Monthly water situation report

England

Summary – May 2017

Rainfall totals for May were above the long term average (LTA) for the month in many parts of the country, but well below average in parts of north-east England. For England as a whole, the May rainfall total was 97% of the 1961-90 LTA. Soils were drier than average for the time of year, with soil moisture deficits for the end of May of between 70 and 100mm across some parts of England. Monthly mean river flows decreased compared to April at three-quarters of indicator sites and are below normal or lower for the time of year at two-thirds of locations. Groundwater levels decreased at almost all indicator boreholes. Reservoir stocks decreased at the majority of reported reservoirs or reservoir groups. Overall reservoir storage for England is 84% of total capacity, a small decrease compared to April.

Rainfall

Rainfall totals during May were significantly higher than for April. Cumulative rainfall totals were below 25mm in parts of north-east, central and south-west England, but elsewhere cumulative rainfall totals were above 75mm across much of England. The highest rainfall totals were in north-west England where catchments in Cumbria received approximately 100mm. Rainfall totals were well above the long term average (LTA) for May across almost two-thirds of hydrological areas in England. For hydrological areas in Northumberland, parts of Cheshire and Shropshire, rainfall totals were less than 50% of the LTA (Figure 1.1).

May rainfall totals were classed as normal for the time of year for half of hydrological areas across England and above normal for a third of catchments. For hydrological areas in Northumberland, parts of Cheshire, Shropshire and Devon, rainfall totals were below normal or lower for the time of year. The rainfall accumulations over the previous 6-month and 12-month periods are below normal or lower across most parts of England. Accumulations from October (the start of the UK water year) to May have been the third driest 8-month period on record (starting in 1910) in the Teign and Torbay hydrological area (Devon) and fourth driest in a further 5 hydrological areas (Devon and hydrological areas in the Welsh and Scottish borders) (Figure 1.2).

Overall, rainfall totals for May ranged from 66% of the LTA in the north-east of England to 133% in east England. Across England as a whole, monthly rainfall totals were close to the 1961-90 LTA for April at 97% (99% of the 1981-2010 LTA (Figure 1.3).

Soil moisture deficit

Soil moisture deficits (SMDs) decreased briefly in response to rainfall during May, but end of the month SMDs were larger than for April and ranged from 10 to 100mm. Soils were significantly drier than the May LTA across almost all parts of England, particularly in the north and west (Figure 2.1).

At a regional scale, soils were drier at the end of May than at the end of April, with end of month SMDs ranging from just over 50mm in south-west England to just over 70mm in central England. Soils were drier than average across all regions (Figure 2.2).

River flows

Compared with April, monthly mean river flows for May decreased at more than three-quarters of the indicator sites across England. River flows were classed as below normal or lower for the time of year at more than two-thirds of the indicator sites. The remaining sites were classed as normal for the time of year (Figure 3.1). At the regional index sites, monthly mean river flows ranged from normal for the time of year on the Bedford Ouse at Offord in east England and the Exe at Thorverton in south-west England, to exceptionally low on the South Tyne at Haydon Bridge in north-east England (Figure 3.2).

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Groundwater levels

Groundwater levels decreased at all except one of the indicator sites during May compared to the end of April. End of month groundwater levels were normal or lower for the time of year at all except one of the indicator sites, and notably low for the time of year at nearly one-quarter of all sites. These sites are predominantly in the chalk and Jurassic limestone aquifers (Figure 4.1).

End of month groundwater levels at the major aquifer index sites range from normal for the time of year at Heathlanes (Shropshire sandstone), Dalton Holme (Hull and East Riding chalk) and Skirwith (Carlisle Basin and Eden Valley sandstone) to notably low at Redlands Hall (Cam and Ely Ouse chalk), Little Bucket (East Kent Stour chalk) and Jackaments Bottom (Burford Jurassic limestone) (Figure 4.2).

Reservoir storage

During May, reservoir stocks decreased at almost three-quarters of all the reported reservoirs or reservoir groups. Notable decreases of 10% occurred for the Teesdale, NCZ Regional Pennines groups of reservoirs and at Clatworthy. Reservoir stocks at Hanningfield and the Lower Lee Group increased very slightly and for the remaining one-fifth of reservoirs or reservoir groups, there was no change in storage. End of month stocks were classed as normal or higher for the time of year at more than half of all reported reservoirs or reservoir groups. The remaining sites were classed as below normal or lower for the time of year, although stocks in the Teesdale Group have been affected by operational activities to Cow Green reservoir (Figure 5.1).

Reservoir stocks remained unchanged or decreased in all regions compared with the end of April. The largest decrease of 8% occurred in north-west England. End of May stocks ranged from 79% of total capacity in north-west England to 94% in east England. Overall storage for England decreased by 4% to 85% of total capacity (Figure 5.2).

Forward look

The beginning of June is likely to be unsettled with periods of showers and heavier rain affecting most parts of England. Towards the middle of June, the unsettled conditions are likely to continue, especially in north-west England, with the possibility of drier, brighter conditions in the south. Towards the end of the month, a more settled period of weather is likely to develop, with drier conditions, especially in south England, although there is a chance that the end of the month could see a return to unsettled and wetter weather. Over the 3 month period June to August, the chances of above and below average precipitation are fairly balanced[1].

Projections for river flows at key sites[2]

More than three-quarters of the modelled sites have a greater than expected chance of cumulative river flows being below normal or lower by both the end of September 2017 and the end of March 2018.

For scenario based projections of cumulative river flows at key sites by September 2017 see Figure 6.1
For scenario based projections of cumulative river flows at key sites by March 2018 see Figure 6.2
For probabilistic ensemble projections of cumulative river flows at key sites by September 2017 see Figure 6.3
For probabilistic ensemble projections of cumulative river flows at key sites by March 2018 see Figure 6.4

Projections for groundwater levels in key aquifers[2]

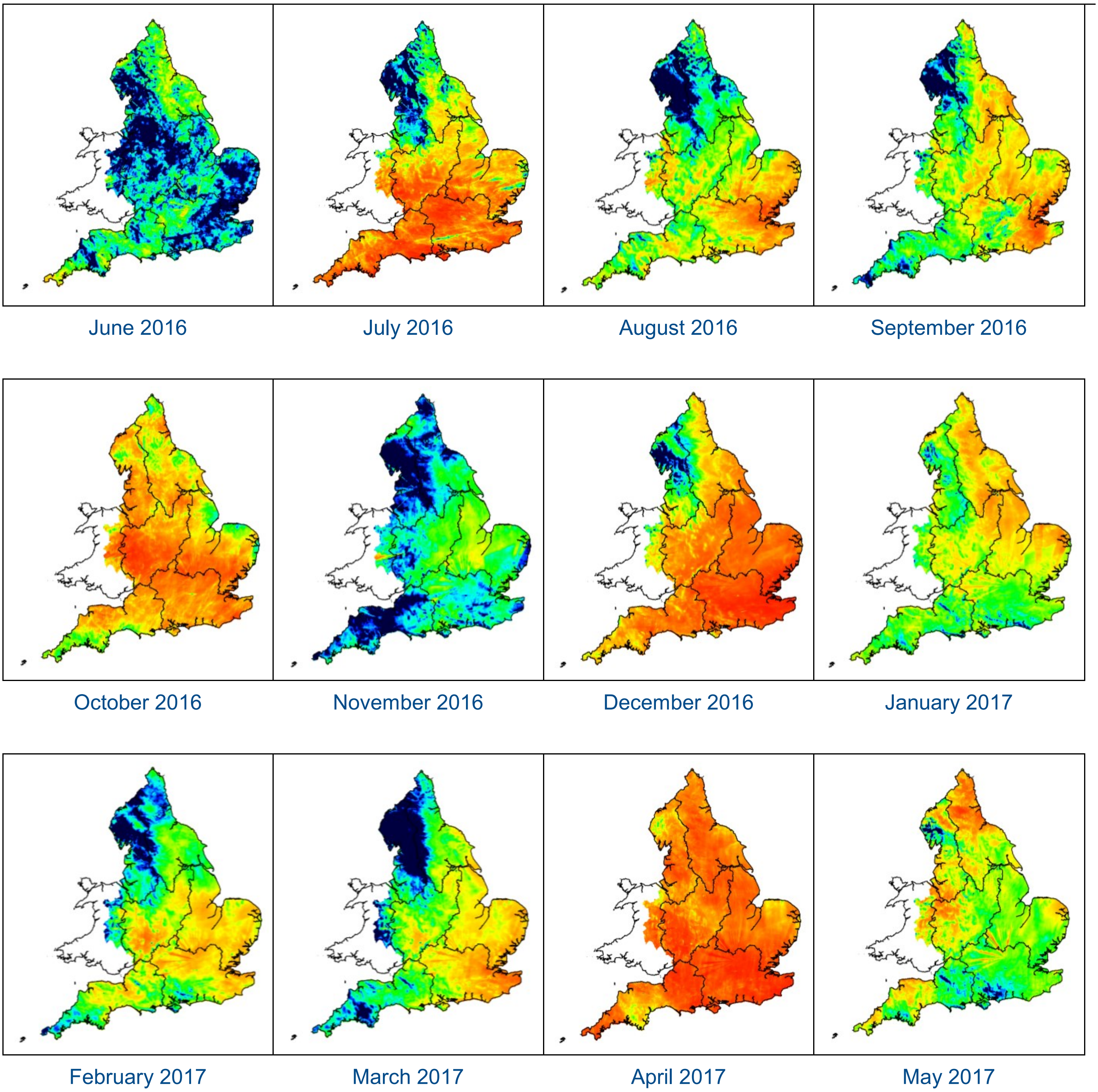
Nearly two-thirds of the modelled sites have a greater than expected chance of below normal or lower groundwater levels for the time of year at the end of September 2017. By March 2018, this proportion falls to just over one third of the modelled sites.

For scenario based projections of groundwater levels in key aquifers in September 2017 see Figure 6.5
For scenario based projections of groundwater levels in key aquifers in March 2018 see Figure 6.6
For probabilistic ensemble projections of groundwater levels in key aquifers in September 2017 see Figure 6.7
For probabilistic ensemble projections of groundwater levels in key aquifers in March 2018 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



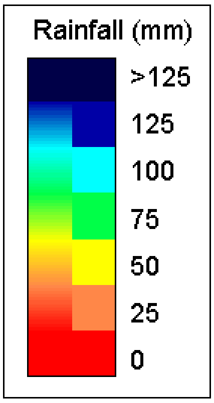


Figure 1.1: Monthly rainfall across England and Wales for the past 12 months. UKPP radar data (Source: Met Office © Crown Copyright, 2017). Note: Radar beam blockages in some regions may give anomalous totals in some areas. Crown copyright. All rights reserved. Environment Agency, 100026380, 2017.

