Monthly water situation report

England

Summary – May 2021

May was a wet month, and a real contrast to April, with above average rainfall totals recorded across England and record high May rainfall totals in 10 catchments. Soils were wetter than average, or close to average, across most of the country by the end of the month. River flows increased at three-quarters of reported sites, with flows at over a third classed as notably high or exceptionally high for the time of year. At all but one indicator site, end of month groundwater levels were classed as normal or higher for the time of year. Total reservoir stocks for England were at 92% of total capacity at the end of May.

Rainfall

The May rainfall total for England was 111mm, which represents 186% of the 1961-1990 LTA (191% of the 1981-2010 LTA). This is over ten times the rainfall total for April, which was a very dry month. The highest rainfall totals for the month were in parts of western England (Figure 1.1).

Monthly rainfall totals were classed as either notably high or exceptionally high for the time of year in over four-fifths of catchments, with above average rainfall totals recorded across all of England. Exceptionally high rainfall totals were recorded in much of south-west England and large parts of north-east, north-west and central England.

The highest rainfall total as a proportion of the LTA was over the River Teign and Torbay catchment (Devon), with 229mm of rainfall representing 311% of the LTA for May. This made it the wettest May in this catchment (records since 1891). In nine other catchments it was also the wettest May on record and in over half of the catchments across England the May rainfall total ranked in the top ten wettest. The six and twelve-month cumulative rainfall totals across most catchments in England are classed as above normal or higher. In the River Dee catchment (which flows from Wales) the six-month cumulative rainfall total, ending in May, is the highest on record. The twelve-month cumulative rainfall total is classed as exceptionally high across much of northern England (Figure 1.2).

At a regional scale, May rainfall totals ranged from 168% of the LTA in south-east England, to 224% of LTA in south-west England (Figure 1.3). The rainfall totals were classed as exceptionally high for the time of year in all regions other than the south-east, where it was classed as notably high. The monthly total for the south-west is the highest May on record (records since 1891). The twelve-month cumulative rainfall total, ending in May, for north-west England is also the wettest on record (records since 1891).

Soil moisture deficit

At the end of May, soils were wetter than the LTA for the time of year, or close to average, across much of south-west, central, north-west and north-east England, in response to the rainfall this month. This contrasts with the end of April when soils were drier than average across the country (Figure 2.1).

At a regional scale, the end of May SMD values were wetter than average, for the time of year, in all regions and soils were wetter than at the end of April (Figure 2.2).

River flows

In response to the high rainfall totals across much of England during May, river flows increased at three-quarters of the sites reported on, compared with last month. Monthly mean river flows for the month were classed as normal or higher for the time of year, at all reported sites, with flows at over a third classed as notably high or exceptionally high. This is quite a contrast to April, where flows at over two-thirds of sites was classed as below normal or lower in response to the low rainfall totals last month.

Monthly mean flows on the River Torridge, Exe and Wharfe were all classed as notably low in April, but were classed as exceptionally high in May. At Tadcaster on the River Wharfe (North Yorkshire) and at Manley Hall gauging station on the River Dee (Wrexham County Borough, on the border with Wales), river flows represented the highest monthly mean flow for May on record (records since 1991 and 1970 respectively) (Figure 3.1).

At the regional index sites monthly mean flows ranged from being classed as normal on the South Tyne at Haydon Bridge (north-east England) to exceptionally high on the Exe at Thorverton (south-west England). Flow at all other regional index sites were classed as either above normal or notably high (Figure 3.2).

Groundwater levels

Groundwater levels decreased at most (all but three) of the sites reported on during May, as is typical for this time of year. At all but one indicator site, end of month groundwater levels were classed as normal or higher for the time of year; the exception was at Tilshead (Upper Hampshie Avon Chalk aquifer) where the groundwater levels were classed as below normal (Figure 4.1).

Skirwith (Carlisle Basin and Eden Valley sandstone), Aycliffe (Wear Magnesian Limestone), Priors Heyes (West Cheshire sandstone), Coxmoor (Idle and Torne Permotriassic sandstone) and Weir Farm (Bridgnorth sandstone) all recorded the highest end of May levels on record (records go back to 1978, 1979, 1972, 1969 and 1983 respectively). Levels at Priors Heyes remain high compared to historic levels because the aquifer is recovering from the effects of historic abstraction. For Weir Farm, it was the fifth consecutive month with the highest levels on record for the time of year, and the third consecutive month for Aycliffe.

End of month groundwater levels at the major aquifer index sites ranged from normal in the Jurassic limestone aquifer at Jackaments Bottom (south-east England), and chalk aquifers at Chilgrove (south-east England), Dalton Estate Well (north-east England) and Redlands Hall (east England) to exceptionally high in the sandstone aquifers at Weir Farm (central England) and at Skirwith (north-west England) (Figure 4.2).

Reservoir storage

Reservoir stocks decreased at two-fifths of the reservoirs and reservoir groups we report on, and increased at a similar proportion during May. At four reservoirs and reservoir groups, stocks remained unchanged compared with the end of April. The biggest increases, as a proportion of total capacity, were at the Yorkshire Supply Group of reservoirs and at Clatworthy reservoir (Somerset). Here, stocks increased by 10% of capacity, ending the month at 96% and 100% full respectively.

Reservoir stocks were classed as normal in four-fifths of the reservoirs and reservoir groups we report on; six were classed as below normal or lower for the time of year (Figure 5.1).

At a regional scale, total reservoir stocks ranged from 91% in south-east, south-west and north-west England to 94% in central England. Total reservoir stocks for England were at 92% of total capacity at the end of May (Figure 5.2).

Forward look

The start of June was notably fine and dry across England, with just a brief interlude of wetter weather affecting some areas. These warm, dry conditions are expected to continue for most parts of England throughout the first half of the month, although north-west England is likely to see some less settled weather with occasional spells of rain. These more unsettled conditions could spread to other parts of England during the second half of June, with occasional showers - possibly thundery in southern England - occurring at times, and perhaps more persistent rain in northern England. Overall, however, the end of June is expected to remain largely fine and dry.

For the three-month period June to August, there is a slightly higher than normal chance of wet conditions; however, the likelihood of either wet or dry conditions are very close to the normal chance of these occurring[1].

Projections for river flows at key sites[2]

By the end of September 2021, two-thirds of the modelled sites have a greater than expected chance of cumulative river flows being above normal or higher for the time of year. By the end of March 2022, four-fifths of the modelled sites have a greater than expected chance of cumulative river flows being normal or higher for the time of year.

1 Source: Met Office

2 Information produced by the Water Situation Forward Look group led by Environment Agency in partnership with the Centre for Ecology and Hydrology, British Geological Survey, Met Office (www.hydoutuk.net).

For scenario based projections of cumulative river flows at key sites by September 2021 see Figure 6.1
For scenario based projections of cumulative river flows at key sites by March 2022 see Figure 6.2
For probabilistic ensemble projections of cumulative river flows at key sites by September 2021 see Figure 6.3
For probabilistic ensemble projections of cumulative river flows at key sites by March 2022 see Figure 6.4

Projections for groundwater levels in key aquifers[2]
By the end of September 2021, around half of the modelled sites have a greater than expected chance of groundwater levels being above normal or higher for the time of year. By the end of March 2022, nearly three-quarters of the modelled sites have a greater than expected chance of groundwater levels being normal or higher for the time of year.

For scenario based projections of groundwater levels in key aquifers in September 2021 see Figure 6.5
For scenario based projections of groundwater levels in key aquifers in March 2022 see Figure 6.6
For probabilistic ensemble projections of groundwater levels in key aquifers in September 2021 see Figure 6.7
For probabilistic ensemble projections of groundwater levels in key aquifers in March 2022 see Figure 6.8

Authors: National Water Resources Hydrology Team

Rainfall

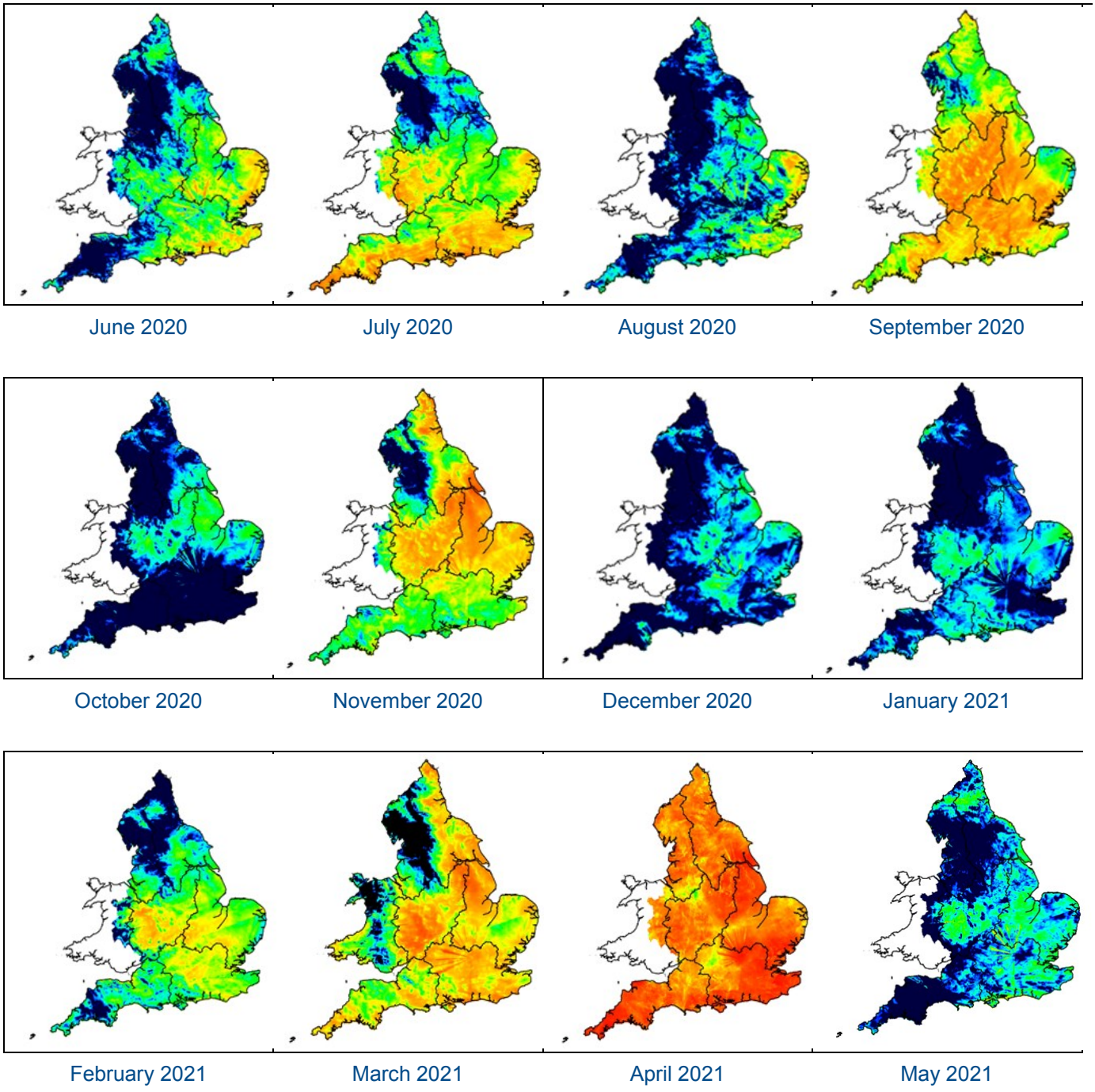


Figure 1.1: Monthly rainfall across England and Wales for the past 12 months. UKPP radar data (Source: Met Office © Crown Copyright, 2021). Note: Radar beam blockages in some regions may give anomalous totals in some areas. Crown copyright. All rights reserved. Environment Agency, 100024198, 2021.

