Monthly water situation report

England

Summary – April 2020

April rainfall totals were lower than average across all regions of England. The lowest rainfall totals for this month were recorded in north-east England. As a result of the below average rainfall, soils across England were drier than average for the time of year. Monthly mean river flows for April decreased at all sites reported on, compared with March, and were classed as below normal or lower at half of the sites. End of month groundwater levels were classed as normal or higher at the majority of sites reported on. Total reservoir stocks across England were at 89% capacity at the end of April.

Rainfall

The April rainfall total for England was 28mm, which is 50% of the 1961-90 long-term average (LTA) (48% of 1981-2010 LTA). A very dry first half of the month across most of England persisted through the latter part of April in much of north-east and north-west England, and parts of central, east and south-west England. Wetter conditions were seen in the latter half of April across south-east, and parts of east and south-west England. The lowest April rainfall totals were in north-east England (Figure 1.1).

There was a clear divide across England, with April rainfall totals classed as exceptionally low or notably low for the time of year in all catchments in north-east and north-west England, whereas the majority of catchments in the southern half of England were classed as normal for the time of year (Figure 1.2). Rainfall totals, as a percentage of the LTA, ranged from an exceptionally low 6% in the Northumbria North Sea Tributaries catchment in Northumberland, to an above normal 137% in the River Bourne catchment in Hampshire. Many catchments in north-east and north-west England experienced some of the lowest April rainfall totals on record (record starts 1891); of particular note are the Tyne, Tees, Northumbria North Sea Tributaries and Tweed catchments in north-east England, and Esk Dumfries catchment in north-west England that had the driest April on record. The 3 month and 6 month cumulative rainfall totals ending in April were classed as above normal or higher in the vast majority of catchments across England. In the Ribble, and Wyre and Lune catchments in north-west England, the 3 month period ending in April was the wettest February-April on record (Figure 1.2).

At a regional scale, April rainfall totals were lower than the LTA in all regions. Totals ranged from 8mm (14% of the LTA) in north-east England to 45mm in south-west England (73% of the LTA). In north-east England, this was the second driest April on record (record starts in 1891) (Figure 1.3).

Soil moisture deficit

Soil moisture deficits increased through April, with soils drier than average for the time of year across all of England by the end of the month. Deficits across England ranged from 24-74mm, with most areas having a soil moisture deficit of greater than 50mm (Figure 2.1). This is reflected at a regional scale, with higher than average soil moisture deficits in all regions at the end of April (Figure 2.2).

River flows

Monthly mean river flows decreased at all of the key sites reported on, compared to March. April river flows were classed as below normal or lower at half of the indicator sites, the majority of these located in north-east, north-west and south-west England. Eight rivers were classed as exceptionally low for the time of year: the Swale at Crakehill Topcliffe, South Tyne at Haydon Bridge and Wharfe at Tadcaster in north-east England, the Lune at Caton, Derwent at Ouse Bridge, Eamont at Pooley Bridge and Wyre at St Michaels in north-west England, and the Dee at Manley Hall in north Wales. The majority of sites in central, south and east England were classed as normal for the time of year (Figure 3.1).

River flows for the regional indicator sites ranged from normal for the Bedford Ouse at Offord, Great Stour at Horton and Thames at Kingston to exceptionally low for the South Tyne at Haydon Bridge and Lune at Caton (Figure 3.2).

Groundwater levels

Groundwater levels fell during April at just over three-quarters of the indicator sites reported on. Despite this, the end of month groundwater levels were classed as normal or higher at nearly all of the sites, with one-third of sites classed as notably high or higher for the time of year. Three sandstone aquifer sites - Coxmoor, Weir Farm and Priors Heyes – had the highest end of April groundwater levels on record. Two sites, Redlands Hall in the Cam and Ely Ouse chalk aquifer and Jackaments Bottom in the Burford Jurassic Limestone were classed as below normal for the time of year (Figures 4.1 and 4.2).

Groundwater levels in the major aquifer index sites either fell or remained stable throughout April, and ranged from below normal at Redlands Hall (Cam and Ely Ouse chalk aquifer in east England) and Jackaments Bottom (Burford Jurassic Limestone in south-east England) to exceptionally high in the sandstone aquifers recorded at Weir Farm (central England) and Skirwith (north-west England) (Figures 4.1 and 4.2).

Reservoir storage

Reservoir stocks decreased at three-quarters of the reservoirs and reservoir groups that we report on during April. The biggest decrease in reservoir stocks, as a proportion of total storage capacity, was seen in the Strategic Haweswater and Thirlmere reservoir group (north-west England) with a 20% reduction. The largest increase in reservoir stocks was seen at Grafham Water in east England, with an 8% increase at this site. At the end of April, reservoir stocks ranged from exceptionally low for the time of year for the Teesdale group (north-east England) to above normal at Rutland Water (east England), Draycote Water (central England), Bewl Reservoir and Farmoor (south-east England) and Chew Valley Lake and Roadford Reservoir (south-west England). Reservoir stocks were classed as normal or higher at more than half of the sites reported on at the end of April (Figure 5.1).

Total reservoir stocks across England were at 89% capacity at the end of April. This is a decrease in storage since the end of March, and is below the LTA storage for the time of year. At a regional scale, total reservoir stocks were above the LTA for the time of year in east, south-east and south-west England, and below the LTA in central, north-east and north-west England (Figure 5.2).

Forward look

The beginning of May is expected to be fairly dry across much of England, with warm spells and occasional sharp showers in some places. Largely dry conditions, with some light rain, are expected to continue through the middle of the month, although southern England may experience longer spells of rain. More unsettled conditions are expected to arrive from the south-west towards the end of May.

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

Projections for river flows at key sites[1]

A fifth of the modelled sites have a greater than expected chance of cumulative river flows being notably low or lower for the time of year by the end of September 2020. By the end of March 2021, half of all 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 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]

Nine-tenths of all of 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 September 2020. By the end of March 2021, a third of 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: E&B Hydrology Team

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1 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

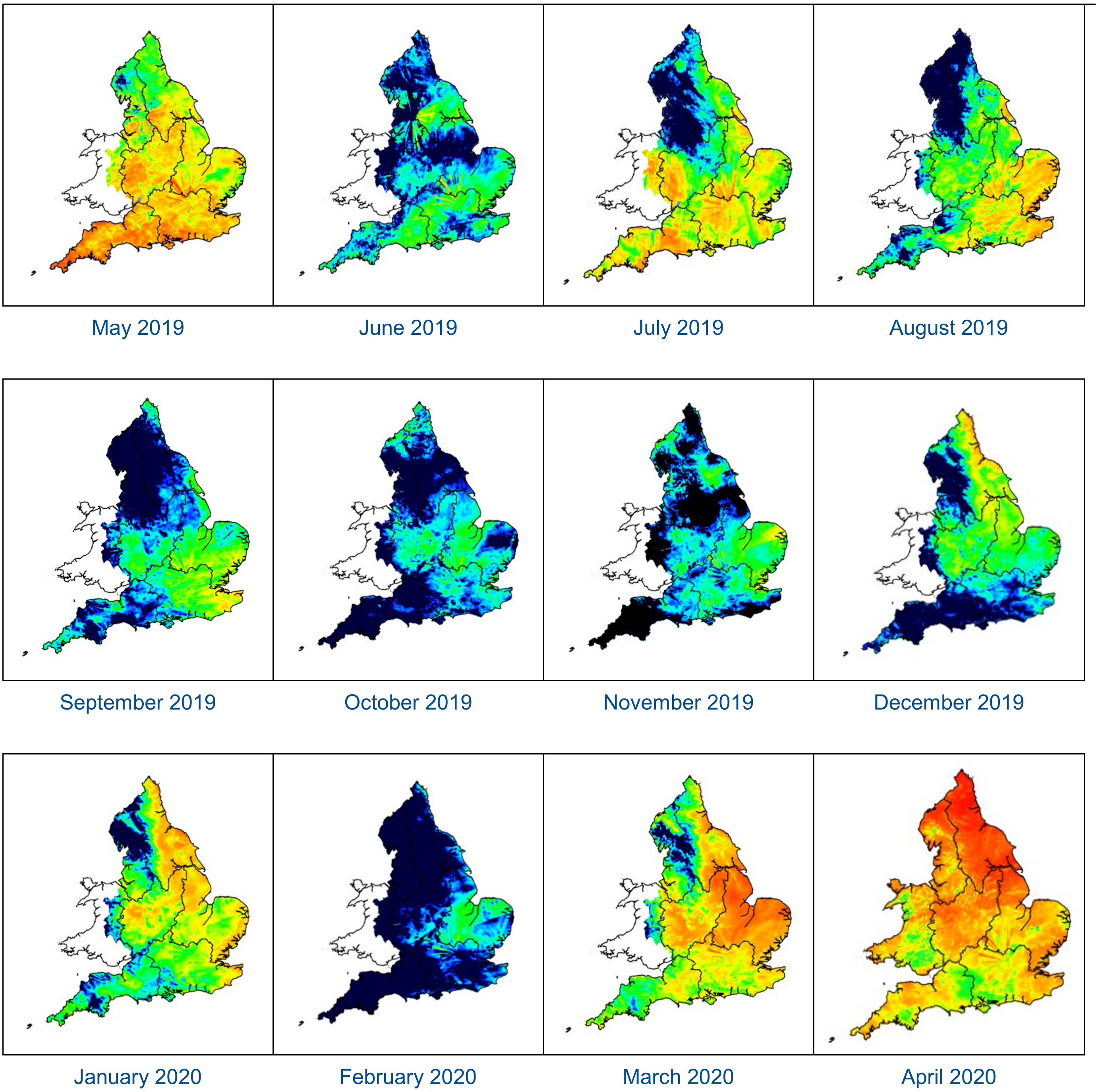
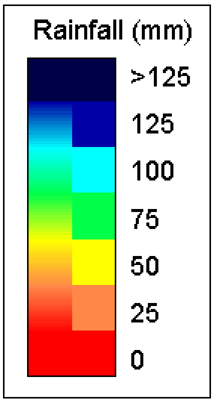


Figure 1.1: Monthly rainfall across England and Wales for the past 12 months. UKPP radar data (Source: Met Office © Crown Copyright, 2020). Note: Radar beam blockages in some regions may give anomalous totals in some areas. Crown copyright. All rights reserved. Environment Agency, 100024198, 2020.