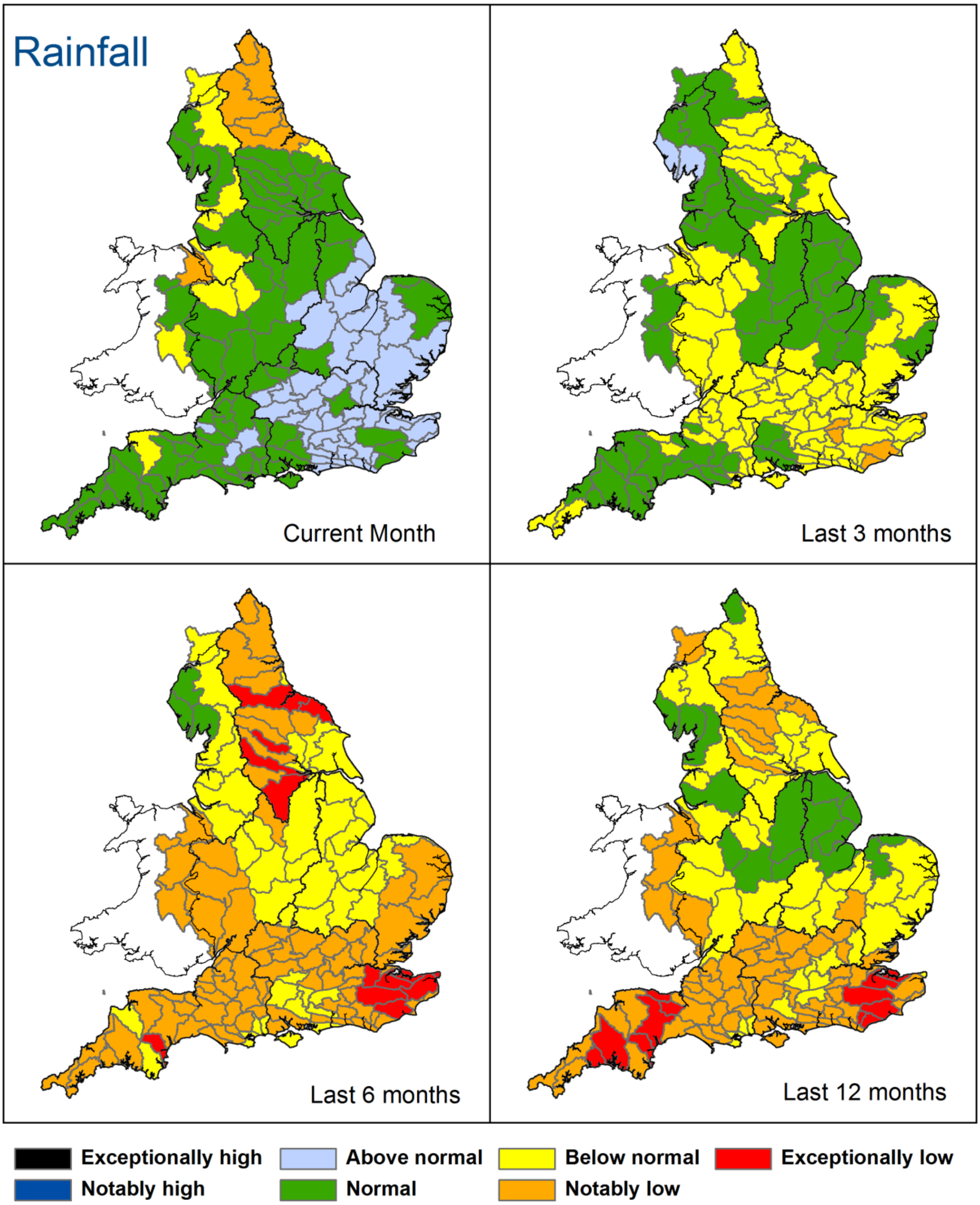


Figure 1.2: Total rainfall for hydrological areas across England for the current month (up to 31 May), the last 3 months, the last 6 months, and the last 12 months, classed relative to an analysis of respective historic totals. Final NCIC (National Climate Information Centre) data based on the Met Office 5km gridded rainfall dataset derived from rain gauges *(Source: Met Office © Crown Copyright, 2017).* 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, 2017.

Rainfall charts

Above average rainfall

Below average rainfall

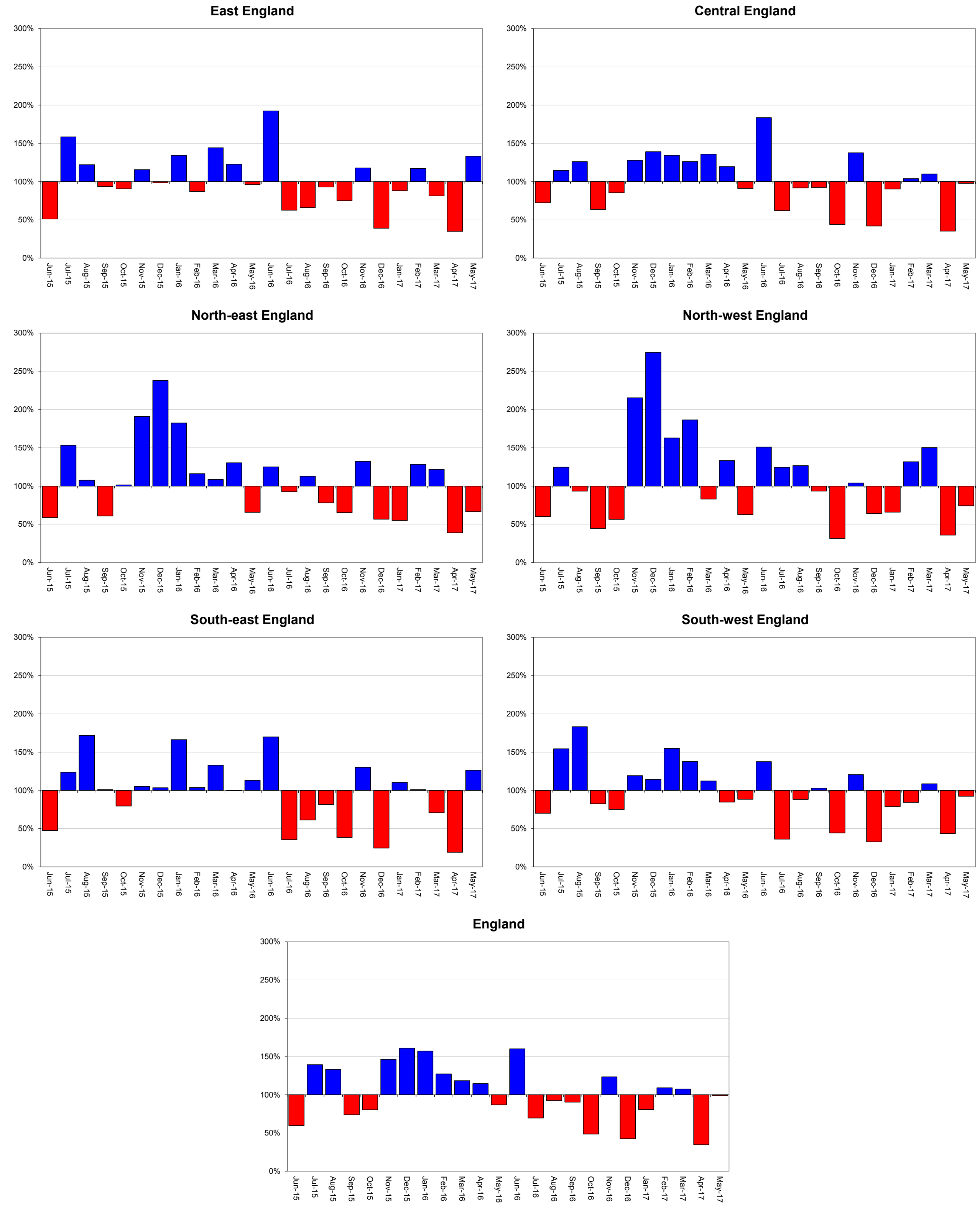


Figure 1.3: Monthly rainfall totals for the past 24 months as a percentage of the 1961 – 1990 long term average for each region and for England. NCIC (National Climate Information Centre) data. (Source: Met Office © Crown Copyright, 2017).

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Soil moisture deficit

End of April 2017[1]	End of May 2017[2]

