# Hydrological Summary for Great Britain

## *JUNE 1994*

## Rainfall

June was a month of large regional variations in temperatures, sunshine amounts and rainfall. North-western Britain was mostly dull and cool and a sequence of frontal systems produced above average June rainfall. Some localities in the western Highlands were extremely wet but in parts of eastern and central Scotland the warm, dry conditions which characterised May continued into early June, producing some notable sequences of dry days. Most of southern, central and eastern England remained dry throughout the majority of the month but, locally, convectional storms resulted in a few exceptionally intense downpours, on the 24th especially. For example, 43 mm was recorded in around three hours in the Peak District at Hollingsclough (including a 23 mm burst in 15 minutes, the associated return period is around 100 years) and 41 mm in two hours at Hambleden Lock on the Thames, producing localised flooding. A remarkable fall of 52 mm in 15 minutes at Teviothead (Borders) was also reported. Considerable difficulties attend the measurement of such extreme intensities but, if confirmed, it would be a monumental event. The provisional June rainfall total for England and Wales is the lowest monthly total since August 1991 and the driest June since 1976. The meagre rainfall contributed to significant three-month rainfall deficiencies in parts of northern England and eastern Scotland. Elsewhere, it terminated protracted sequences of wet months in a number of regions: South-West and Wessex registered their first dry month of 1994 and June ended a run of nine successive wet months for the Anglian region. This lengthy wet phase is reflected in the long term rainfall accumulations which remain above, to well above, average in 1994 and in the twelve month timeframe.

## River Flow

Rapidly drying soils reduced the hydrological effectiveness of the June rainfall and in the great majority of catchments recessions were protracted - an interesting feature in northern Scotland was the clearly evident diurnal variation caused by headwater snowmelt. In parts of Scotland, the contrast with late spring flow conditions is marked, but runoff rates have also declined briskly in impervious catchments in southern Britain. By contrast, healthy baseflow contributions maintained above-average flows in many spring-fed rivers in the English Lowlands where flows have remained significantly above average for extended periods. A number of western Highland catchments registered new maximum June runoff totals; examples include the Rivers Carron and Nevis, and inflows to the Lochaber hydro-power scheme (near Fort William) were the highest, for June, in 50 years. Throughout most of western and northern Britain however, June runoff totals were below average - substantially so in the North-East and the Midlands; nonetheless, average flows remain within the normal range and, typically two or three times the June minima established during the 1989-92 drought. Sustained recessions in Chalk streams have produced the lowest flows since the late summer of 1993 but runoff totals over the intervening months are, mostly, very high - the nine-month accumulations for the Mimram and Kennet, for example, are unprecedented.

## Groundwater

Many index boreholes exhibited an extreme range of variation over the two or three years up to the spring of 1994 but levels have now generally returned to well within the seasonal range. Regional variations remain notable however. Evaporative losses were high in June and soil moisture deficits increased briskly to exceed the month-end average over wide areas. Correspondingly, infiltration during June was restricted to a few isolated localities and most aquifers experienced substantial water-table declines. Recessions were especially steep in the Yorkshire Chalk where levels fell to just below the June average. Despite recent declines, levels remain notably high in large parts of the eastern Chalk - at the Holt especially. The sustained 1988 recession - which continued until the early winter and is being loosely paralleled in parts of southern Britain - provides a reminder of how the resources outlook can change within the space of six months, but given normal rainfall, the 1989-92 minima will not be approached this year.

## General

The warm, dry conditions triggered heavy water usage, particularly in those regions where demand is greatest and reservoir stocks declined significantly in some areas (northern England particularly). Overall, stocks remain healthy and generally well above those recorded at the same time in 1989 and 1990.

Institute of Hydrology



British Geological Survey

Data for this report have been provided principally by the regional divisions of the National Rivers Authority* in England and Wales, the River Purification Boards in Scotland and by the Meteorological Office. Reservoir contents information has been supplied by the Water Services Companies, the NRA or, in Scotland, the Lothians Regional Council. The most recent areal rainfall figures are derived from a restricted network of raingauges and a proportion of the river flow data is of a provisional nature.

A map (Figure 3) is provided to assist in the location of the principal monitoring sites.

Financial support towards the production of the Hydrological Summaries is given by the Department of the Environment and the National Rivers Authority.

The Hydrological Summaries are available on annual subscription at a current cost of £48 per year - enquiries should be directed to the National Water Archive Office at the address below. No charge is made to those organisations providing data for the Summaries.

* For reasons of consistency and to provide greater spatial discrimination, the original ten regional divisions of the NRA have been retained for use in the Hydrological Summaries.

MORECS

Most of the recent monthly regional rainfall data featured in the Hydrological Summaries are MORECS assessments. MORECS is the generic name for The Meteorological Office services involving the calculation of evaporation and soil moisture routinely for Great Britain. Products include a weekly issue of maps and tables of potential and actual evaporation, soil moisture deficits, effective rainfall and the hydrometeorological variables used to calculate them. The data are used to provide values for 40 km squares - or larger areas - and various sets of maps and tables are available according to user requirements. Options include a day-by-day retrospective calculation of soil moisture at any of 4000 rain-gauge sites.

Further information about MORECS services may be obtained from: The Meteorological Office, Sutton House, London Road, Bracknell, RG12 2SY

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## TABLE 1 1993/94 RAINFALL AS A PERCENTAGE OF THE 1961-90 AVERAGE



| | | Jun 1993 | Jul | Aug | Sep | Oct | Nov | Dec | Jan 1994 | Feb | Mar | Apr | May | Jun |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| England and Wales | mm | 66 | 83 | 55 | 113 | 89 | 74 | 167 | 123 | 82 | 93 | 75 | 61 | 34 |
| | % | 102 | 134 | 72 | 147 | 105 | 82 | 178 | 140 | 130 | 129 | 125 | 95 | 52 |
| NRA REGIONS | | | | | | | | | | | | | | |
| North West | mm | 57 | 109 | 80 | 87 | 51 | 65 | 248 | 145 | 70 | 151 | 151 | 39 | 67 |
| | % | 70 | 128 | 75 | 76 | 40 | 53 | 200 | 120 | 90 | 159 | 213 | 52 | 82 |
| Northumbria | mm | 39 | 59 | 77 | 109 | 91 | 63 | 135 | 108 | 70 | 82 | 65 | 24 | 45 |
| | % | 65 | 91 | 95 | 149 | 120 | 73 | 167 | 129 | 119 | 117 | 116 | 38 | 75 |
| Severn-Trent | mm | 72 | 79 | 43 | 95 | 74 | 67 | 137 | 94 | 71 | 74 | 59 | 52 | 25 |
| | % | 122 | 149 | 64 | 148 | 116 | 94 | 178 | 134 | 131 | 121 | 107 | 89 | 43 |
| Yorkshire | mm | 48 | 68 | 78 | 132 | 62 | 63 | 134 | 117 | 68 | 69 | 61 | 45 | 31 |
| | % | 80 | 115 | 105 | 194 | 85 | 79 | 161 | 148 | 117 | 101 | 103 | 74 | 52 |
| Anglian | mm | 49 | 69 | 45 | 105 | 90 | 70 | 85 | 73 | 44 | 52 | 52 | 51 | 23 |
| | % | 96 | 141 | 82 | 214 | 176 | 121 | 155 | 146 | 119 | 111 | 113 | 106 | 45 |
| Thames | mm | 57 | 55 | 33 | 103 | 111 | 47 | 104 | 97 | 59 | 49 | 59 | 77 | 25 |
| | % | 104 | 112 | 57 | 175 | 179 | 72 | 149 | 152 | 131 | 88 | 118 | 138 | 45 |
| Southern | mm | 53 | 62 | 37 | 123 | 134 | 63 | 154 | 124 | 63 | 57 | 78 | 88 | 39 |
| | % | 98 | 129 | 65 | 178 | 168 | 74 | 188 | 155 | 117 | 90 | 147 | 162 | 71 |
| Wessex | mm | 69 | 76 | 36 | 120 | 122 | 63 | 169 | 126 | 99 | 79 | 63 | 88 | 25 |
| | % | 121 | 146 | 55 | 167 | 154 | 76 | 182 | 145 | 152 | 113 | 119 | 144 | 44 |
| South West | mm | 108 | 128 | 39 | 168 | 119 | 107 | 264 | 186 | 174 | 124 | 87 | 93 | 32 |
| | % | 157 | 186 | 46 | 181 | 103 | 86 | 190 | 135 | 172 | 125 | 126 | 129 | 47 |
| Welsh | mm | 99 | 111 | 75 | 118 | 81 | 113 | 259 | 183 | 130 | 177 | 115 | 73 | 56 |
| | % | 125 | 144 | 74 | 103 | 59 | 80 | 169 | 128 | 134 | 165 | 144 | 89 | 71 |
| Scotland | mm | 72 | 113 | 74 | 76 | 118 | 76 | 234 | 215 | 99 | 249 | 134 | 30 | 100 |
| | % | 84 | 120 | 63 | 54 | 76 | 50 | 155 | 142 | 97 | 199 | 176 | 35 | 116 |
| RIVER PURIFICATION BOARDS | | | | | | | | | | | | | | |
| Highland | mm | 83 | 142 | 89 | 52 | 139 | 68 | 266 | 257 | 84 | 338 | 188 | 29 | 134 |
| | % | 85 | 134 | 70 | 30 | 70 | 33 | 135 | 137 | 66 | 209 | 207 | 32 | 137 |
| North-East | mm | 59 | 79 | 69 | 88 | 171 | 44 | 113 | 132 | 105 | 105 | 77 | 15 | 47 |
| | % | 89 | 108 | 79 | 101 | 176 | 44 | 122 | 133 | 162 | 135 | 128 | 22 | 71 |
| Tay | mm | 58 | 90 | 58 | 100 | 127 | 77 | 157 | 200 | 114 | 229 | 103 | 19 | 78 |
| | % | 79 | 117 | 62 | 88 | 98 | 64 | 124 | 139 | 120 | 210 | 166 | 23 | 107 |
| Forth | mm | 72 | 73 | 50 | 79 | 108 | 73 | 187 | 160 | 88 | 204 | 83 | 16 | 61 |
| | % | 104 | 97 | 53 | 72 | 94 | 65 | 170 | 136 | 111 | 217 | 141 | 22 | 88 |
| Tweed | mm | 62 | 54 | 52 | 91 | 134 | 55 | 171 | 140 | 86 | 122 | 71 | 18 | 48 |
| | % | 95 | 74 | 59 | 102 | 141 | 59 | 184 | 140 | 128 | 154 | 125 | 25 | 74 |
| Solway | mm | 72 | 101 | 65 | 102 | 54 | 97 | 266 | 197 | 117 | 191 | 120 | 27 | 81 |
| | % | 86 | 112 | 55 | 71 | 34 | 67 | 180 | 126 | 116 | 163 | 156 | 32 | 96 |
| Clyde | mm | 77 | 137 | 89 | 74 | 67 | 113 | 300 | 269 | 114 | 301 | 148 | 33 | 138 |
| | % | 83 | 126 | 66 | 41 | 35 | 63 | 168 | 142 | 97 | 205 | 176 | 36 | 148 |

