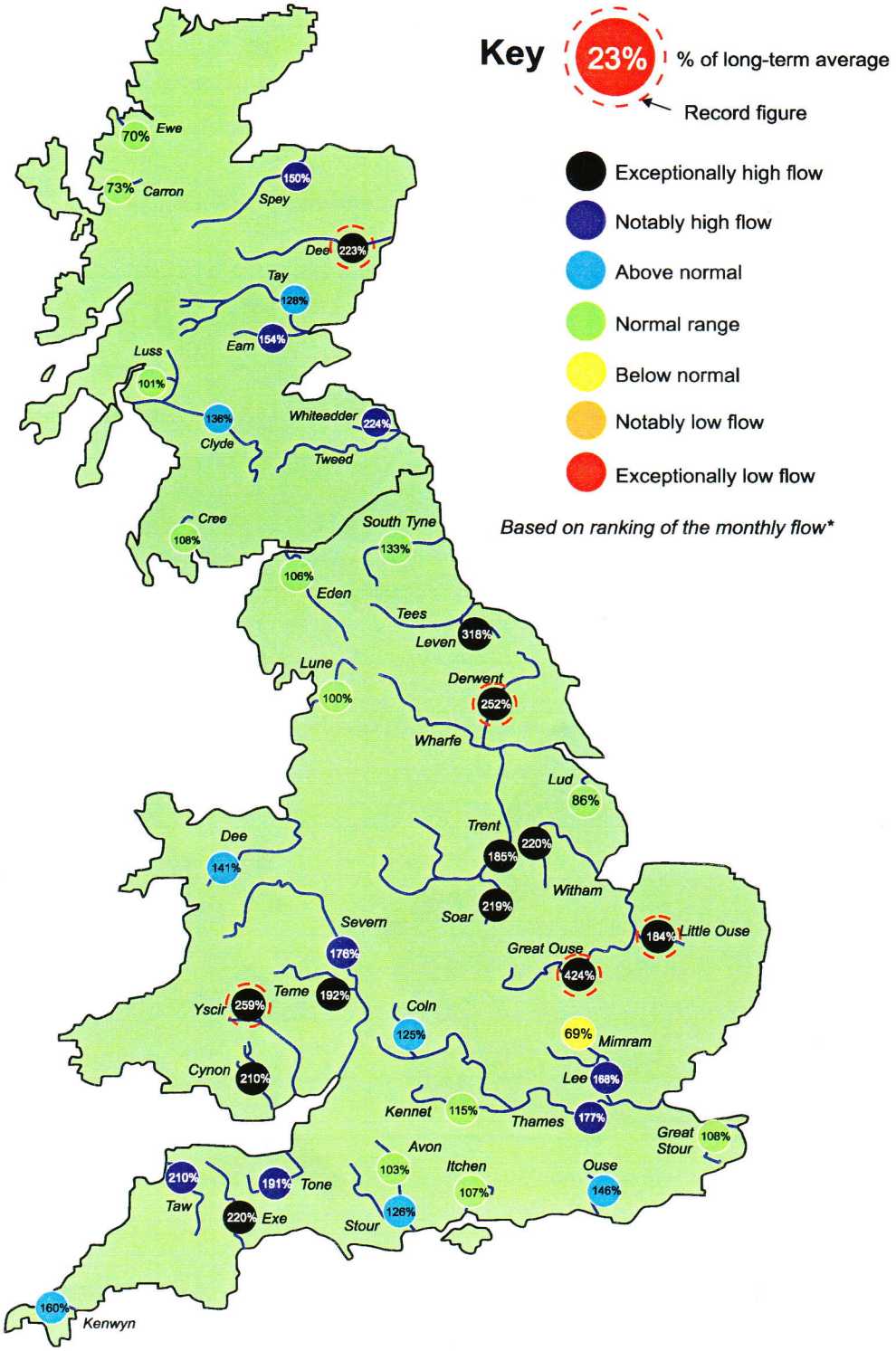


November 1997 - April 1998 **May 1997 - April 1998**

Rainfall accumulation maps

Much of Britain has been notably wet over both the last 6 and last 12 month periods. For England and Wales the May-April period was the fourth wettest in the last 30 years and the November-April rainfall adds to a cluster of recent winter/spring periods when rainfall totals are substantially different from the 1961-90 average.

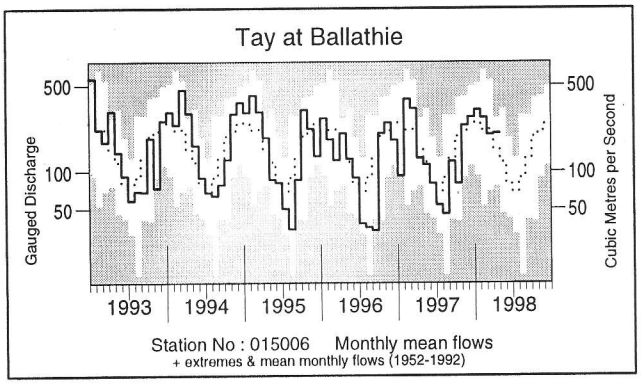
River flow . . . River flow . . .

