Monthly water situation report

England

Summary – January 2019

January was a drier than average month across England. The rainfall total for England was 37 mm, which is 46% of the 1961-1990 long-term average. Despite this, soils generally ended the month wetter than at the beginning of the month. River flows reflected the low rainfall totals. Monthly mean flows were classed as exceptionally low or notably low for the time of year at almost three quarters of indicator sites. Groundwater levels rose at less than half of the indicator sites during January and fell at a number of key chalk aquifer indicator sites. Total reservoir stocks for England increased slightly and ended the month at 86% of total capacity.

Rainfall

The first half of January was very dry and monthly rainfall totals across England were below the Long Term Average (LTA) for the month. Towards the end of the month precipitation fell as snow in many areas. Rainfall totals were lowest in north-east and east England and highest in the north-west. The area around Seaham, in County Durham received the lowest rainfall total during January, with 13 mm (representing 23% of the LTA) (Figure 1.1).

January rainfall totals were classed as below normal or lower across all catchments in England. In over half of the catchments totals were classed as either notably low or exceptionally low (Figure 1.2). In the River Brue, River Chew and Mendips catchments (Somerset) and River Esk catchment (Dumfries) the cumulative rainfall total for the last 12 months was the lowest since January 1976.

The January rainfall total for England was 37 mm, which is 46% of the 1961-1990 LTA (45% of the 1981-2010 LTA). This is less than half of the December rainfall total (100 mm) for England and meant that in eight of the last twelve months the rainfall total was below average. At a regional scale, January rainfall totals ranged from 35% of LTA in north-east England to 59% of LTA in north-west England (Figure 1.3).

Soil moisture deficit

Although soils did start to dry out during the dry weather at the start to the month, by the end of January soils were generally wetter than at the start of the month. The driest soils at the end of the month were still in parts of East Anglia, particularly around the River Great Ouse where a significant soil moisture deficit (SMD) persisted (Figure 2.1).

At a regional scale, SMDs were close to average for the time of year in south-west, north-west and north-east England, but ended the month slightly drier than average in south-east, east and central England (Figure 2.2).

River flows

Across England, monthly mean river flows were significantly lower than in December at most indicator sites apart from a small number of groundwater dominated catchments which saw slightly higher flows. Flows were classed as exceptionally low at almost a quarter of indicator sites and at almost half of sites flows were classed as notably low (Figure 3.1). The River Till in Northumberland and River Swale in North Yorkshire had their lowest January monthly mean on record (records go back to April 2002 and May 1980 respectively). The River Itchen, in Hampshire, was the only indicator river at which flows were in the normal range for the time of year; this groundwater dominated catchment has received normal rainfall totals over the last 12 months ((Figure 1.2).

At all regional indicator sites January monthly mean flows were lower than in December. On the South Tyne in north-east England, at Haydon Bridge, flows were in the normal range in December, but fell to an exceptionally low monthly mean flow for the time of year in January (Figure 3.2).

Groundwater levels

Groundwater levels rose during January at less than half of the indicator sites and by the end of January, levels were classed as normal or higher at around two-fifths of sites. At all other indicator sites groundwater levels were classed as either below normal or notably low.

Groundwater levels fell at a number of key chalk aquifer indicator sites, including Stonor Park (South-west Chilterns Chalk), Ashley Green (East Chilterns Chalk), Redlands Hall (Cam and Ely Ouse Chalk) and Chilgrove (Chichester Chalk). At Jackaments Bottom (Burford Jurassic Limestone) the groundwater level was classed as in the normal range at the end of December, but had fallen to a notably low level by the end of January (Figures 4.1 and 4.2).

Reservoir storage

Reservoir stocks increased or remained stable at almost three-quarters of reservoirs and reservoir groups in England during January. The biggest increase, as a proportion of total storage, was at Stithians Reservoir in Cornwall, where a 10% increase in stocks saw the reservoir full at the end of the month. At just over a quarter of reservoirs and reservoir groups stocks decreased. The biggest decrease in stocks (-9% of storage capacity) was in the NCZ Regional Group of reservoirs in north-west England. The end of month stocks in approximately half of reservoirs and reservoir groups were classed as either below normal or notably low for the time of year. Stocks in the Dove Group of reservoirs (Midlands) increased by 7% of total storage capacity, but were still classed as exceptionally low for the time of year at the end of January (Figure 5.1).

At a regional scale, total reservoir storage decreased slightly in north-west and north-east England (-6% and -1% of capacity respectively) and increased slightly in all other regions (between 1-6% increase). Total reservoir stocks for England ended the month close to average for the time of year at 86% of total capacity (Figure 5.2).

Forward look

Unsettled conditions at the start of February are expected to give way to a period of predominantly settled weather around the middle of the month, particularly across the south-east. Some wind and rain are likely in the north and west and conditions may generally turn more unsettled again towards the end of the month. For the 3-month period February-March-April, above-average precipitation is more likely than below-average precipitation[1].

Projections for river flows at key sites[2]

All but two 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 both March and September 2019.

For scenario based projections of cumulative river flows at key sites by March 2019 see Figure 6.1
For scenario based projections of cumulative river flows at key sites by September 2019 see Figure 6.2
For probabilistic ensemble projections of cumulative river flows at key sites by March 2019 see Figure 6.3
For probabilistic ensemble projections of cumulative river flows at key sites by September 2019 see Figure 6.4

Projections for groundwater levels in key aquifers[2]

Four-fifths 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 2019. By September 2019, just over two-thirds of modelled sites have a greater than expected chance of levels being below normal or lower.

For scenario based projections of groundwater levels in key aquifers in March 2019 see Figure 6.5
For scenario based projections of groundwater levels in key aquifers in September 2019 see Figure 6.6
For probabilistic ensemble projections of groundwater levels in key aquifers in March 2019 see Figure 6.7
For probabilistic ensemble projections of groundwater levels in key aquifers in September 2019 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

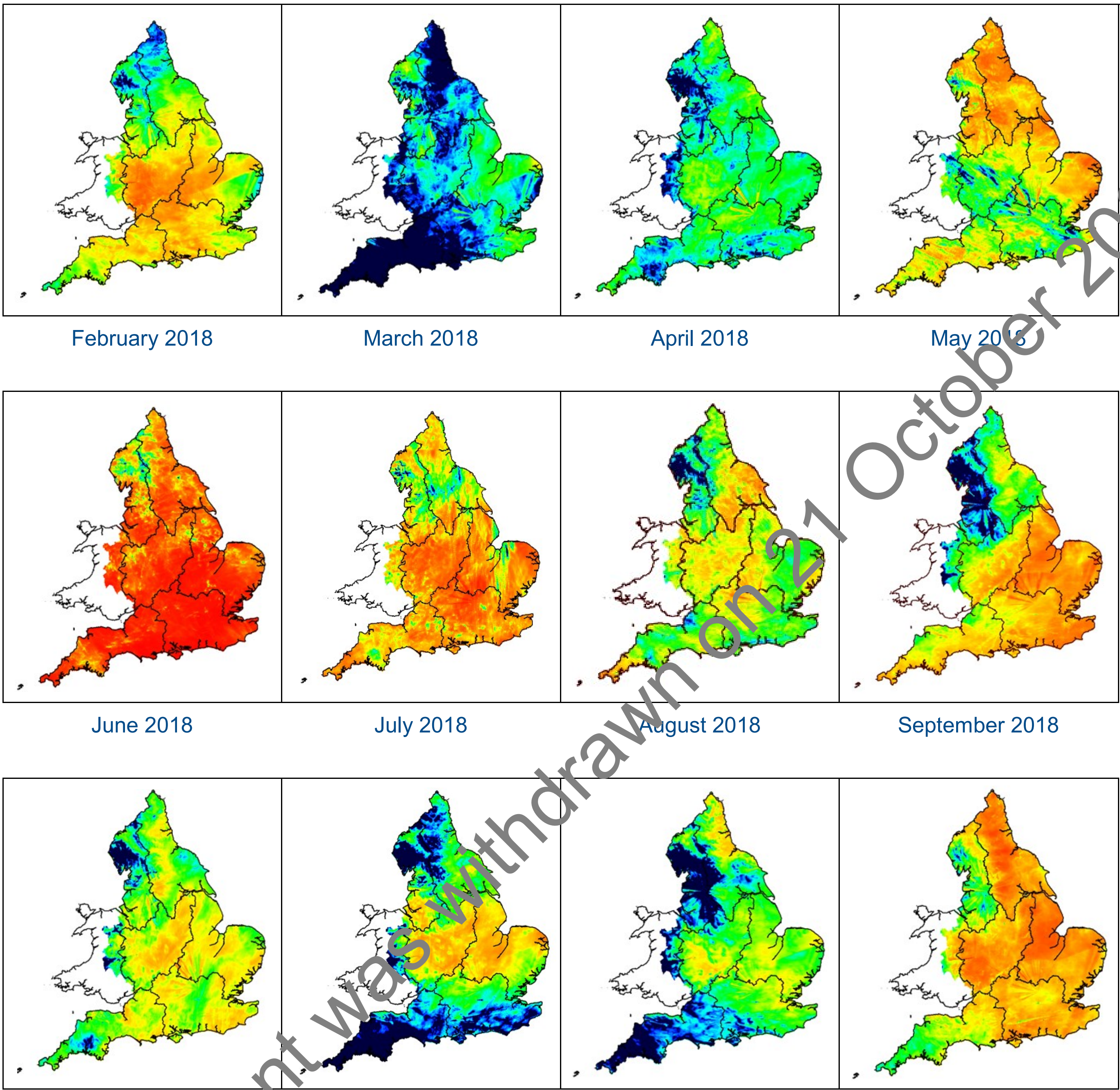
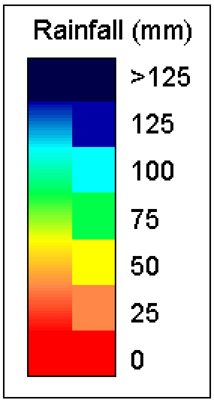


Figure 1.1: Monthly rainfall across England and Wales for the past 12 months. UKPP radar data (Source: Met Office © Crown Copyright, 2019). Note: Radar beam blockages in some regions may give anomalous totals in some areas. Crown copyright. All rights reserved. Environment Agency, 100026380, 2019.