Note: The monthly rainfall figures for the NRA regions for May and June correspond to the MORECS areal assessments derived by The Meteorological Office. In northern England these initial assessments may have a particularly wide error band associated with them. The figures for the RPB regions for May and June 1994 were derived by IH in collaboration with the RPBs. The provisional figures for England and Wales and for Scotland are derived using a different raingauge network. Regional areal rainfall figures are regularly updated (normally one or two months in arrears) using figures derived from a far denser raingauge network.

## TABLE 2 RAINFALL RETURN PERIOD ESTIMATES

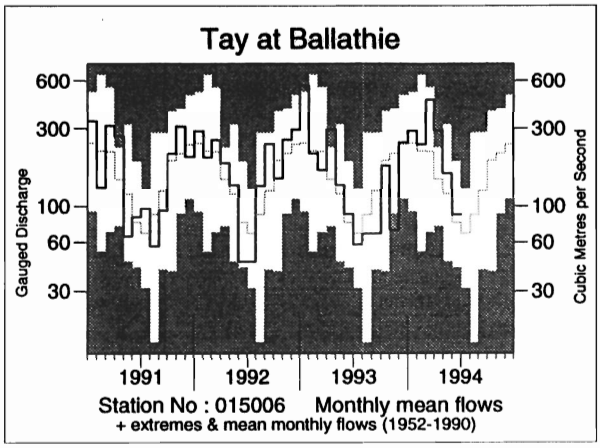
| | | Apr94-Jun94 | Est Return Period, years | Jan94-Jun94 | Est Return Period, years | Jul93-Jun94 | Est Return Period, years | Sep92-Jun94 | Est Return Period, years |
|---|---|---|---|---|---|---|---|---|---|
| England and Wales | mm | 170 | | 468 | | 1049 | | 1850 | |
| | % LTA | 90 | 2-5 | 114 | 2-5 | 117 | 5-15 | 112 | 5-10 |
| NRA REGIONS | | | | | | | | | |
| North West | mm | 256 | | 622 | | 1262 | | 2309 | |
| | % LTA | 113 | 2-5 | 120 | 5-10 | 105 | 2-5 | 104 | 2-5 |
| Northumbria | mm | 134 | | 394 | | 928 | | 1704 | |
| | % LTA | 75 | 5-10 | 101 | 2-5 | 109 | 2-5 | 109 | 5-10 |
| Severn-Trent | mm | 137 | | 376 | | 871 | | 1528 | |
| | % LTA | 79 | 2-5 | 105 | 2-5 | 116 | 5-10 | 110 | 5-10 |
| Yorkshire | mm | 137 | | 391 | | 928 | | 1631 | |
| | % LTA | 76 | 5-10 | 102 | 2-5 | 113 | 5-10 | 108 | 2-5 |
| Anglian | mm | 126 | | 295 | | 759 | | 1305 | |
| | % LTA | 87 | 2-5 | 106 | 2-5 | 127 | 30-40 | 120 | 25-40 |
| Thames | mm | 161 | | 366 | | 819 | | 1479 | |
| | % LTA | 100 | <2 | 112 | 2-5 | 119 | 5-10 | 116 | 10-15 |
| Southern | mm | 204 | | 448 | | 1021 | | 1731 | |
| | % LTA | 127 | 5-10 | 125 | 5-10 | 131 | 35-50 | 119 | 15-25 |
| Wessex | mm | 176 | | 480 | | 1066 | | 1823 | |
| | % LTA | 103 | 2-5 | 122 | 5-10 | 127 | 20-30 | 117 | 10-20 |
| South West | mm | 213 | | 697 | | 1522 | | 2615 | |
| | % LTA | 101 | 2-5 | 127 | 10-15 | 130 | 35-45 | 119 | 20-30 |
| Welsh | mm | 244 | | 734 | | 1491 | | 2663 | |
| | % LTA | 101 | 2-5 | 125 | 5-10 | 114 | 5-10 | 109 | 5 |
| Scotland | mm | 264 | | 827 | | 1518 | | 2981 | |
| | % LTA | 107 | 2-5 | 132 | 40-60 | 106 | 2-5 | 112 | 10-20 |
| RIVER PURIFICATION BOARDS | | | | | | | | | |
| Highland | mm | 351 | | 1030 | | 1786 | | 3608 | |
| | % LTA | 125 | 5-10 | 136 | 60-90 | 102 | 2-5 | 110 | 5-10 |
| North-East | mm | 139 | | 481 | | 1045 | | 1916 | |
| | % LTA | 71 | 5-10 | 110 | 2-5 | 107 | 2-5 | 107 | 2-5 |
| Tay | mm | 200 | | 743 | | 1352 | | 2660 | |
| | % LTA | 92 | 2-5 | 131 | 15-25 | 110 | 2-5 | 116 | 15-25 |
| Forth | mm | 160 | | 612 | | 1182 | | 2323 | |
| | % LTA | 79 | 5 | 124 | 10-15 | 107 | 2-5 | 113 | 10-20 |
| Tweed | mm | 137 | | 485 | | 1042 | | 1191 | |
| | % LTA | 71 | 5-10 | 111 | 2-5 | 107 | 2-5 | 112 | 5-10 |
| Solway | mm | 228 | | 733 | | 1418 | | 2754 | |
| | % LTA | 93 | 2-5 | 118 | 5-10 | 100 | <2 | 105 | 2-5 |
| Clyde | mm | 319 | | 1003 | | 1783 | | 3471 | |
| | % LTA | 119 | 2-5 | 139 | 70-100 | 105 | 2-5 | 110 | 5-10 |

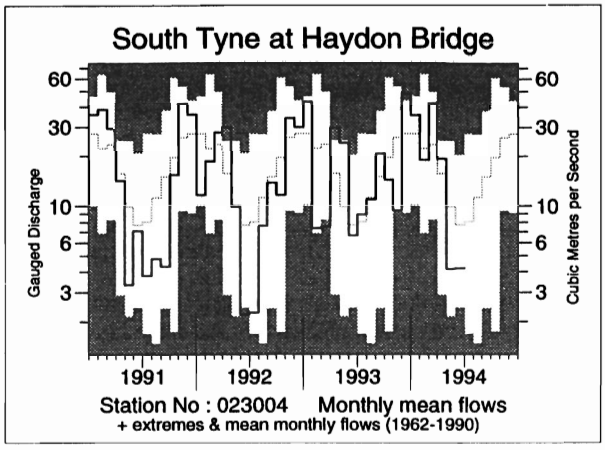
LTA refers to the period 1961-90.