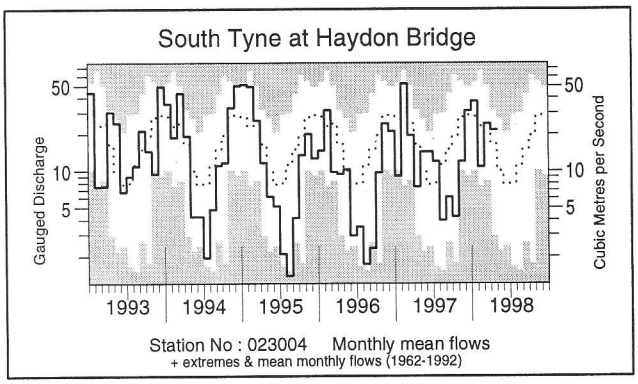


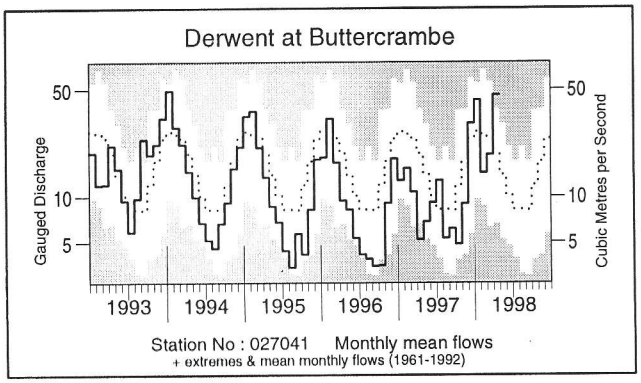
River flows - April 1998

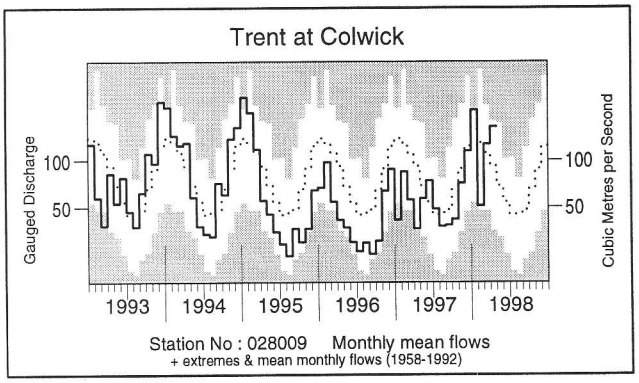
Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much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

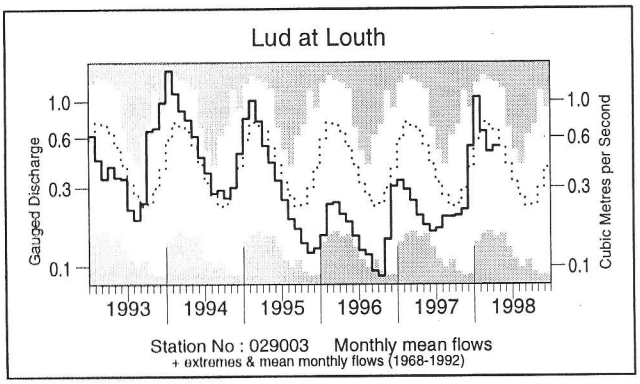
Errata: The percentage river flows were correctly featured on the March 1998 map but erroneous colour codes were used for several of the station symbols (including those for the Yscir, Dee and Trent). A correct version of the map may be viewed on the Institute of Hydrology's Web Site (see back page) - navigate via Water Watch.

