# Monthly water situation report

## England

### Summary – March 2022

It has been the driest March across England since 2012, with the majority of areas being classed as normal or below normal for the time of year. With slightly drier conditions than would be expected, soil moisture deficits grew across the country and at the end of March soils were generally drier than average for the time of year. River flows decreased at almost all the indicator sites we report on, with the majority of sites classed as normal for the time of year. End of March groundwater levels were classed as normal at the majority of sites we report on. Reservoir stocks saw a mixed month with half of the reservoirs and reservoir groups we report on recording an increase in stocks, while the other half remained the same or decreased.

### Rainfall

The March rainfall total for England was 42mm which represents 63% of the 1961-1990 long term average (LTA) (72% of the 1991-2020 LTA). Around a fifth of catchments received less than half the average rainfall during March, with the lowest monthly totals seen across north-west England. (Figure 1.1)

Monthly rainfall totals were classed as normal for the time of year in the majority of catchments across the England. In the north-west where rainfall totals were lowest, most catchments were below normal for the time of year, and six catchments were notably low. It has been the driest March across England for 10 years. The south-east and east were also drier than expected with many catchments below normal for the time of year.

The three month cumulative totals are mixed across the country, with the far south-east and far north-east both notably low, with surrounding areas being below normal. In contrast some units in the north were above normal, although the majority were normal. Six month cumulative rainfall totals were below average in the south-west and south-east, where Cuckmere and Pevensey Levels (East Sussex) are both notably low, while the north-west is mostly above normal (Figure 1.2)

At a regional scale, March totals were normal for east, central, south east and south west England. In the North east it was below normal. (Figure 1.3)

### Soil moisture deficit

At the end of March, soil moisture deficits (SMD) were greater than the long term average LTA for the time of year for most of the country meaning soils were drier than would be typically be expected, although the north east was closer to the LTA than elsewhere (Figure 2.2).

With slightly drier conditions than would be expected during March, soil moisture deficits grew across the country particularly in the second half of the month. (Figure 2.1)

### River flows

Following a drier than average month for much of the country, March monthly mean river flows decreased at 70% of the indicator sites we report on compared to February. More than three quarters of sites across England were classed as normal for the time of year. Nine sites were classed as below normal for the time of year, including four in the north of England that were previously above normal or higher in February. (Figure 3.1)

At four of the regional index sites monthly mean flows were normal for the time of year. The Great Stour in the south-east and South Tyne in the north-east were both below normal, while the River Lune at Caton was notably low. (Figure 3.2)

### Groundwater levels

Groundwater levels rose at more than three quarters of the reported indicator sites during March. At the end of March groundwater levels were classed as normal for the time of year at 17 of the indicator sites reported on.

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Five sites in the south were below normal, including Houndean Bottom (Brighton Chalk), Clanville Gate (Test Chalk), Stonor Estate (South West Chilterns Chalk) and Tilshead (Upper Hampshire Avon Chalk). (Figures 4.2)

Three sites remained notably high or exceptionally high for the time of year having been in the same bands in February. This included Priors Heyes (West Cheshire Sandstone) in the north-west which is recovering from the effects of historic abstraction which makes recent levels appear high compared to the historic record. In the north-west, Skirtwith in the Eden Valley Sandstone was above normal having recovered quickly from below normal levels at the end of February. (Figures 4.1)

At the major aquifer index sites March groundwater levels were mixed, from below normal in the Burford Jurassic Limestone at Jackaments Bottom, to notably high at Weir Farm in the Bridgnorth Sandstone. The Chalk index sites were all normal for the time of year, except Stonor Park in the South West Chilterns which was below normal.

## Reservoir storage

At the end of March reservoir stocks had increased at half of the reservoirs and reservoir groups we report on, with all seeing an increase of less than 10% of total capacity. 11 reservoirs and reservoir groups recorded a decrease in stocks in March, with the largest being a 12% decrease at Derwent Valley in Derbyshire. (Figure 5.1)

End of month reservoir stocks were classed as above normal or notably high at a quarter of reported reservoir sites. 13 reservoirs or reservoir groups were classed as normal for the time of year, and 10 were classed as below normal. (Figure 5.2)

At a regional scale, total reservoir stocks were above 90% across the country, with the south-east having the highest stocks at 96%. Total reservoir stocks for England were at 93% of total capacity at the end of March.

## Forward look

Showery conditions are forecast for the first half of April however from the middle of the month and towards the end of April high pressure should remain dominant, with spells of dry weather and below average precipitation becoming increasingly likely.
From April to June, the 3-month period is likely to be warmer than normal, with a slightly increased chance of it being wetter than normal. There is an increased chance of windy conditions at the beginning of the period[1].

**Projections for river flows at key sites[2]**
By the end of September 2022 and March 2023 the majority of modelled sites have a greater than expected chance of cumulative river flows being normal or lower for the time of year.

For scenario based projections of cumulative river flows at key sites by September 2022 see Figure 6.1
For scenario based projections of cumulative river flows at key sites by March 2023 see Figure 6.2
For probabilistic ensemble projections of cumulative river flows at key sites by September 2022 see Figure 6.3
For probabilistic ensemble projections of cumulative river flows at key sites by March 2023 see Figure 6.4

**Projections for groundwater levels in key aquifers[2]**
By the end of September 2022 the majority of modelled sites have a greater than expected chance of normal or lower groundwater levels for the time of year. By the end of March 2023 there is a slightly higher chance of above normal groundwater levels at the majority of sites.

For scenario based projections of groundwater levels in key aquifers in September 2022 see Figure 6.5
For scenario based projections of groundwater levels in key aquifers in March 2023 see Figure 6.6
For probabilistic ensemble projections of groundwater levels in key aquifers in September 2022 see Figure 6.7
For probabilistic ensemble projections of groundwater levels in key aquifers in March 2023 see Figure 6.8

**Authors:** **National Water Resources Hydrology Team**

1 Source: Met Office
2 Information produced by the Hydrological Outlook, a partnership between UK Centre for Ecology and Hydrology, British Geological Survey, Met Office, Environment Agency and other devolved agencies.


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## Rainfall

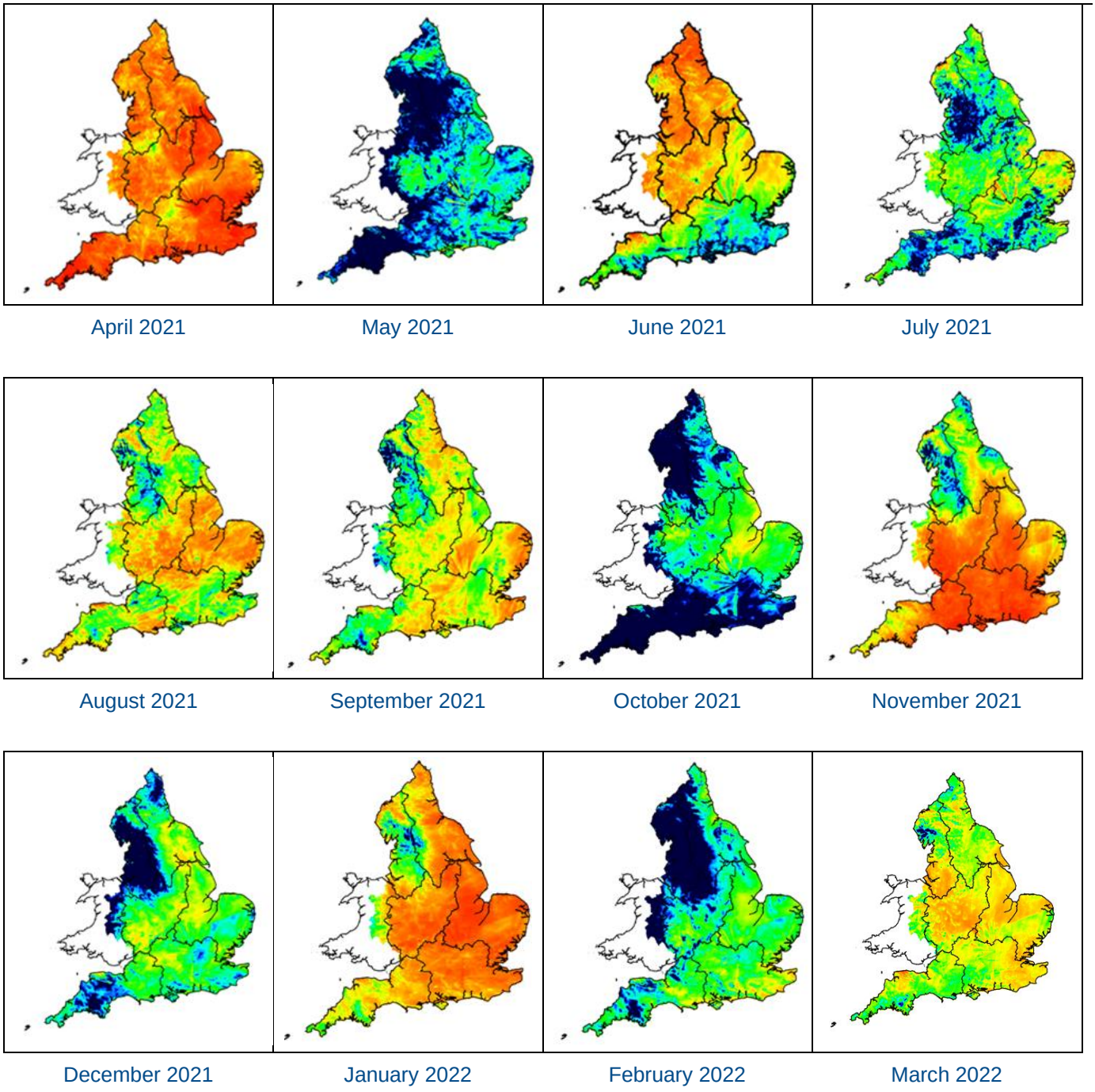


**Figure 1.1**: Monthly rainfall across England and Wales for the past 12 months. UKPP radar data (Source: Met Office © Crown Copyright, 2022). Note: Radar beam blockages in some regions may give anomalous totals in some areas. Crown copyright. All rights reserved. Environment Agency, 100024198, 2022.


