Monthly water situation report

England

Summary – July 2020

Exceptionally high rainfall totals for July were recorded in parts of north-west England, but totals for the month were within the normal range for the time of year across much of the rest of the country. In much of north-west England soil was close to saturation by the end of the month. Exceptionally high flows were recorded on the River Derwent, Lune and Wyre catchments (north-west England) as a result. End of month groundwater levels were classed as normal or higher at three-quarters of indicator sites. Total reservoir stocks for England were at 80% of capacity at the end of July, below the long-term average for the time of year.

Rainfall

The July rainfall total for England was 65mm, which is 110% of the 1961 to 1990 long-term average (LTA) (104% of 1981 to 2010 LTA). The highest rainfall totals for June were in parts of north-west England (Figure 1.1).

Exceptionally high rainfall totals for July were recorded in the River Kent, Esk, Wyre and Lune catchments (Cumbria and Lancashire). The River Kent catchment received the highest rainfall total as a proportion of LTA, with 224mm of rainfall during July, representing 206% of LTA. July rainfall totals were classed as normal for the month in the majority of catchments. Below normal rainfall totals were recorded in over a fifth of catchments, mainly in parts of south-east, south-west and central England. A notably low rainfall total for July was recorded over the River Otter, Sid, Axe and Lim catchments (in Devon and Dorset) with 28mm, representing less than half (49%) of the long-term average (Figure 1.2).

At a regional scale, the July rainfall total ranged from 41mm (85% of LTA) in south-east England to 143mm (168% of LTA) in north-west England (Figure 1.3).

Soil moisture deficit

Soil generally got drier in south-east England and wetter in north-west England during July. In much of north-west England soil was close to saturation (a soil-moisture deficit of <5mm) by the end of the month. By contrast, the soil-moisture deficit (SMD) around Poole Harbour and the Isle of Wight was approximately 150mm by the end of July. Soil was drier than average for the time of year across most of England (Figure 2.1).

At a regional scale, soil was wetter the LTA for the time of year in north-west and just wetter than the LTA in north-east England. Soil was drier than average in all other regions (Figure 2.2).

River flows

River flows decreased at over two-thirds of indicator sites, compared to June, with notably low flows recorded on the River Cam (Cambridgeshire) and the River Derwent (North Yorkshire). Despite this, monthly mean river flows for July were classed as normal or higher for the time of year at four-fifths of indicator sites. Exceptionally high flows were recorded on the River Derwent (Cumbria), Lune and Wyre catchments in response to the high rainfall in these areas. The river flows on the River Derwent (Cumbria) and River Lune were the highest monthly mean flows for July on record, (records from 1968 and 1959 respectively) representing 287% and 314% of the LTA respectively (Figure 3.1).

Monthly mean river flows for the regional indicator sites were classed as above normal on the South Tyne at Haydon Bridge (north-east England) and exceptionally high on the River Lune at Caton (north-west England). Flows were within the normal range for July at all other regional indicator sites. (Figure 3.2).

Groundwater levels

Groundwater levels receded at all of the indicator sites we report on during July, although levels were still classed as normal or higher at three-quarters of indicator sites at the end of the month. Groundwater levels were classed as exceptionally high at Weir Farm (Bridgnorth Sandstone), Coxmoor (Idle and Torne Sandstone) and Prior

Hayes (West Cheshire Sandstone). These sites recorded the highest end of July levels on record (Figures 4.1 and 4.2). Levels at Priors Heyes remain high, compared to historic levels, because the aquifer is recovering from the effects of historic abstraction.

End of month groundwater levels at the major aquifer index sites ranged from being classed as exceptionally low at Jackaments Bottom (Burford Jurassic Limestone in the Cotswolds) to exceptionally high in the sandstone aquifer recorded at Weir Farm (Bridgnorth Sandstone) (Figures 4.1 and 4.2).

Reservoir storage

Reservoir stocks decreased at just over a half of the reservoirs and reservoir groups that we report on during July. At Hanningfield (east England), Ardingly (south-east England) and Blagdon (south-west England) reservoir stocks reduced by more than 10% of total storage capacity. The biggest decrease was at Blagdon reservoir where stocks fell from 74% of capacity at the end of June to 56% of capacity at the end of July. In the Derwent Valley reservoir group total stocks rose 20% and were classed as above normal at the end of July (at 84% of capacity). Reservoir stocks were classed as normal or higher for the time of year at almost two-thirds of reservoirs and reservoir groups at the end of the month (Figure 5.1).

Total reservoir stocks for England were at 80% of capacity at the end of July, below the LTA for the time of year. At a regional level, total reservoir stocks were below the LTA in north-west and south-west England and either very close to the LTA, or above it, in all other regions (Figure 5.2).

Forward look

The early part of August is expected to be largely warm and dry, particularly in south-east England, with some wetter weather expected in the north. Through the middle of the month, there is likely to be a gradual shift to more changeable conditions, moving in from the west, albeit with plenty of fine and dry weather remaining across England. There is a risk of heavy showers and thunderstorms, particularly in southern England. Towards the end of August, the finest and driest conditions are expected across southern England, with other areas experiencing periods of dry, settled weather interspersed with wetter spells, particularly in north-west England.

For the 3 month period August to October, across the UK, above average precipitation is slightly more likely than below average precipitation[1].

Projections for river flows at key sites[2]

Half of the modelled sites have a greater than expected chance of cumulative river flows being below normal or lower for the time of year by the end of September 2020. By the end of March 2021, two-thirds of 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 2020 see Figure 6.1
For scenario based projections of cumulative river flows at key sites by March 2021 see Figure 6.2
For probabilistic ensemble projections of cumulative river flows at key sites by September 2020 see Figure 6.3
For probabilistic ensemble projections of cumulative river flows at key sites by March 2021 see Figure 6.4

Projections for groundwater levels in key aquifers[2]

By the end of September 2020, 90% of all the modelled sites have a greater than expected chance of groundwater levels being normal or higher for the time of year. By the end of March 2021, half of the modelled sites have a greater than expected chance of groundwater levels being below normal or lower for the time of year.

For scenario based projections of groundwater levels in key aquifers in September 2020 see Figure 6.5
For scenario based projections of groundwater levels in key aquifers in March 2021 see Figure 6.6
For probabilistic ensemble projections of groundwater levels in key aquifers in September 2020 see Figure 6.7
For probabilistic ensemble projections of groundwater levels in key aquifers in March 2021 see Figure 6.8

Authors: National Water Resources Hydrology Team

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).

Rainfall

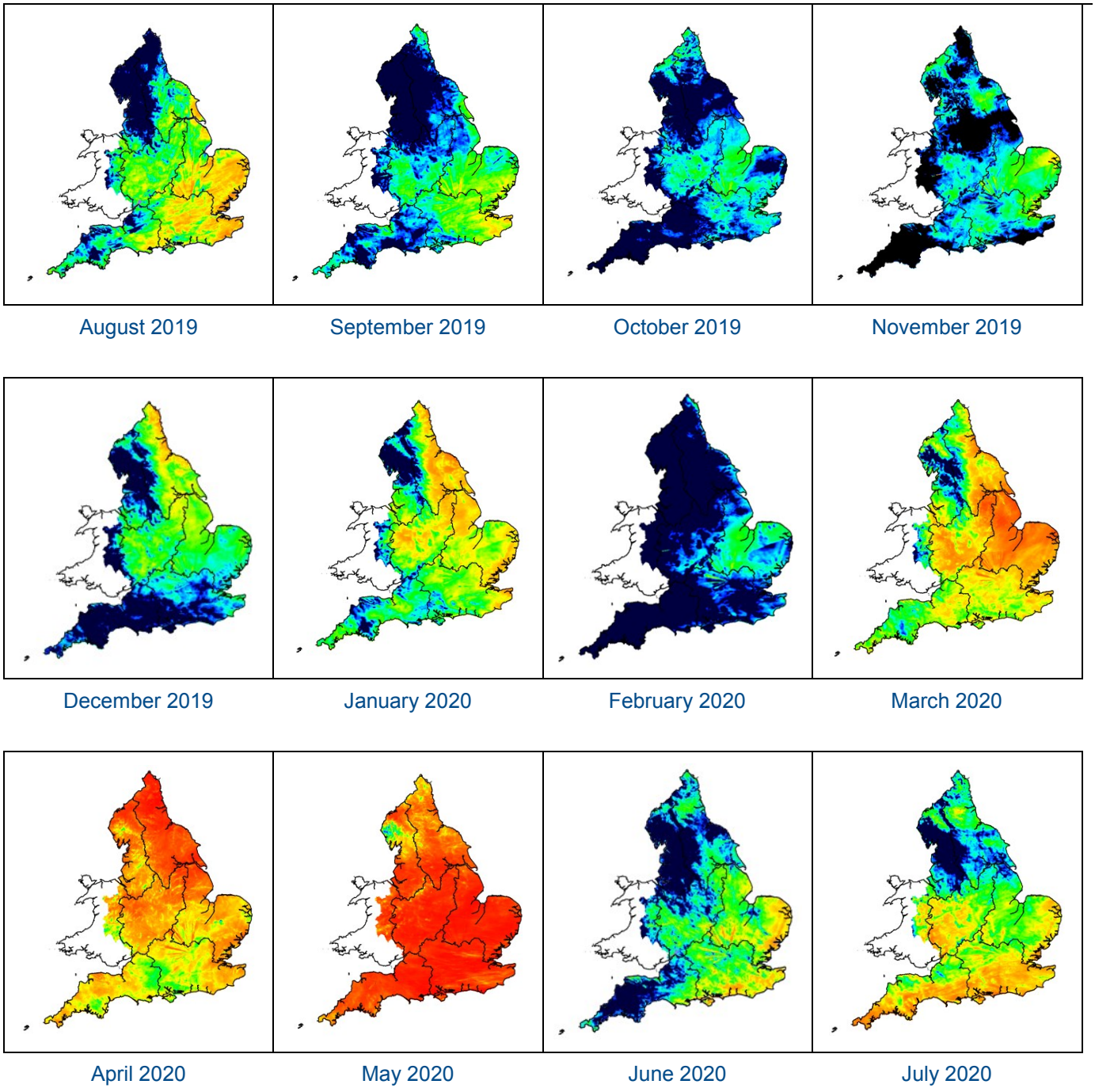
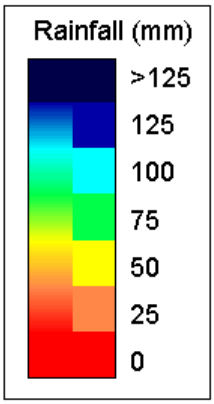


Figure 1.1: Monthly rainfall across England and Wales for the past 12 months. UKPP radar data (Source: Met Office © Crown Copyright, 2020). Note: Radar beam blockages in some regions may give anomalous totals in some areas. Crown copyright. All rights reserved. Environment Agency, 100024198, 2020.