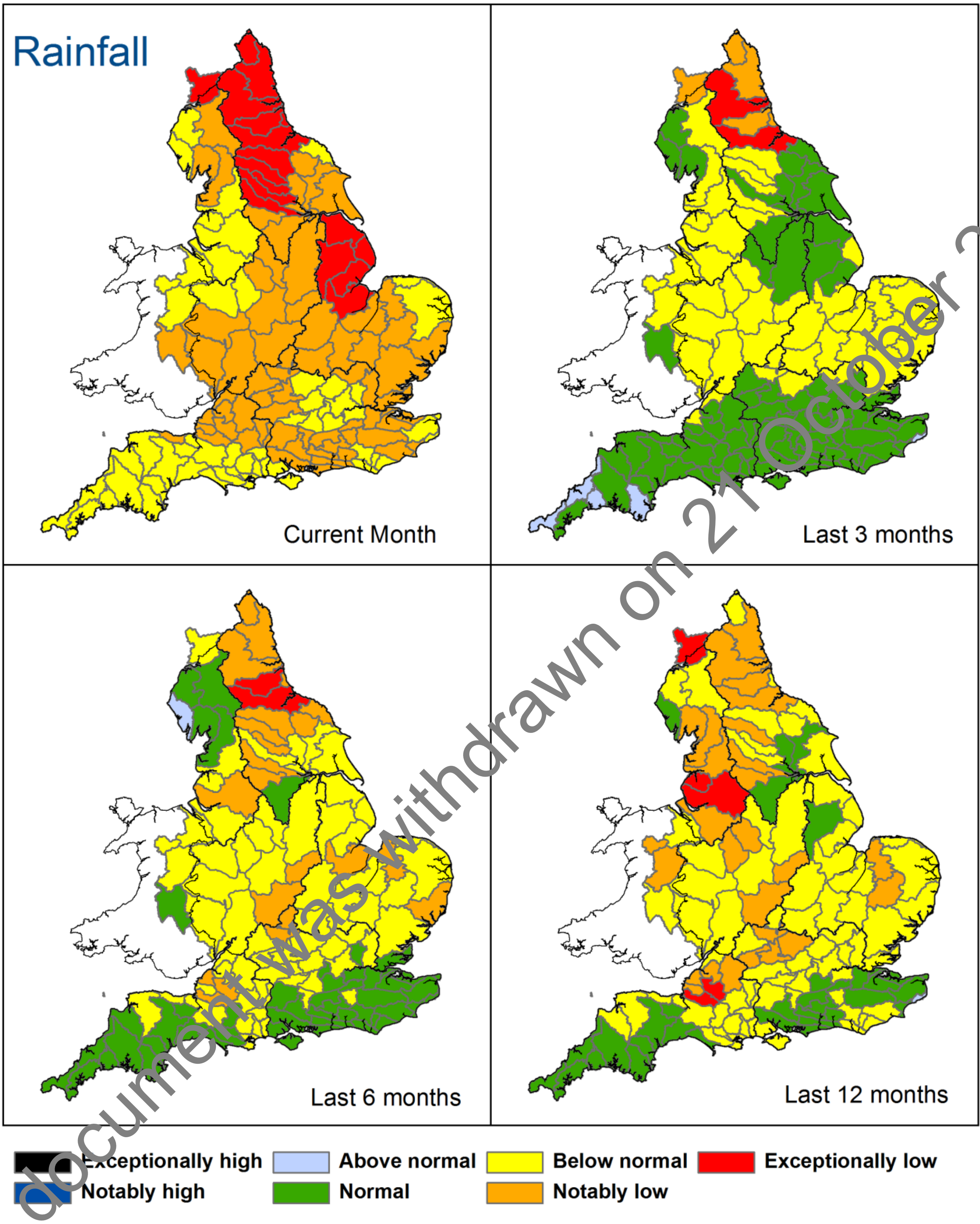


Figure 1.2: Total rainfall for hydrological areas across England for the current month (up to 31 January), the last 3 months, the last 6 months, and the last 12 months, classed relative to an analysis of respective historic totals. Final NCIC (National Climate Information Centre) data based on the Met Office 5km 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

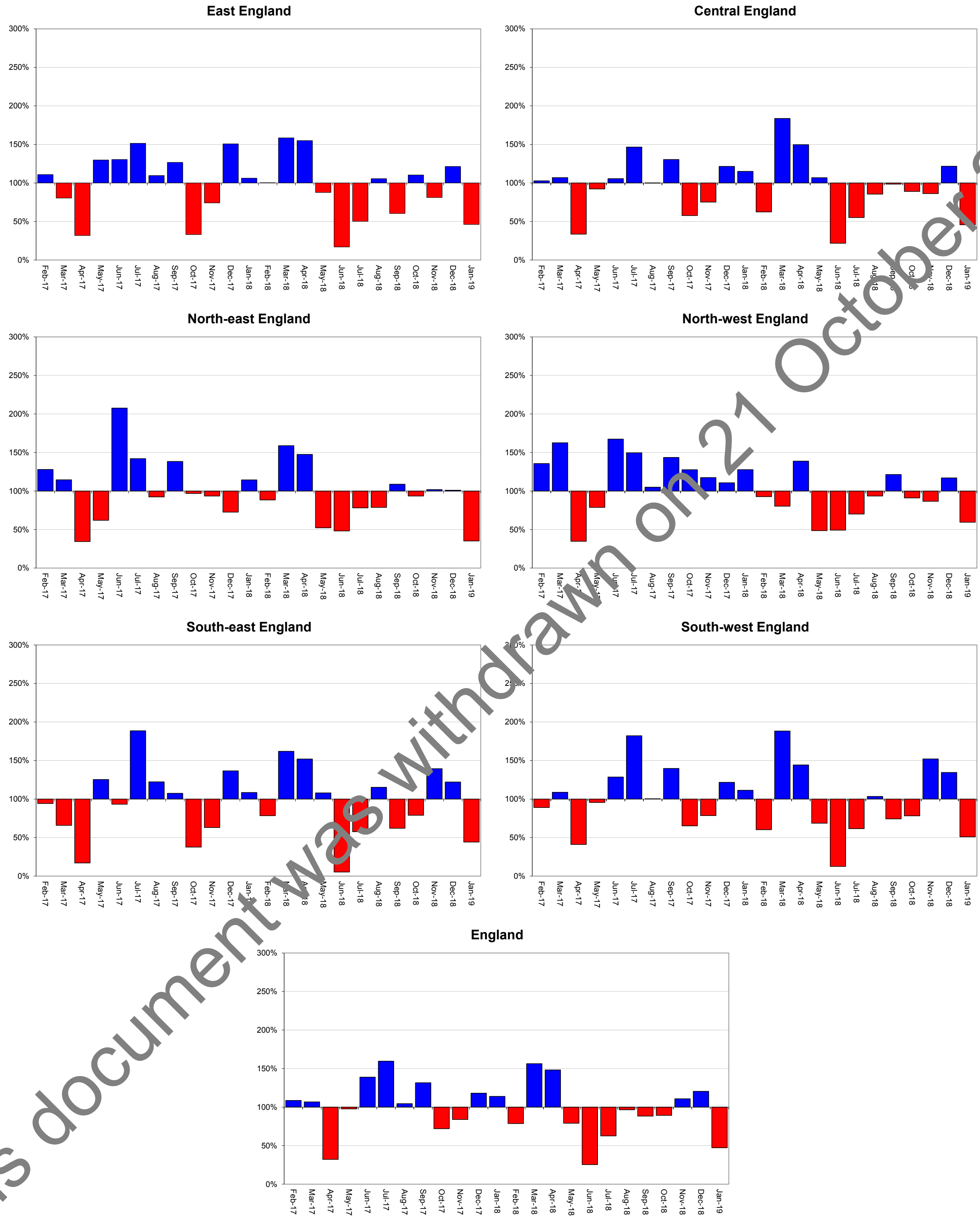


Figure 1.3: Monthly rainfall totals for the past 24 months as a percentage of the 1961 – 1990 long term average for each region and for England. NCIC (National Climate Information Centre) data. (Source: Met Office © Crown Copyright, 2019).

Soil moisture deficit

End of December 2018[1]	End of January 2019[2]