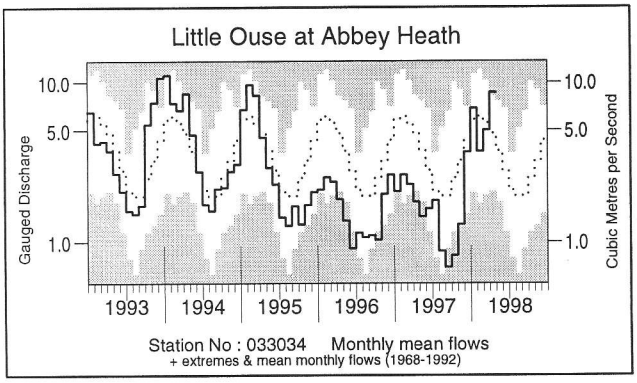


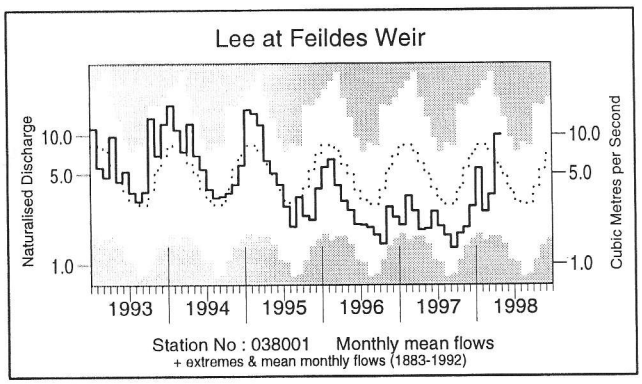


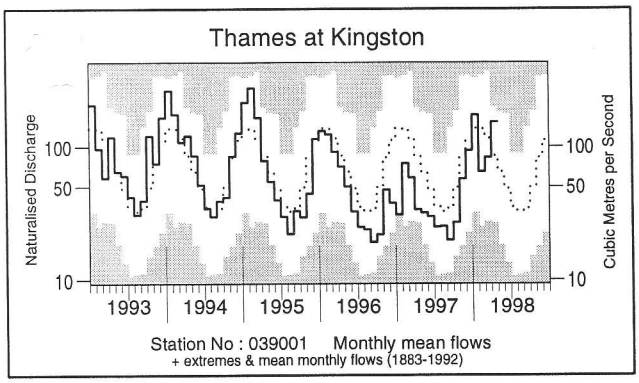








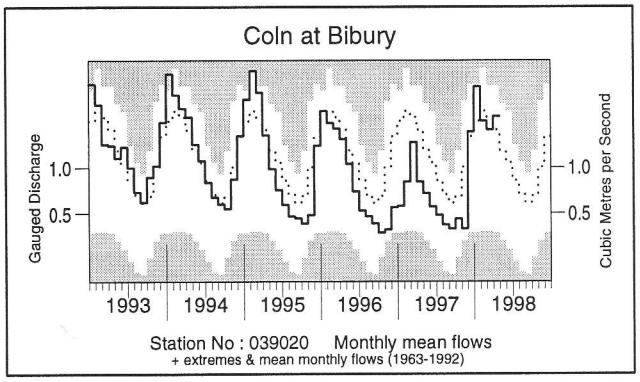


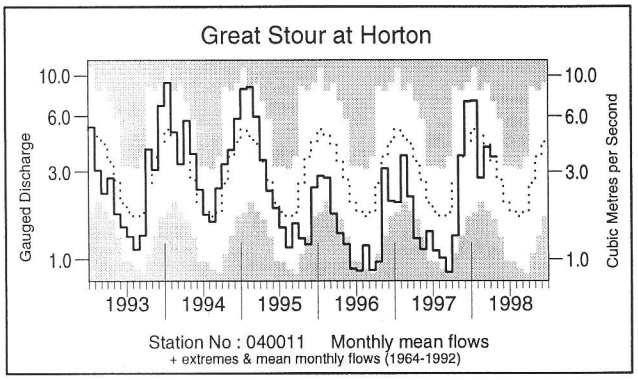


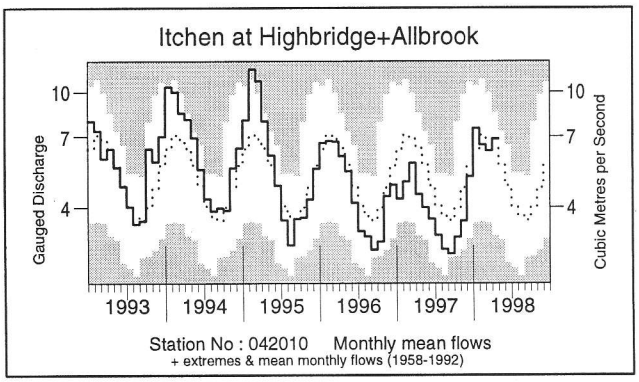
Monthly river flow hydrographs

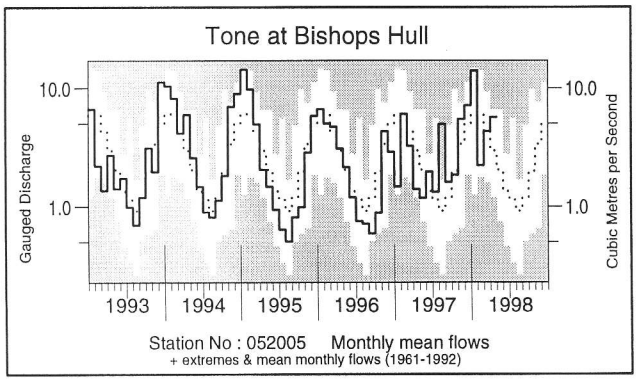
The river flow hydrographs show the monthly mean flow (bold trace), the long term average monthly flow (dotted trace) and the maximum and minimum flow prior to 1992 (shown by the shaded areas). Monthly flows falling outside the maximum/ minimum range are indicated where the bold trace enters the shaded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

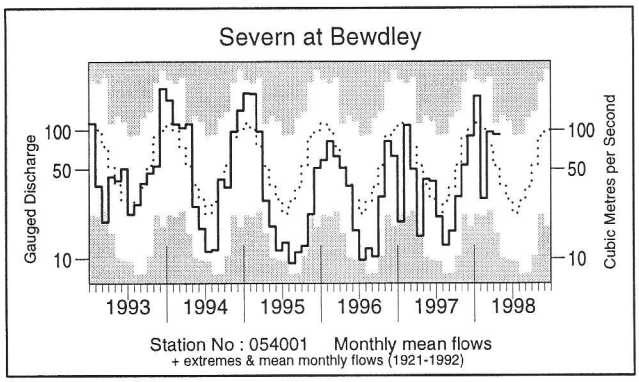
River flow . . . River flow . . .

