Monthly water situation report

England

Summary – June 2022

Rainfall for June was below average across England although monthly rainfall totals for the majority of catchments were classed as normal for the time of year. As expected for the time of year, soil moisture deficits have continued to increase across the country with end of June soils generally drier than would typically be expected for the time of year. River flows decreased in June at most of the indicator sites we report on and the majority of sites are classed as notably low for the time of year. Groundwater levels also decreased during June but remain normal or below normal at the majority of sites for the time of year. Reservoir stocks in June decreased at nearly all the reservoirs and reservoir groups we report on.

Rainfall

The June rainfall total for England was 45mm which represents 74% of the 1961-1990 long term average (LTA) (75% of the 1991-2020 LTA). The majority of catchments received below average rainfall during June, with the lowest monthly totals seen across south-east England. The Parrett catchment in south-west England was wettest part of the country receiving 137% of the LTA for the time of year. South London was the driest receiving 36% of the LTA. (Figure 1.1)

June rainfall totals were classed as normal at three quarters of catchments across the country. The three month cumulative totals show the majority of catchments were classed as below normal and more than a third of catchments were notably low. The six month cumulative rainfall totals are largely below normal and notably low across the majority of England with three catchments in south-east England classed as exceptionally low. Twelve month cumulative totals show that nearly three-quarters of catchments across the country are classed as below normal or notably low (Figure 1.2)

At a regional scale, with the exception of the north-east which was below normal, all June rainfall totals were normal across all regions and for England as a whole. It is interesting to note that in England it has been the driest 8 months November 2021 to June 2022 since 1975/6 (Figure 1.3)

Soil moisture deficit

Soil moisture deficits (SMD) continued to increase across the country as expected at this time of year due to warmer temperatures. (Figure 2.1)

End of June soil moisture deficits were greater than the long term average for the time of year; soils were drier than would be typically expected for June throughout England. Soils in parts of north-west England remain closer to the LTA than the rest of the country. (Figure 2.2)

River flows

June monthly mean river flows decreased at all but five of the indicator sites we report on compared to the previous month. Nearly a third of sites across England remain classed as normal although the majority of sites were classed as notably low with four sites classed as exceptionally low for the time of year. (Figure 3.1)

With the exception of the River Lune in north-west England which remains classed as normal all other regional index sites' monthly mean flows were classed as below normal or notably low for the time of year. (Figure 3.2)

Groundwater levels

Groundwater levels at all of the reported indicator sites during June decreased as they continue their seasonal decline. End of month groundwater levels were classed as normal or below normal at more than three-quarters of the indicator sites. One site, Jackaments Bottom in the Burford Jurassic Limestone in the Cotswolds is exceptionally low for the time of year (Figures 4.1)

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The major aquifer index sites show a varied picture at the end of June. Index sites in the major aquifers ranged from normal levels at Redlands Hall (Cam and Ely Ouse Chalk) and Skirwith (Carlisle Basin and Eden Valley Sandstone) to exceptionally low at Jackaments Bottom (Burford Jurassic Limestone). (Figures 4.2).

Reservoir storage

Reservoir stocks in June decreased at all except one of the reservoirs and reservoir groups we report on. Eight reservoirs or groups recorded a decrease of over 10% of total capacity in comparison to the end of May, the Yorkshire Supply Group had the largest decrease at 16%. (Figure 5.1)

End of month reservoir stocks were classed as normal for the time of year at a nearly a quarter of reported reservoirs. The majority of reservoirs were classed as below normal. There are four reservoirs or reservoir groups classed as exceptionally low for the time of year: the Elan Valley and Dee System in Wales which supply the Midlands and north-west respectively and Blithfield and the Derwent Valley in central England. (Figure 5.1)

At a regional scale, total reservoir stocks ranged from 69% in south-west England to 90% in east England. Total reservoir stocks for England were at 78% of total capacity at the end of June (Figure 5.2)

Forward look

July began with dry conditions for much of England, and these conditions are expected to continue in the coming weeks as high pressure settles over the country. Later in the month the chance of cooler weather and rain increases in the north of England, with unsettled conditions potentially becoming more widespread towards the end of the month. [1]

From July to September, the three month period has a higher than normal chance of hot conditions, with rainfall likely to be around average for the period. Wetter weather during the period is likely to be in heavy, localised showers or thunderstorms.

Projections for river flows at key sites[2]

By the end of September 2022 the majority of modelled sites have a greater than expected chance of cumulative river flows being normal or below normal for the time of year. By the end of March 2023 the majority of modelled sites have a greater than expected chance of cumulative river flows being below 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 most modelled sites have a greater than expected chance of normal or lower groundwater levels for the time of year. In particular modelled sites in Chalk aquifers have a greater than expected chance of below normal groundwater levels for the time of year. By the end of March 2023 the majority of modelled sites have a greater than expected chance of normal or lower groundwater levels for the time of year.

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

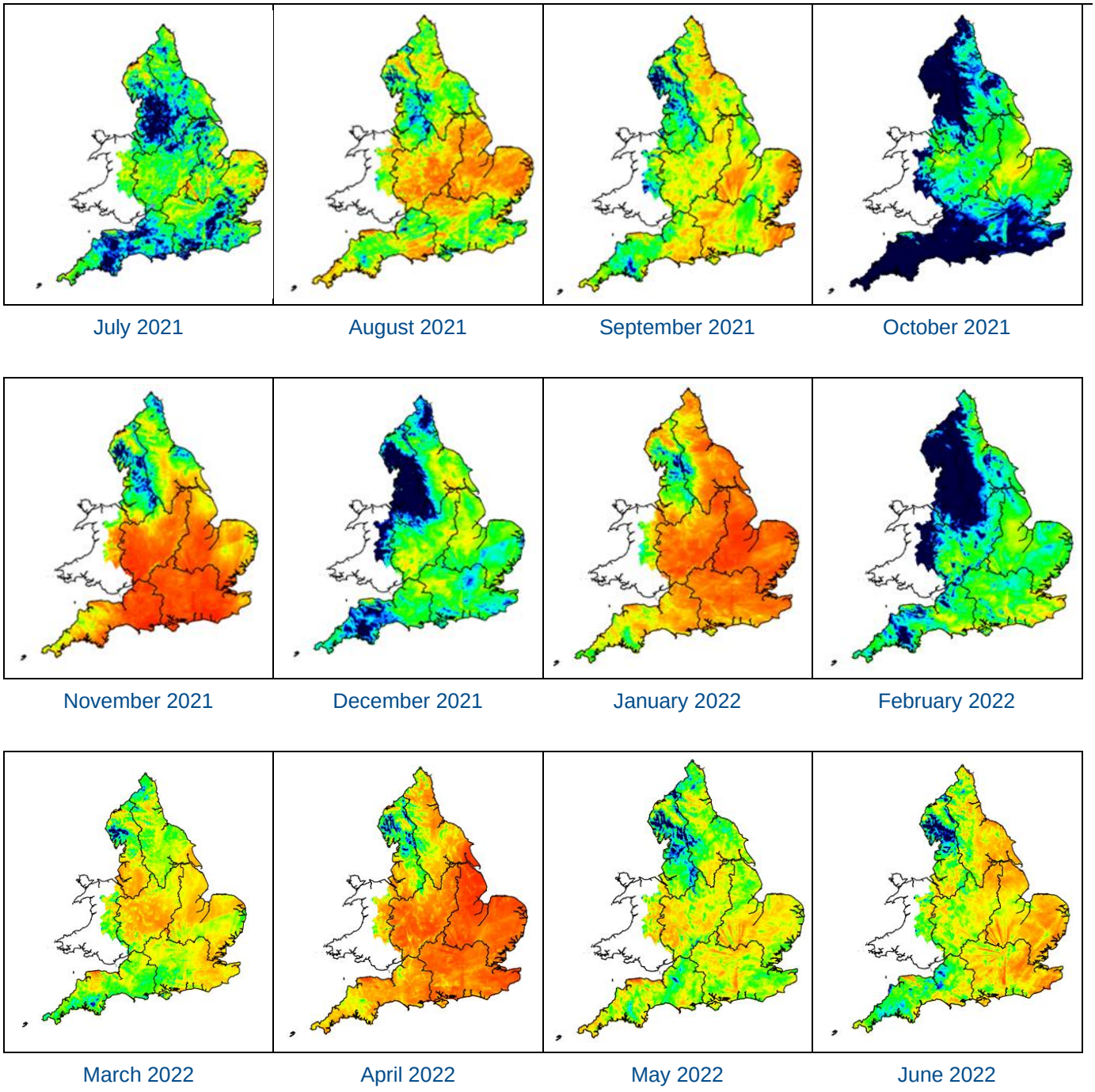
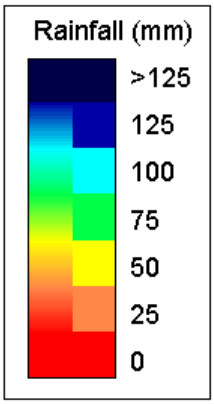


Figure 1.1: Monthly rainfall across England and Wales for the past 12 months. UKPP radar data (Source: Met Office © Crown Copyright, 2022). Note: Radar beam blockages in some regions may give anomalous totals in some areas. Crown copyright. All rights reserved. Environment Agency, 100024198, 2022.