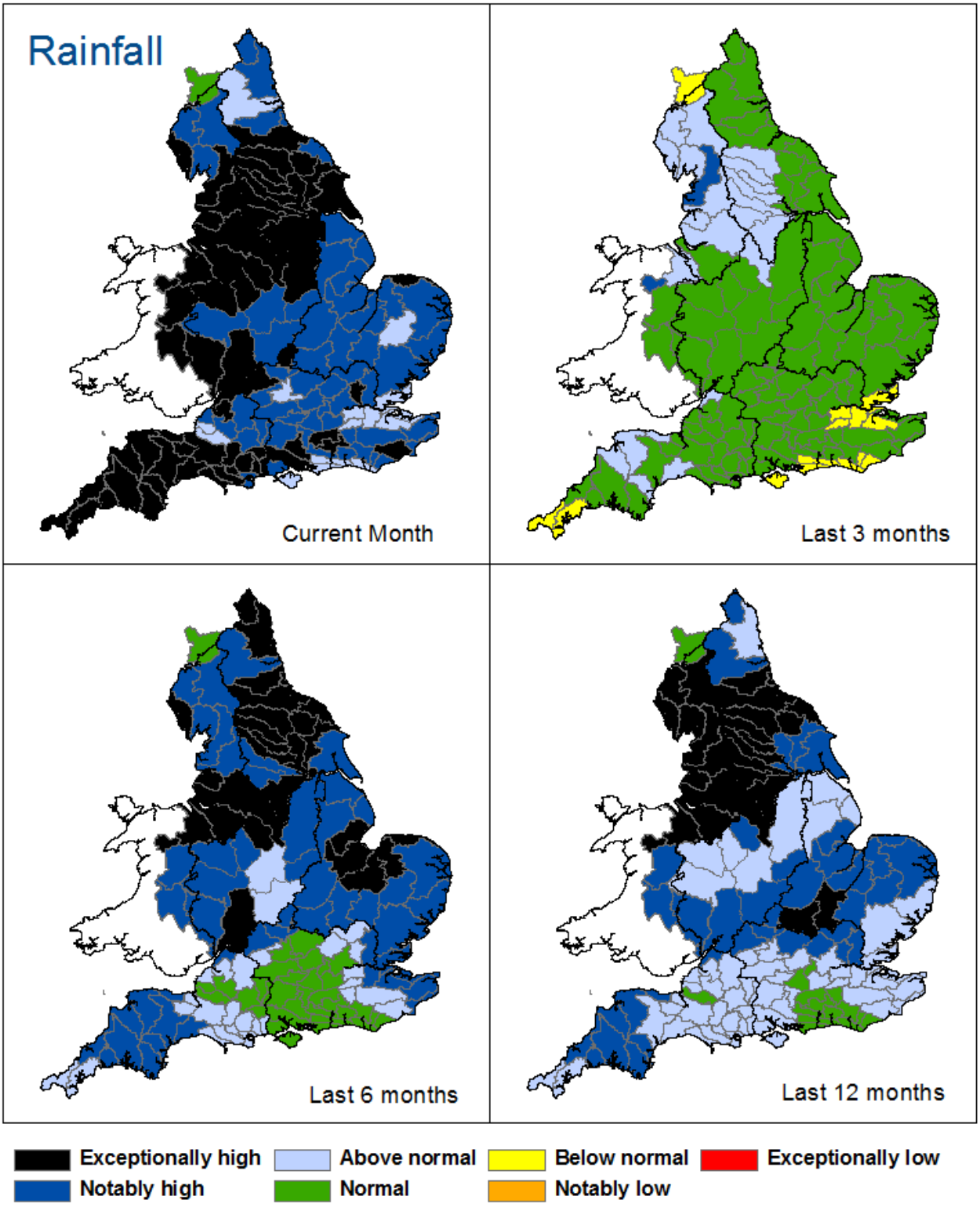


Figure 1.2: Total rainfall for hydrological areas across England for the current month (up to 31 May), the last 3 months, the last 6 months, and the last 12 months, classed relative to an analysis of respective historic totals. HadUK data based on the Met Office 1km gridded rainfall dataset derived from rain gauges *(Source: Met Office © Crown Copyright, 2021).* 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, 2021.

Rainfall charts

Above average rainfall

Below average rainfall

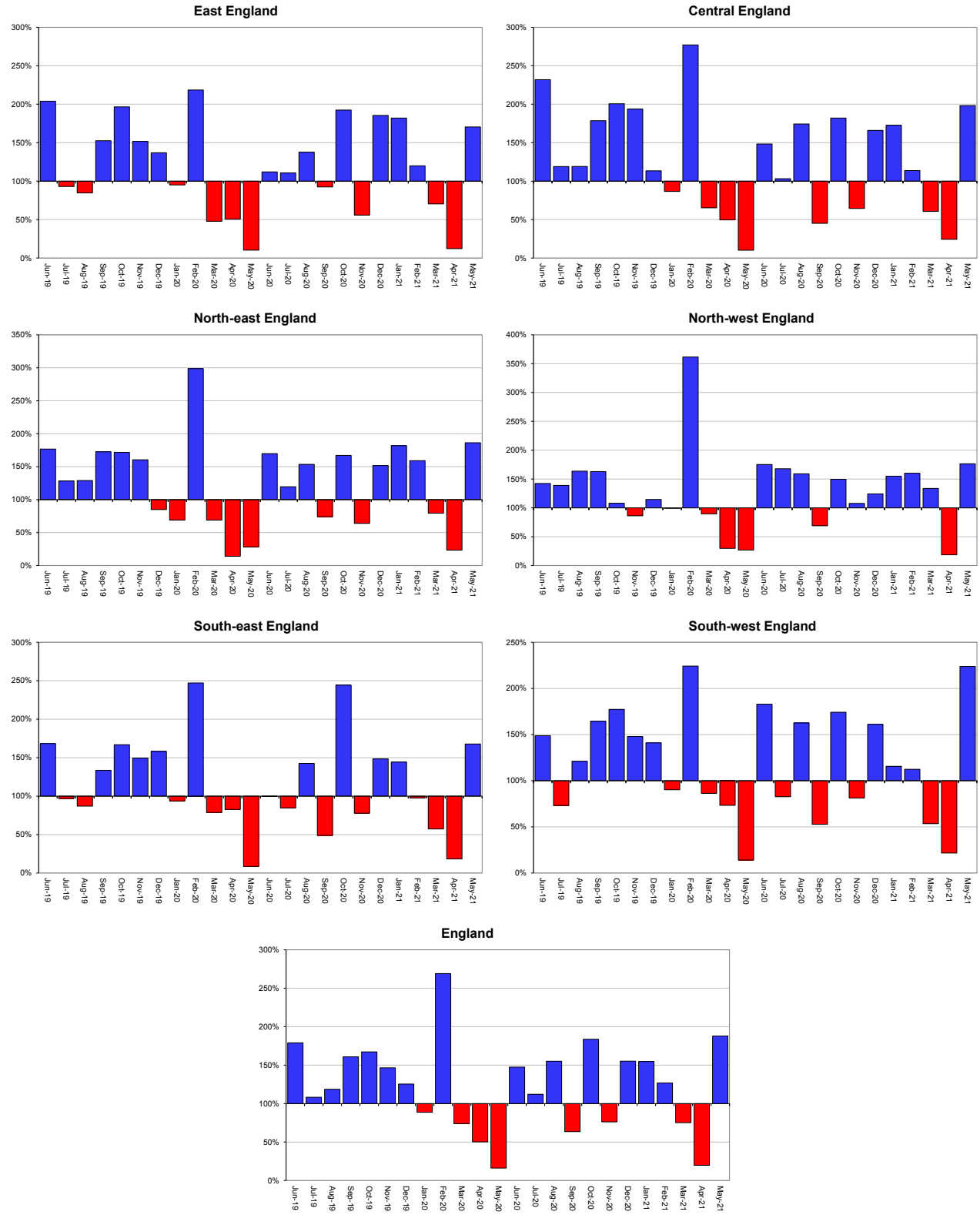


Figure 1.3: Monthly rainfall totals for the past 24 months as a percentage of the 1961 to 1990 long term average for each region and for England. HadUK rainfall data. (Source: Met Office © Crown Copyright, 2021).