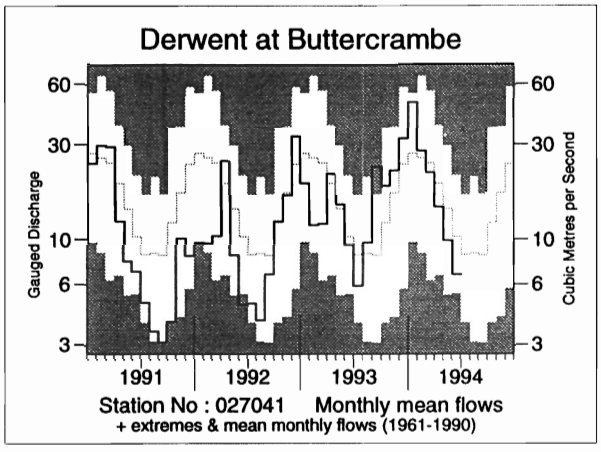
Return period assessments are based on tables provided by the Meteorological Office*. The tables reflect rainfall totals over the period 1911-70 only and the estimate assumes a sensibly stable climate. They assume a start in a specified month; return periods for a start in any month may be expected to be an order of magnitude less - for the longest durations the return period estimates converge. "Wet" return periods underlined.

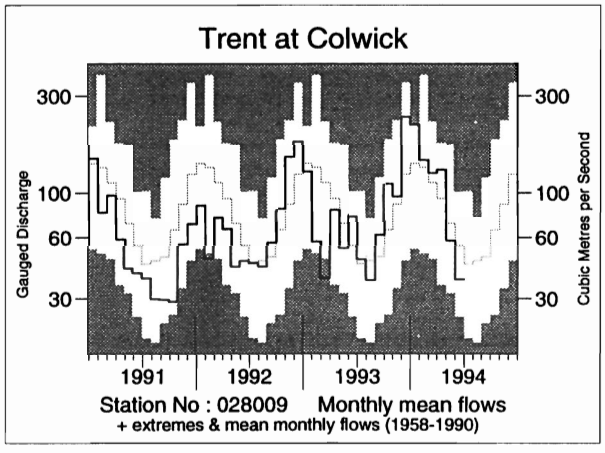
* Tabony, R.C., 1977, The Variability of long duration rainfall over Great Britain, Scientific Paper No. 37, Meteorological Office.

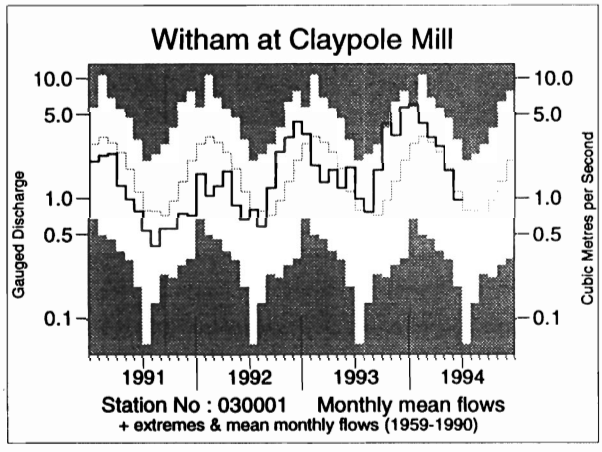
# FIGURE 1 MONTHLY RIVER FLOW HYDROGRAPHS