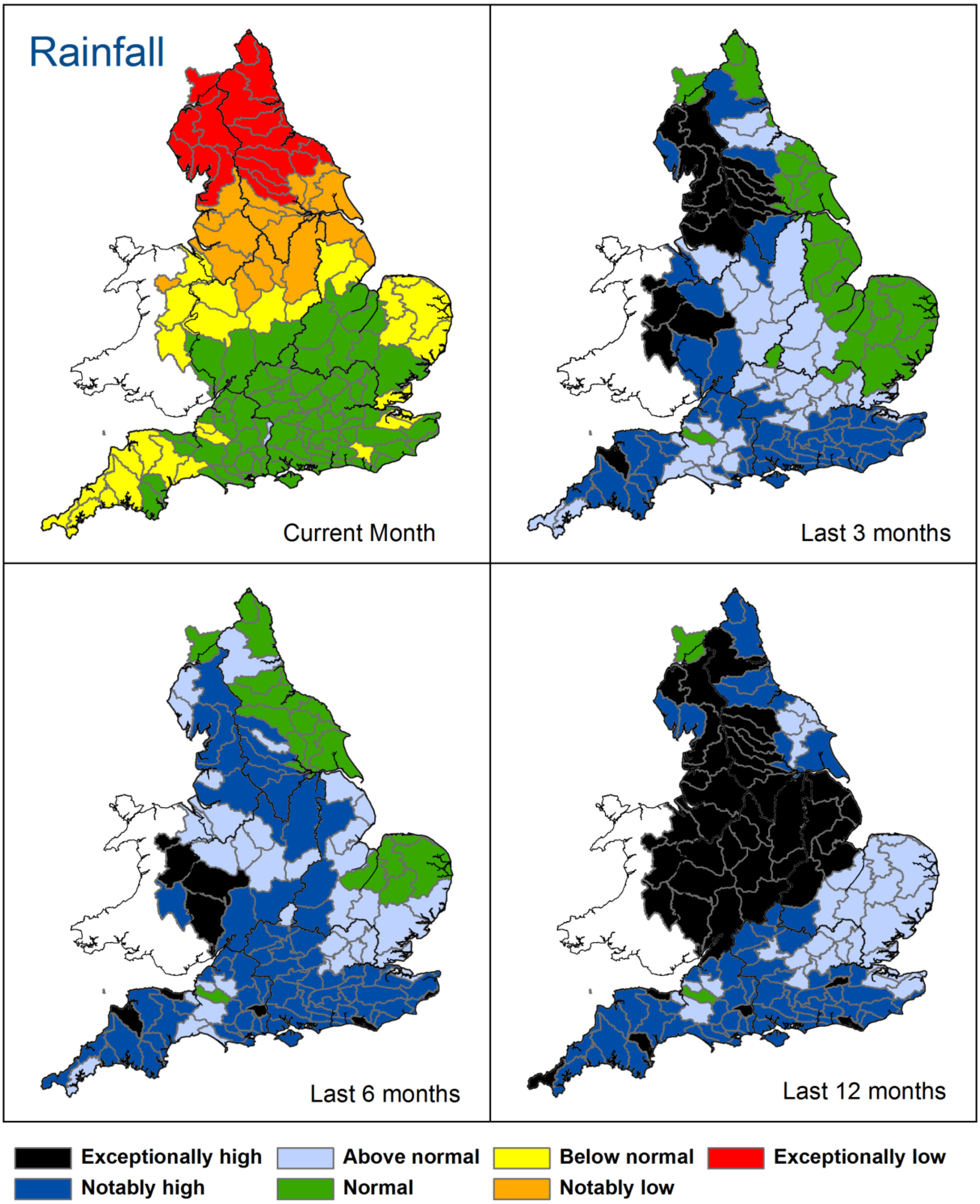


Figure 1.2: Total rainfall for hydrological areas across England for the current month (up to 30 April), the last 3 months, the last 6 months, and the last 12 months, classed relative to an analysis of respective historic totals. HadUK data based on the Met Office 1km gridded rainfall dataset derived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

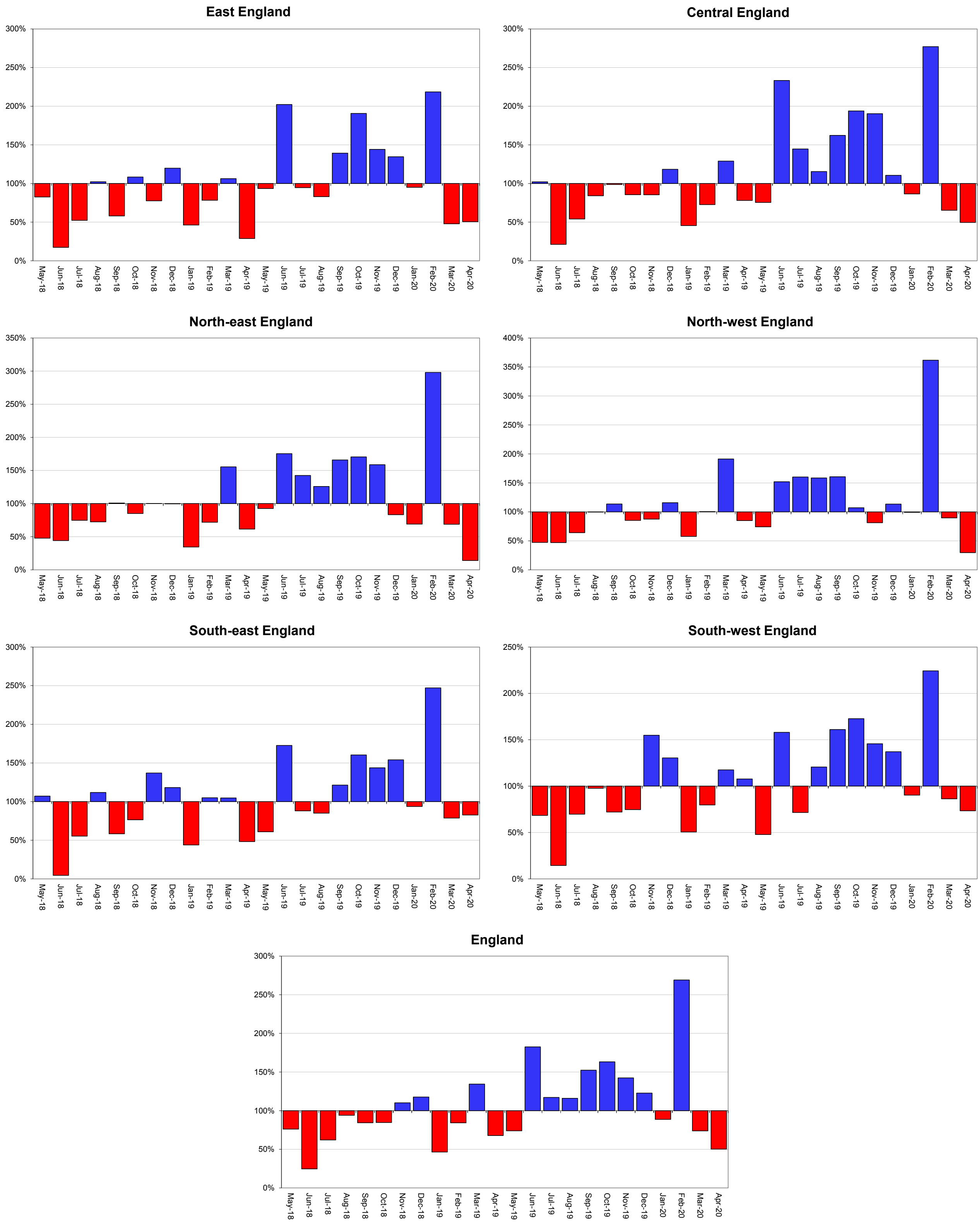


Figure 1.3: Monthly rainfall totals for the past 24 months as a percentage of the 1961 to 1990 long term average for each region and for England. HadUK rainfall data. (Source: Met Office © Crown Copyright, 2020).

Soil moisture deficit

End of March 2020[1]	End of April 2020[2]

