Monthly water situation report

England

Summary – August 2021

August rainfall totals were below average in most catchments across England and generally lower than July totals. Across much of England soils got drier during the month. River flows were classed as normal or higher for the time of year at four-fifths of indicator sites, with above average flows recorded at all of the indicator sites in south-east England. At all but one indicator site, the end of August groundwater levels were classed as normal or higher for the time of year. Total reservoir stocks for England were at 75% of total capacity at the end of August, below the long-term average for the time of year (84%).

Rainfall

The August rainfall total for England was 49mm, which represents 68% of the 1961-1990 long term average LTA (70% of the 1981-2010 LTA). Rainfall totals across much of the country were lower during August than they were in July (Figure 1.1).

Monthly rainfall totals were classed as below normal or notably low for the time of year in over half of catchments across England. In all other catchments rainfall was in the normal range for August. The highest rainfall total as a proportion of the LTA was over the Dover Chalk catchment on the Kent coast, with 68mm of rainfall representing 118% of the LTA for August. The lowest rainfall total as a proportion of the LTA was over the Witham to Chapel Hill area of Lincolnshire, with 23mm of rainfall representing only 37% of the LTA. Across all of the catchments in central England the rainfall totals were classed as either below normal or notably low.

The three month cumulative rainfall totals ending in August were classed as exceptionally low across most of Cumbria. In the River Derwent catchment in Cumbria these three month cumulative rainfall totals represented only 56% of the LTA total for June, July and August. There is a strong regional pattern to the three-month cumulative rainfall totals with below average rainfall in much of northern England and above average totals in much of south-east England. On the Isle of Wight the three-month cumulative rainfall total was classed as exceptionally high, representing 181% of the LTA. Looking back over the last year, the 12 month cumulative rainfall totals are classed as normal or higher in all catchments across England, except for the River Esk catchment (Dumfries) on the Scottish border. Here the cumulative rainfall totals were classed as notably low (Figure 1.2).

At a regional scale, August rainfall totals ranged from a notably low 56% of the LTA in east England to 85% of the LTA in south-east England, which was classed as normal for the time of year (Figure 1.3).

Soil moisture deficit

Across much of England soils got drier during August (soil moisture deficit increased). End of August soil moisture deficit (SMD) values remained smaller than the LTA for the time of year (soils were wetter than average) across much of south-east England and parts of south-west England. Soil moisture deficit values were greater than the LTA across much of east, central and northern England (soils were drier than average for the time of year) at the end of the month (Figure 2.1).

At a regional scale, the end of August SMD values meant that soils were wetter than average for the time of year in south-west and south-east England, and drier than average in north-west England. In central, east, south-east and south-west England, soils were drier at the end of August than at the end of July (Figure 2.2).

River flows

August monthly mean river flows decreased at three-quarters of the indicator sites we report on, compared to July. Despite this, flows were classed as normal or higher for the time of year at four-fifths of indicator sites. August monthly mean river flows were higher than July at all indicator sites in north-west England. At Ouse Bridge on the River Derwent and Pooley Bridge on the River Eamont July flows were classed exceptionally low,

but increased and were back in the normal range for August. On the River Till in Northumbria, monthly mean river flows dropped to 42% of the LTA and were classed as notably low for the time of year (Figure 3.1).

By contrast, monthly mean flows at almost all of the indicator sites we report on in south-east England were classed as above normal or higher, with flows at five sites classed as exceptionally high for the time of year. Of these five, the highest flow as a proportion of LTA was recorded at Udiam on the River Rother, where flows were over five-times the August long-term average (527% of LTA) (Figure 3.1).

At the regional index sites monthly mean flows ranged from being classed as below normal on the River Lune at Caton (north-west England) and on the South Tyne at Haydon Bridge (north-east England) to notably high (naturalised flows) on the Thames at Kingston (south-east England) (Figure 3.2).

Groundwater levels

Groundwater levels were in recession at all but one of the reported indicator sites during August, as is usual for this time of year. At all but one site, the end of August groundwater levels were classed as normal or higher for the time of year. The exception was in the Burford Jurassic limestone aquifer at Jackaments Bottom, where groundwater levels were classed as below normal at the end of the month. Groundwater levels at a fifth of sites were classed as either notably high or exceptionally high for the time of year (Figure 4.1).

At Priors Heyes (West Cheshire sandstone) and Coxmoor (Idle and Torne Permotriassic sandstone) the highest end of August levels on record were recorded (records go back to 1972 and 1969 respectively). Levels at Priors Heyes remain high compared to historic levels because the aquifer is recovering from the effects of historic abstraction. (Figure 4.1).

End of August groundwater levels at the major aquifer index sites ranged from being classed as notably high in the sandstone aquifers at Weir Farm (central England) and Skirwith (north-west England), and the chalk aquifer at Chilgrove (south-east England), to below normal at Jackaments Bottom (also in south-east England) (Figure 4.2).

Reservoir storage

End of August reservoir stocks decreased compared with the end of July at over four-fifths of the reservoirs and reservoir groups we report upon. Reductions of over 10% of total capacity were recorded at the Derwent Valley (-19%) and Draycote Water (-13%) reservoirs in central England, as well as at Stithians reservoirs (-11%) in south-west England. End of month reservoir stocks were classed as below normal or notably low at a quarter of reported reservoirs and reservoir groups (Figure 5.1).

At a regional scale, total reservoir stocks ranged from 66% in north-west England to 88% in east England. Total reservoir stocks for north-east, north-west and central England were below the LTA for the time of year. Total reservoir stocks for England were at 75% of total capacity at the end of August (Figure 5.2)

Forward look

The beginning of September was warm and dry across England. This warm weather is expected to continue into the second week of the month, but conditions are likely to become unsettled, with showery weather affecting many parts of the country. Heavy, thundery downpours are possible in some areas. These unsettled periods will be interspersed with brighter spells. The middle of September is likely to be a mix of unsettled conditions and drier, brighter spells, with showers or heavier rain affecting many parts of England. There is uncertainty around expected conditions for the end of the month, but chances are it will remain unsettled for the end of September across much of England.

For the 3 month period September to November, there is a higher than normal chance of near average rainfall, and a lower than normal chance of wet conditions. There is more than double the chance of a warm autumn compared to normal[1].

Projections for river flows at key sites[2]

By the end of September 2021, two-thirds of the modelled sites have a greater than expected chance of cumulative river flows being below normal or lower for the time of year, and just over a third of sites have a greater than expected chance of cumulative river flows being normal or higher for the time of year. By the end of March 2022, two-thirds of the modelled sites have a greater than expected chance of cumulative river flows being below normal or lower for the time of year.

1 Source: Met Office

2 Information produced by the Hydrological Outlook a partnership between UK Centre for Ecology and Hydrology, British Geological Survey, Met Office, Environment Agency and other devolved agencies

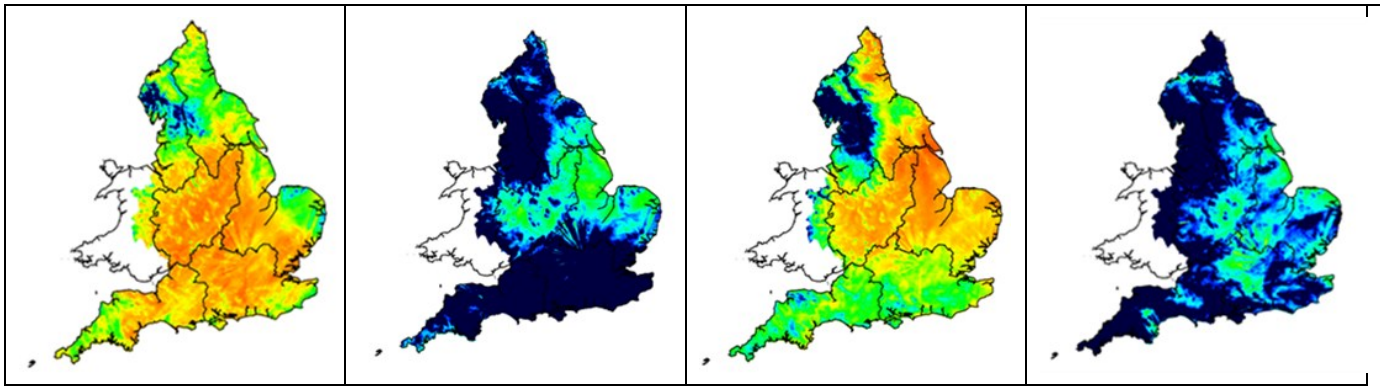
For scenario based projections of cumulative river flows at key sites by September 2021 see Figure 6.1
For scenario based projections of cumulative river flows at key sites by March 2022 see Figure 6.2
For probabilistic ensemble projections of cumulative river flows at key sites by September 2021 see Figure 6.3
For probabilistic ensemble projections of cumulative river flows at key sites by March 2022 see Figure 6.4

Projections for groundwater levels in key aquifers[2]
By the end of September 2021, nearly 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 March 2022, three-quarters of the modelled sites have a greater than expected chance of groundwater levels being normal or higher for the time of year.

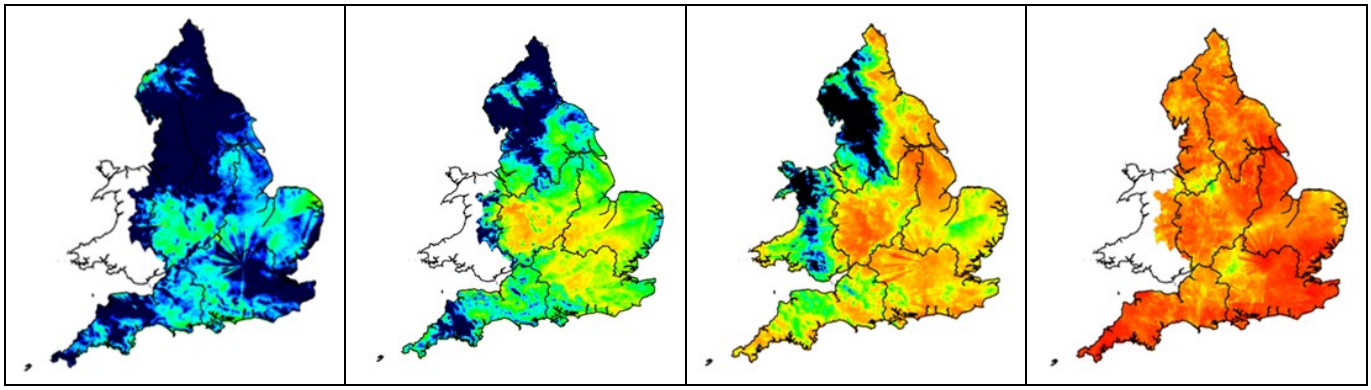
For scenario based projections of groundwater levels in key aquifers in September 2021 see Figure 6.5
For scenario based projections of groundwater levels in key aquifers in March 2022 see Figure 6.6
For probabilistic ensemble projections of groundwater levels in key aquifers in September 2021 see Figure 6.7
For probabilistic ensemble projections of groundwater levels in key aquifers in March 2022 see Figure 6.8