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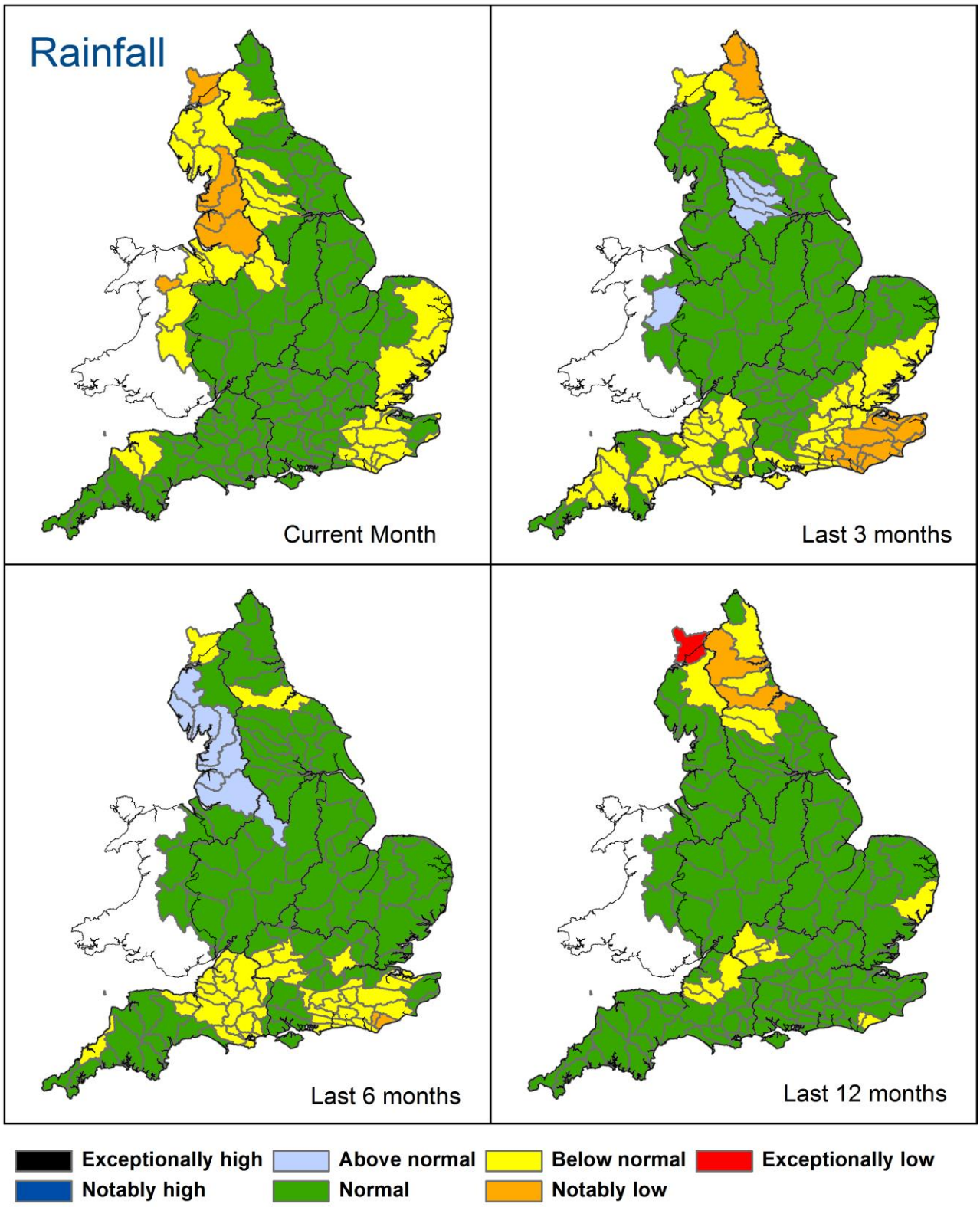


**Figure 1.2**: Total rainfall for hydrological areas across England for the current month (up to 31 March), the last 3 months, the last 6 months, and the last 12 months, classed relative to an analysis of respective historic totals. HadUK data based on the Met Office 1km gridded rainfall dataset derived from rain gauges *(Source: Met Office © Crown Copyright, 2022).* Provisional data based on Environment Agency 1km gridded rainfall dataset derived from Environment Agency intensity rain gauges. Crown copyright. All rights reserved. Environment Agency, 100024198, 2022.


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## Rainfall charts

Above average rainfall

Below average rainfall

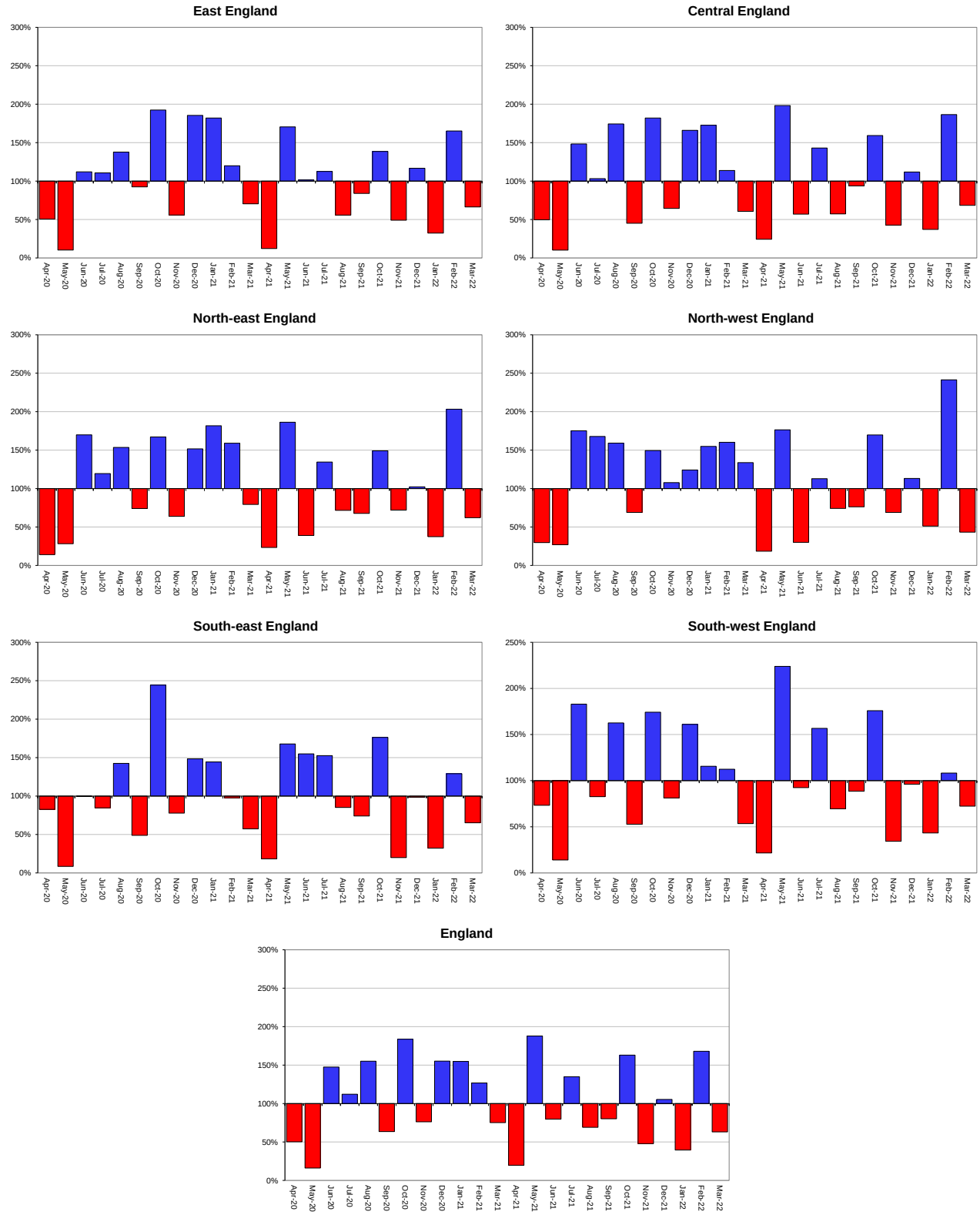


**Figure 1.3**: Monthly rainfall totals for the past 24 months as a percentage of the 1961 to 1990 long term average for each region and for England. HadUK rainfall data. (Source: Met Office © Crown Copyright, 2022).


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# Soil moisture deficit

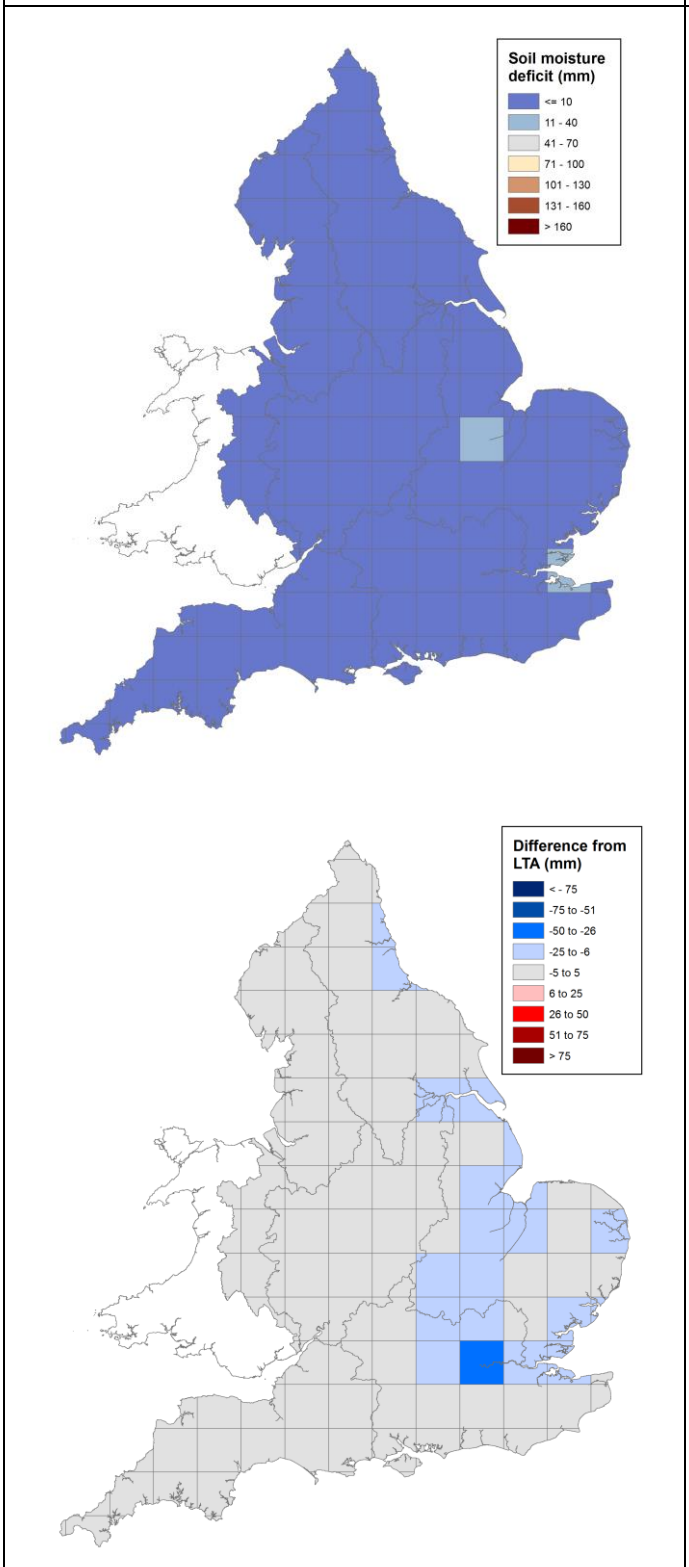
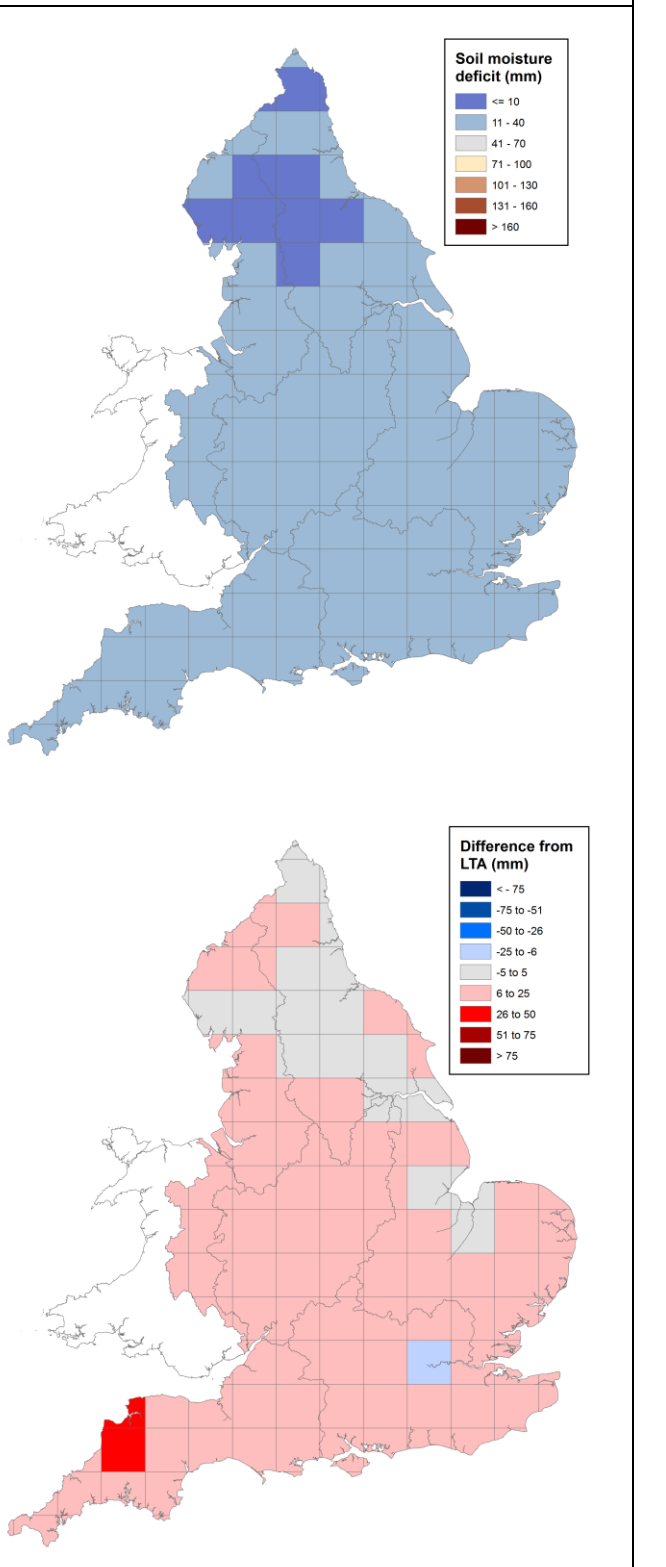
| End of February 2022[1] | End of March 2022[2] |
|---|---|
|  |  |