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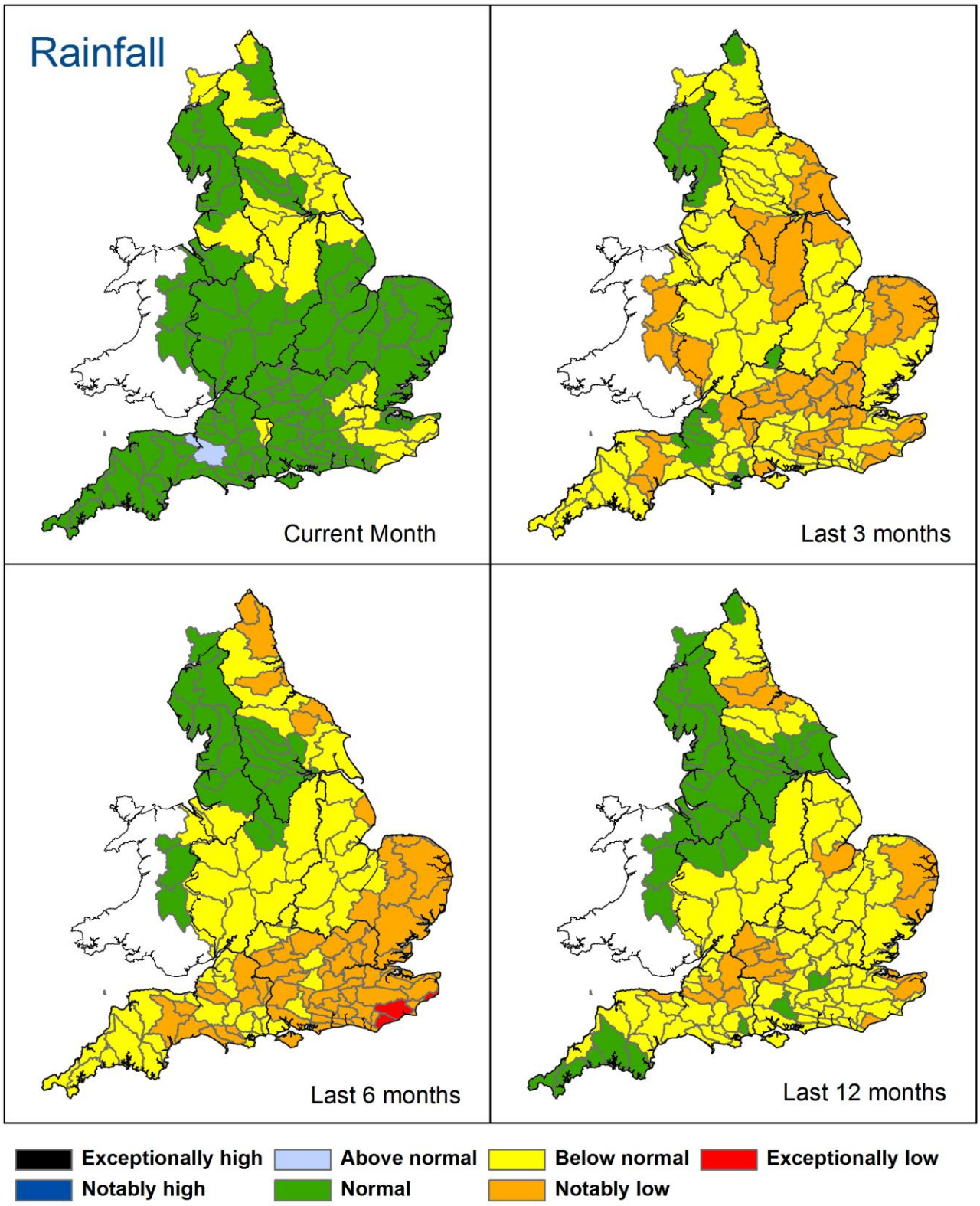

Figure 1.2: Total rainfall for hydrological areas across England for the current month (up to 30 June), the last 3 months, the last 6 months, and the last 12 months, classed relative to an analysis of respective historic totals. HadUK data based on the Met Office 1km gridded rainfall dataset derived 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

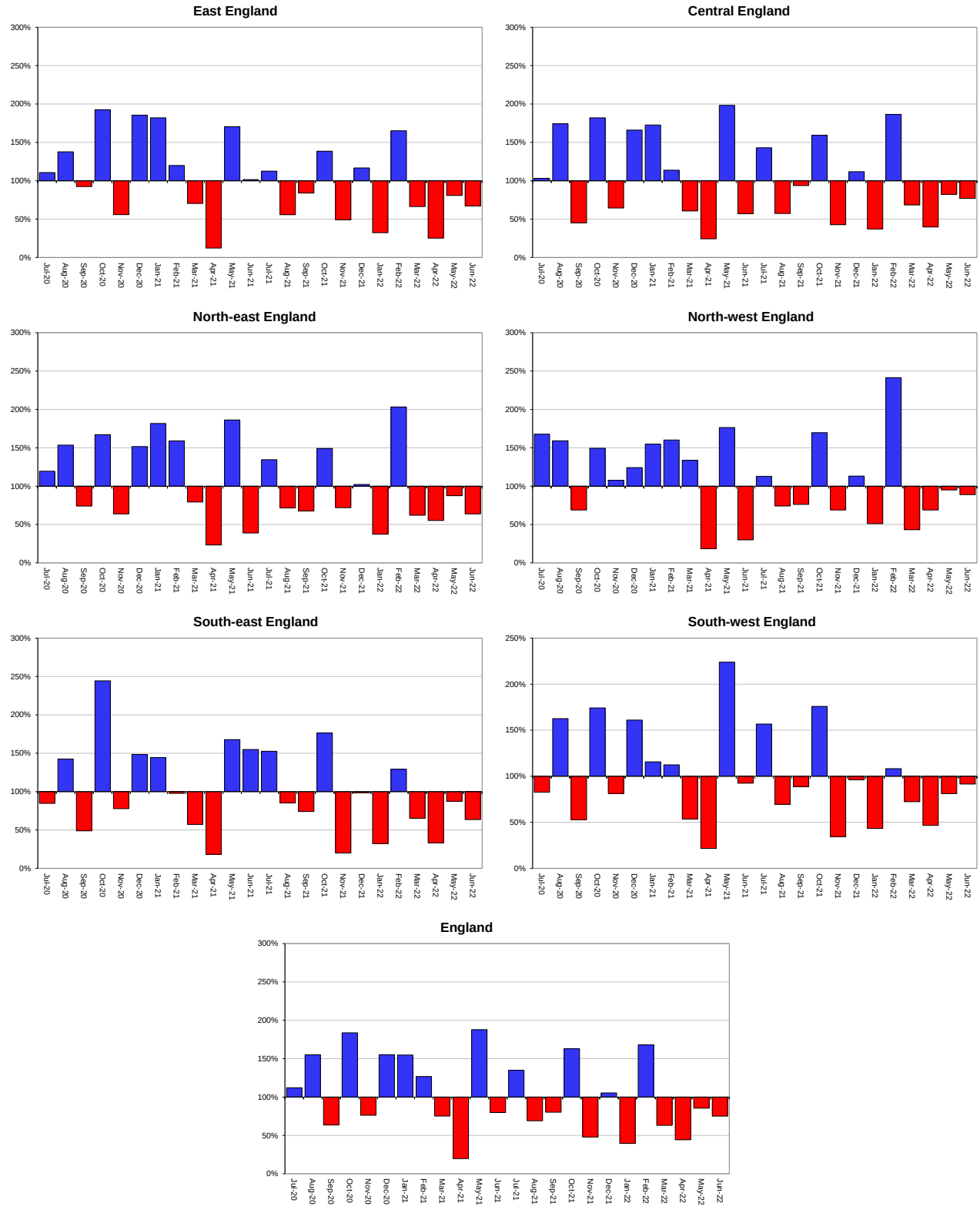

Figure 1.3: Monthly rainfall totals for the past 24 months as a percentage of the 1961 to 1990 long term average for each region and for England. HadUK rainfall data. (Source: Met Office © Crown Copyright, 2022).

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Soil moisture deficit

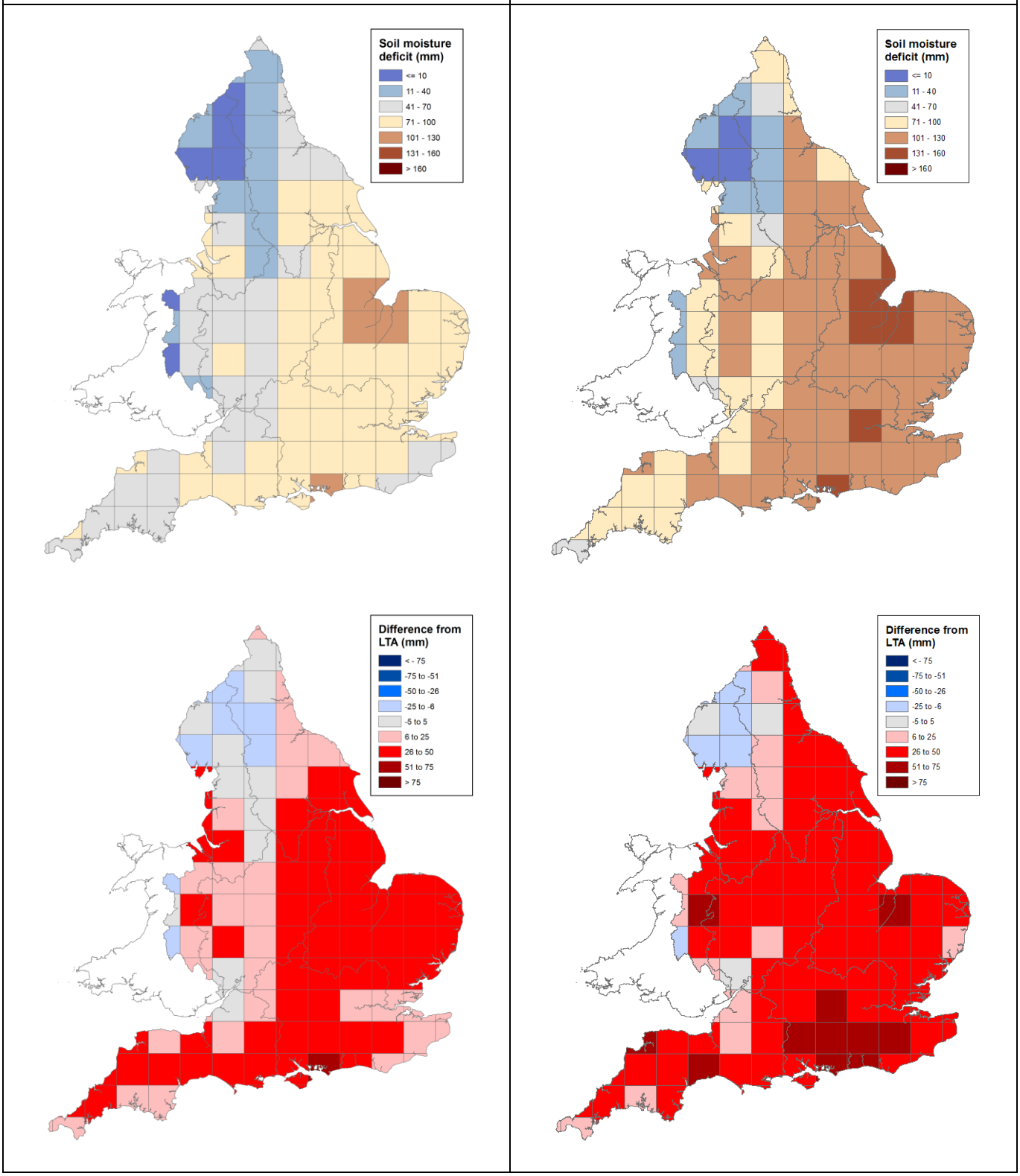
End of May 2022[1]	End of June 2022[2]
	