Soil moisture deficit

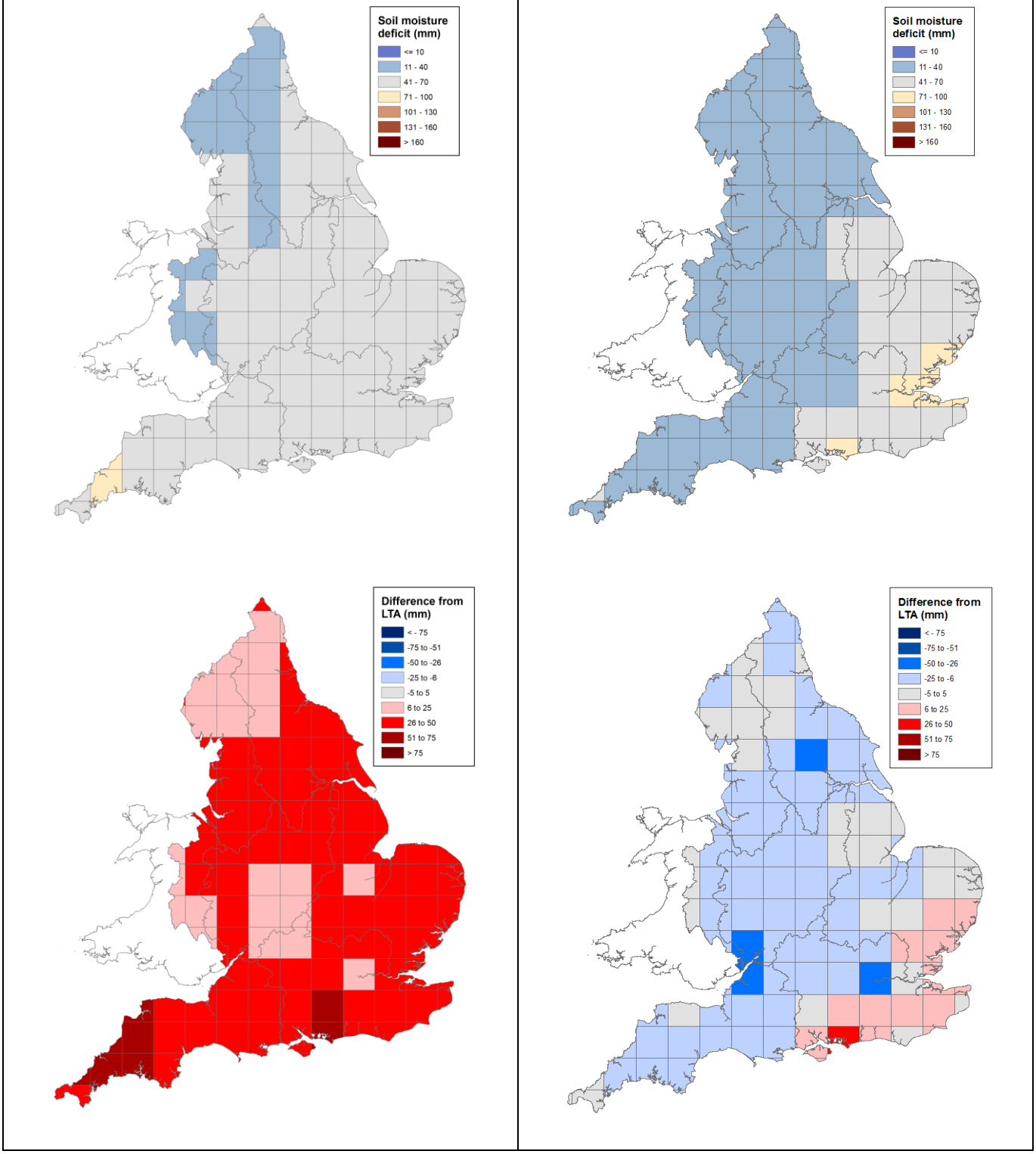
End of April 2021[1]	End of May 2021[2]
	

Figure 2.1: Soil moisture deficits for weeks ending 28 April 2021 [1] (left panel) and 02 June 2021 [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, 2021). Crown copyright. All rights reserved. Environment Agency, 100024198, 2021

Soil moisture deficit charts

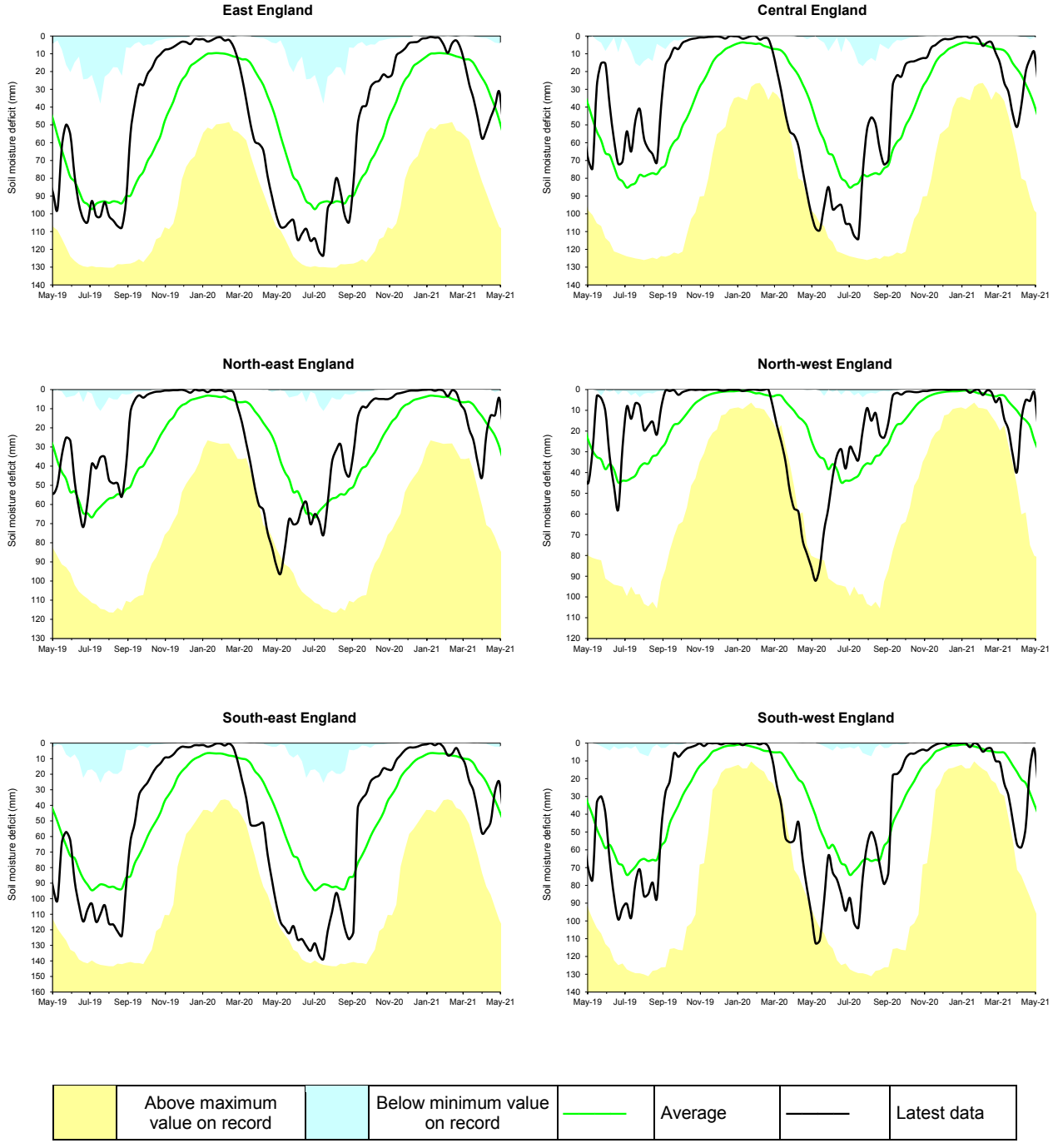
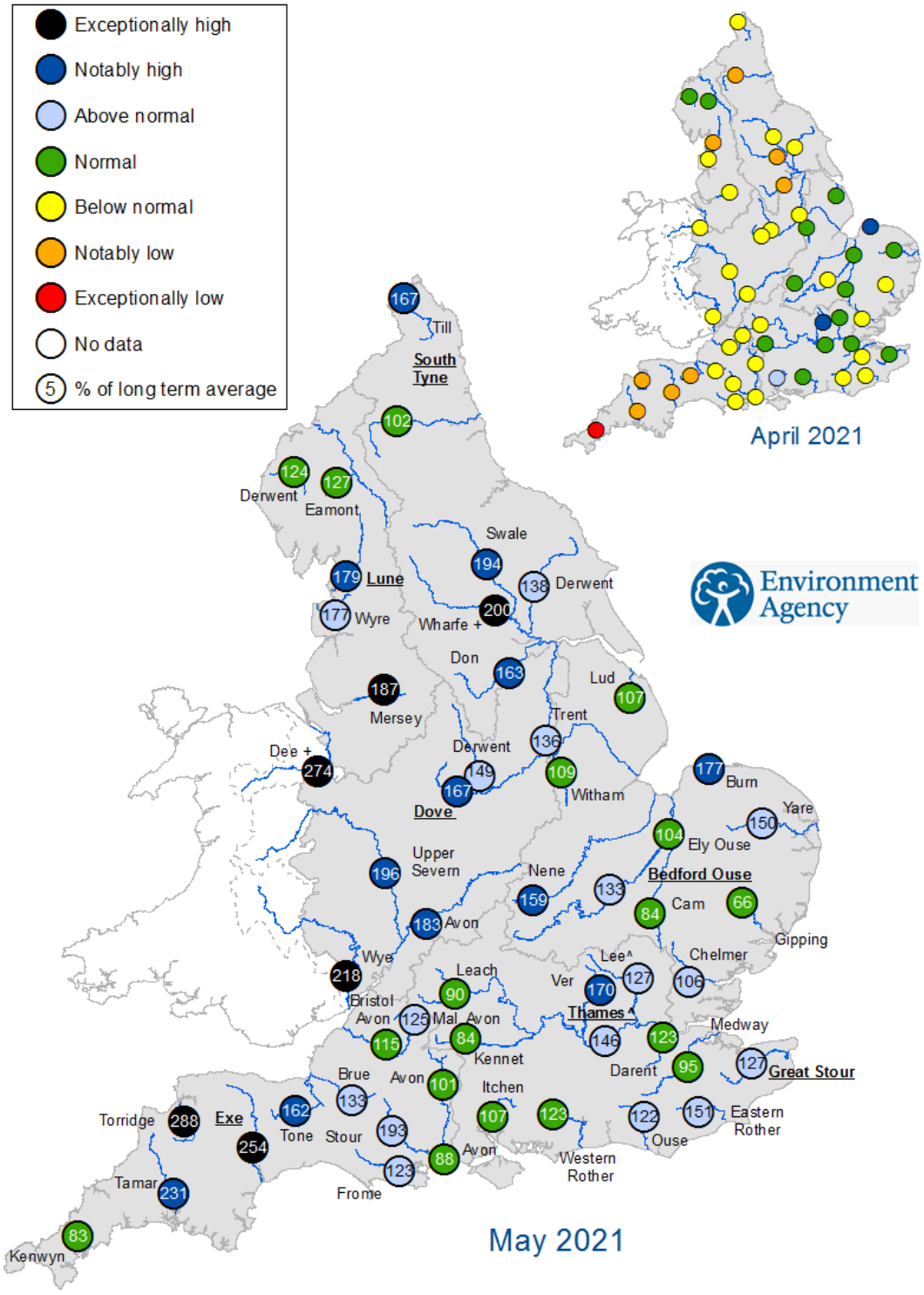


Figure 2.2: Latest soil moisture deficits for all geographic regions compared to maximum, minimum and 1961 to 90 long term average. Weekly MORECS data for real land use. (Source: Met Office © Crown Copyright, 2021).