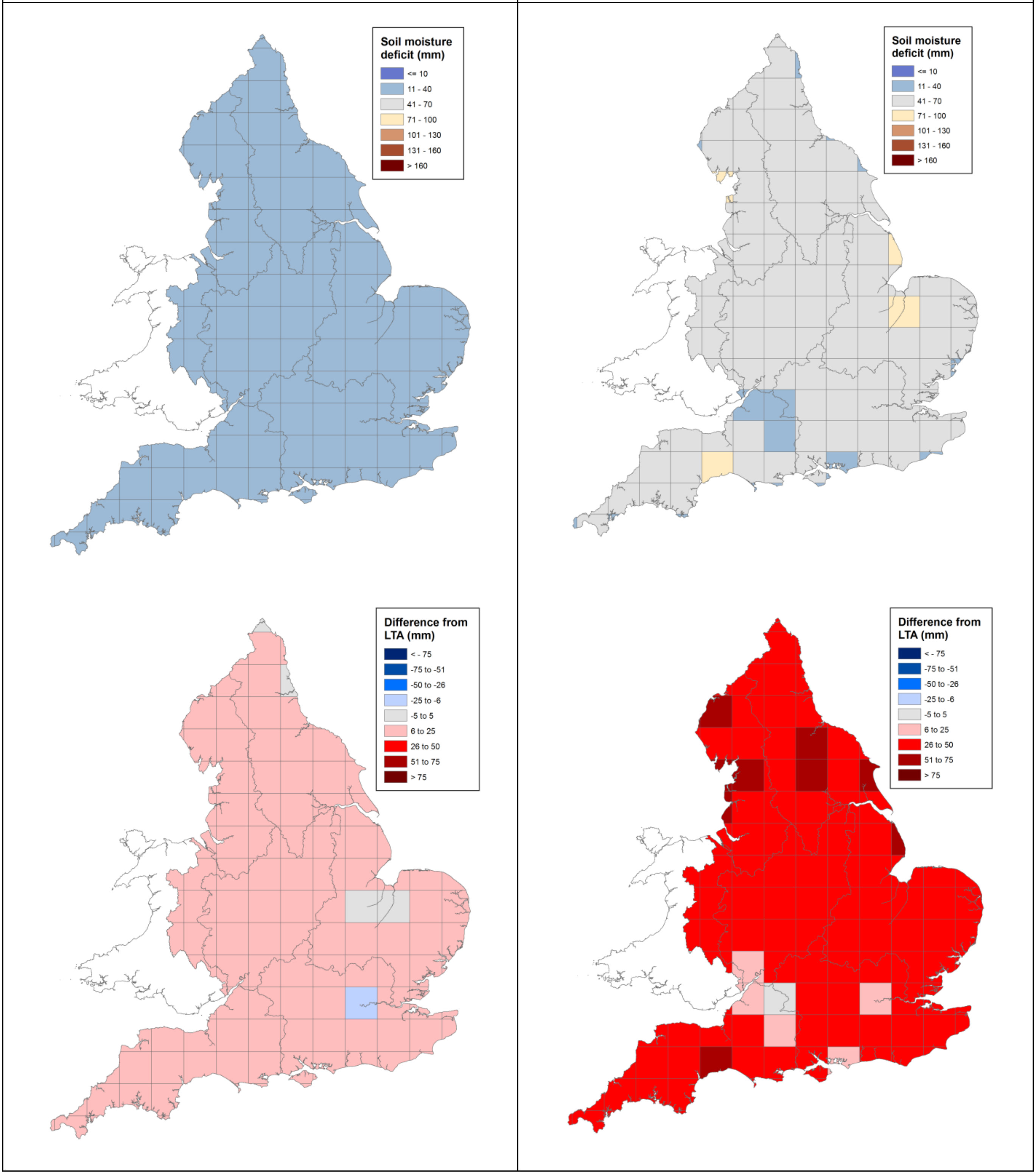
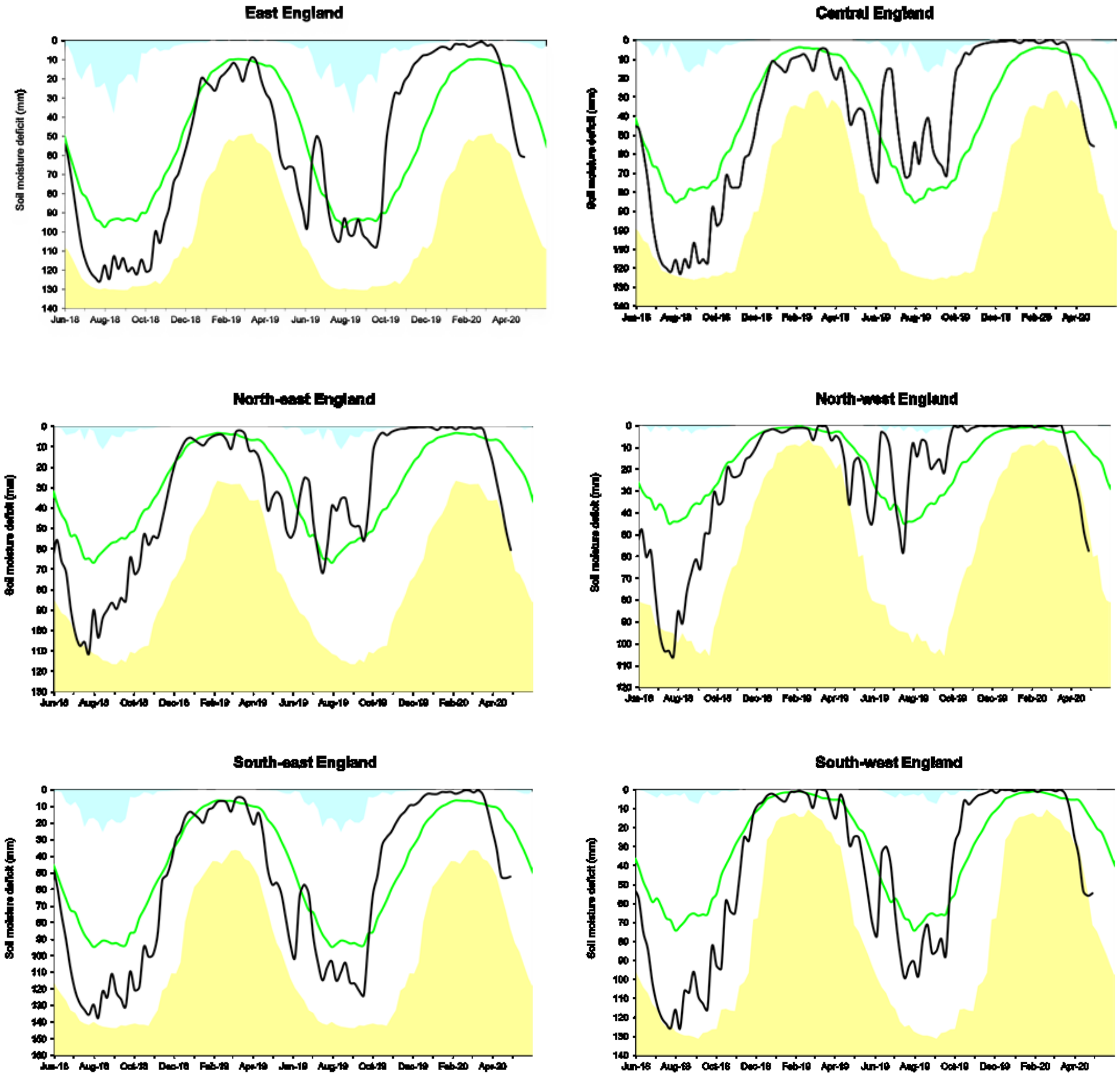


Figure 2.1: Soil moisture deficits for weeks ending 31 March 2020 [1] (left panel) and 28 April 2020 [2] (right panel). Top row shows actual soil moisture deficits (mm) and bottom row shows the difference (mm) of the actual from the 1961 to 90 long term average soil moisture deficits. MORECS data for real land use (Source: Met Office © Crown Copyright, 2020). Crown copyright. All rights reserved. Environment Agency, 100024198, 2020

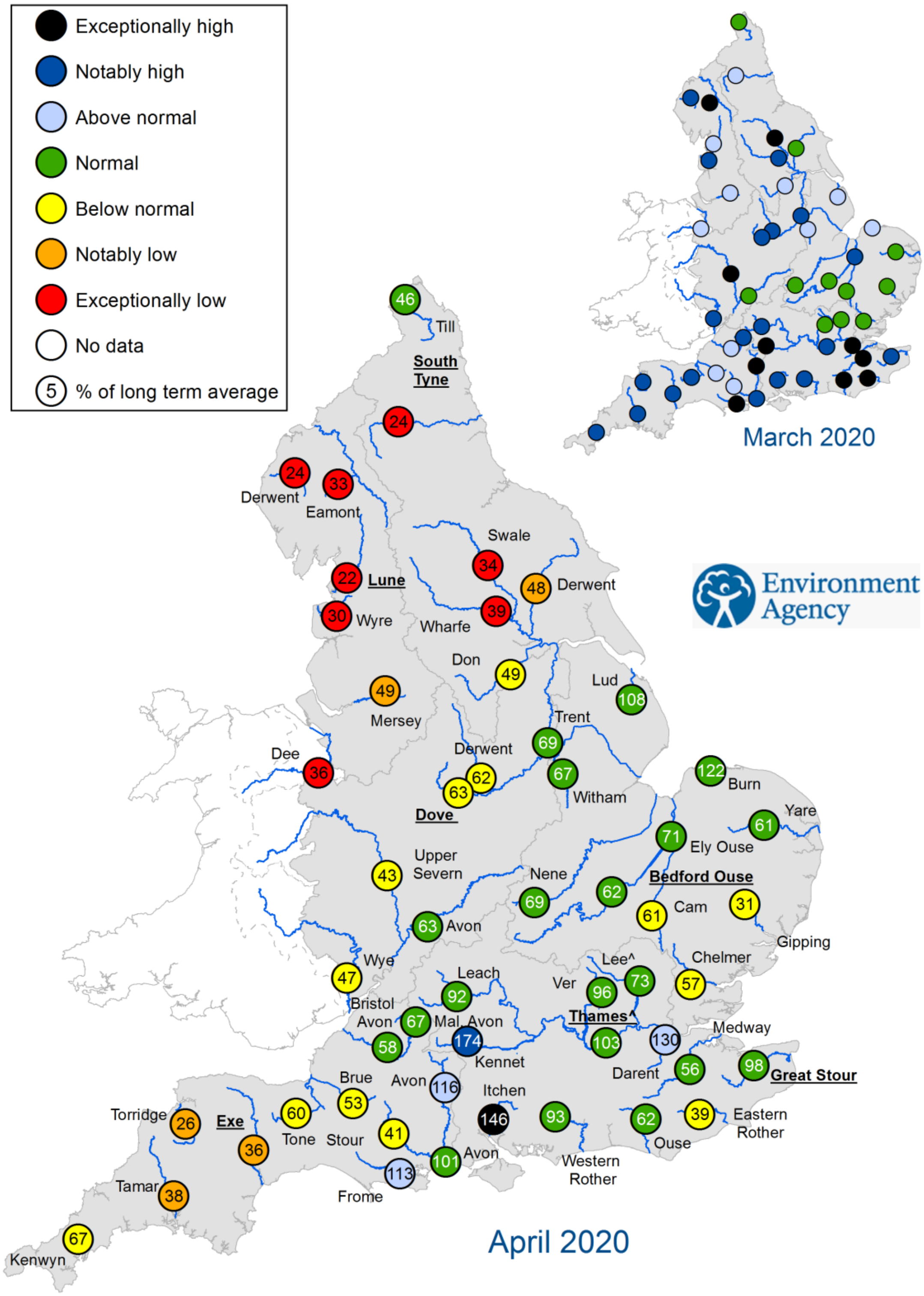
Soil moisture deficit charts



	Below minimum monthly level		Above maximum monthly level		Average		Latest data

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

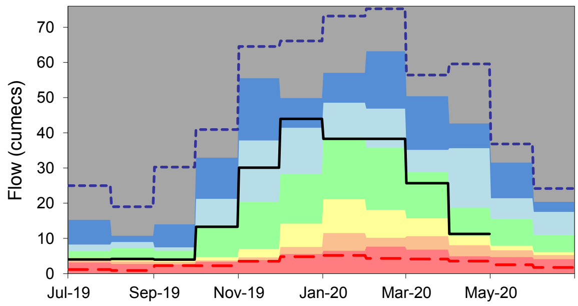
Underlined sites are regional index sites and are shown on the hydrographs in Figure 3.2

Figure 3.1: Monthly mean river flow for indicator sites for March 2020 and April 2020, expressed as a percentage of the respective long term average and classed relative to an analysis of historic March and April monthly means (Source: Environment Agency).