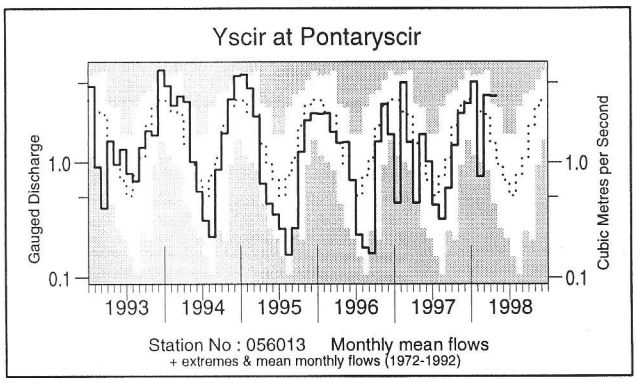


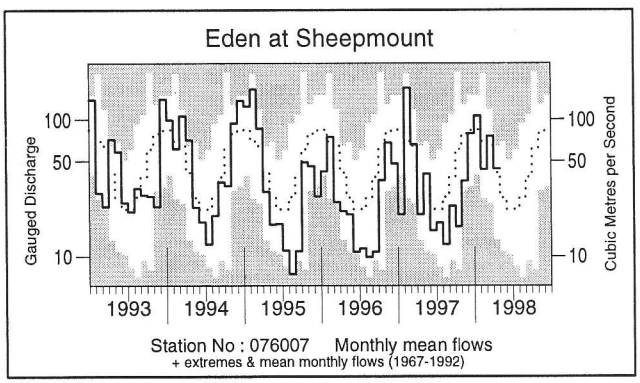


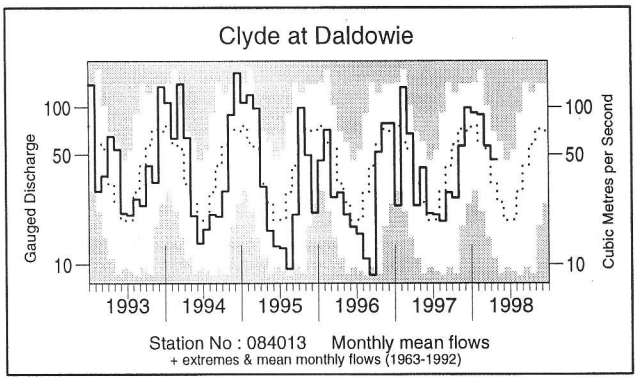










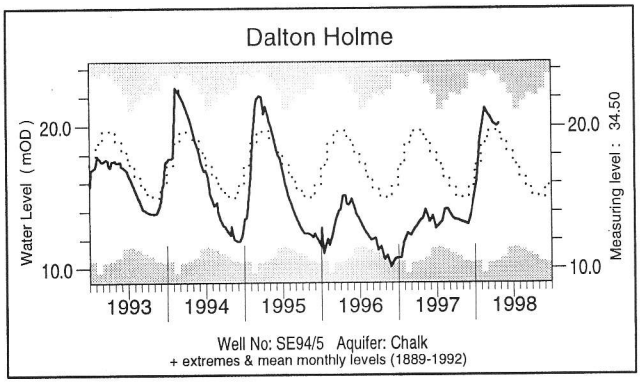


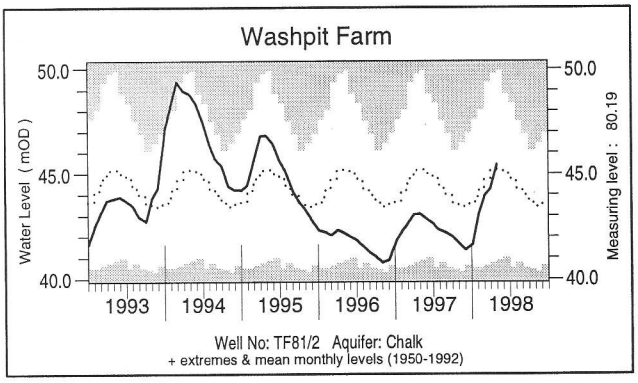
Notable runoff accumulations February 1998 - April 1998 (a); May 1997 - April 1998 (b)

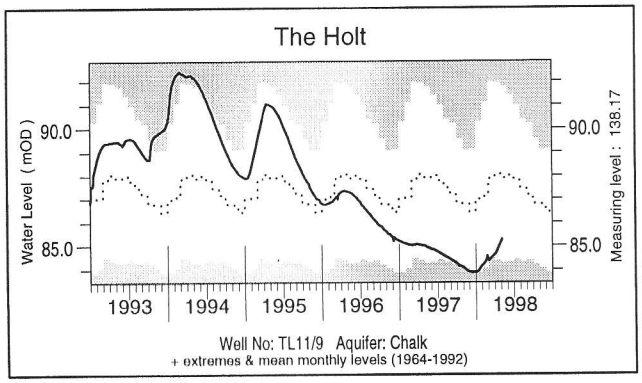
(a) River	%lta	Rank	(b) River	%lta	Rank	River	%lta	Rank
Ewe	**148**	**25/28**	S.Tyne	88	8/34	Itchen	77	5/33
Mimram	50	7/46	**Witham**	**144**	**33/39**	**Otter**	**121**	**30/35**
Ouse	79	9/36	Mimram	38	3/45	**Kenwyn**	**114**	**23/28**
Stour	76	7/26	**Mole**	**132**	**20/23**	**Brue**	**141**	**35/37**
Yscir	**125**	**21/26**	**Lymington**	**121**	**28/35**	Lune	85	8/30
Dee(Welsh)	**114**	**21/29**				Carron	88	3/18