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 on record for the current month (note that record length varies between sites)

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 April 2021 and May 2021, expressed as a percentage of the respective long term average and classed relative to an analysis of historic April and May monthly means (Source: Environment Agency). Crown copyright. All rights reserved. Environment Agency, 100024198, 2021.

River flow charts

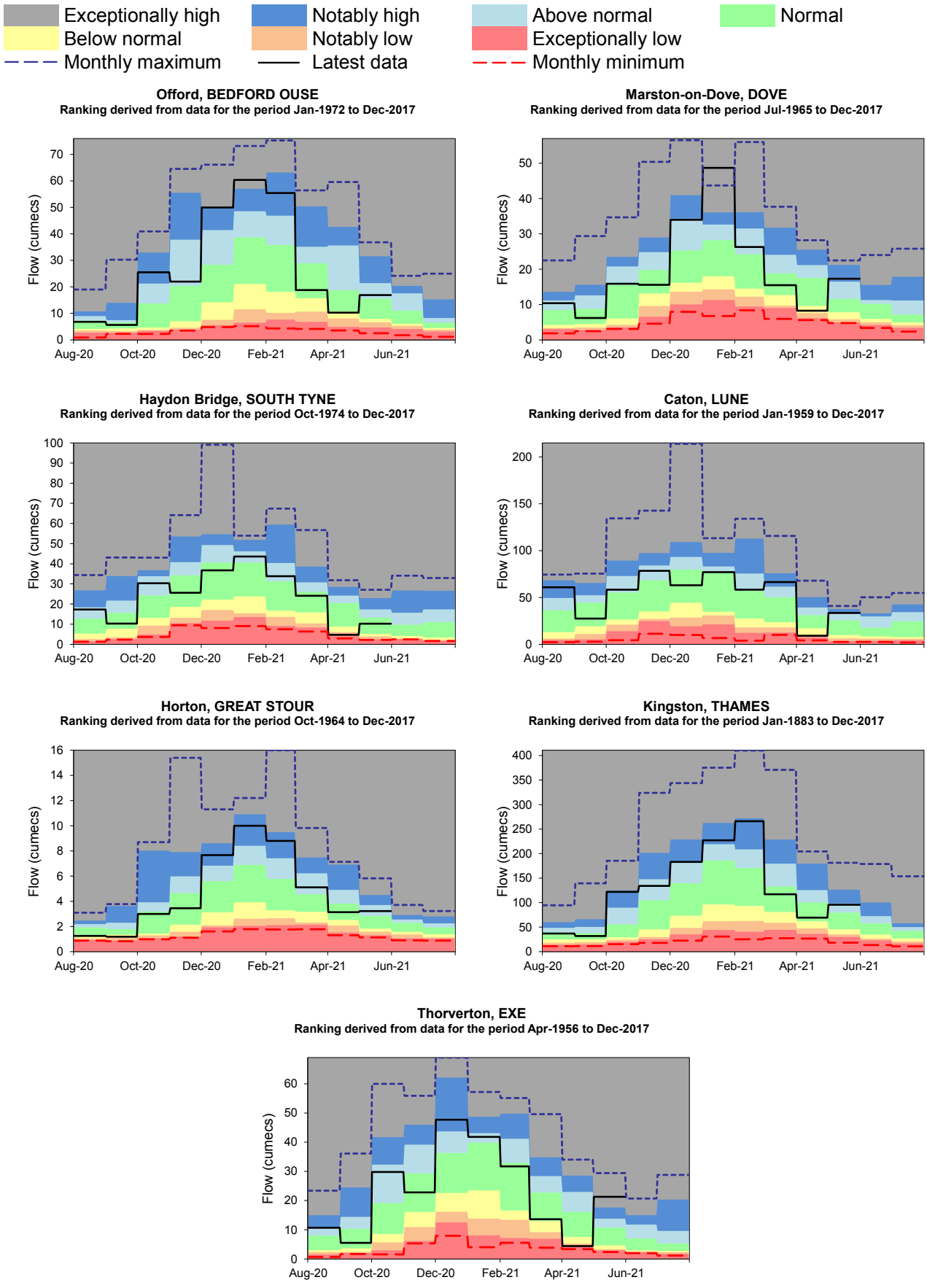
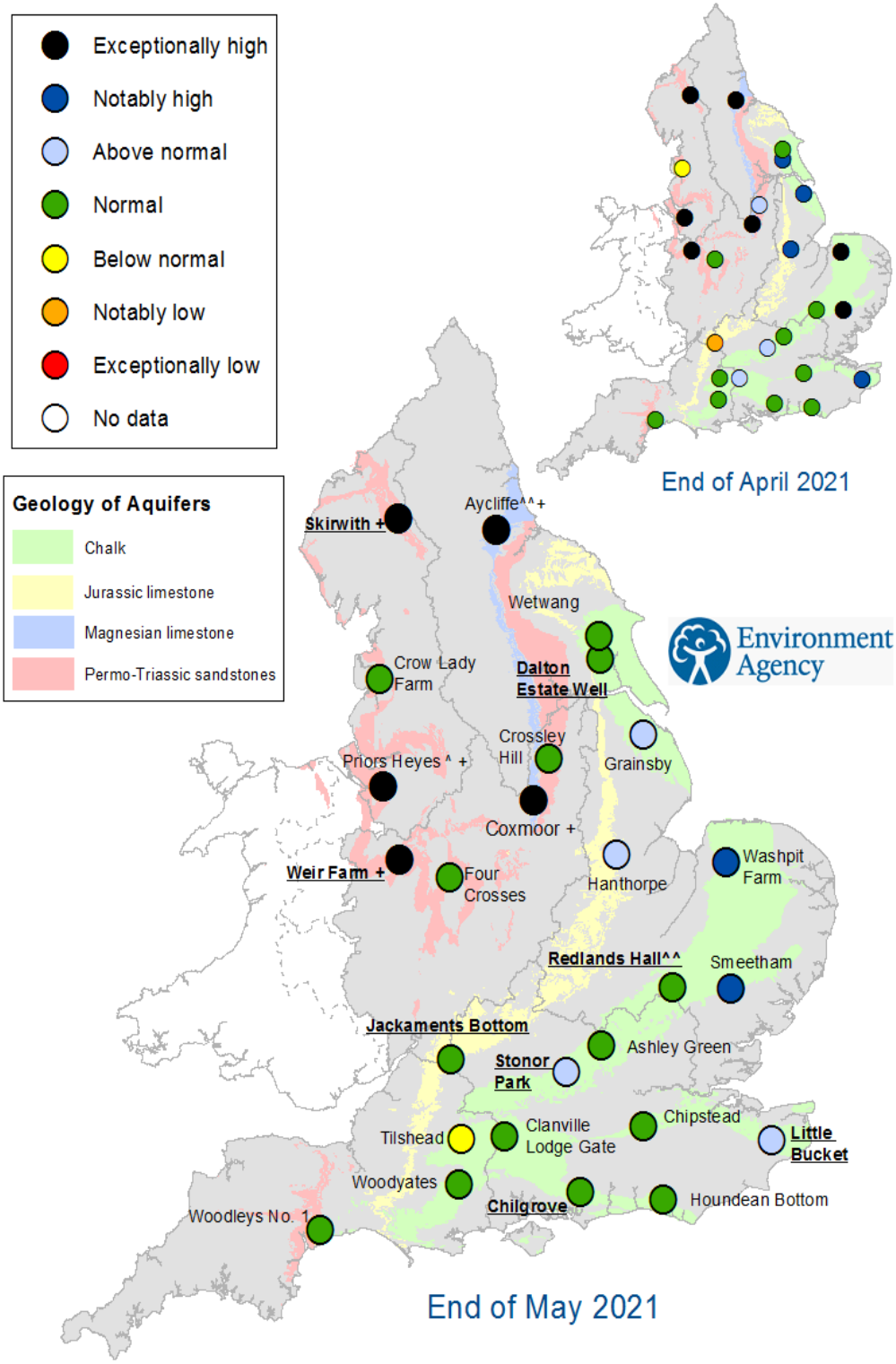


Figure 3.2: Index river flow sites for each geographic region. Monthly mean flow compared to an analysis of historic monthly mean flows, long term maximum and minimum flows. (Source: Environment Agency).

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 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 April 2021 and May 2021, classed relative to an analysis of respective historic April and May levels (Source: Environment Agency). Geological map reproduced with kind permission from UK Groundwater Forum, BGS © NERC. Crown copyright. All rights reserved. Environment Agency, 100024198, 2021.