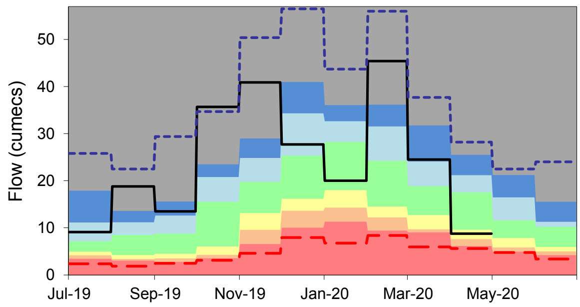
River flow charts

Exceptionally high | Notably high | Above normal | Normal
Below normal | Notably low | Exceptionally low
Monthly maximum | Latest data | Monthly minimum

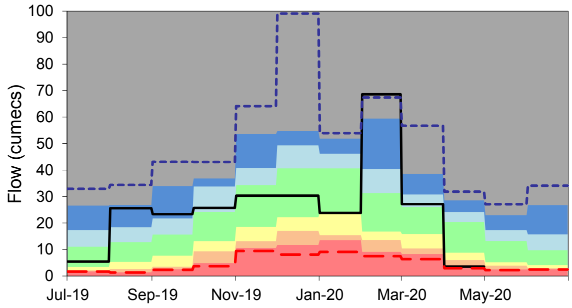
Offord, BEDFORD OUSE
Ranking derived from data for the period Jan-1972 to Dec-2017



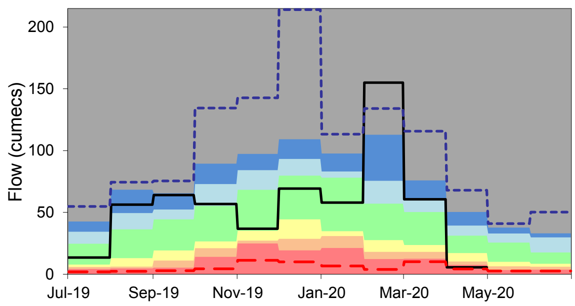
Marston-on-Dove, DOVE
Ranking derived from data for the period Jul-1965 to Dec-2017



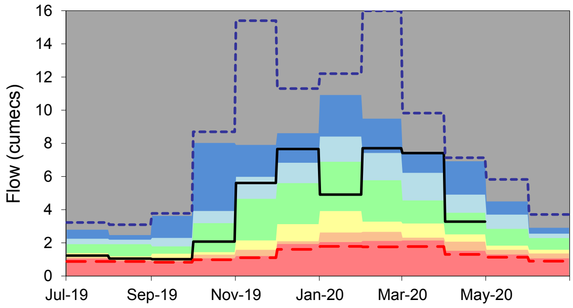
Haydon Bridge, SOUTH TYNE
Ranking derived from data for the period Oct-1974 to Dec-2017



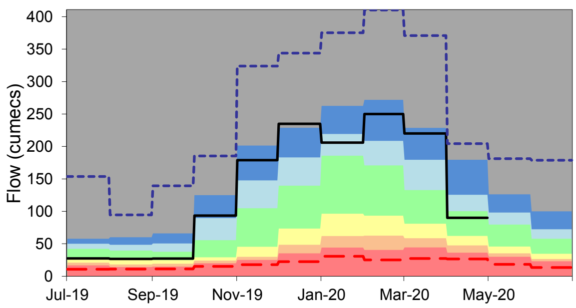
Caton, LUNE
Ranking derived from data for the period Jan-1959 to Dec-2017



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

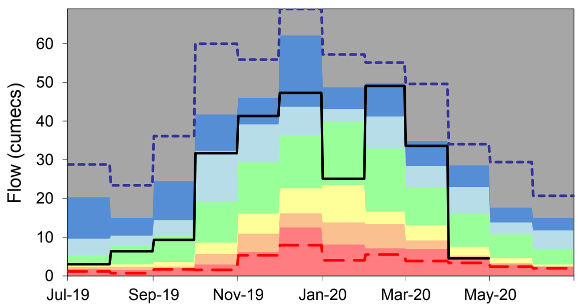
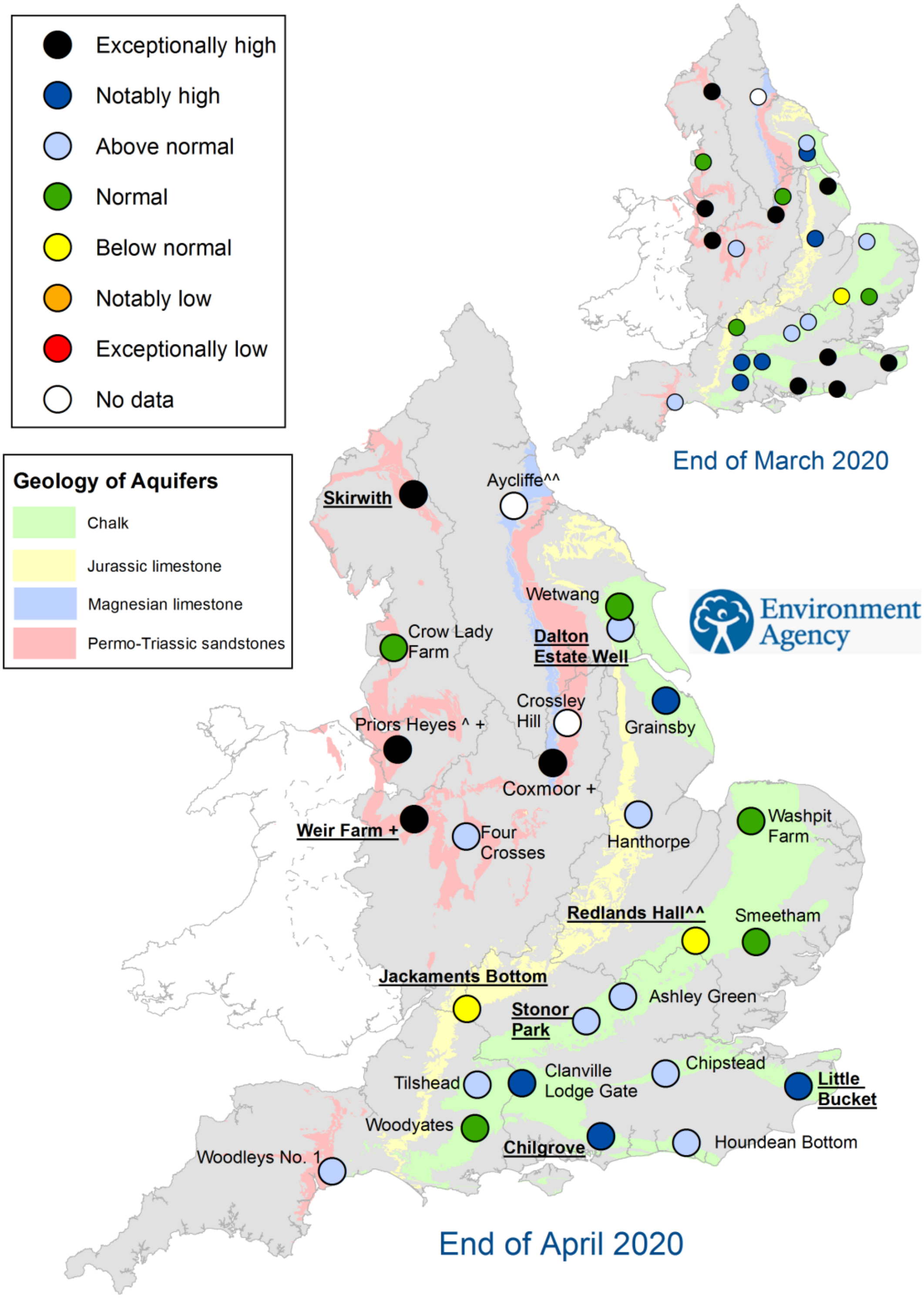


Figure 3.2: Index river flow sites for each geographic region. Monthly mean flow compared to an analysis of historic monthly mean flows, long term maximum and minimum flows. (Source: Environment Agency).

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 March 2020 and April 2020, classed relative to an analysis of respective historic March and April 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