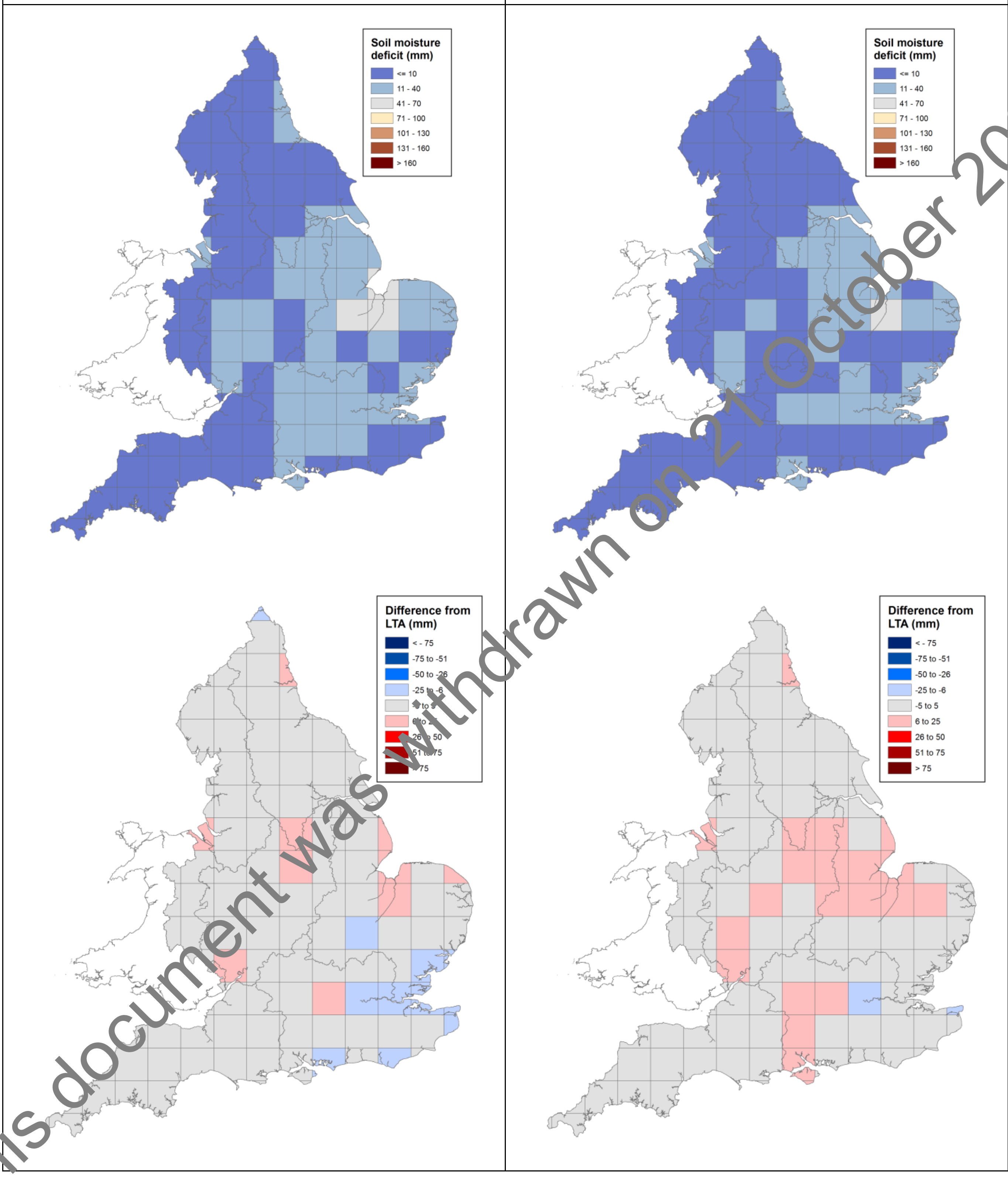
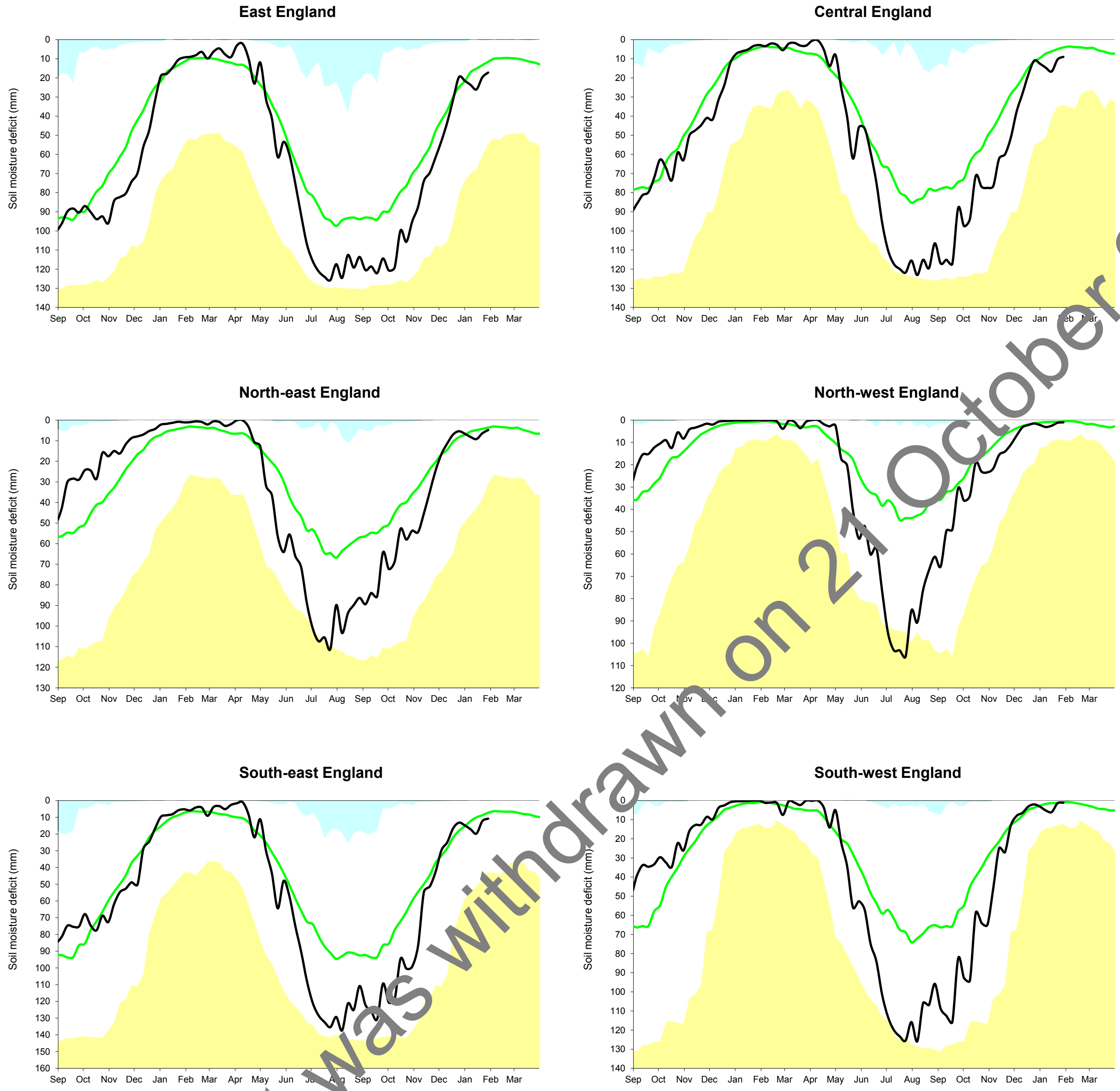


Figure 2.1: Soil moisture deficits for weeks ending 1 January 2019 [1] (left panel) and 29 January 2019 [2] (right panel). Top row shows actual soil moisture deficits (mm) and bottom row shows the difference (mm) of the actual from the 1961-90 long term average soil moisture deficits. MORECS data for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

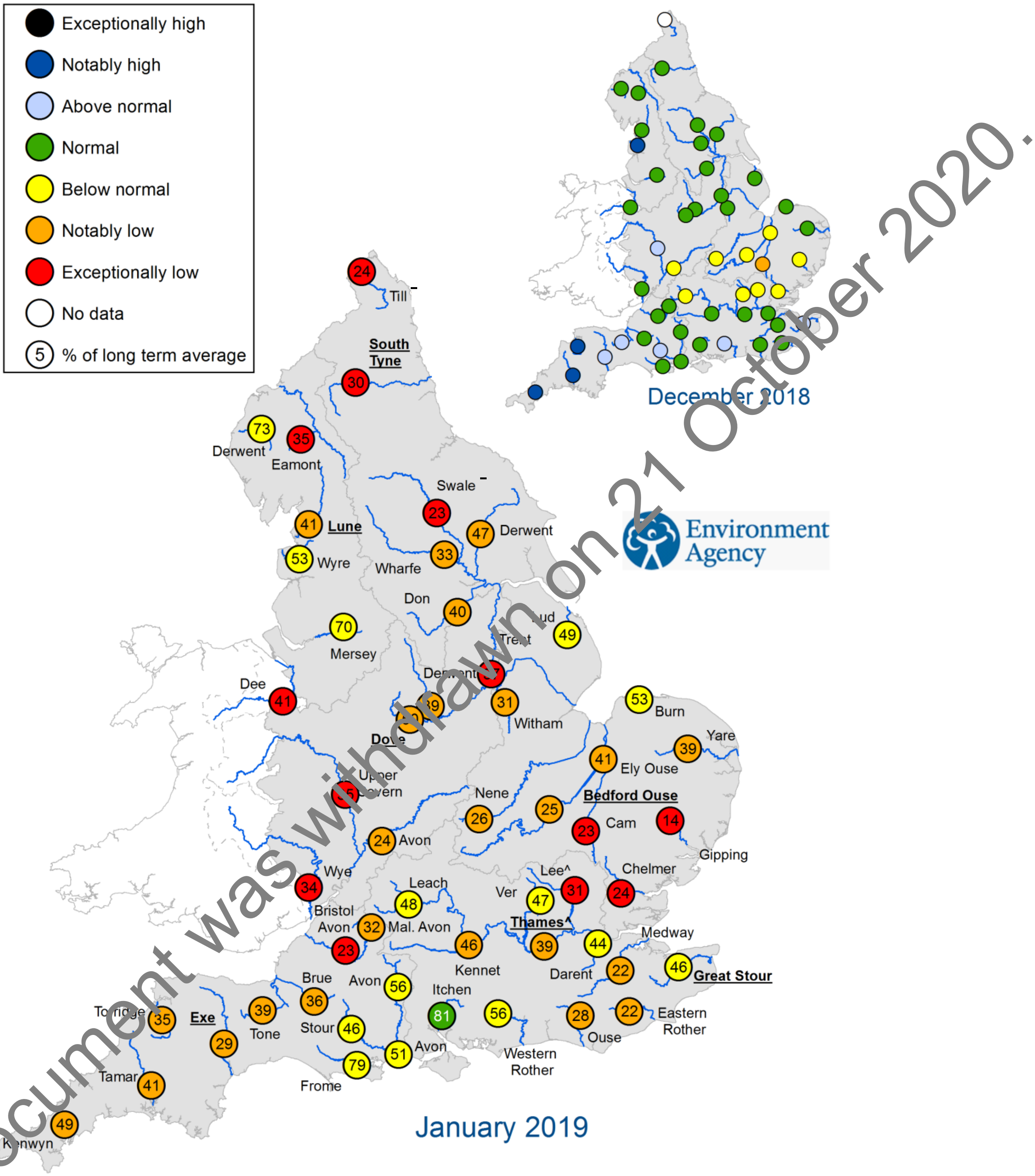
Soil moisture deficit charts



	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 1961-90 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 lowest 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 December 2018 and January 2019 expressed as a percentage of the respective long term average and classed relative to an analysis of historic December and January monthly means (Source: Environment Agency). Crown copyright. All rights reserved. Environment Agency, 100026380, 2019.

