Monthly water situation report

England

Summary – October 2019

Most of England received above average rainfall during October, with some catchments receiving over double the average monthly total. Soils were wetter than average for the time of year across most of the country, by the end of October. Monthly mean river flows were classed as exceptionally high at just over a third of indicator sites. There was a generally improving flow picture in parts of east and south-east England, however flows remain low for the time of year in parts of Cambridgeshire and Hertfordshire, reflecting the low groundwater levels in these areas. Groundwater levels increased at over two-thirds of indicator sites during October. In some of the chalk aquifers in east and south-east England and the Otter sandstone in Devon, groundwater levels continued to fall and were classed as being at a notably low or exceptionally low level at the end of the month. The total reservoir stocks across England increased during October and were at 87% of capacity at the end of the month.

Rainfall

The October rainfall total for England was 125 mm, representing 162% of the 1961-90 long-term average LTA (136% of the 1981-2010 LTA). High rainfall totals were recorded in much of south-west and northern England (Figure 1.1).

Most catchments across England received above average rainfall during October. The highest rainfall totals, as a percentage of LTA, were recorded in Lincolnshire in the Witham to Chapel Hill catchment (246% of LTA) and South Forty Foot and Hobhole catchments (255% of LTA). The lowest October rainfall totals, as a percentage of LTA, were recorded in the River Esk catchment on the border between England and Scotland (67% of LTA). The cumulative rainfall totals for the last 6 months were the wettest on record in 9 catchments in north-east and central England. Despite the rainfall this month, the 12 month cumulative rainfall totals in parts of Suffolk, Cambridgeshire and Hertfordshire were still classed as below normal (Figure 1.2).

At a regional scale, October rainfall totals were above average in all regions and were classed as notably high in east and central England with 191% and 194% of LTA rainfall respectively. October was the 5th consecutive month where the areal average rainfall total for England was above average (Figure 1.3).

Soil moisture deficit

Soils got wetter across most of England during October. By the end of the month, soils moisture deficits across most of England were smaller than average (soils were wetter than average) by at least 26mm (Figure 2.1).

At a regional scale, soils at the end of October were wetter than average in all regions. In south-east England soil moisture deficit decreased by 38mm during October, ending the month 34mm smaller (soils were wetter) than the LTA for the time of year (Figure 2.2).

River flows

Monthly mean river flows increased at almost all indicator sites, relative to September. Monthly mean flows only decreased on the River Lune and River Derwent, in north-west England, but were still classed as above normal and normal respectively. This reflects the lower rainfall totals in parts of northern England during October, compared to much of the rest of the country (Figure 3.1).

October monthly mean river flows were classed as exceptionally high at just over a third of indicator sites. Of these, it was the highest recorded October monthly mean flow at ten indicator sites. On the River Don, in Yorkshire, the new October record high mean monthly flow represented 398% of the October LTA, exceeding the previous October record from 1960. Across much of east England and parts of south-east England monthly mean river flows were classed as normal or higher for the time of year. Flows on the River Cam (Cambridgeshire) were classed as notably low for October, but this represents an improvement following 7 consecutive months where the monthly mean flow was classed as exceptionally low. Flows in this river are strongly influenced by groundwater levels in the area, which remain lower than normal for the time of year (Figure 3.1).

October monthly mean flows were classed as normal or higher at all of the regional index sites. On the Great Stour in south-east England the monthly mean flow was classed as notably low in September, but increased to a flow classed as normal in October. Flows on the Bedford Ouse, in east England, also increased, going from a below normal September flow to a normal monthly mean flow in October (Figure 3.2).

Groundwater levels

Groundwater levels increased at over two-thirds of indicator sites during October. By the end of October the groundwater level at just under two-thirds of indicator sites was classed as normal or higher for the time of year; this contrasts with only just over a third of sites at the end of September (Figures 4.1 and 4.2).

In the Cam and Ely Ouse chalk aquifer at Redlands Hall and the East Chilterns chalk aquifer at Ashley Green, groundwater levels continued to fall during October and were still classed as notably low for the time of year at the end of the month. At Stonor Park, in the South West Chilterns Chalk aquifer, groundwater levels were also still in recession and were classed as exceptionally low. Groundwater levels in the Otter Sandstone aquifer (Devon) at Woodleys No.1, were also classed as notably low for the time of year (Figures 4.1 and 4.2).

Recharge of the groundwater levels in the Hull and East Riding Chalk aquifer meant that the end of October levels at Wetwang and Dalton Estate Well were classed as exceptionally high and above normal respectively, having both been classed as below normal at the end of September. There was similar significant recharge in groundwater levels at Chilgrove, in the Chichester Chalk aquifer, where the groundwater level had been classed as exceptionally low at the end of September but had recovered to a normal level at the end October. At four indicator sites groundwater levels were the highest on record for the end of October; one of these was the regional index site Jackaments Bottom (Burford Jurassic Limestone aquifer) where levels had been classed as normal at the end of September.

Reservoir storage

Reservoir stocks increased at over three-quarters of reported reservoirs and reservoir groups during October. The end of month reservoir stocks were classed as below normal at less than a fifth of the reported reservoirs and reservoir groups. Of these, Abberton and Hanningfield reservoirs, in east England, ended the month at 50% and 52% of total storage capacity respectively. Roadford and Colliford, in south-west England, were at 54% and 51% of total storage capacity at the end of October. The biggest increase in reservoir stocks, as a proportion of total capacity, were in the Lower Thames Group of reservoirs with a 28% increase (Figure 5.1).

The total reservoir stocks across England were at 87% of capacity at the end of October. This is a 5% increase from the end of September. At a regional scale, total reservoir stocks were at or above the long-term average in all regions; they ranged from 70% of total capacity in south-west England to 95% of total capacity in central England, at the end of October (Figure 5.2).

Forward look

November is forecast to start rather cold and unsettled, with rain or showers for many as well as some snow over high ground in the north. Occasional stormier periods are possible in the south, followed by more settled weather, as rain and stronger winds are displaced further northwest. Through the second half of the month confidence remains very low. There may be unsettled conditions, with the rain and wind expected to be more prevalent in the northwest of the UK. There are indications that there could be a slow transition into more settled weather, especially in the south and east of England. This could mean that temperatures may return close to the average by the end of the month, although it could still be rather cold at times.

For the three month period November to January, above average precipitation is more likely than below average precipitation[1].

Projections for river flows at key sites[2]

Seventy percent of the modelled sites have a greater than expected chance of cumulative river flows being notably high or higher for the time of year by the end of March 2020. By the end of September 2020, over three-quarters of the modelled sites have a greater than expected chance of flows being above normal or higher for the time of year.

For scenario based projections of cumulative river flows at key sites by March 2020 see Figure 6.1
For scenario based projections of cumulative river flows at key sites by September 2020 see Figure 6.2

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 probabilistic ensemble projections of cumulative river flows at key sites by March 2020 see Figure 6.3
For probabilistic ensemble projections of cumulative river flows at key sites by September 2020 see Figure 6.4

Projections for groundwater levels in key aquifers[2]
Around a third of the modelled sites have a greater than expected chance of groundwater levels being below normal or lower for the time of year by the end of March 2020. By the end of September 2020, around a third 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 March 2020 see Figure 6.5
For scenario based projections of groundwater levels in key aquifers in September 2020 see Figure 6.6
For probabilistic ensemble projections of groundwater levels in key aquifers in March 2020 see Figure 6.7
For probabilistic ensemble projections of groundwater levels in key aquifers in September 2020 see Figure 6.8

Authors: National Water Resources Hydrology Team

Rainfall

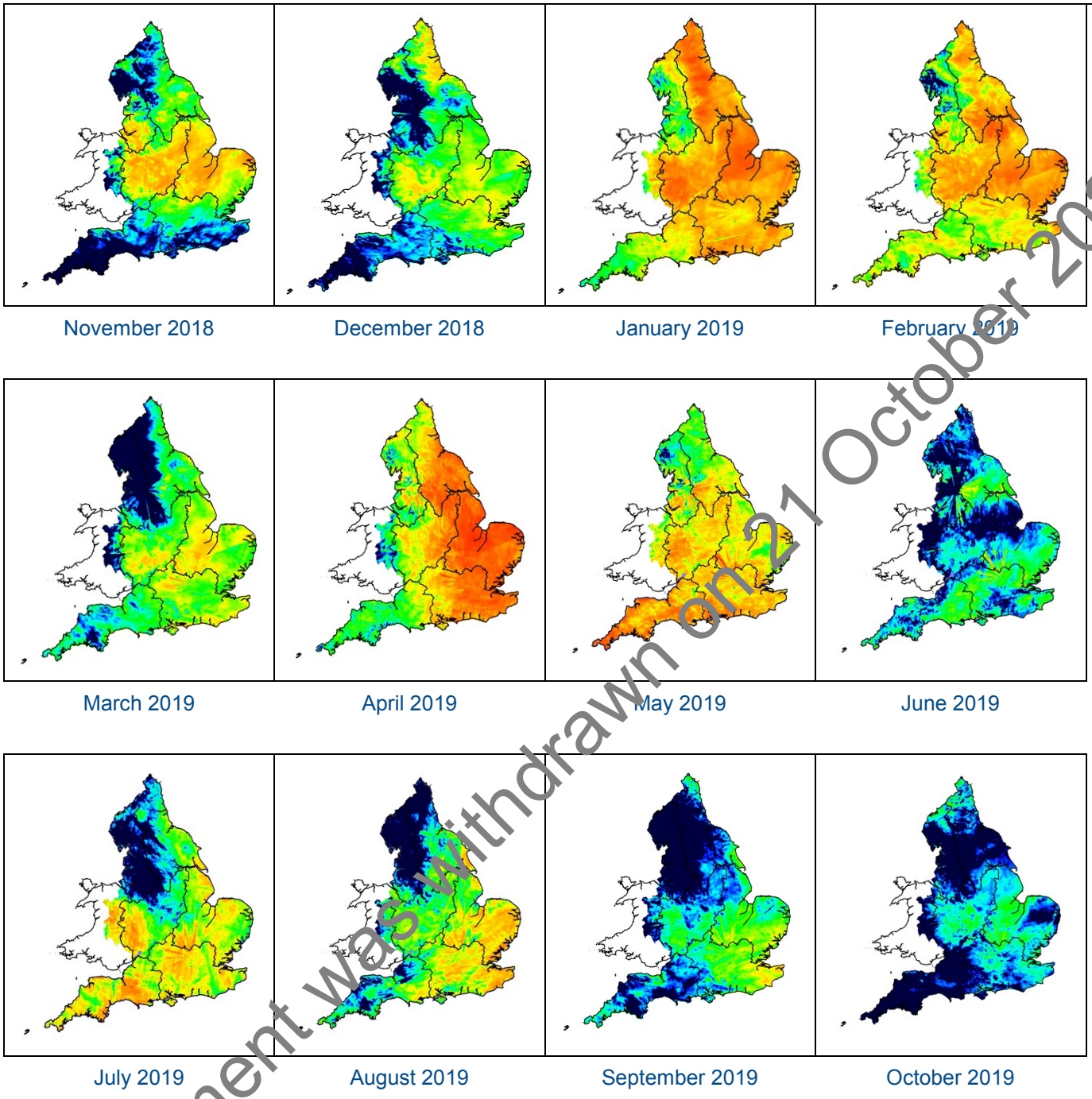


Figure 1.1: Monthly rainfall across England and Wales for the past 12 months. UKPP radar data (Source: Met Office © Crown Copyright, 2019). Note: Radar beam blockages in some regions may give anomalous totals in some areas. Crown copyright. All rights reserved. Environment Agency, 100026380, 2019.