Figure 2.1: Soil moisture deficits for weeks ending 31 May 2022 [1] (left panel) and 28 June 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

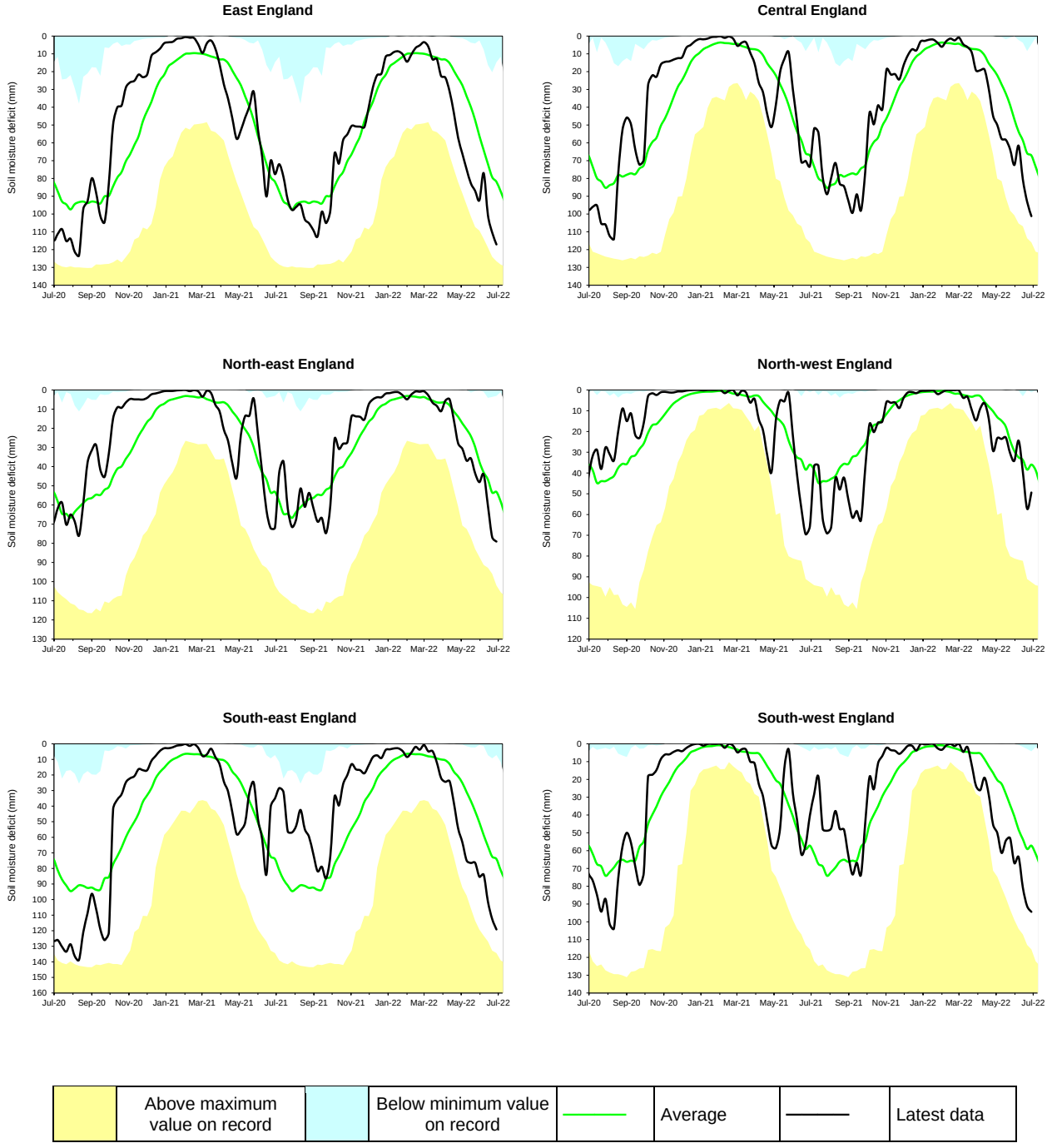


Figure 2.2: Latest soil moisture deficits for all geographic regions compared to maximum, minimum and 1961 to 90 long term average. Weekly MORECS data for real land use. (Source: Met Office © Crown Copyright, 2022).

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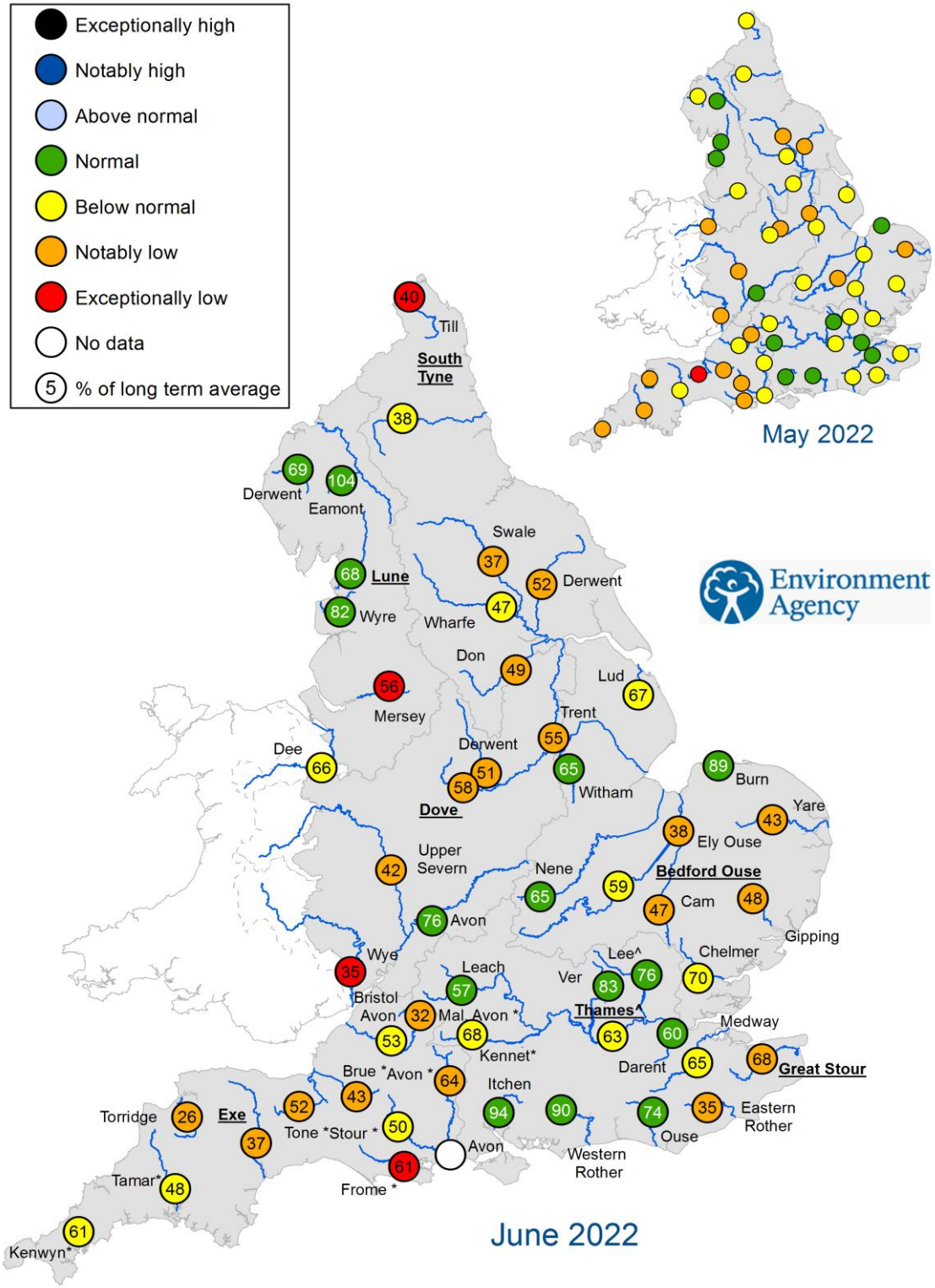
River flows



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

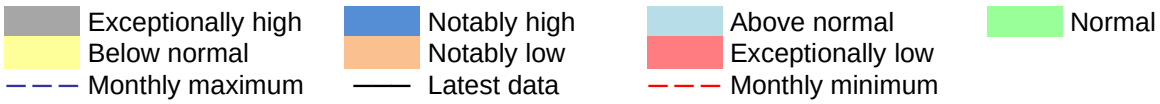
+/- Monthly mean flow is the highest/lowest on record for the current month (note that record length varies between sites)

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

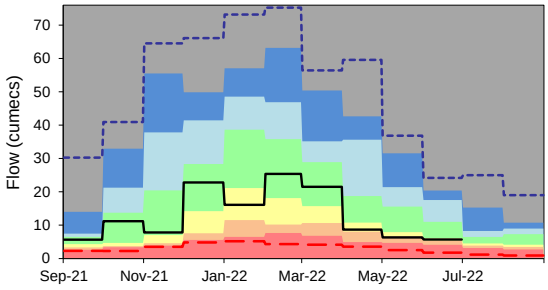
Underlined sites are regional index sites and are shown on the hydrographs in Figure 3.2

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

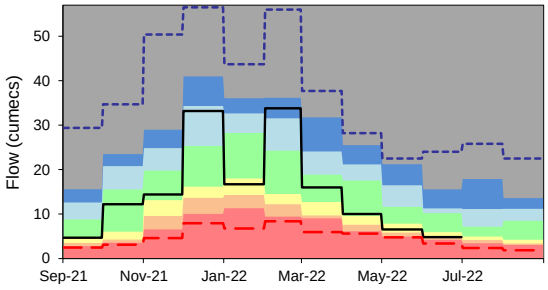
River flow charts



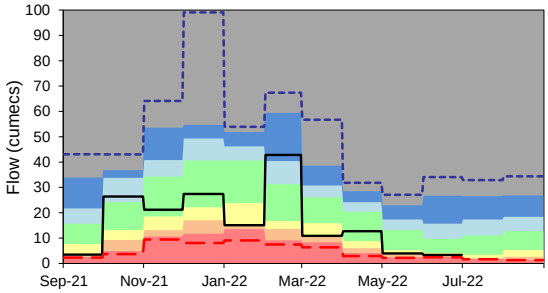
Offord, BEDFORD OUSE
Ranking derived from data for the period Jan-1972 to Dec-2017