**Figure 2.1**: Soil moisture deficits for weeks ending 01 March 2022 [1] (left panel) and 29 March 2022 [2] (right panel). Top row shows actual soil moisture deficits (mm) and bottom row shows the difference (mm) of the actual from the 1961 to 90 long term average soil moisture deficits. MORECS data for real land use (Source: Met Office © Crown Copyright, 2022). Crown copyright. All rights reserved. Environment Agency, 100024198, 2022

# Soil moisture deficit charts

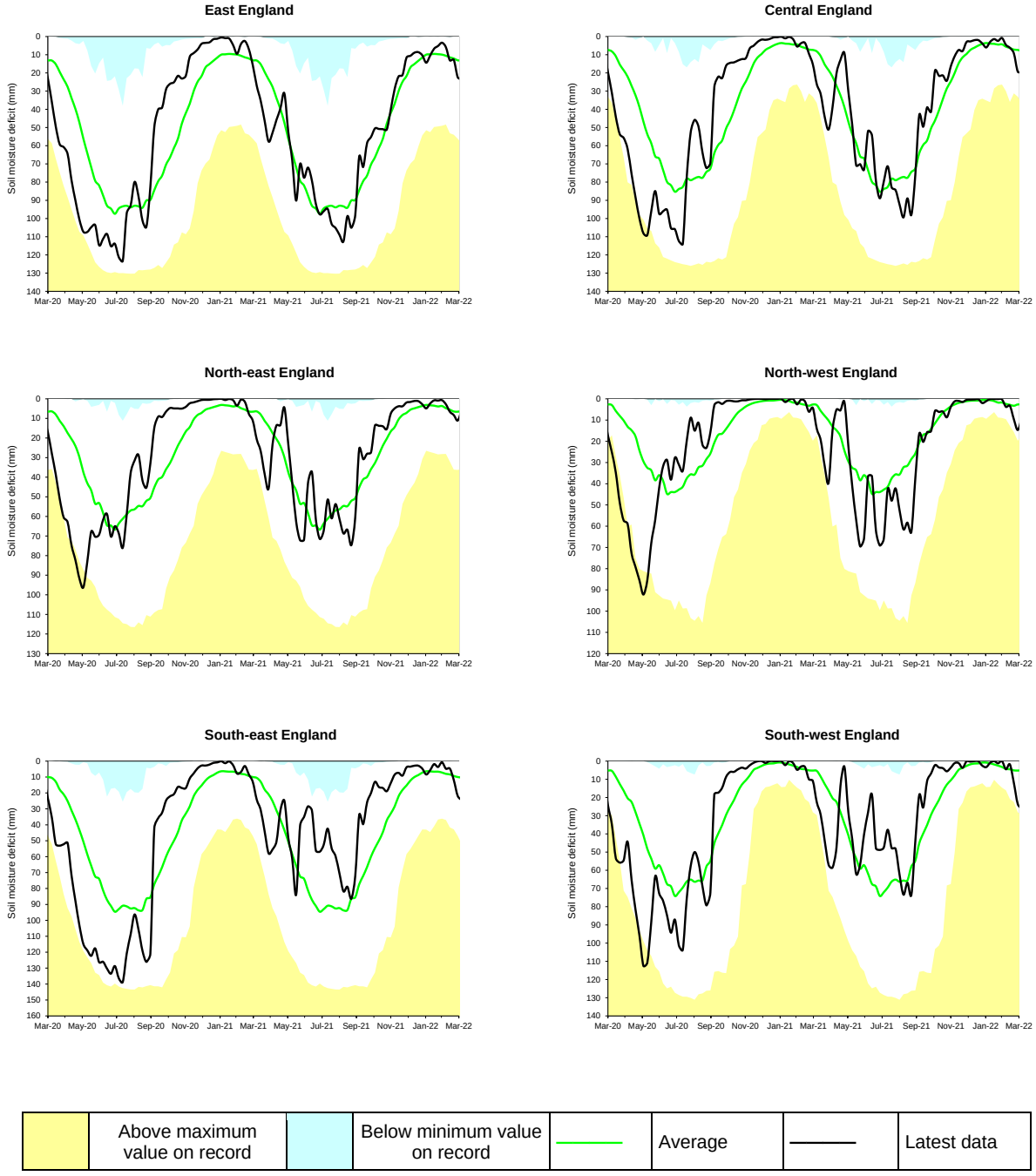



**Figure 2.2**: Latest soil moisture deficits for all geographic regions compared to maximum, minimum and 1961 to 90 long term average. Weekly MORECS data for real land use. (Source: Met Office © Crown Copyright, 2022).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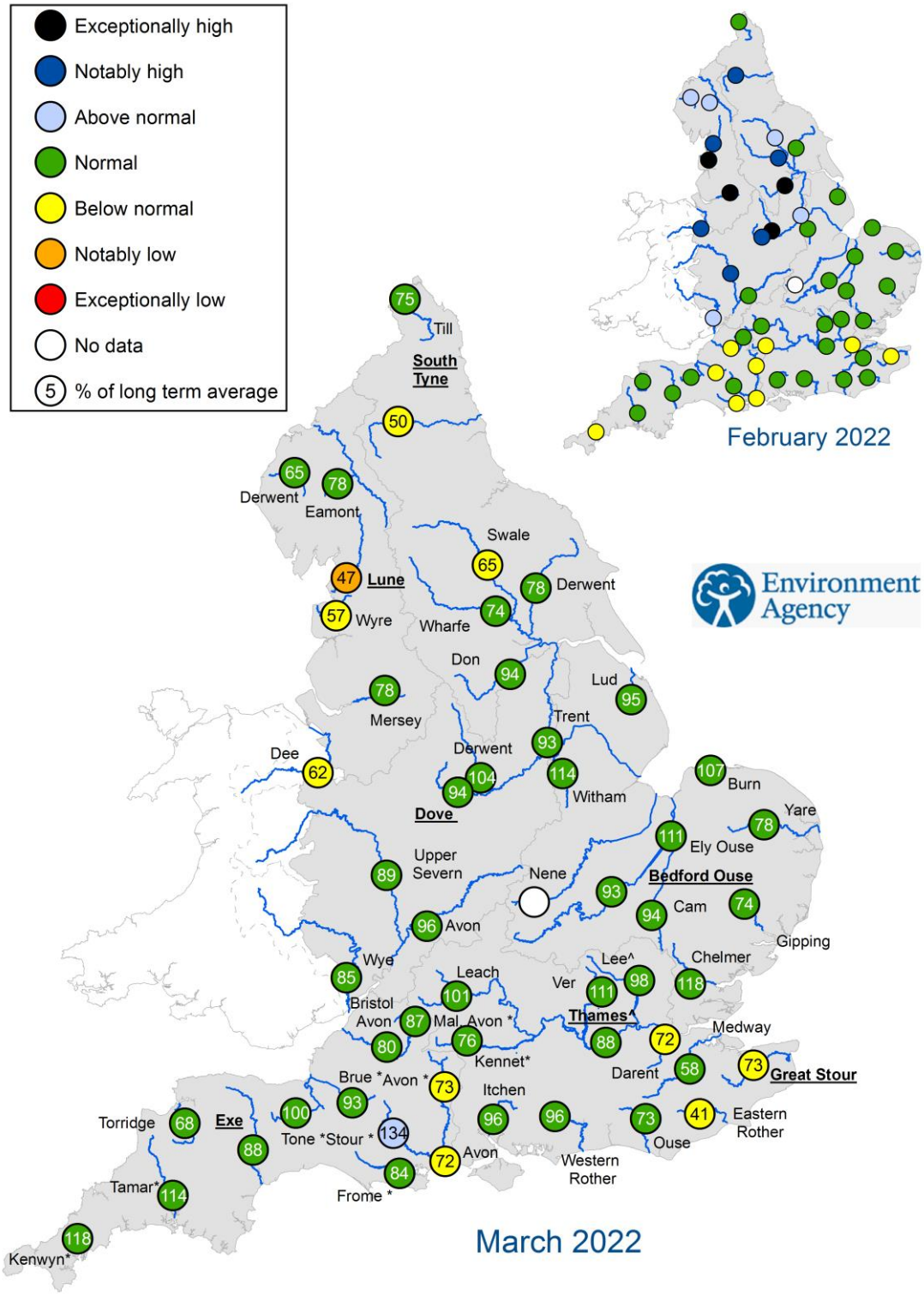
# River flows




^ "Naturalised" flows are provided for the River Thames at Kingston and the River Lee at Feildes Weir

+/- Monthly mean flow is the highest/lowest on record for the current month (note that record length varies between sites)

* Flows may be overestimated at these sites – data should be treated with caution

Underlined sites are regional index sites and are shown on the hydrographs in Figure 3.2

**Figure 3.1**: Monthly mean river flow for indicator sites for February 2022 and March 2022, expressed as a percentage of the respective long term average and classed relative to an analysis of historic February and March monthly means (Source: Environment Agency). Crown copyright. All rights reserved. Environment Agency, 100024198, 2022.