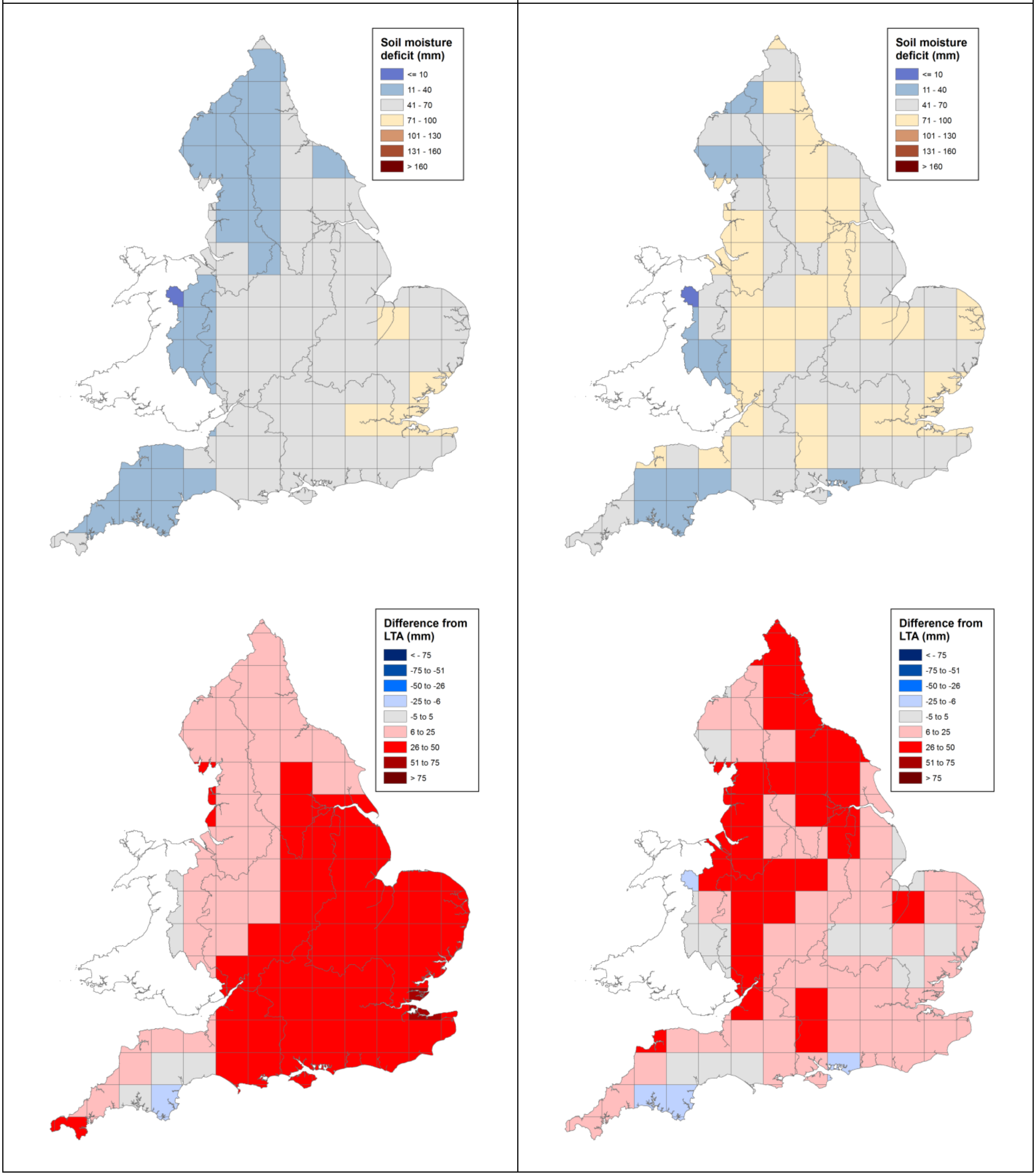

Figure 2.1: Soil moisture deficits for weeks ending 2 May 2017 [1] (left panel) and 30 May 2017 [2] (right panel). Top row shows actual soil moisture deficits (mm) and bottom row shows the difference (mm) of the actual from the 1961-90 long term average soil moisture deficits. MORECS data for real land use (Source: Met Office © Crown Copyright, 2017). Crown copyright. All rights reserved. Environment Agency, 100026380, 2017

Soil moisture deficit charts

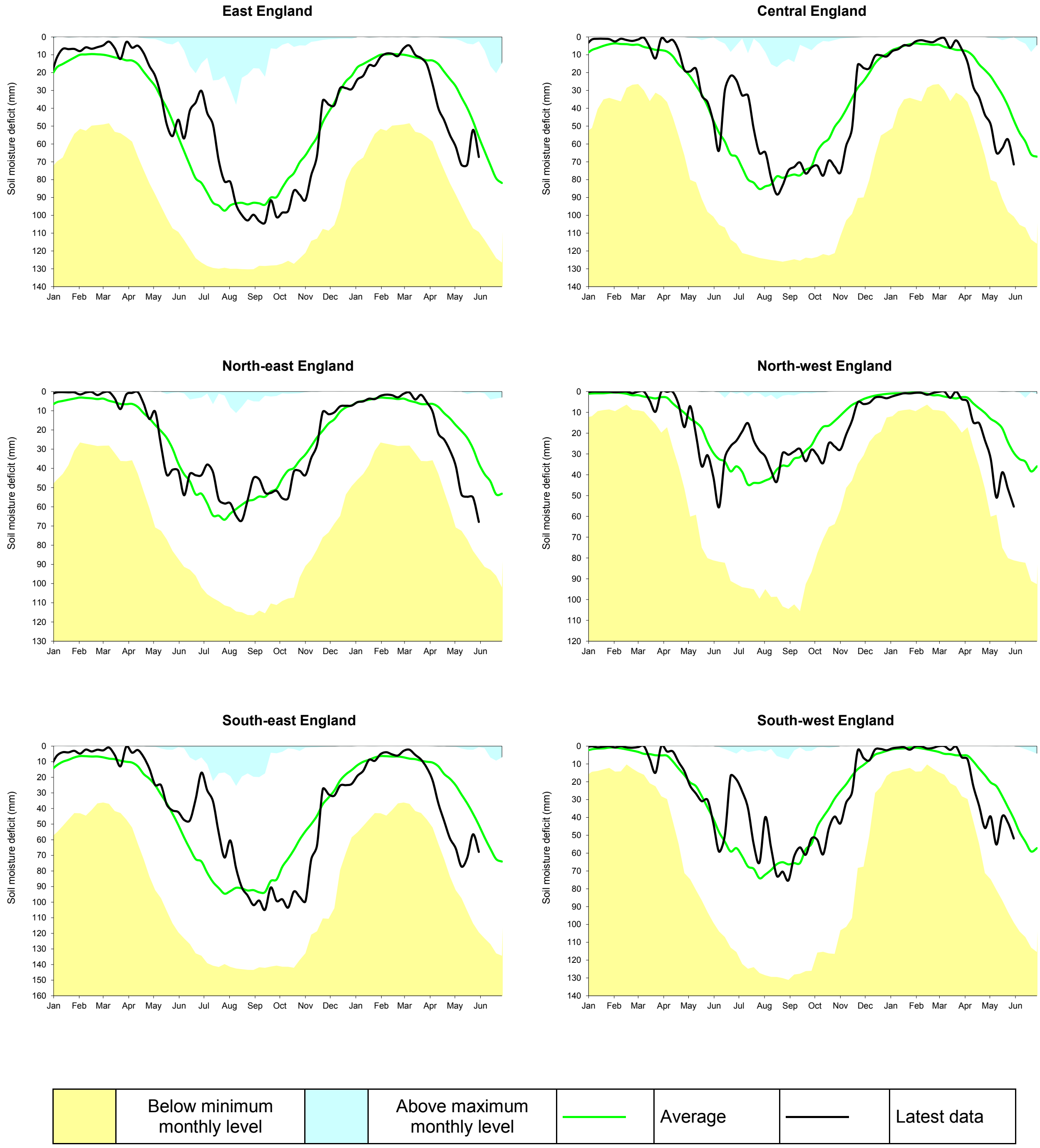

Figure 2.2: Latest soil moisture deficits for all geographic regions compared to maximum, minimum and 1961-90 long term average. Weekly MORECS data for real land use. (Source: Met Office © Crown Copyright, 2017).

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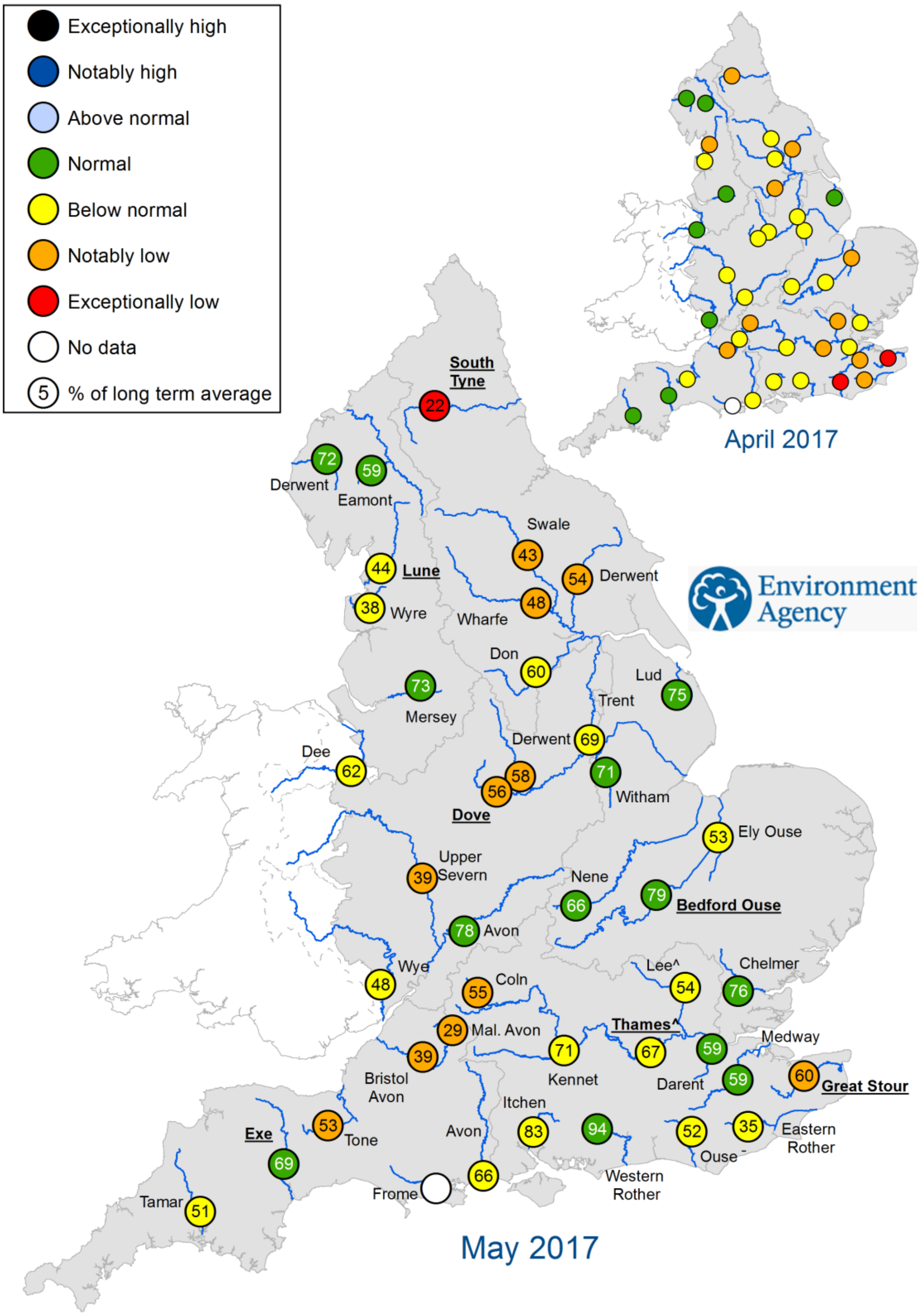
River flows



^ “Naturalised” flows are provided for the ‘Thames at Kingston’ and the ‘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 April 2017 and May 2017, expressed as a percentage of the respective long term average and classed relative to an analysis of historic April and May monthly means (Source: Environment Agency). Crown copyright. All rights reserved. Environment Agency, 100026380, 2017.