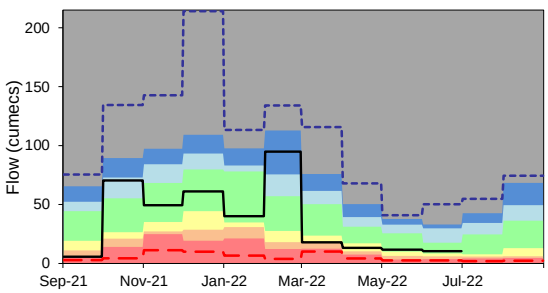
Marston-on-Dove, DOVE
Ranking derived from data for the period Jul-1965 to Dec-2017



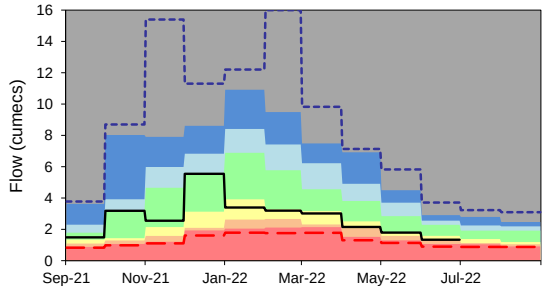
Haydon Bridge, SOUTH TYNE
Ranking derived from data for the period Oct-1974 to Dec-2017



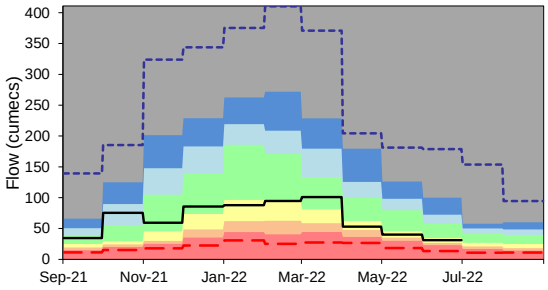
Caton, LUNE
Ranking derived from data for the period Jan-1959 to Dec-2017



Horton, GREAT STOUR
Ranking derived from data for the period Oct-1964 to Dec-2017



Kingston, THAMES
Ranking derived from data for the period Jan-1883 to Dec-2017



Thorverton, EXE
Ranking derived from data for the period Apr-1956 to Dec-2017

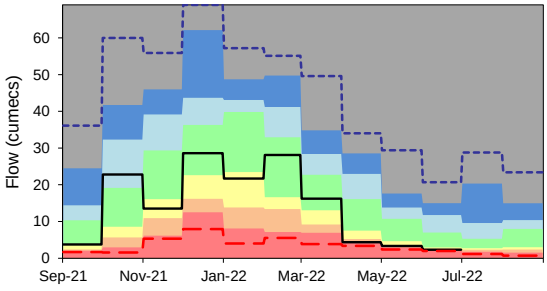


Figure 3.2: Index river flow sites for each geographic region. Monthly mean flow compared to an analysis of historic monthly mean flows, long term maximum and minimum flows. (Source: Environment Agency).

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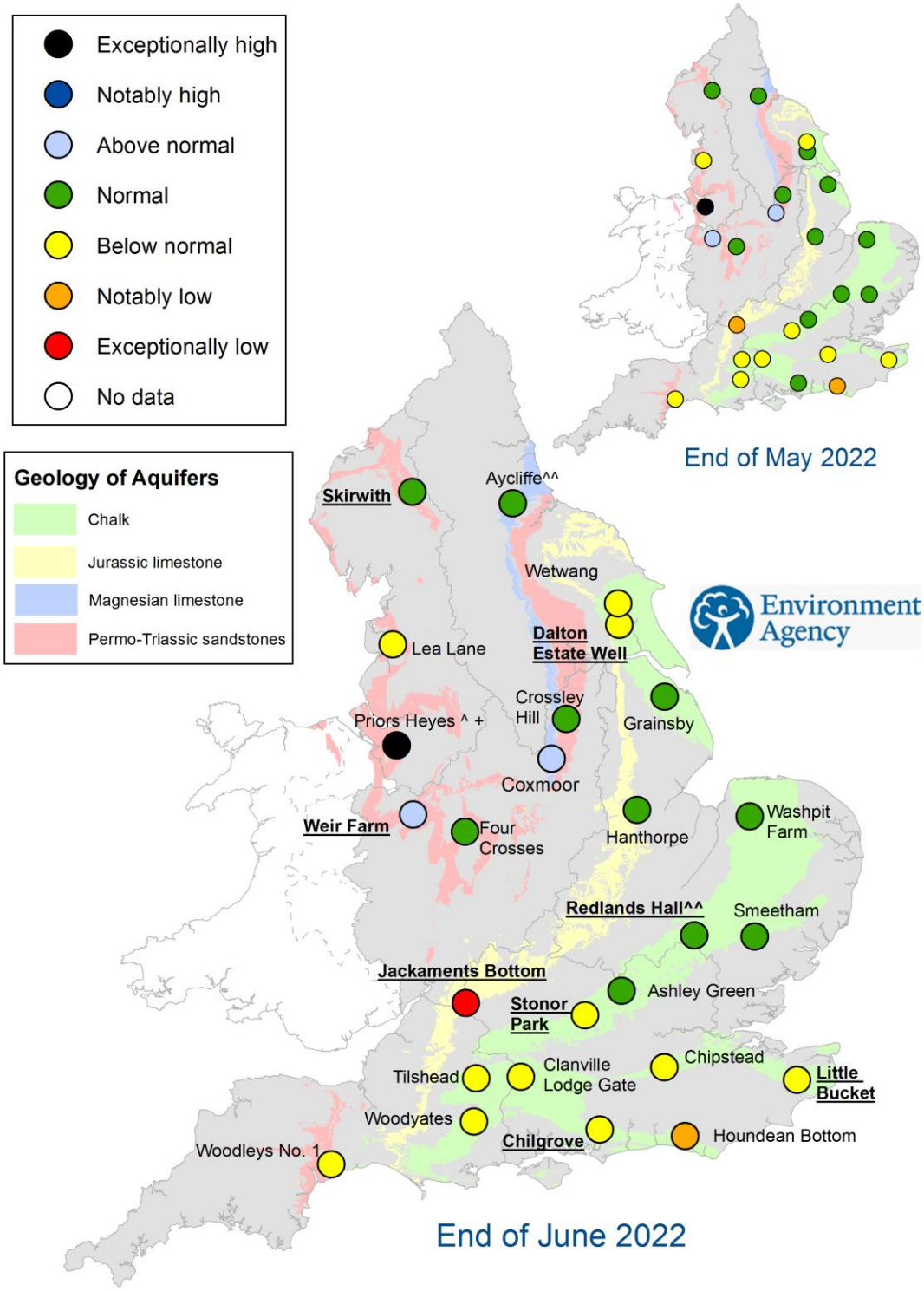
Groundwater levels



^ 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 May 2022 and June 2022, classed relative to an analysis of respective historic May and June 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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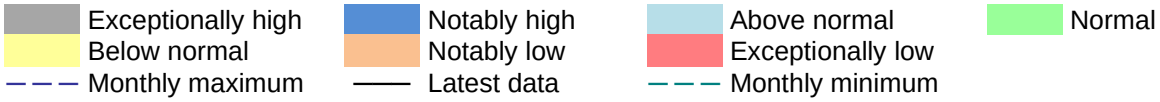
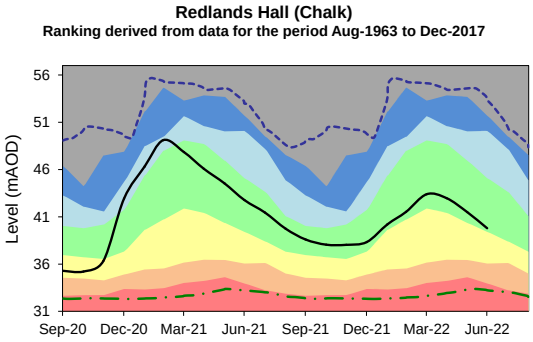
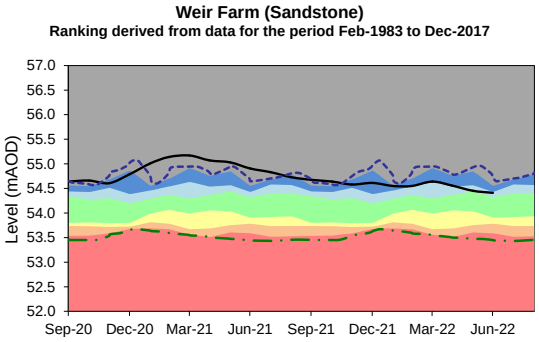
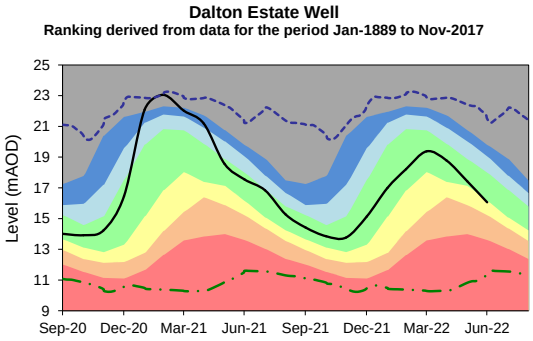
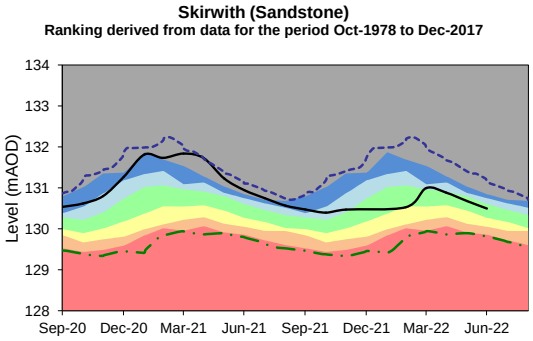
Groundwater level charts