Groundwater level charts

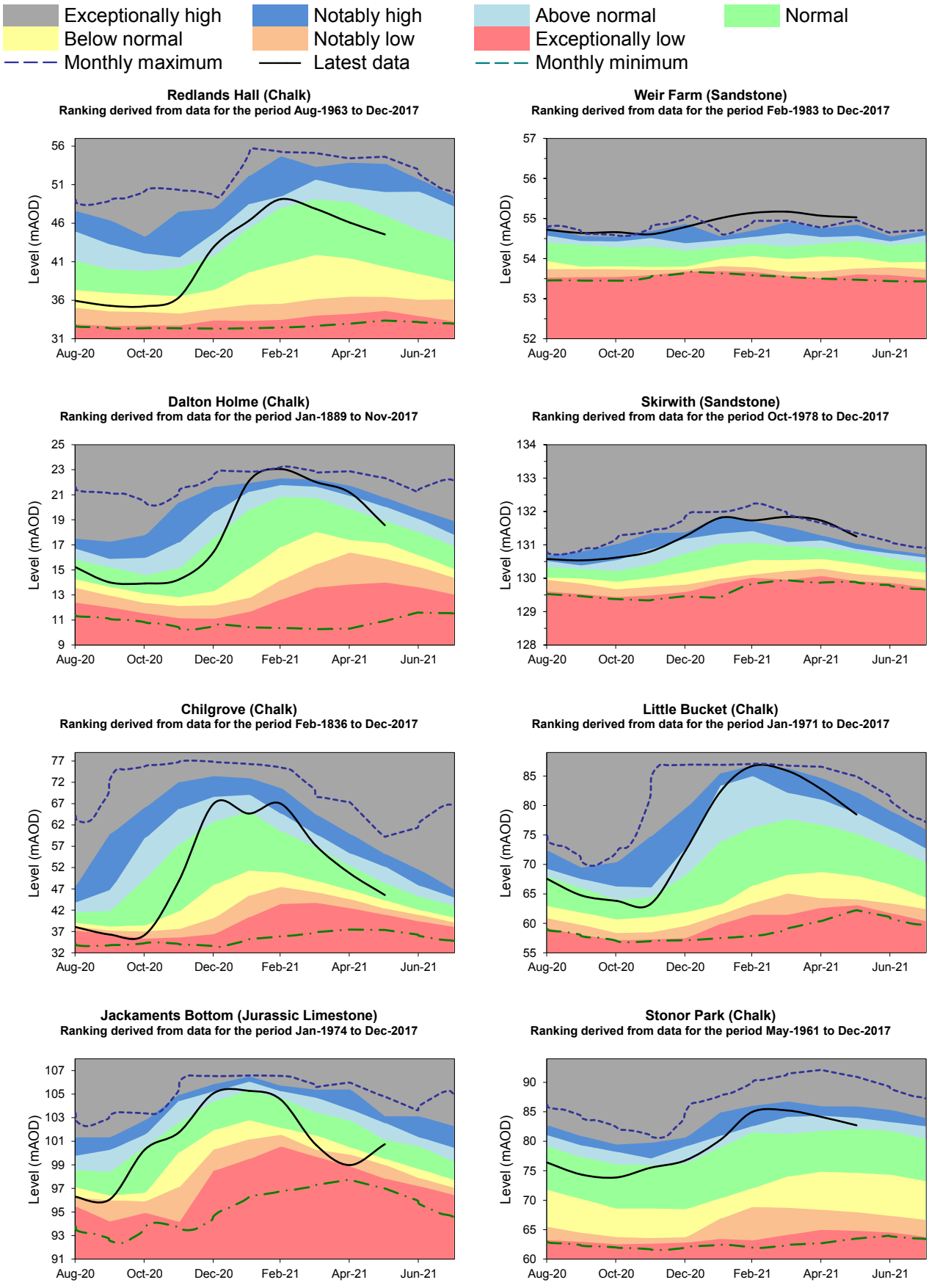
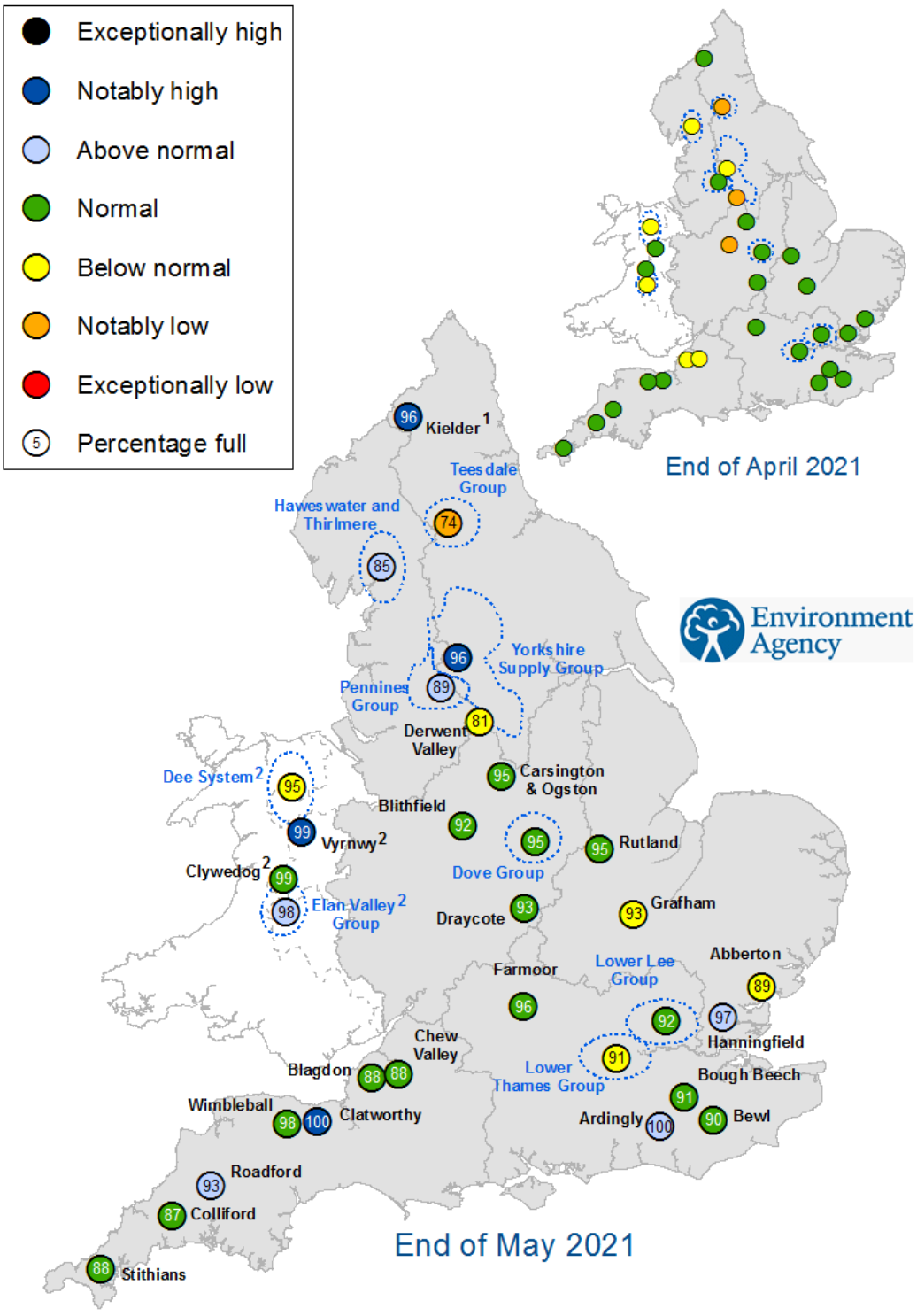


Figure 4.2: Index groundwater level sites for major aquifers. End of month groundwater levels months compared to an analysis of historic end of month levels and long term maximum and minimum levels. (Source: Environment Agency, 2021).

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 April 2021 and May 2021 as a percentage of total capacity and classed relative to an analysis of historic April and May 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.

Reservoir storage charts

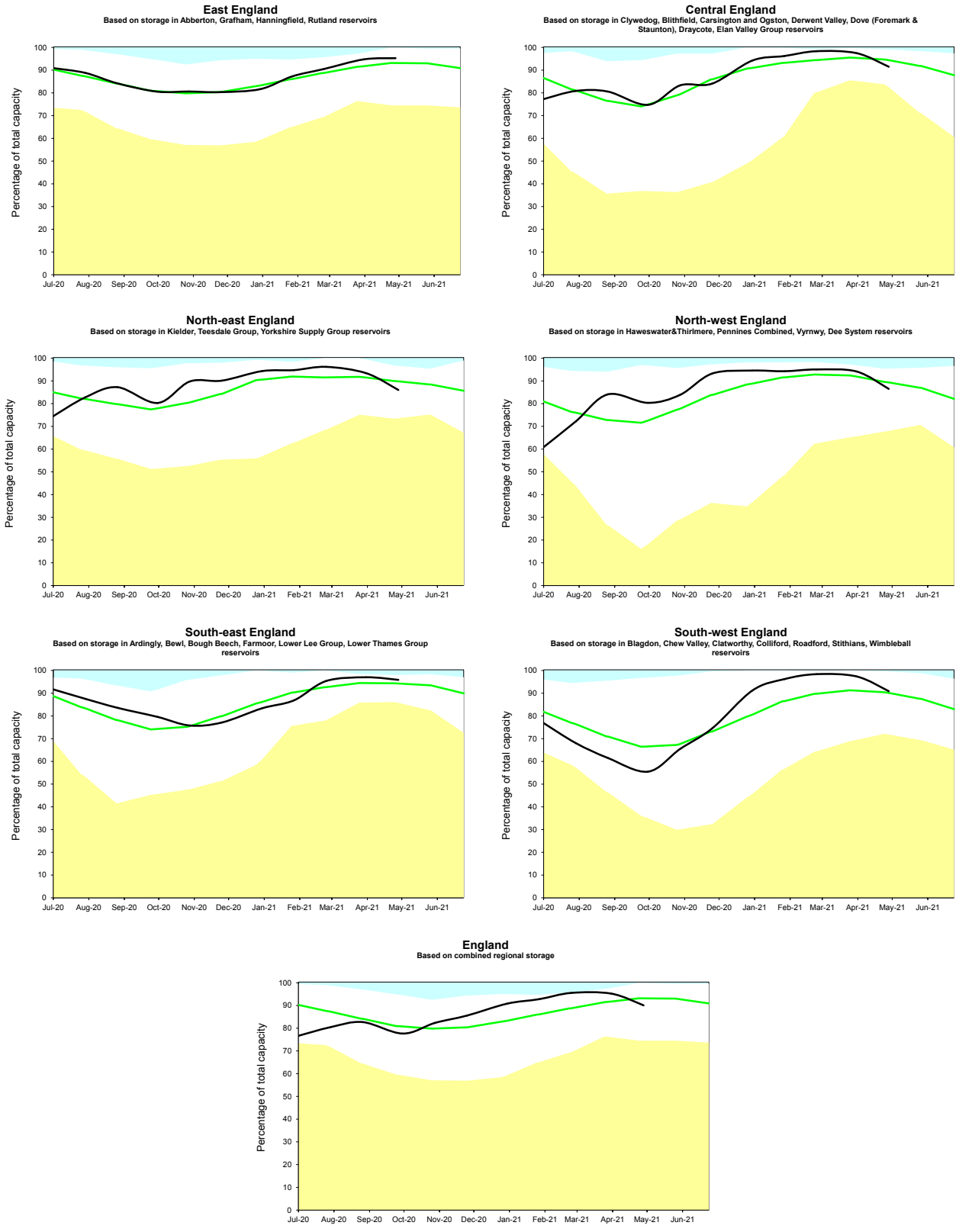


Figure 5.2: Regional reservoir stocks. End of month reservoir stocks compared to long term maximum, minimum and average stocks (Source: Water Companies). Note: Historic records of individual reservoirs/reservoir groups making up the regional values vary in length.