Authors: National Water Resources Hydrology Team

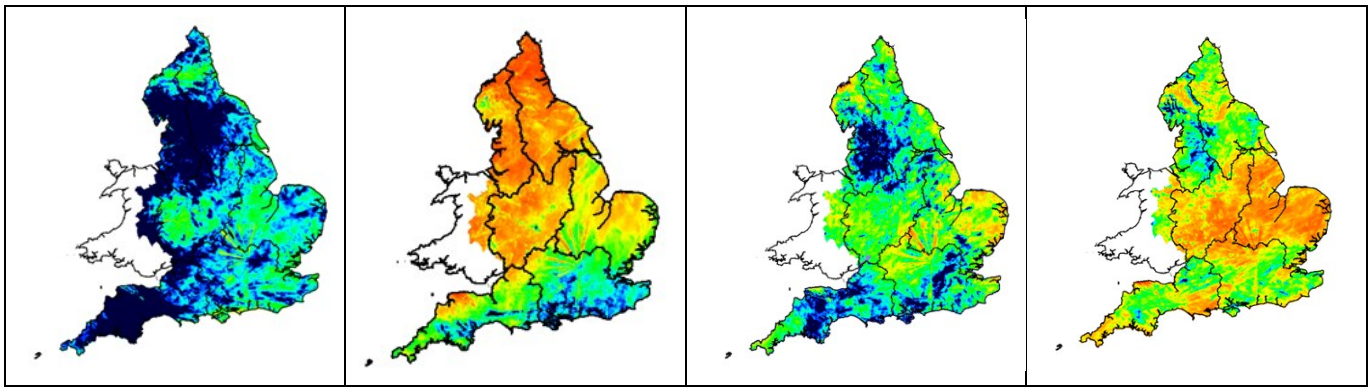
Rainfall



September 2020 | October 2020 | November 2020 | December 2020

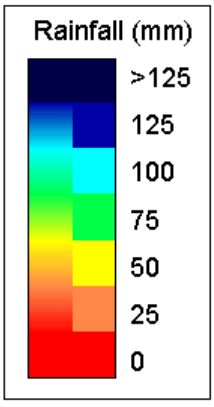


January 2021 | February 2021 | March 2021 | April 2021



May 2021 | June 2021 | July 2021 | August 2021

Figure 1.1: Monthly rainfall across England and Wales for the past 12 months. UKPP radar data (Source: Met Office © Crown Copyright, 2021). Note: Radar beam blockages in some regions may give anomalous totals in some areas. Crown copyright. All rights reserved. Environment Agency, 100024198, 2021.



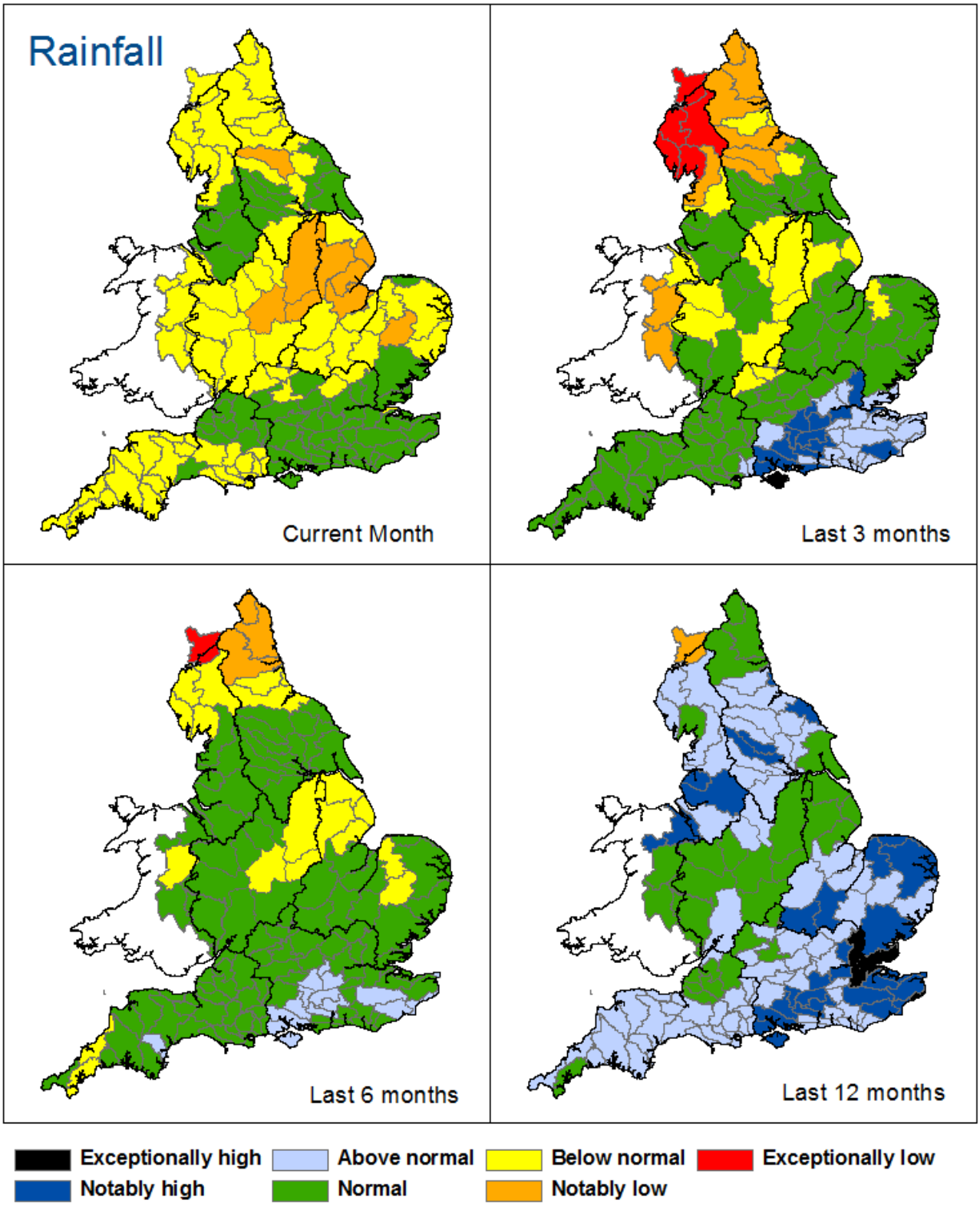


Figure 1.2: Total rainfall for hydrological areas across England for the current month (up to 31 August), the last 3 months, the last 6 months, and the last 12 months, classed relative to an analysis of respective historic totals. HadUK data based on the Met Office 1km gridded rainfall dataset derived from rain gauges *(Source: Met Office © Crown Copyright, 2021).* 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, 2021.

Rainfall charts

Above average rainfall

Below average rainfall

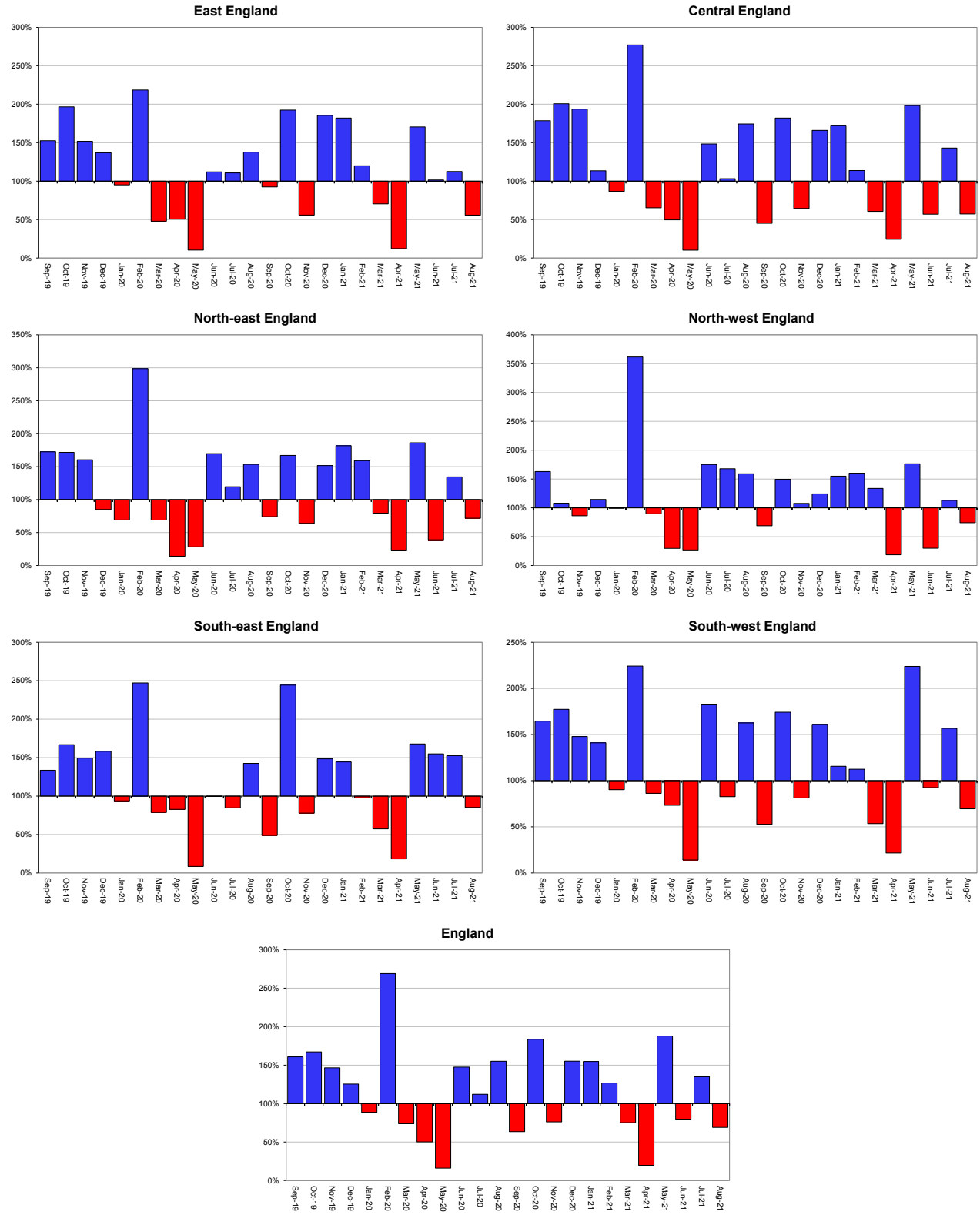


Figure 1.3: Monthly rainfall totals for the past 24 months as a percentage of the 1961 to 1990 long term average for each region and for England. HadUK rainfall data. (Source: Met Office © Crown Copyright, 2021).