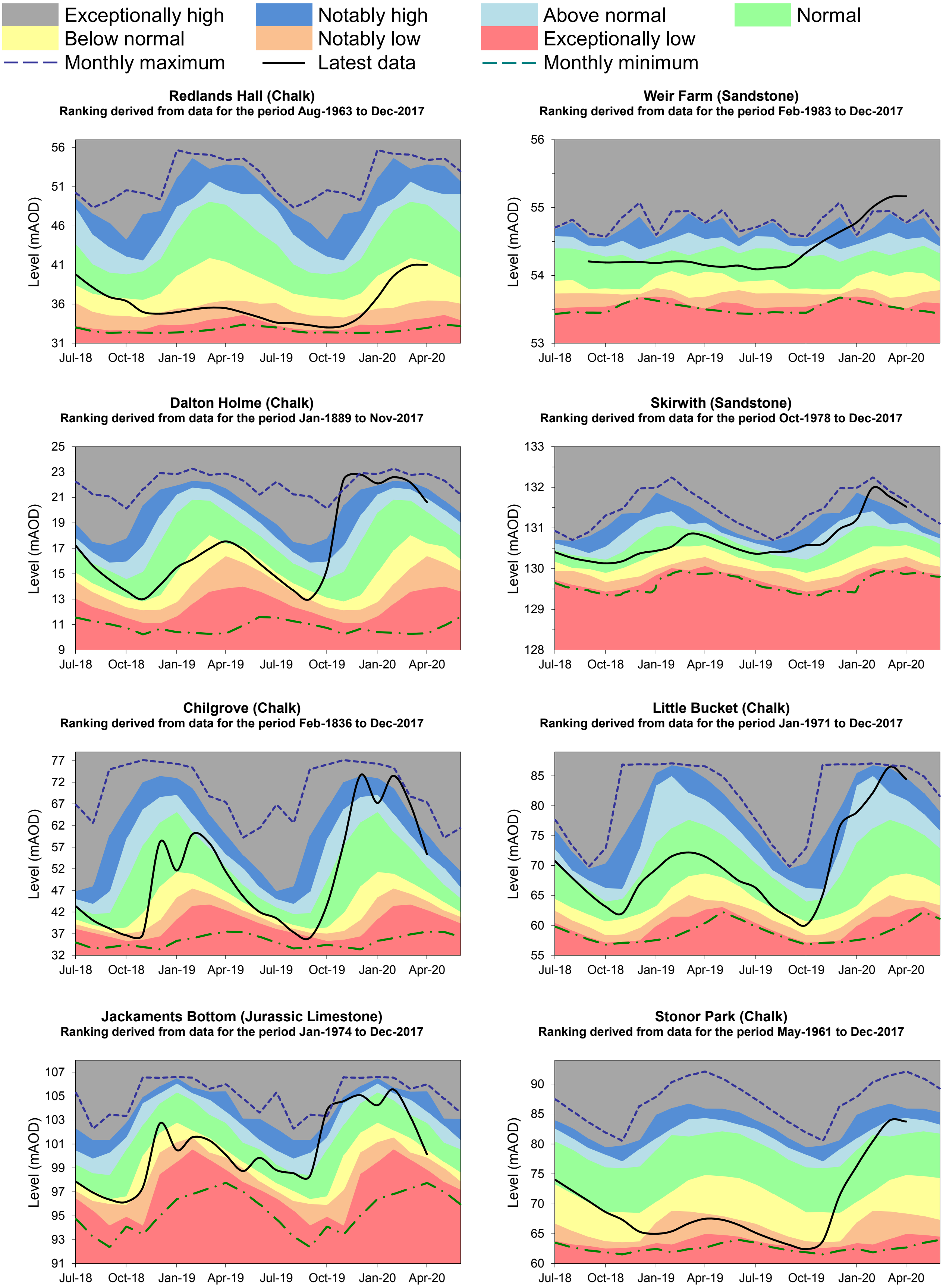
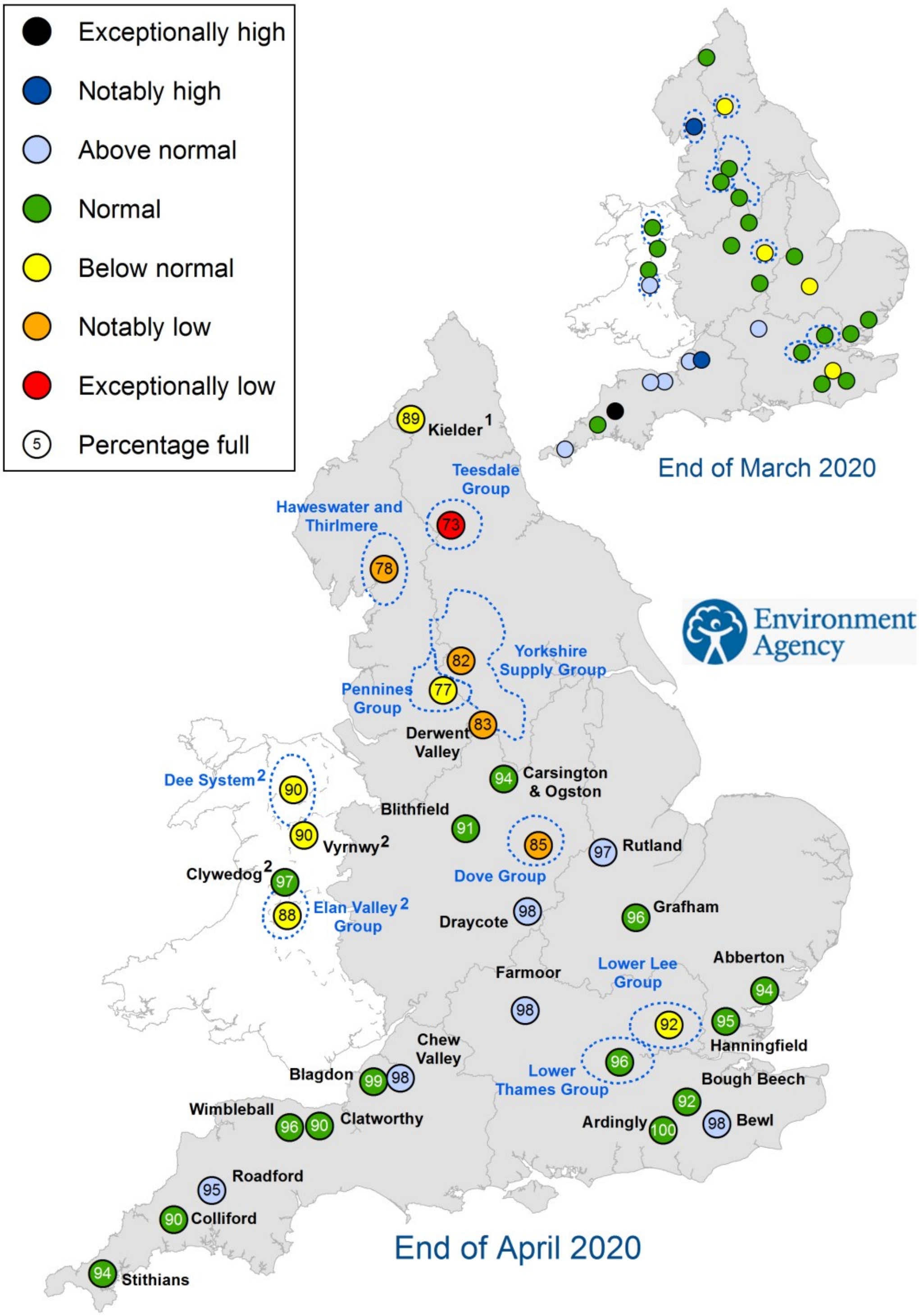


Figure 4.2: Index groundwater level sites for major aquifers. End of month groundwater levels months compared to an analysis of historic end of month levels and long term maximum and minimum levels. (Source: Environment Agency, 2020).

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 March 2020 and April 2020 as a percentage of total capacity and classed relative to an analysis of historic March and April 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, 2020.

Reservoir storage charts

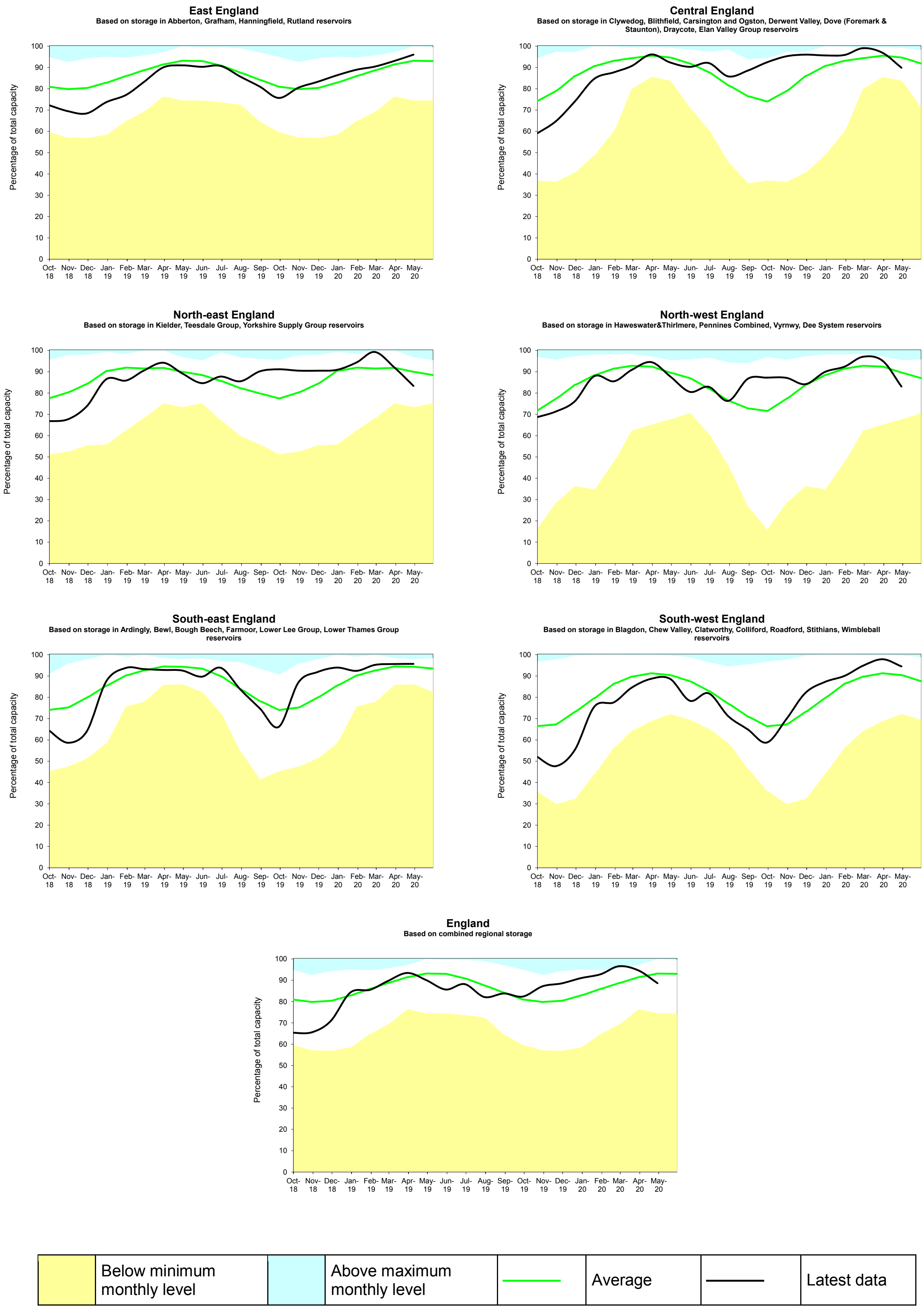


Figure 5.2: Regional reservoir stocks. End of month reservoir stocks compared to long term maximum, minimum and average stocks (Source: Water Companies). Note: Historic records of individual reservoirs/reservoir groups making up the regional values vary in length.