Forward look: river flow

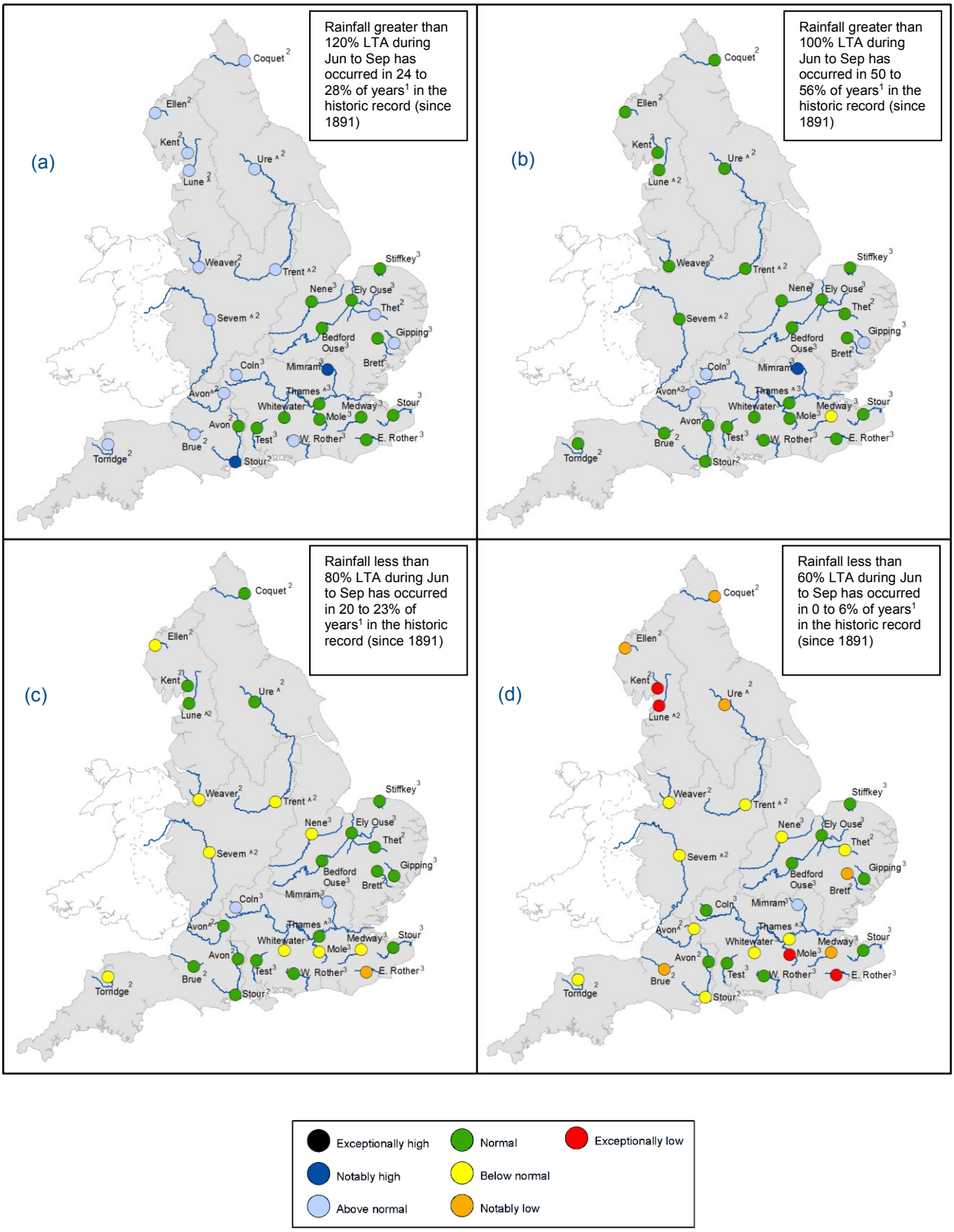


Figure 6.1: Projected river flows at key indicator sites up until the end of September 2021. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between June 2021 and September 2021 (Source: Centre for Ecology and Hydrology, Environment Agency)

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

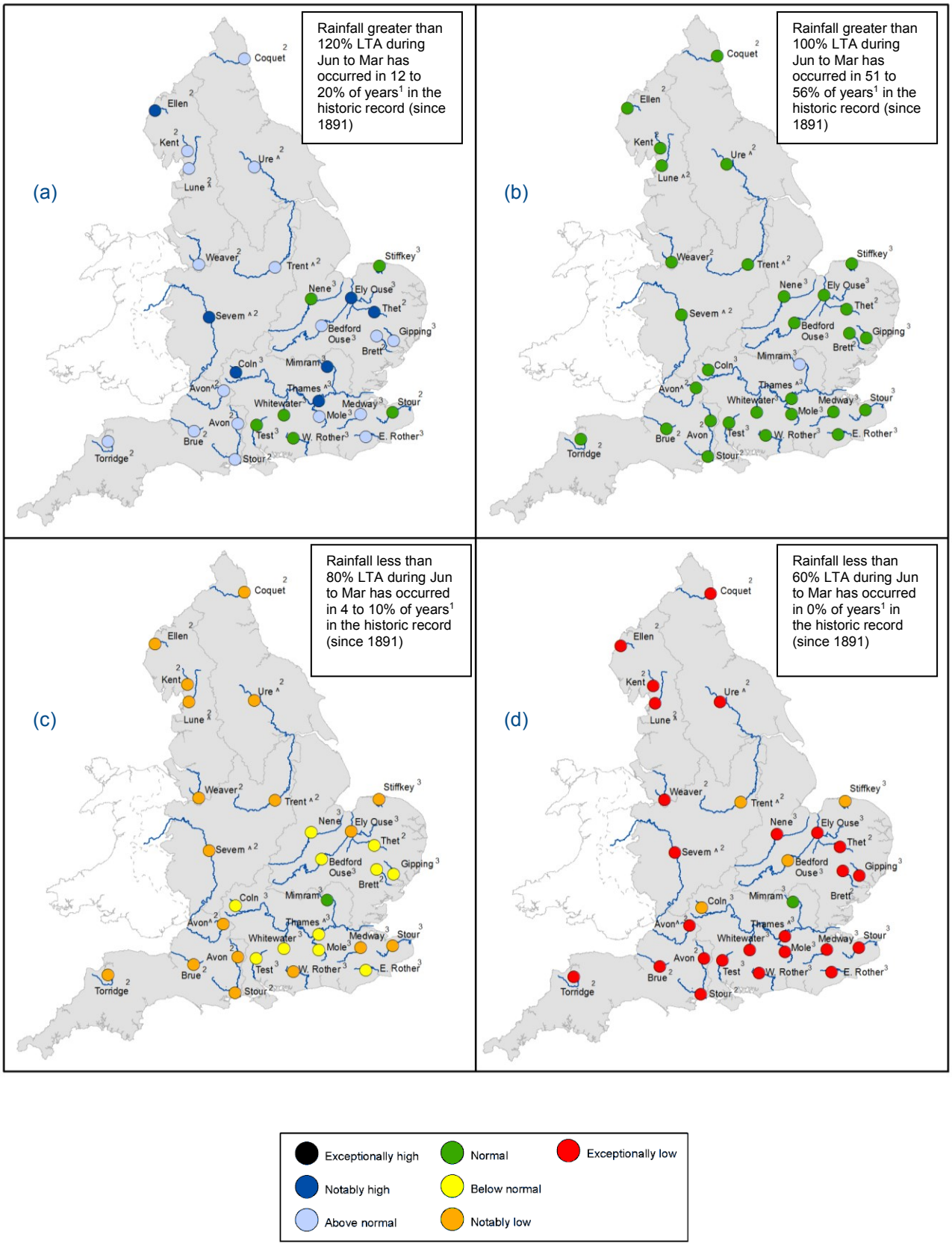


Figure 6.2: Projected river flows at key indicator sites up until the end of March 2022. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between June 2021 and March 2022 (Source: Centre for Ecology and Hydrology, Environment Agency)

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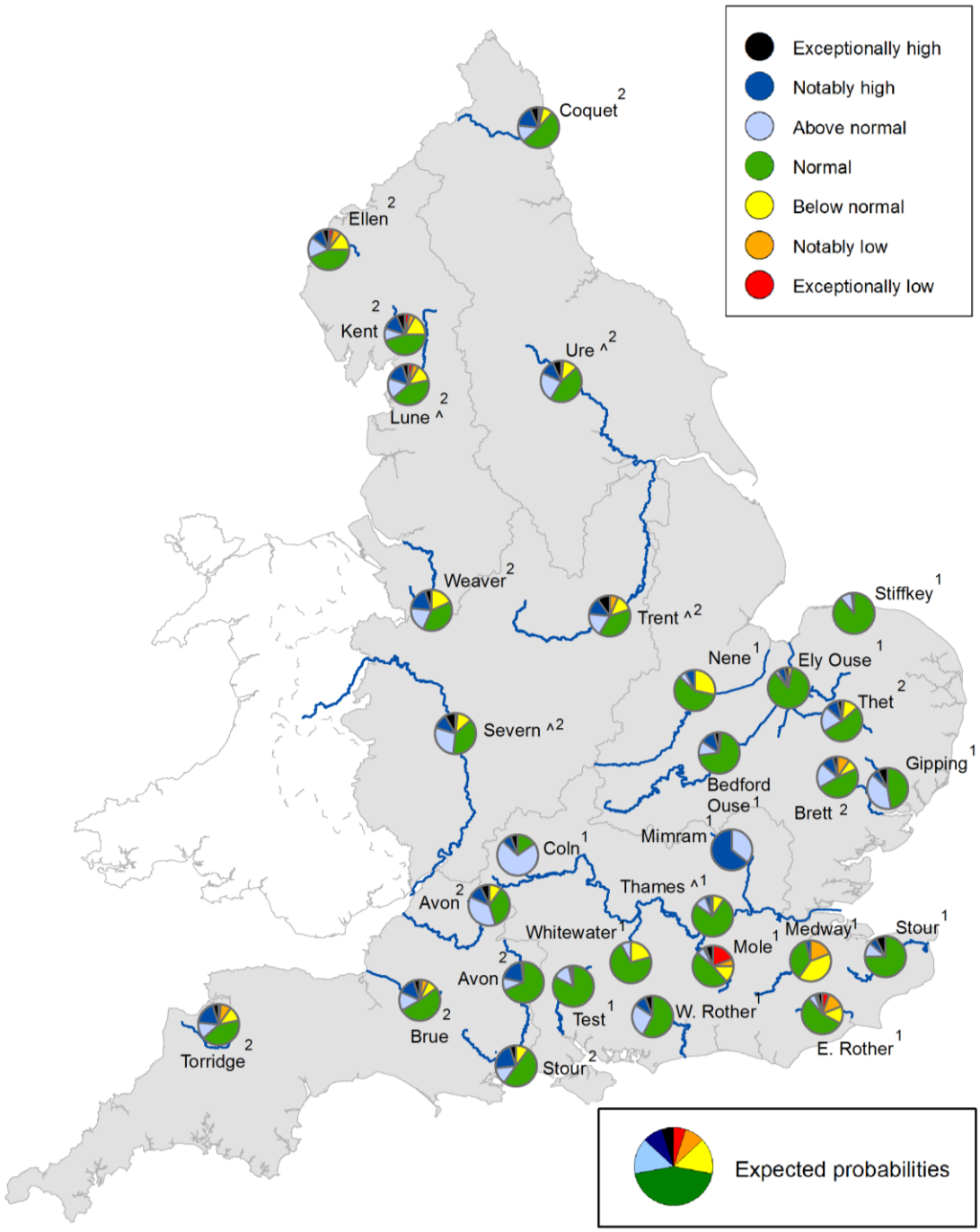

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are 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 2021. 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: Centre for Ecology and Hydrology, Environment Agency).