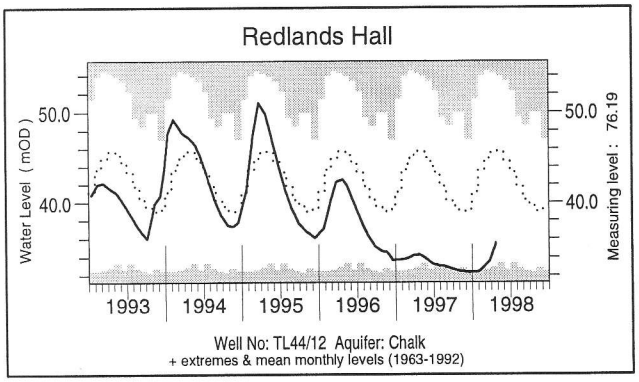
lta = long term average
Rank 1 = lowest on record

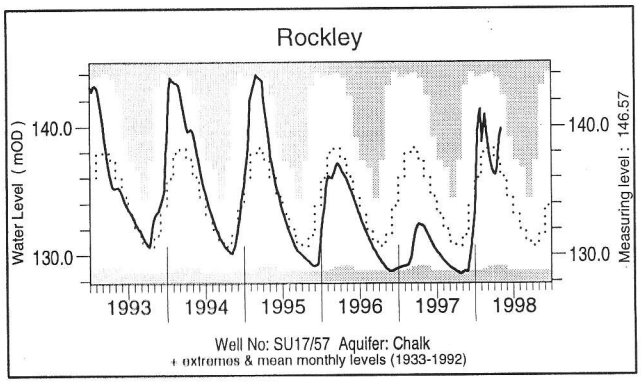
Groundwater . . . Groundwater

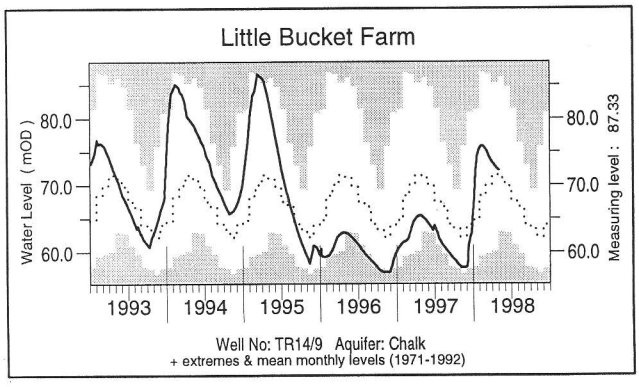


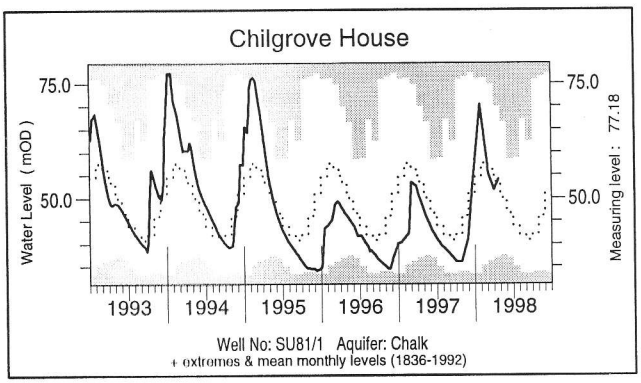


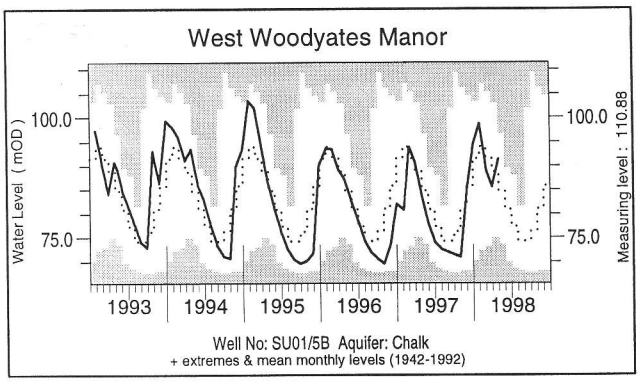








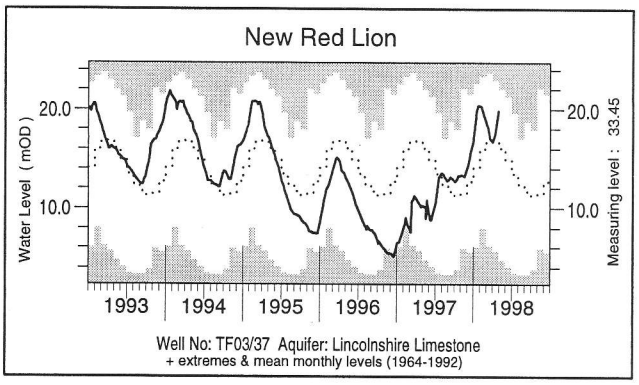


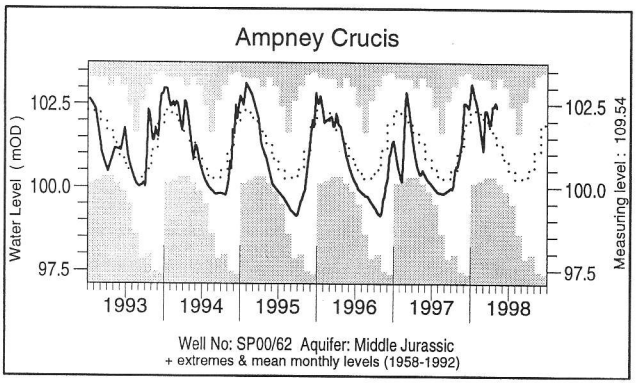


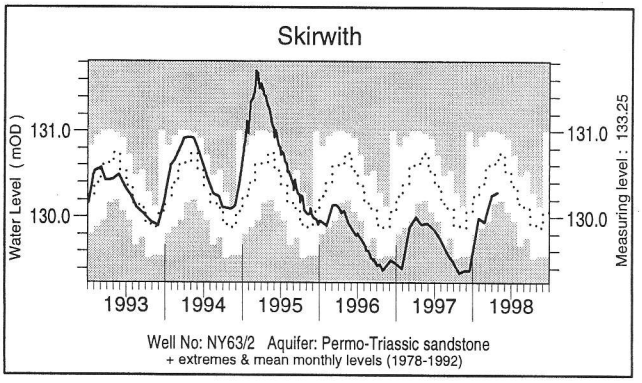
What is groundwater?

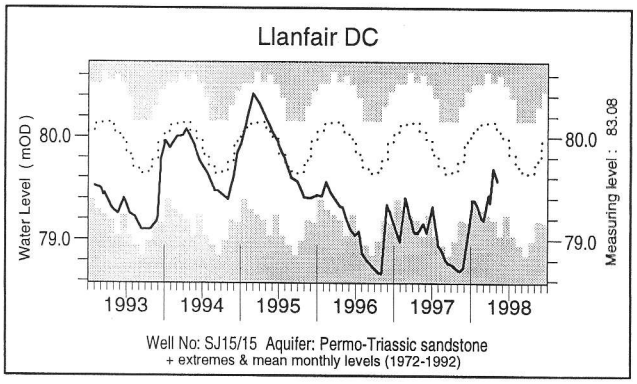
Groundwater is stored in the natural water bearing rock strata (or aquifers) which are found mostly in southern and eastern England (see page 11) where groundwater is the major water supply source. Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment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