Soil moisture deficit

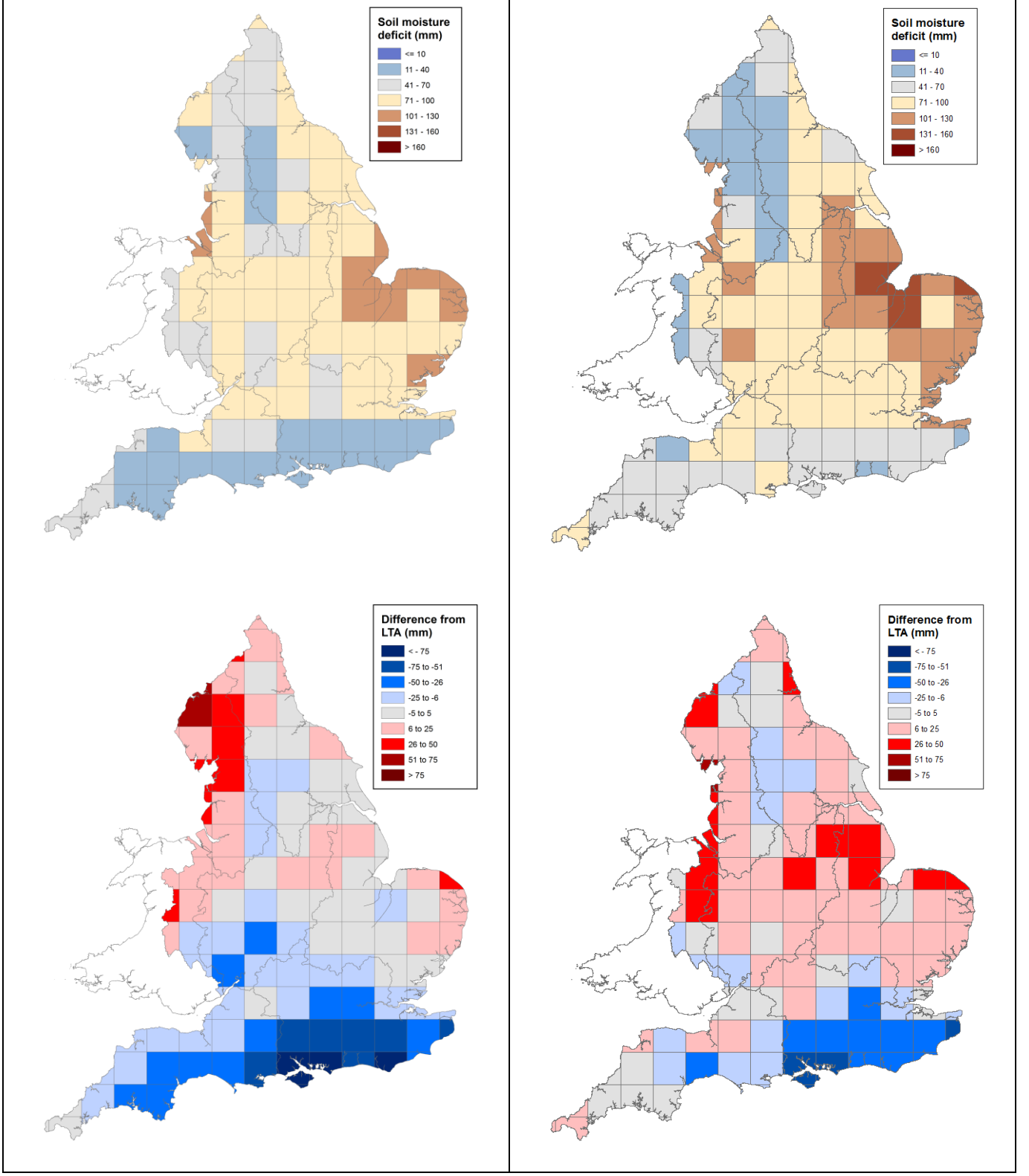
End of July 2021[1]	End of August 2021[2]
	

Figure 2.1: Soil moisture deficits for weeks ending 03 August 2021 [1] (left panel) and 31 August 2021 [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, 2021). Crown copyright. All rights reserved. Environment Agency, 100024198, 2021

Soil moisture deficit charts

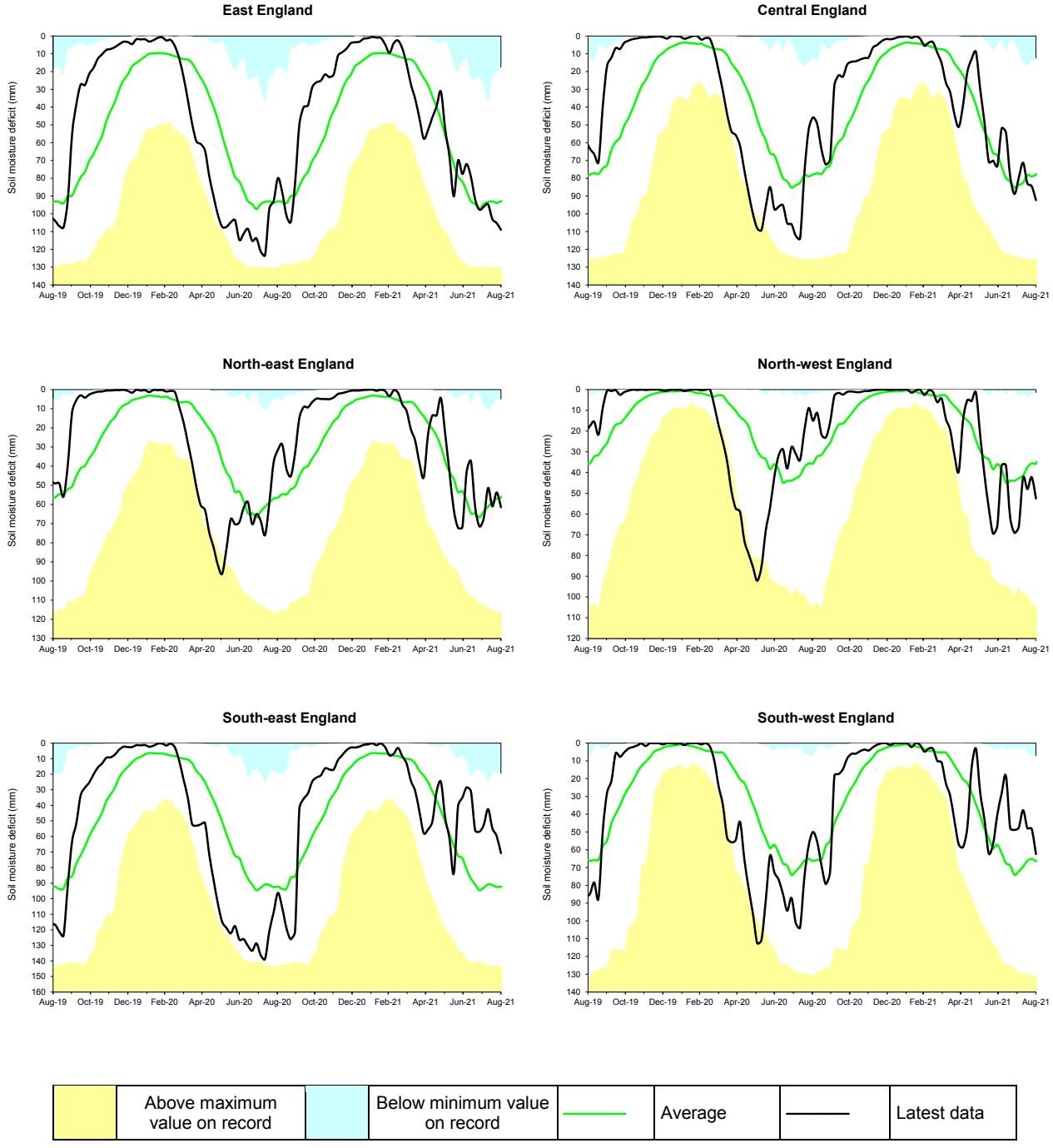
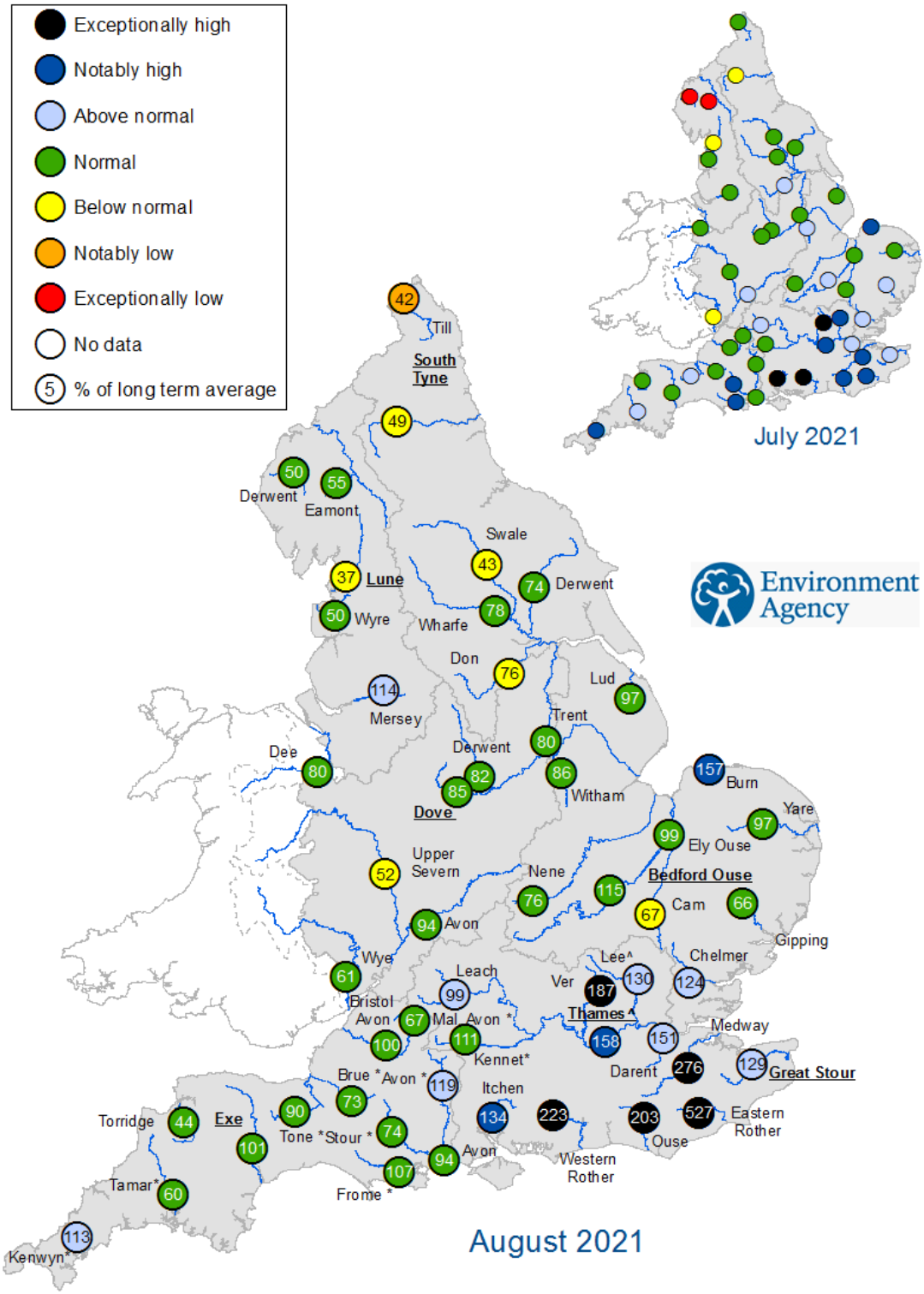


Figure 2.2: Latest soil moisture deficits for all geographic regions compared to maximum, minimum and 1961 to 90 long term average. Weekly MORECS data for real land use. (Source: Met Office © Crown Copyright, 2021).