## River flow charts

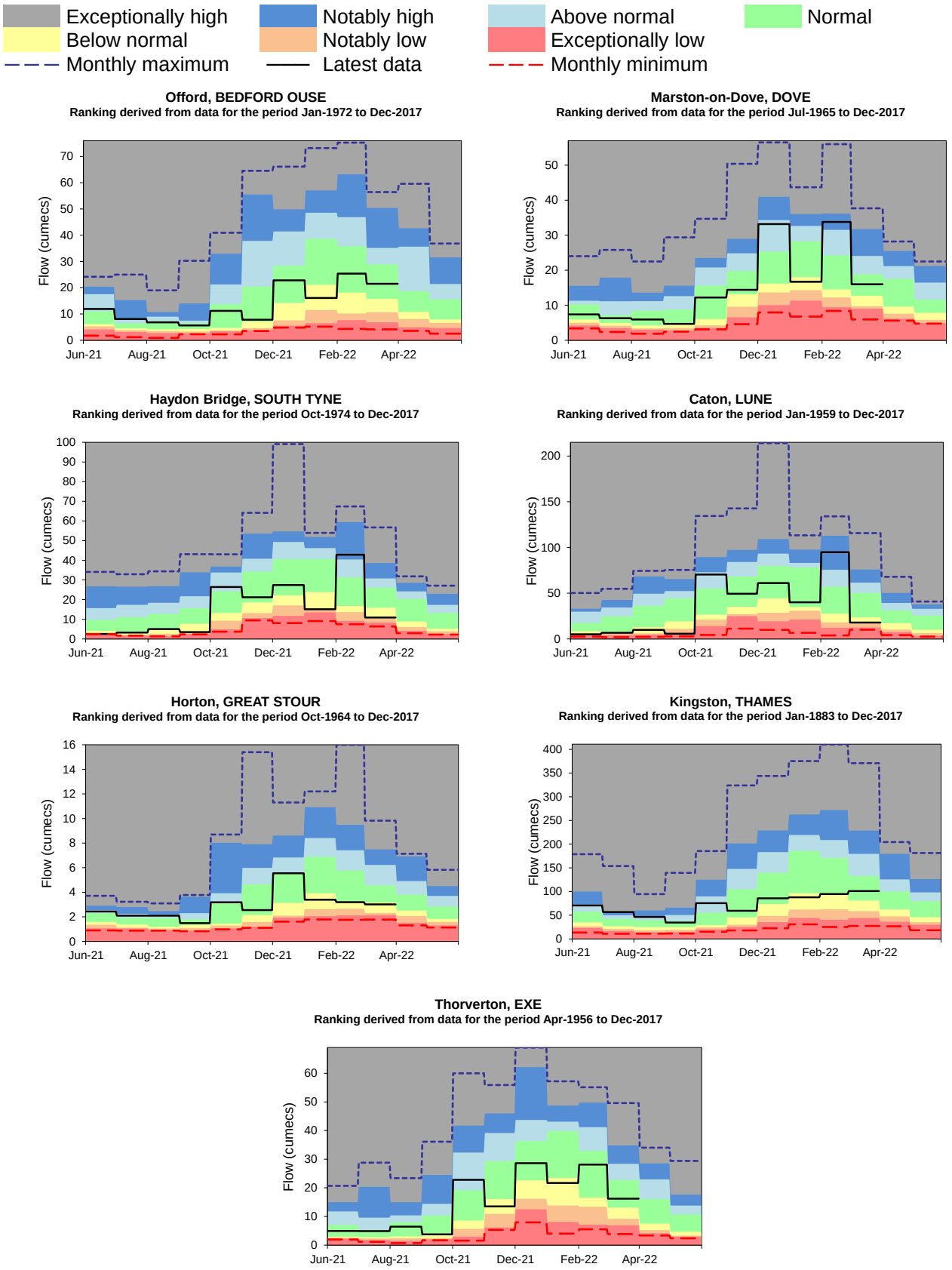



**Figure 3.2**: Index river flow sites for each geographic region. Monthly mean flow compared to an analysis of historic monthly mean flows, long term maximum and minimum flows. (Source: Environment Agency).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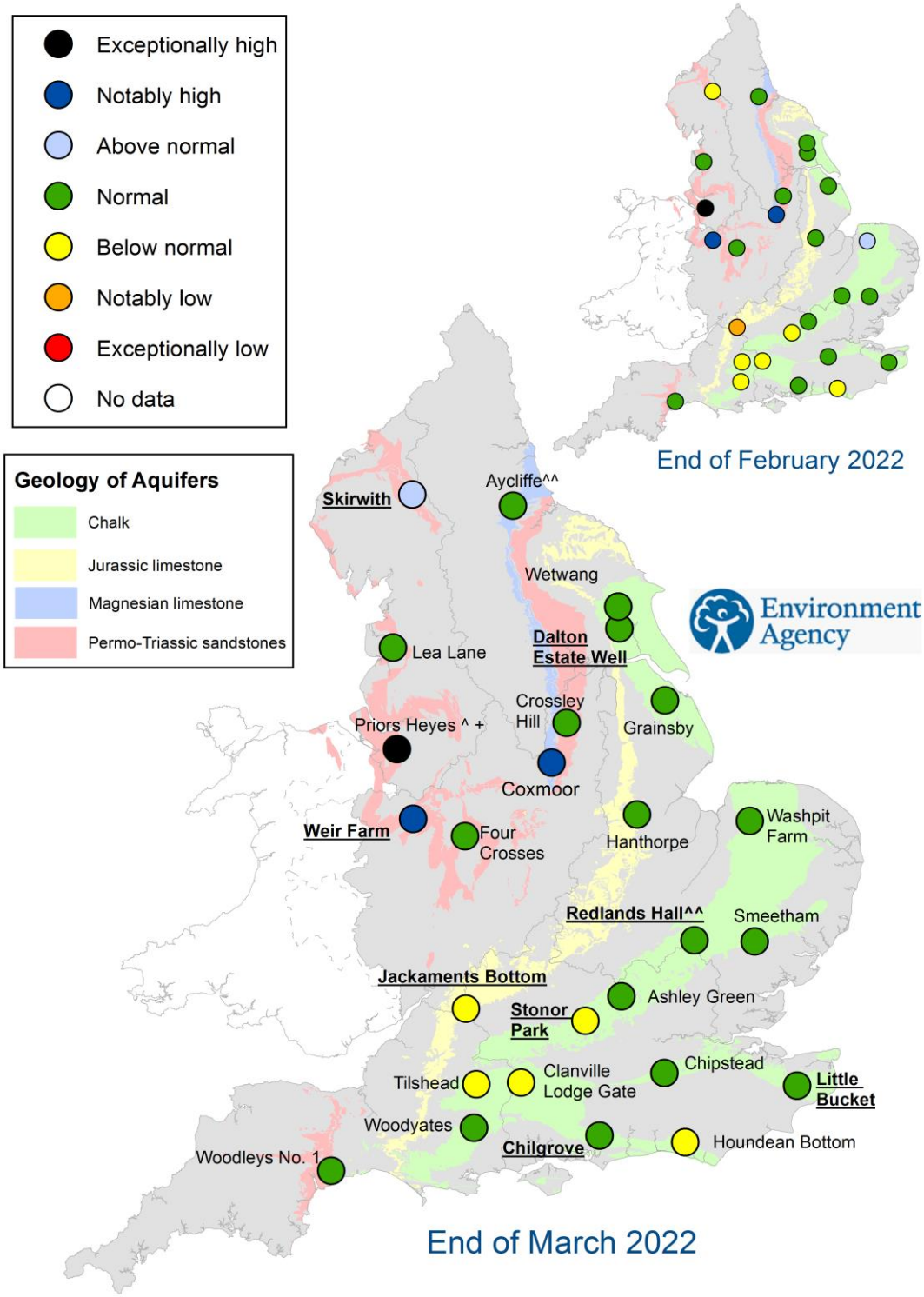
# Groundwater levels




^ The level at Priors Heyes remains high compared to historic levels because the aquifer is recovering from the effects of historic abstraction
^^ Sites are manually dipped at different times during the month. They may not be fully representative of levels at the month end
+/- End of month groundwater level is the highest/lowest on record for the current month (note that record length varies between sites). Underlined sites are major aquifer index sites and are shown in the groundwater level charts in Figure 4.2

**Figure 4.1**: Groundwater levels for indicator sites at the end of February 2022 and March 2022, classed relative to an analysis of respective historic February and March levels (Source: Environment Agency). Geological map reproduced with kind permission from UK Groundwater Forum, BGS © NERC. Crown copyright. All rights reserved. Environment Agency, 100024198, 2022.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## Groundwater level charts

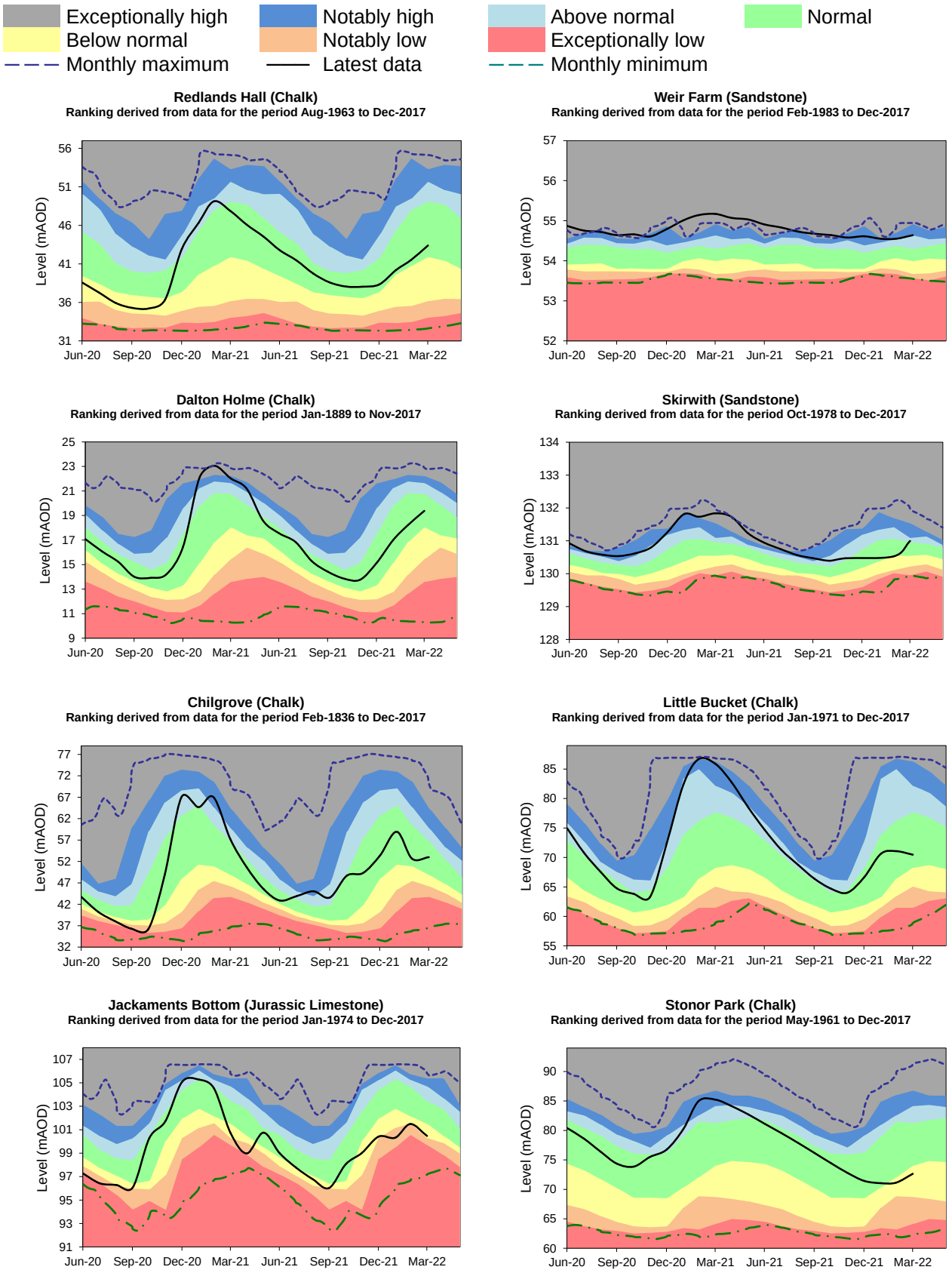


**Figure 4.2**: Index groundwater level sites for major aquifers. End of month groundwater levels months compared to an analysis of historic end of month levels and long term maximum and minimum levels. (Source: Environment Agency, 2022).