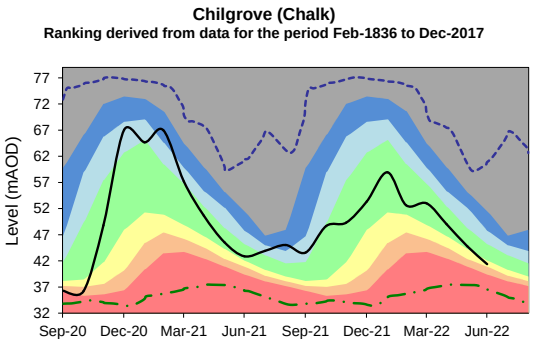


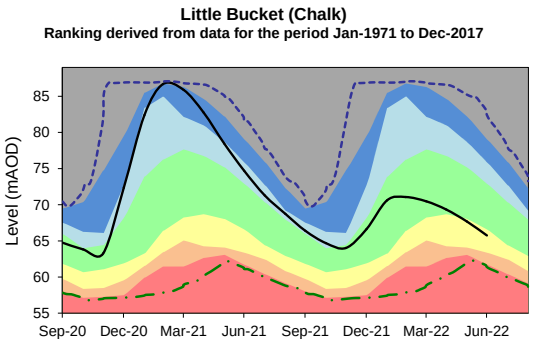


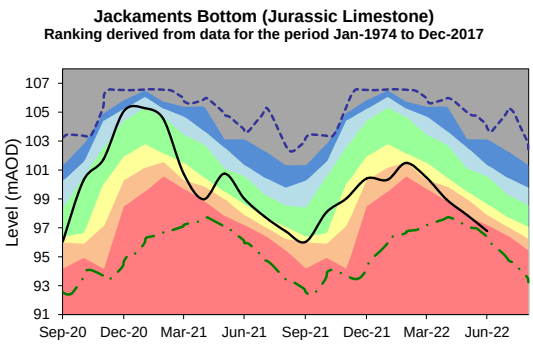












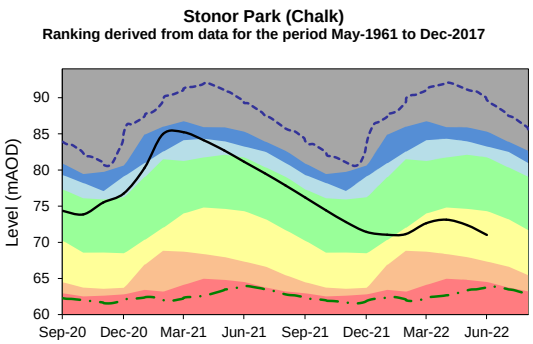


Figure 4.2: Index groundwater level sites for major aquifers. End of month groundwater levels months compared to an analysis of historic end of month levels and long term maximum and minimum levels. (Source: Environment Agency, 2022).

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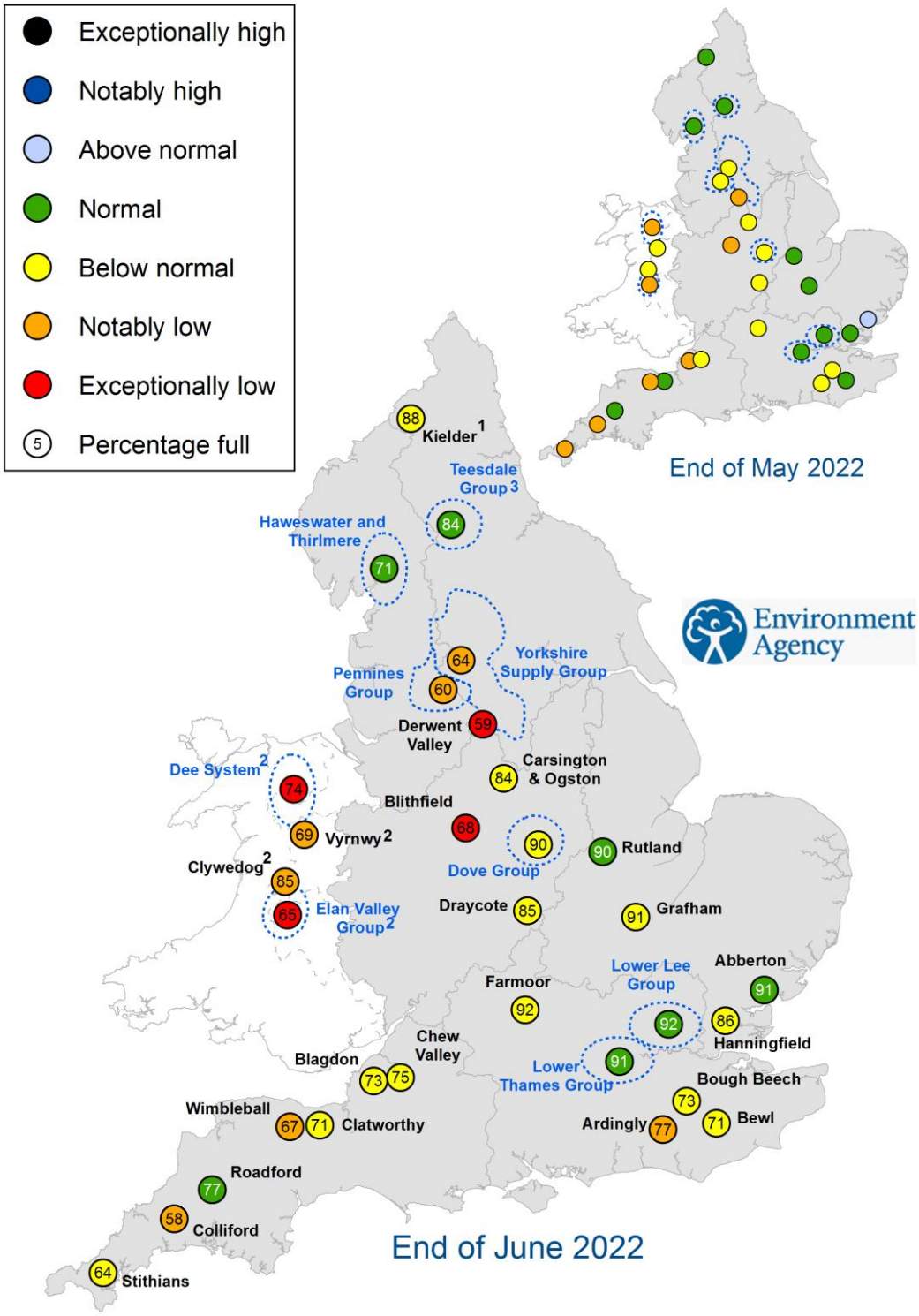
Reservoir storage



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 May 2022 and June 2022 as a percentage of total capacity and classed relative to an analysis of historic May and June 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

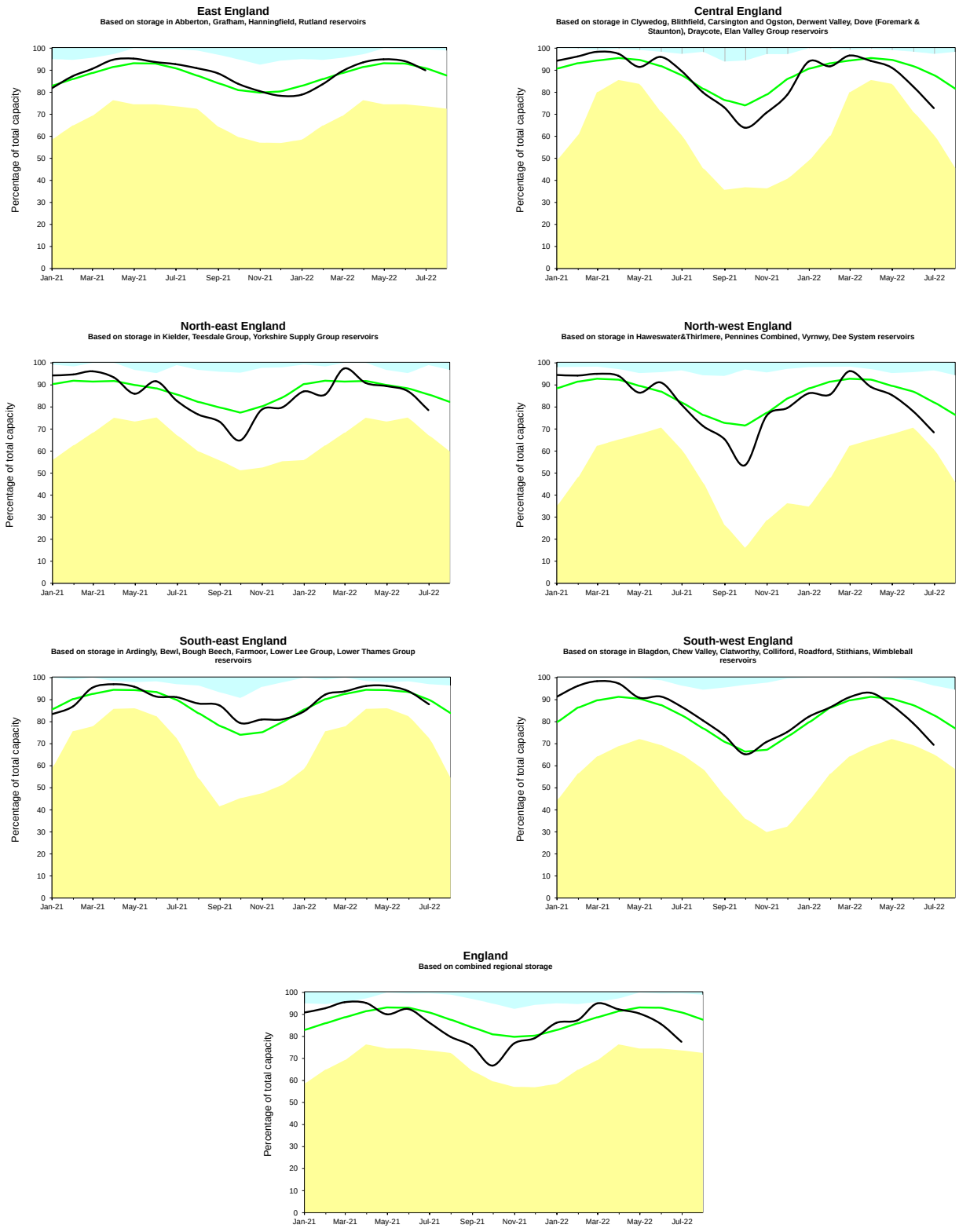


Figure 5.2: Regional reservoir stocks. End of month reservoir stocks compared to long term maximum, minimum and average stocks (Source: Water Companies). Note: Historic records of individual reservoirs/reservoir groups making up the regional values vary in length.