River flow charts

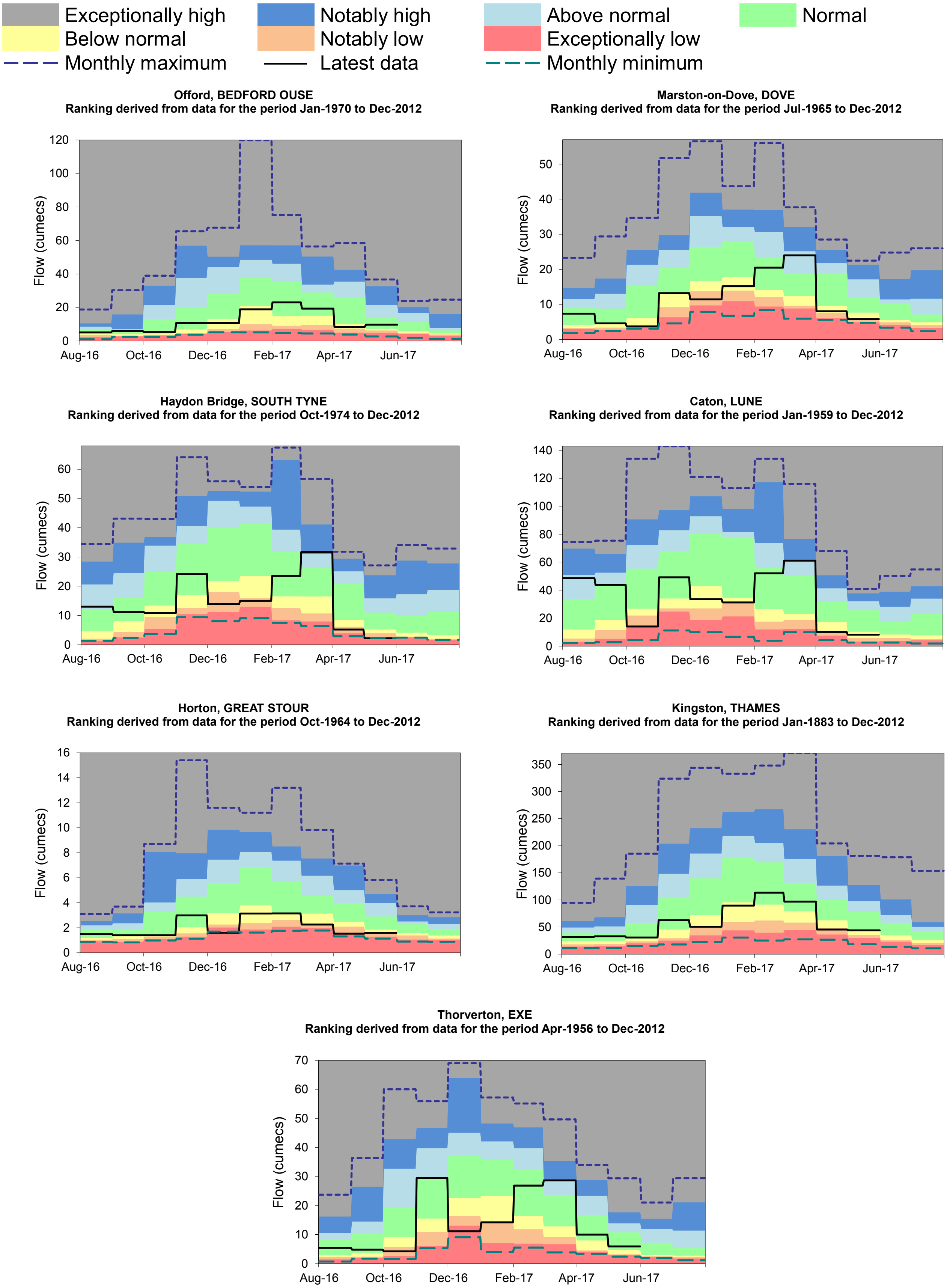


Figure 3.2: Index river flow sites for each geographic region. Monthly mean flow compared to an analysis of historic monthly mean flows, long term maximum and minimum flows. (Source: Environment Agency).

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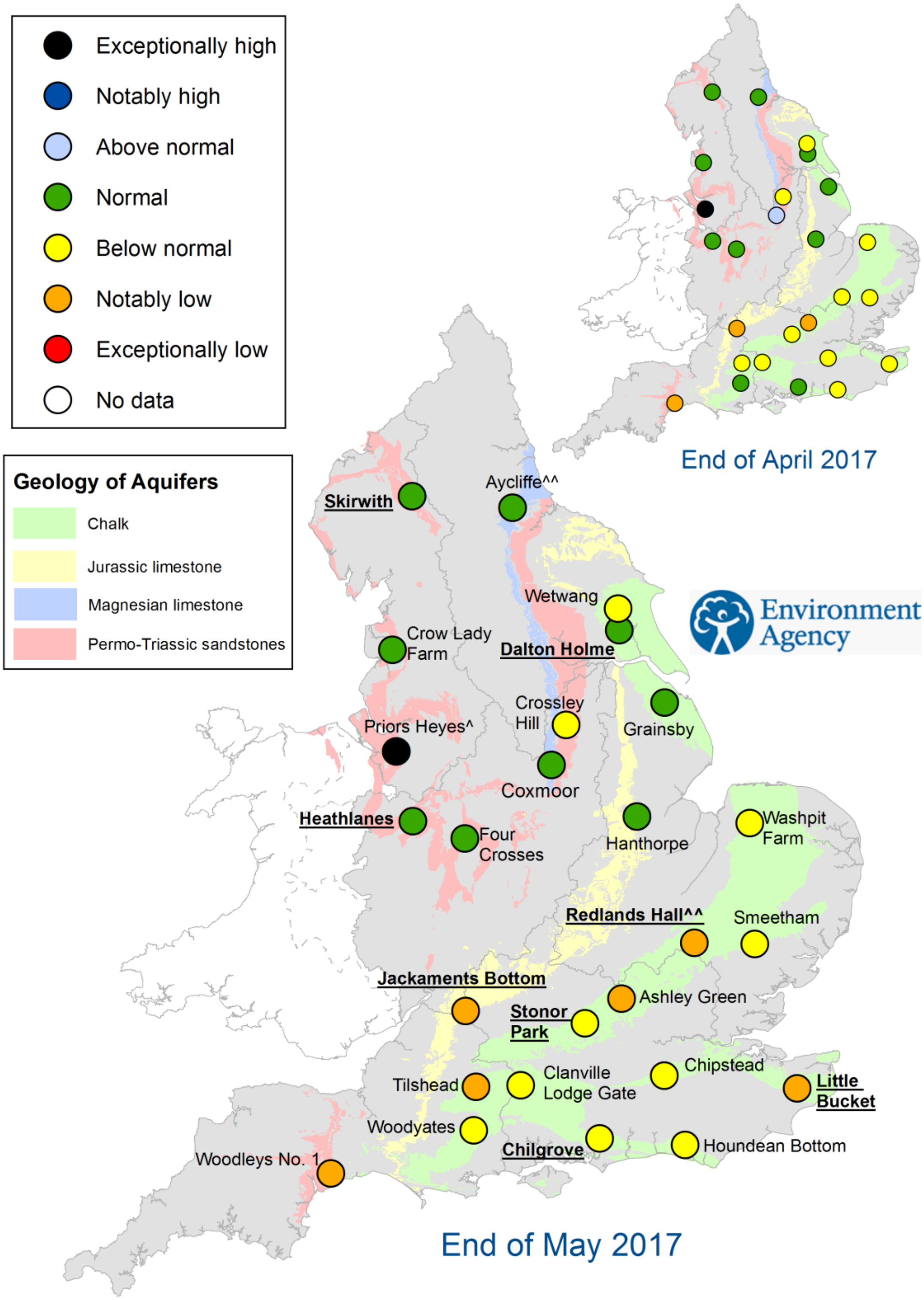
Groundwater levels



^ 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 April 2017 and May 2017, classed relative to an analysis of respective historic April and May levels (Source: Environment Agency). Geological map reproduced with kind permission from UK Groundwater Forum, BGS © NERC. Crown copyright. All rights reserved. Environment Agency, 100026380, 2017.

Groundwater level charts

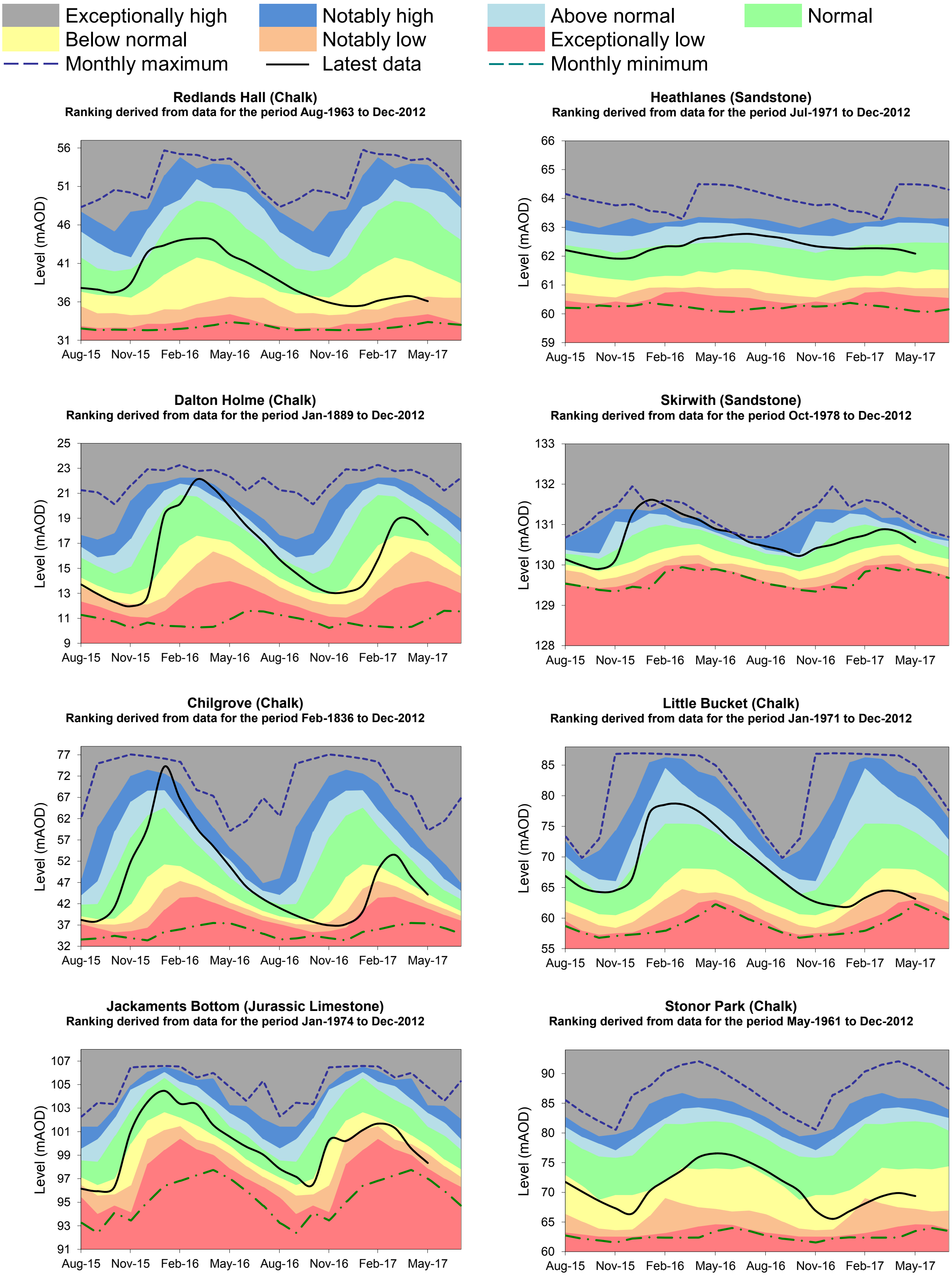


Figure 4.2: Index groundwater level sites for major aquifers. End of month groundwater levels months compared to an analysis of historic end of month levels and long term maximum and minimum levels. (Source: Environment Agency, 2017).