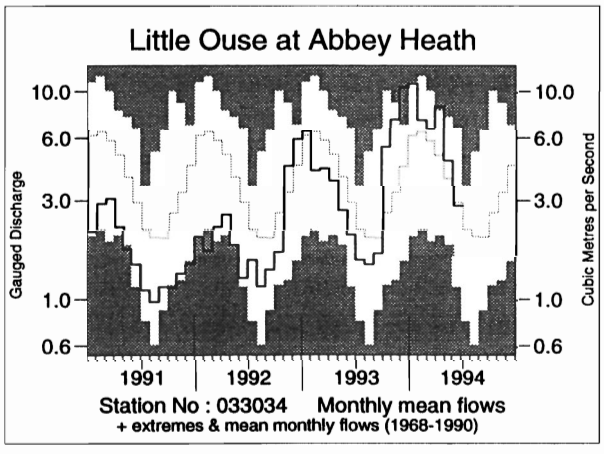


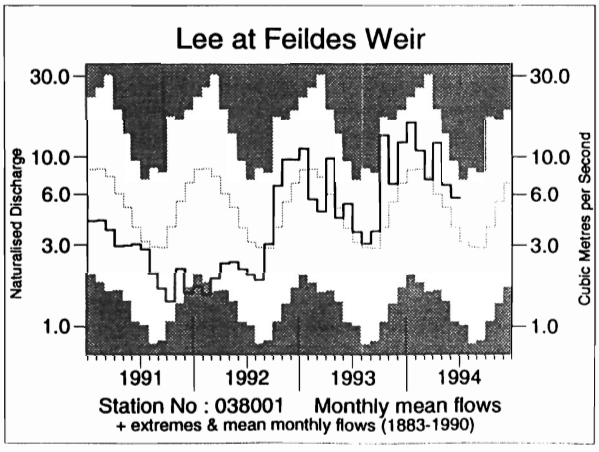



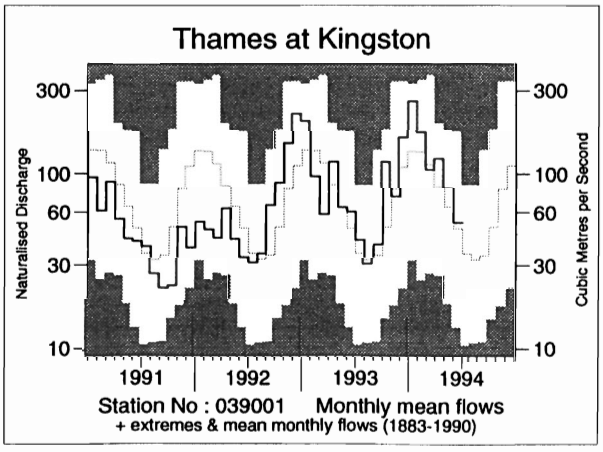



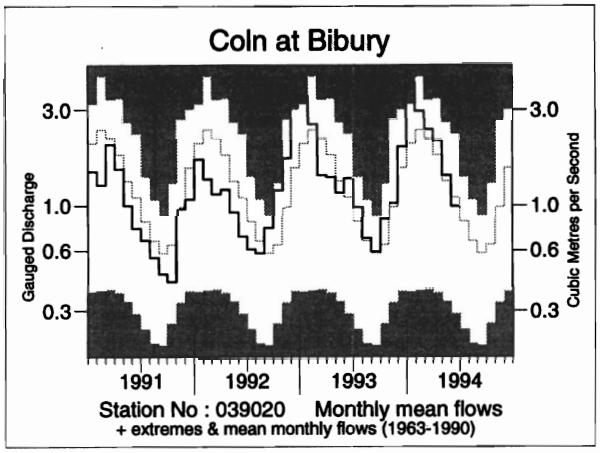



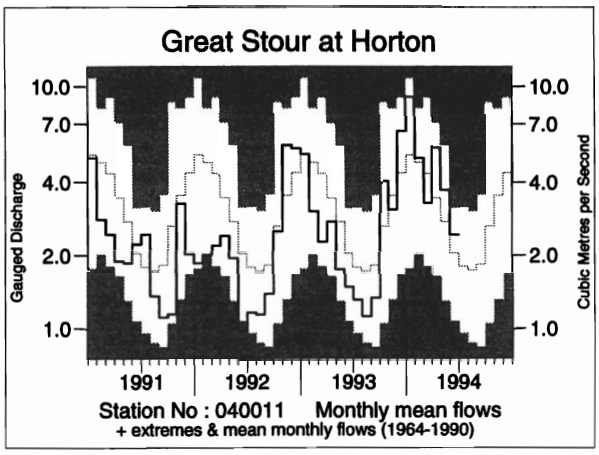



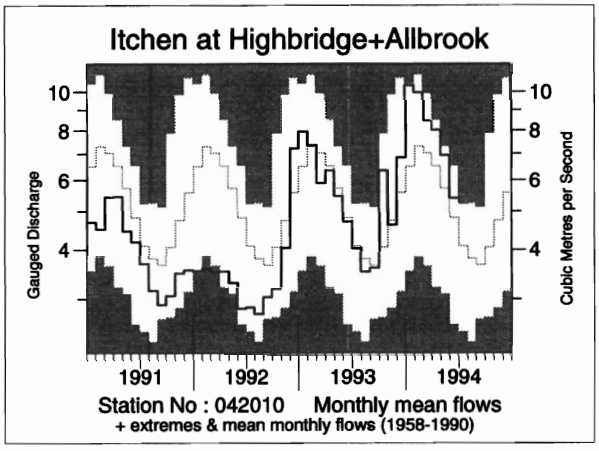



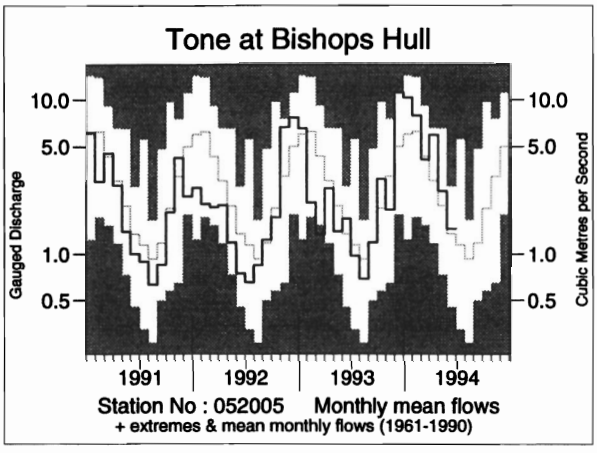



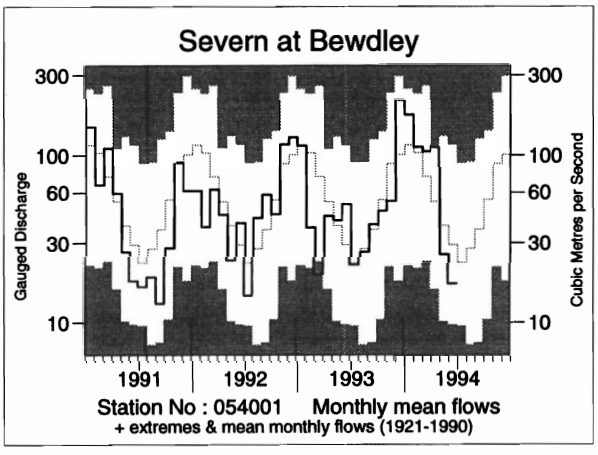



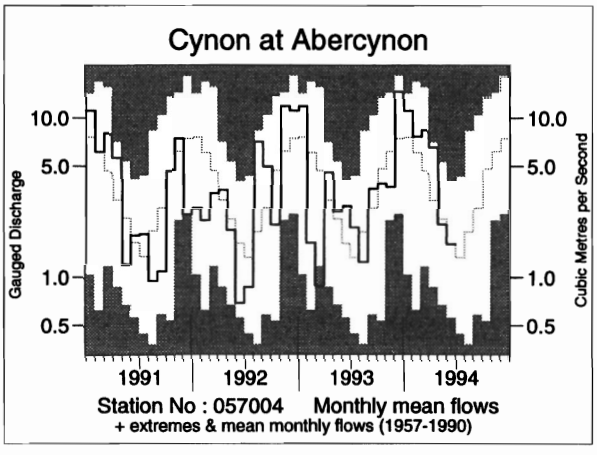

Coln at Bibury
Gauged Discharge
Cubic Metres per Second
3.0
1.0
0.6
0.3
1991
1992
1993
1994
Station No : 039020 Monthly mean flows
+ extremes & mean monthly flows (1963-1990)

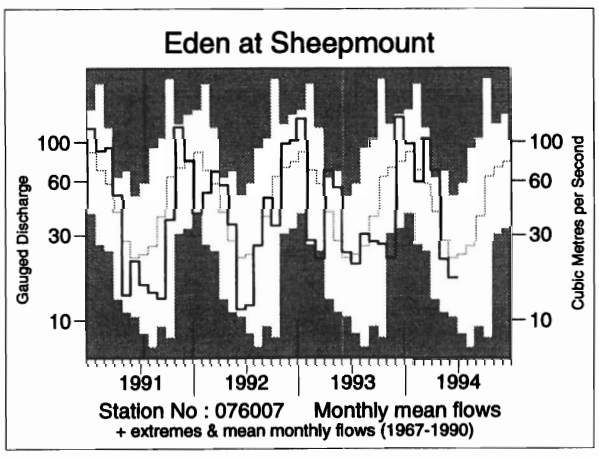

Great Stour at Horton
Gauged Discharge
Cubic Metres per Second
10.0
7.0
4.0
2.0
1.0
1991
1992
1993
1994
Station No : 040011 Monthly mean flows
+ extremes & mean monthly flows (1964-1990)

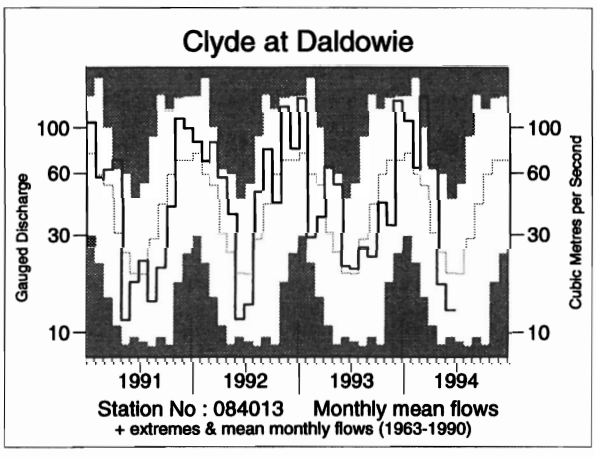

Itchen at Highbridge+Allbrook
Gauged Discharge
Cubic Metres per Second
10
8
6
4
1991
1992
1993
1994
Station No : 042010 Monthly mean flows
+ extremes & mean monthly flows (1958-1990)


Tone at Bishops Hull
Gauged Discharge
Cubic Metres per Second
10.0
5.0
1.0
0.5
1991
1992
1993
1994
Station No : 052005 Monthly mean flows
+ extremes & mean monthly flows (1961-1990)


Severn at Bewdley
Gauged Discharge
Cubic Metres per Second
300
100
60
30
10
1991
1992
1993
1994
Station No : 054001 Monthly mean flows
+ extremes & mean monthly flows (1921-1990)


Cynon at Abercynon
Gauged Discharge
Cubic Metres per Second
10.0
5.0
1.0
0.5
1991
1992
1993
1994
Station No : 057004 Monthly mean flows
+ extremes & mean monthly flows (1957-1990)


Eden at Sheepmount
Gauged Discharge
Cubic Metres per Second
100
60
30
10
1991
1992
1993
1994
Station No : 076007 Monthly mean flows
+ extremes & mean monthly flows (1967-1990)


Clyde at Daldowie
Gauged Discharge
Cubic Metres per Second
100
60
30
10
1991
1992
1993
1994
Station No : 084013 Monthly mean flows
+ extremes & mean monthly flows (1963-1990)