River flows



^ "Naturalised" flows are provided for the River Thames at Kingston and the River Lee at Feildes Weir

* Flows may be overestimated at these sites the data should be treated with caution
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 July 2021 and August 2021, expressed as a percentage of the respective long term average and classed relative to an analysis of historic July and August monthly means (Source: Environment Agency). Crown copyright. All rights reserved. Environment Agency, 100024198, 2021.

River flow charts

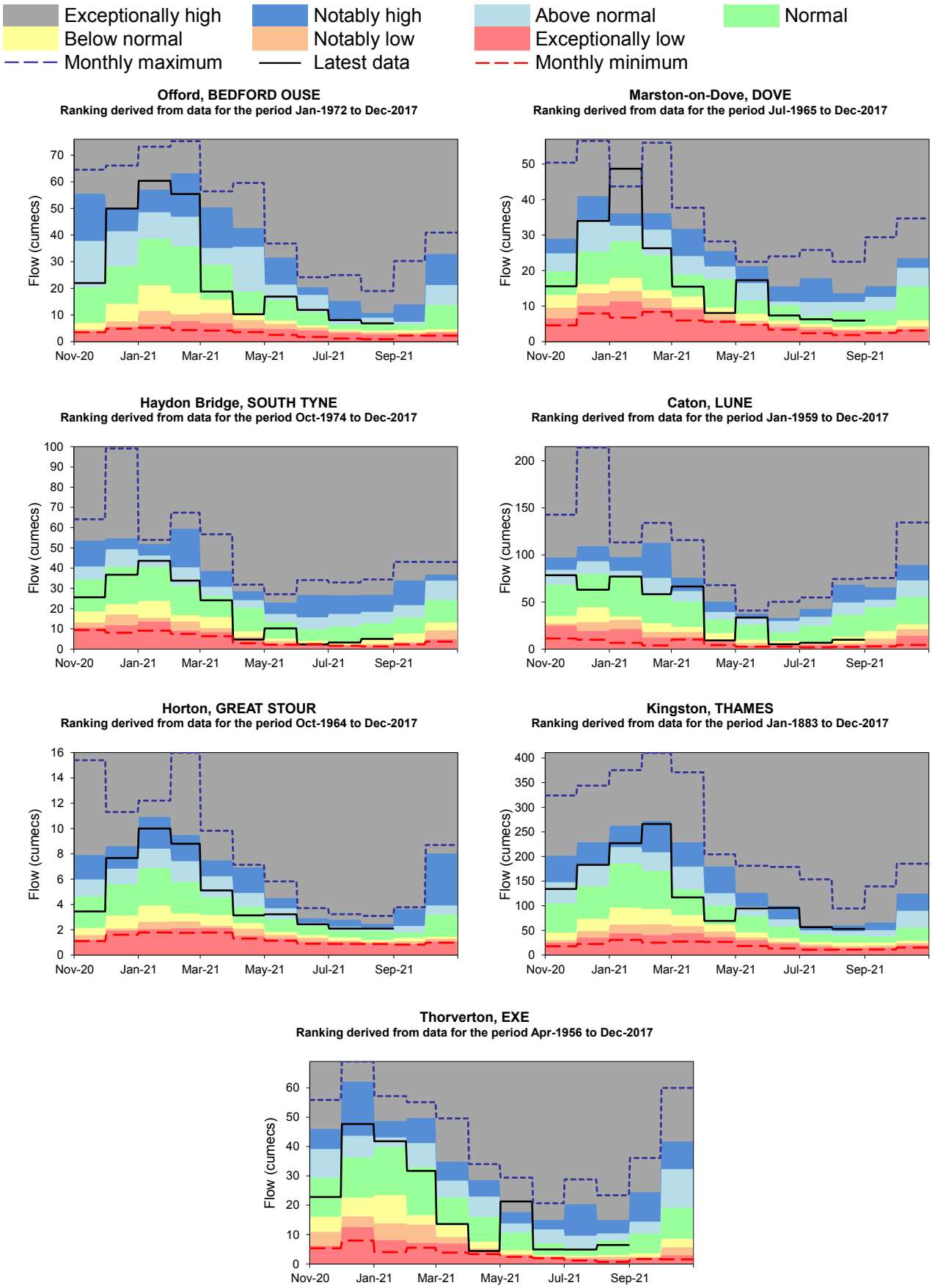
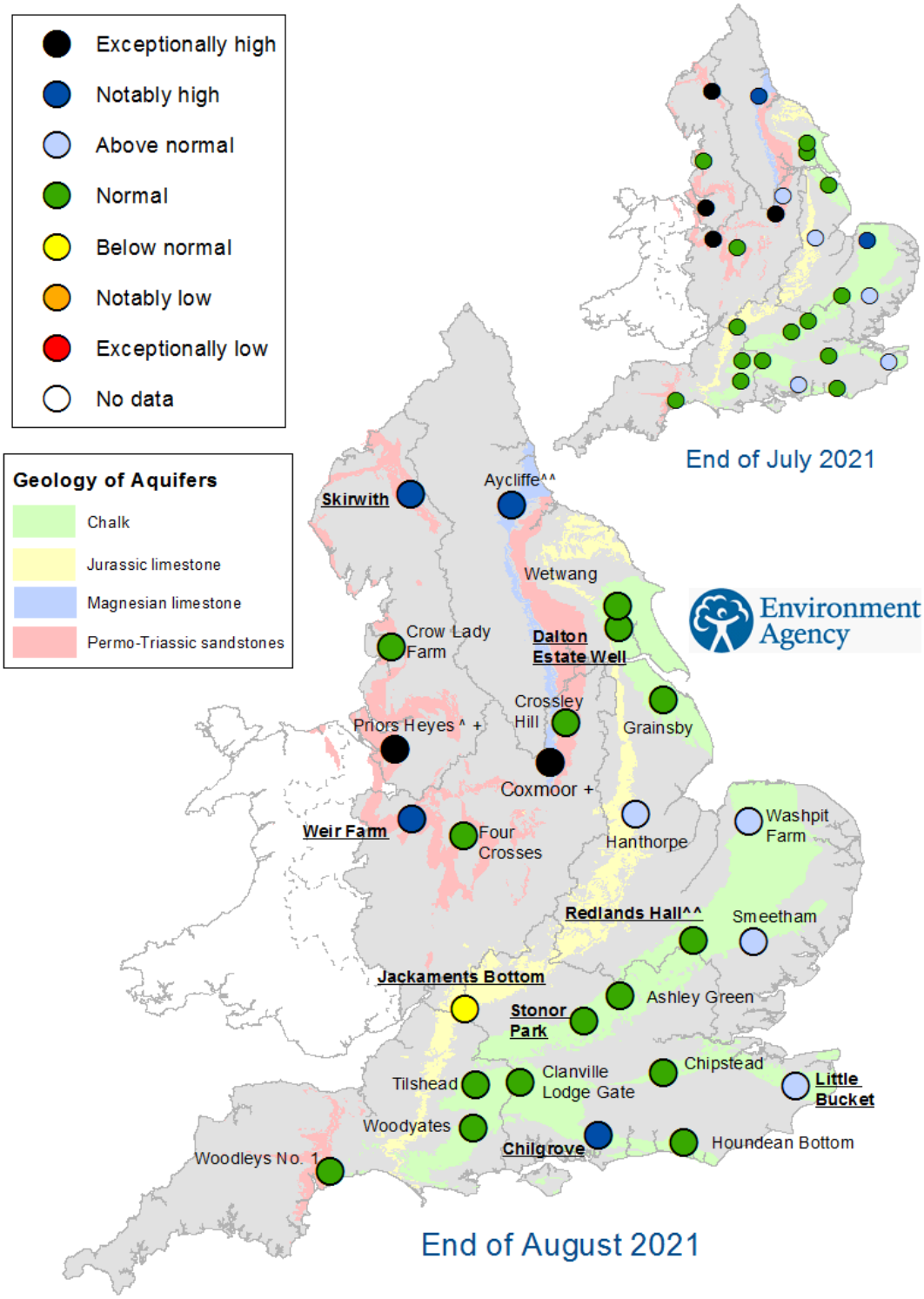


Figure 3.2: Index river flow sites for each geographic region. Monthly mean flow compared to an analysis of historic monthly mean flows, long term maximum and minimum flows. (Source: Environment Agency).

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/lowest 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 July 2021 and August 2021, classed relative to an analysis of respective historic July and August levels (Source: Environment Agency). Geological map reproduced with kind permission from UK Groundwater Forum, BGS © NERC. Crown copyright. All rights reserved. Environment Agency, 100024198, 2021.