Forward look: river flow

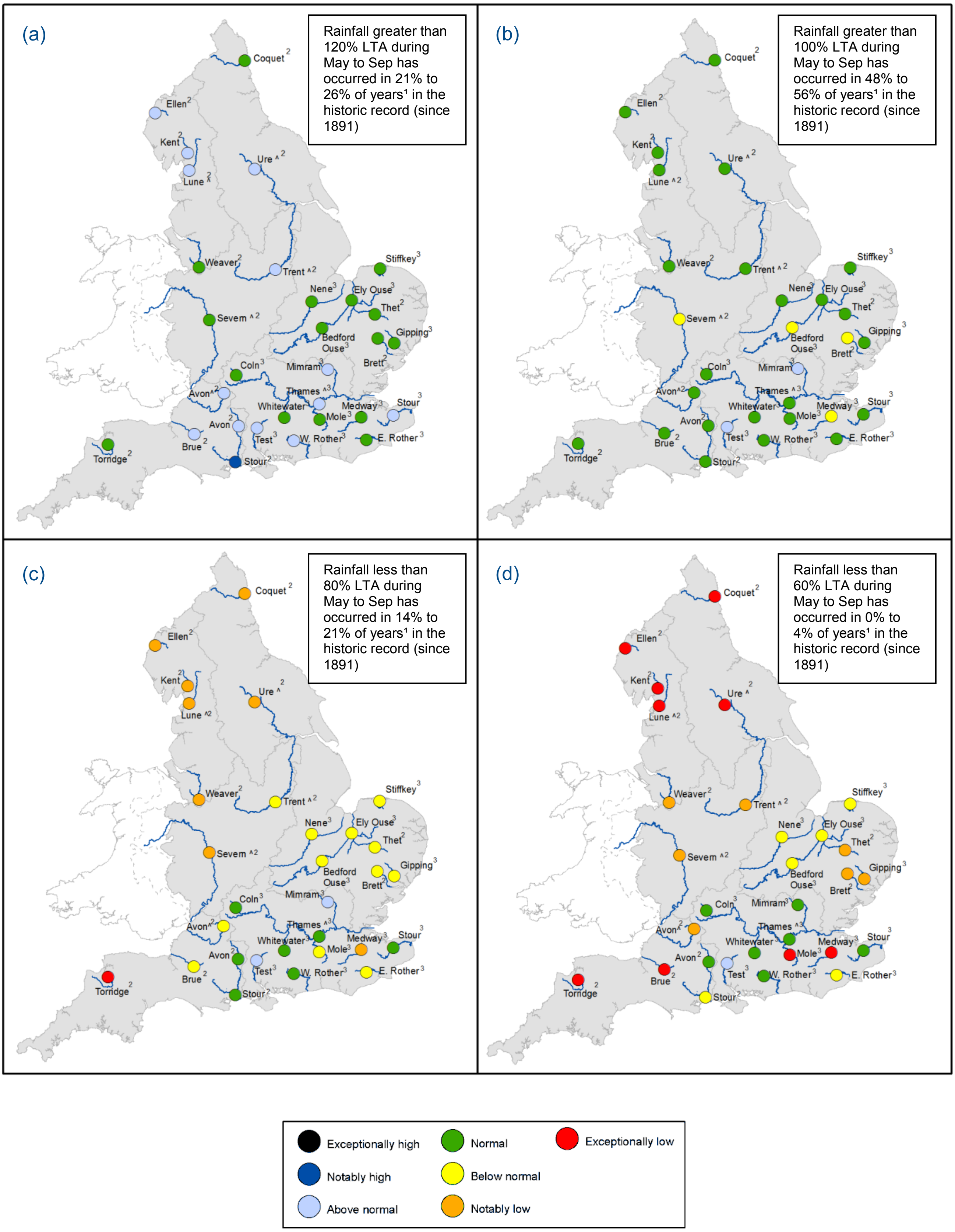


Figure 6.1: Projected river flows at key indicator sites up until the end of September 2020. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between May 2020 and September 2020 (Source: Centre for Ecology and Hydrology, Environment Agency)

[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*

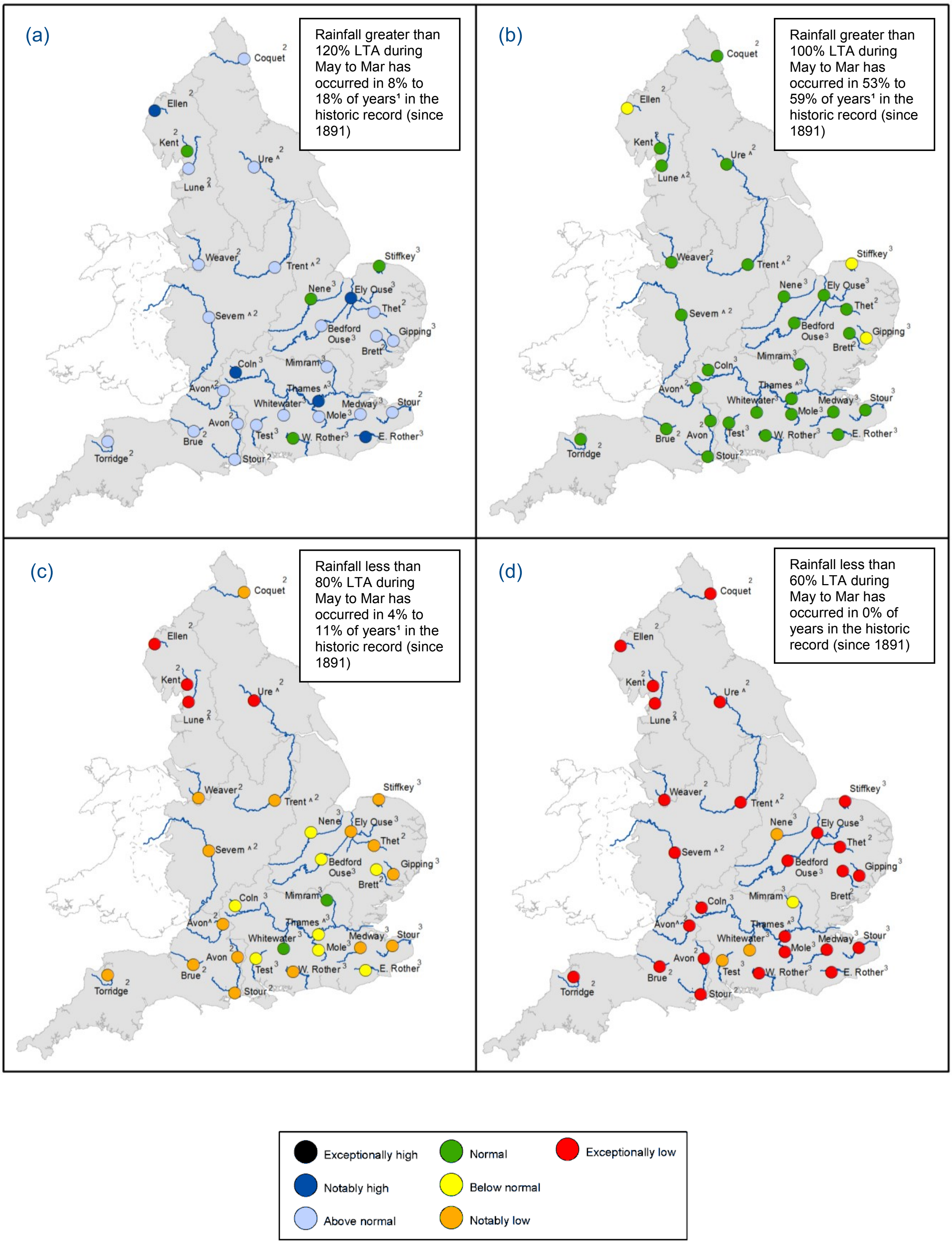


Figure 6.2: Projected river flows at key indicator sites up until the end of March 2021. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between May 2020 and March 2021 (Source: Centre for Ecology and Hydrology, Environment Agency)