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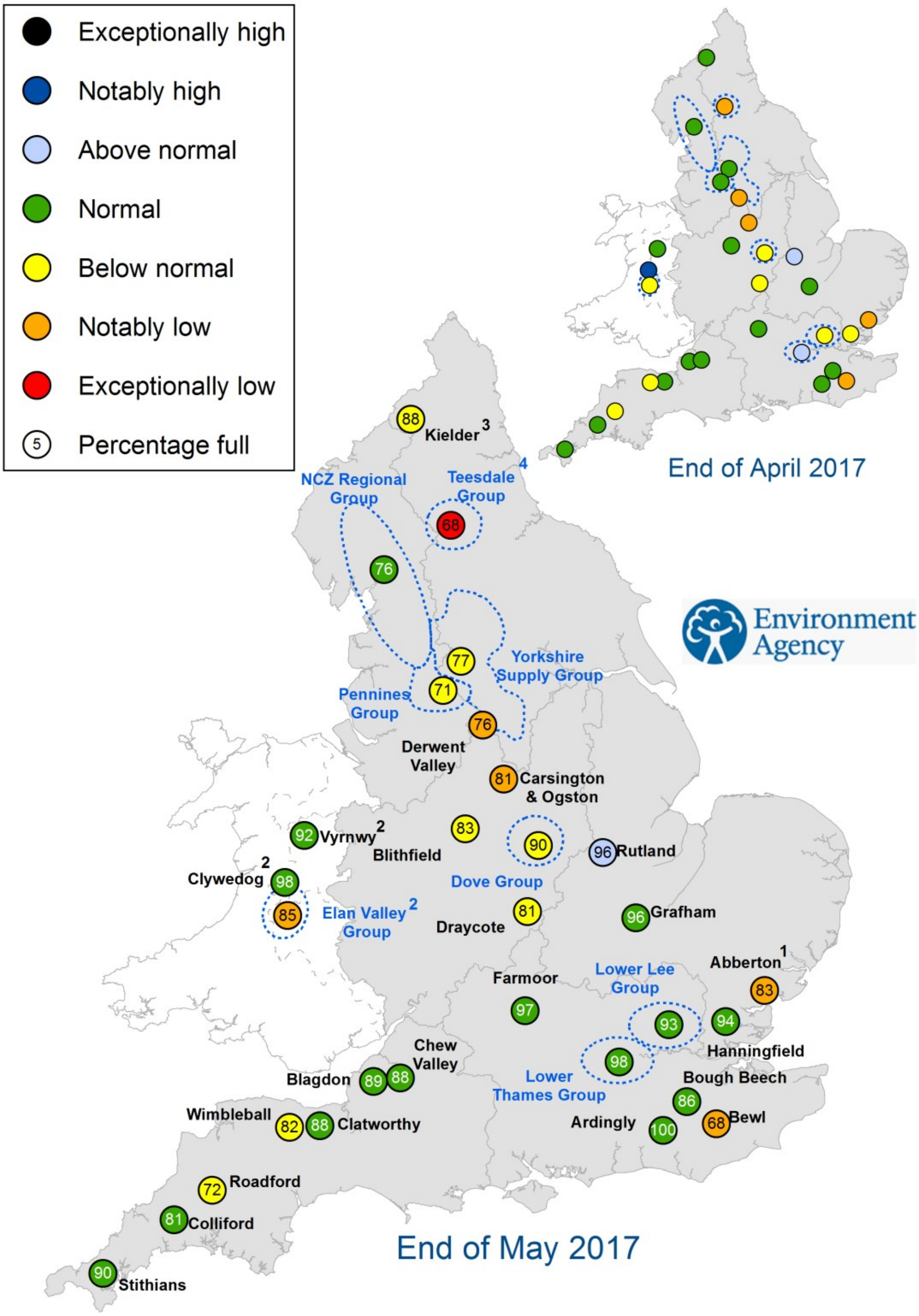
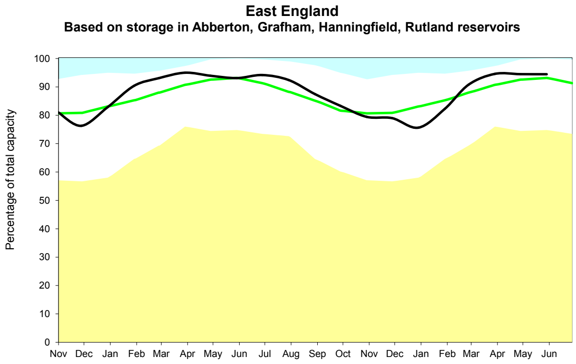
Reservoir storage

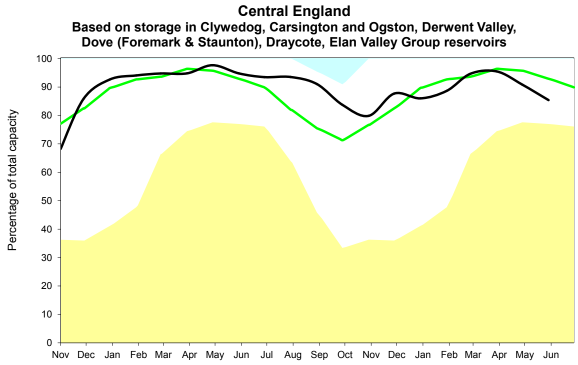


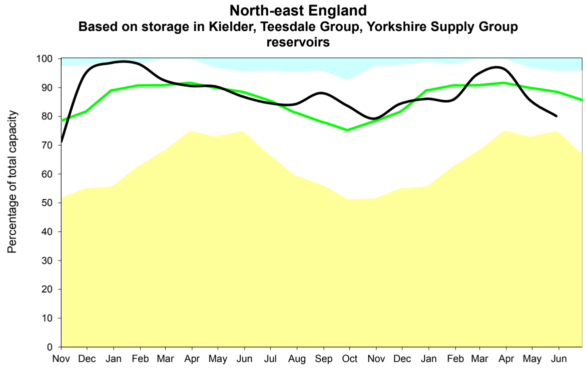
1. Engineering work at Abberton Reservoir in east England to increase capacity has been completed
2. Vyrnwy, Clywedog and Elan Valley reservoirs are located in Wales but provide a water resource to Central and north-west England
3. Current levels at Kielder will be deliberately lower than historical levels during a trial of a new flood alleviation control curve
4. Current levels in the Teesdale Group have been affected by maintenance work on Cow Green reservoir

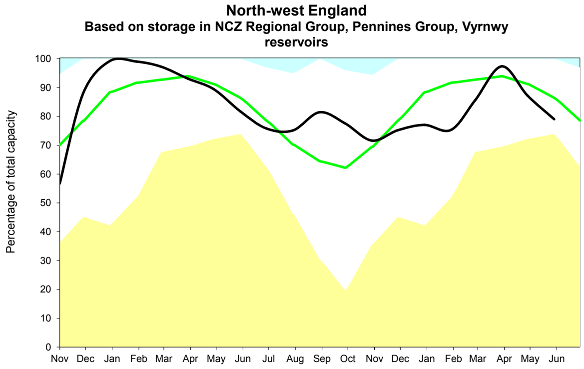
Figure 5.1: Reservoir stocks at key individual and groups of reservoirs at the end of April 2017 and May 2017 as a percentage of total capacity and classed relative to an analysis of historic April and May values respectively (Source: Water Companies). Note: Classes shown may not necessarily relate to control curves or triggers for drought actions. As well as for public water supply, some reservoirs are drawn down to provide flood storage, river compensation flows or for reservoir safety inspections. In some cases current reservoir operating rules may differ from historic ones. Crown copyright. All rights reserved. Environment Agency, 100026380, 2017.

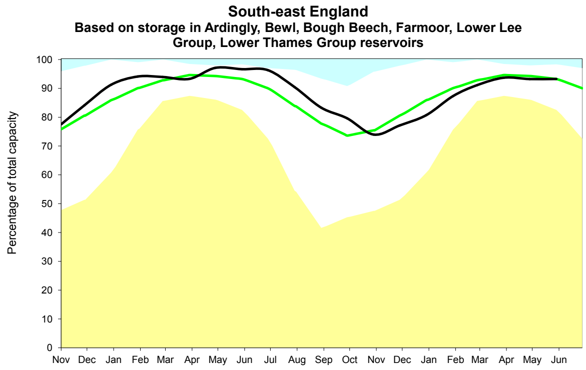
Reservoir storage charts

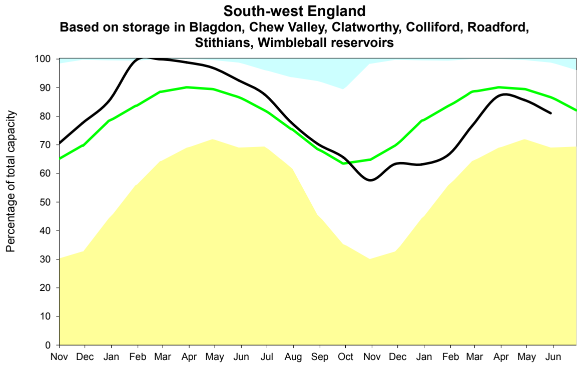


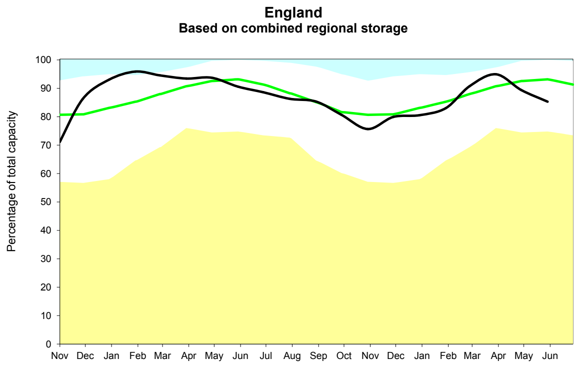












	Below minimum monthly level		Above maximum monthly level		Average		Latest data

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.