Groundwater level charts

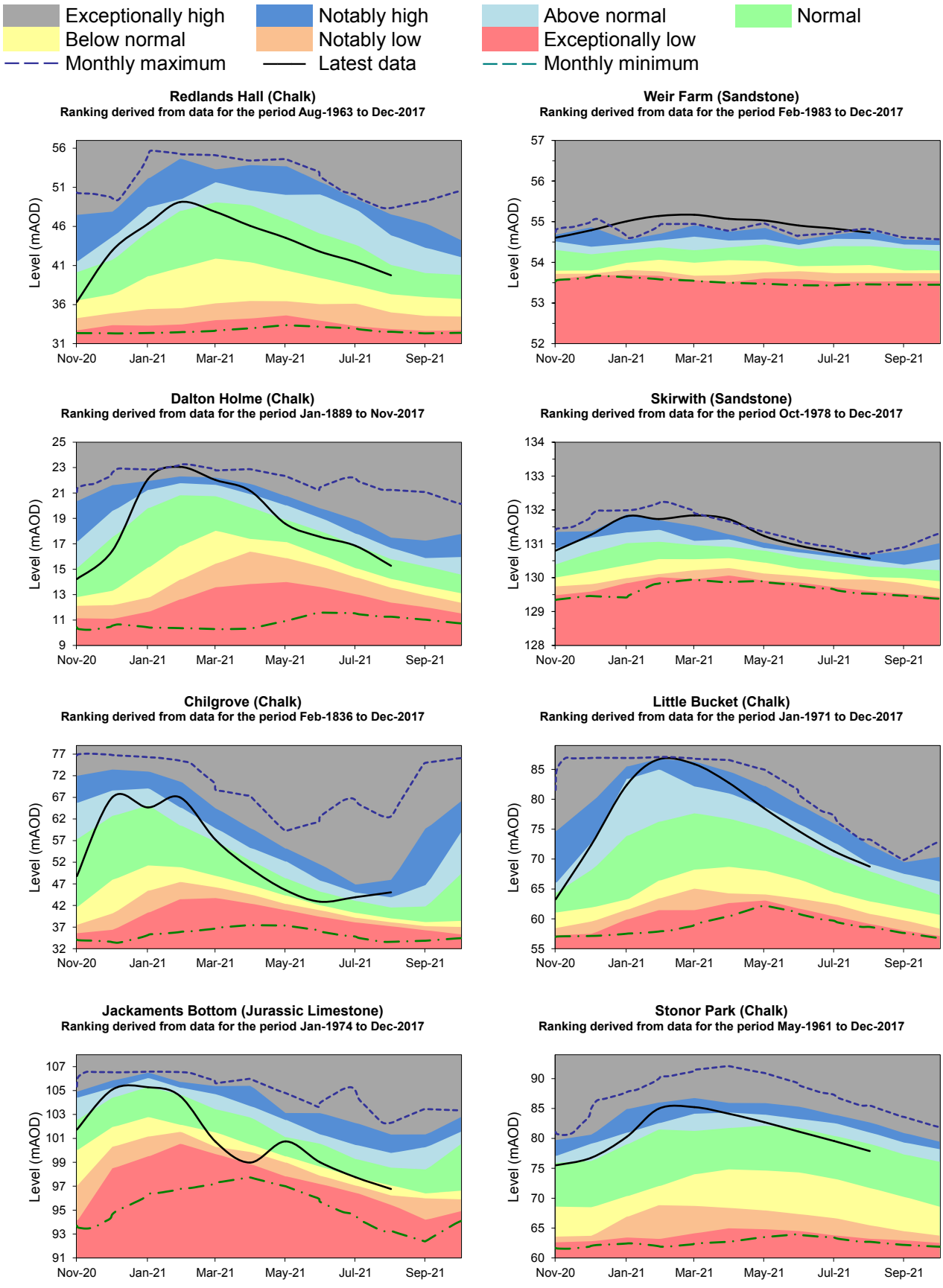
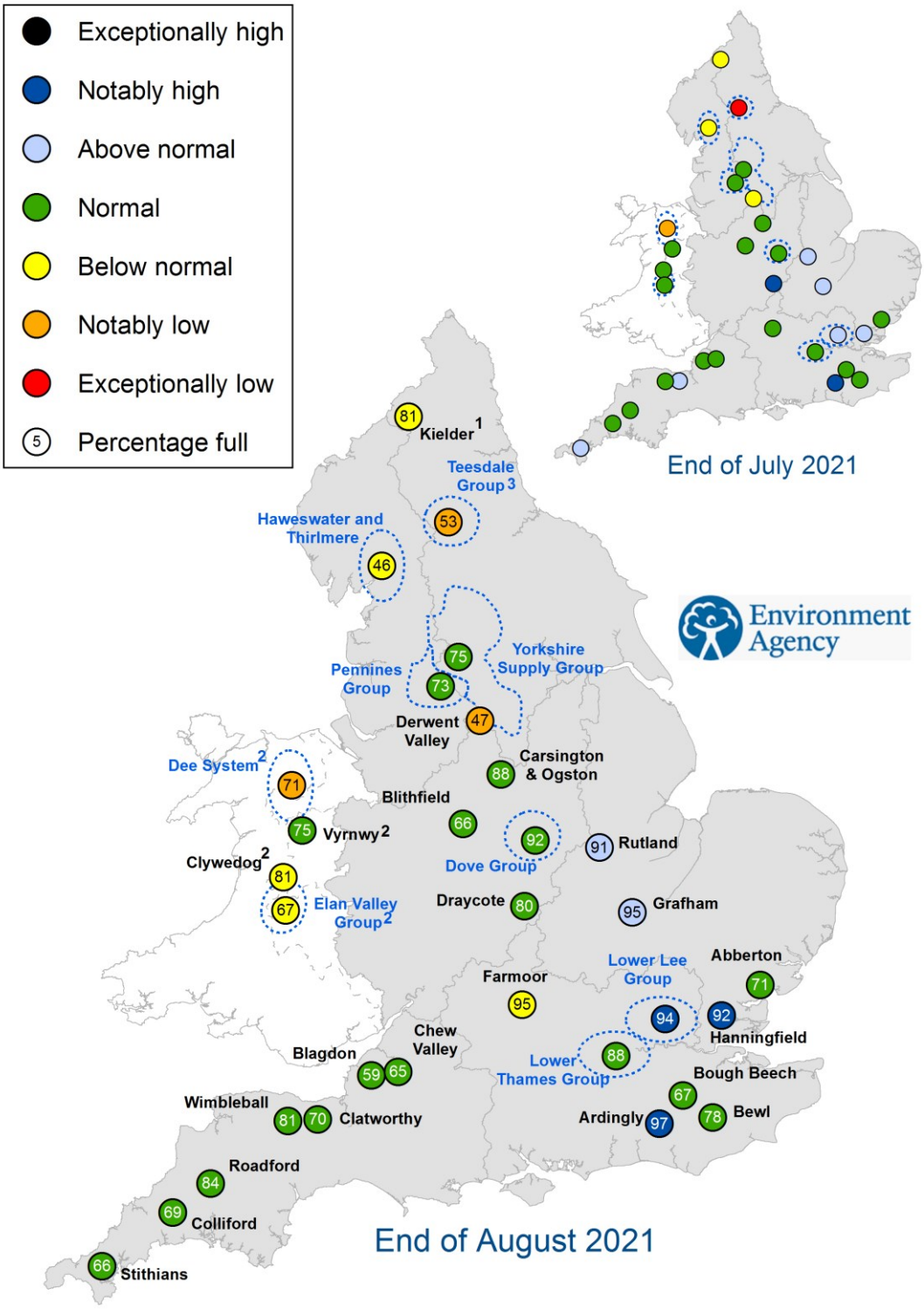


Figure 4.2: Index groundwater level sites for major aquifers. End of month groundwater levels months compared to an analysis of historic end of month levels and long term maximum and minimum levels. (Source: Environment Agency, 2021).

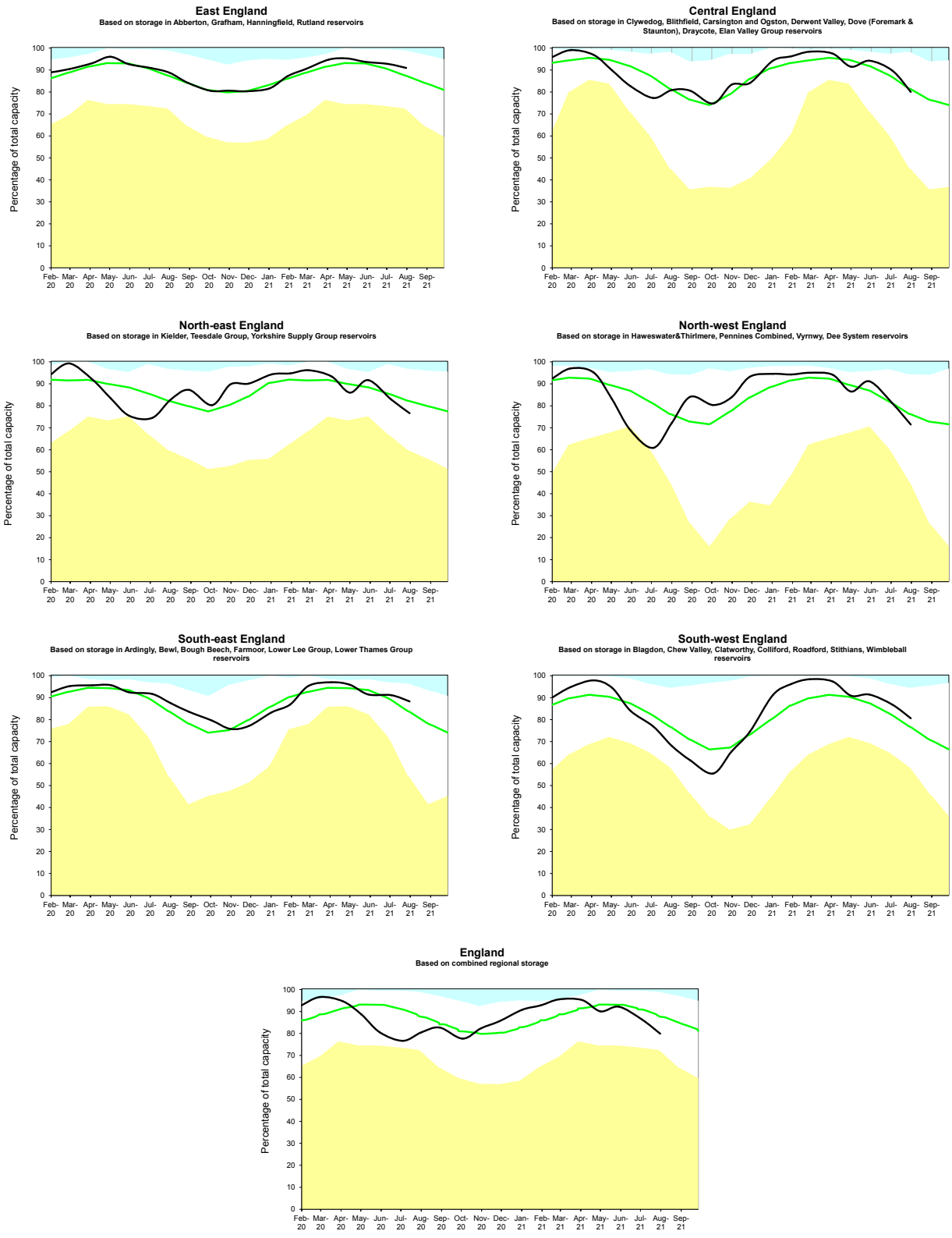
Reservoir storage



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
3. Current levels in the Teesdale Group have been drawn down for maintenance and safety inspections

Figure 5.1: Reservoir stocks at key individual and groups of reservoirs at the end of July 2021 and August 2021 as a percentage of total capacity and classed relative to an analysis of historic July and August 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



	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.