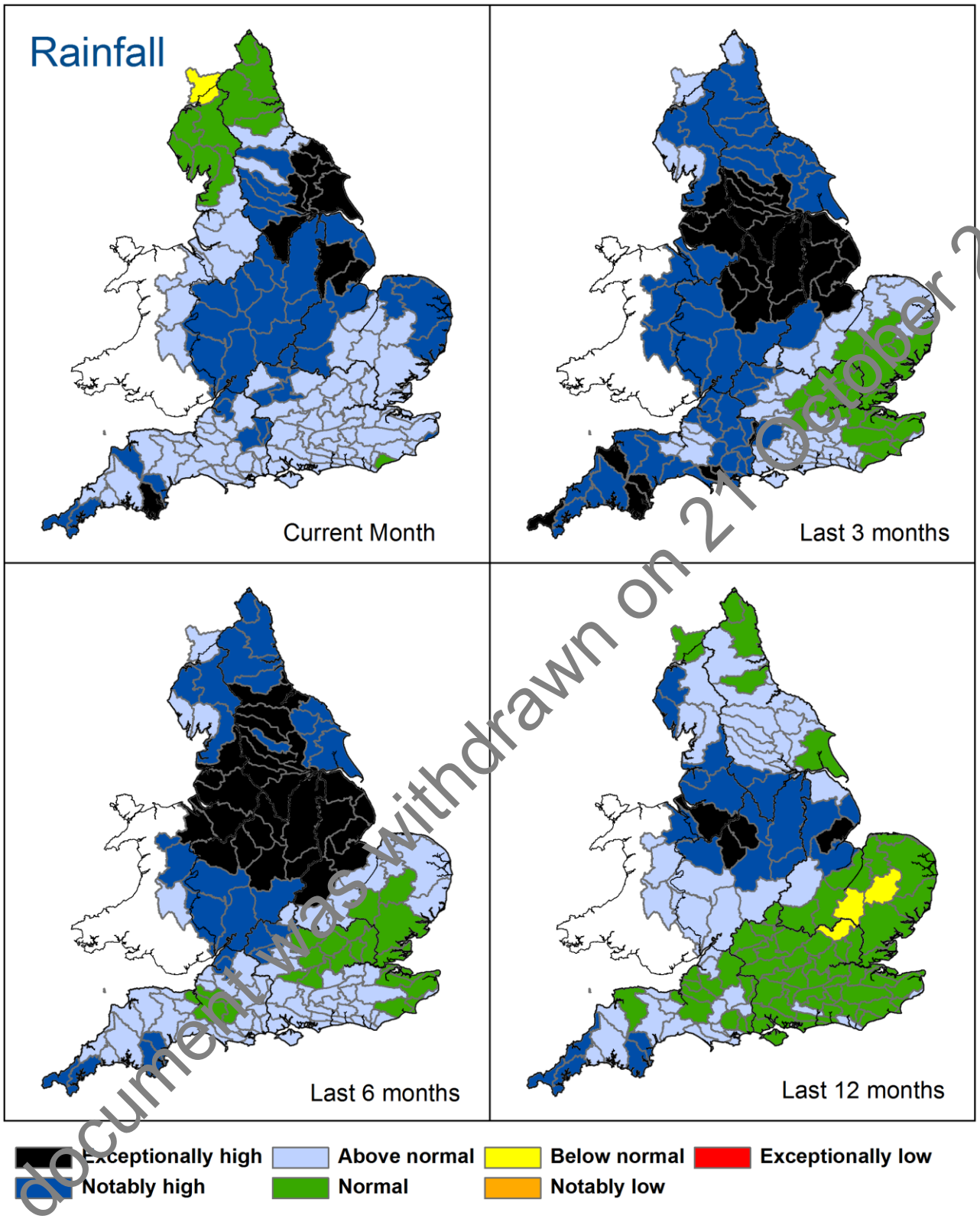


Figure 1.2: Total rainfall for hydrological areas across England for the current month (up to 31 October), the last 3 months, the last 6 months, and the last 12 months, classed relative to an analysis of respective historic totals. HadUK data based on the Met Office 1km gridded rainfall dataset derived from rain gauges *(Source: Met Office © Crown Copyright, 2019).* Provisional data based on Environment Agency 1km gridded rainfall dataset derived from Environment Agency intensity rain gauges. Crown copyright. All rights reserved. Environment Agency, 100026380, 2019.

Rainfall charts

Above average rainfall

Below average rainfall

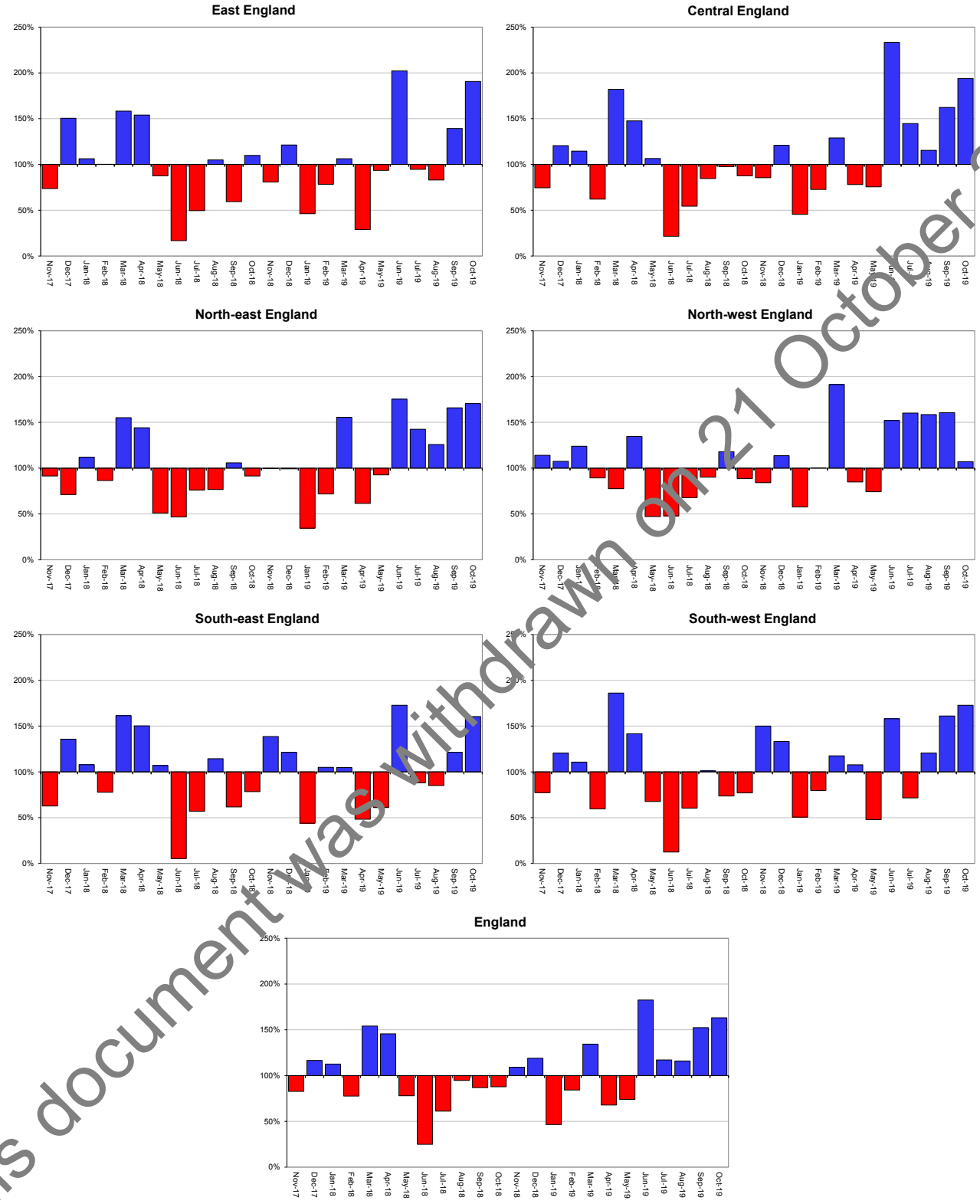


Figure 1.3: Monthly rainfall totals for the past 24 months as a percentage of the 1961 to 1990 long term average for each region and for England. HadUK rainfall data. (Source: Met Office © Crown Copyright, 2019).