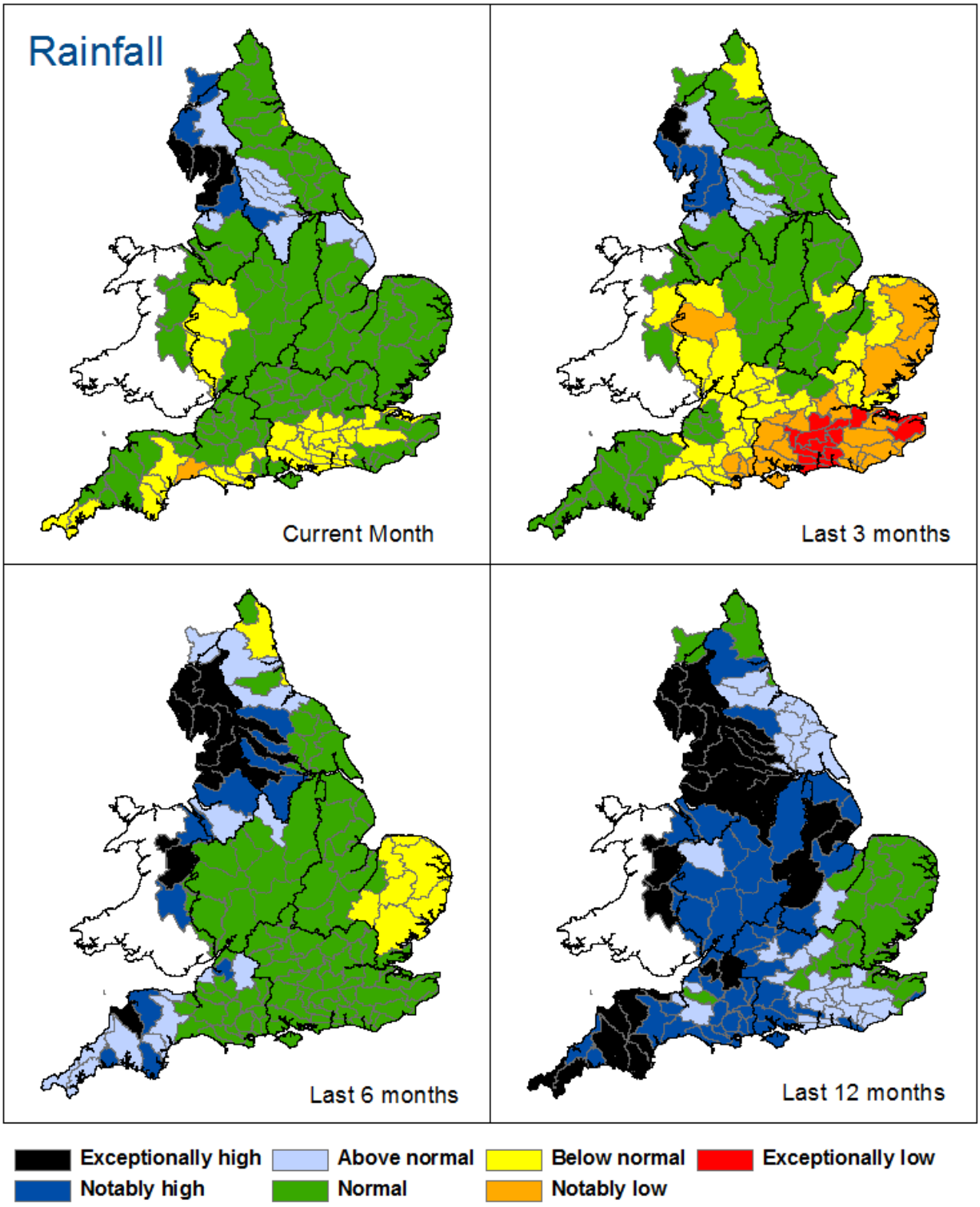


Figure 1.2: Total rainfall for hydrological areas across England for the current month (up to 31 July), the last 3 months, the last 6 months, and the last 12 months, classed relative to an analysis of respective historic totals. HadUK data based on the Met Office 1km gridded rainfall dataset derived from rain gauges *(Source: Met Office © Crown Copyright, 2020).* 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, 2020.

Rainfall charts

Above average rainfall

Below average rainfall

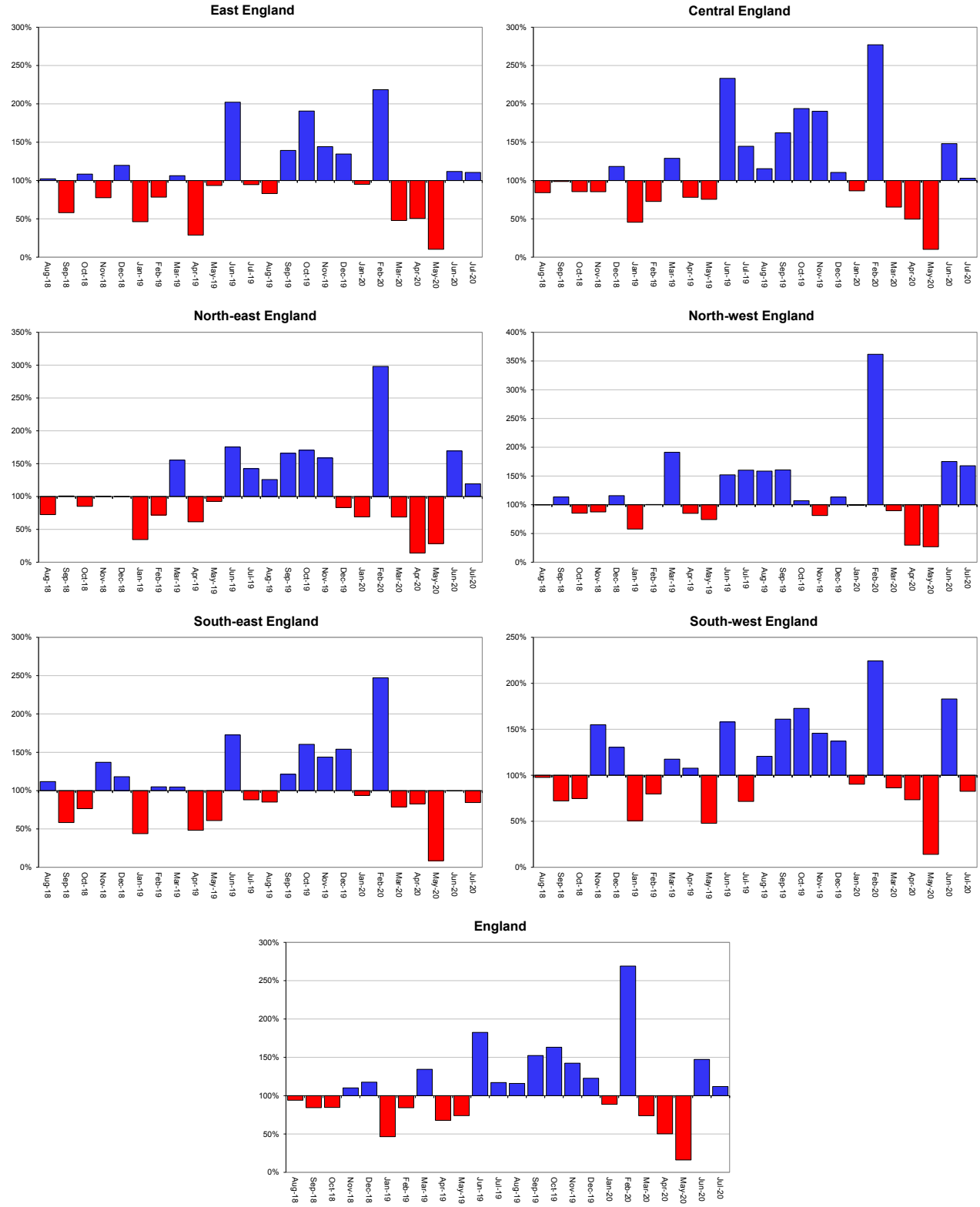


Figure 1.3: Monthly rainfall totals for the past 24 months as a percentage of the 1961 to 1990 long term average for each region and for England. HadUK rainfall data. (Source: Met Office © Crown Copyright, 2020).