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Forward look – river flow

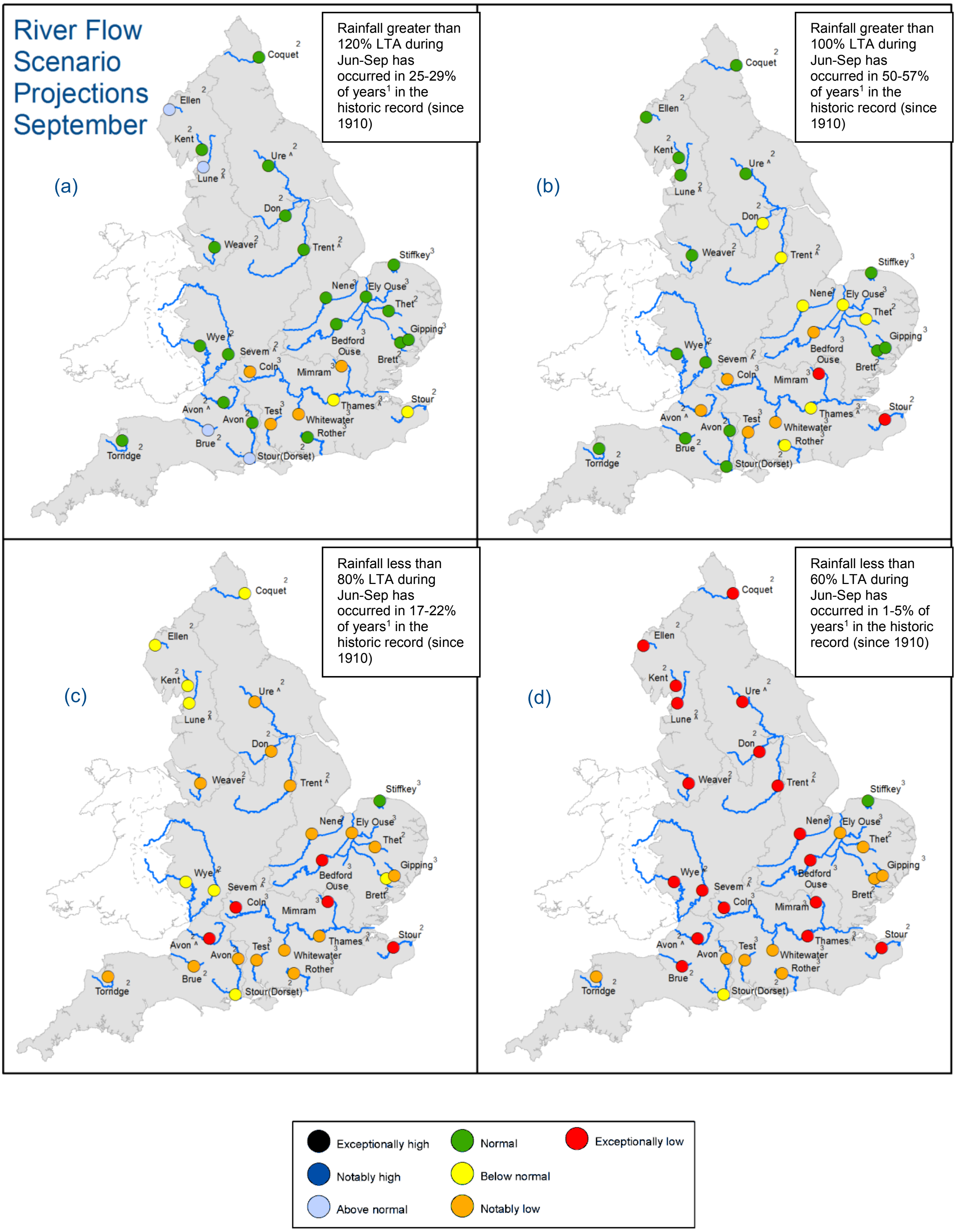

Figure 6.1: Projected river flows at key indicator sites up until the end of September 2017. Forecasts based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between June 2017 and September 2017 (Source: Centre for Ecology and Hydrology, Environment Agency).

[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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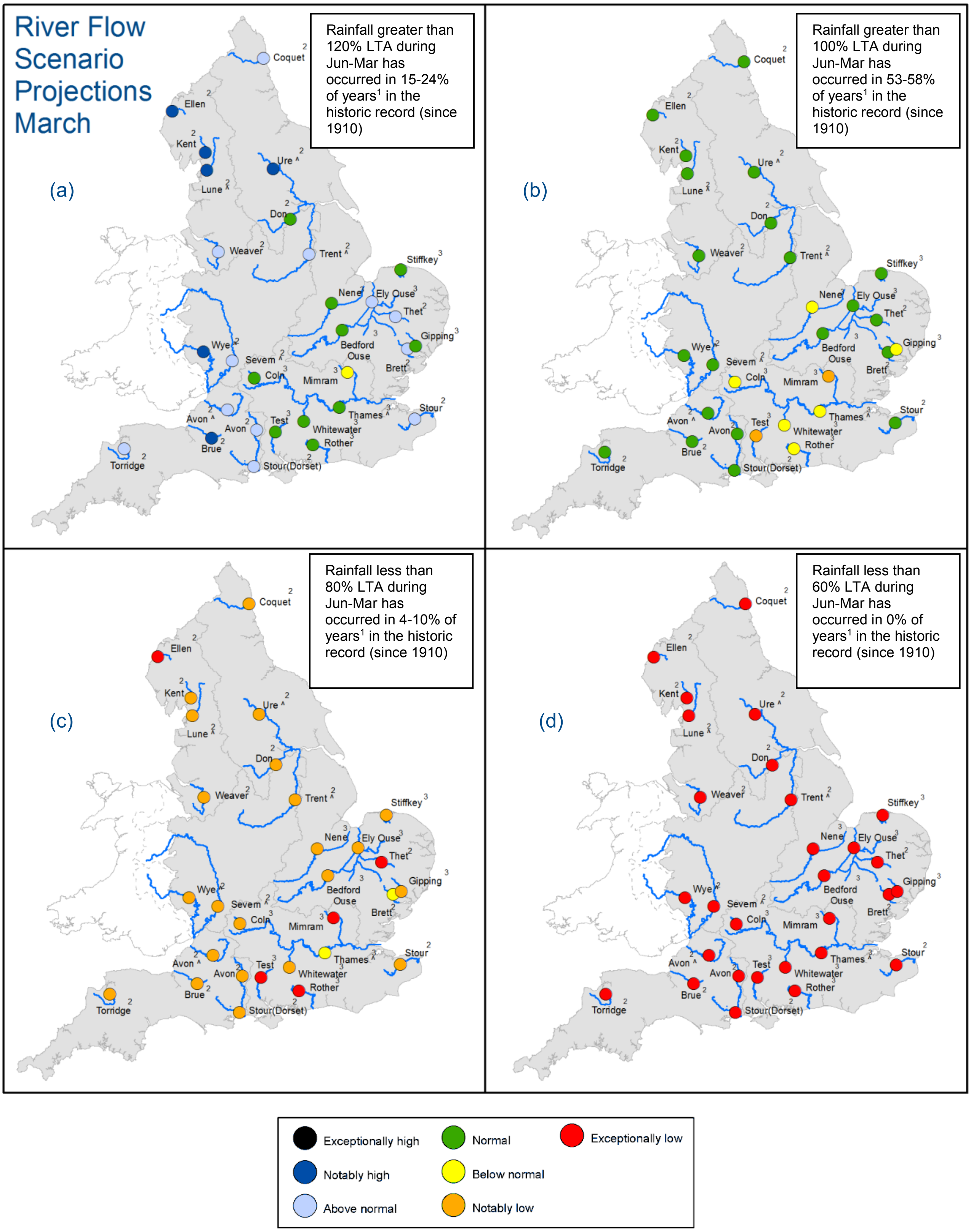

Figure 6.2: Projected river flows at key indicator sites up until the end of March 2018. Forecasts based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between June 2017 and March 2018 (Source: Centre for Ecology and Hydrology, Environment Agency)

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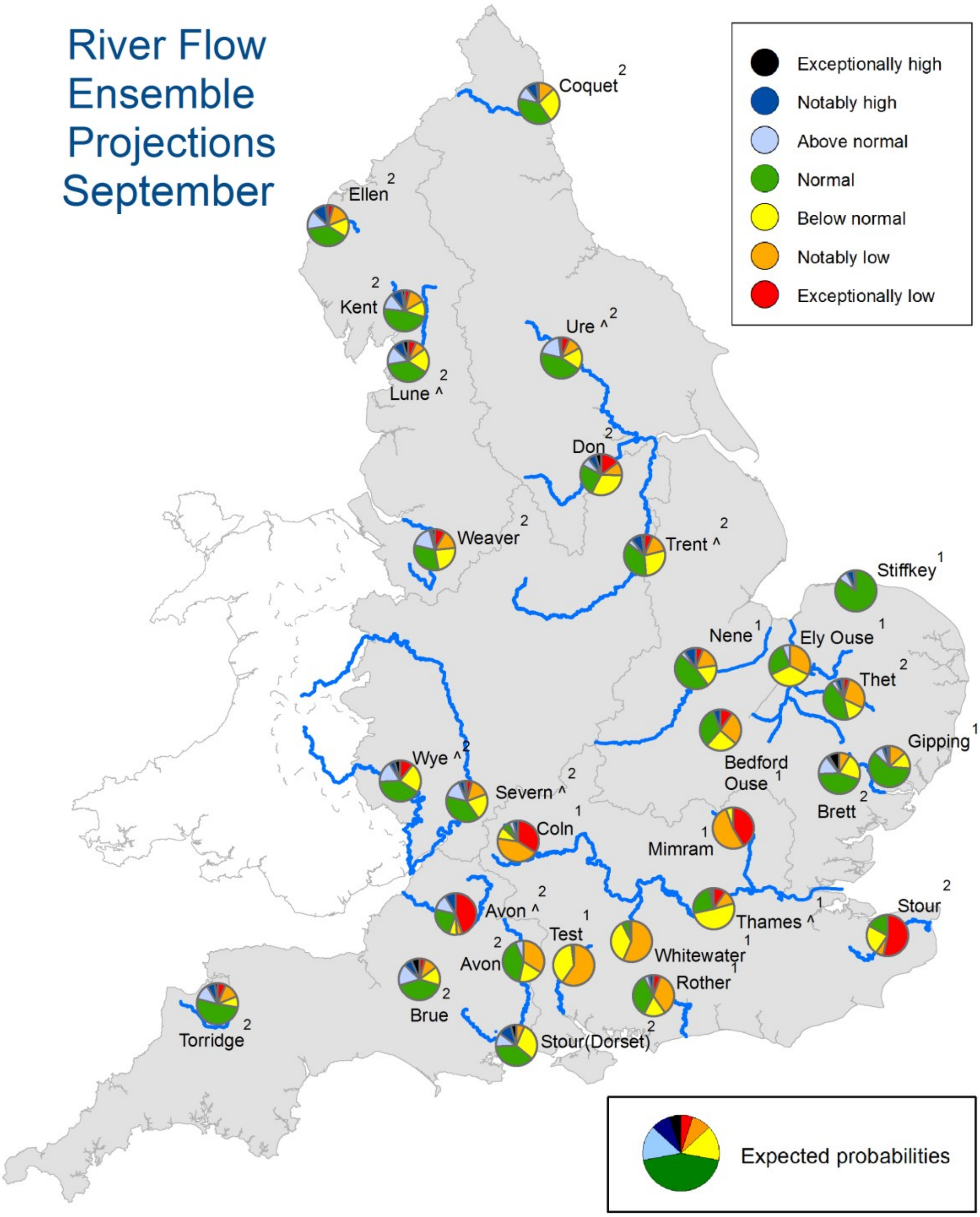