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Forward look: river flow

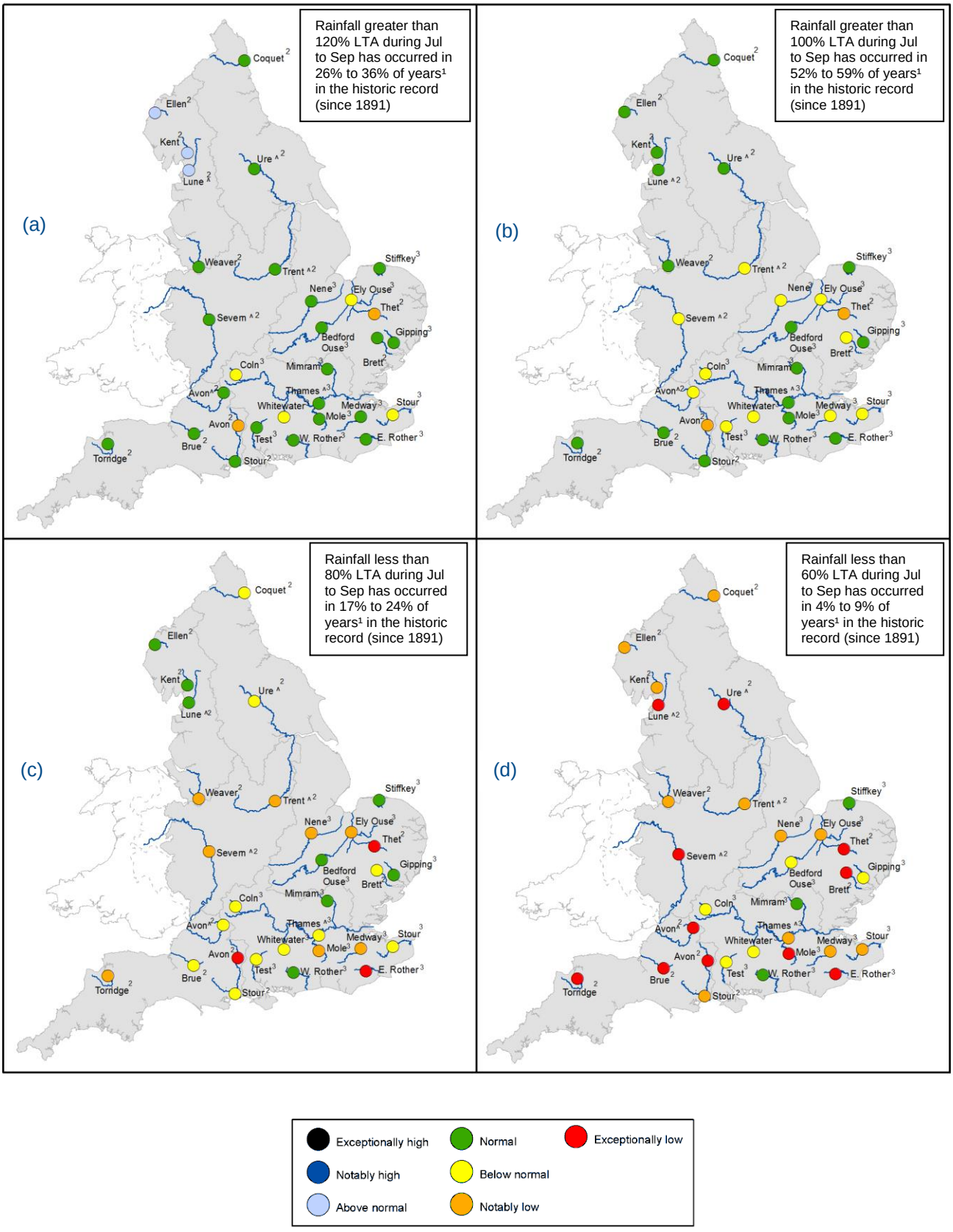

Figure 6.1: Projected river flows at key indicator sites up until the end of September 2022. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between July and September 2022 (Source: UK Centre for Ecology and Hydrology, Environment Agency)

[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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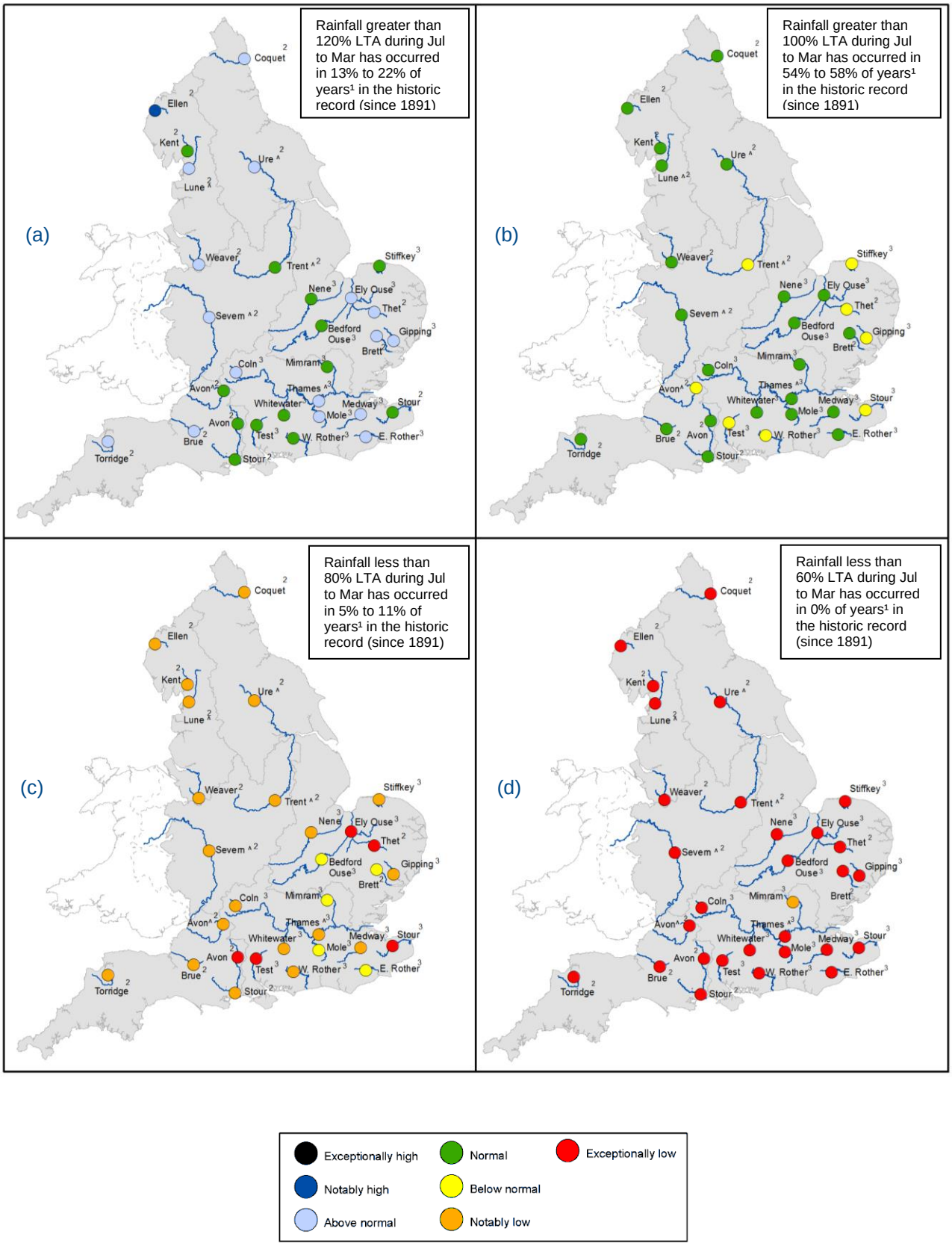

Figure 6.2: Projected river flows at key indicator sites up until the end of March 2023. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between July 2022 and March 2023 (Source: UK Centre for Ecology and Hydrology, Environment Agency)

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[2] Projections for these sites are produced by UK CEH
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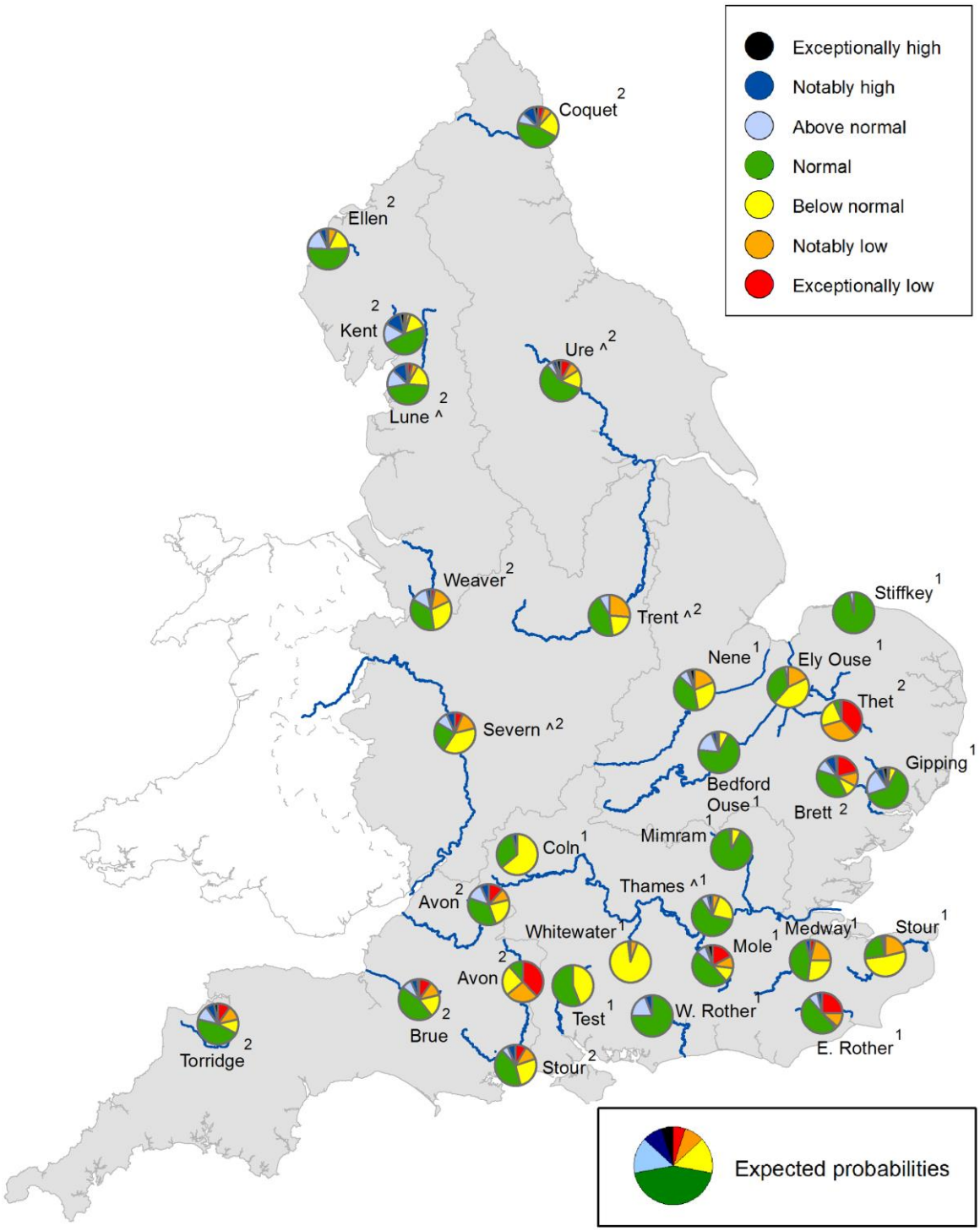