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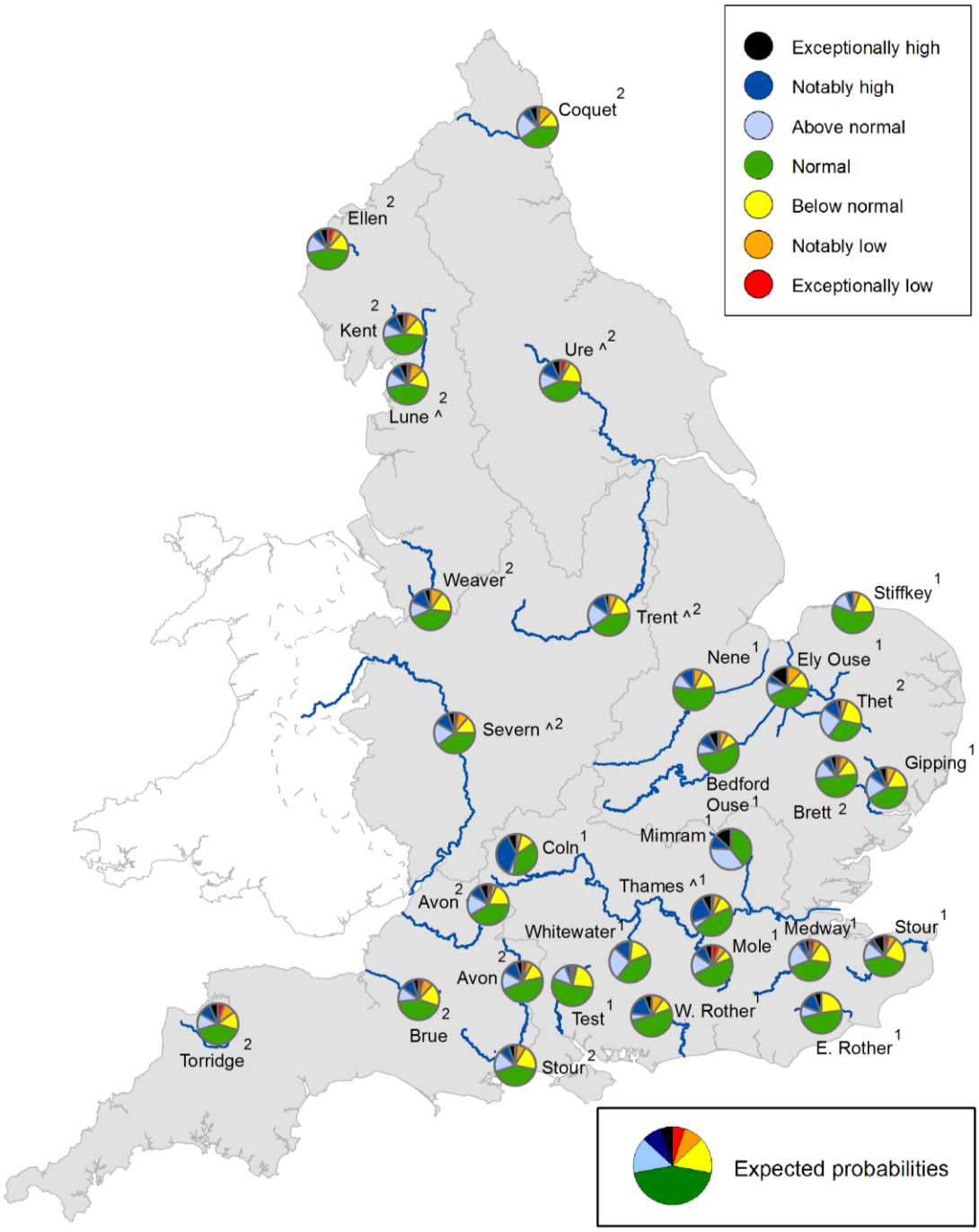

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Figure 6.4: Probabilistic ensemble projections of river flows at key indicator sites up until the end of March 2022. Pie charts indicate probability, based on climatology, of the surface water flow at each site being e.g. exceptionally low for the time of year. (Source: 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 CEH
^"Naturalised" flows are projected for these sites

Forward look: groundwater

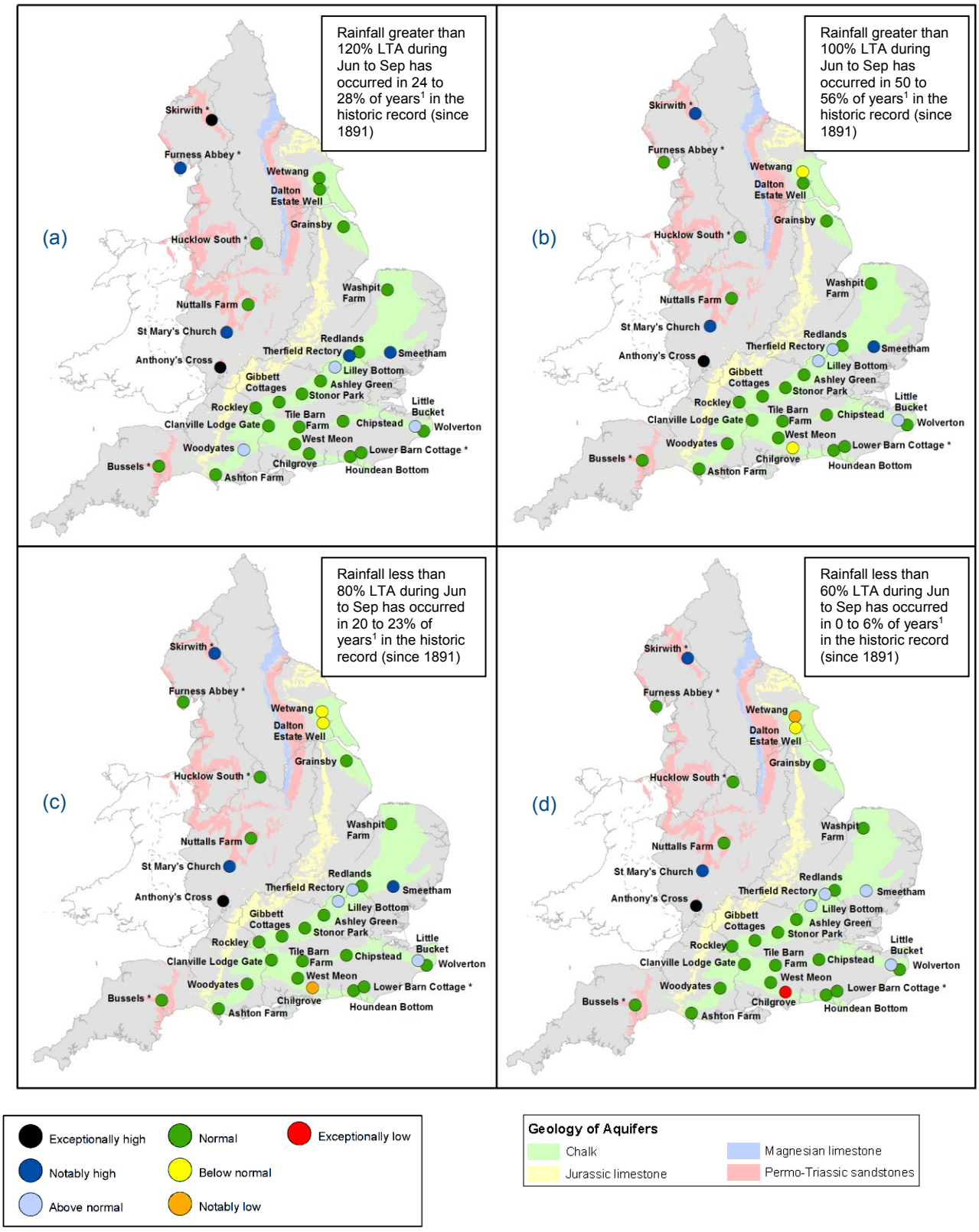

Figure 6.5: Projected groundwater levels at key indicator sites at the end of September 2021. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between June 2021 and September 2021 (Source: Environment Agency) Geological map reproduced with kind 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