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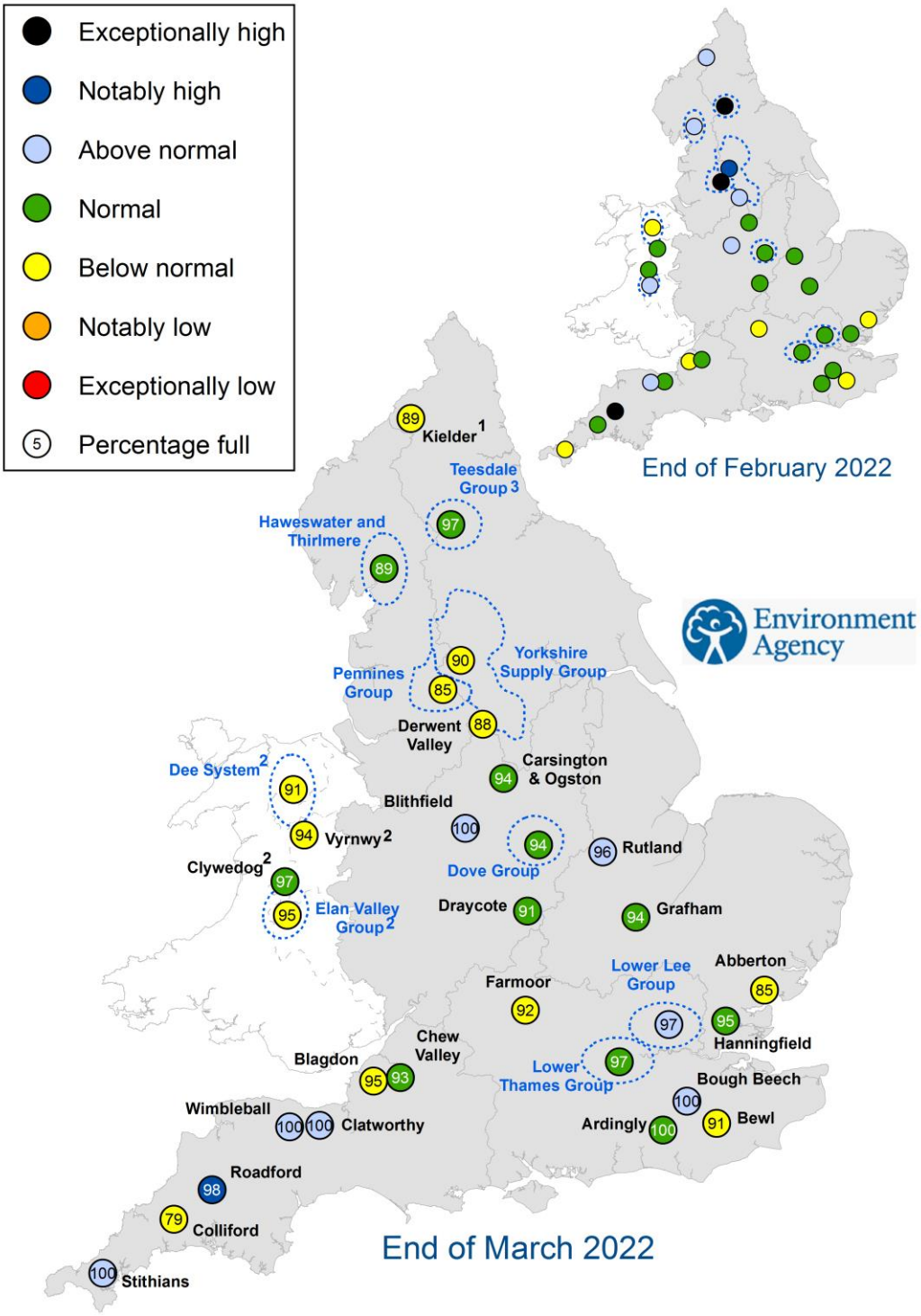
# Reservoir storage




1. Current levels at Kielder are lower than historical levels due to the implementation of a new flood alleviation control curve
2. Vyrnwy, Clywedog and Elan Valley reservoirs are located in Wales but provide a water resource to Central and north-west England

**Figure 5.1**: Reservoir stocks at key individual and groups of reservoirs at the end of February 2022 and March 2022 as a percentage of total capacity and classed relative to an analysis of historic February and March values respectively (Source: Water Companies). Note: Classes shown may not necessarily relate to control curves or triggers for drought actions. As well as for public water supply, some reservoirs are drawn down to provide flood storage, river compensation flows or for reservoir safety inspections. In some cases current reservoir operating rules may differ from historic ones. Crown copyright. All rights reserved. Environment Agency, 100024198, 2022.

# Reservoir storage charts

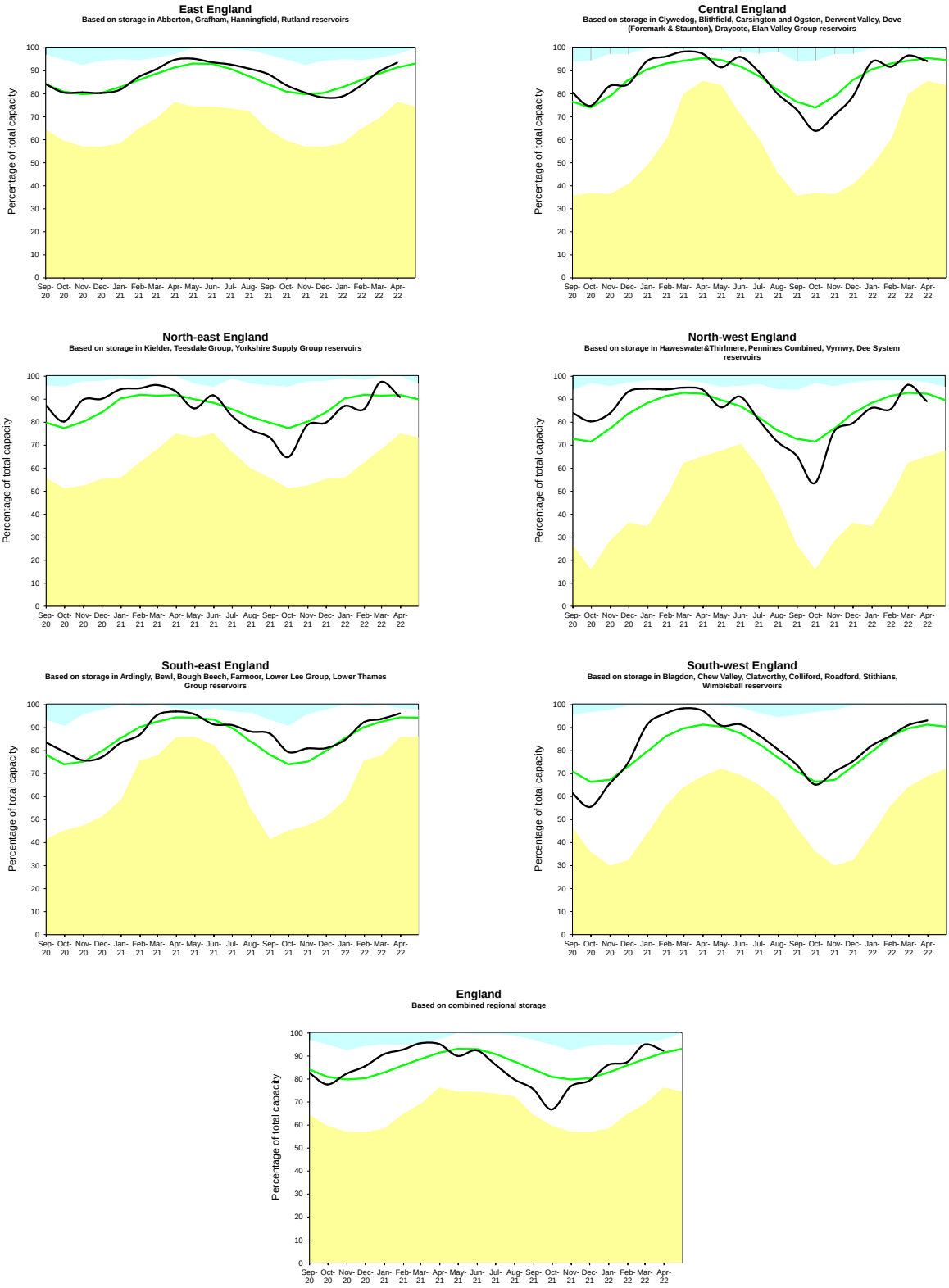



**Figure 5.2**: Regional reservoir stocks. End of month reservoir stocks compared to long term maximum, minimum and average stocks (Source: Water Companies). Note: Historic records of individual reservoirs/reservoir groups making up the regional values vary in length.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# Forward look: river flow