# TABLE 3 RUNOFF AS MM. AND AS A PERCENTAGE OF THE PERIOD OF RECORD AVERAGE WITH SELECTED PERIODS RANKED IN THE RECORD

| River/ Station name | Feb 1994 | Mar | Apr | May | Jun 1994 | | 4/94 to 6/94 | | 1/94 to 6/94 | | 7/93 to 6/94 | | 9/92 to 6/94 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | mm %LT | mm %LT | mm %LT | mm %LT | mm %LT | rank /yrs | mm %LT | rank /yrs | mm %LT | rank /yrs | mm %LT | rank /yrs | mm %LT | rank /yrs |
| Dee at Park | 64 89 | 167 178 | 96 123 | 48 78 | 24 67 | 7 /22 | 168 95 | 10 /22 | 521 119 | 21 /22 | 906 114 | 18 /21 | 1699 111 | 16 /20 |
| Tay at Ballathie | 126 110 | 268 209 | 166 194 | 94 136 | 50 113 | 29 /42 | 310 152 | 41 /42 | 873 146 | 41 /42 | 1273 112 | 35 /41 | 2645 121 | 36 /40 |
| Tweed at Boleside | 78 100 | 165 205 | 81 151 | 33 79 | 19 71 | 13 /34 | 133 106 | 22 /34 | 527 135 | 33 /34 | 903 118 | 29 /33 | 1773 122 | 32 /32 |
| Whiteadder Water at Hutton Castle | 55 114 | 51 101 | 26 67 | 14 53 | 9 52 | 4 /25 | 48 59 | 7 /25 | 266 112 | 18 /25 | 490 124 | 20 /24 | 857 113 | 16 /24 |
| South Tyne at Haydon Bridge | 61 83 | 155 182 | 67 120 | 15 43 | 15 56 | 10 /32 | 96 81 | 12 /32 | 438 117 | 27 /32 | 843 110 | 23 /30 | 1579 108 | 21 /28 |
| Wharfe at Flint Mill Weir | 64 84 | 117 152 | 73 134 | 19 50 | 15 59 | 14 /39 | 106 91 | 19 /39 | 441 120 | 32 /39 | 815 113 | 29 /38 | 1432 104 | 22 /37 |
| Derwent at Buttercrambe | 43 109 | 37 90 | 24 76 | 17 71 | 11 67 | 6 /33 | 51 73 | 8 /33 | 213 109 | 21 /33 | 399 123 | 26 /32 | 661 106 | 18 /31 |
| Trent at Colwick | 47 111 | 45 113 | 45 141 | 21 84 | 13 69 | 9 /36 | 79 104 | 24 /36 | 248 120 | 29 /36 | 458 129 | 31 /35 | 777 115 | 25 /34 |
| Lud at Louth | 48 148 | 42 123 | 38 123 | 33 128 | 22 112 | 16 /26 | 92 122 | 15 /26 | 257 149 | 23 /26 | 399 160 | 24 /25 | 573 121 | 18 /25 |
| Witham at Claypole Mill | 34 133 | 29 112 | 23 114 | 15 99 | 8 87 | 20 /36 | 47 103 | 22 /35 | 166 135 | 29 /35 | 315 170 | 33 /35 | 515 145 | 33 /34 |
| Little Ouse at Abbey Heath | 26 121 | 26 120 | 32 180 | 18 126 | 10 101 | 17 /27 | 60 142 | 22 /27 | 154 142 | 23 /26 | 262 152 | 24 /26 | 400 125 | 22 /25 |
| Colne at Lexden | 23 128 | 13 71 | 22 167 | 10 112 | 5 87 | 17 /35 | 36 133 | 30 /35 | 105 124 | 28 /35 | 195 142 | 30 /34 | 341 131 | 29 /33 |
| Lee at Feildes Weir (natr.) | 25 130 | 19 98 | 30 203 | 18 138 | 14 152 | 97 /109 | 62 167 | 99 /108 | 148 151 | 96 /108 | 258 158 | 99 /107 | 436 141 | 98 /105 |
| Thames at Kingston (natr.) | 43 129 | 29 94 | 32 145 | 23 132 | 14 109 | 79 /112 | 69 131 | 89 /112 | 212 138 | 96 /112 | 337 137 | 97 /111 | 637 135 | 101 /110 |
| Coln at Bibury | 67 127 | 61 114 | 51 121 | 35 109 | 24 93 | 17 /31 | 111 110 | 20 /31 | 341 131 | 28 /31 | 494 125 | 28 /30 | 949 126 | 28 /29 |
| Great Stour at Horton | 36 108 | 26 78 | 43 166 | 29 140 | 18 120 | 24 /29 | 90 146 | 27 /28 | 223 133 | 25 /28 | 358 123 | 23 /27 | 599 108 | 15 /25 |
| Itchen at Highbridge+Allbrook | 67 140 | 63 123 | 58 126 | 52 124 | 39 114 | 28 /36 | 148 121 | 31 /36 | 356 131 | 35 /36 | 569 124 | 33 /35 | 970 113 | 29 /34 |
| Piddle at Baggs Mill | 79 138 | 73 132 | 59 140 | 43 139 | 28 122 | 26 /31 | 131 134 | 28 /31 | 398 150 | 30 /30 | 611 150 | 29 /29 | 1017 131 | 25 /27 |
| Exe at Thorverton | 137 132 | 125 148 | 133 238 | 34 90 | 21 89 | 19 /39 | 188 157 | 34 /38 | 659 151 | 38 /38 | 1152 139 | 37 /38 | 1911 119 | 34 /37 |
| Taw at Umberleigh | 124 146 | 112 165 | 112 256 | 25 85 | 12 75 | 17 /36 | 148 163 | 33 /36 | 577 160 | 36 /36 | 1043 149 | 34 /35 | 1737 128 | 33 /34 |
| Tone at Bishops Hull | 96 131 | 55 97 | 77 201 | 34 128 | 19 110 | 22 /34 | 130 156 | 32 /34 | 419 144 | 32 /33 | 672 143 | 32 /33 | 1107 121 | 29 /32 |
| Severn at Bewdley | 63 109 | 65 141 | 67 213 | 16 68 | 10 59 | 20 /74 | 94 128 | 62 /74 | 329 133 | 68 /73 | 575 128 | 62 /73 | 972 112 | 53 /72 |
| Teme at Knightsford Bridge | 65 125 | 33 68 | 47 142 | 11 53 | 6 42 | 3 /25 | 63 95 | 12 /25 | 253 110 | 16 /24 | 444 122 | 22 /24 | 770 109 | 14 /23 |
| Cynon at Abercynon | 175 128 | 213 178 | 164 214 | 56 95 | 40 101 | 20 /36 | 260 145 | 32 /36 | 929 147 | 36 /36 | 1666 131 | 34 /34 | 3026 124 | 31 /32 |
| Dee at New Inn | 176 106 | 319 175 | 195 183 | 41 62 | 65 113 | 17 /25 | 300 126 | 18 /25 | 1097 134 | 25 /25 | 1994 111 | 21 /25 | 3512 102 | 14 /24 |
| Eden at Sheepmount | 63 85 | 122 173 | 79 168 | 26 80 | 20 79 | 11 /24 | 125 116 | 16 /24 | 424 119 | 21 /24 | 732 106 | 13 /22 | 1441 110 | 15 /20 |
| Clyde at Daldowie | 81 106 | 199 259 | 91 203 | 24 70 | 18 67 | 10 /31 | 133 121 | 23 /31 | 564 150 | 30 /31 | 959 122 | 27 /30 | 1891 126 | 29 /29 |
| Carron at New Kelso | 84 40 | 451 158 | 300 213 | 56 56 | 183 250 | 16 /16 | 540 167 | 16 /16 | 1439 126 | 13 /16 | 2345 91 | 4 /15 | 4878 99 | 6 /14 |
| Ewe at Poolewe | 159 86 | 326 163 | 264 190 | 119 120 | 124 170 | 22 /24 | 507 160 | 24 /24 | 1251 128 | 20 /24 | 2089 97 | 10 /23 | 4567 111 | 18 /22 |

Notes:
(i) Values based on gauged flow data unless flagged (natr.), when naturalised data have been used.
(ii) Values are ranked so that lowest runoff is rank 1.
(iii) %LT means percentage of long term average from the start of the record to 1992. For the long periods (at the right of this table), the end date for the long term is 1993.