River flow charts

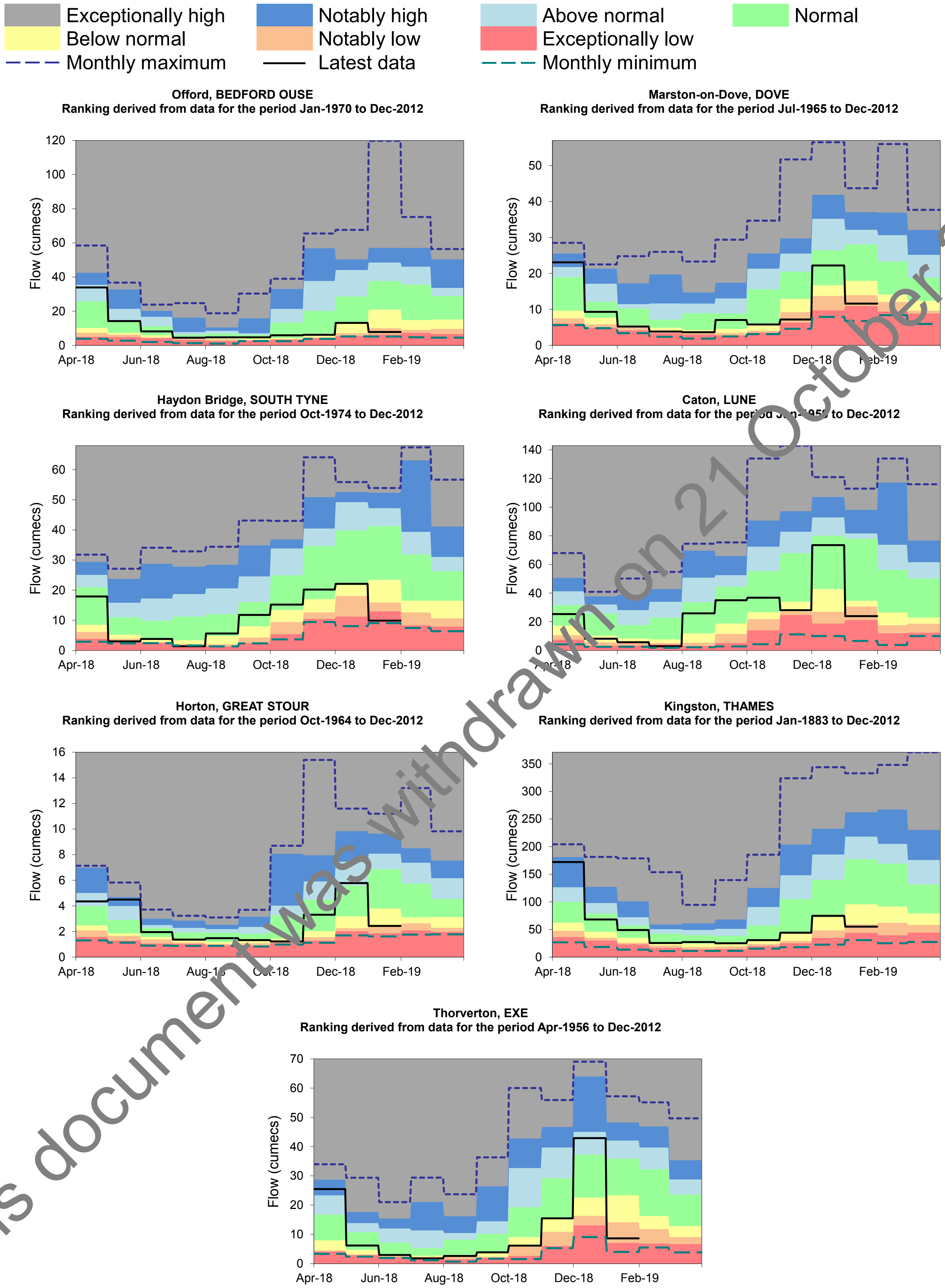
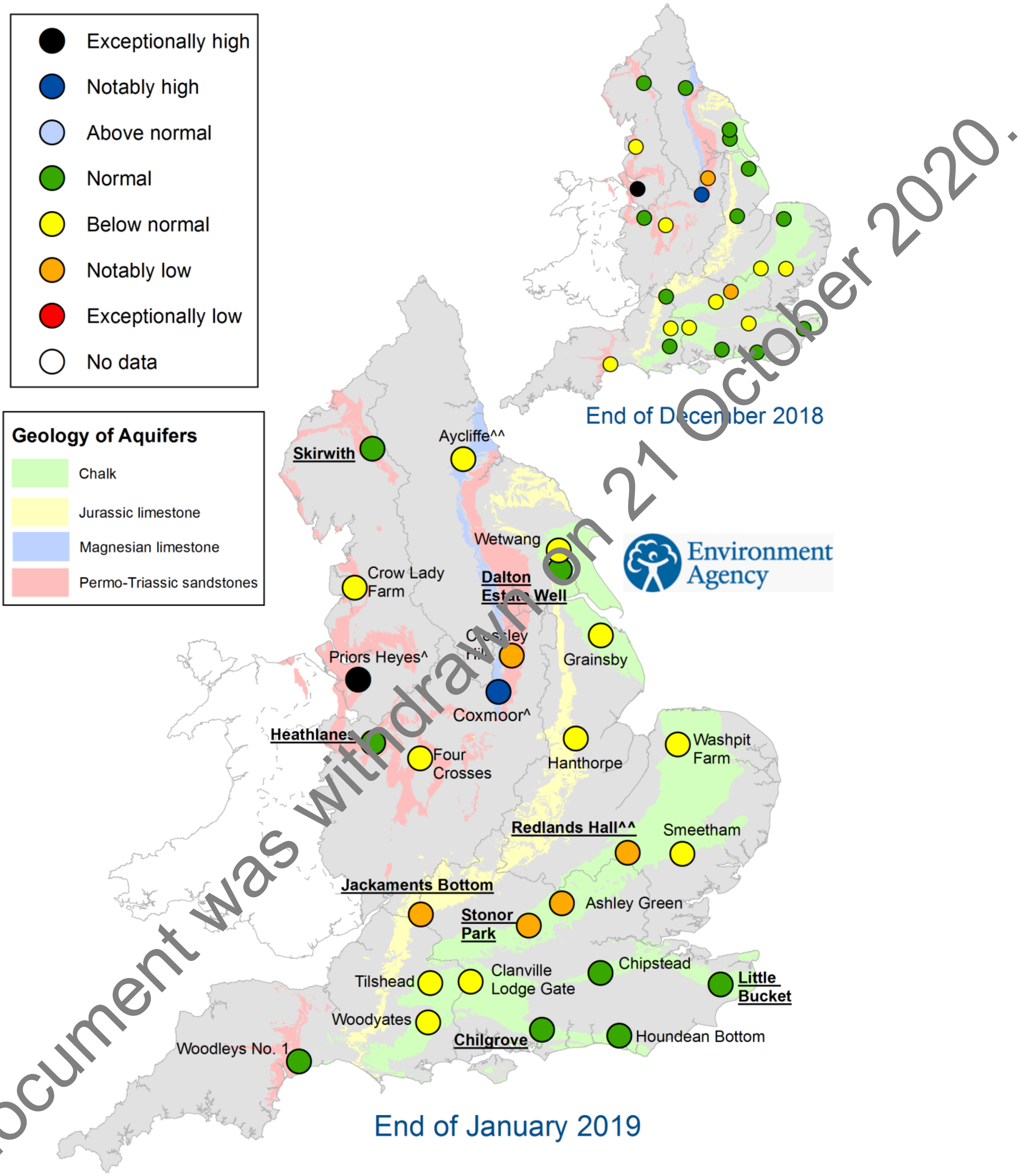


Figure 3.2: Index river flow sites for each geographic region. Monthly mean flow compared to an analysis of historic monthly mean flows, long term maximum and minimum flows. (Source: Environment Agency).

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
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 December 2018 and January 2019, classed relative to an analysis of respective historic December and January 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

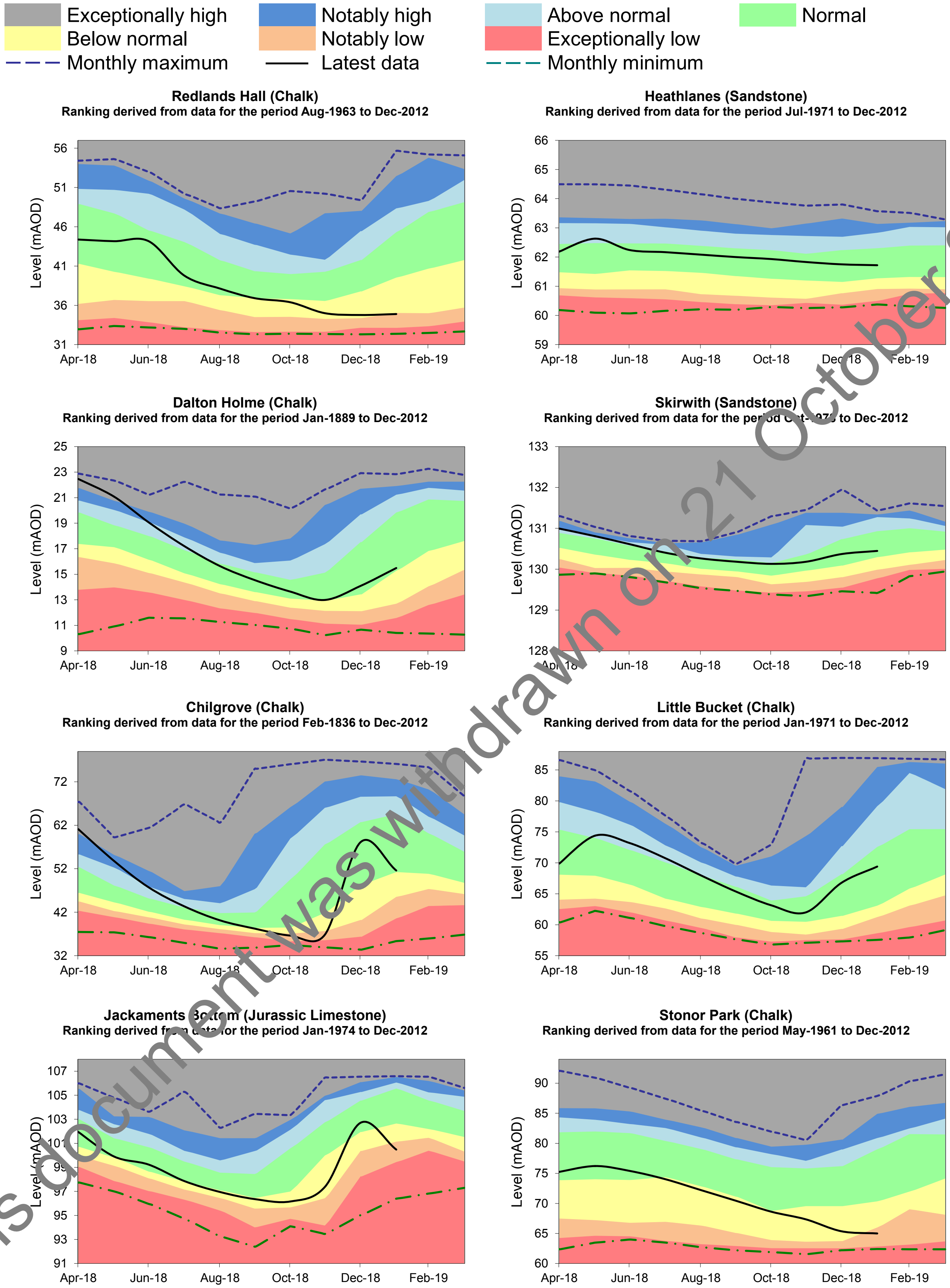
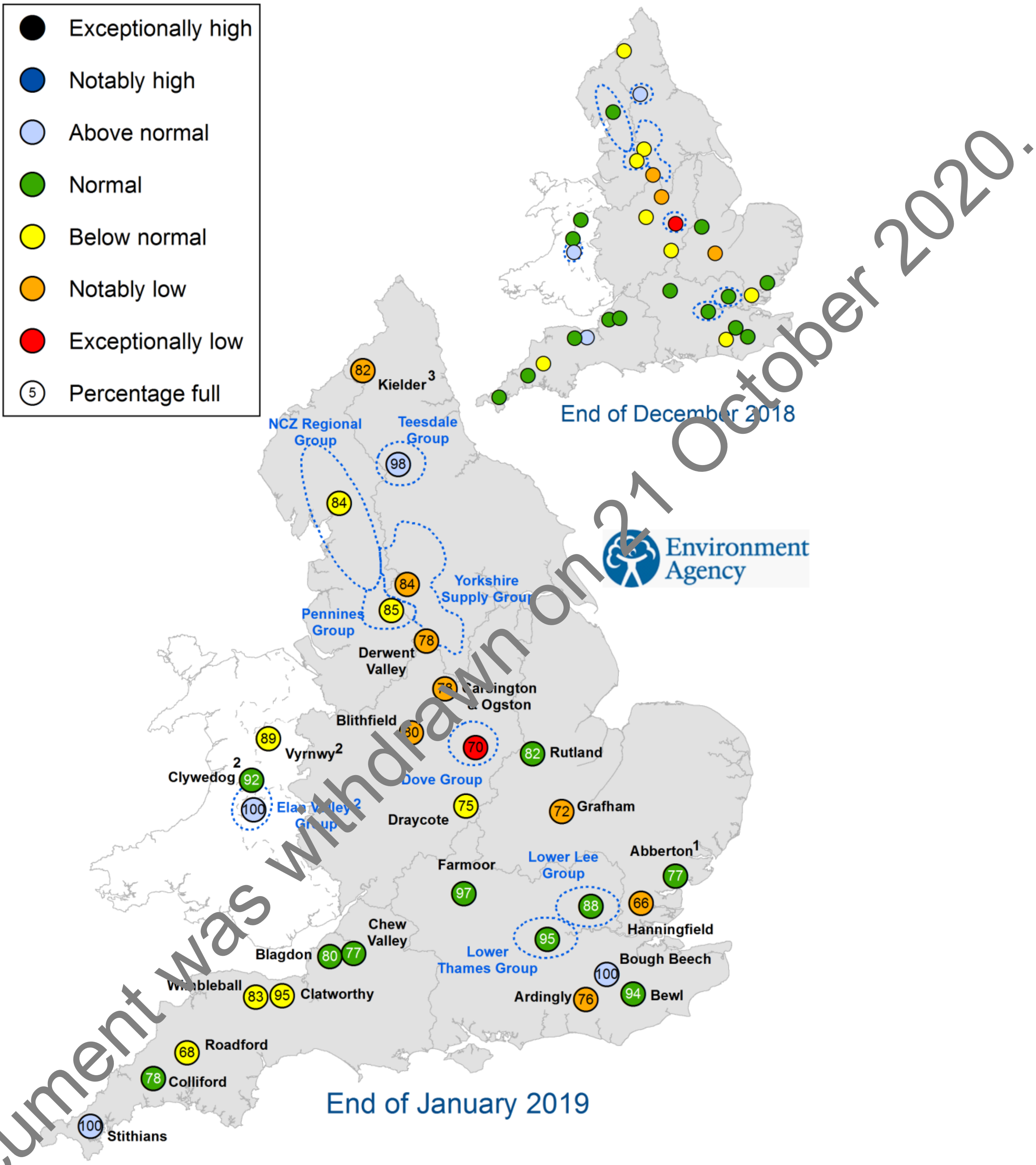