Soil moisture deficit

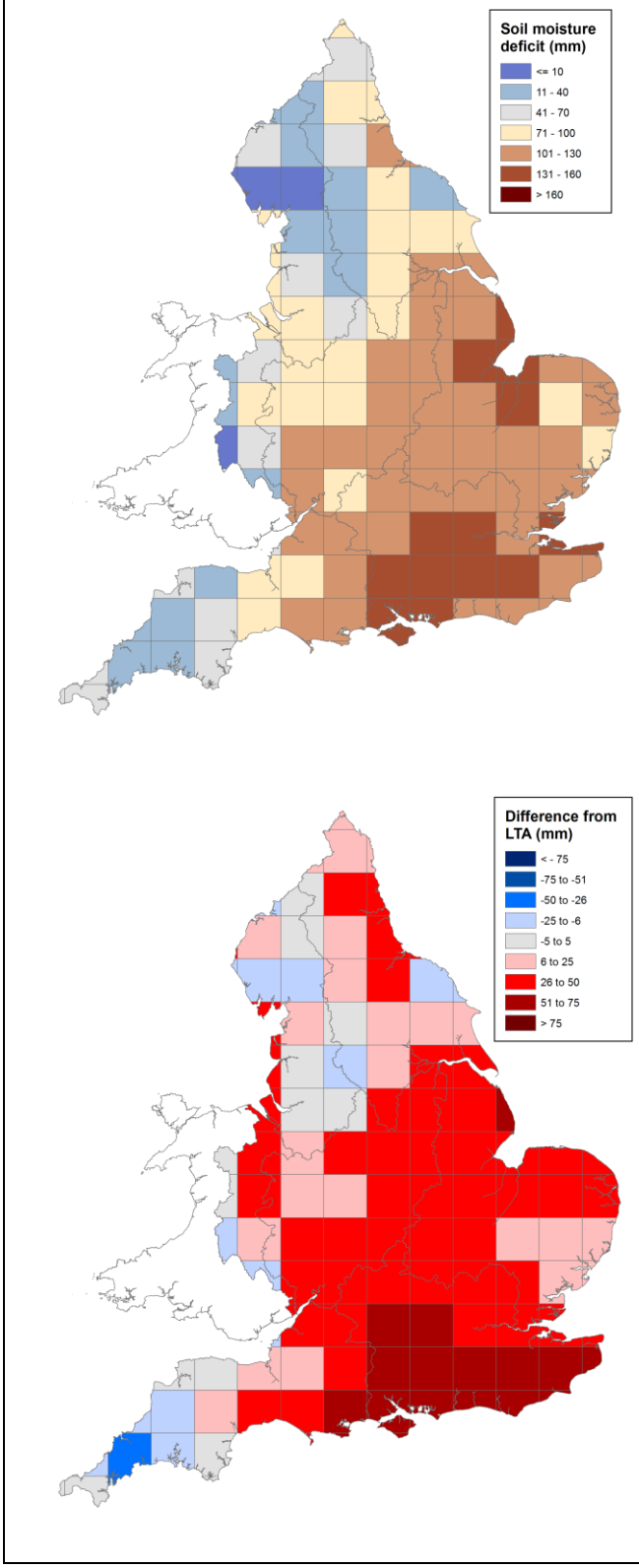
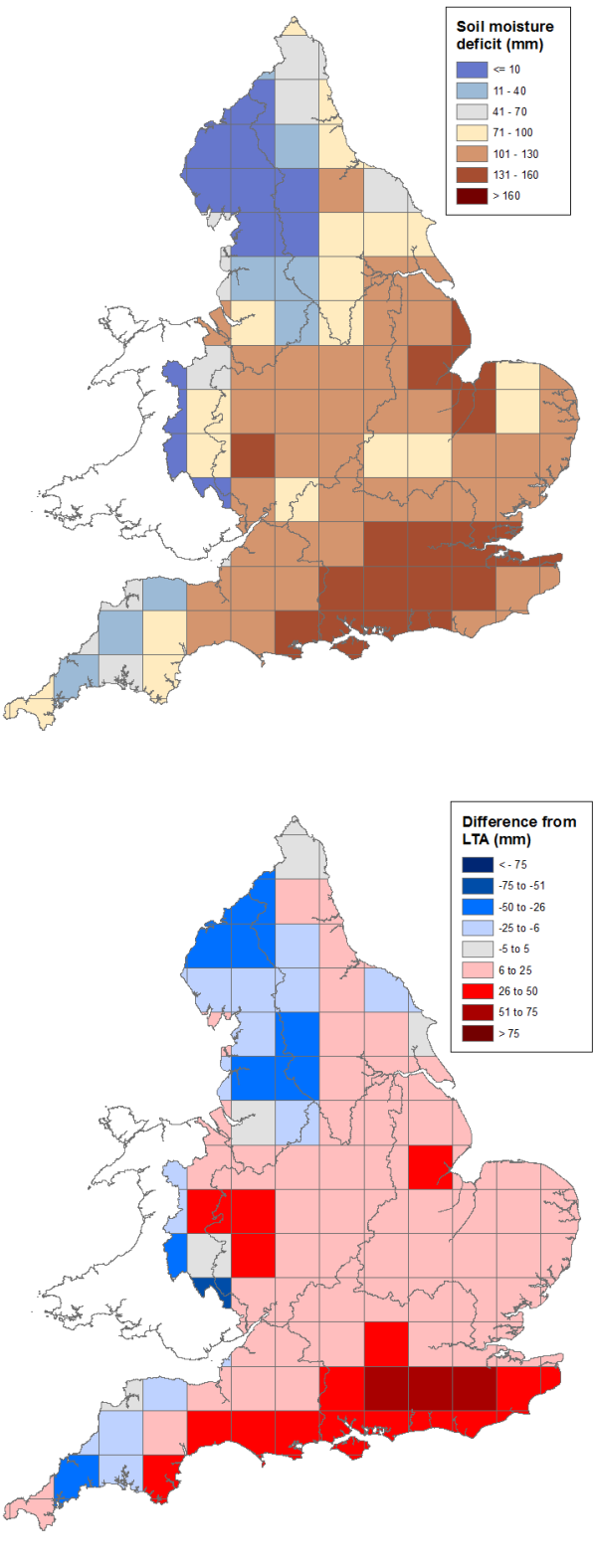
End of June 2020[1]	End of July 2020[2]
	

Figure 2.1: Soil moisture deficits for weeks ending 30 June 2020 [1] (left panel) and 28 July 2020 [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, 2020). Crown copyright. All rights reserved. Environment Agency, 100024198, 2020

Soil moisture deficit charts

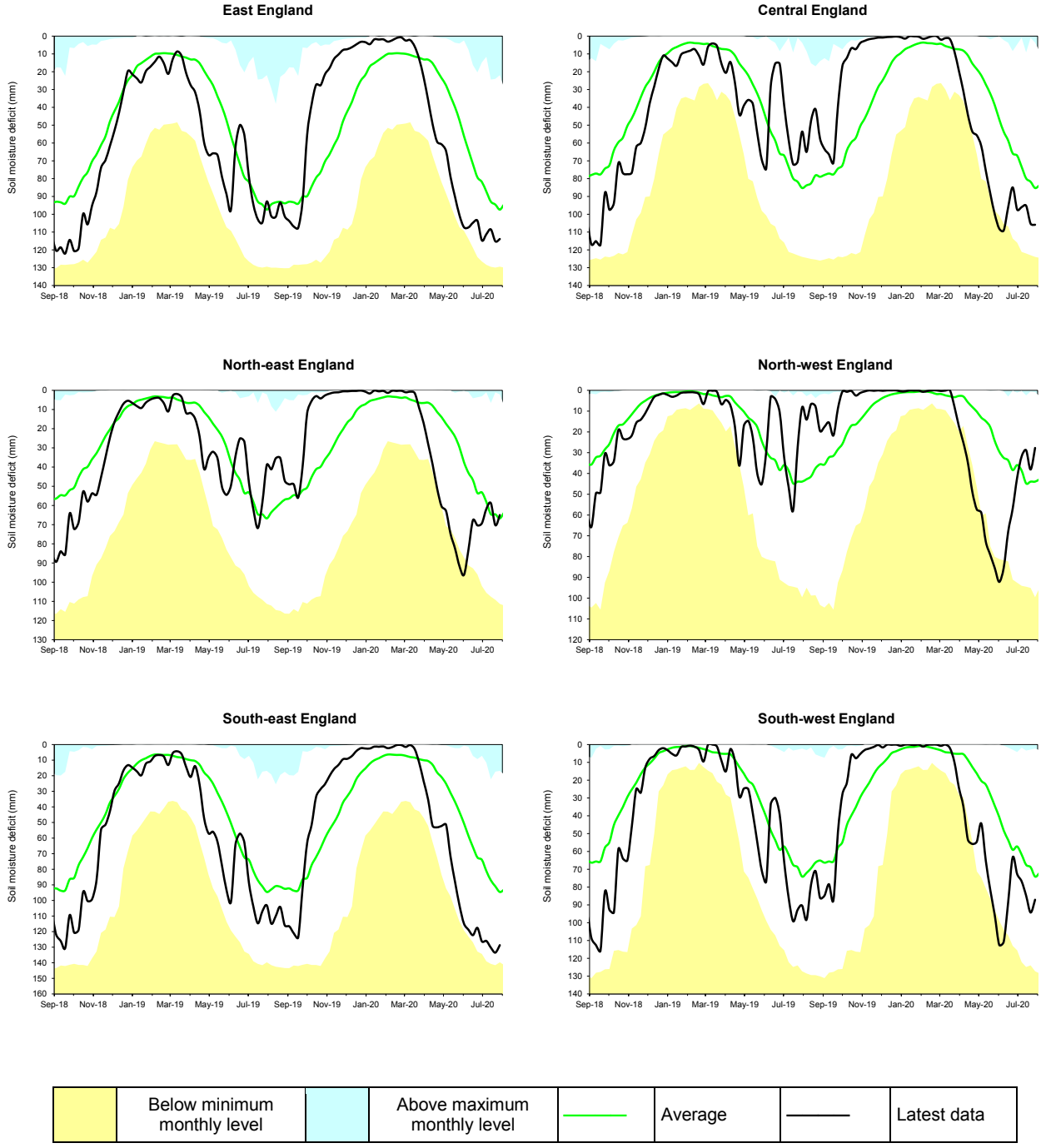
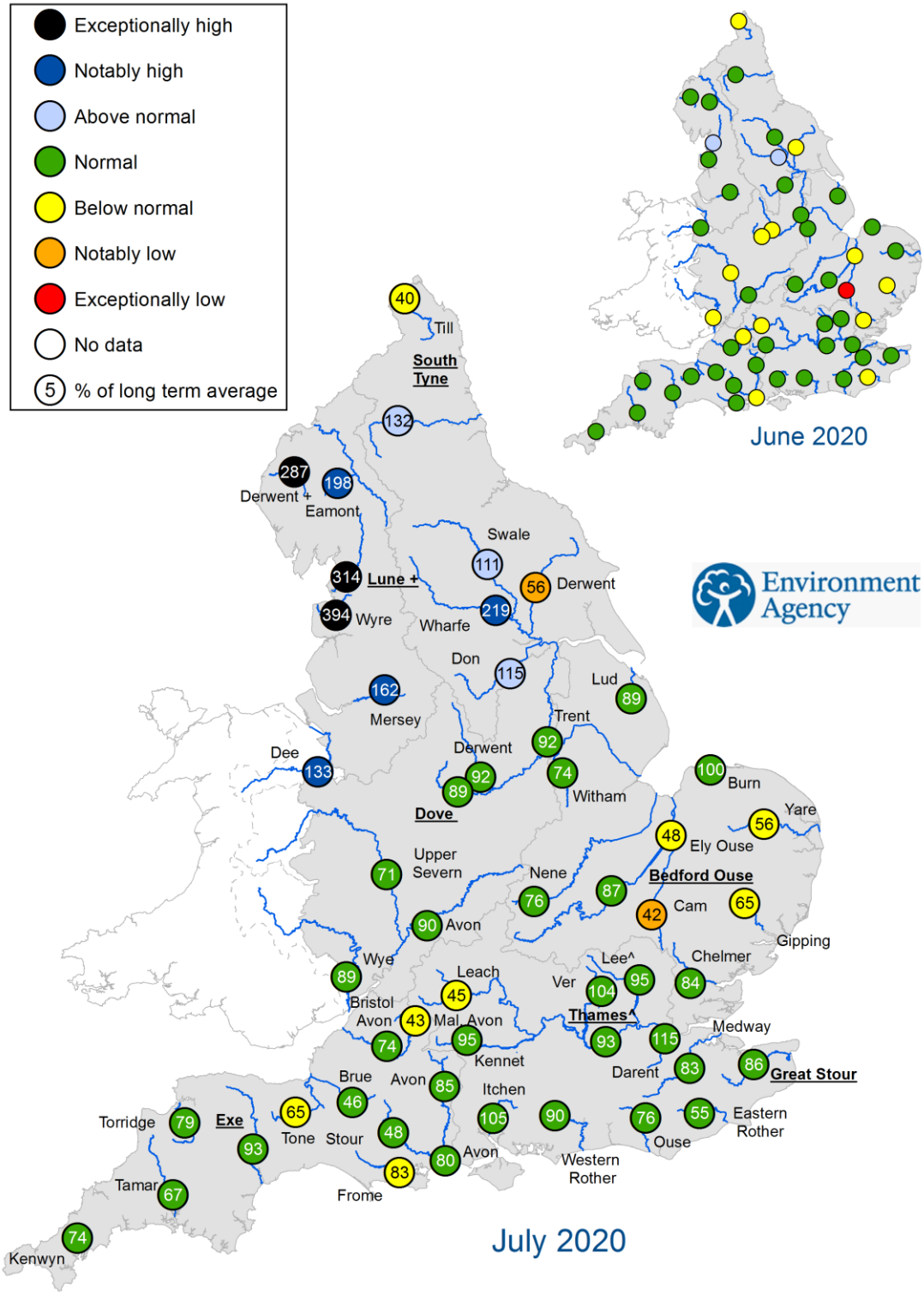


Figure 2.2: Latest soil moisture deficits for all geographic regions compared to maximum, minimum and 1961 to 90 long term average. Weekly MORECS data for real land use. (Source: Met Office © Crown Copyright, 2020).