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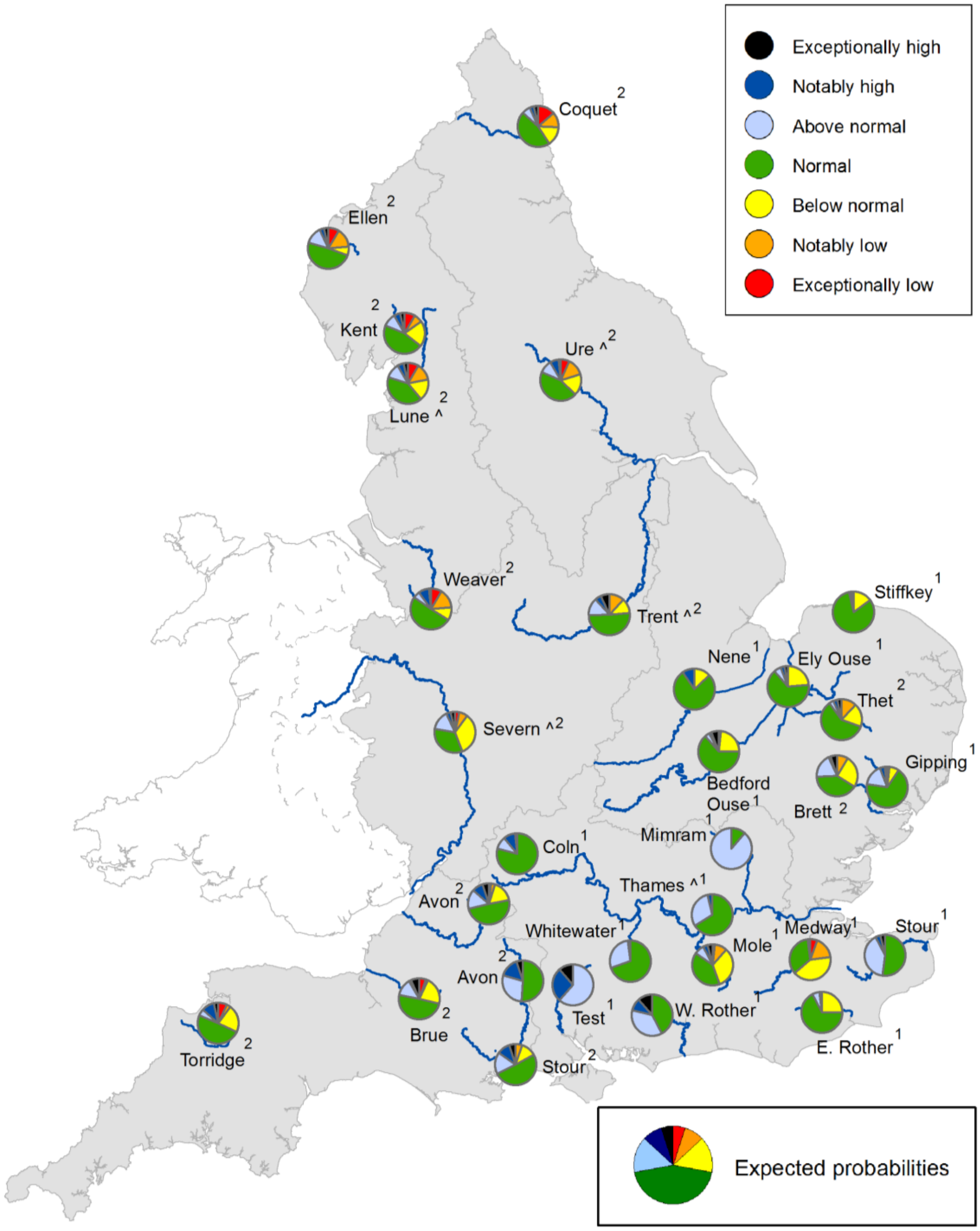
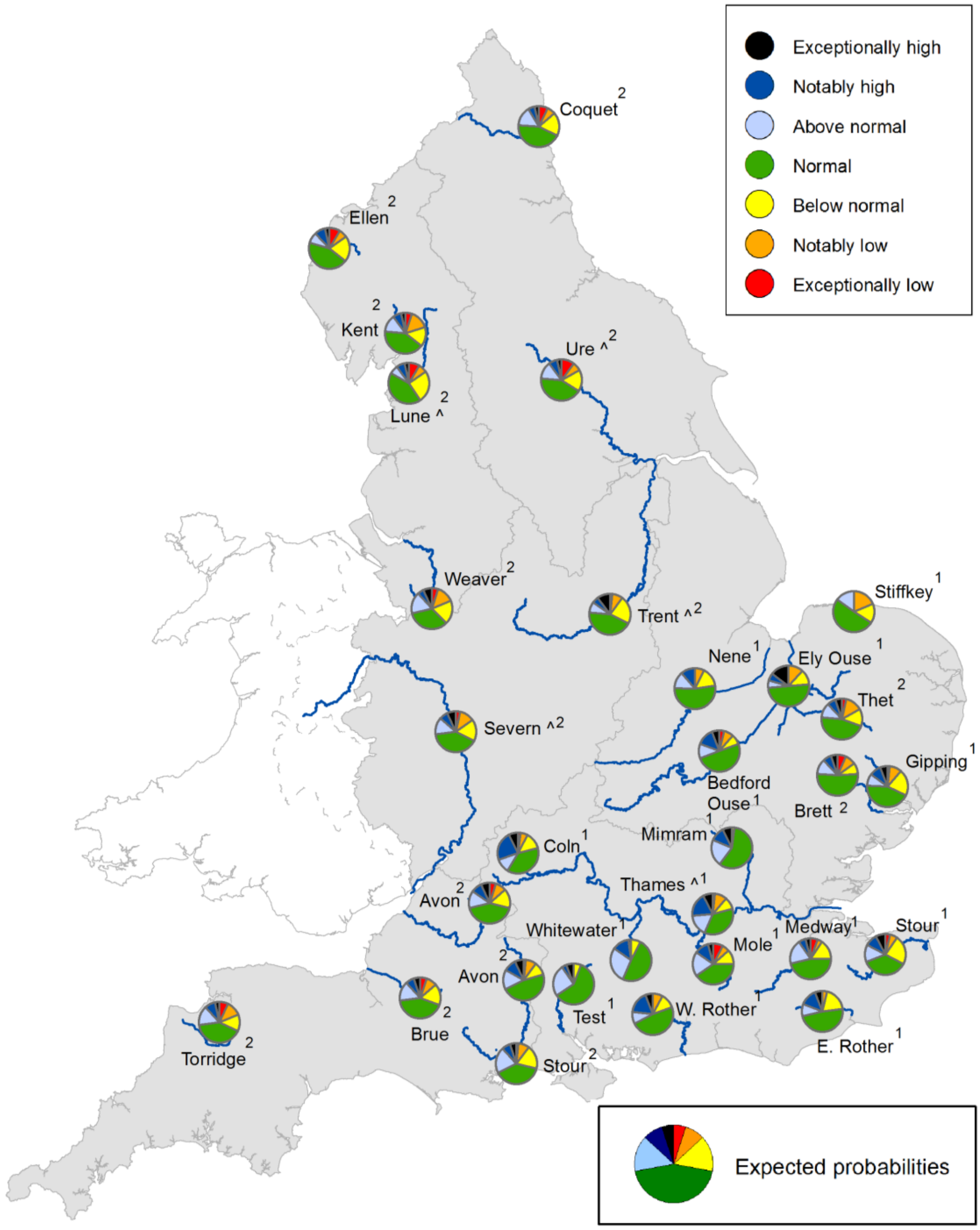


Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are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

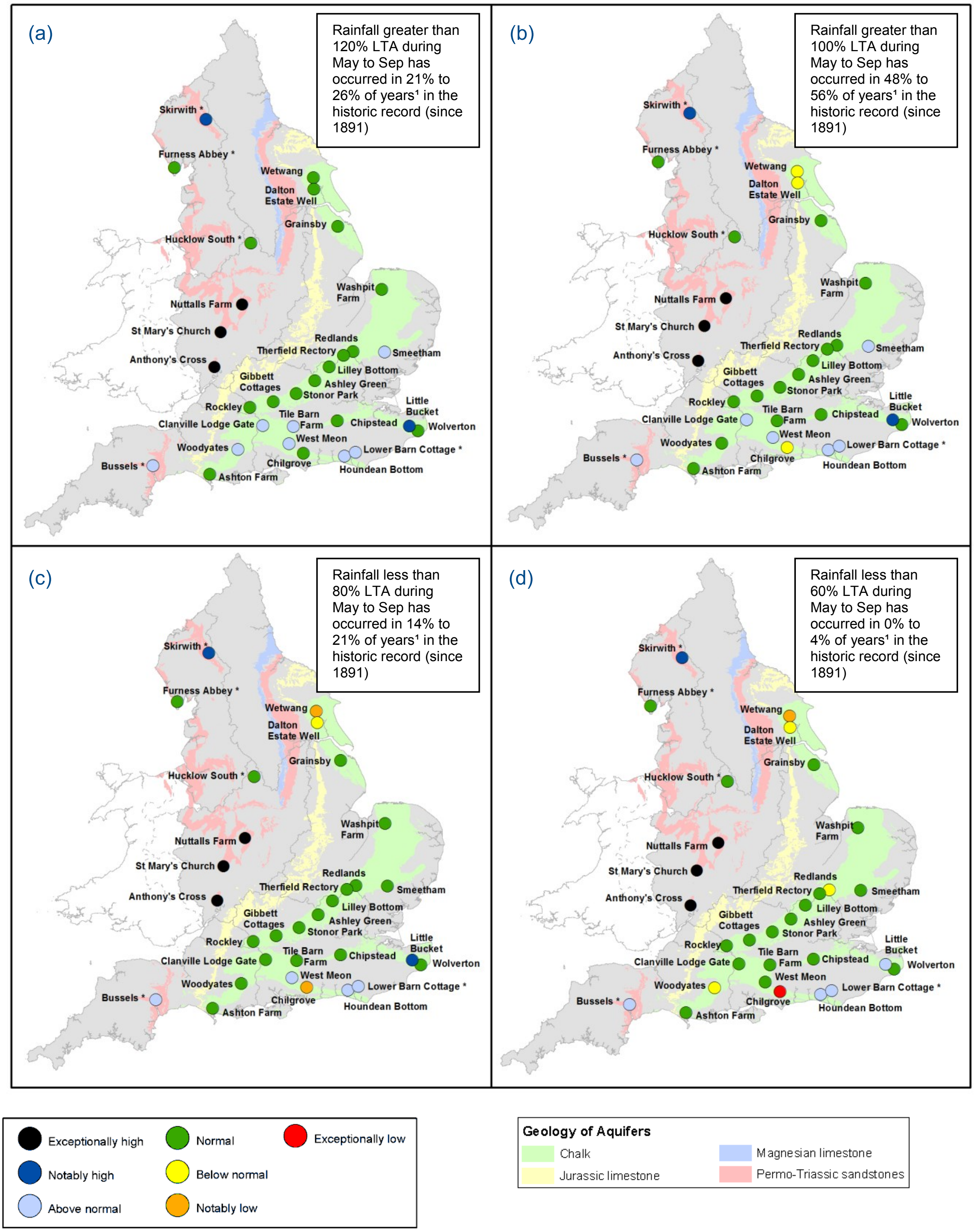


Figure 6.5: Projected groundwater levels at key indicator sites at the end of September 2020. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between May 2020 and September 2020 (Source: Environment Agency) Geological map reproduced with kind 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