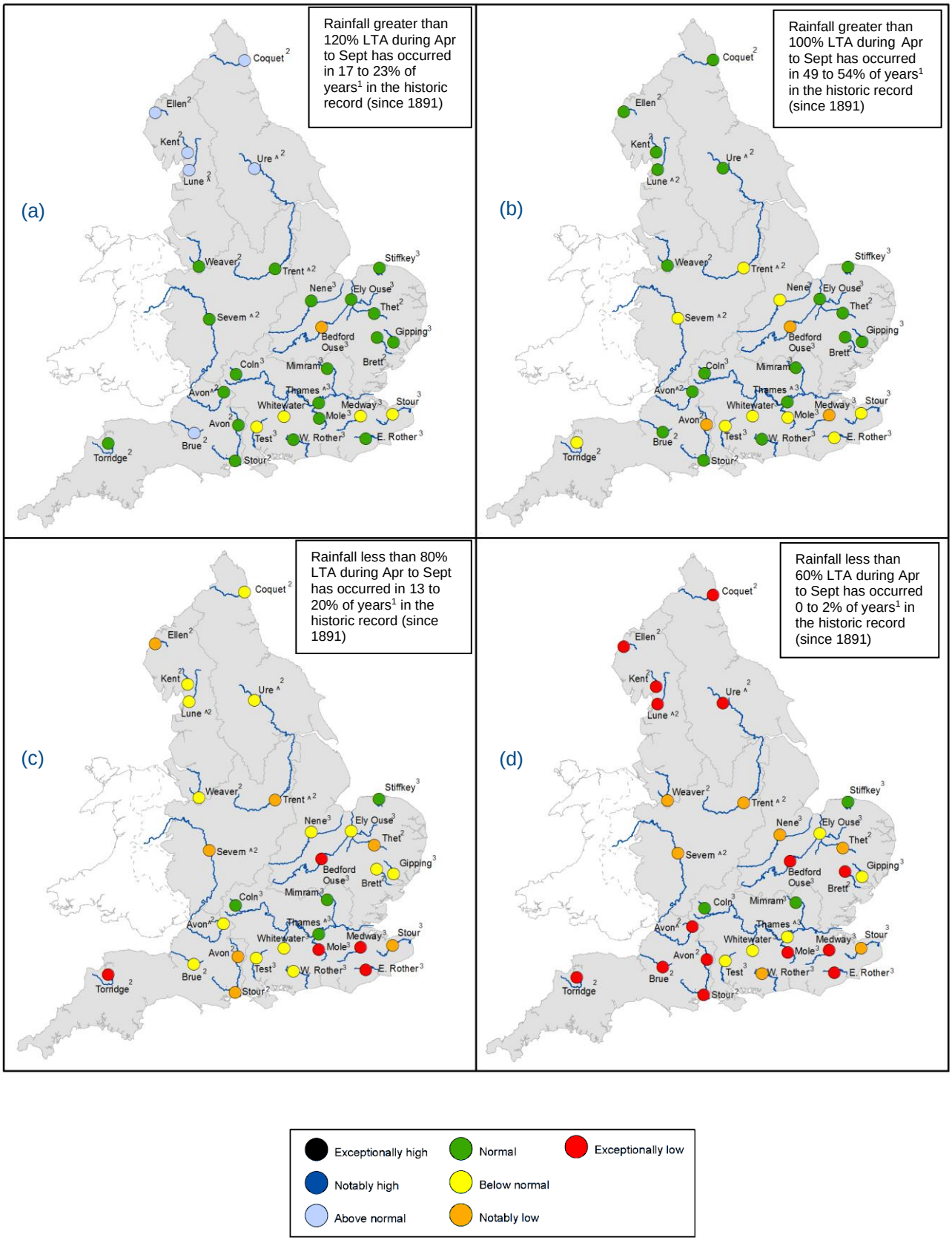


**Figure 6.1**: Projected river flows at key indicator sites up until the end of September 2022. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between April 2022 and September 2022 (Source: UK Centre for Ecology and Hydrology, Environment Agency)

[1] This range of probabilities is a regional analysis
[2] Projections for these sites are produced by UK CEH
[3] Projections for these sites are produced by the Environment Agency
^ *"Naturalised" flows are projected for these sites*


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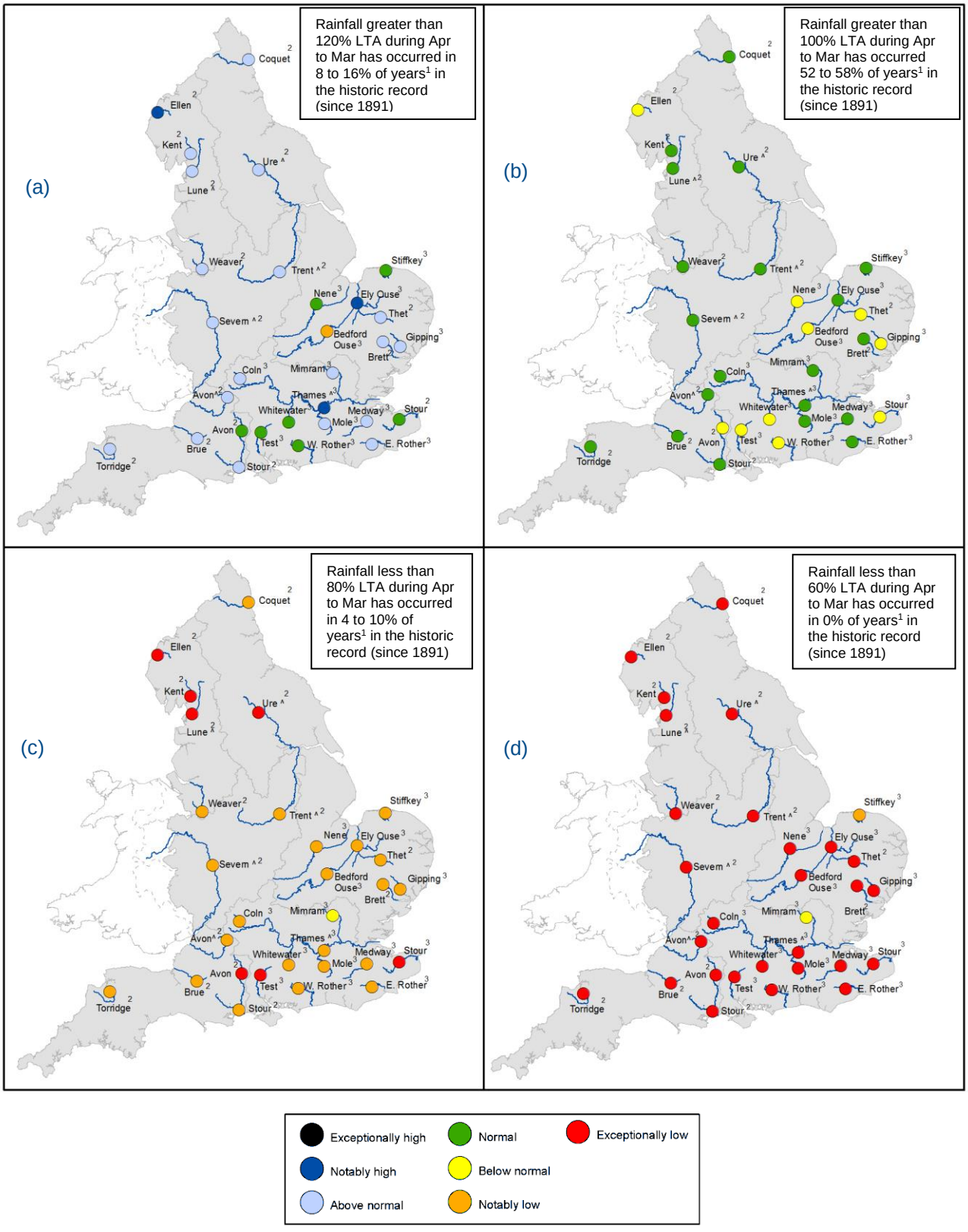


**Figure 6.2**: Projected river flows at key indicator sites up until the end of March 2023. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between April 2022 and March 2023 (Source: UK Centre for Ecology and Hydrology, Environment Agency)

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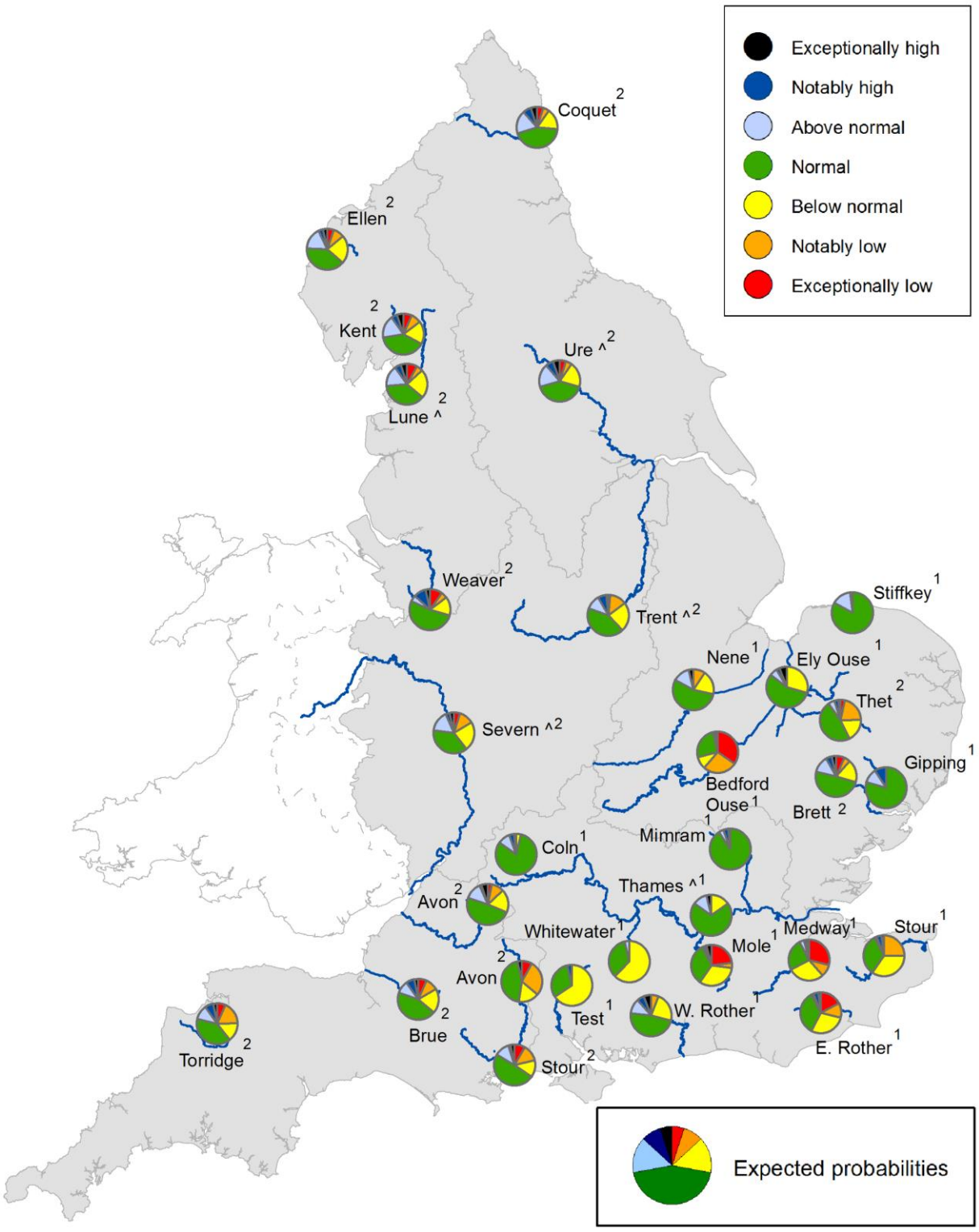


*Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are those which would typically occur 44% of the time within the historic record.*

**Figure 6.3**: Probabilistic ensemble projections of river flows at key indicator sites up until the end of September 2022. Pie charts indicate probability, based on climatology, of the surface water flow at each site being e.g. exceptionally low for the time of year. (Source: UK Centre for Ecology and Hydrology, Environment Agency).