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 June and July 2020, expressed as a percentage of the respective long term average and classed relative to an analysis of historic June and July monthly means (Source: Environment Agency). Crown copyright. All rights reserved. Environment Agency, 100024198, 2020.

River flow charts

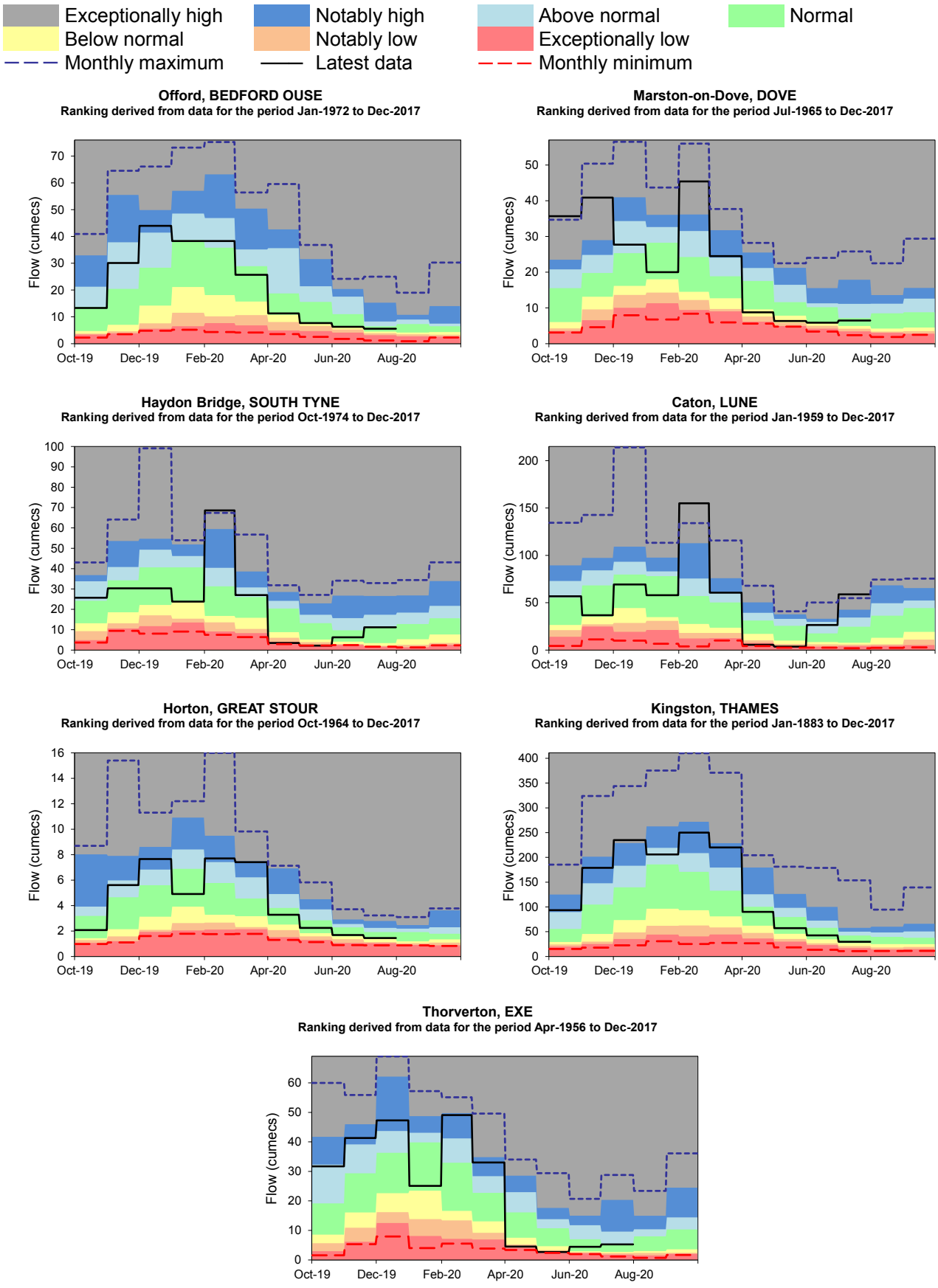
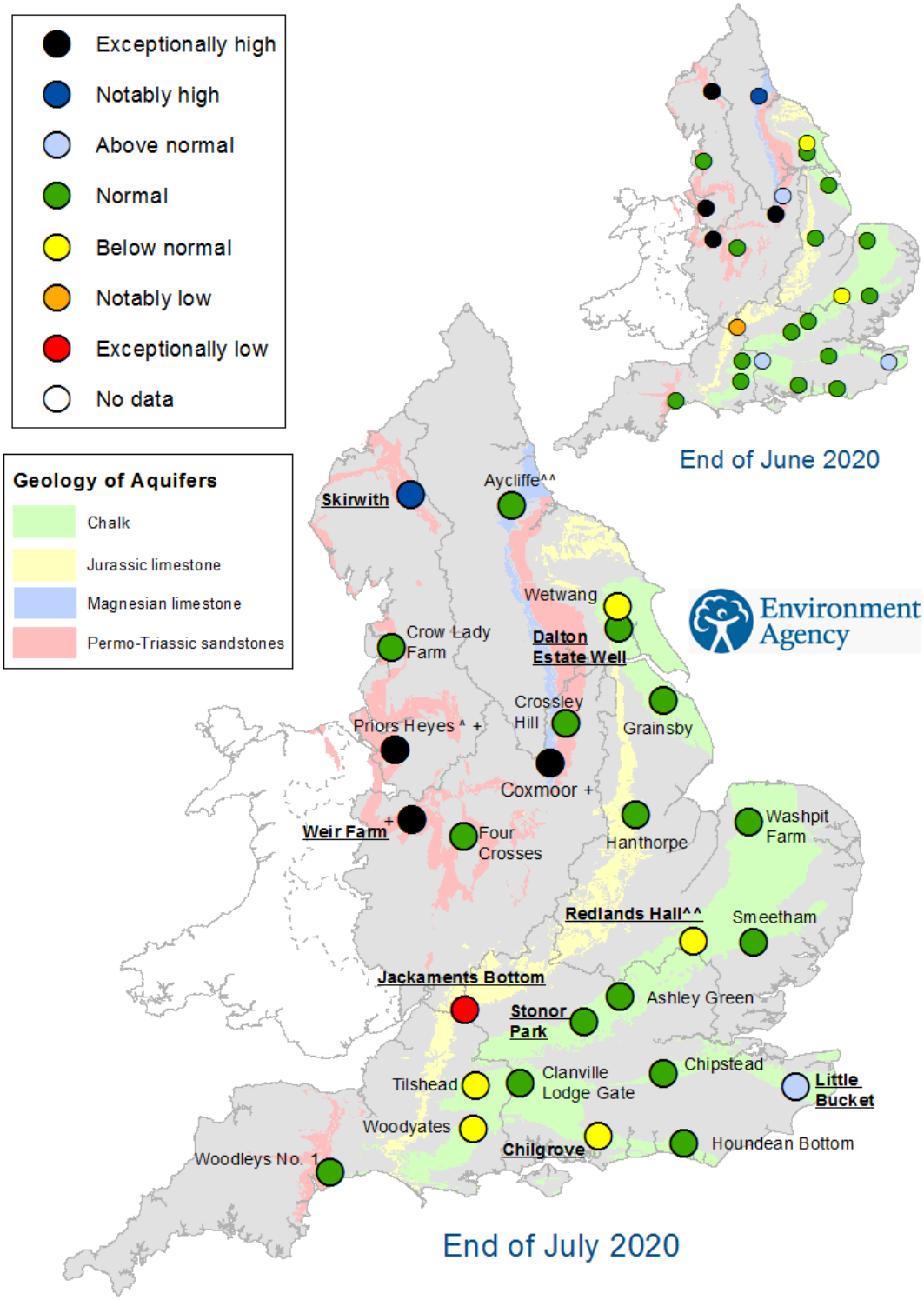


Figure 3.2: Index river flow sites for each geographic region. Monthly mean flow compared to an analysis of historic monthly mean flows, long term maximum and minimum flows. (Source: Environment Agency).

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 June and July 2020, classed relative to an analysis of respective historic June and July levels (Source: Environment Agency). Geological map reproduced with kind permission from UK Groundwater Forum, BGS © NERC. Crown copyright. All rights reserved. Environment Agency, 100024198, 2020.