Figure 4.2: Index groundwater level sites for major aquifers. End of month groundwater levels months compared to an analysis of historic end of month levels and long term maximum and minimum levels. (Source: Environment Agency, 2018).

Reservoir storage



1. Current levels at Abberton Reservoir in east England are relative to increased capacity
2. Vyrnwy, Clywedog and Elan Valley reservoirs are located in Wales but provide a water resource to central and north-west England
3. Current levels at Kielder are lower than historical levels due to the implementation of a new flood alleviation control curve

Figure 5.1: Reservoir stocks at key individual and groups of reservoirs at the end of December 2018 and January 2019 as a percentage of total capacity and classed relative to an analysis of historic December and January 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, 100026380, 2019.

Reservoir storage charts

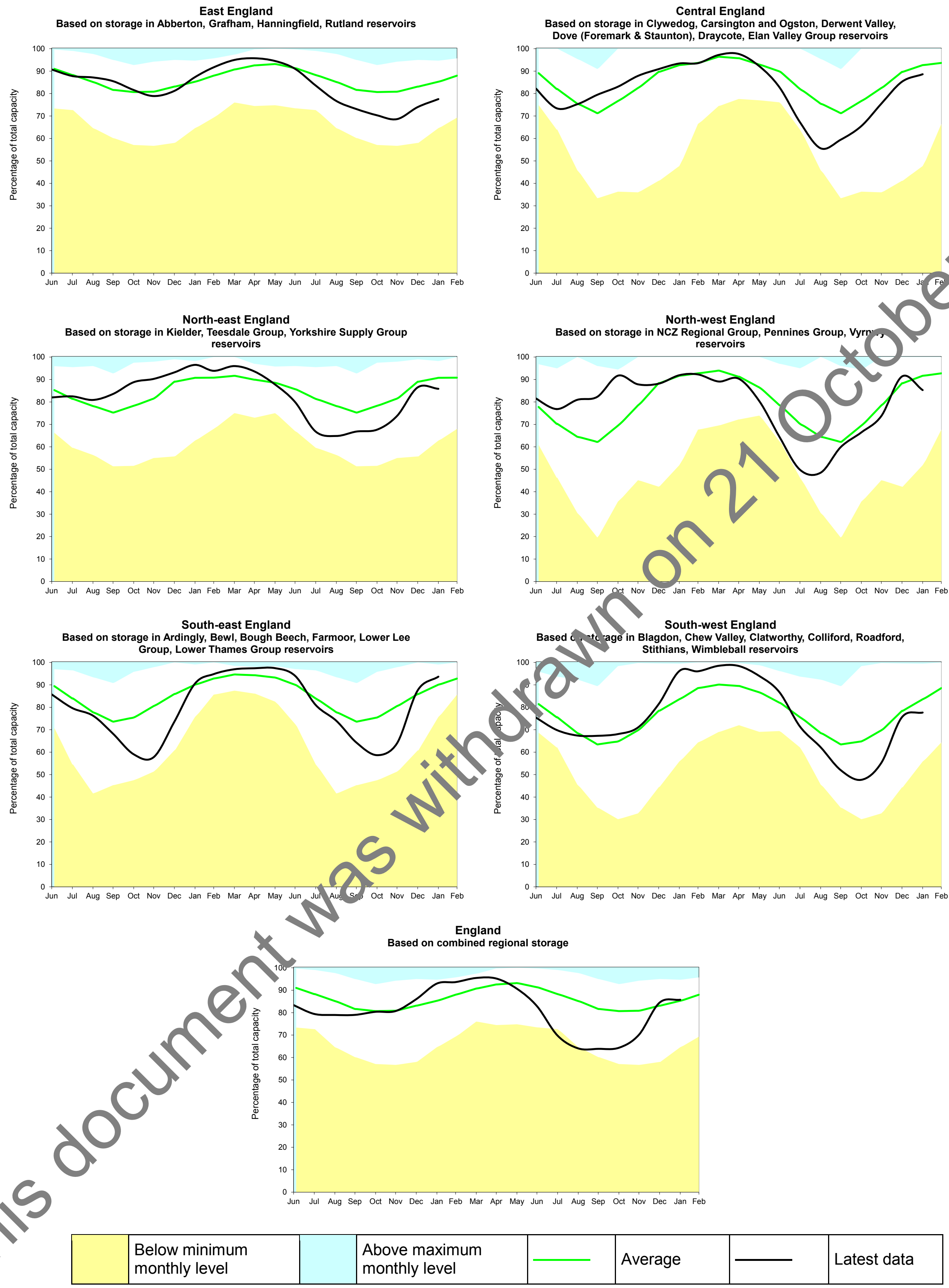


Figure 5.2: Regional reservoir stocks. End of month reservoir stocks compared to long term maximum, minimum and average stocks (Source: Water Companies). Note: Historic records of individual reservoirs/reservoir groups making up the regional values vary in length.

Forward look – river flow

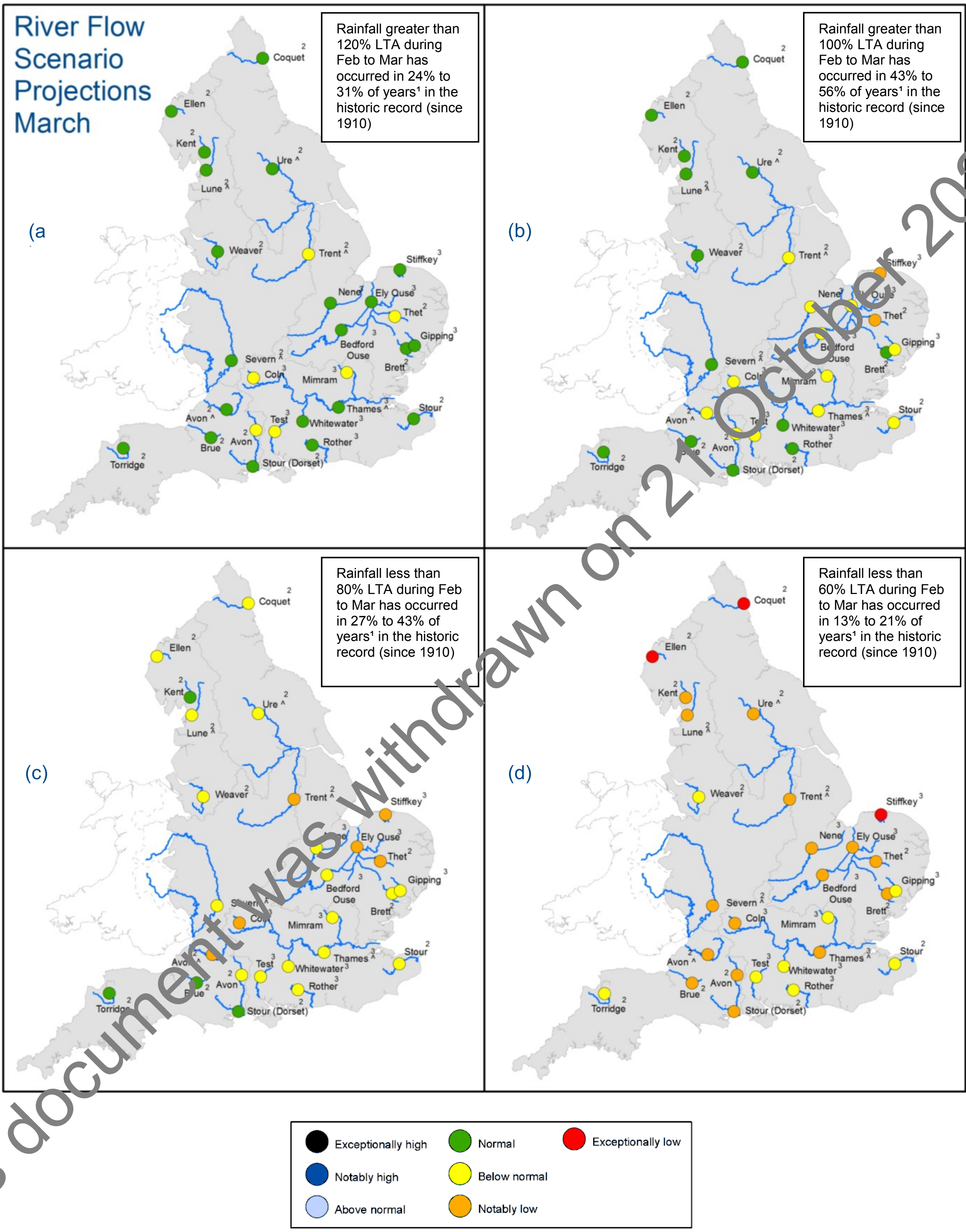


Figure 6.1: Projected river flows at key indicator sites up until the end of March 2019. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between February and March 2019 (Source: Centre for Ecology and Hydrology, Environment Agency).