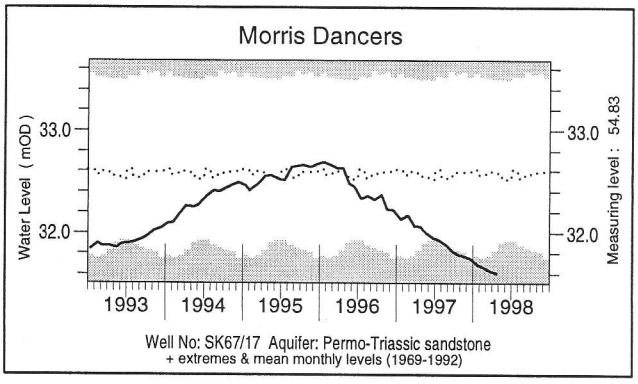
Groundwater . . . Groundwater

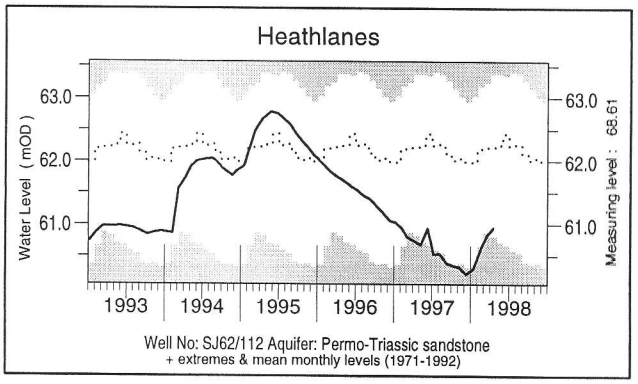


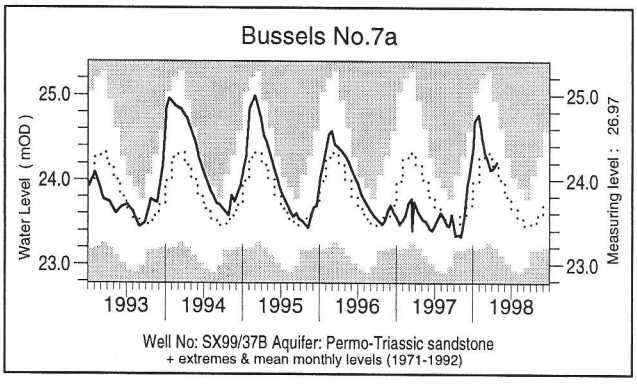


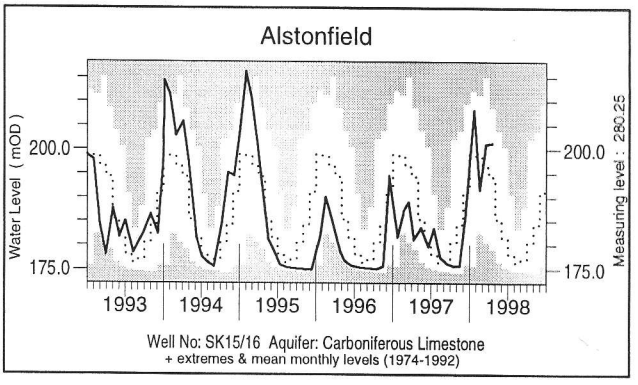










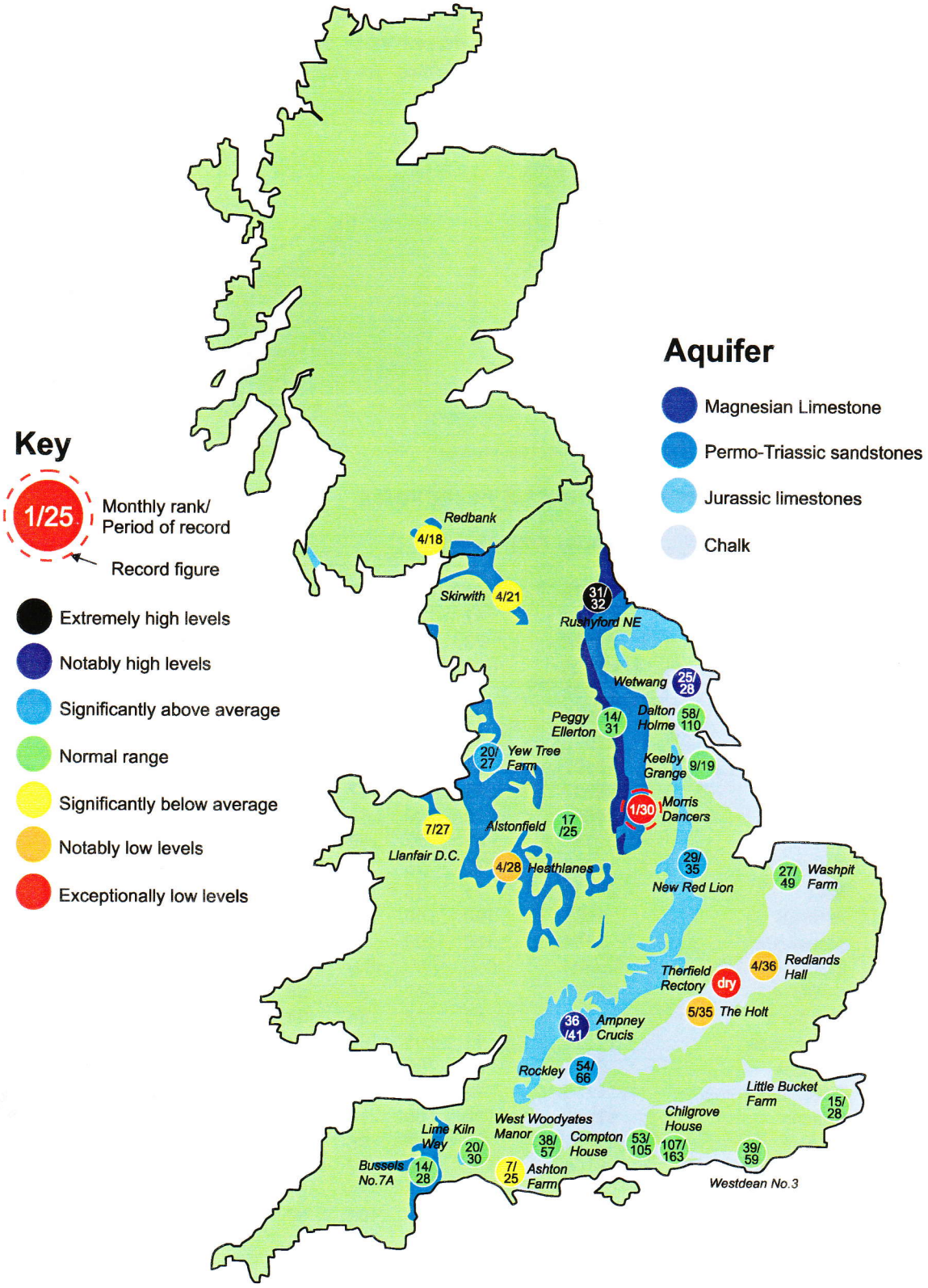


Groundwater levels April/May 1998

Borehole	Level	Date	Apr av.	Borehole	Level	Date	Apr av.	Borehole	Level	Date	Apr av.
Dalton Holme	20.14	24/04	19.50	Chilgrove	54.10	22/04	52.21	Llanfair DC	79.57	05/05	79.97
Washpit Farm	45.42	01/05	45.17	W Woodyates	91.32	30/04	88.22	Morris Dancers	31.61	23/04	32.48
The Holt	85.29	05/05	88.16	New Red Lion	19.83	28/04	16.44	Heathlanes	60.95	16/04	62.08
Redlands Hall	35.50	23/04	35.50	Ampney Crucis	102.4	05/05	101.71	Bussels	24.21	24/04	24.15
Ashton Farm	68.46	30/04	69.41	Skirwith	130.3	27/04	130.60	Alstonfield	201.3	17/04	193.47
Little Bucket	72.19	05/05	71.69								