Groundwater level charts

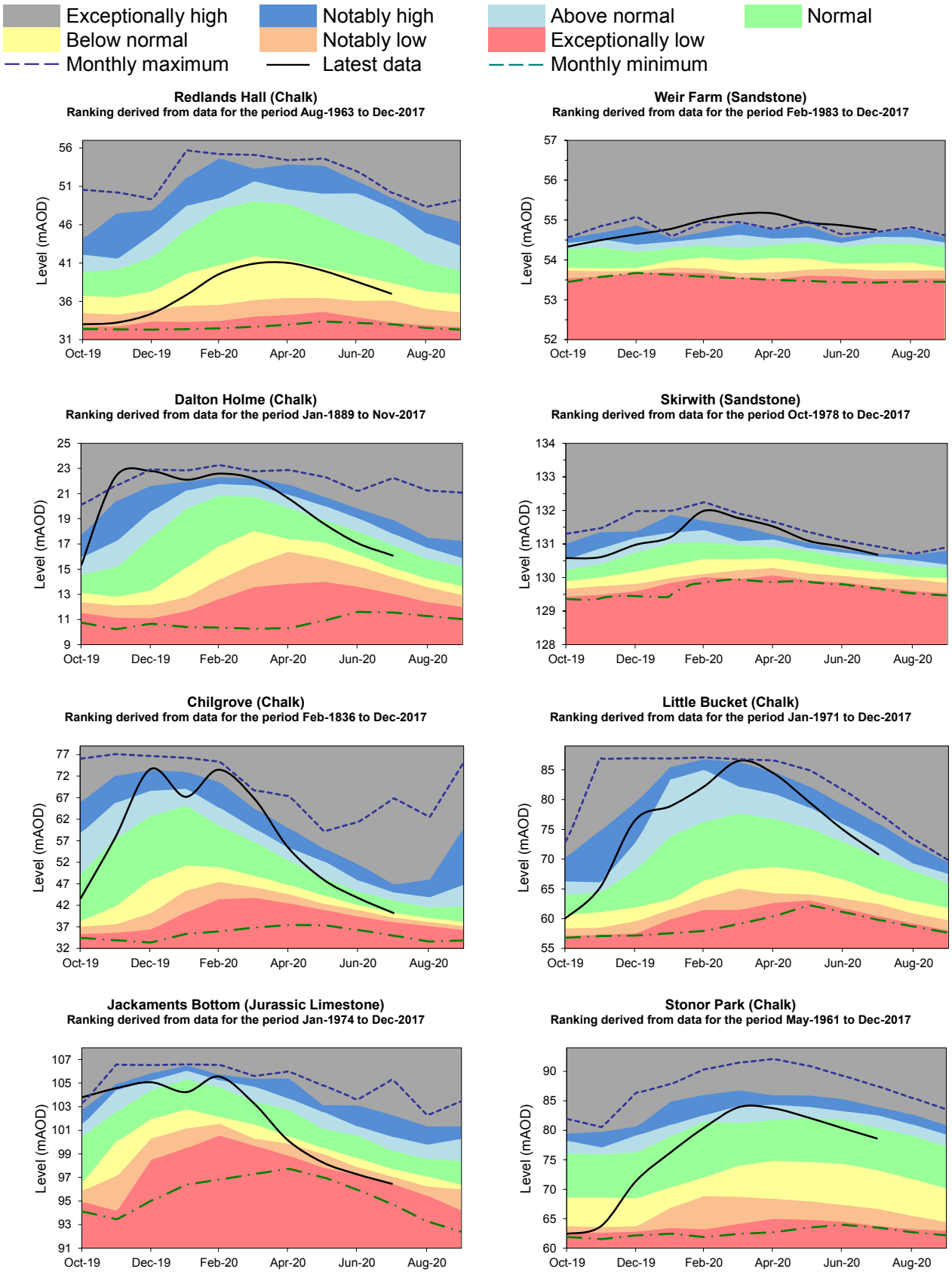
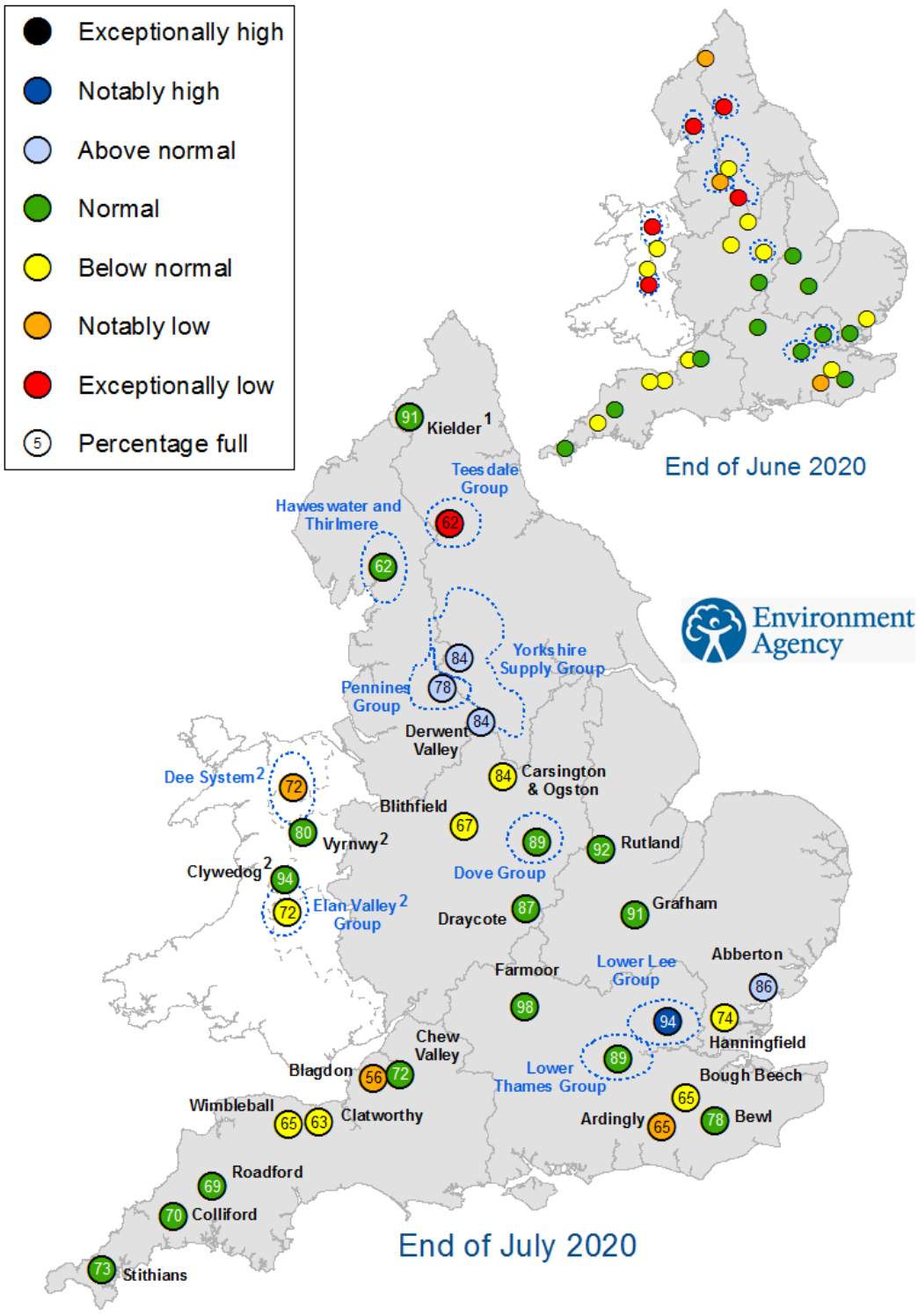


Figure 4.2: Index groundwater level sites for major aquifers. End of month groundwater levels months compared to an analysis of historic end of month levels and long term maximum and minimum levels. (Source: Environment Agency, 2020).

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 June and July 2020 as a percentage of total capacity and classed relative to an analysis of historic June and July 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

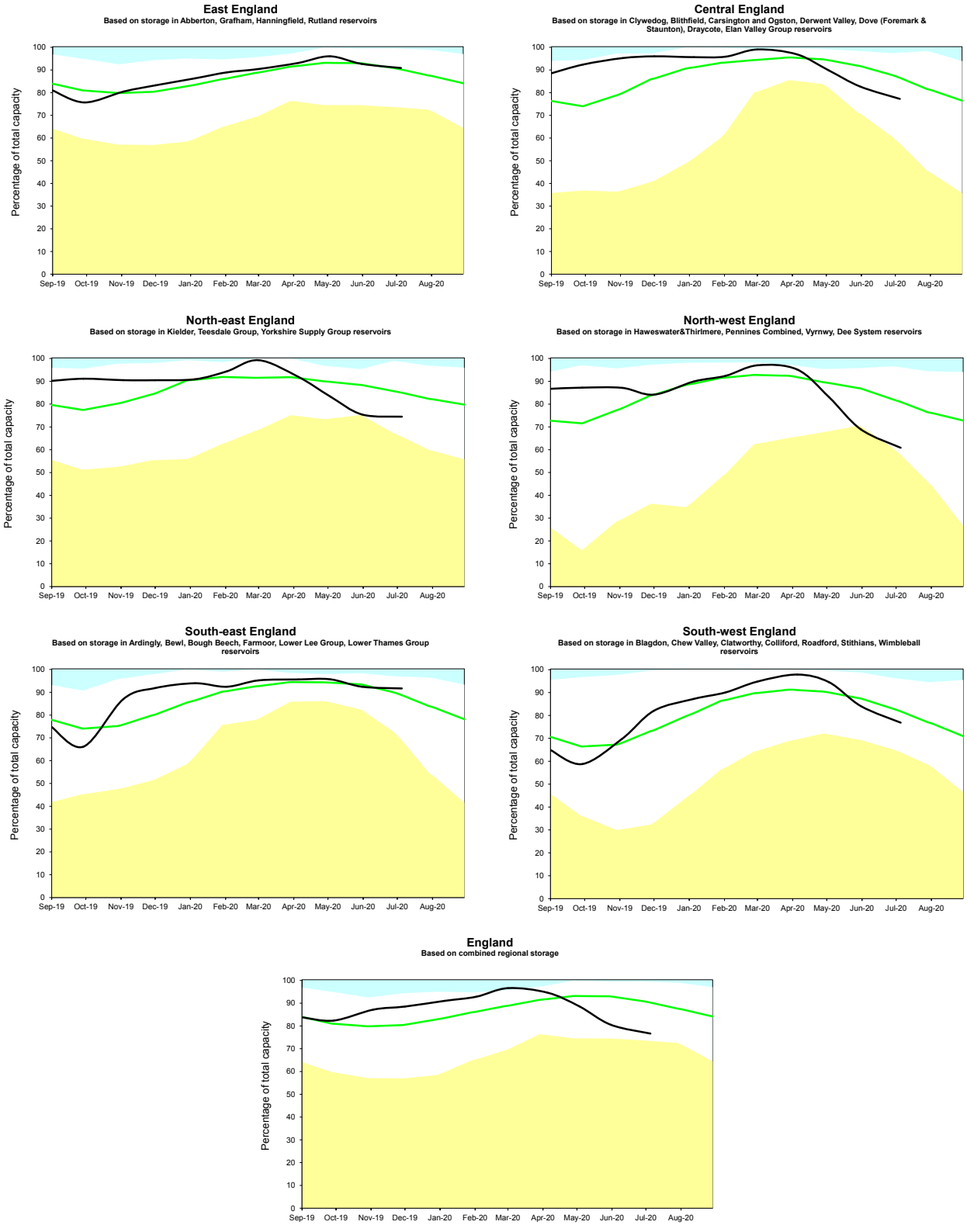


Figure 5.2: Regional reservoir stocks. End of month reservoir stocks compared to long term maximum, minimum and average stocks (Source: Water Companies). Note: Historic records of individual reservoirs/reservoir groups making up the regional values vary in length.