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are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

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

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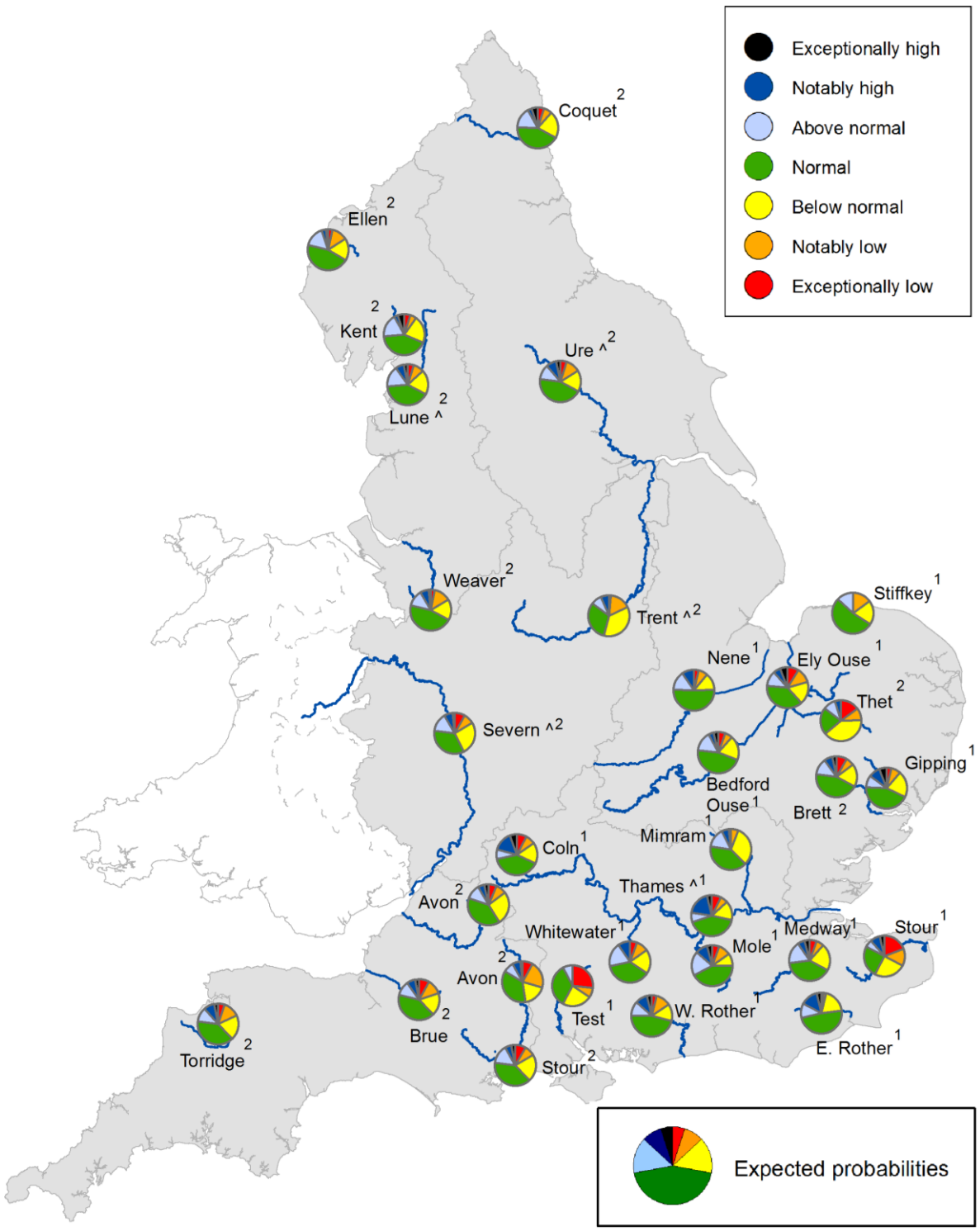

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are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

Figure 6.4: 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).

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

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Forward look: groundwater

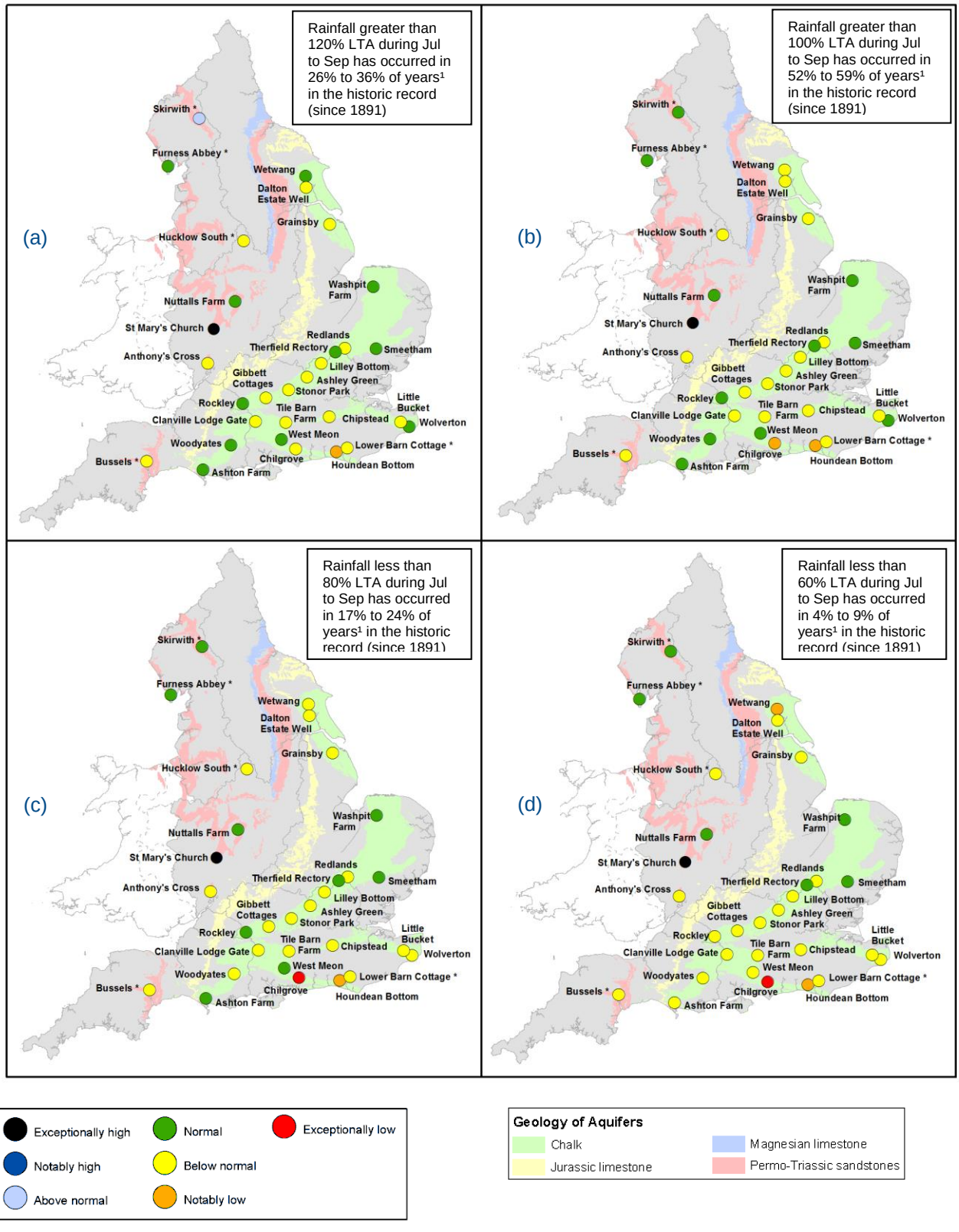

Figure 6.5: Projected groundwater levels at key indicator sites at the end of September 2022. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between July and September 2022 (Source: Environment Agency) Geological map reproduced with kind permission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

St Mary's Church is currently being monitored due to uncertainty with data.