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are 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 2017. 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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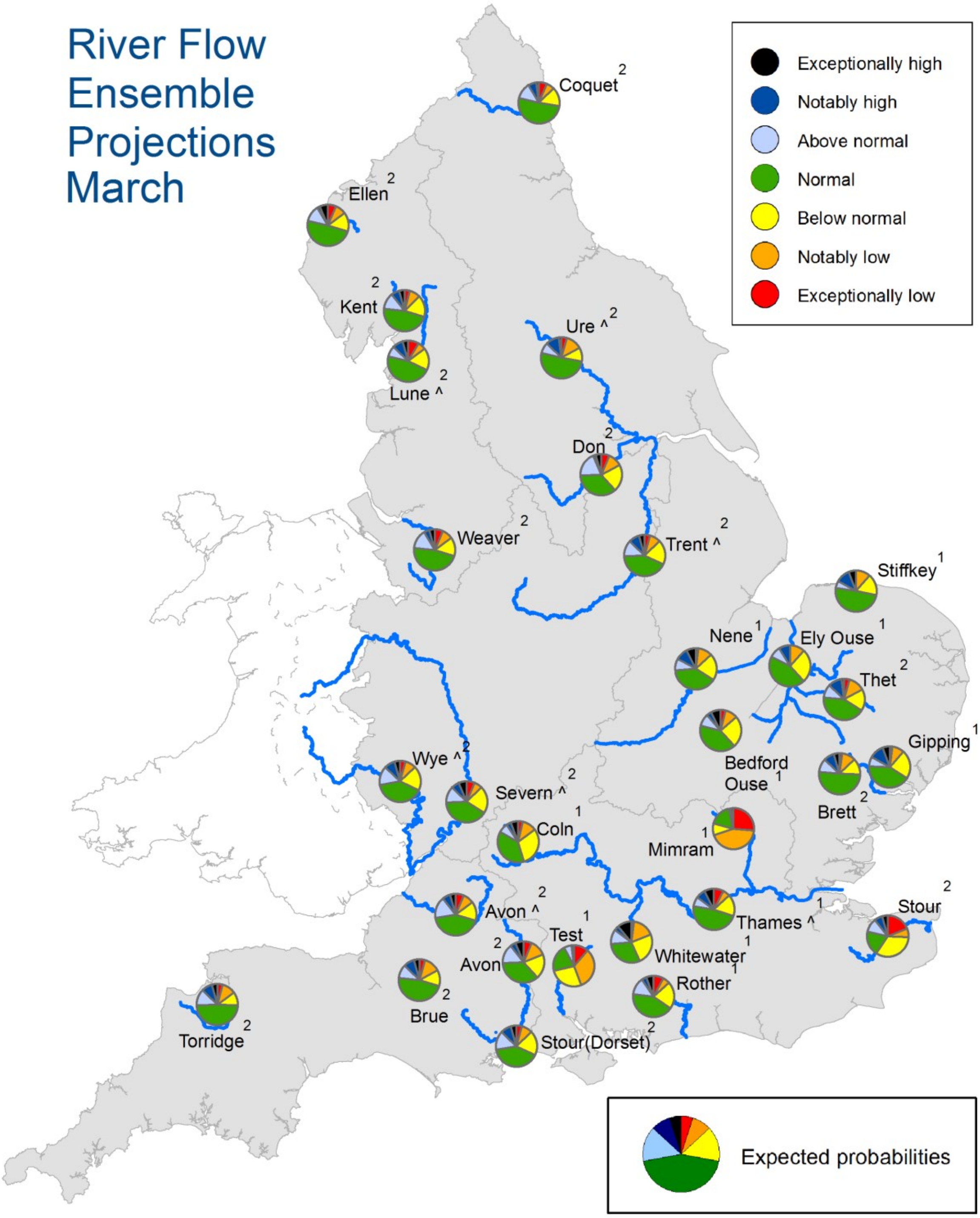

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are 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 March 2018. 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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[2] Projections for these sites are produced by CEH
^"Naturalised" flows are projected for these sites

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Forward look - groundwater

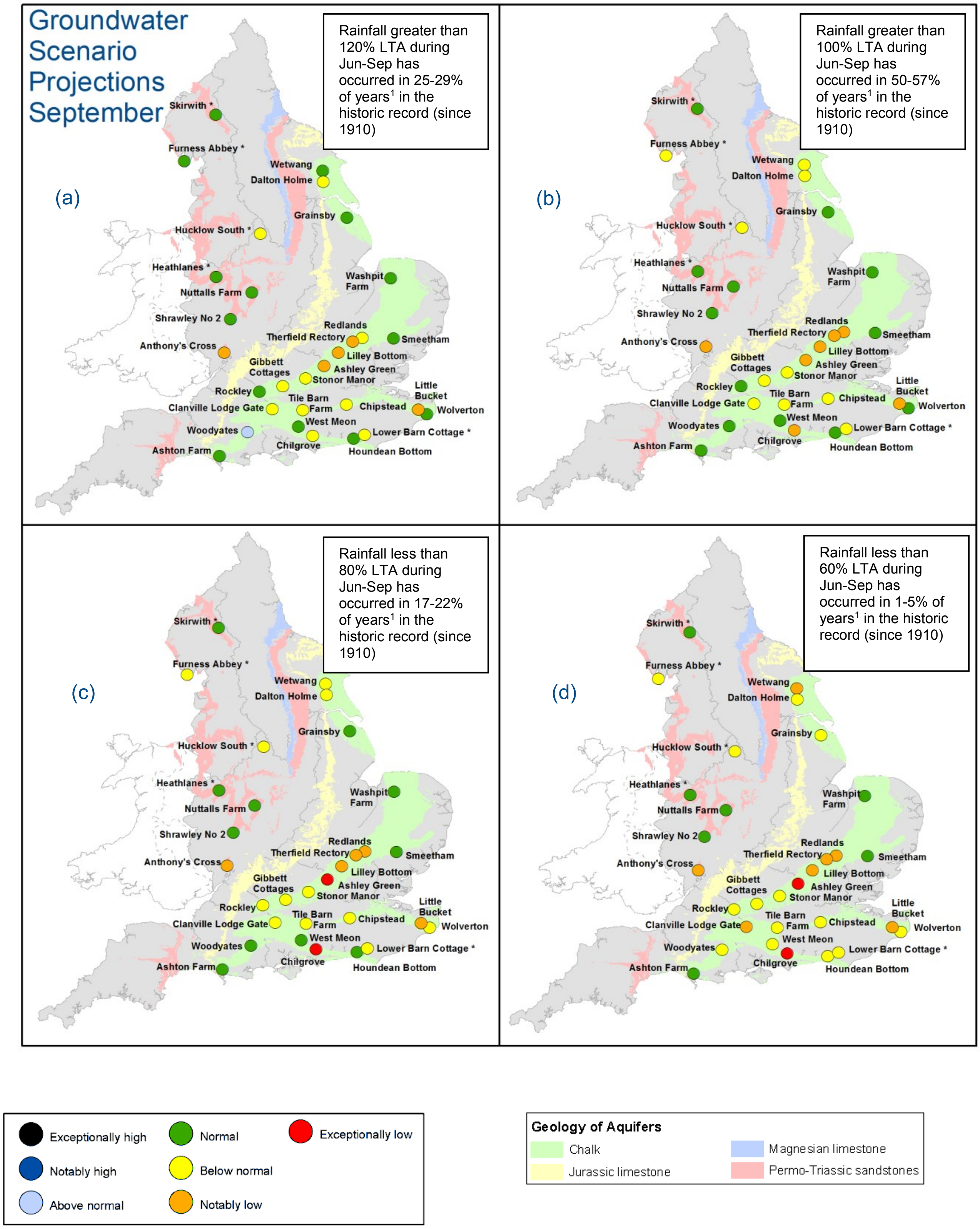

Figure 6.5: Projected groundwater levels at key indicator sites at the end of September 2017. Forecasts based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between June 2017 and September 2017 (Source: Environment Agency) Geological map reproduced with kind permission from UK Groundwater Forum BGS © NERC. Crown copyright all rights reserved. Environment Agency 100026380, 2017.