Soil moisture deficit

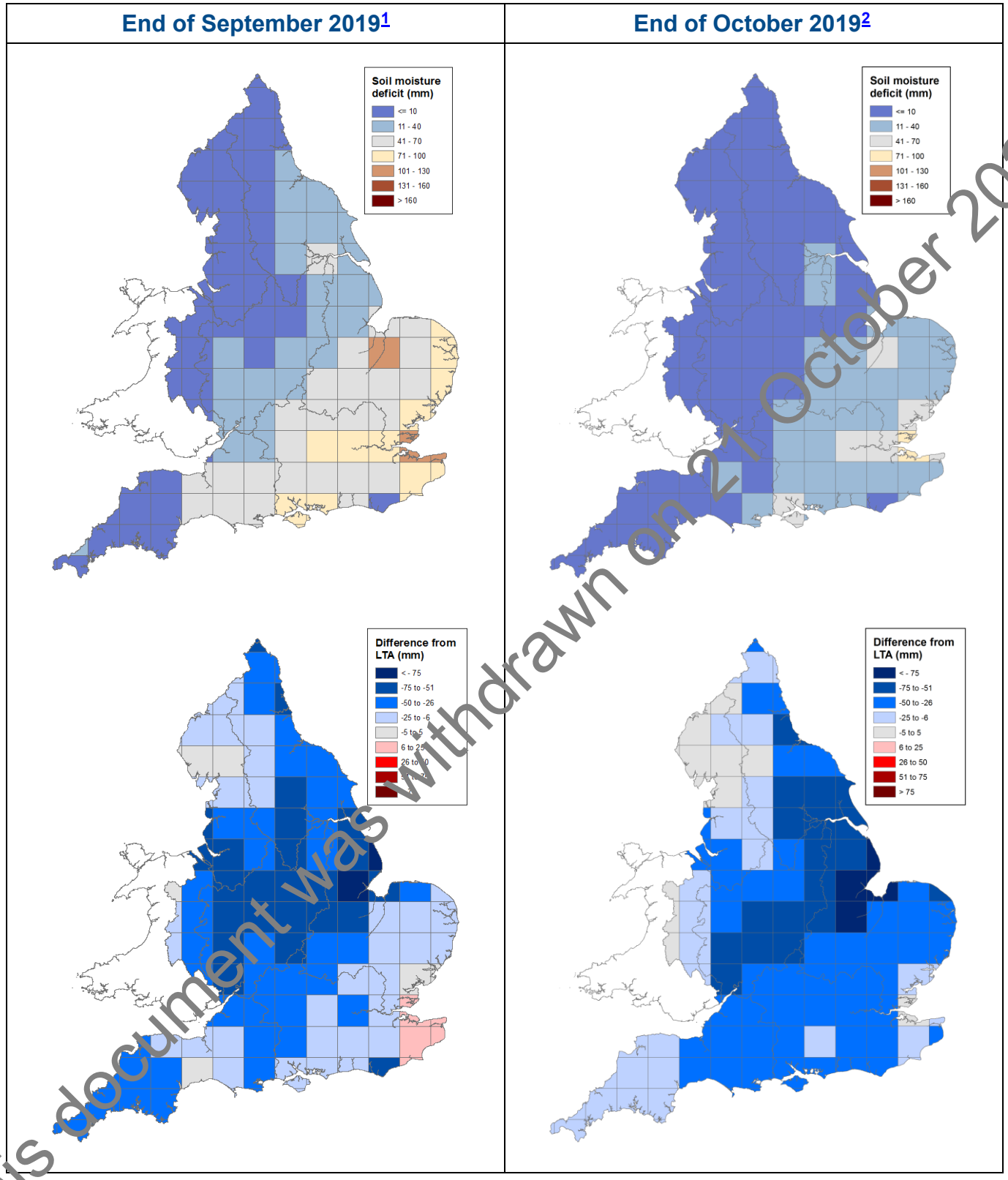


Figure 2.1: Soil moisture deficits for weeks ending 4 October 2019 [1] (left panel) and 29 October 2019 [2] (right panel). Top row shows actual soil moisture deficits (mm) and bottom row shows the difference (mm) of the actual from the 1961 to 90 long term average soil moisture deficits. MORECS data for real land use (Source: Met Office © Crown Copyright, 2019). Crown copyright. All rights reserved. Environment Agency, 100026380, 2019

Soil moisture deficit charts

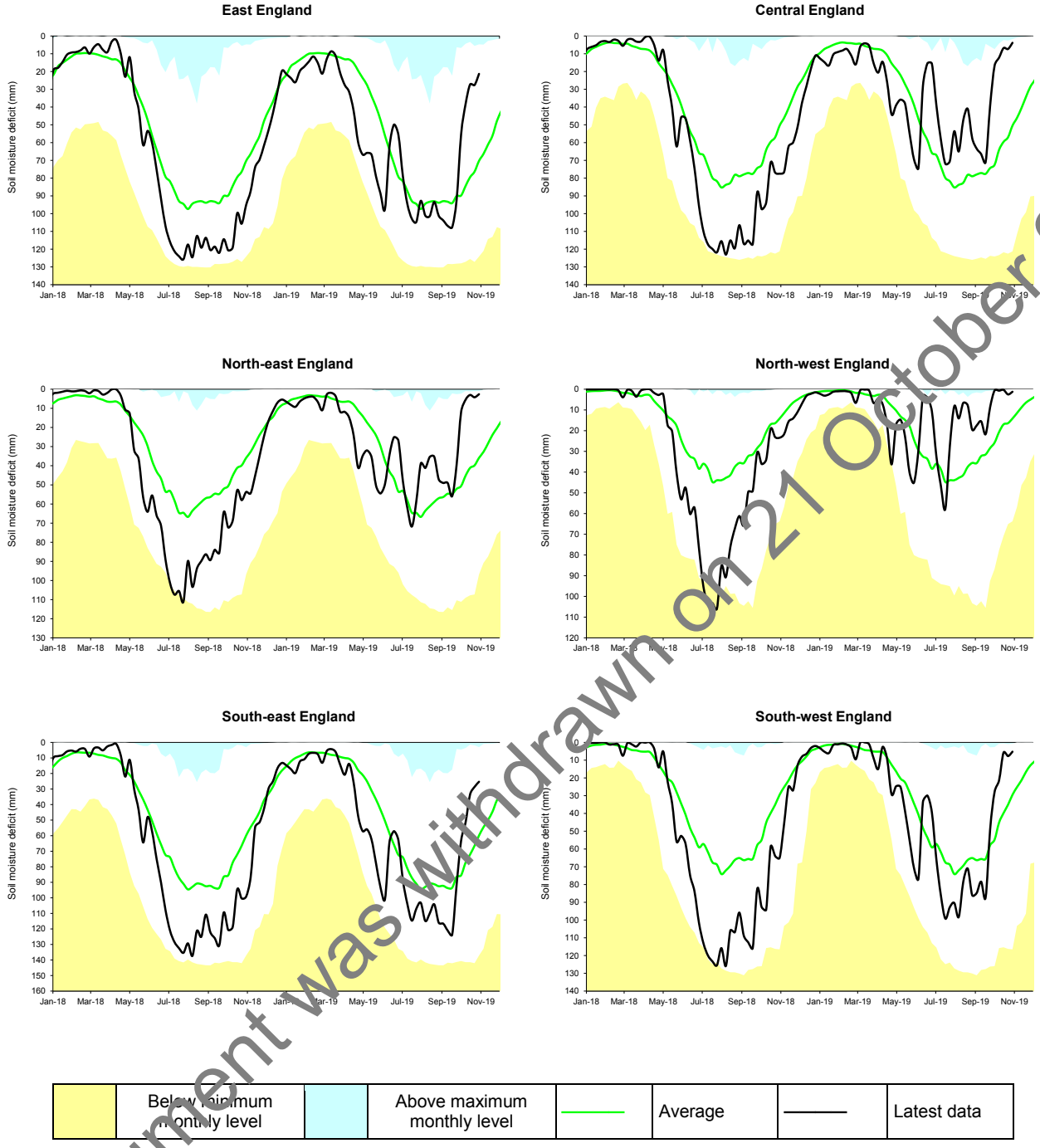
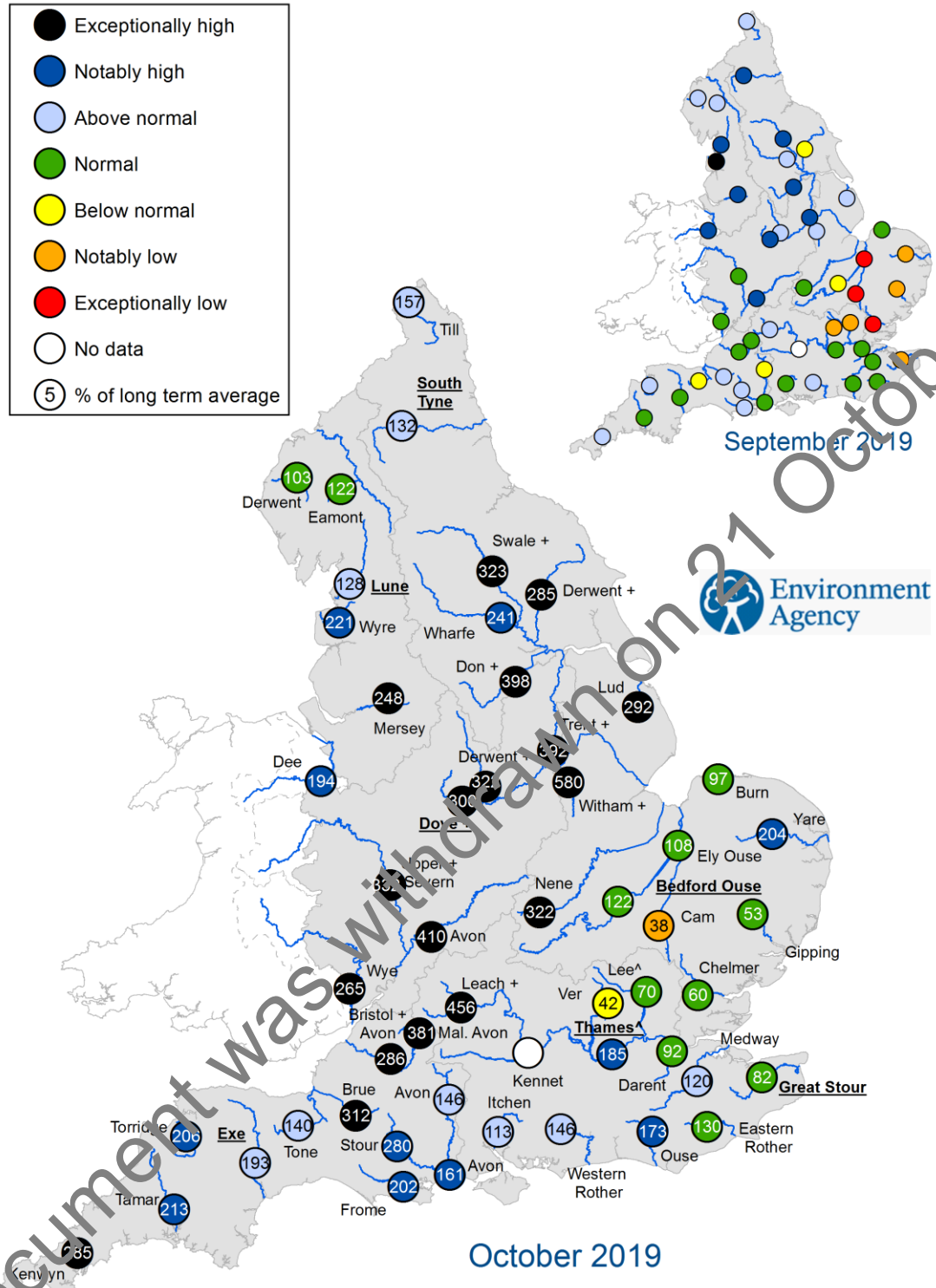


Figure 2.2: Latest soil moisture deficits for all geographic regions compared to maximum, minimum and 1961 to 90 long term average. Weekly MORECS data for real land use. (Source: Met Office © Crown Copyright, 2019).