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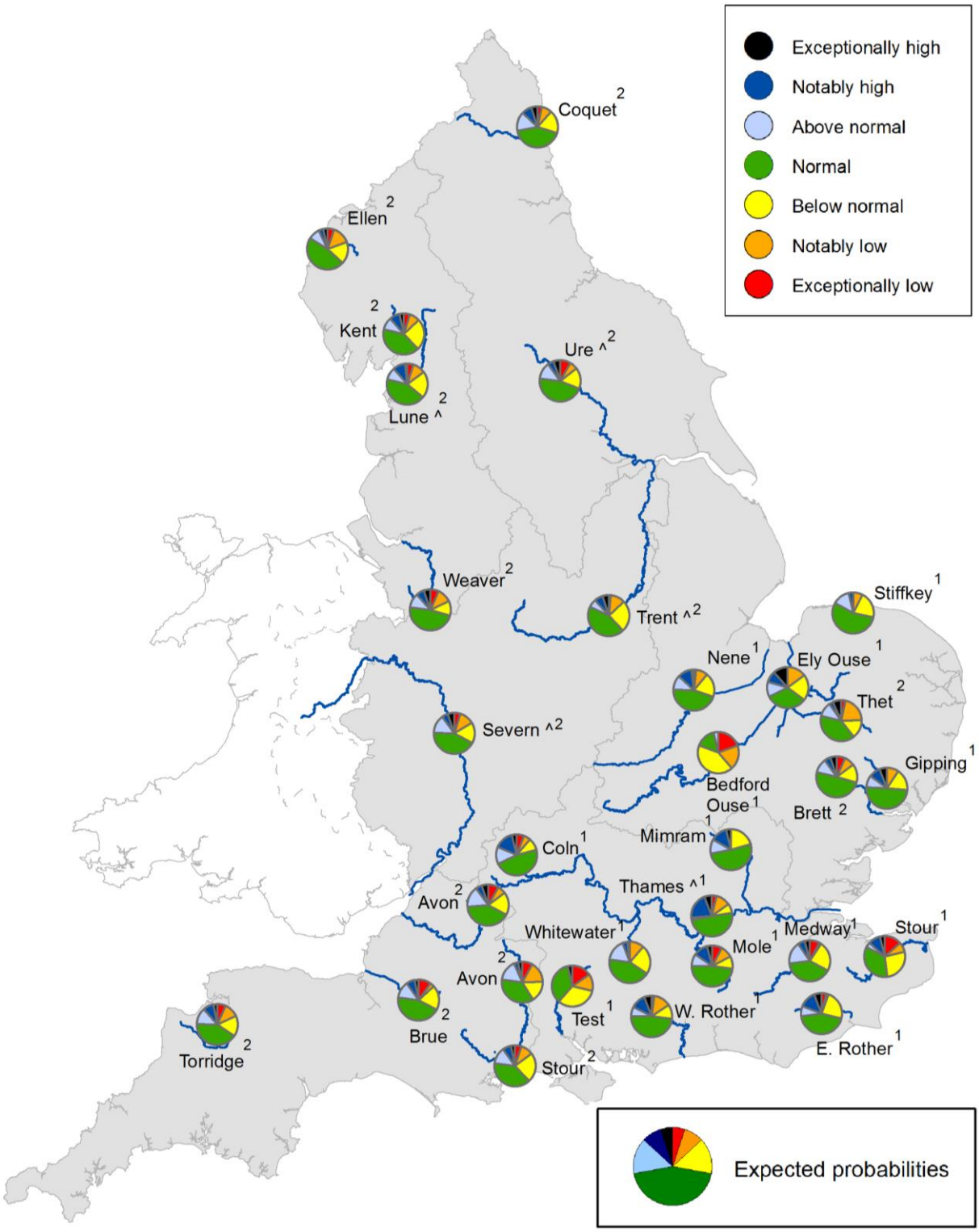


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**Figure 6.4**: Probabilistic ensemble projections of river flows at key indicator sites up until the end of March 2023. Pie charts indicate probability, based on climatology, of the surface water flow at each site being e.g. exceptionally low for the time of year. (Source: UK Centre for Ecology and Hydrology, Environment Agency).

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[2] Projections for these sites are produced by UK CEH
^"Naturalised" flows are projected for these sites


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# Forward look: groundwater

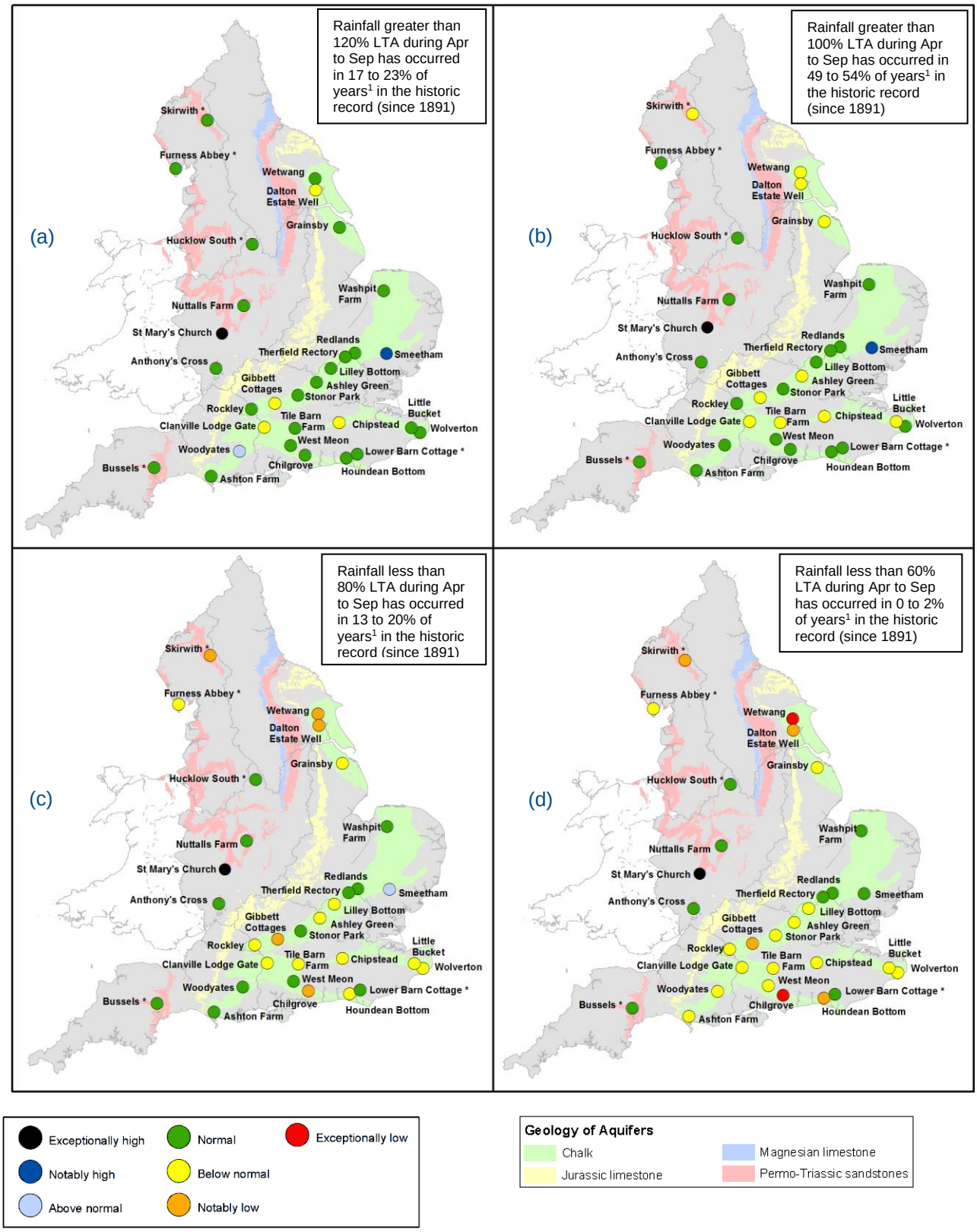


**Figure 6.5**: Projected groundwater levels at key indicator sites at the end of September 2022. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between April 2022 and September 2022 (Source: Environment Agency) Geological map reproduced with kind permission from UK Groundwater Forum BGS © NERC. Crown copyright all rights reserved. Environment Agency 100024198, 2021.

* Projections for these sites are produced by BGS
[1] This range of probabilities is a regional analysis


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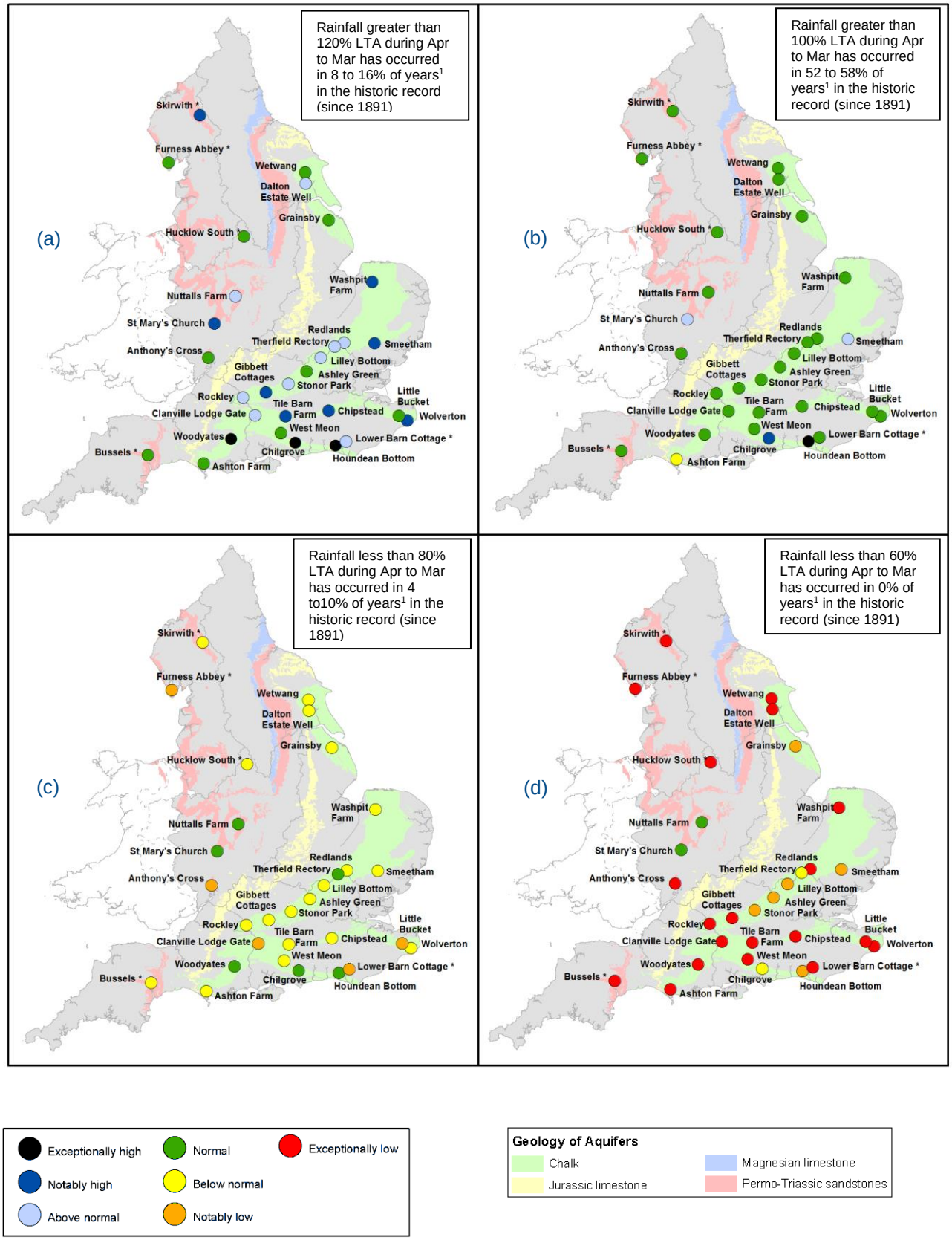


**Figure 6.6**: Projected groundwater levels at key indicator sites at the end of March 2023. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between April 2022 and March 2023 (Source: Environment Agency) Geological map reproduced with kind permission from UK Groundwater Forum BGS © NERC Crown copyright. All rights reserved. Environment Agency 100024198 2021.