## TABLE 4 START-MONTH RESERVOIR STORAGES UP TO JULY 1994

| Area | Reservoir (R)/ Group (G) | | Capacity● (Ml) | 1994 Feb | Mar | Apr | May | June | July | 1993 July |
|---|---|---|---|---|---|---|---|---|---|---|
| North West | Northern Command Zone[1] | (G) | 133375 | 97 | 93 | 100 | 97 | 85 | 73 | 77 |
| | Vyrnwy | (R) | 55146 | 100 | 100 | 100 | 94 | 87 | 79 | 89 |
| Northumbria | Teesdale[2] | (G) | 87936 | 97 | 96 | 100 | 99 | 83 | 72 | 80 |
| | Kielder | (R) | 199175* | 98* | 91* | 96* | 93* | 92* | 93* | 91* |
| Severn-Trent | Clywedog | (R) | 44922 | 100 | 98 | 99 | 96 | 93 | 93 | 93 |
| | Derwent Valley[3] | (G) | 39525 | 100 | 99 | 100 | 97 | 90 | 78 | 79 |
| Yorkshire | Washburn[4] | (G) | 22035 | 100 | 98 | 100 | 94 | 89 | 68 | 96 |
| | Bradford supply[5] | (G) | 41407 | 99 | 98 | 98 | 96 | 83 | 66 | 93 |
| Anglian | Grafham | (R) | 58707 | 93 | 98 | 91 | 96 | 96 | 94 | 81 |
| | Rutland | (R) | 130061 | 96 | 97 | 96 | 96 | 95 | 93 | 80 |
| Thames | London[6] | (G) | 207569 | 87 | 87 | 89 | 89 | 88 | 86 | 95 |
| | Farmoor [7] | (G) | 13843 | 98 | 99 | 98 | 98 | 98 | 95 | 96 |
| Southern | Bewl | (R) | 28170 | 100 | 92 | 100 | 100 | 100 | 98 | 91 |
| | Ardingly | (R) | 4685 | 100 | 100 | 100 | 100 | 100 | 100 | 99 |
| Wessex | Clatworthy | (R) | 5364 | 100 | 100 | 100 | 99 | 84 | 85 | 91 |
| | Bristol W [8] | (G) | 38666* | 88* | 99* | 99* | 98* | 94* | 85* | 76* |
| South West | Colliford | (R) | 28540 | 100 | 100 | 100 | 100 | 96 | 87 | 87 |
| | Roadford | (R) | 34500 | 98 | 97 | 100 | 97 | 92 | 87 | 82 |
| | Wimbleball[9] | (R) | 21320 | 100 | 100 | 100 | 99 | 99 | 92 | 89 |
| | Stithians | (R) | 5205 | 100 | 100 | 100 | 96 | 93 | 82 | 99 |
| Welsh | Celyn + Brenig | (G) | 131155 | 100 | 100 | 100 | 99 | 97 | 94 | 100 |
| | Brianne | (R) | 62140 | 100 | 100 | 100 | 100 | 96 | 90 | 98 |
| | Big Five[10] | (G) | 69762 | 99 | 99 | 100 | 97 | 93 | 89 | 89 |
| | Elan Valley[11] | (G) | 99106 | 100 | 100 | 100 | 99 | 95 | 91 | 97 |
| Lothian | Edinburgh/Mid Lothian | (G) | 97639 | 97 | 94 | 99 | 98 | 93 | 84 | 96 |
| | West Lothian | (G) | 5613 | 99 | 96 | 99 | 100 | 91 | 77 | 99 |
| | East Lothian | (G) | 10206 | 97 | 99 | 98 | 99 | 95 | 86 | 99 |

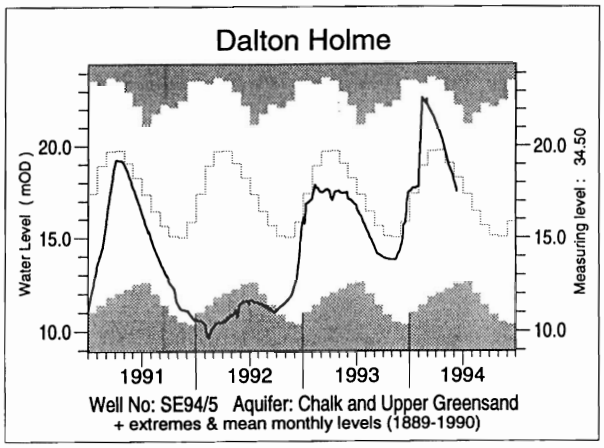
● Live or usable capacity (unless indicated otherwise)

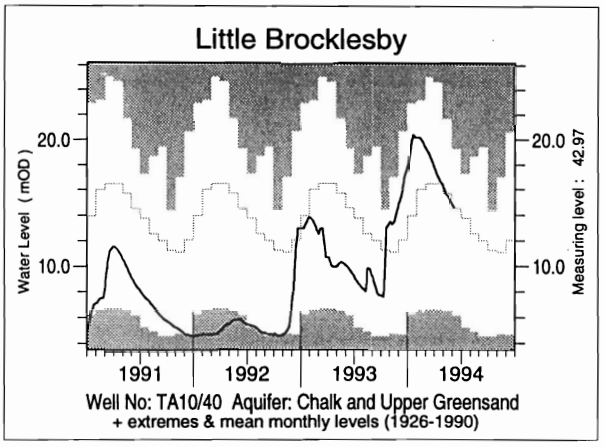
* Gross storage/percentage of gross storage

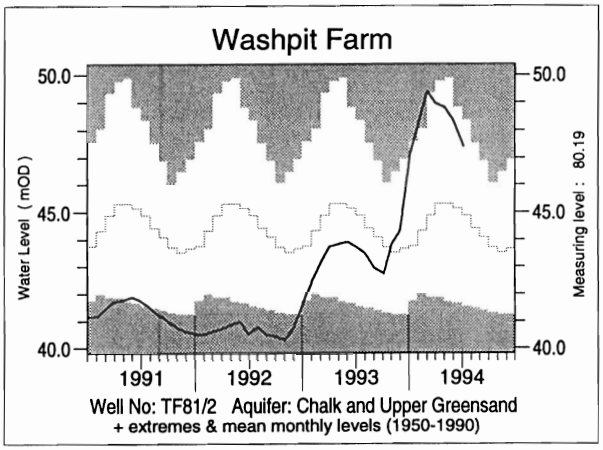
1. Includes Haweswater, Thirlmere, Stocks and Barnacre.
2. Cow Green, Selset, Grassholme, Balderhead, Blackton and Hury.
3. Howden, Derwent and Ladybower.
4. Swinsty, Fewston, Thruscross and Eccup.
5. The Nidd/Barden group (Scar House, Angram, Upper Barden, Lower Barden and Chelker) plus Grimwith.
6. Lower Thames (includes Queen Mother, Wraysbury, Queen Mary, King George VI and Queen Elizabeth II) and Lee Valley (includes King George and William Girling) groups - pumped storages.
7. Farmoor 1 and 2 - pumped storages.
8. Blagdon, Chew Valley and others.
9. Shared between South West (river regulation for abstraction) and Wessex (direct supply).
10. Usk, Talybont, Llandegfedd (pumped storage), Taf Fechan, Taf Fawr.
11. Claerwen, Caban Coch, Pen y Garreg and Craig Goch.

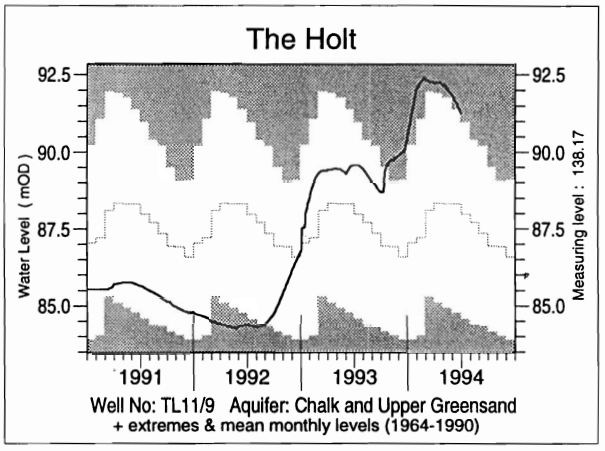
Note: Variations in storage depend on the balance between inputs (from catchment rainfall and any pumping) and outputs (to supply, compensation flow, HEP, amenity). There will be additional losses due to evaporation, especially in the summer months. Operational strategies for making the most efficient use of water stocks will further affect reservoir storages. Table 4 provides a link between the hydrological conditions described elsewhere in the report and the water resources situation.