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 September and October 2019, expressed as a percentage of the respective long term average and classed relative to an analysis of historic September and October monthly means (Source: Environment Agency). Crown copyright. All rights reserved. Environment Agency, 100026380, 2019.

River flow charts

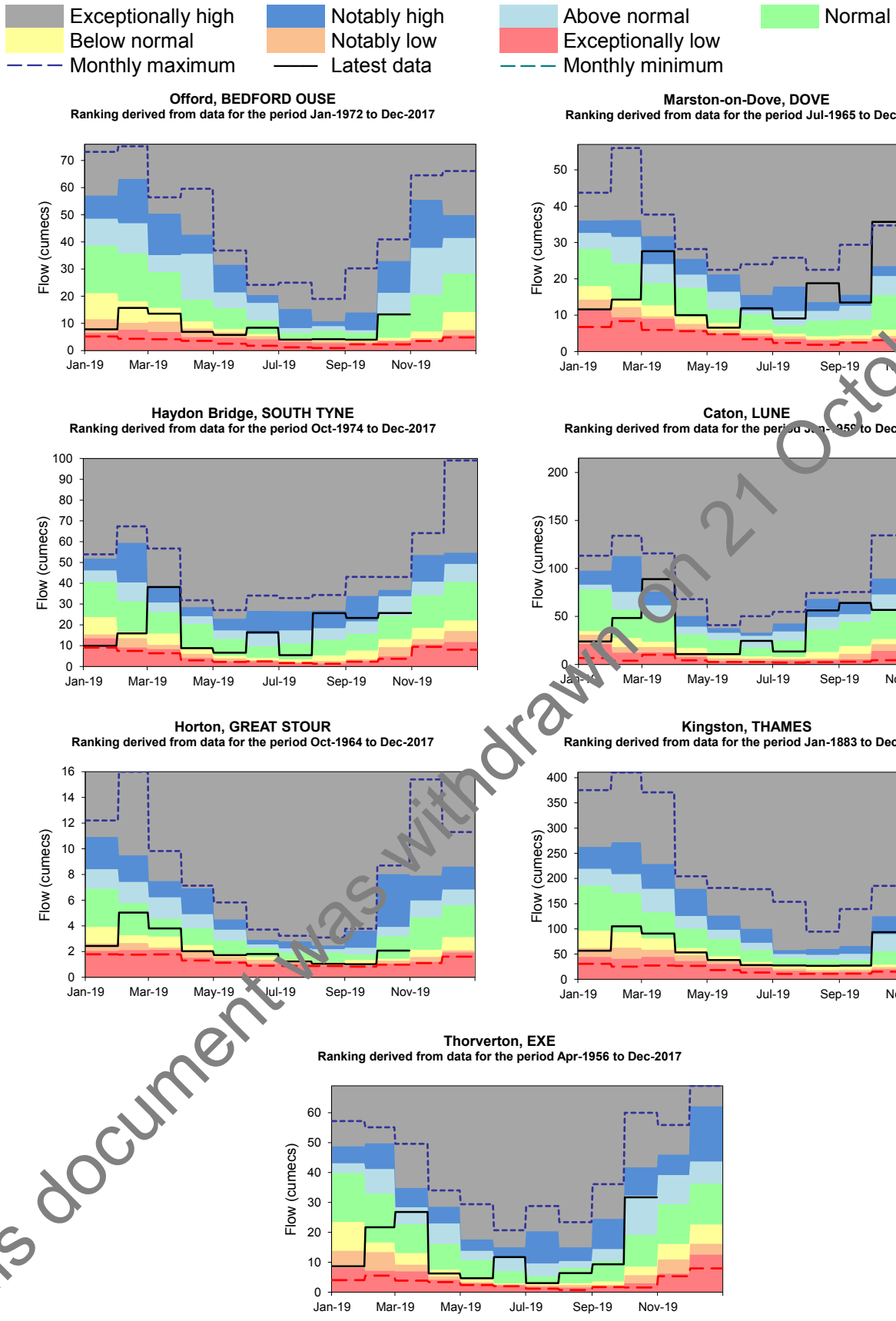
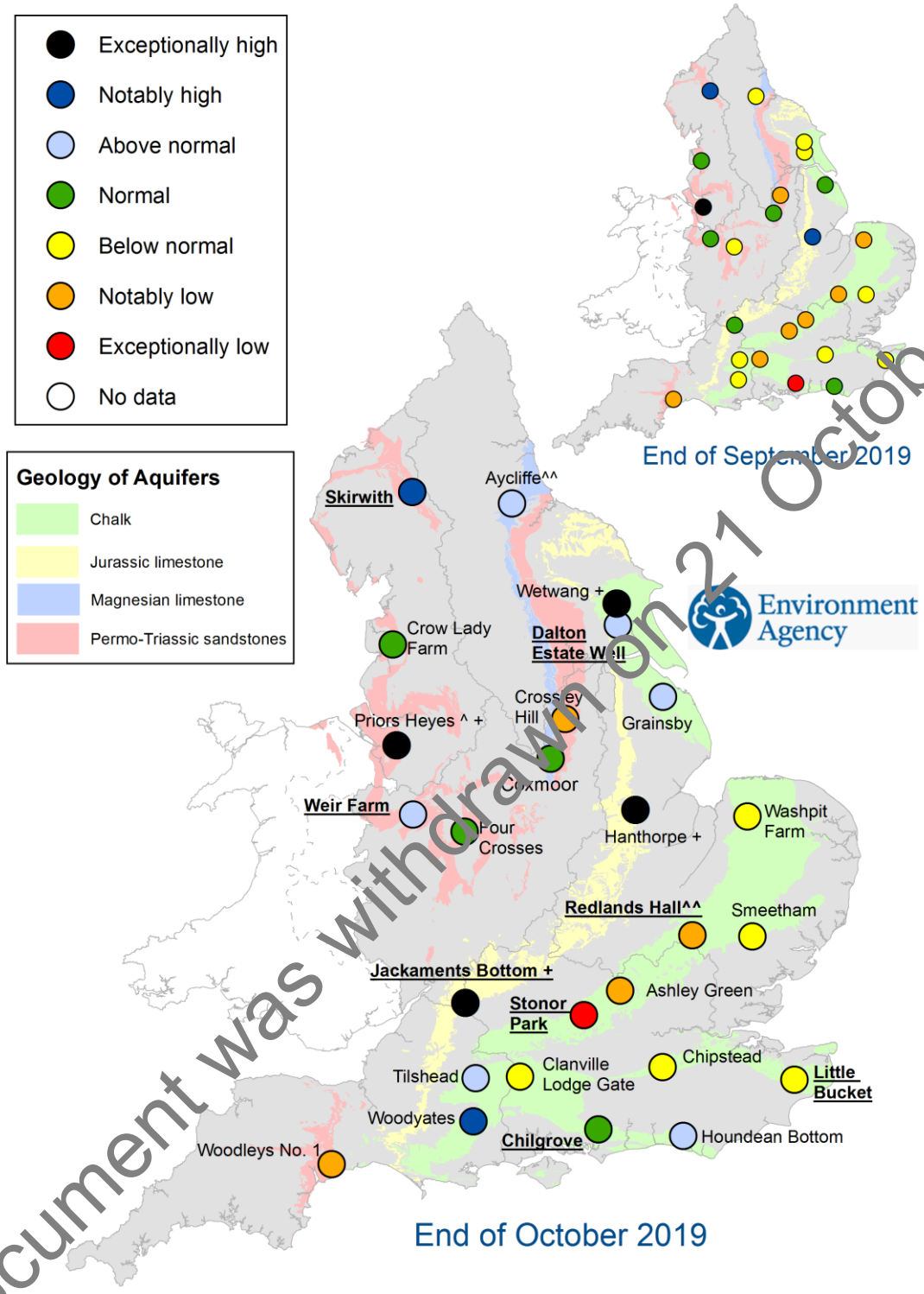


Figure 3.2: Index river flow sites for each geographic region. Monthly mean flow compared to an analysis of historic monthly mean flows, long term maximum and minimum flows. (Source: Environment Agency).

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 September and October 2019, classed relative to an analysis of respective historic September and October levels (Source: Environment Agency). Geological map reproduced with kind permission from UK Groundwater Forum, BGS © NERC. Crown copyright. All rights reserved. Environment Agency, 100026380, 2019.