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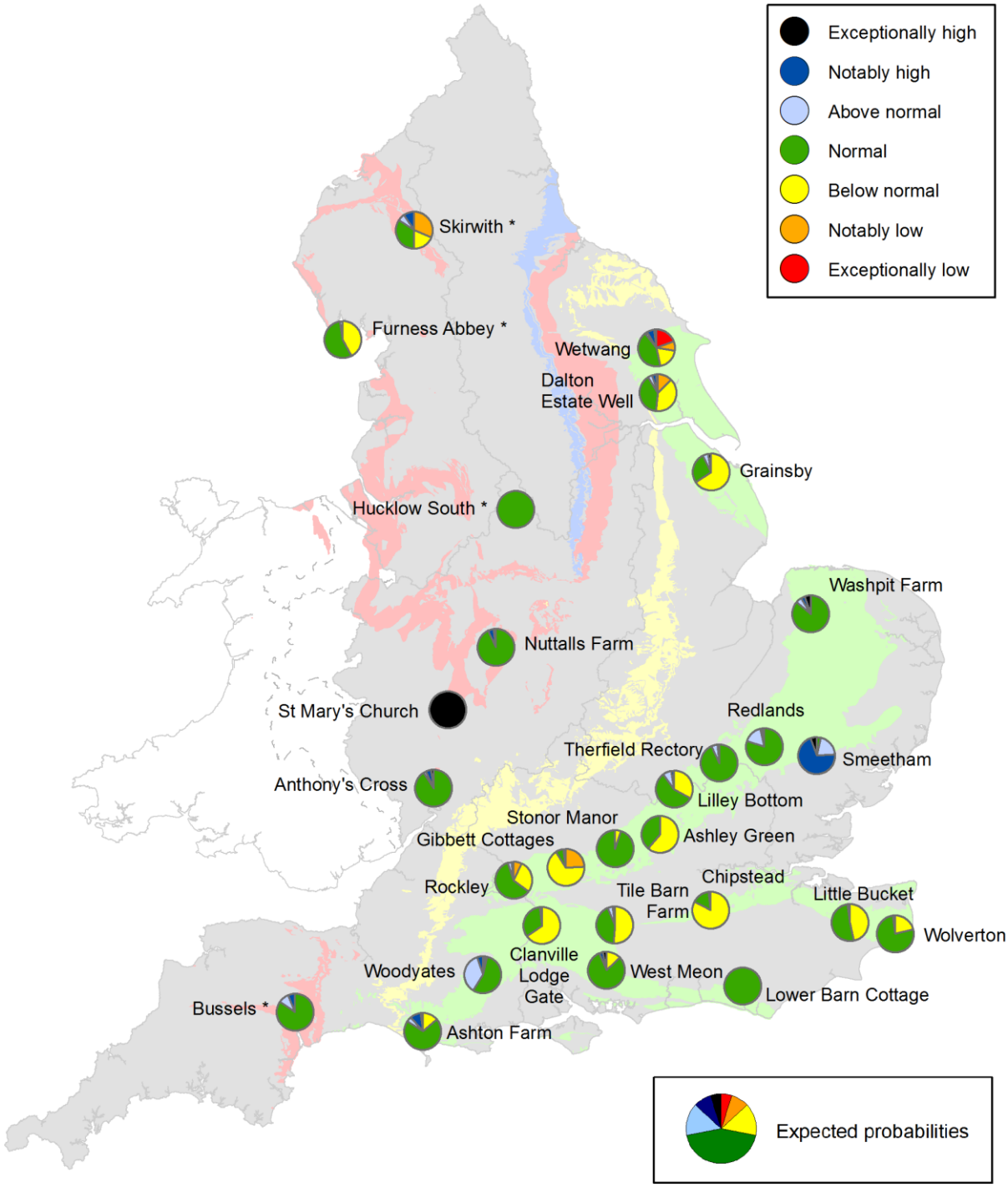


*Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are those which would typically occur 44% of the time within the historic record.*

**Figure 6.7**: Probabilistic ensemble projections of groundwater levels at key indicator sites at the end of September 2022. Pie charts indicate probability, based on climatology, of the groundwater level at each site being e.g. exceptionally low for the time of year. (Source: Environment Agency) Geological map reproduced with kind permission from UK Groundwater Forum, BGS © NERC. Crown copyright. All rights reserved. Environment Agency, 100024198, 2021.

** Projections for these sites are produced by BGS*


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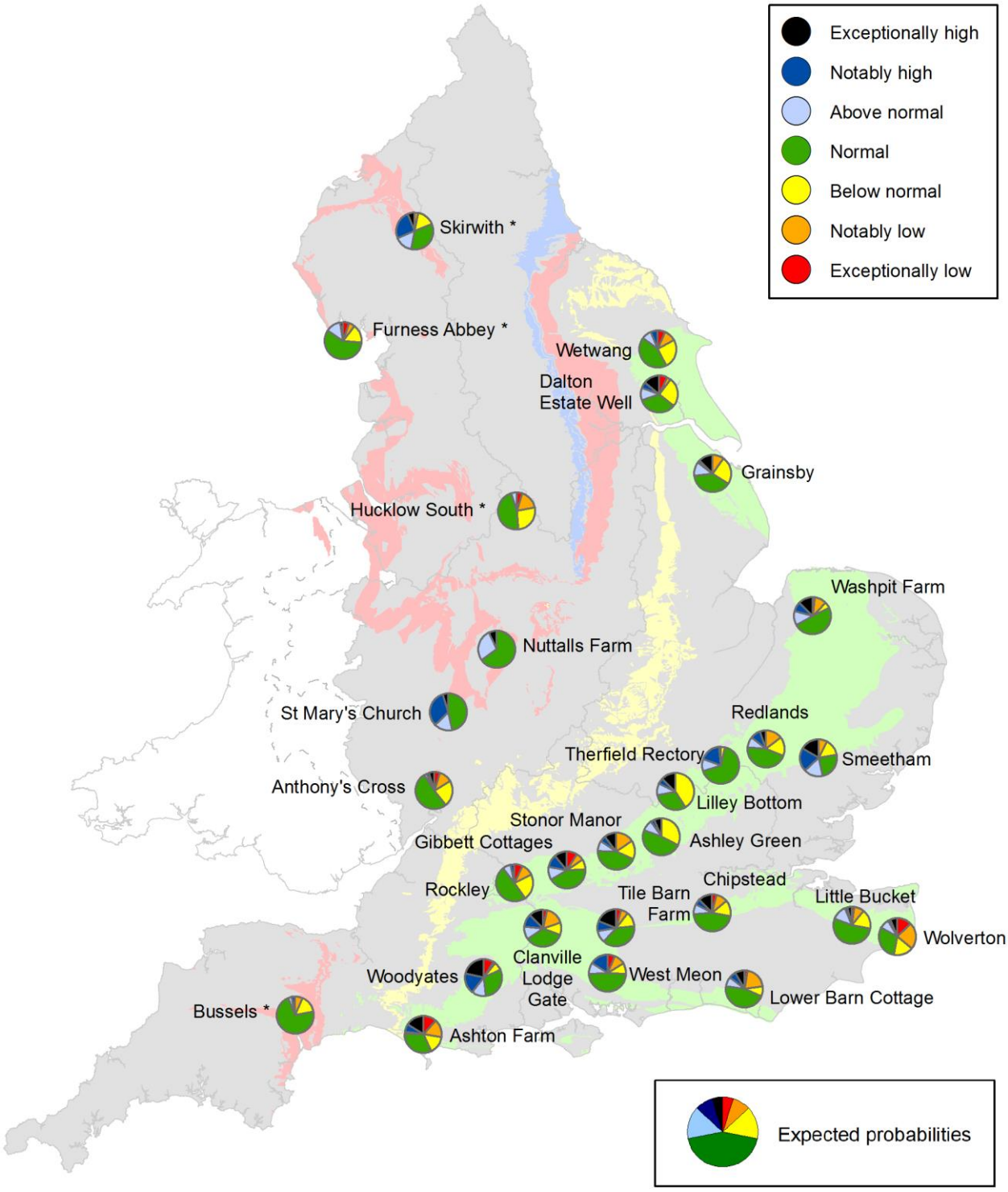


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**Figure 6.8**: Probabilistic ensemble projections of groundwater levels at key indicator sites at the end of March 2023. Pie charts indicate probability, based on climatology, of the groundwater level at each site being e.g. exceptionally low for the time of year. (Source: Environment Agency) Geological map reproduced with kind permission from UK Groundwater Forum, BGS © NERC. Crown copyright. All rights reserved. Environment Agency, 100024198, 2021.

* Projections for these sites are produced by BGS


**Figure 7.1**: Geographic regions

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# Glossary

| Term | Definition |
|---|---|
| Aquifer | A geological formation able to store and transmit water. |
| Areal average rainfall | The estimated average depth of rainfall over a defined area. Expressed in depth of water (mm). |
| Artesian | The condition where the groundwater level is above ground surface but is prevented from rising to this level by an overlying continuous low permeability layer, such as clay. |
| Artesian borehole | Borehole where the level of groundwater is above the top of the borehole and groundwater flows out of the borehole when unsealed. |
| Cumecs | Cubic metres per second ($m^3s^{-1}$) |
| Effective rainfall | The rainfall available to percolate into the soil or produce river flow. Expressed in depth of water (mm). |
| Flood Alert/Flood Warning | Three levels of warnings may be issued by the Environment Agency. Flood Alerts indicate flooding is possible. Flood Warnings indicate flooding is expected. Severe Flood Warnings indicate severe flooding. |
| Groundwater | The water found in an aquifer. |
| Long term average (LTA) | The arithmetic mean, calculated from the historic record. For rainfall and soil moisture deficit, the period refers to 1961 to 1990, unless otherwise stated. For other parameters, the period may vary according to data availability |
| mAOD | Metres Above Ordnance Datum (mean sea level at Newlyn Cornwall). |
| MORECS | Met Office Rainfall and Evaporation Calculation System. Met Office service providing real time calculation of evapotranspiration, soil moisture deficit and effective rainfall on a 40 x 40 km grid. |
| Naturalised flow | River flow with the impacts of artificial influences removed. Artificial influences may include abstractions, discharges, transfers, augmentation and impoundments. |
| NCIC | National Climate Information Centre. NCIC area monthly rainfall totals are derived using the Met Office 5 km gridded dataset, which uses rain gauge observations. |
| Recharge | The process of increasing the water stored in the saturated zone of an aquifer. Expressed in depth of water (mm). |
| Reservoir gross capacity | The total capacity of a reservoir. |
| Reservoir live capacity | The capacity of the reservoir that is normally usable for storage to meet established reservoir operating requirements. This excludes any capacity not available for use (e.g. storage held back for emergency services, operating agreements or physical restrictions). May also be referred to as ‘net’ or ‘deployable’ capacity. |
| Soil moisture deficit (SMD) | The difference between the amount of water actually in the soil and the amount of water the soil can hold. Expressed in depth of water (mm). |

## Categories

| | |
|---|---|
| Exceptionally high | Value likely to fall within this band 5% of the time |
| Notably high | Value likely to fall within this band 8% of the time |
| Above normal | Value likely to fall within this band 15% of the time |
| Normal | Value likely to fall within this band 44% of the time |
| Below normal | Value likely to fall within this band 15% of the time |
| Notably low | Value likely to fall within this band 8% of the time |
| Exceptionally low | Value likely to fall within this band 5% of the time |