[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*

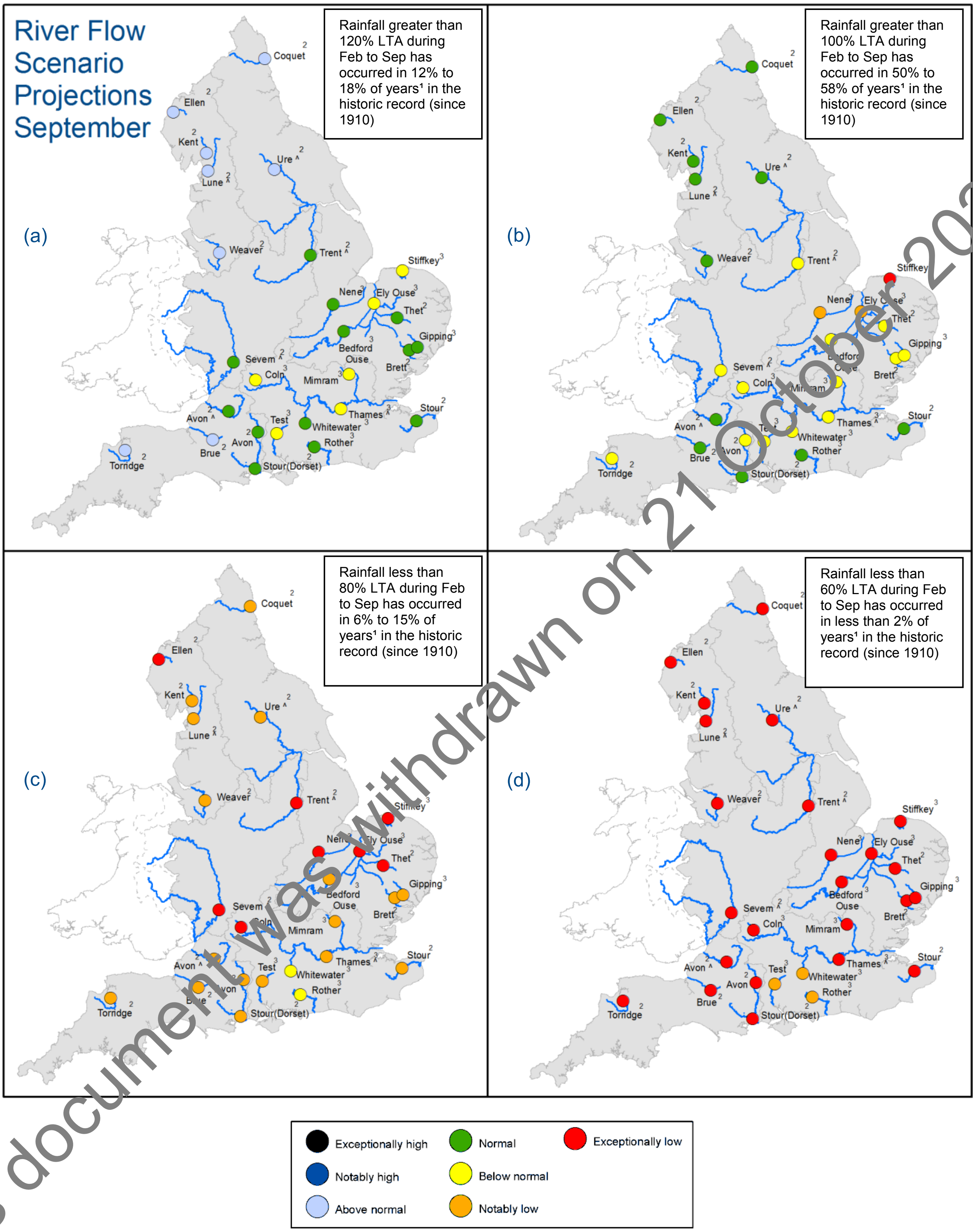


Figure 6.2: Projected river flows at key indicator sites up until the end of September 2019. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between February and September 2019 (Source: Centre for Ecology and Hydrology, Environment Agency).

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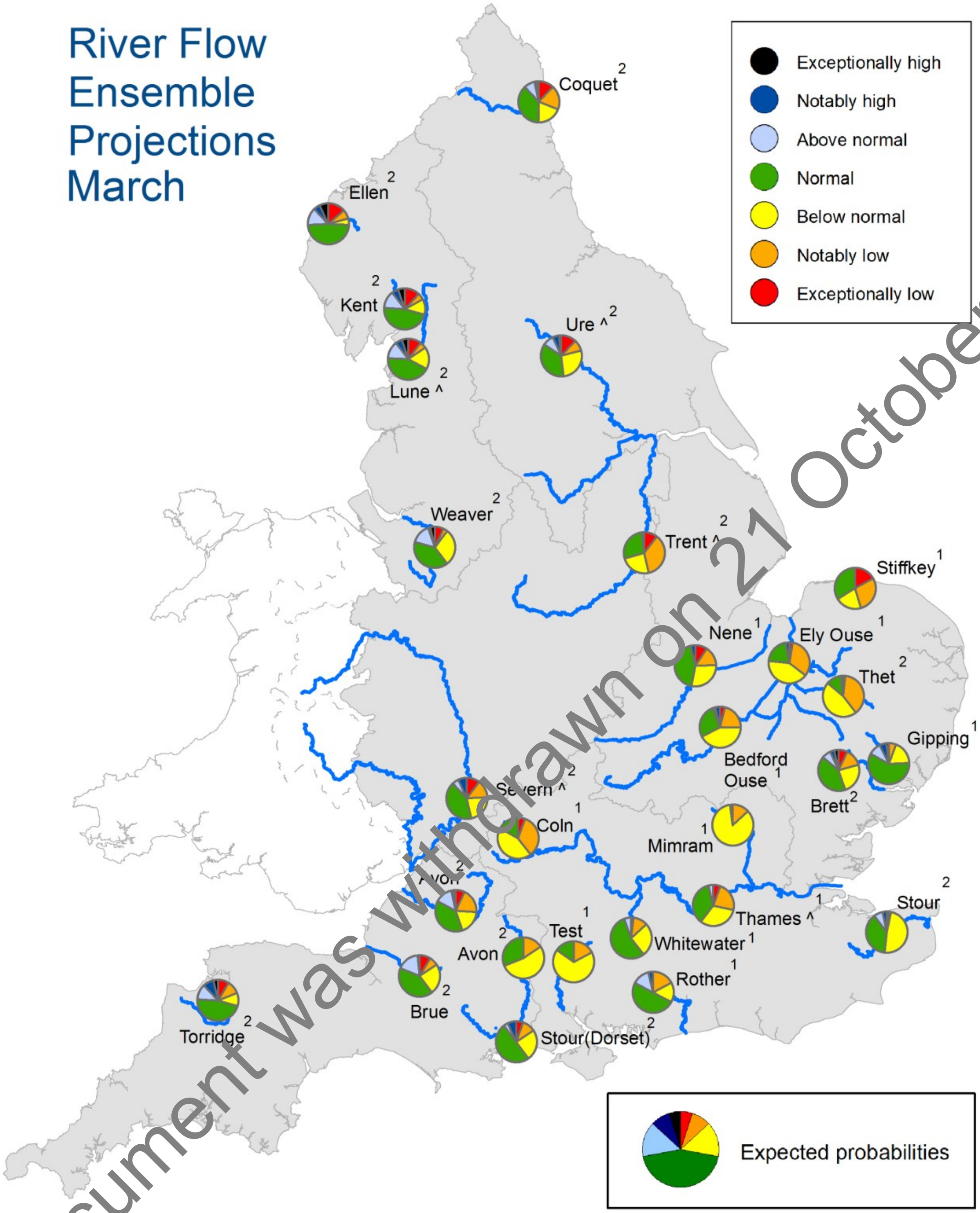

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are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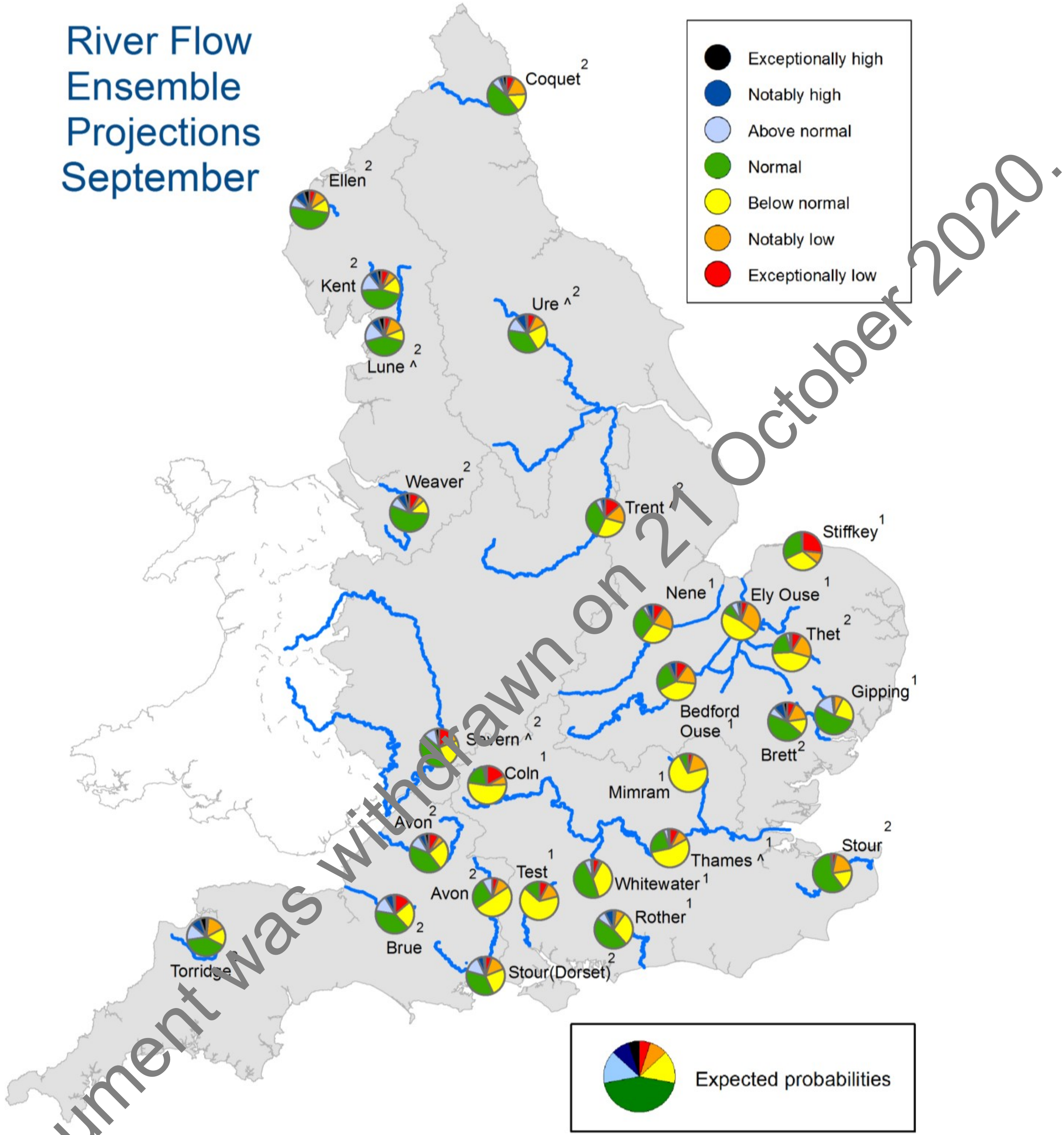