Forward look: river flow

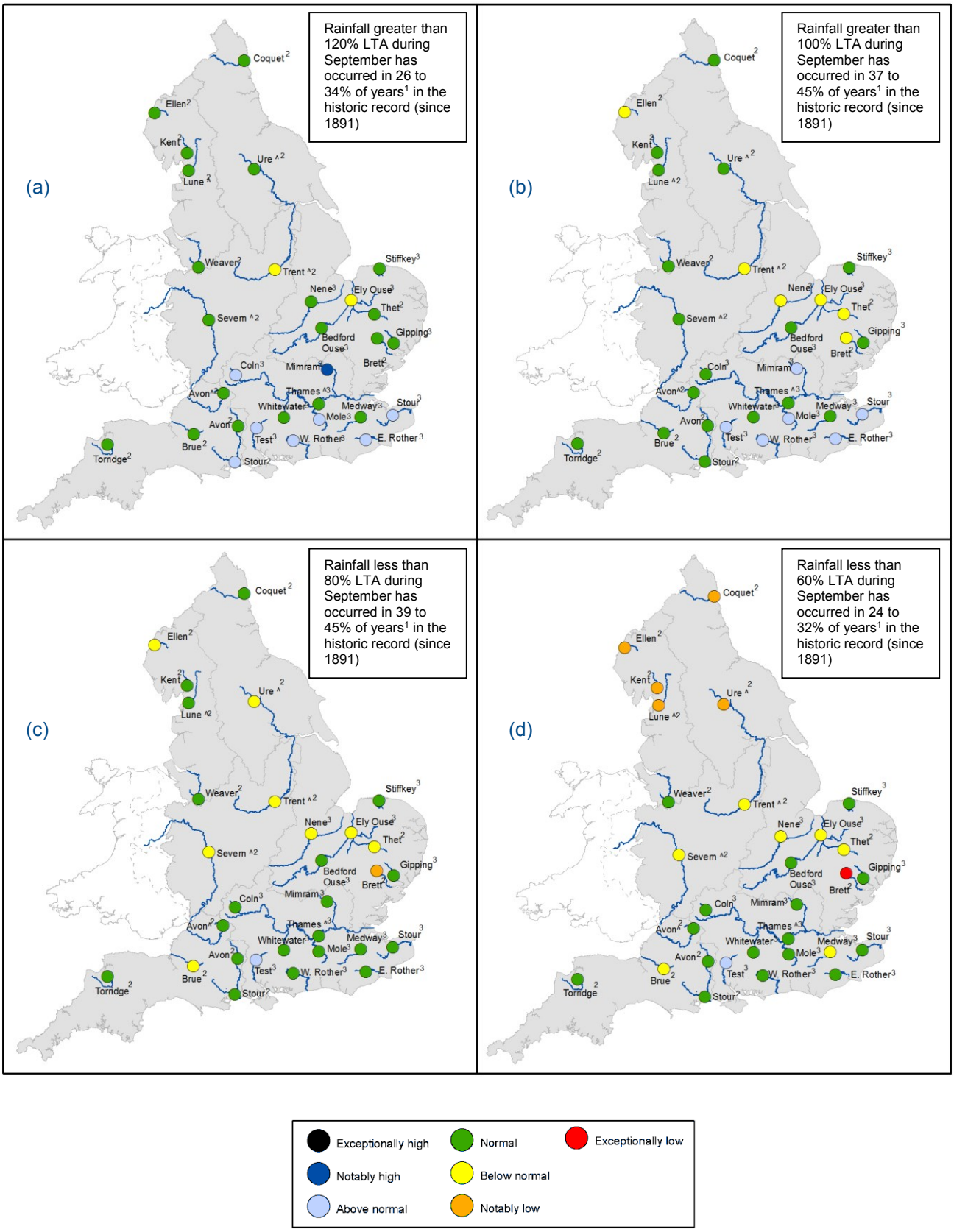


Figure 6.1: Projected river flows at key indicator sites up until the end of September 2021. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between during September 2021 (Source: Centre for Ecology and Hydrology, Environment Agency)

[1] This range of probabilities is a regional analysis
[2] Projections for these sites are produced by UKCEH
[3] Projections for these sites are produced by the Environment Agency
^ *"Naturalised" flows are projected for these sites*

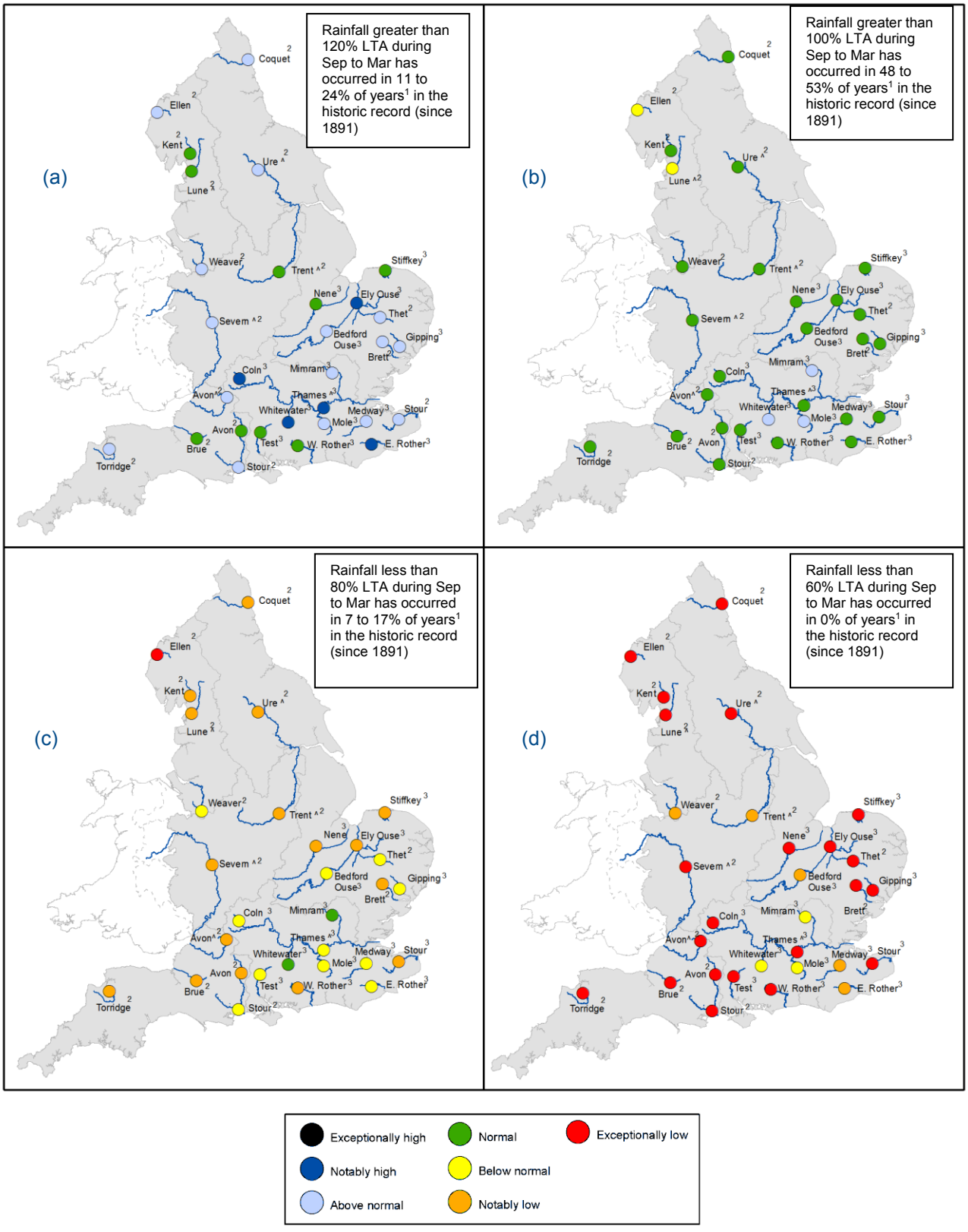


Figure 6.2: Projected river flows at key indicator sites up until the end of March 2022. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between September 2021 and March 2022 (Source: Centre for Ecology and Hydrology, Environment Agency)

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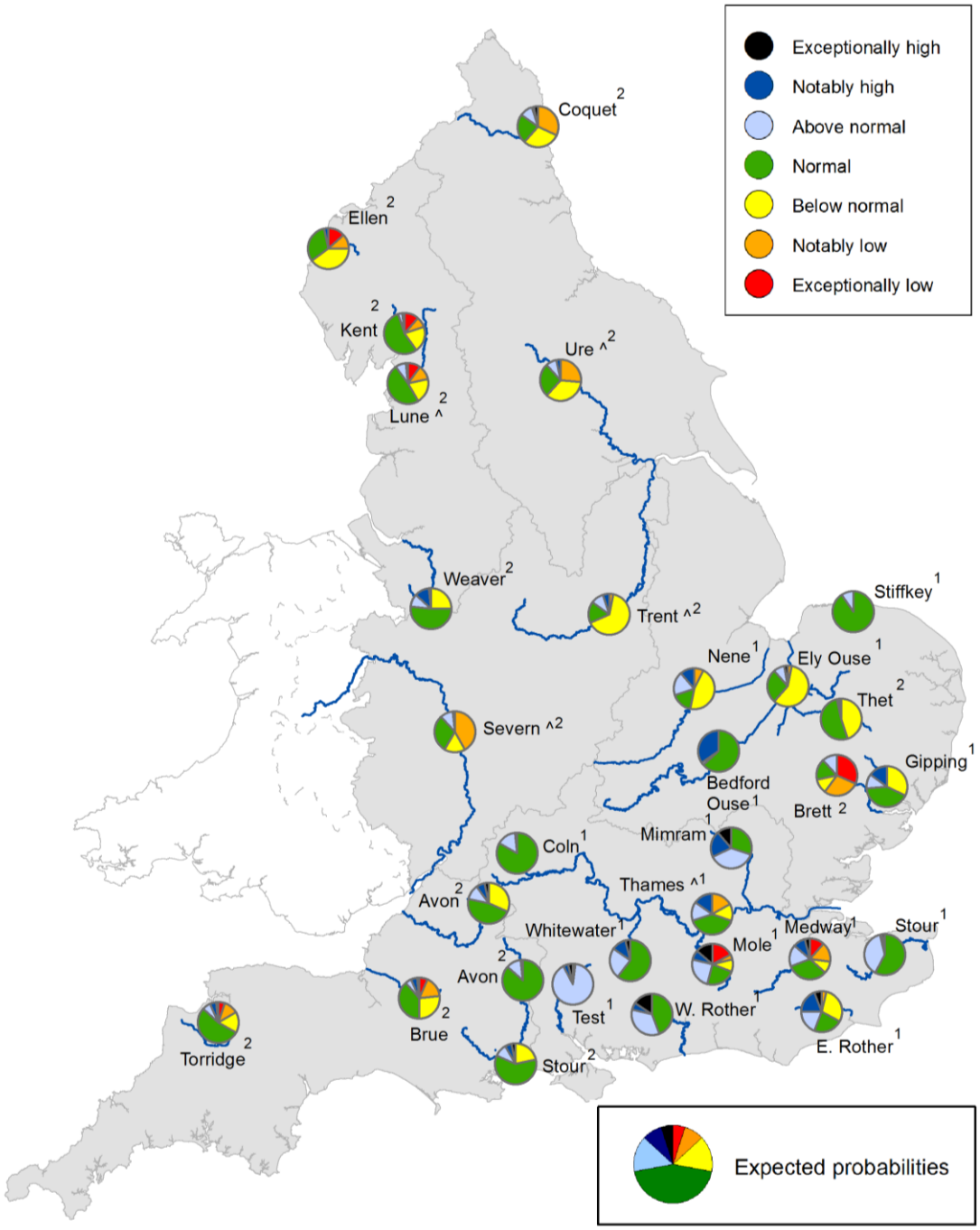

Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are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

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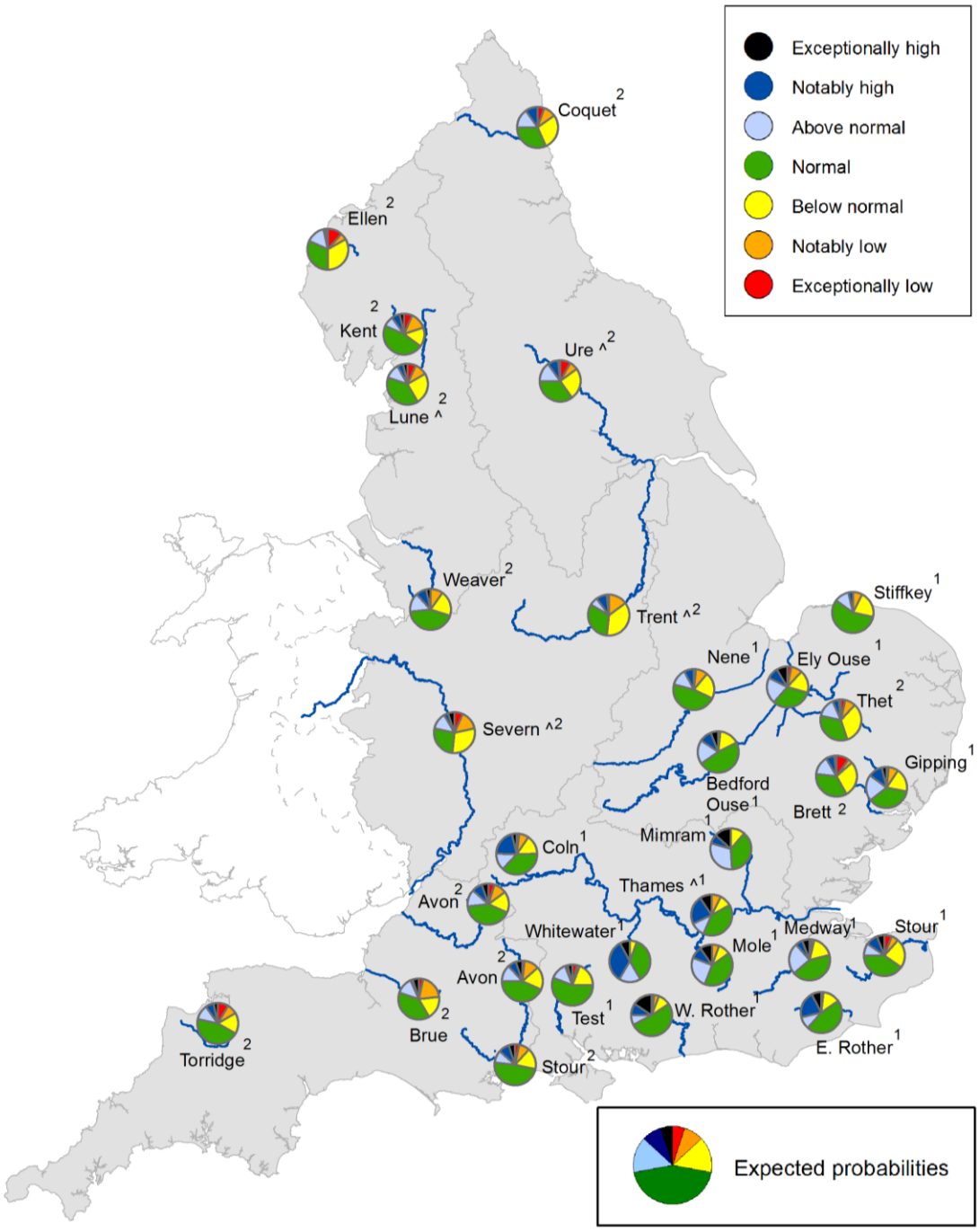
^"Naturalised" flows are projected for these sites



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 2022. 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 UKCEH
^"Naturalised" flows are projected for these sites

Forward look: groundwater

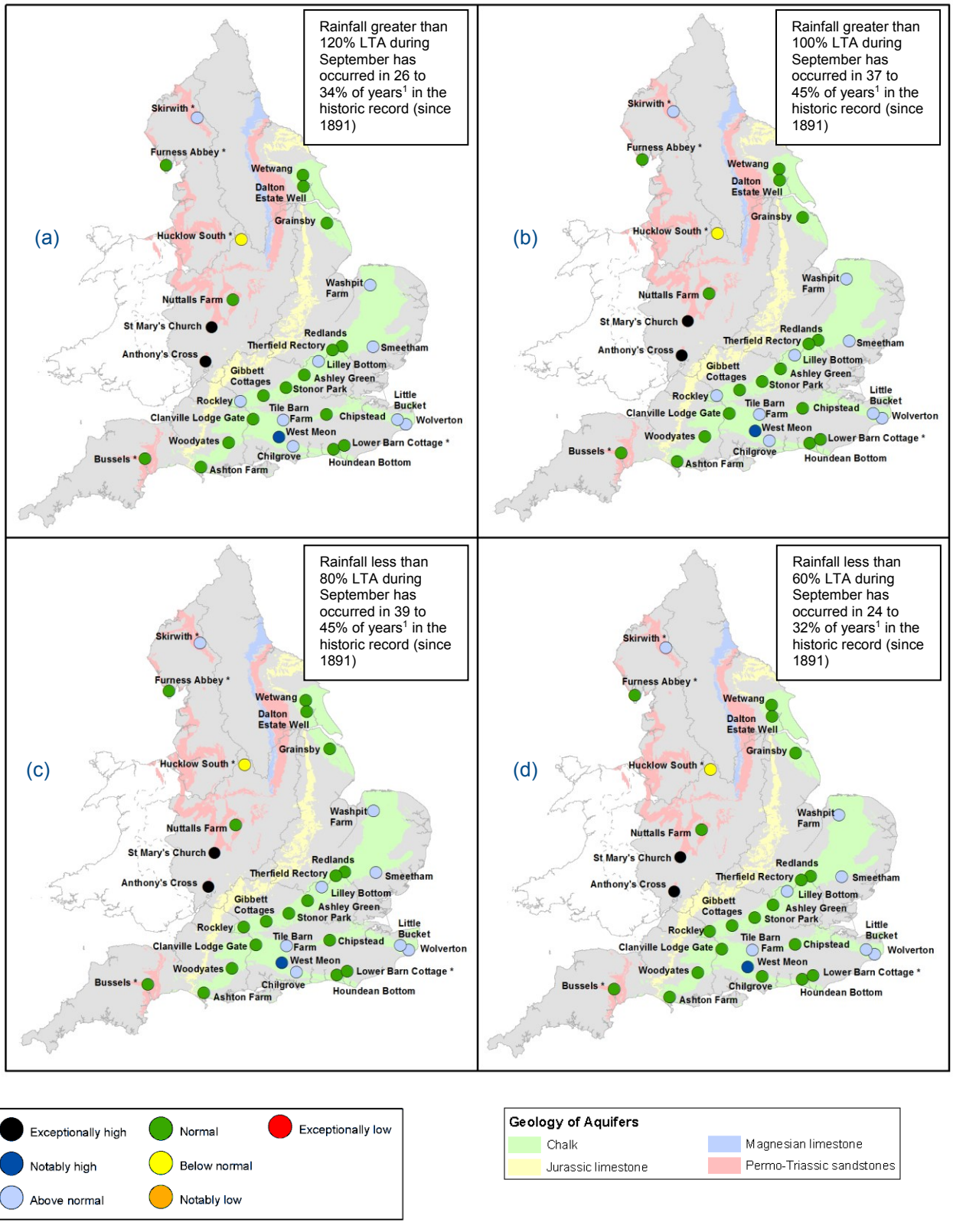


Figure 6.5: Projected groundwater levels at key indicator sites at the end of September 2021. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall during September 2021 (Source: Environment Agency) Geological map reproduced with kind permission from UK Groundwater Forum BGS © NERC. Crown copyright all rights reserved. Environment Agency 100024198, 2021.