Forward look: river flow

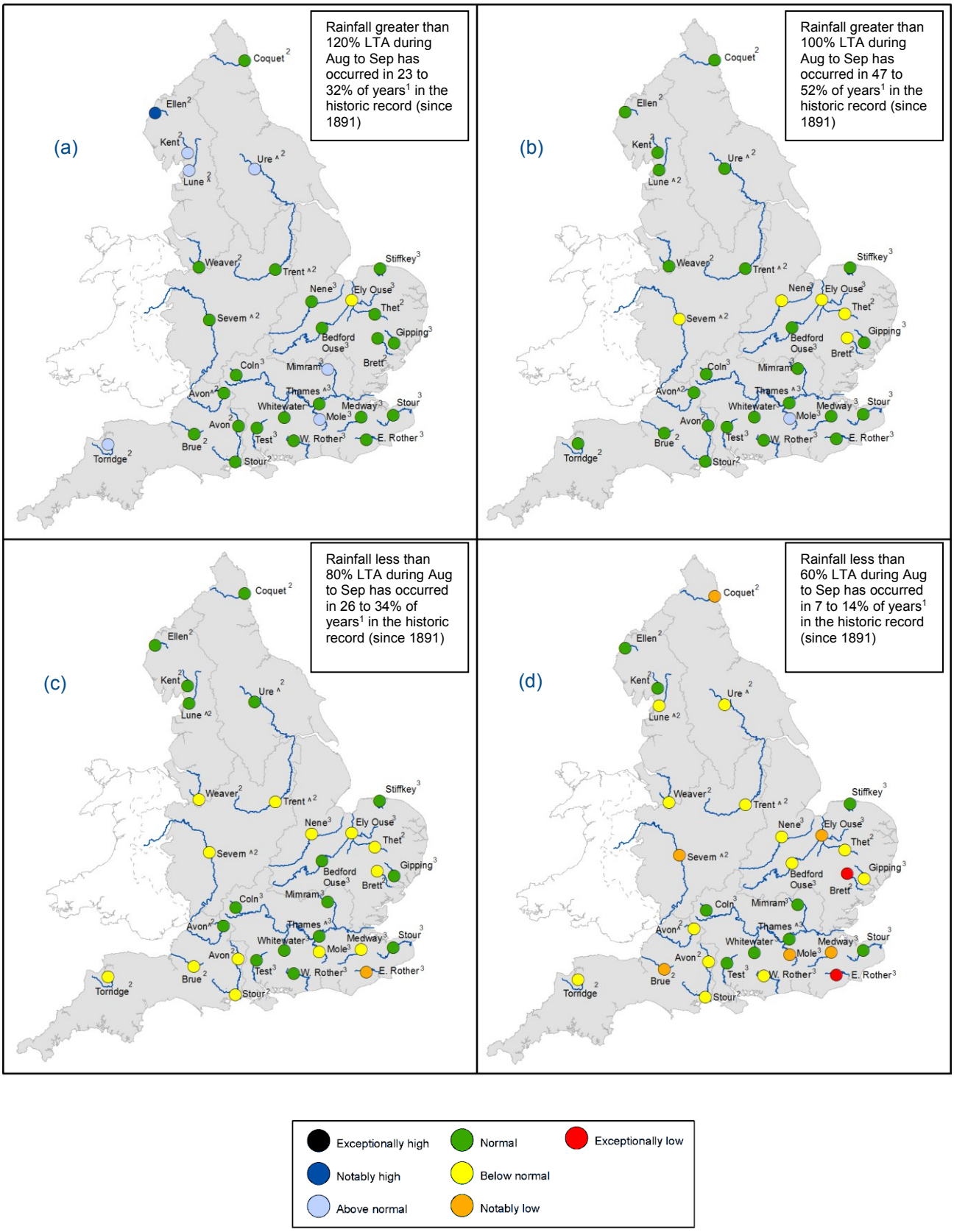


Figure 6.1: Projected river flows at key indicator sites up until the end of September 2020. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between August 2020 and September 2020 (Source: Centre for Ecology and Hydrology, Environment Agency)

[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*

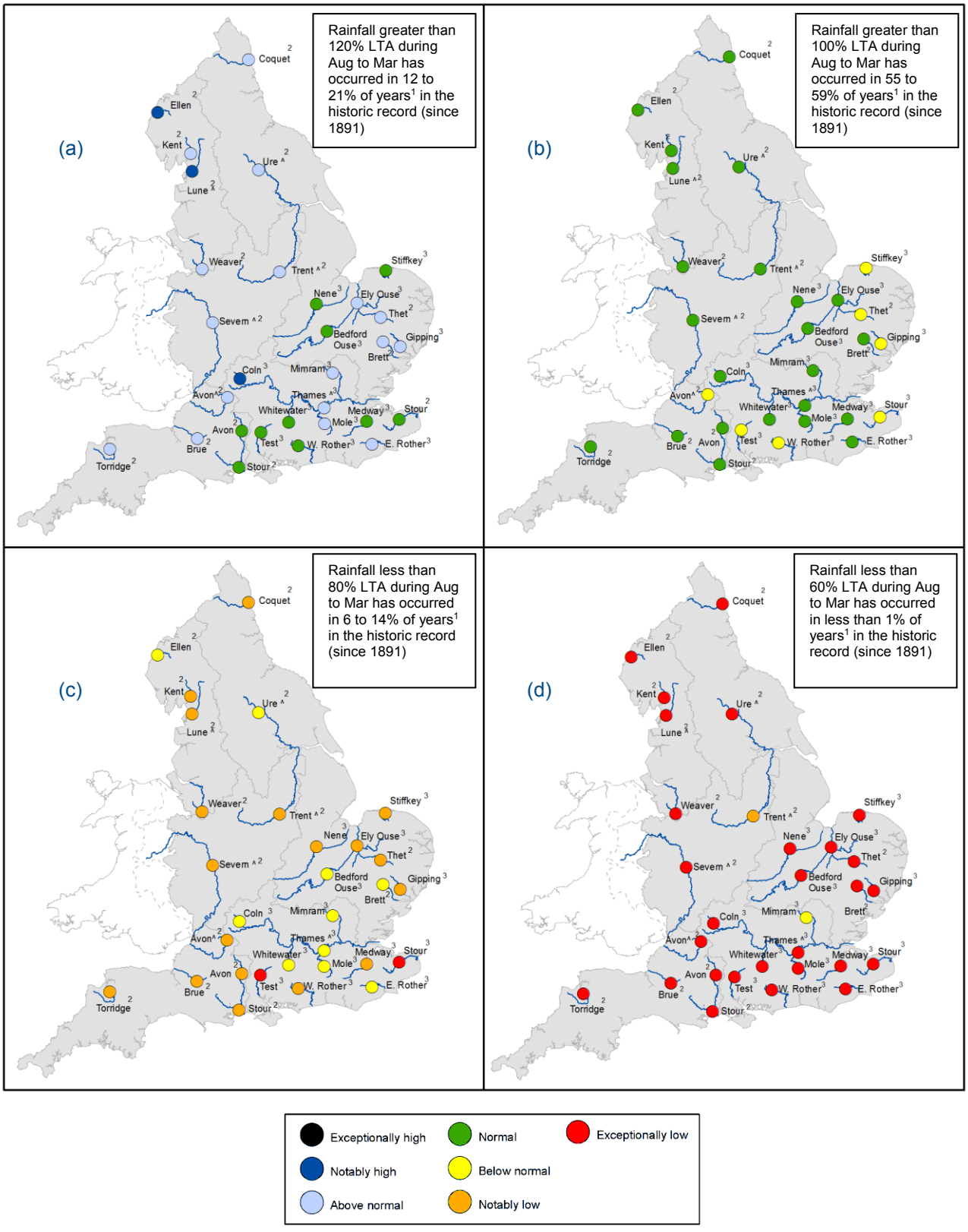


Figure 6.2: Projected river flows at key indicator sites up until the end of March 2021. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between August 2020 and March 2021 (Source: Centre for Ecology and Hydrology, Environment Agency)