Levels in metres above Ordnance Datum

Groundwater . . . Groundwater

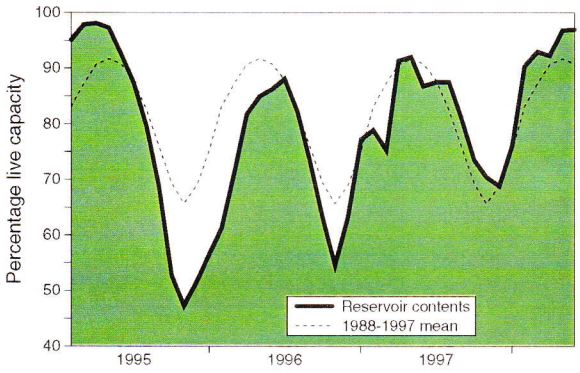


Groundwater levels - April 1998

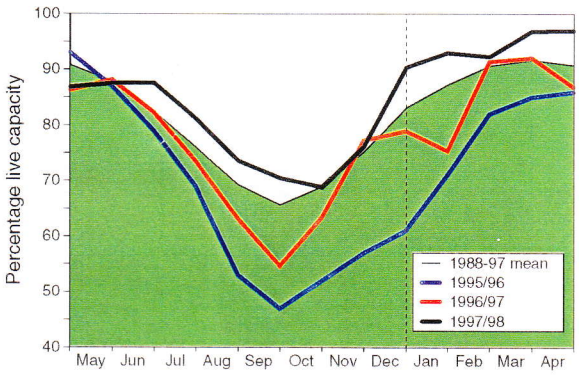
The rankings are based on a comparison of current levels (usually a single reading in a month) with the average level in each corresponding month on record. Caution needs to be exercised when interpreting the ranking, especially during periods of rapid changes in groundwater level. Rankings may be omitted 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)	1997/98 Dec	Jan	Feb	Mar	Apr	**May**	Min. May	Year* of min
NorthWest	N Command Zone	• 133375	64	95	94	92	94	**93**	80	1996
	Vyrnwy	55146	67	100	93	87	100	**97**	70	1996
Northumbrian	Teesdale	• 87936	73	96	97	93	99	**97**	81	1996
	Kielder	(199175)	(75)	(95)	(91)	(91)	(96)	**(95)**	(85)	1990
SevernTrent	Clywedog	44922	86	86	89	86	96	**99**	85	1988
	DerwentValley	• 39525	79	100	100	90	98	**99**	54	1996
Yorkshire	Washburn	• 22035	73	98	98	95	99	**95**	76	1996
	Bradford supply	• 41407	85	99	98	96	100	**99**	60	1996
Anglian	Grafham	58707	47	57	67	75	86	**92**	73	1997
	Rutland	130061	75	88	96	96	98	**98**	72	1997
Thames	London	• 206399	68	72	93	97	99	**98**	86	1990
	Farmoor	• 13843	92	96	94	97	100	**97**	96	1989
Southern	Bewl	28170	76	98	100	99	100	**100**	63	1990
	Ardingly	4685	100	100	100	100	100	**100**	100	**1998**
Wessex	Clatworthy	5364	100	100	92	86	100	**92**	81	1990
	BristolWW	• (38666)	(71)	(97)	(97)	(94)	(98)	**(98)**	(85)	1990
SouthWest	Colliford	28540	53	62	68	68	73	**77**	56	1997
	Roadford	34500	65	78	84	84	91	**98**	41	1996
	Wimbleball	21320	91	100	100	97	100	**100**	79	1992
	Stithians	5205	84	100	100	96	100	**100**	65	1992
Welsh	Celyn and Brenig	• 131155	86	99	97	98	100	**100**	75	1996
	Brianne	62140	100	100	94	94	97	**100**	86	1997
	Big Five	• 69762	87	98	96	91	98	**99**	85	1997
	Elan Valley	• 99106	100	100	97	93	99	**100**	91	1997
East of Scotland	Edinburgh/Mid Lothian	• 97639	67	74	80	79	71	**62****	62	**1998**
	East Lothian	• 10206	63	100	100	99	100	**100**	89	1992
West of Scotland	Loch Katrine	• 111363	86	100	88	95	97	**99**	92	1995
	Daer	22412	87	100	98	100	100	**100**	91	1995
	LochThom	• 11840	82	93	93	100	100	**100**	92	1995

( ) 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 1988-1997 period only. In some gravity-fed reservoirs (eg. Clywedog) stocks are kept below capacity during the winter to provide scope for flood alleviation.

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

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