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

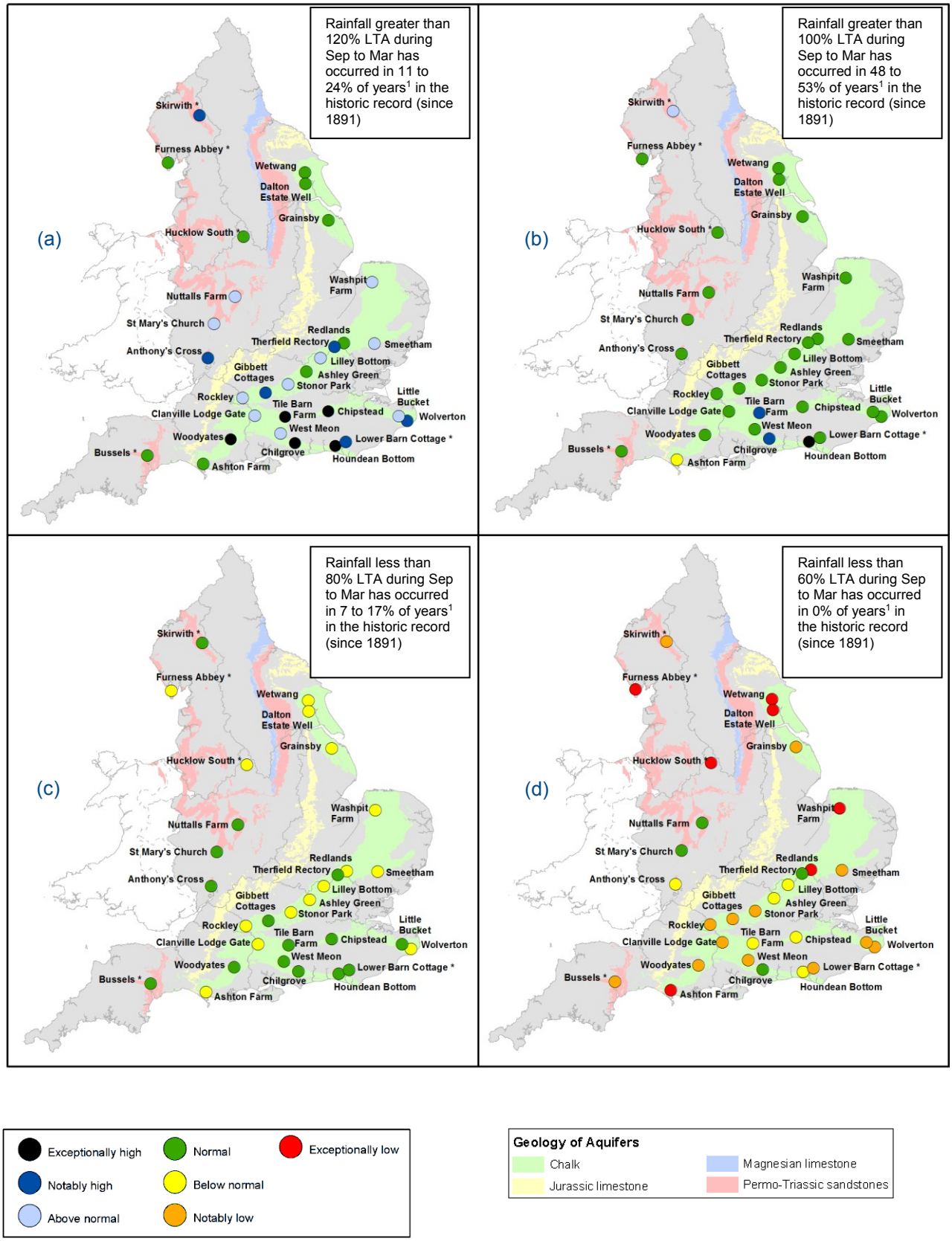
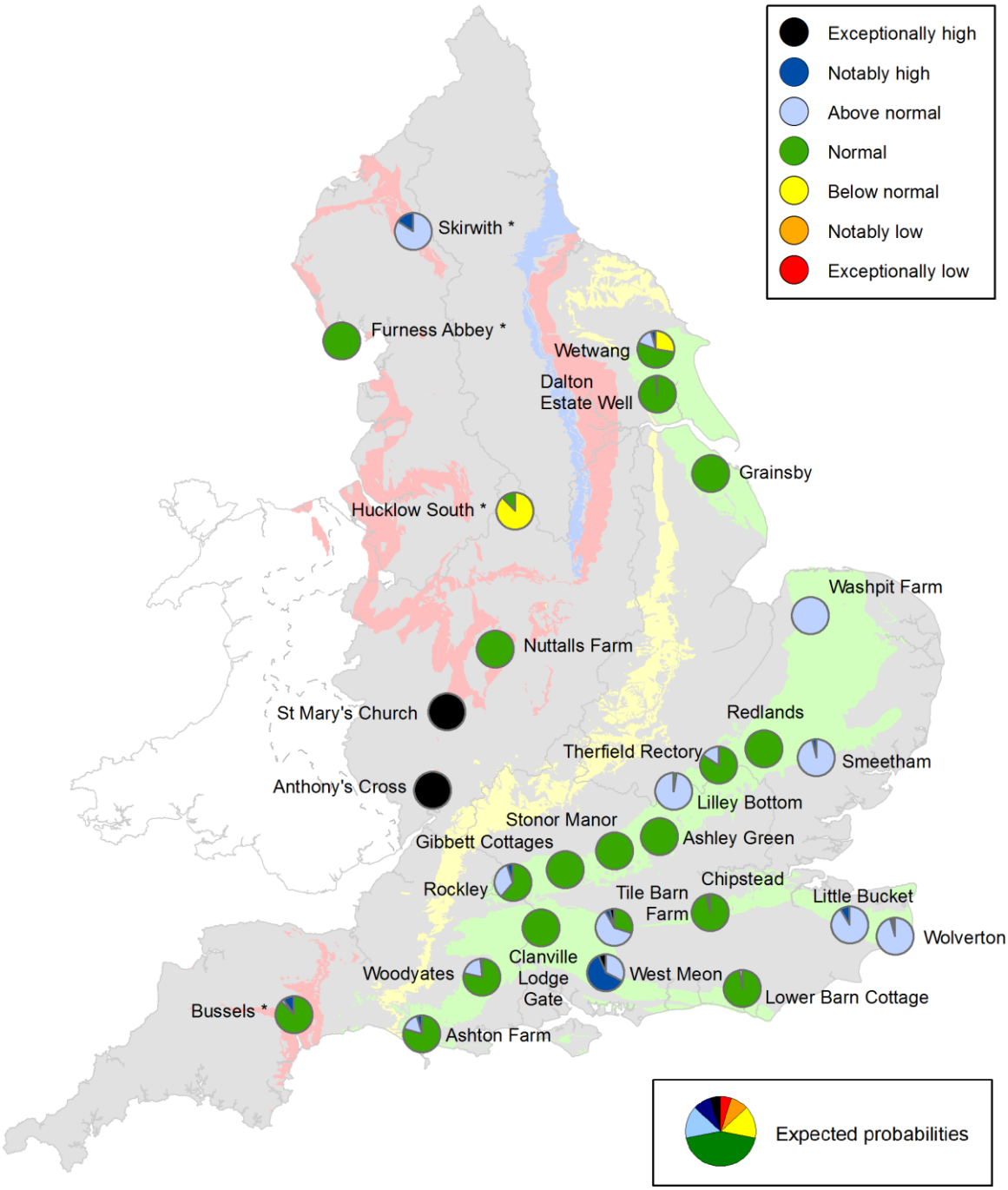


Figure 6.6: Projected groundwater levels at key indicator sites at the end of March 2022. Projections based on four scenarios: 120% (a), 100% (b), 80% (c) and 60% (d) of long term average rainfall between September 2021 and March 2022 (Source: Environment Agency) Geological map reproduced with kind permission from UK Groundwater Forum BGS © NERC Crown copyright. All rights reserved. Environment Agency 100024198 2021.

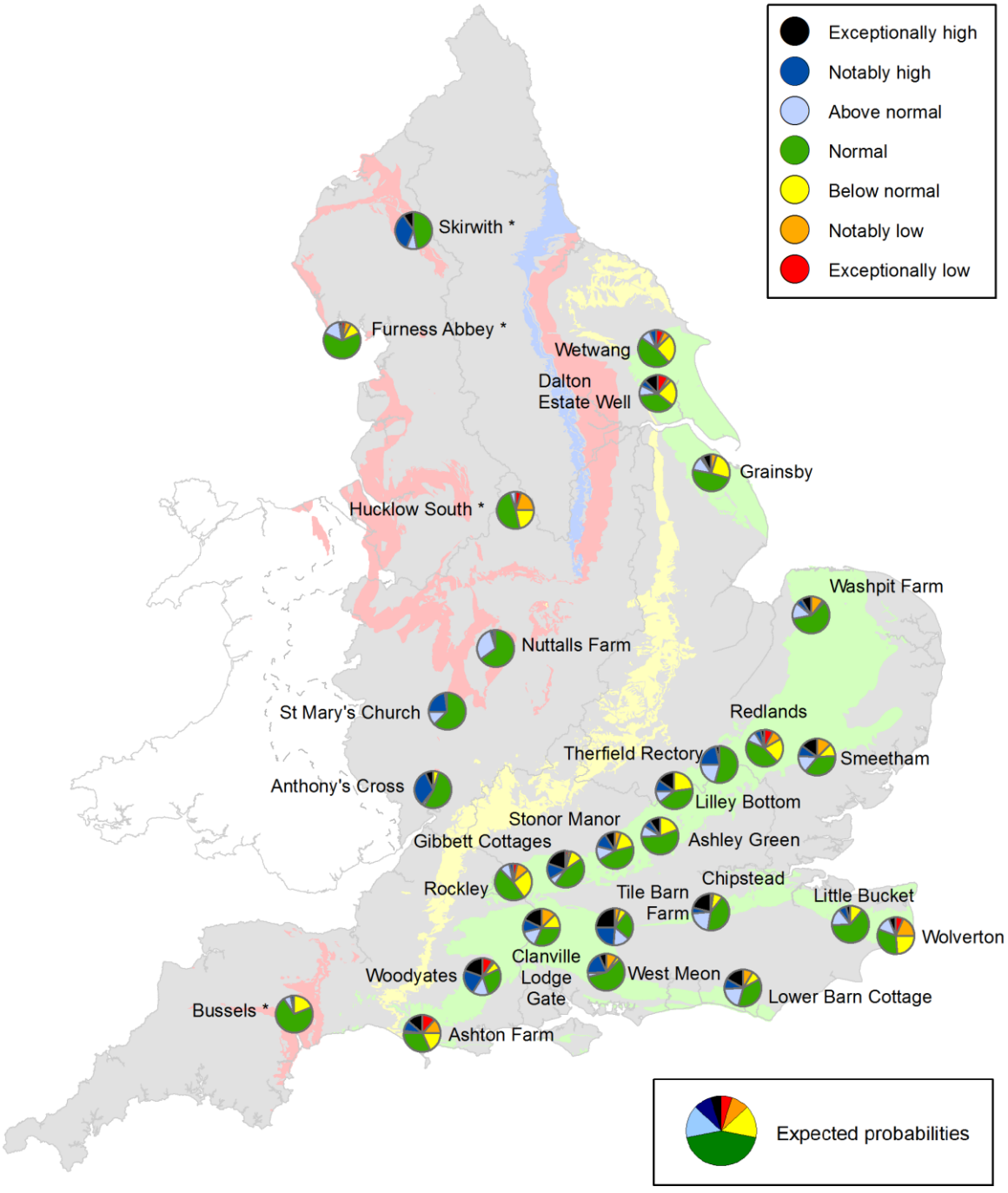
* Projections for these sites are produced by BGS
[1] This range of probabilities is a regional analysis



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 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, 2021.

** 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 2022. 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, 2021.

* 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