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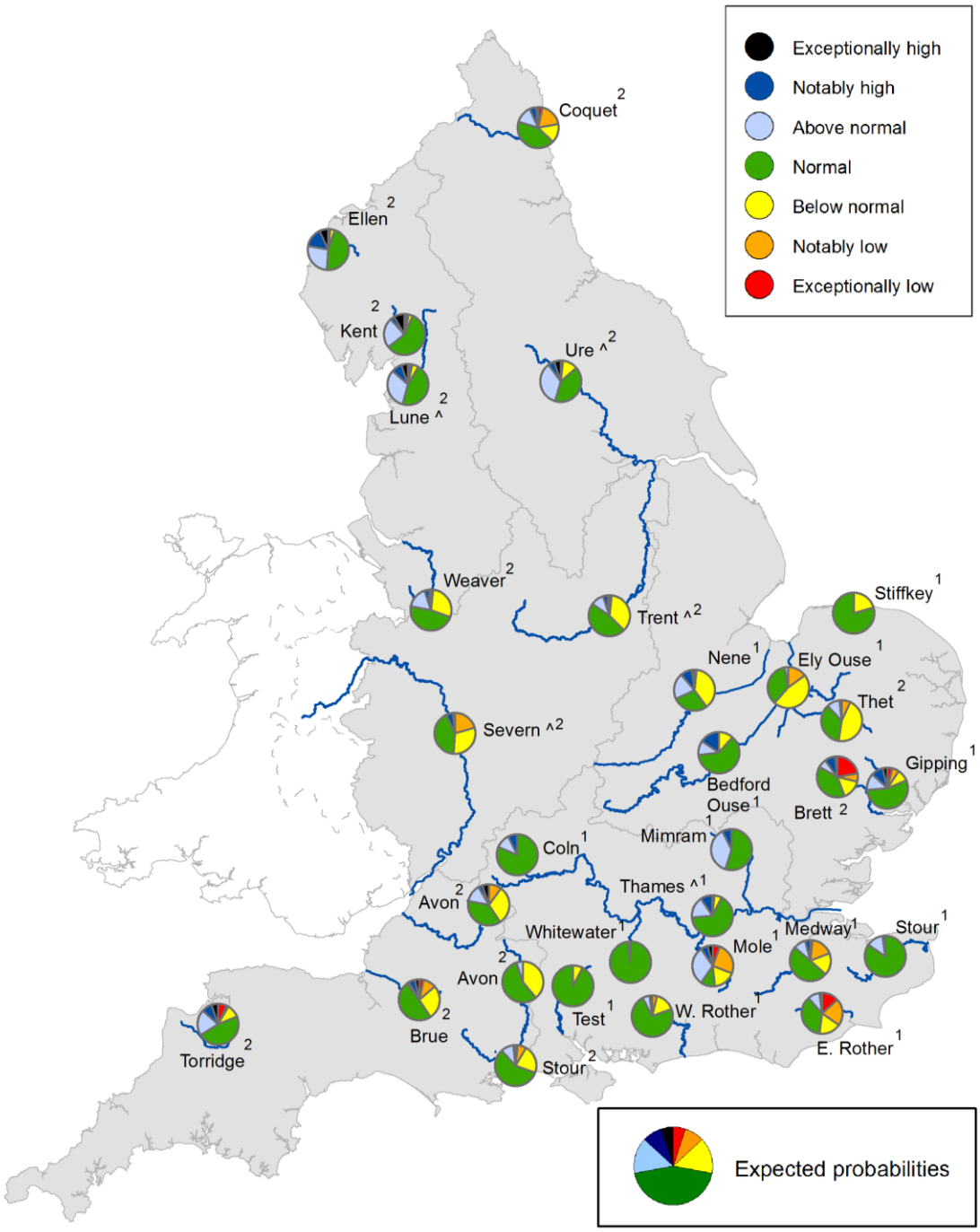
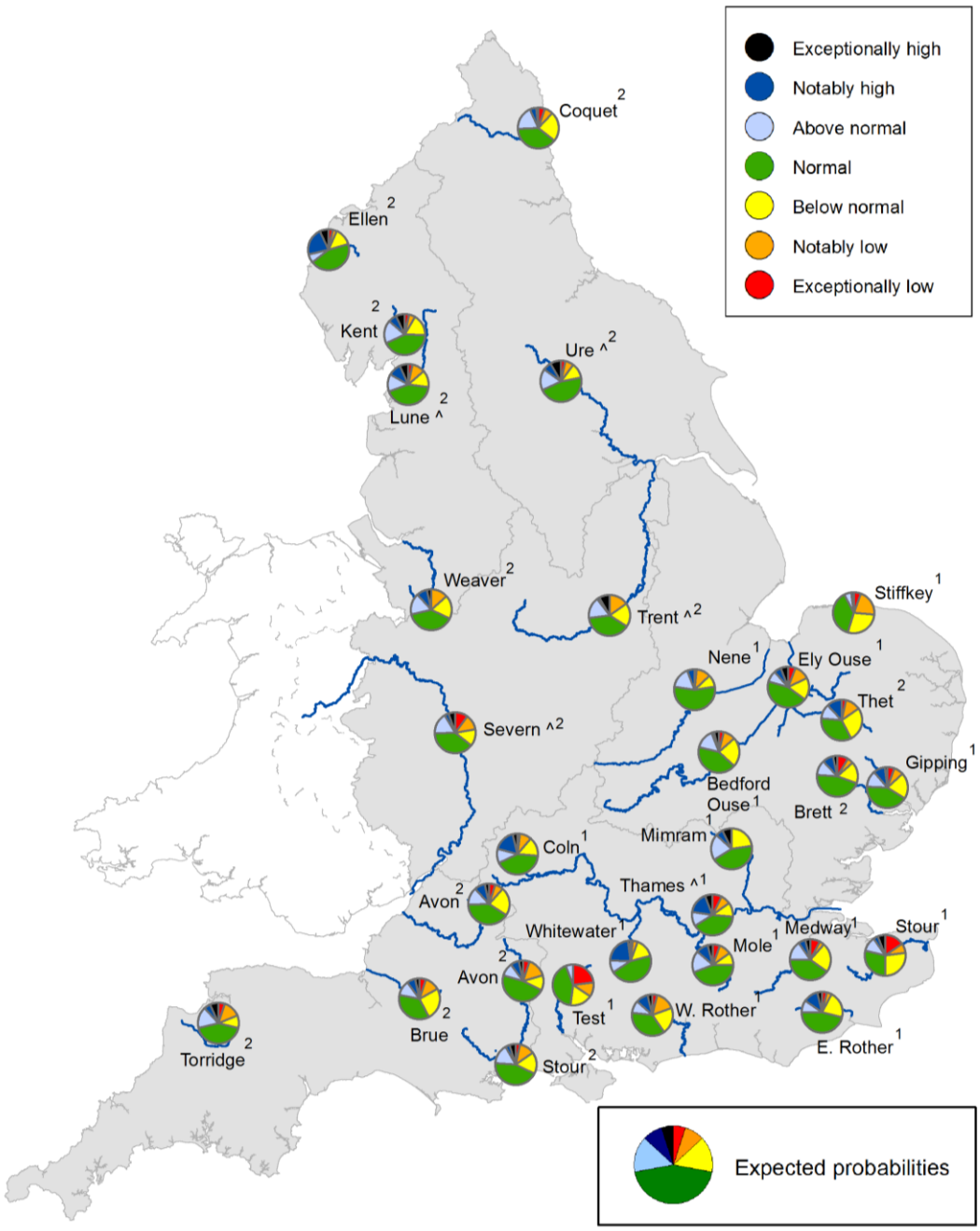


Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are 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 2020. 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



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 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).

[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

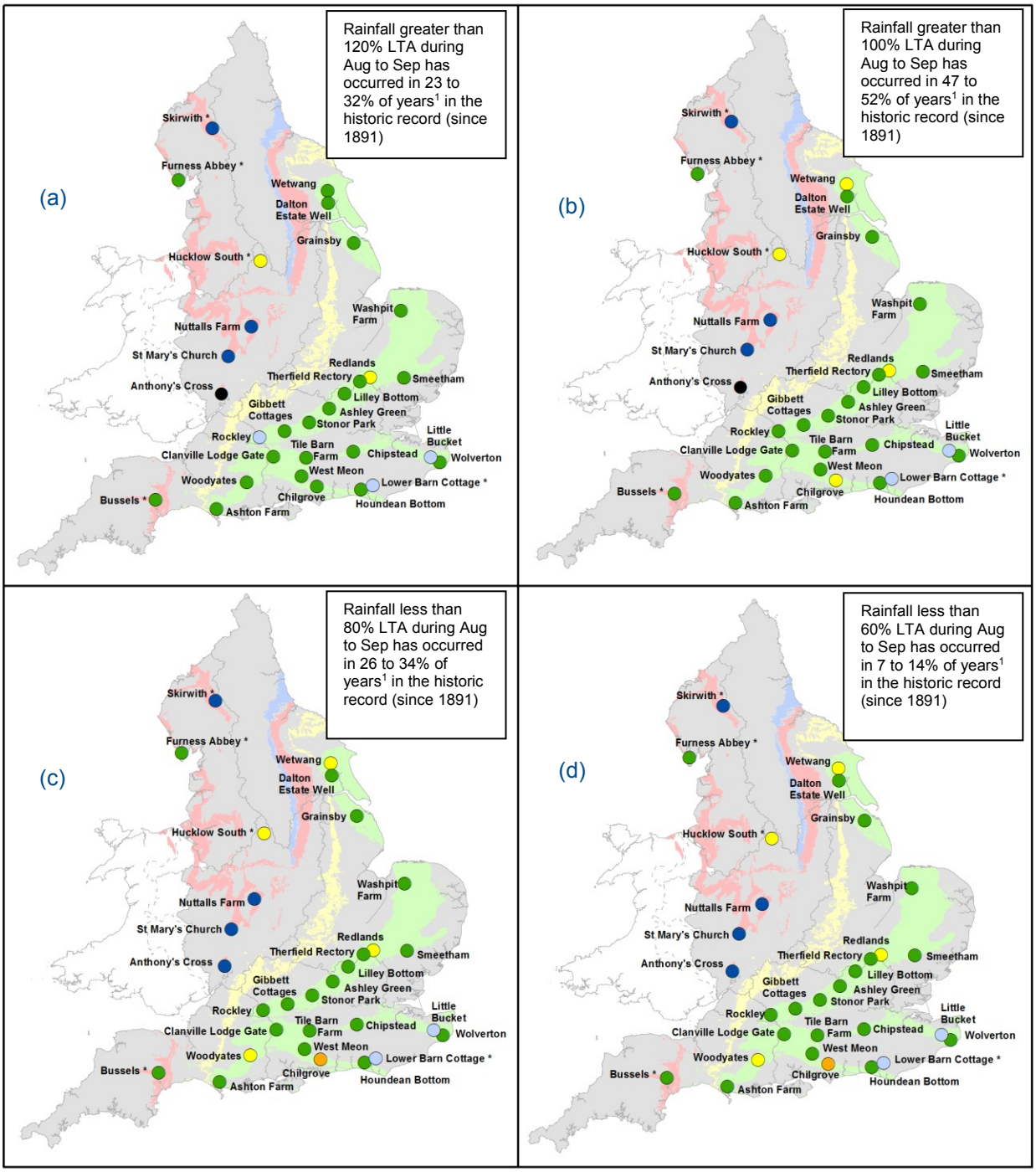


Figure 6.5: Projected groundwater levels at key indicator sites at the end of September 2020. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between August 2020 and September 2020 (Source: Environment Agency) Geological map reproduced with kind permission from UK Groundwater Forum BGS © NERC. Crown copyright all rights reserved. Environment Agency 100024198, 2020.