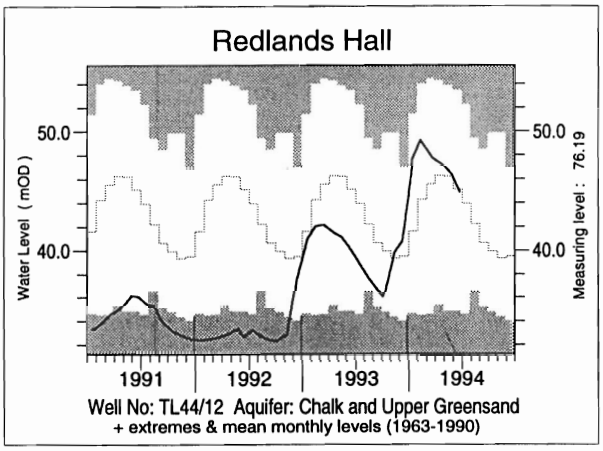
# FIGURE 2 GROUNDWATER LEVEL HYDROGRAPHS

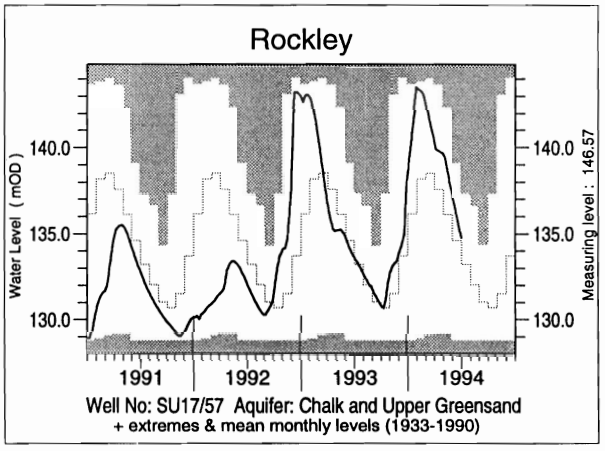


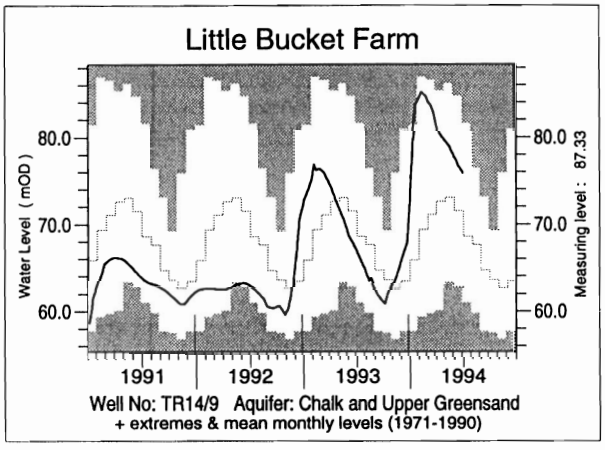



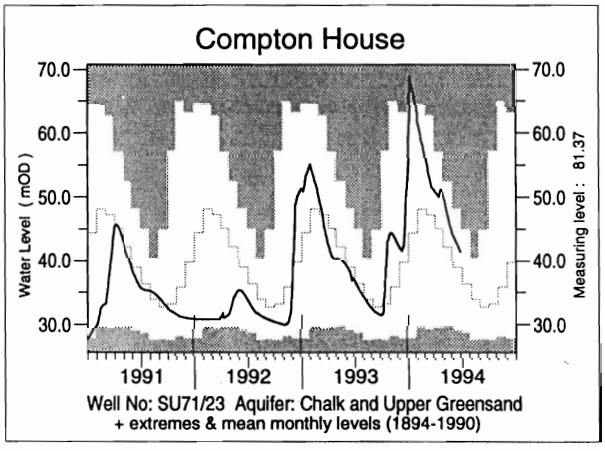



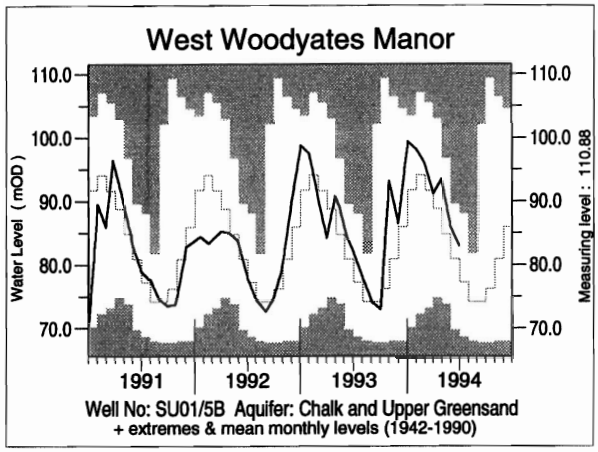



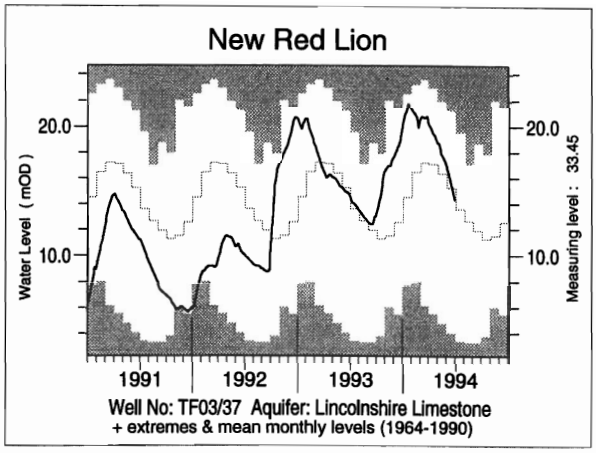



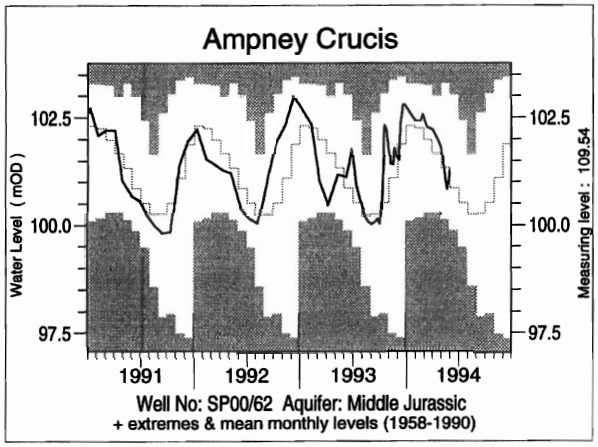



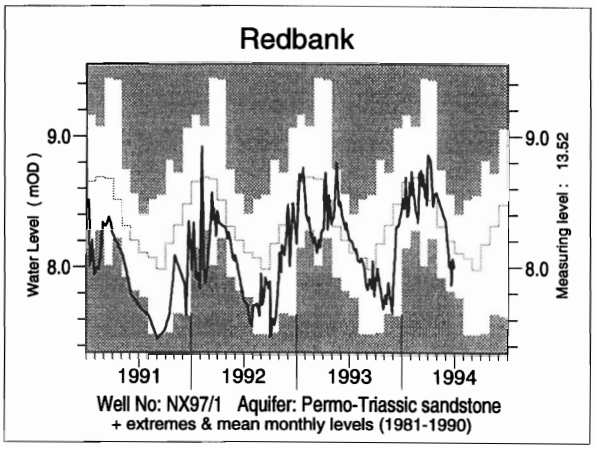



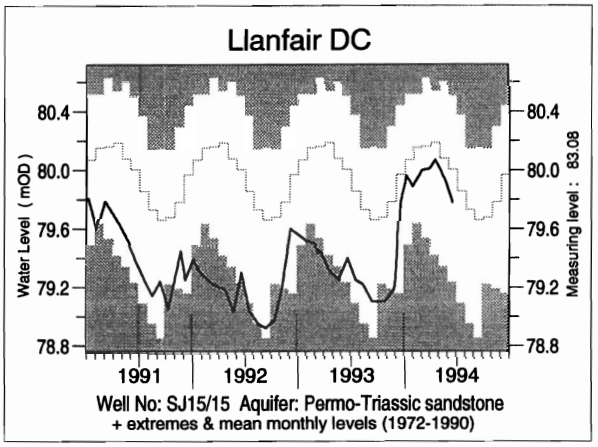



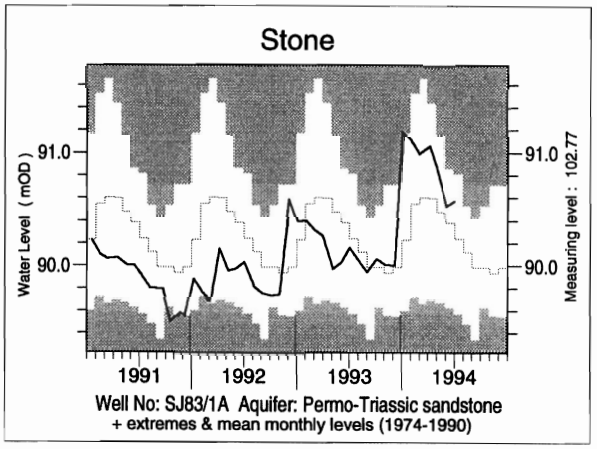

West Woodyates Manor
Water Level ( mOD )
Measuring level : 110.88
110.0
100.0
90.0
80.0
70.0
1991
1992
1993
1994
Well No: SU01/5B Aquifer: Chalk and Upper Greensand
+ extremes & mean monthly levels (1942-1990)