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

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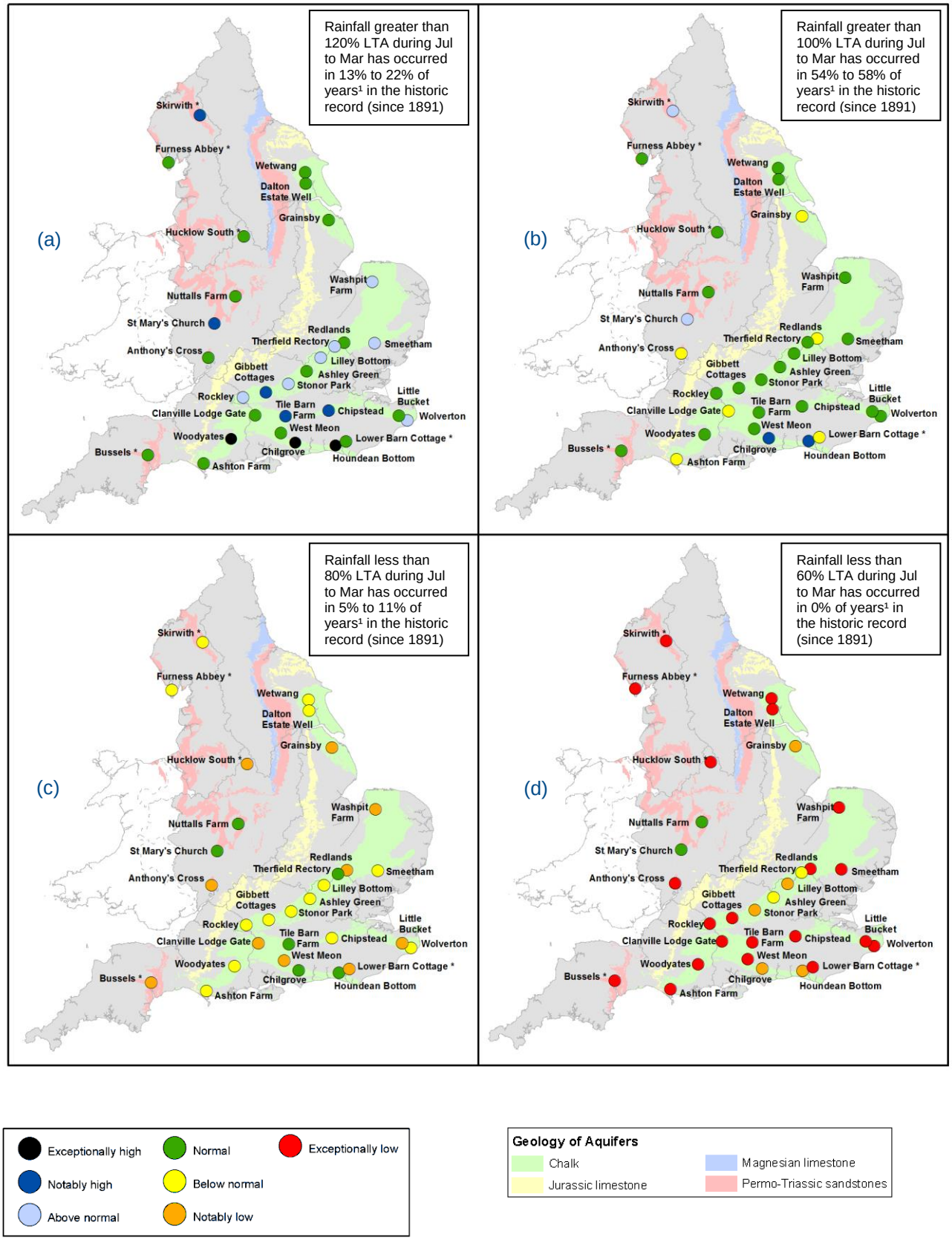

Figure 6.6: Projected groundwater levels at key indicator sites at the end of March 2023. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between July 2022 and March 2023 (Source: Environment Agency) Geological map reproduced with kind permission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

St Mary's Church is currently being monitored due to uncertainty with data.

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

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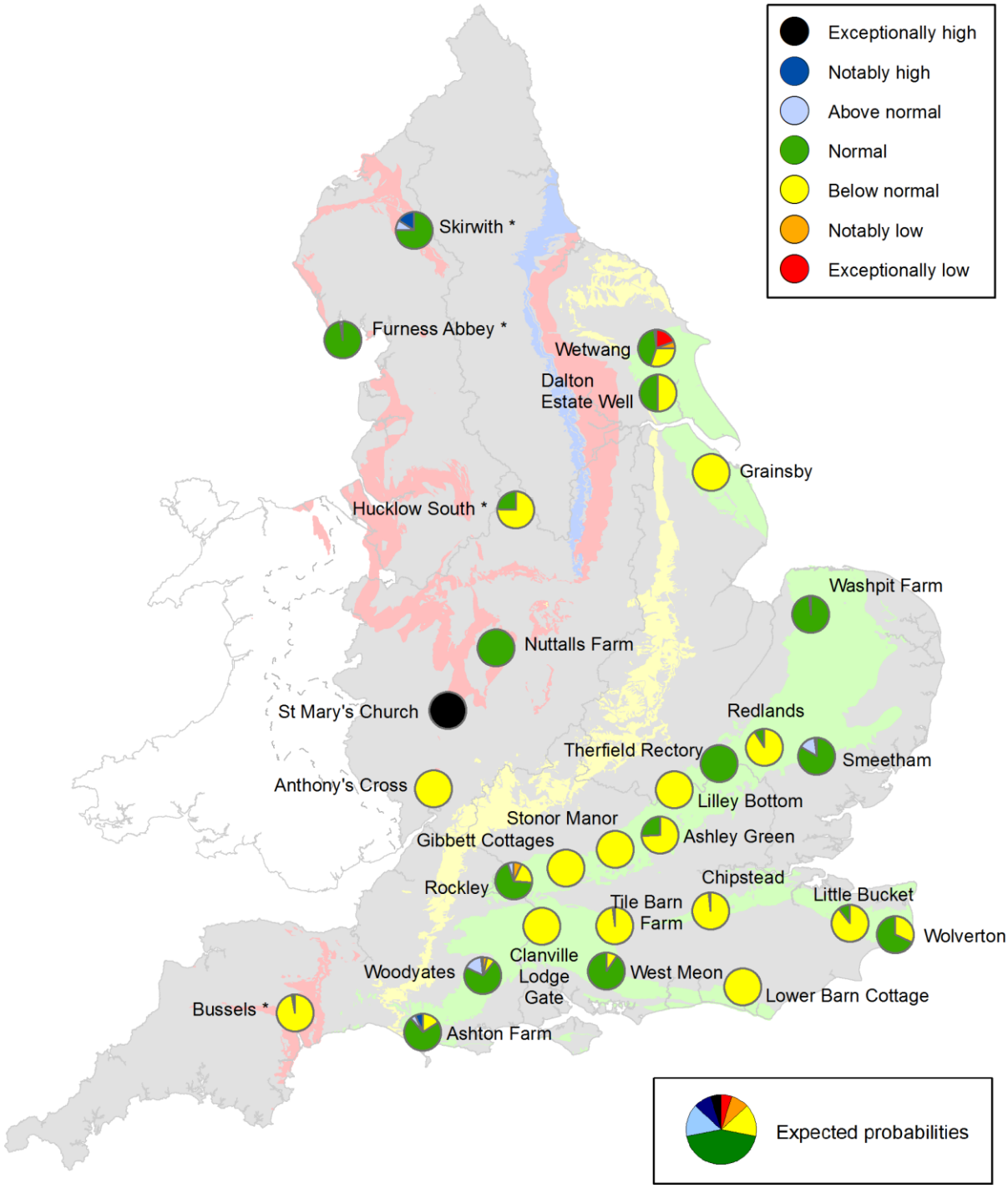
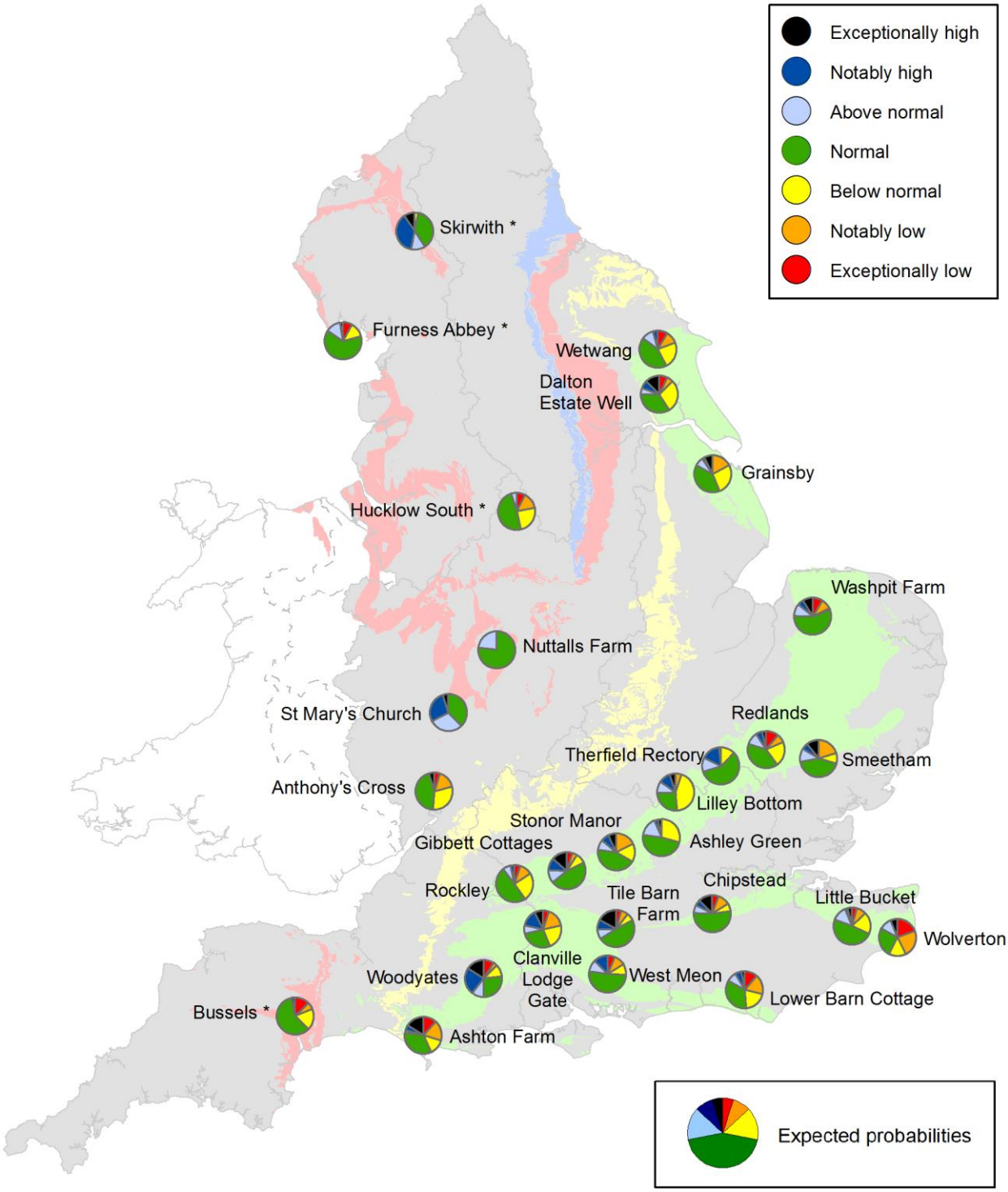


Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are 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, 2022.

* Projections for these sites are produced by BGS St Mary's Church is currently being monitored due to uncertainty with data.



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 6.8: 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, 2022.

* Projections for these sites are produced by BGS

St Mary's Church is currently being monitored due to uncertainty with data

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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