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

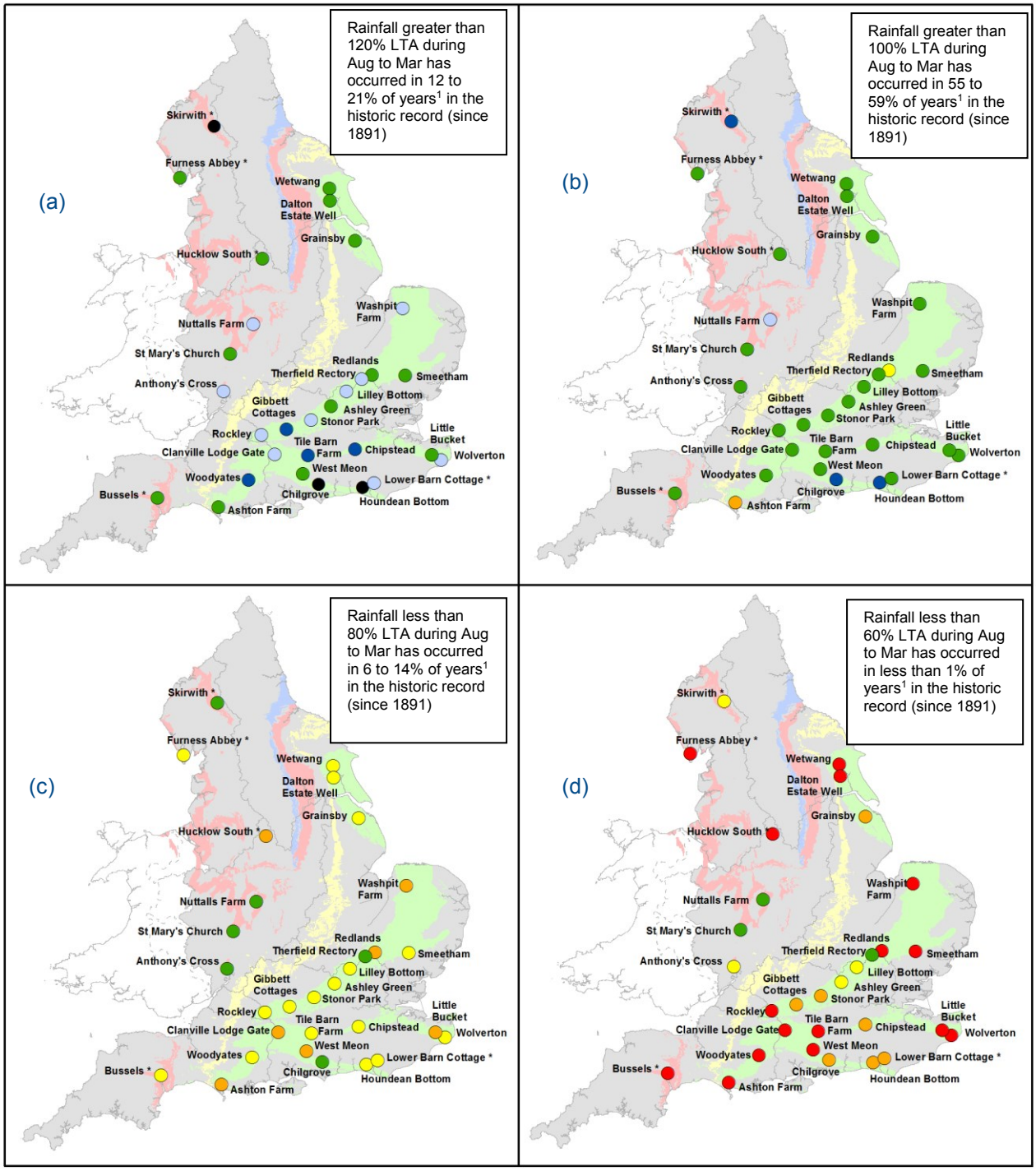


Figure 6.6: Projected groundwater levels at key indicator sites at the end of March 2021. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between August 2020 and March 2021 (Source: Environment Agency) Geological map reproduced with kind permission from UK Groundwater Forum BGS © NERC Crown copyright. All rights reserved. Environment Agency 100024198 2020.

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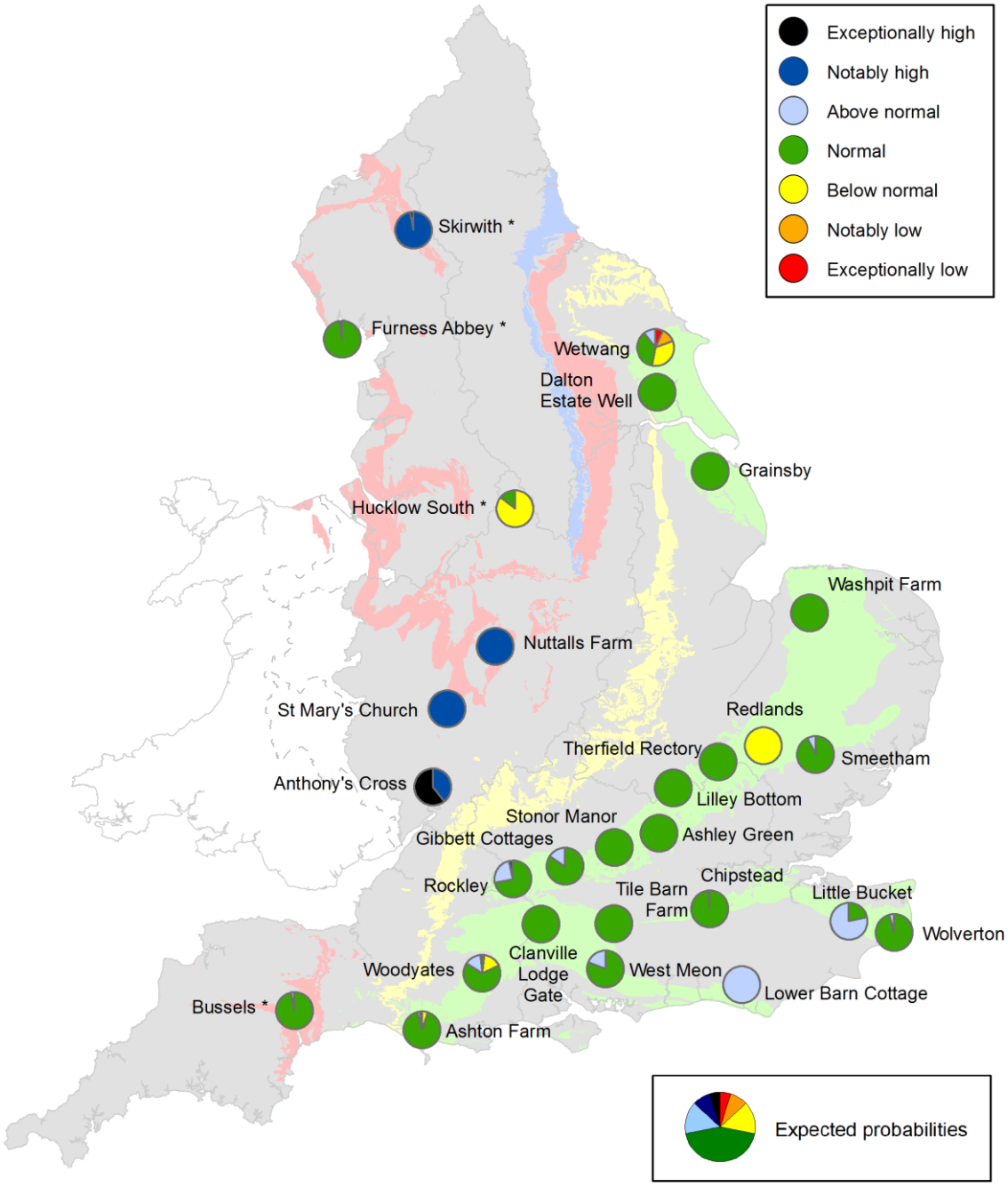
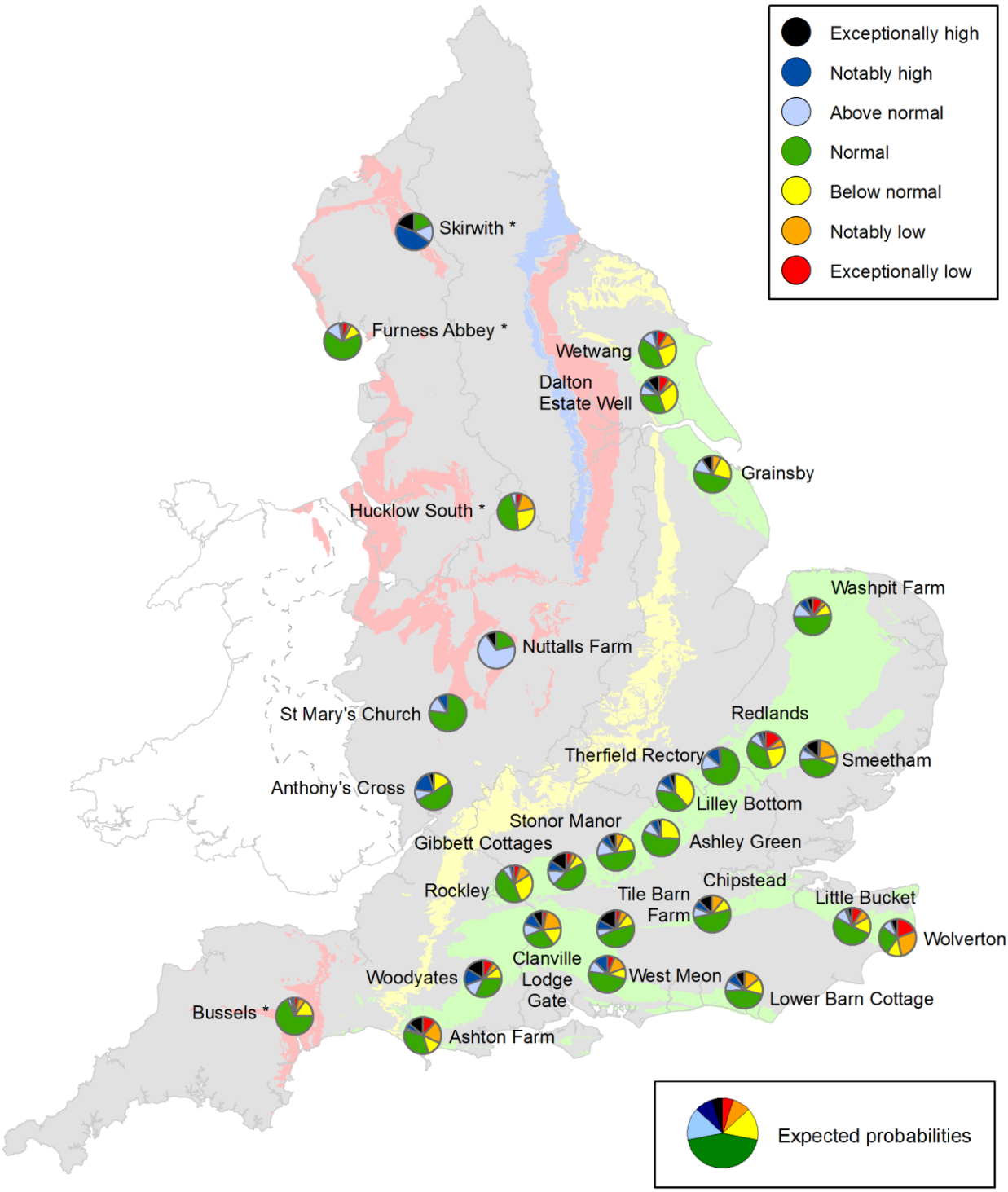


Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are 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 2020. 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, 2020.

** 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 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, 2020.

* 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