Groundwater level charts

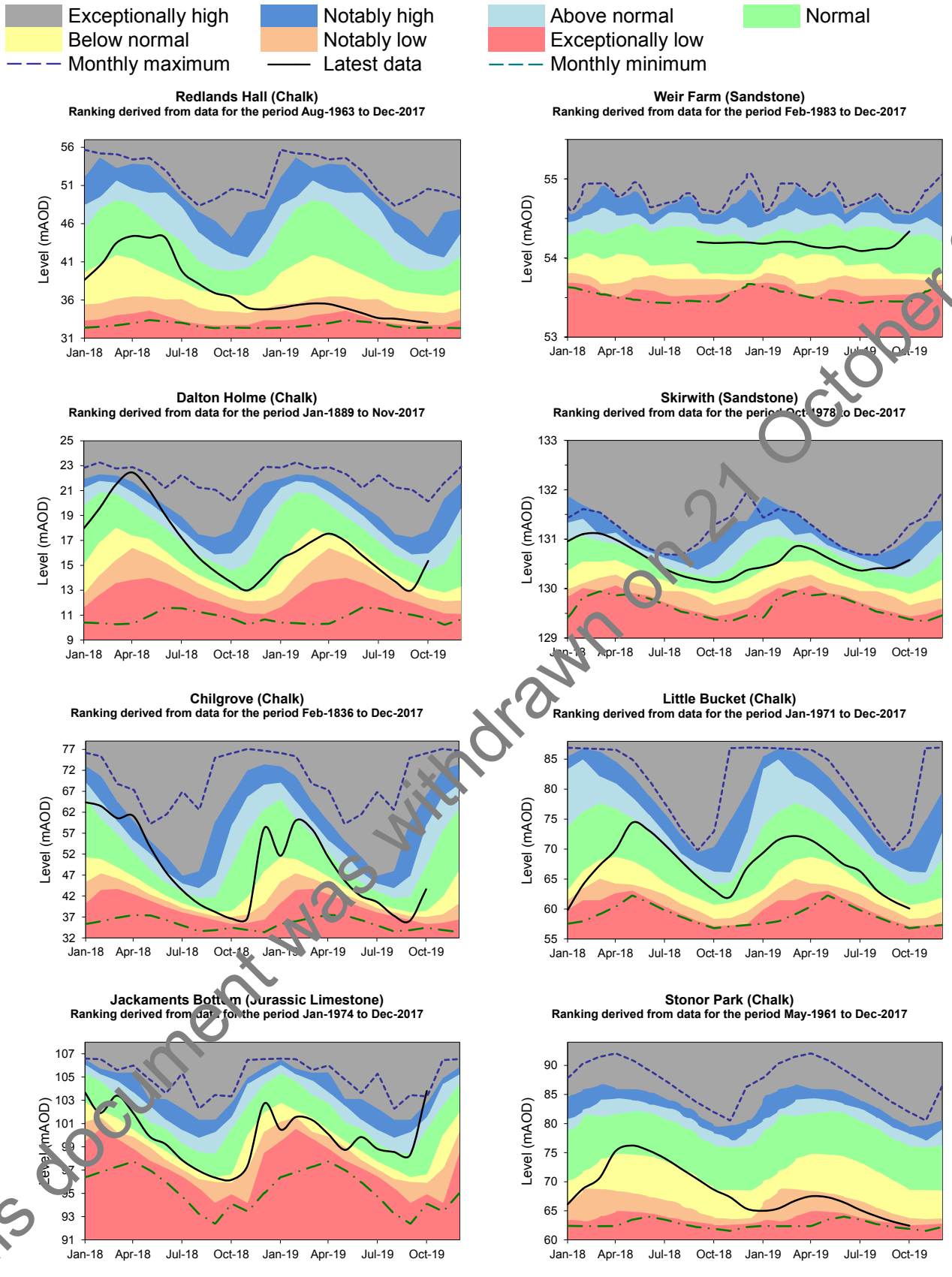
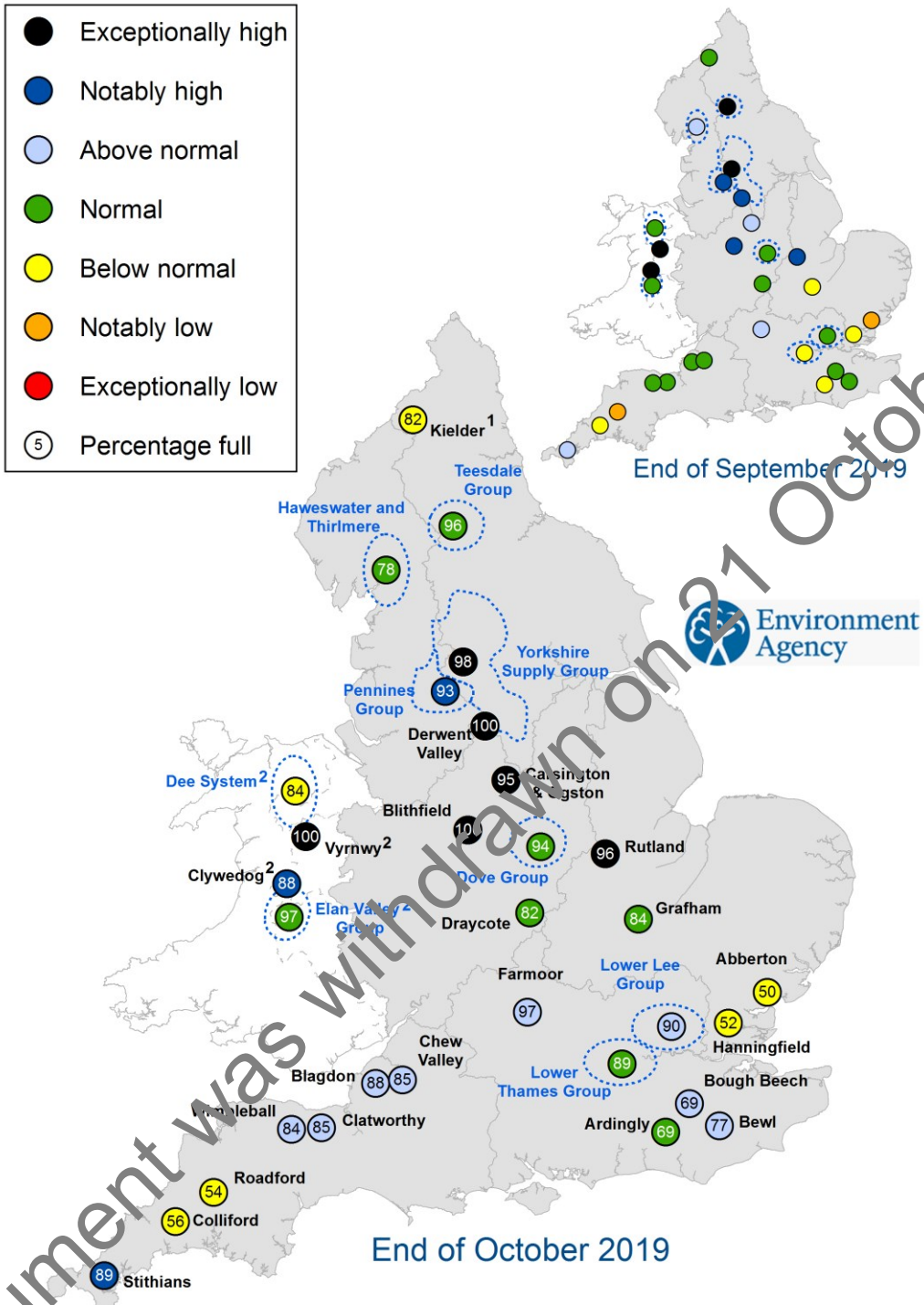


Figure 4.2: Index groundwater level sites for major aquifers. End of month groundwater levels months compared to an analysis of historic end of month levels and long term maximum and minimum levels. (Source: Environment Agency, 2019).

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 September and October 2019 as a percentage of total capacity and classed relative to an analysis of historic September and October 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

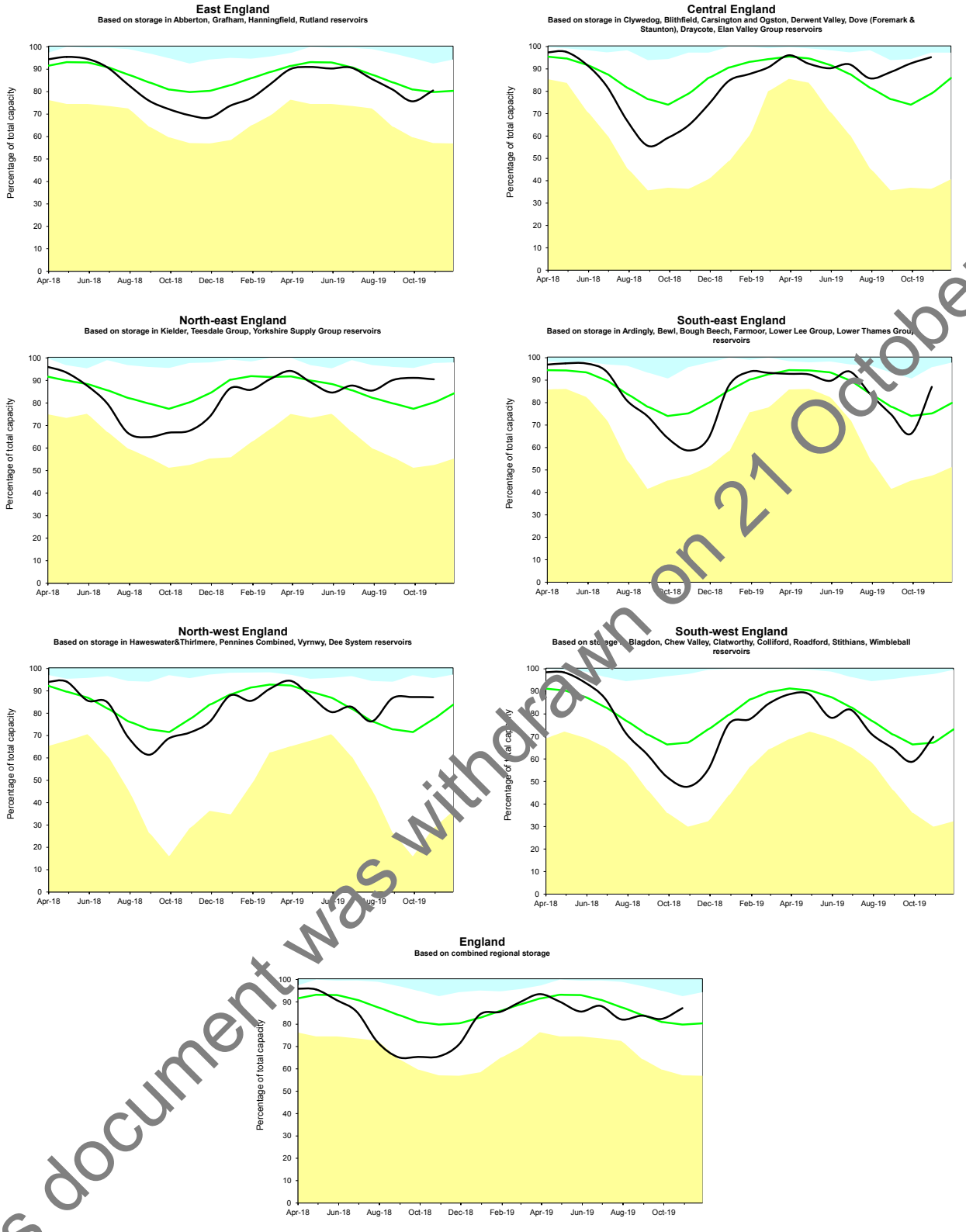


Figure 5.2: Regional reservoir stocks. End of month reservoir stocks compared to long term maximum, minimum and average stocks (Source: Water Companies). Note: Historic records of individual reservoirs/reservoir groups making up the regional values vary in length.