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are 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 September 2019. 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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^"Naturalised" flows are projected for these sites

Forward look - groundwater

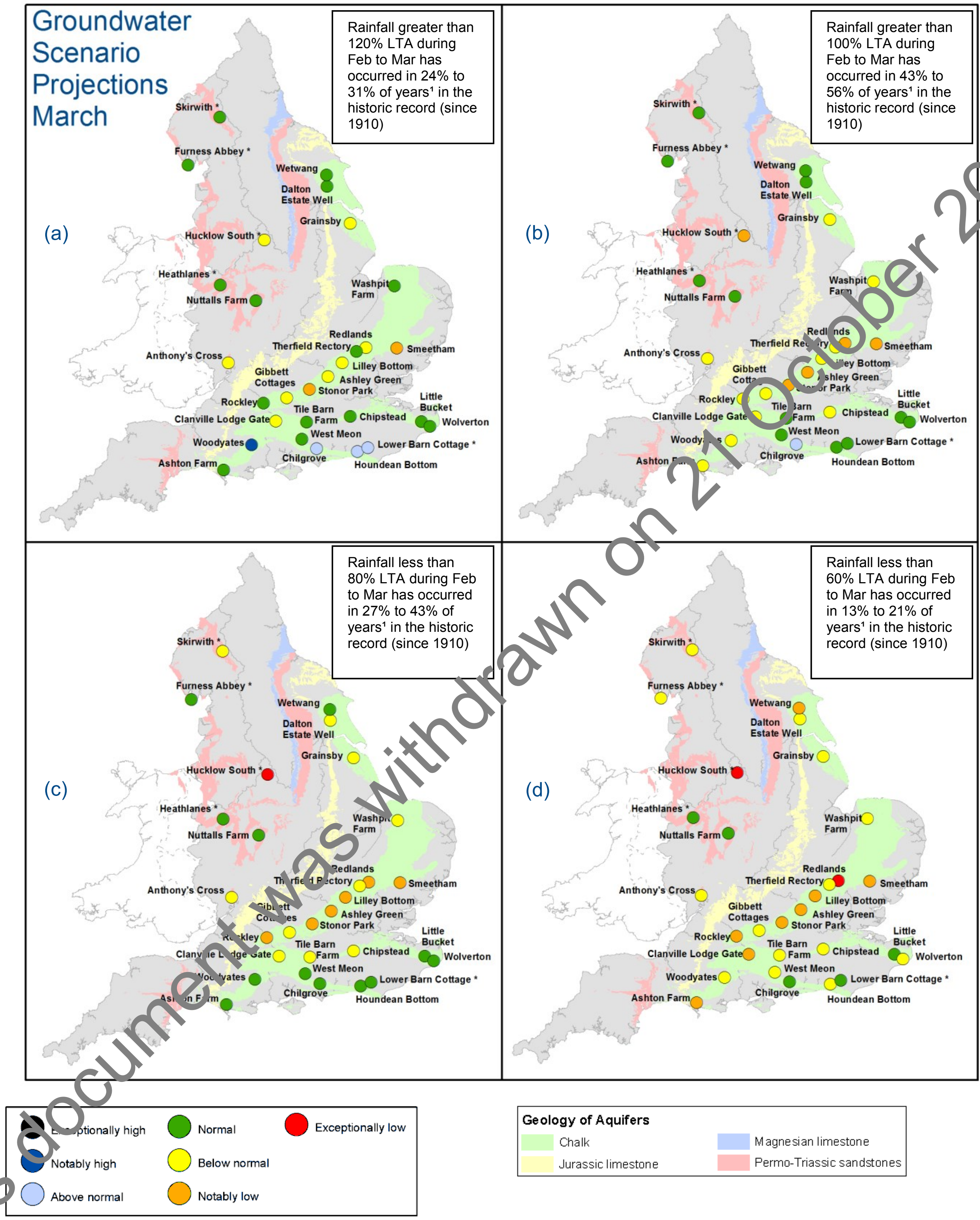

Figure 6.5: Projected groundwater levels at key indicator sites at the end of March 2019. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between February and March 2019 (Source: Environment Agency). Geological map reproduced with kind permission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

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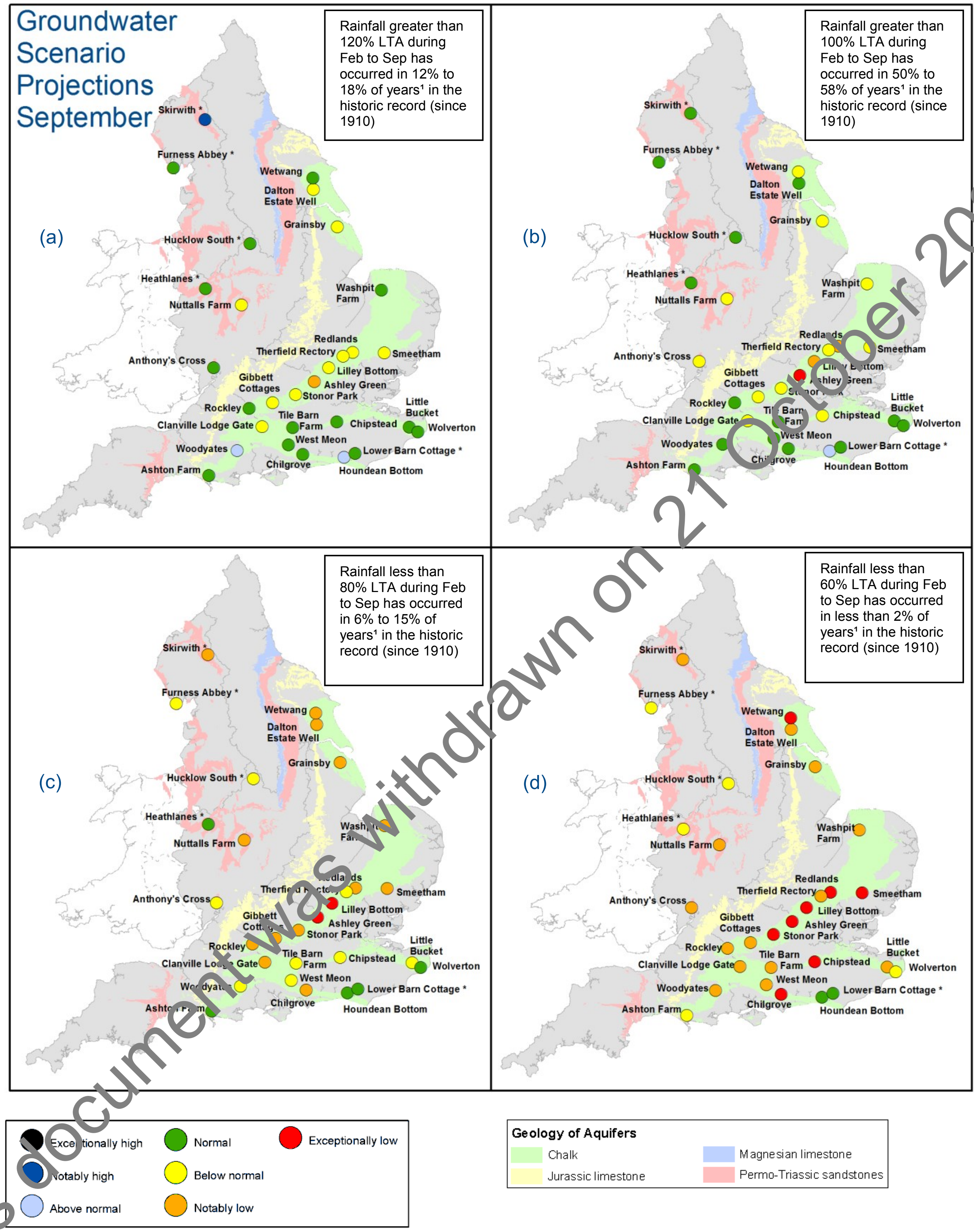

Figure 6.6: Projected groundwater levels at key indicator sites at the end of September 2019. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between February and September 2019 (Source: Environment Agency). Geological map reproduced with kind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