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

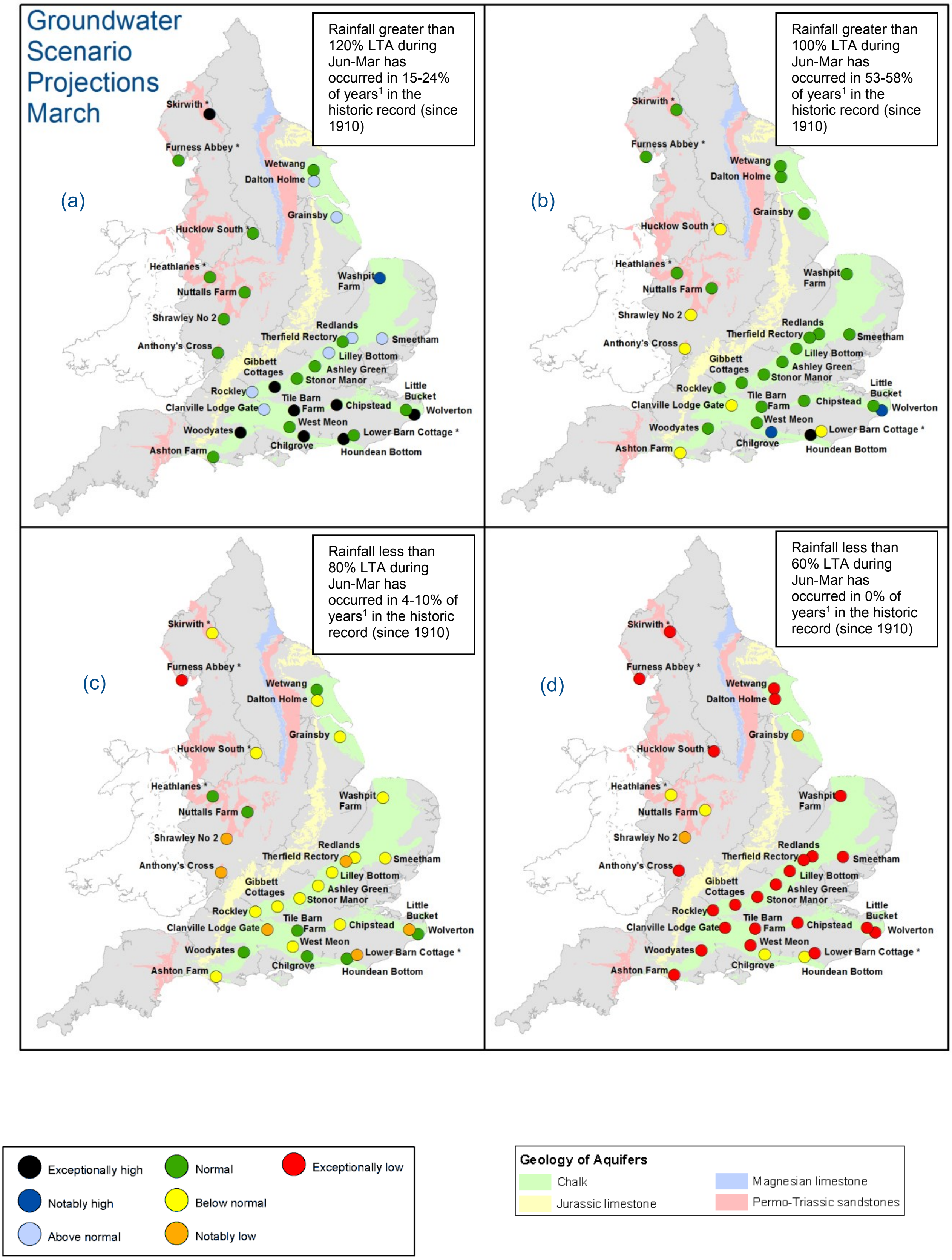

Figure 6.6: Projected groundwater levels at key indicator sites at the end of March 2018. Forecasts based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between June 2017 and March 2018 (Source: Environment Agency) Geological map reproduced with kind permission from UK Groundwater Forum BGS © NERC Crown copyright. All rights reserved. Environment Agency 100026380 2017.

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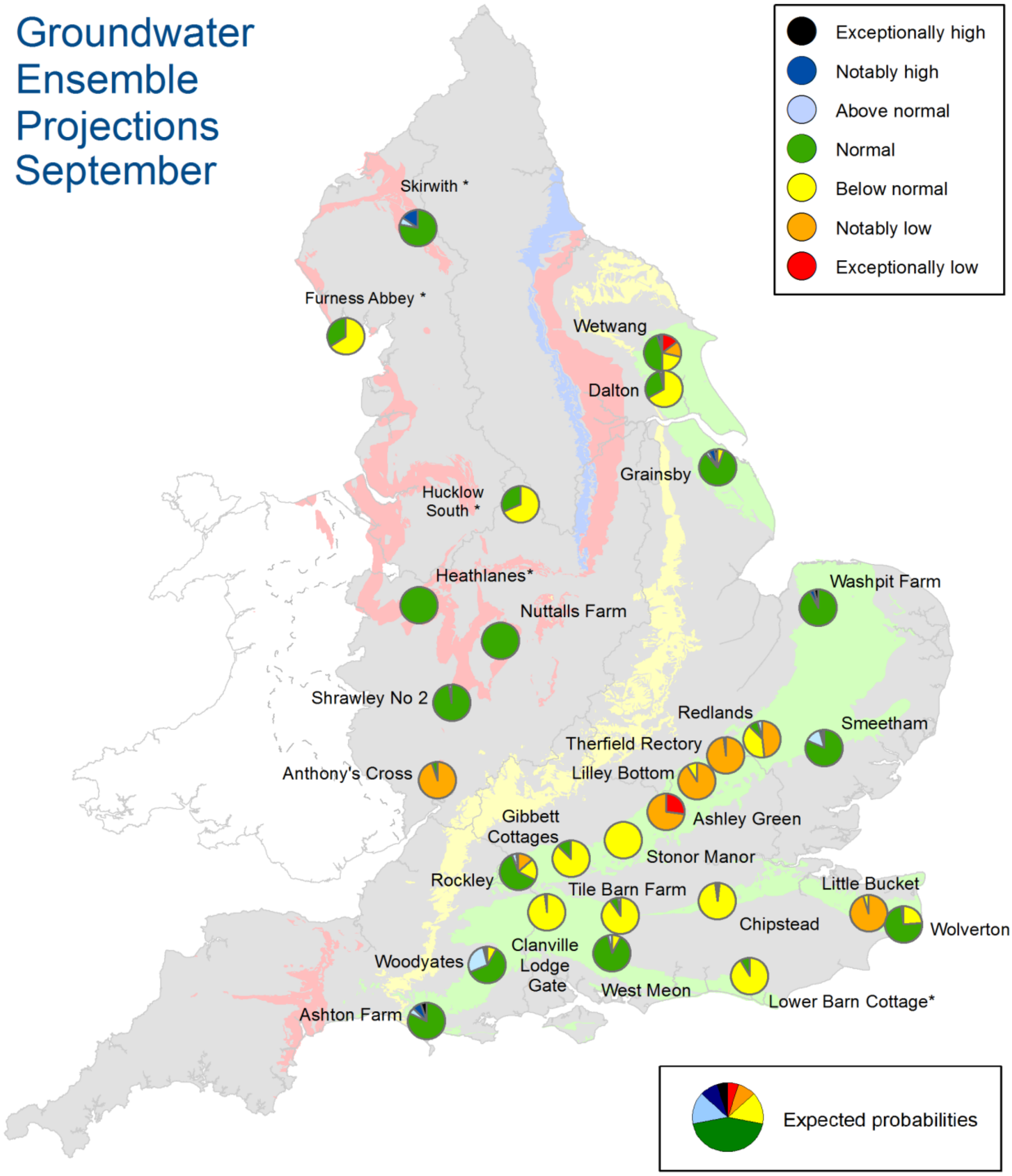
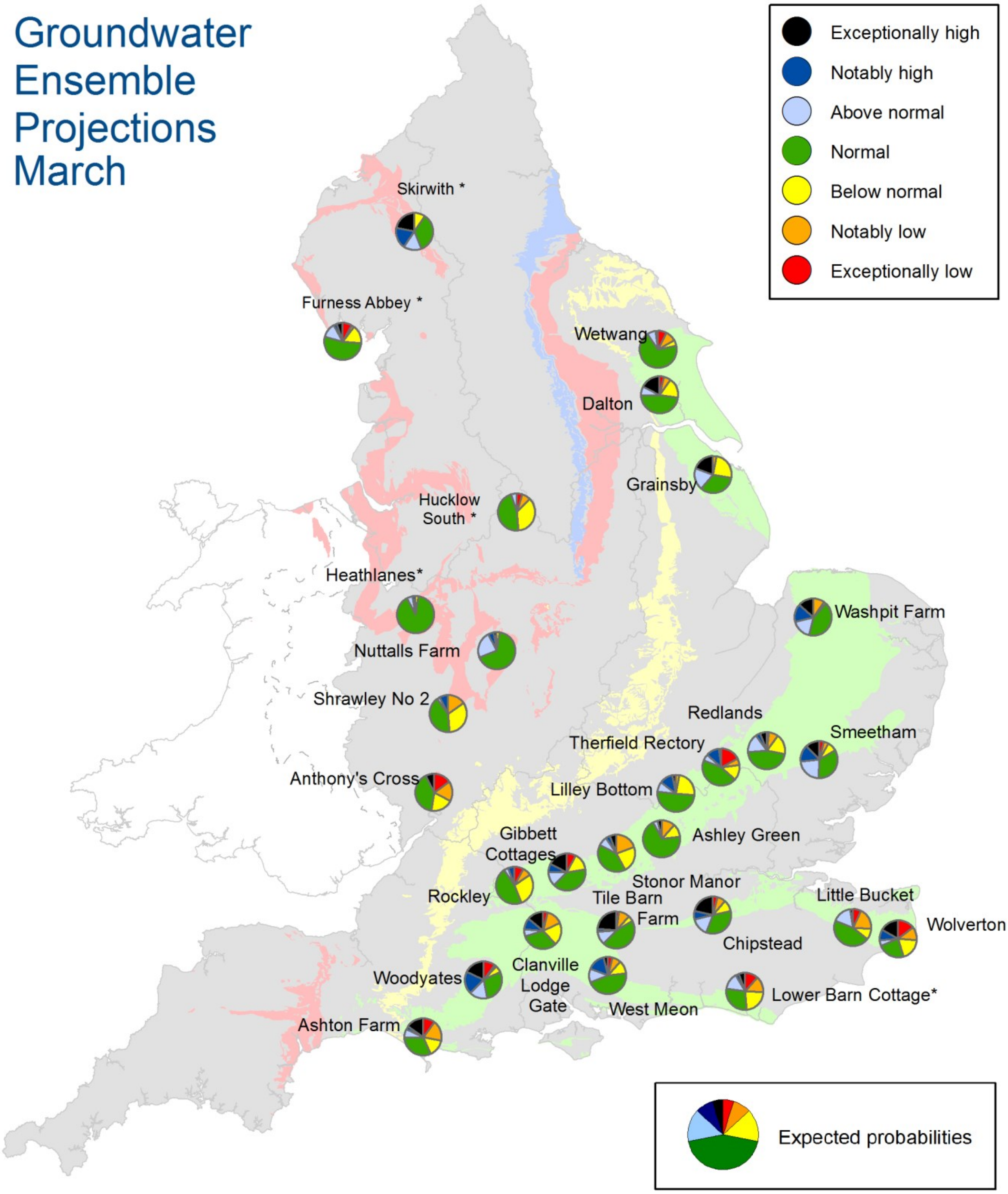


Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are 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 2017. 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, 2017.

** 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 2018. 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, 2017.

* Projections for these sites are produced by BGS

Figure 7.1: Geographic regions

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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