Forward look – river flow

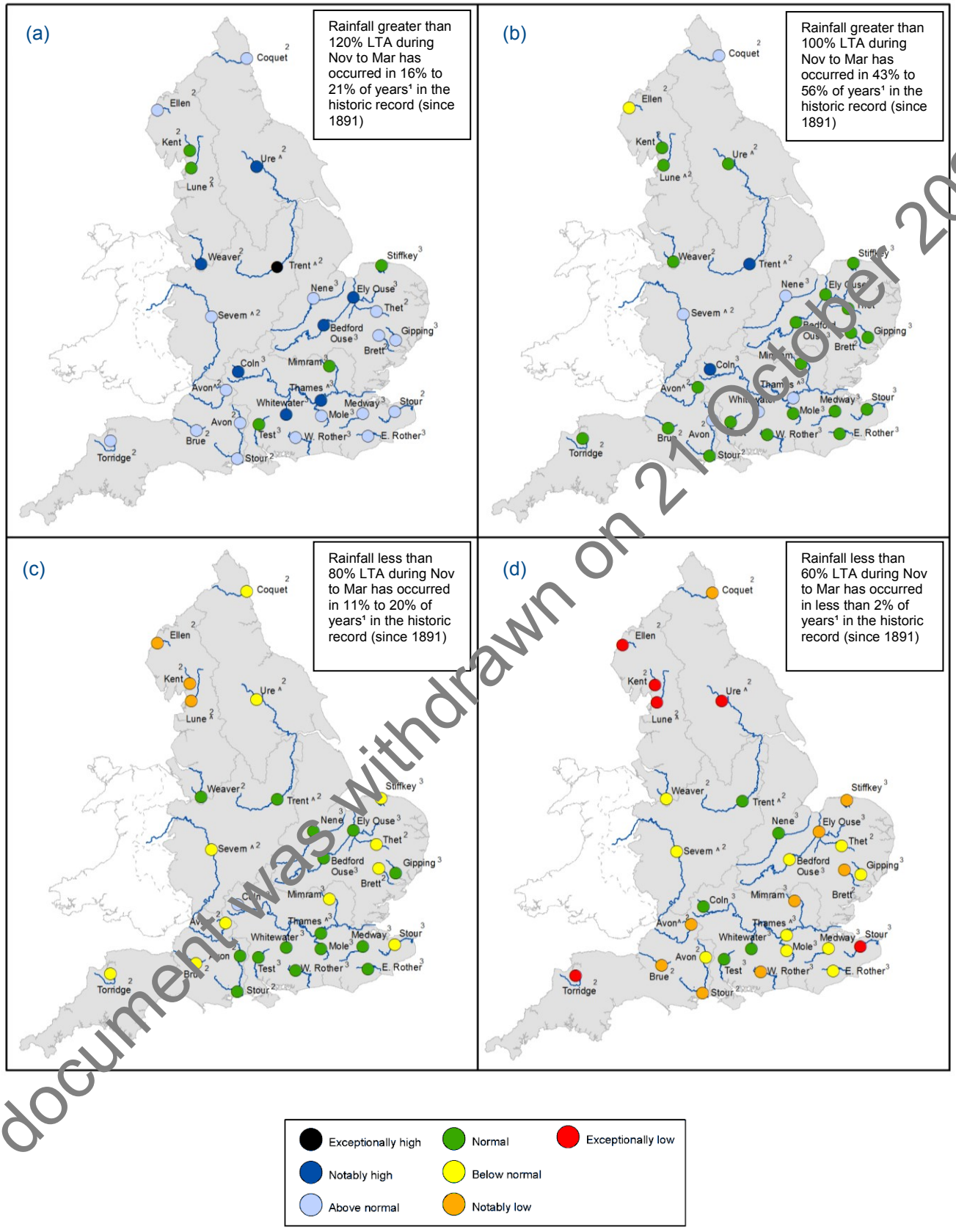
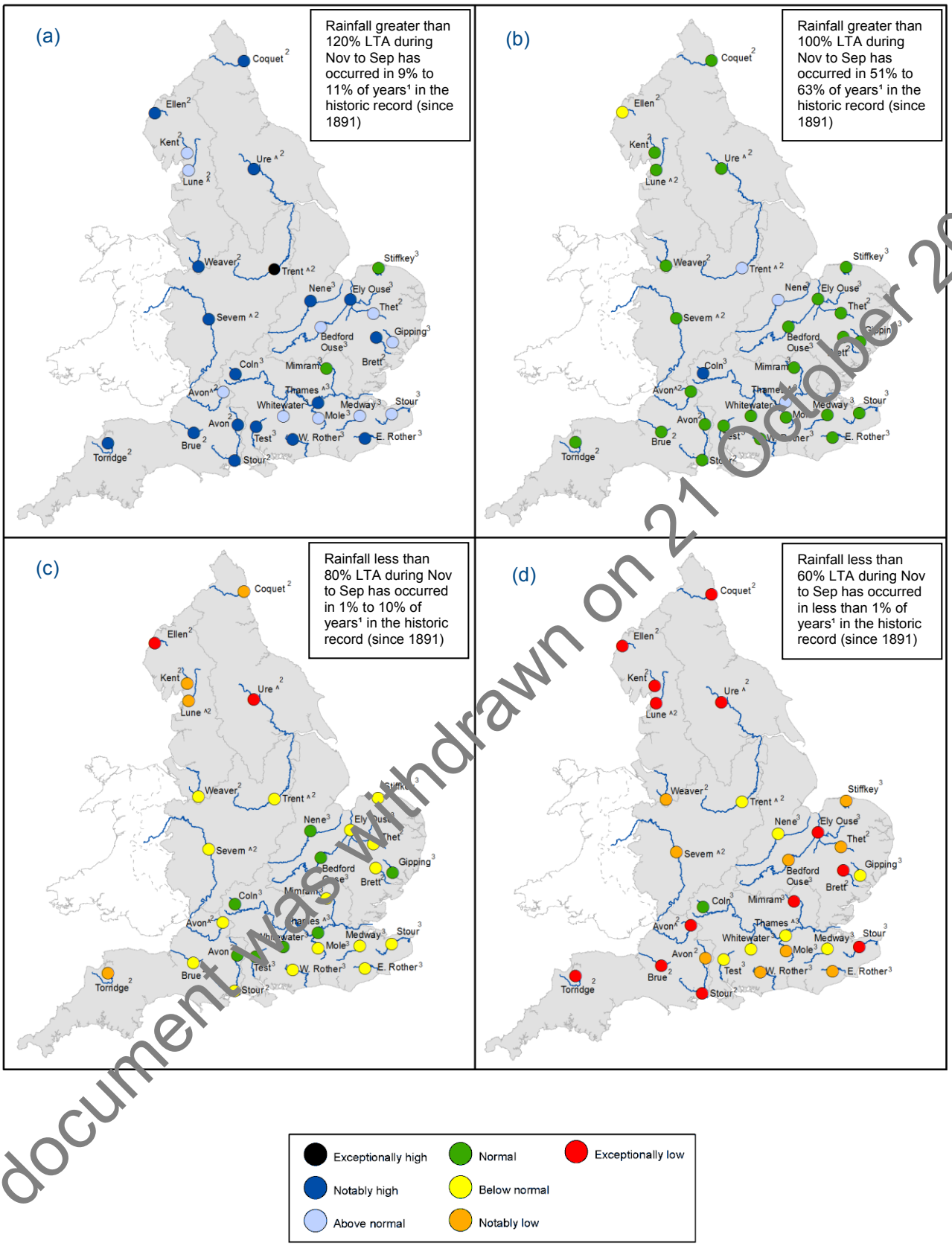


Figure 6.1: Projected river flows at key indicator sites up until the end of March 2020. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between November 2019 and March 2020 (Source: Centre for Ecology and Hydrology, Environment Agency)

[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*



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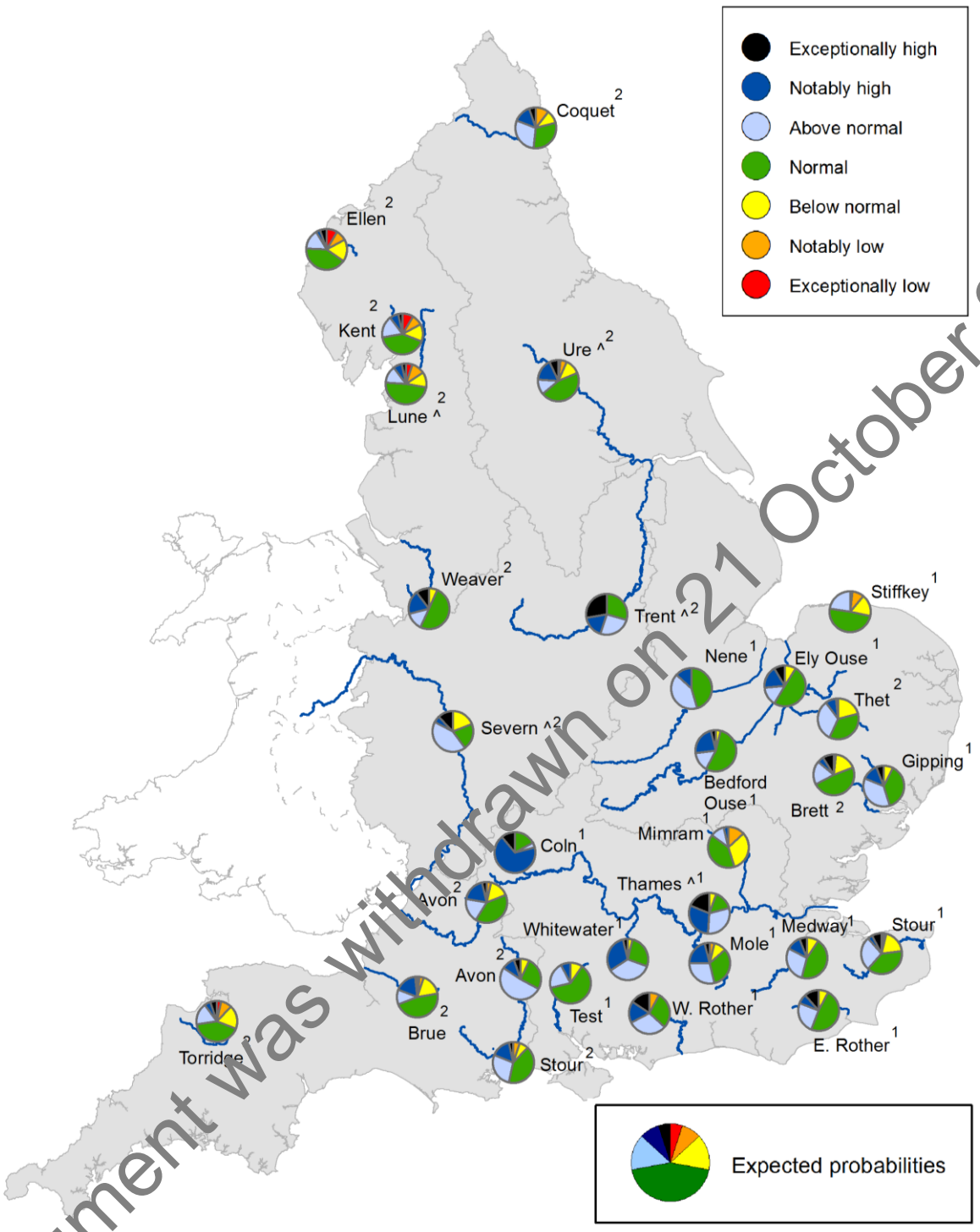