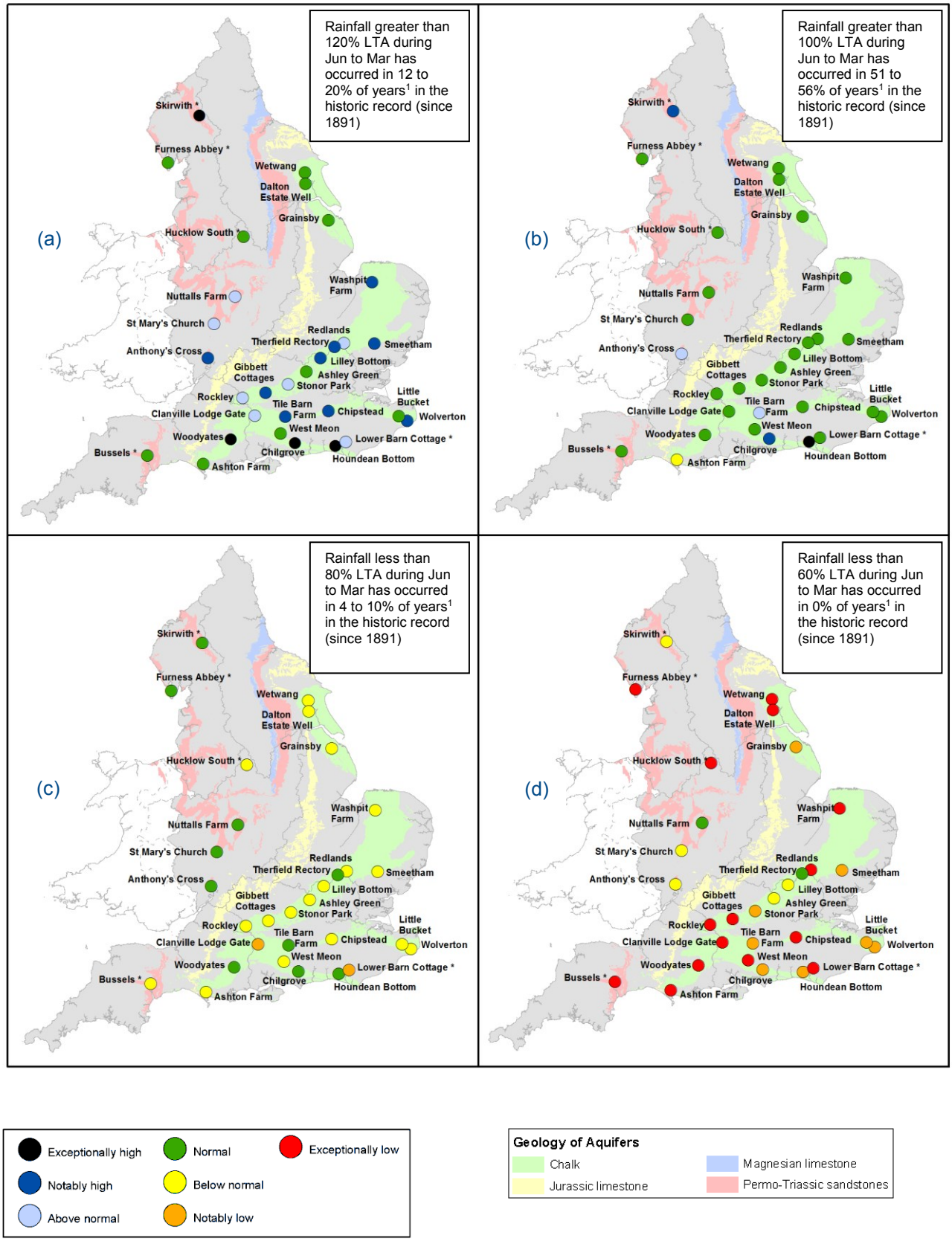

Figure 6.6: Projected groundwater levels at key indicator sites at the end of March 2022. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between June 2021 and March 2022 (Source: Environment Agency) Geological map reproduced with kind permission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

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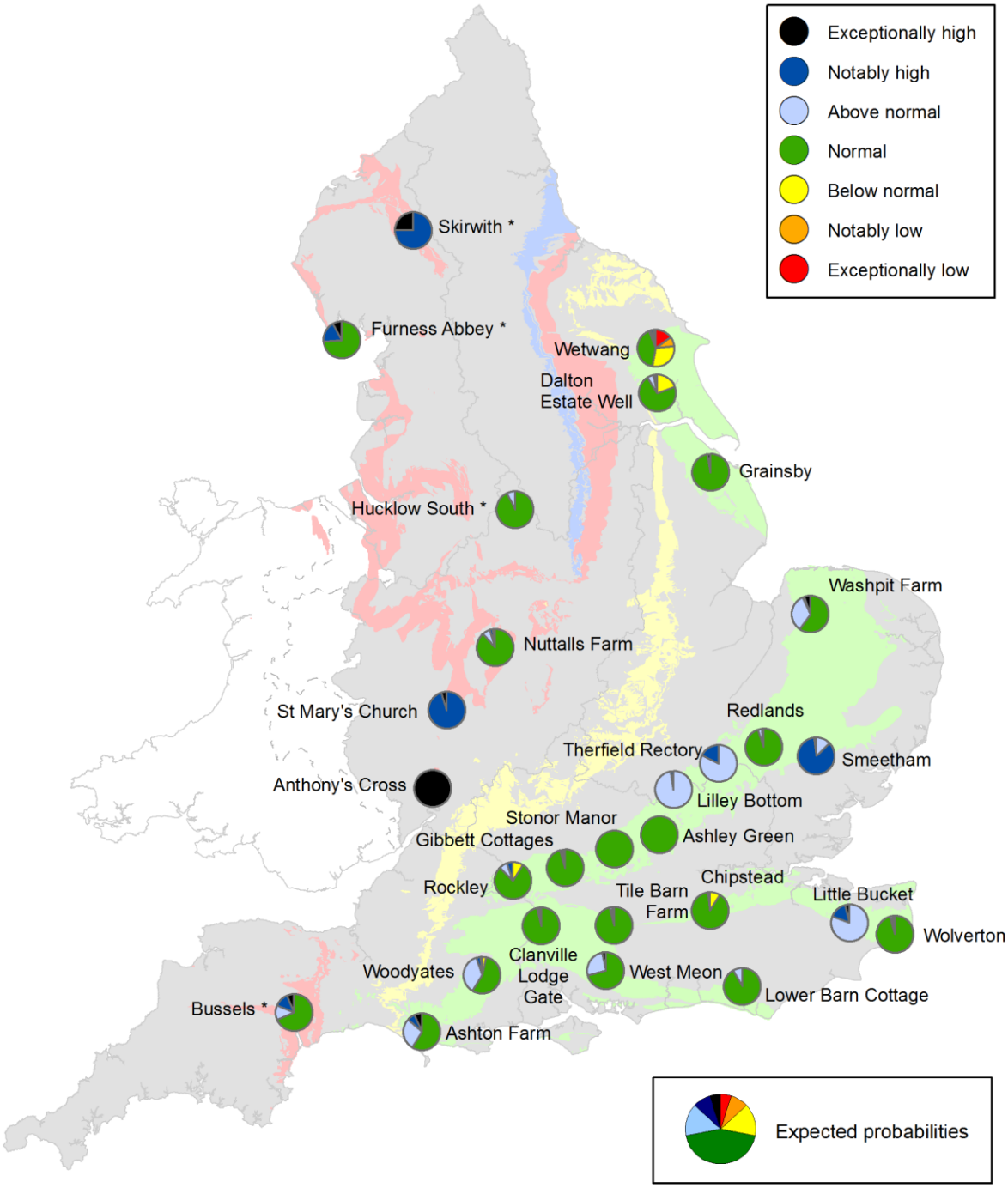
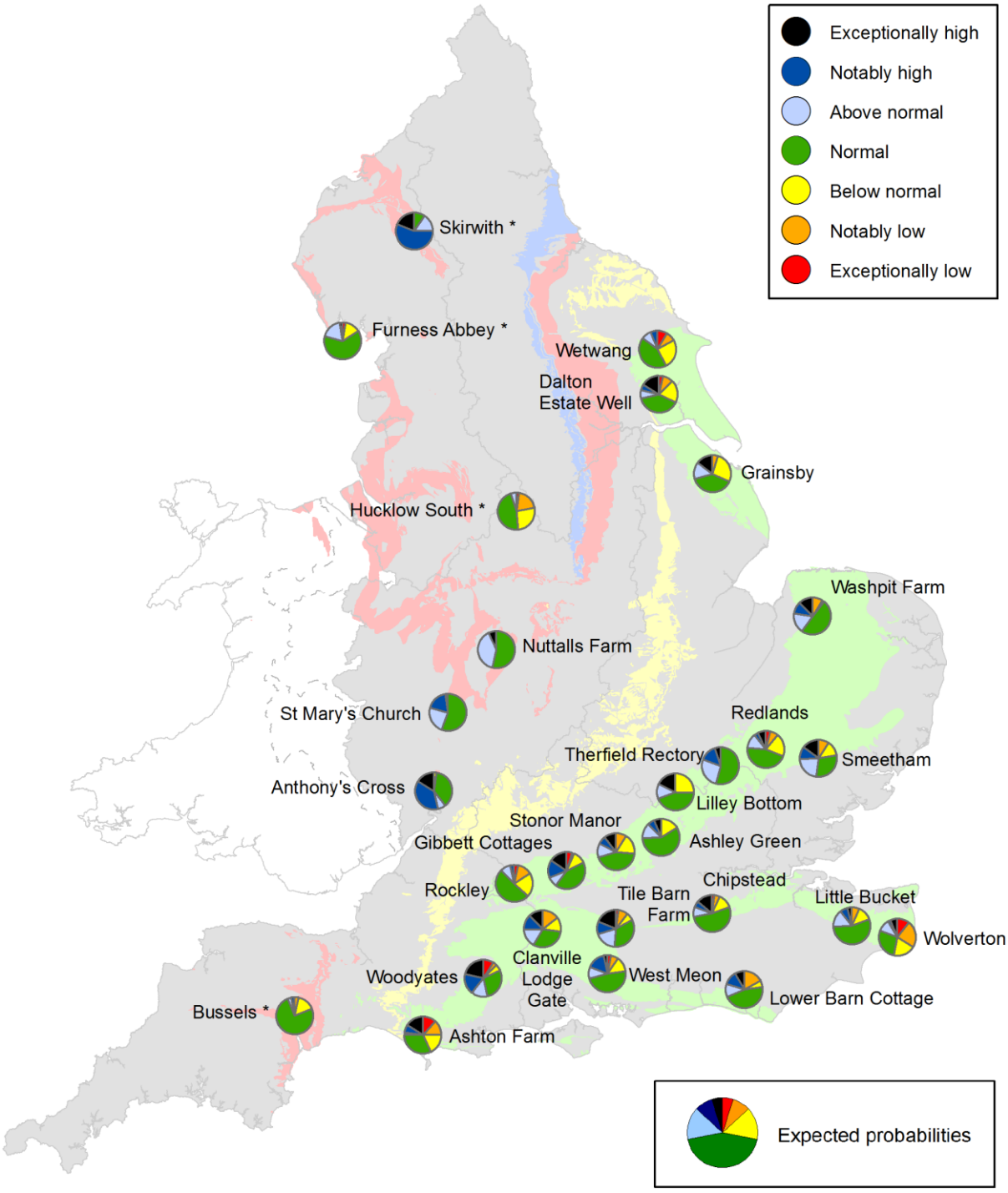


Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are 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 2021. 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*



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 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

Figure 7.1: Geographic regions

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