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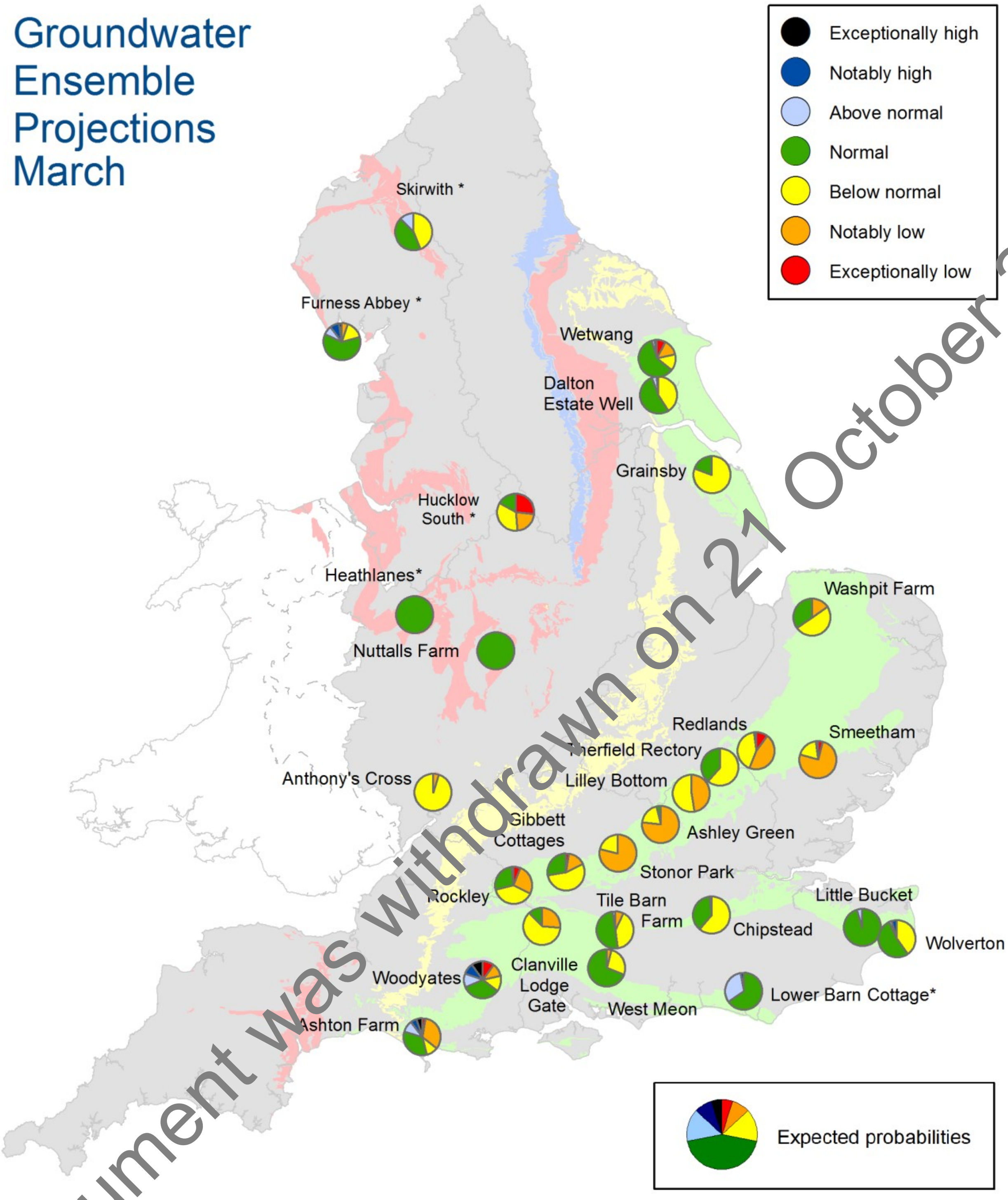

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are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

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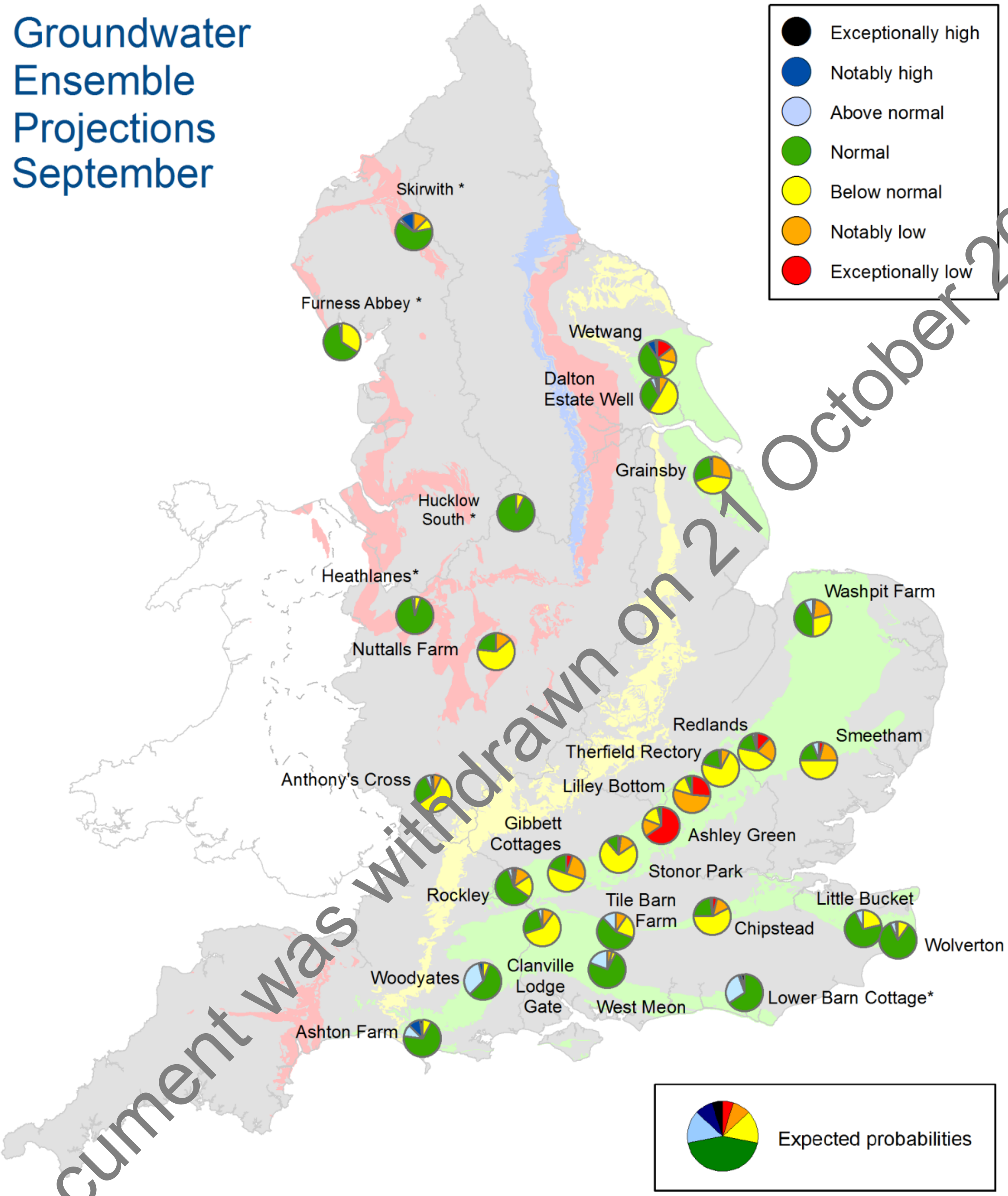

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Figure 6.8: Probabilistic ensemble projections of groundwater levels at key indicator sites at the end of September 2019. Pie charts indicate probability, based on climatology, of the groundwater level at each site being e.g. exceptionally low for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

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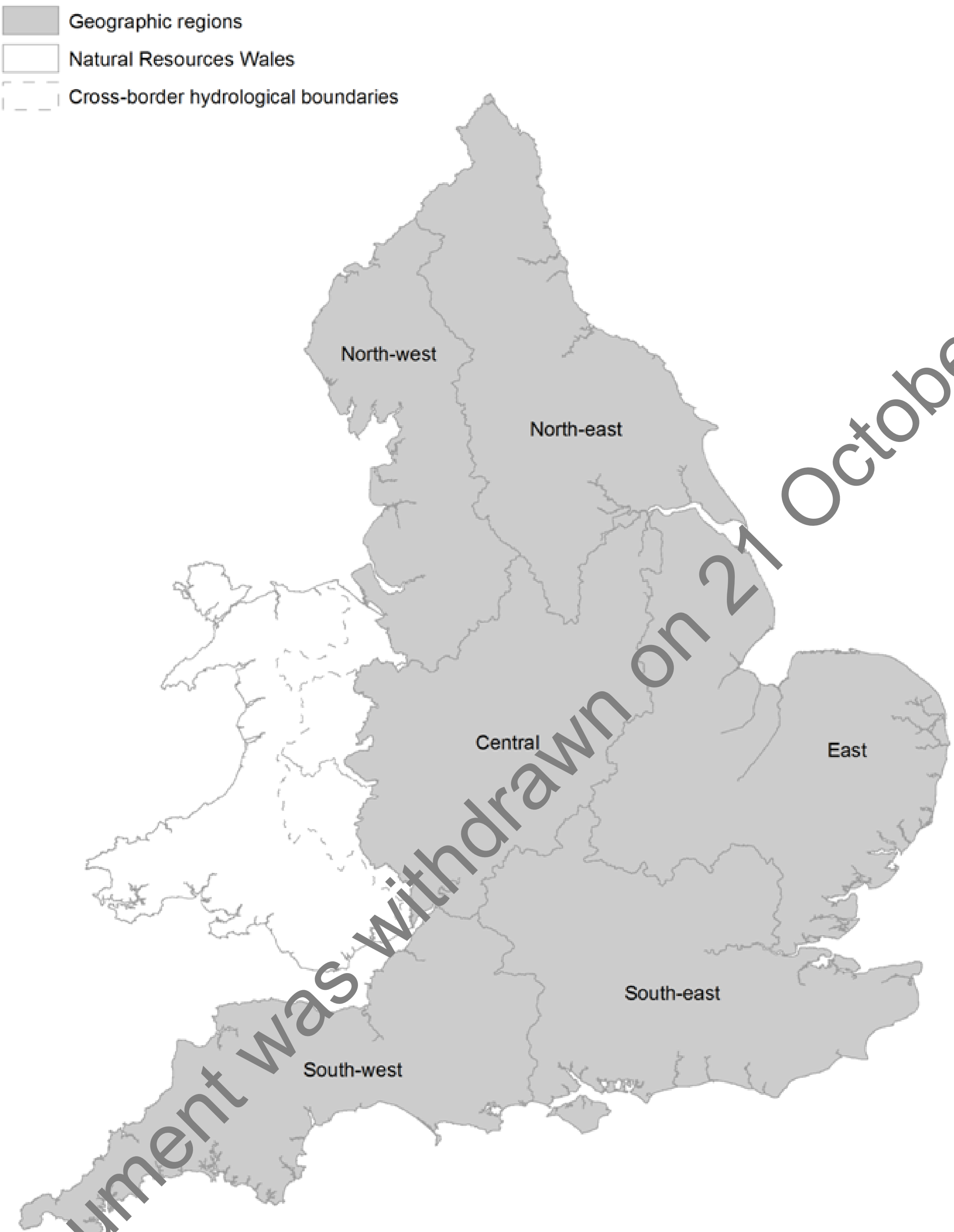

Figure 7.1: Geographic regions

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