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are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

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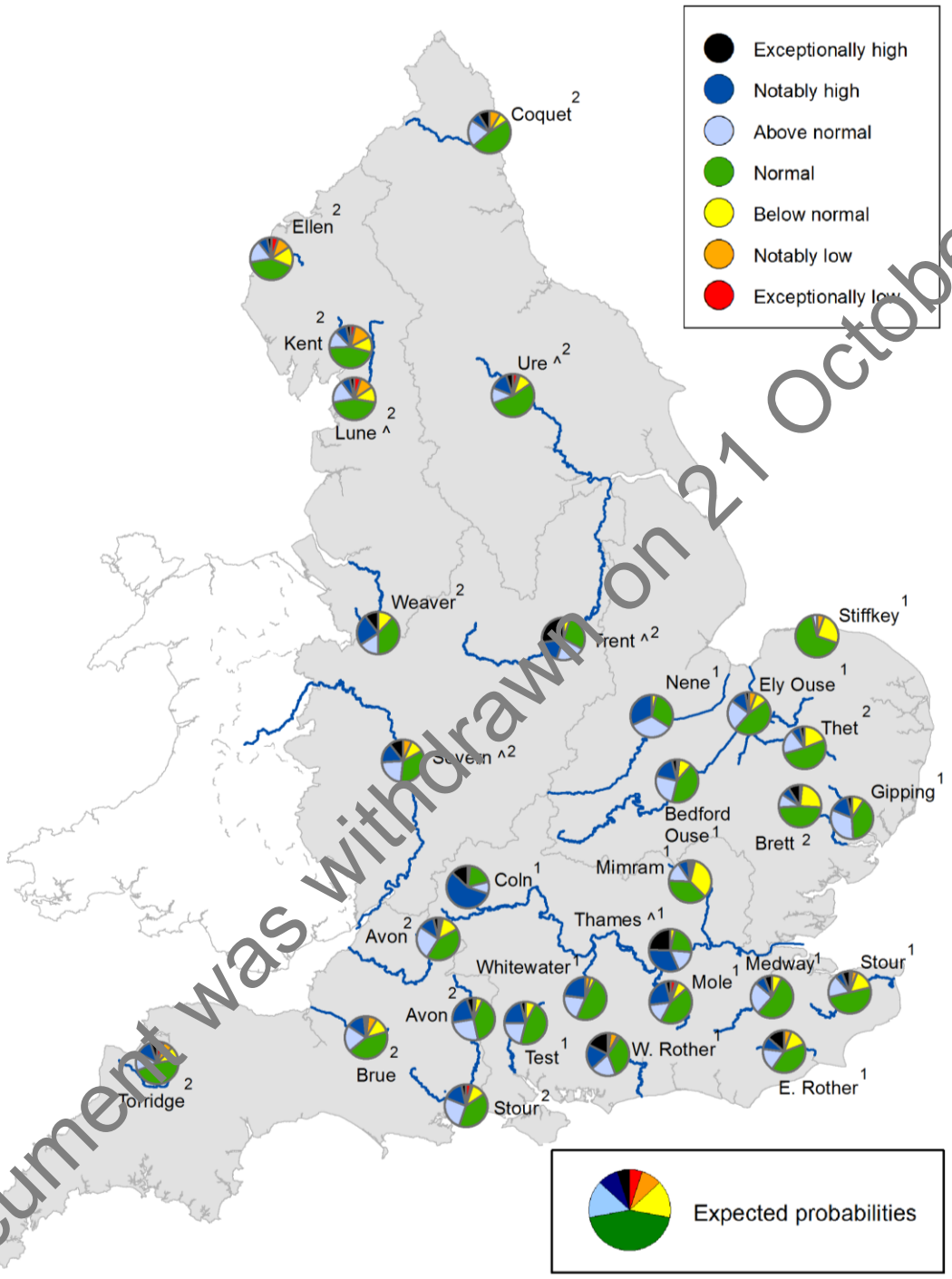

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Figure 6.4: Probabilistic ensemble projections of river flows at key indicator sites up until the end of September 2020. Pie charts indicate probability, based on climatology, of the surface water flow at each site being e.g. exceptionally low for 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
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Forward look - groundwater

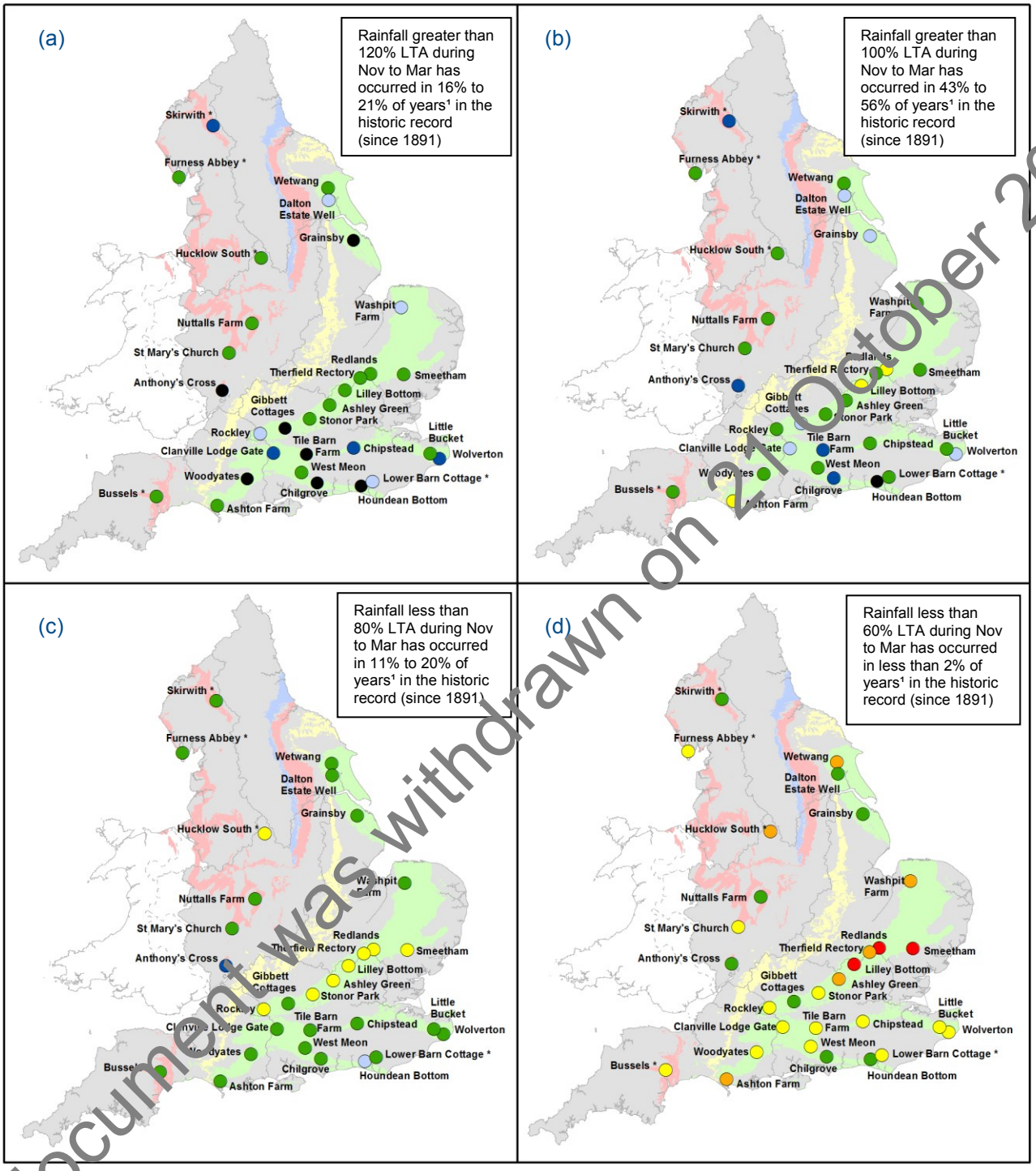

Figure 6.5: Projected groundwater levels at key indicator sites at the end of March 2020. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between November 2019 and Match 2020 (Source: Environment Agency) Geological map reproduced with kind permission from UK Groundwater Forum BGS © NERC. Crown copyright all rights reserved. Environment Agency 100026380, 2019.