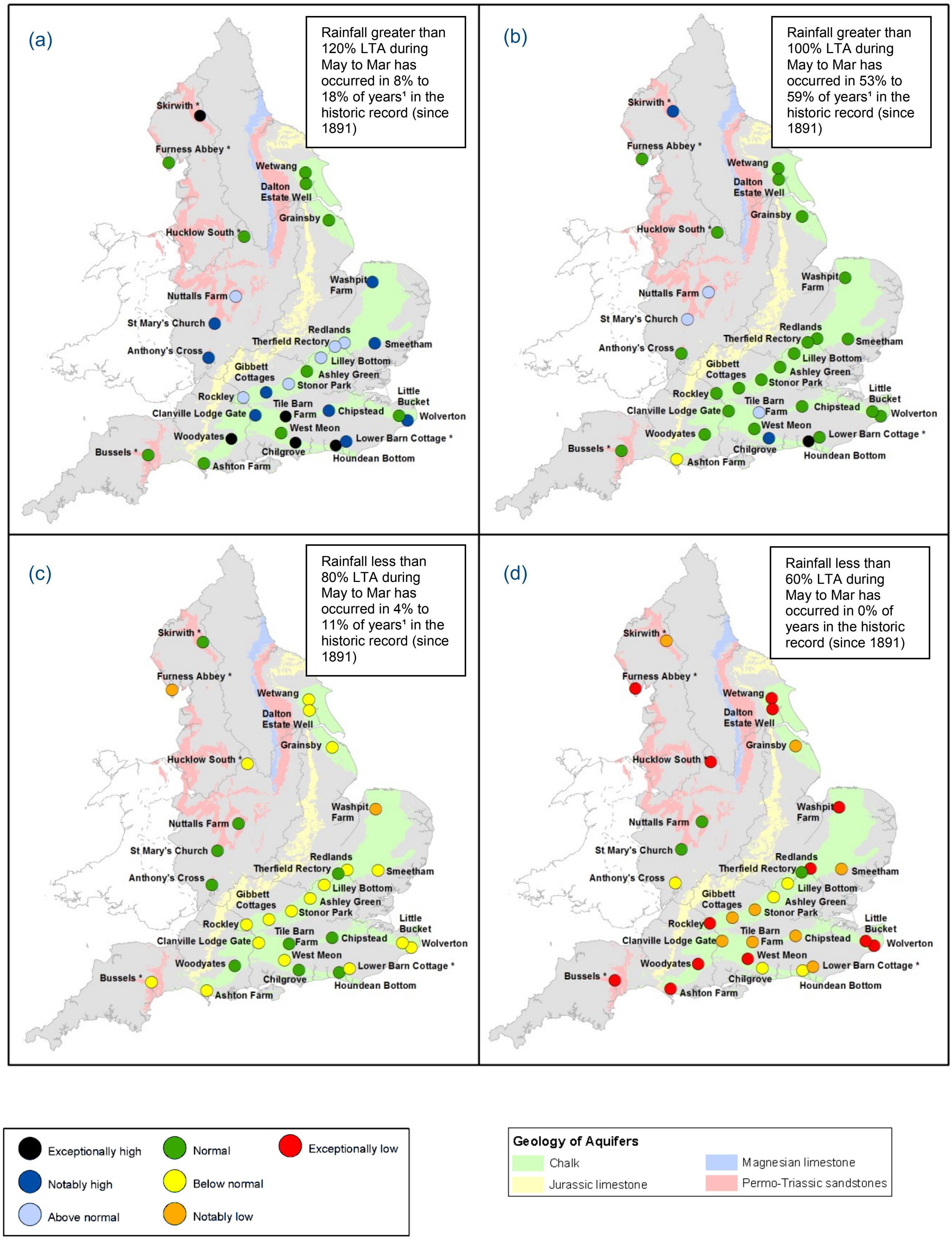
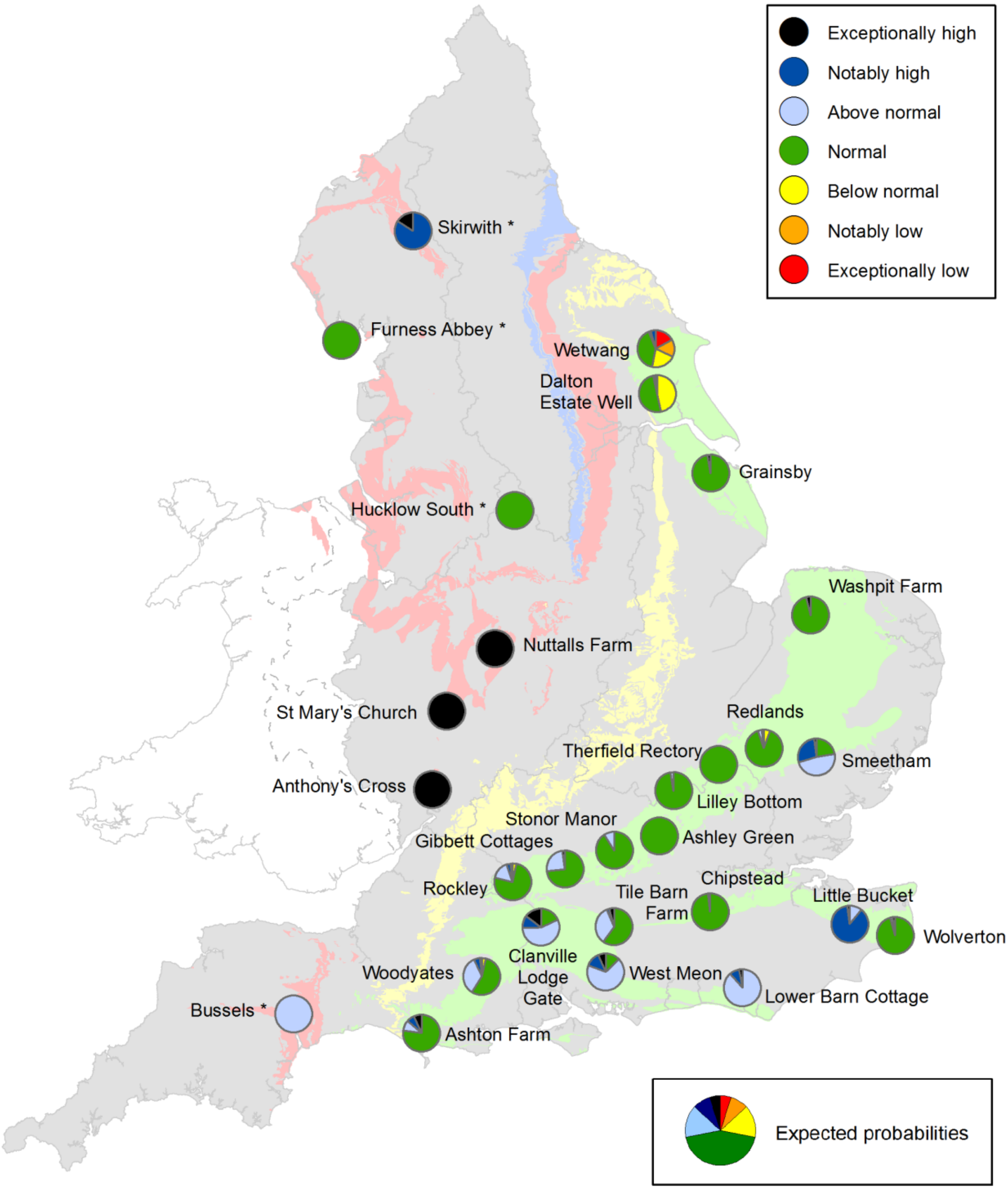


Figure 6.6: Projected groundwater levels at key indicator sites at the end of March 2021. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between May 2020 and March 2021 (Source: Environment Agency) Geological map reproduced with kind permission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

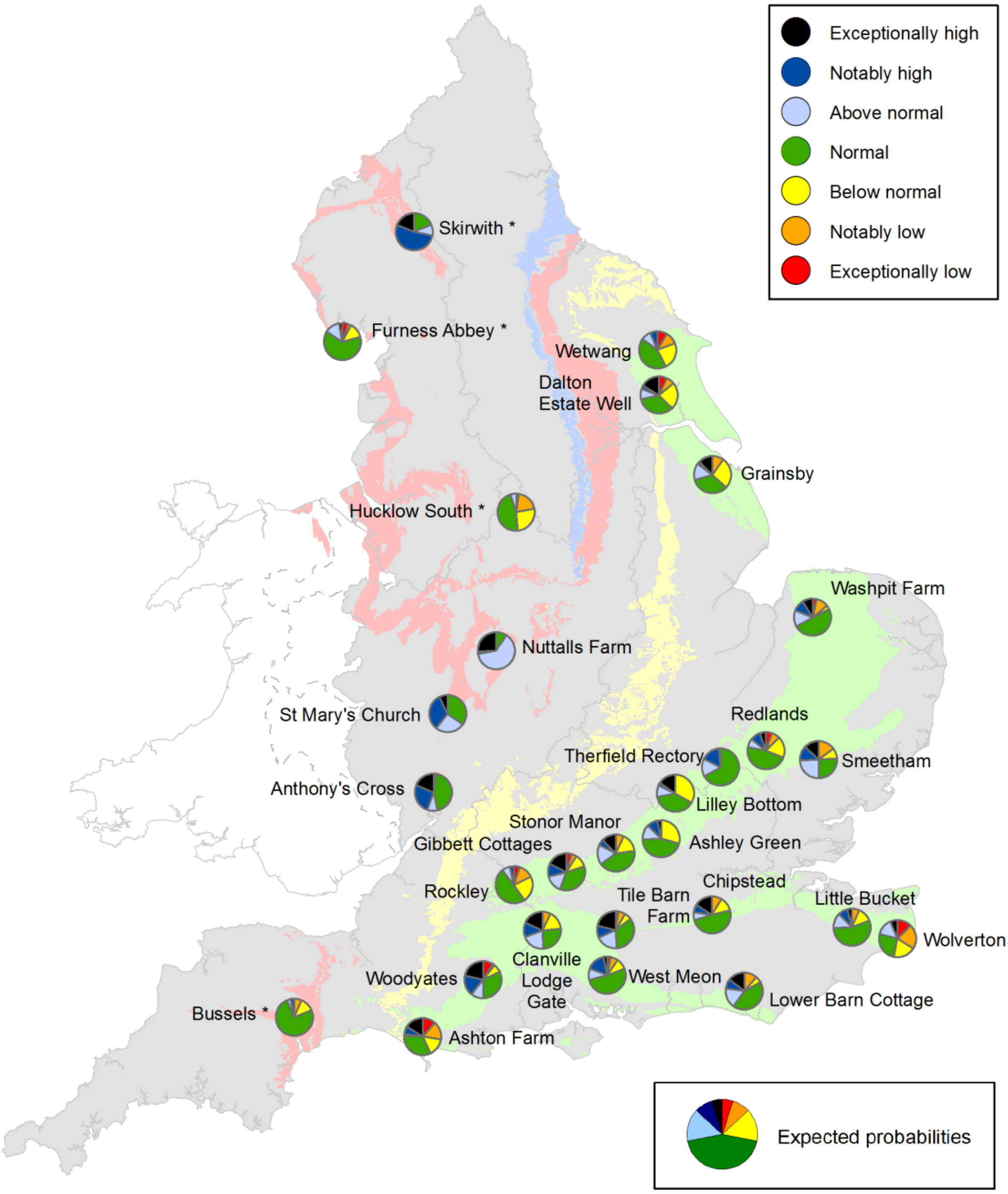
* Projections for these sites are produced by BGS
[1] This range of probabilities is a regional analysis



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