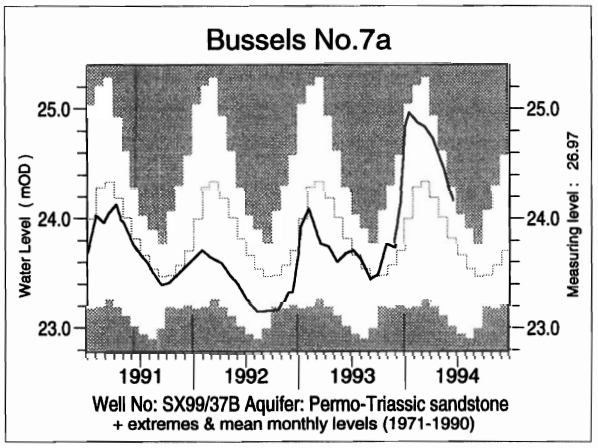

New Red Lion
Water Level ( mOD )
Measuring level : 33.45
20.0
10.0
1991
1992
1993
1994
Well No: TF03/37 Aquifer: Lincolnshire Limestone
+ extremes & mean monthly levels (1964-1990)

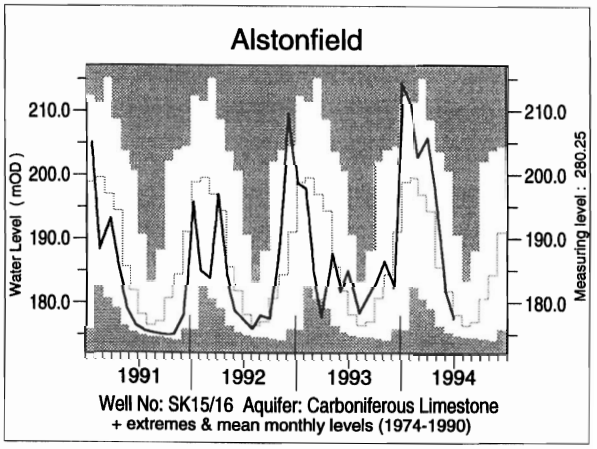

Ampney Crucis
Water Level ( mOD )
Measuring level : 109.54
102.5
100.0
97.5
1991
1992
1993
1994
Well No: SP00/62 Aquifer: Middle Jurassic
+ extremes & mean monthly levels (1958-1990)


Redbank
Water Level ( mOD )
Measuring level : 13.52
9.0
8.0
1991
1992
1993
1994
Well No: NX97/1 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1981-1990)


Llanfair DC
Water Level ( mOD )
Measuring level : 83.08
80.4
80.0
79.6
79.2
78.8
1991
1992
1993
1994
Well No: SJ15/15 Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1972-1990)


Stone
Water Level ( mOD )
Measuring level : 102.77
91.0
90.0
1991
1992
1993
1994
Well No: SJ83/1A Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1974-1990)


Bussels No.7a
Water Level ( mOD )
Measuring level : 26.97
25.0
24.0
23.0
1991
1992
1993
1994
Well No: SX99/37B Aquifer: Permo-Triassic sandstone
+ extremes & mean monthly levels (1971-1990)


Alstonfield
Water Level ( mOD )
Measuring level : 280.25
210.0
200.0
190.0
180.0
1991
1992
1993
1994
Well No: SK15/16 Aquifer: Carboniferous Limestone
+ extremes & mean monthly levels (1974-1990)

## TABLE 5 A COMPARISON OF JUNE GROUNDWATER LEVELS: 1993 AND 1994

| Site | Aquifer | Records commence | Minimum June | Average June | Maximum June | June 1993 | | June/July 1994 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | <1994 | <1994 | <1994 | day | level | day | level |
| Dalton Holme | C & UGS | 1889 | 11.40 | 18.29 | 22.23 | 29/06 | 16.79 | 24/06 | 16.63 |
| Wetwang | C & UGS | 1971 | 18.97 | 21.83 | 27.95 | 24/06 | 21.33 | 24/06 | 20.50 |
| Little Brocklesby | C & UGS | 1926 | 5.57 | 13.76 | 19.28 | 30/06 | 9.24 | 09/06 | 14.60 |
| Washpit Farm | C & UGS | 1950 | 40.96 | 45.04 | 48.84 | 03/06 | 43.91 | 06/07 | 47.40 |
| The Holt | C & UGS | 1964 | 84.33 | 87.98 | 91.41 | 27/06 | 89.57 | 01/07 | 91.29 |
| Therfield Rectory | C & UGS | 1883 | dry <71.6 | 81.86 | 98.77 | 27/06 | 79.97 | 30/06 | 85.97 |
| Redlands Hall | C & UGS | 1964 | 32.64 | 44.18 | 53.46 | 11/06 | 40.16 | 24/06 | 44.84 |
| Rockley | C & UGS | 1933 | dry <128.94 | 134.54 | 139.11 | 27/06 | 133.72 | 20/06 | 135.59 |
| Little Bucket Farm | C & UGS | 1971 | 62.83 | 70.92 | 84.75 | 18/06 | 67.70 | 30/06 | 75.88 |
| Compton House | C & UGS | 1984 | 29.06 | 38.22 | 48.28 | 23/06 | 37.38 | 29/06 | 41.44 |
| Chilgrove House | C & UGS | 1836 | 36.91 | 46.23 | 58.52 | 30/06 | 44.96 | 29/06 | 48.77 |
| West Dean No.3 | C & UGS | 1940 | 1.11 | 1.64 | 2.38 | 25/06 | 1.69 | 24/06 | 2.10 |
| Lime Kiln Way | C & UGS | 1969 | 123.97 | 125.29 | 126.03 | 15/06 | 124.34 | 17/06 | 125.76 |
| Ashton Farm | C & UGS | 1974 | 64.78 | 67.81 | 69.79 | 28/06 | 66.67 | 30/06 | 68.09 |
| West Woodyates Manor | C & UGS | 1942 | 69.78 | 81.03 | 89.58 | 28/06 | 82.23 | 30/06 | 82.92 |
| New Red Lion | LLst | 1964 | 4.11 | 14.86 | 21.28 | 25/06 | 14.78 | 27/06 | 14.34 |
| Ampney Crucis | Mid Jur | 1958 | 99.87 | 100.86 | 103.03 | 27/06 | 101.77 | 01/07 | 100.54 |
| Dunmurry (NI) | PTS | 1985 | 27.23 | 28.01 | 28.66 | 30/06 | 27.23 | 27/06 | 27.41 |
| Yew Tree Farm | PTS | 1973 | 13.01 | 13.51 | 13.87 | 29/06 | 13.53 | 30/06 | 13.48 |
| Llanfair D.C | PTS | 1972 | 79.23 | 79.86 | 80.51 | 22/06 | 79.40 | 15/06 | 79.78 |
| Morris Dancers | PTS | 1969 | 31.89 | 32.48 | 33.61 | 08/06 | 31.89 | 11/07 | 32.35 |
| Weeford Flats | PTS | 1966 | dry <88.61 | 90.09 | 91.58 | 02/06 | 89.06 | 05/07 | 90.04 |
| Stone | PTS | 1974 | 89.63 | 90.33 | 90.87 | 04/06 | 90.03 | 05/07 | 90.58 |
| Skirwith | PTS | 1978 | 130.06 | 130.53 | 130.93 | 28/06 | 130.34 | 30/06 | 130.14 |
| Redbank | PTS | 1981 | 7.79 | 8.16 | 8.56 | 30/06 | 8.21 | 30/06 | 8.00 |
| Bussels No.7A | PTS | 1972 | 23.01 | 23.81 | 24.28 | 10/06 | 23.68 | 22/06 | 24.16 |
| Rushyford NE | MgLst | 1967 | 65.22 | 72.58 | 76.60 | 30/06 | 75.66 | 21/06 | 76.60 |
| Peggy Ellerton | MgLst | 1968 | 31.38 | 34.30 | 36.78 | 07/06 | 31.79 | 22/06 | 33.55 |
| Alstonfield | CLst | 1974 | 175.45 | 181.22 | 200.66 | 04/06 | 181.67 | 05/07 | 177.61 |

groundwater levels are in metres above Ordnance Datum

| | | | |
|---|---|---|---|
| C & UGS | Chalk and Upper Greensand | Mid Jur | Middle Jurassic limestones |
| LLst | Lincolnshire Limestone | MgLst | Magnesian Limestone |
| PTS | Permo-Triassic sandstones | CLst | Carboniferous Limestone |

Note: Table 5 has been redesigned to include both monthly minimum and monthly maximum levels.

**FIGURE 3 LOCATION MAP OF GAUGING STATIONS AND GROUNDWATER INDEX WELLS**