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

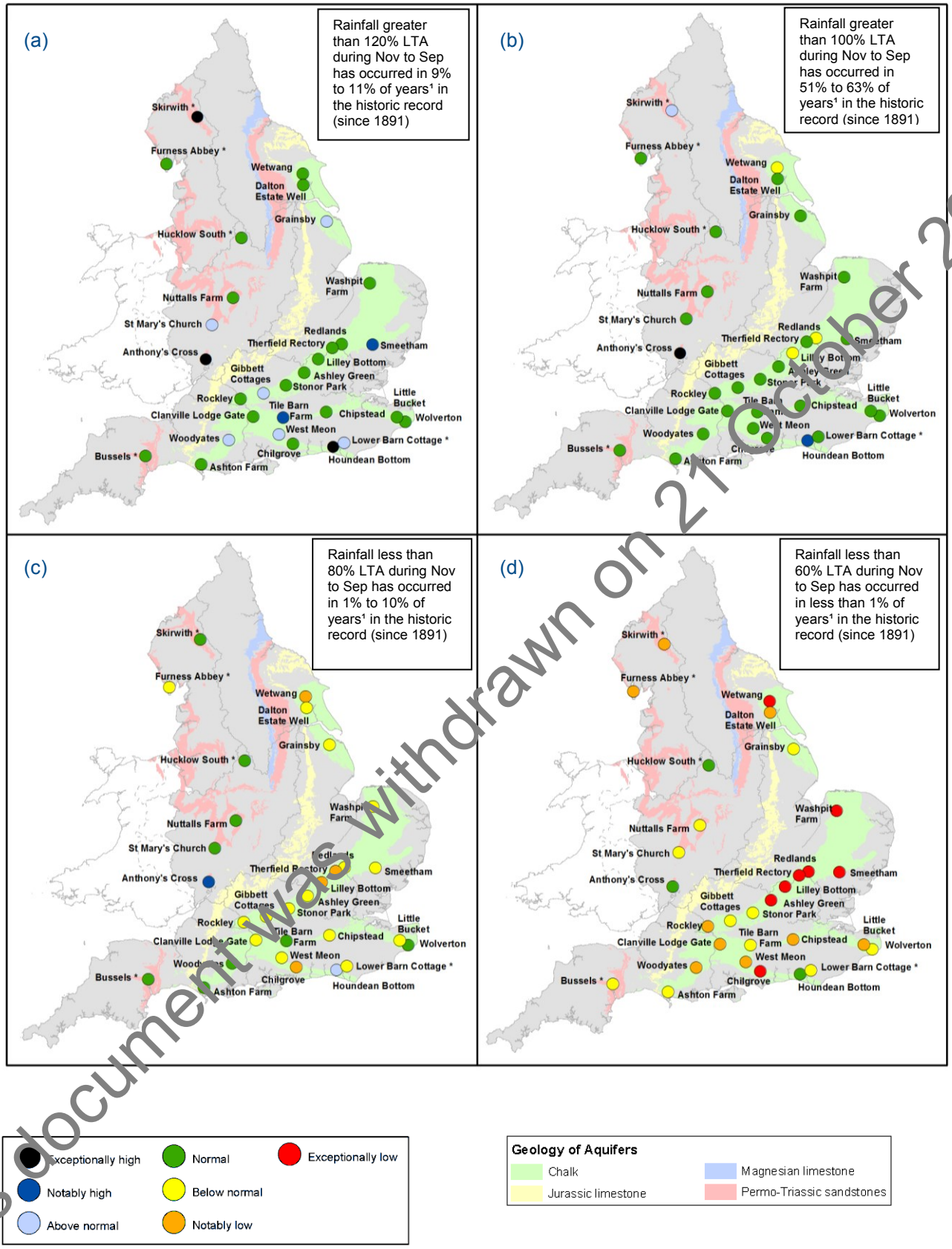

Figure 6.6: Projected groundwater levels at key indicator sites at the end of September 2020. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between November 2019 and September 2020 (Source: Environment Agency) Geological map reproduced with kind permission from UK Groundwater Forum BGS © NERC Crown copyright. All rights reserved. Environment Agency 100026380 2019.

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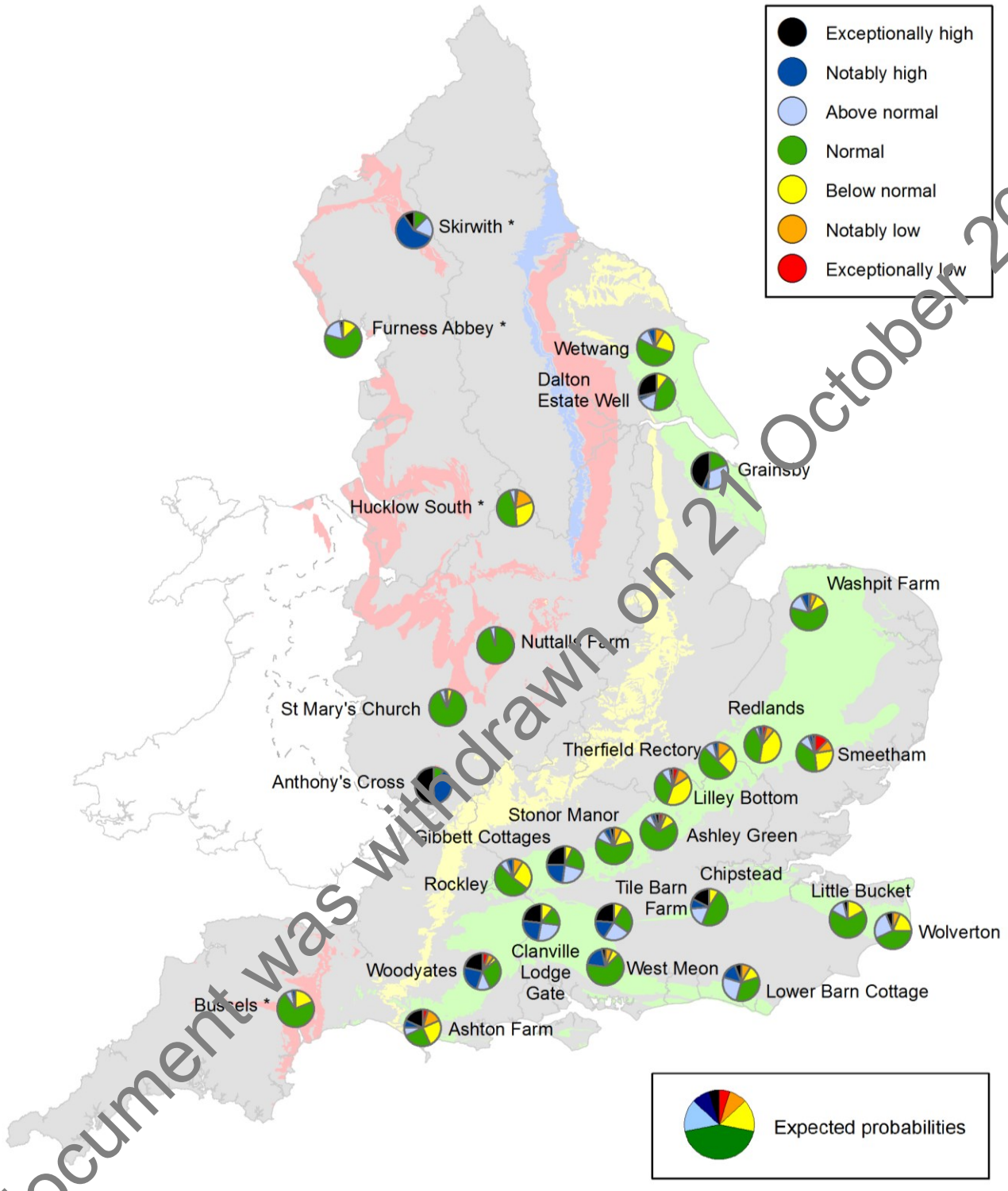

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are 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 March 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, 100026380, 2019.

** Projections for these sites are produced by BGS*

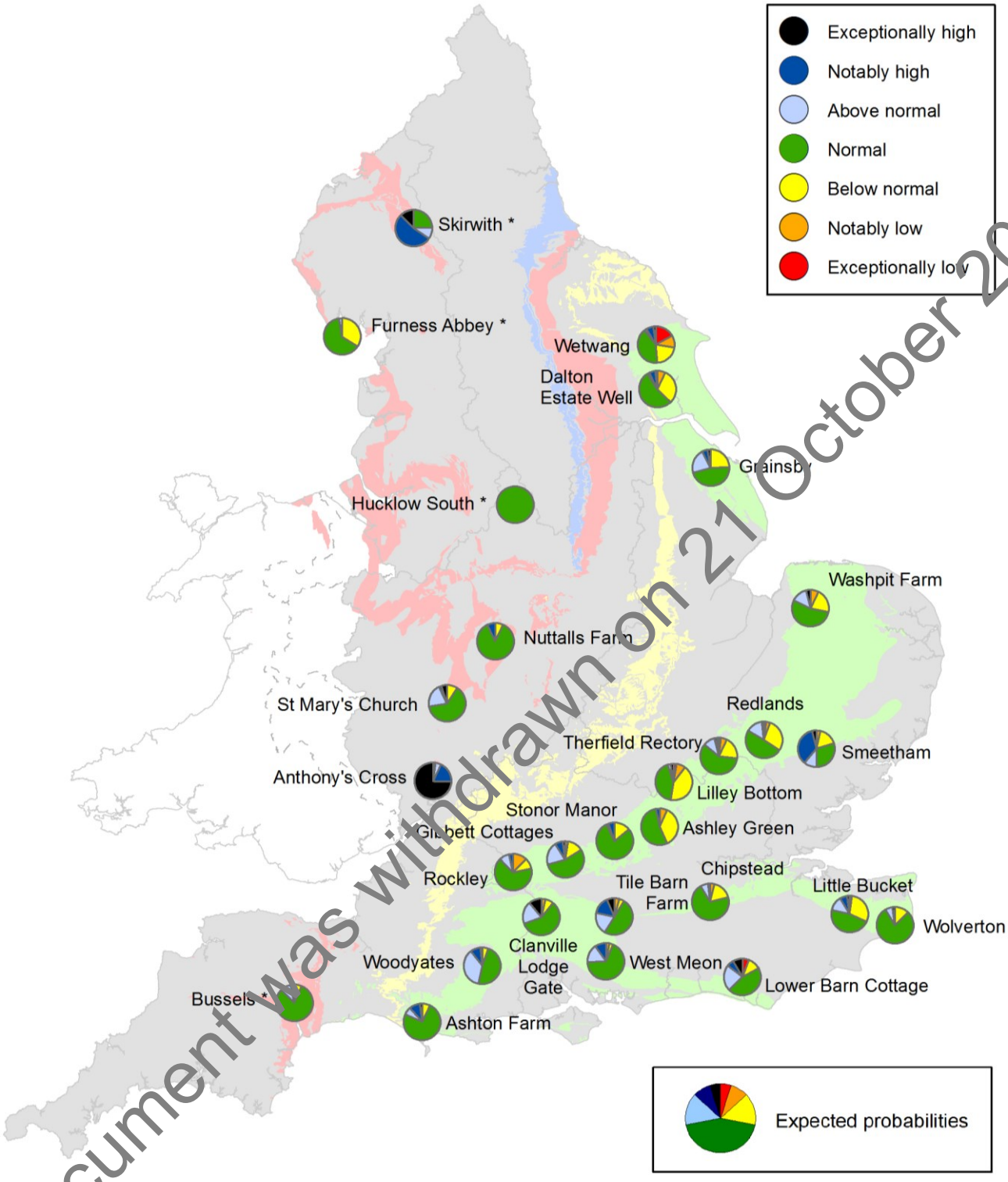

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Figure 6.8: Probabilistic ensemble projections of groundwater levels at key indicator sites at the end of September 2020. Pie charts indicate probability, based on climatology, of the groundwater level at each site being e.g. exceptionally low for 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, 100026380, 2019.

* 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 1961-1990, 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