

Monthly water situation report: North West England

1 Summary – February 2024

1.1 Rainfall

February has continued the trend of what has been a very wet winter, predominantly characterised by the succession of low pressure systems from the Atlantic Ocean throughout the month.

Rainfall for North West England as a whole was classed as Above normal for February, at 176% of the long term average (LTA). Cumbria and Lancashire (CLA) observed 171% of the LTA for February, classed as Above normal; with Greater Manchester, Merseyside, and Cheshire (GMC) observing 196% of the LTA, classed as Exceptionally high.

The highest rainfall (in terms of the LTA) was observed in the Douglas hydrological area (221% of the LTA), which was classed as Exceptionally high, and was ranked as the fifth wettest February since 1871 (153 years). The lowest rainfall was recorded in the Eden hydrological area (126% of the LTA), which was classed as Normal. In the south of the North West, the Ribble, the Mersey and Irwell, and the Cheshire Rivers Group hydrological areas all received rainfall higher than 190% of their LTAs, all classed as Notably high. Along the Cumbrian coast and Morecambe Bay, the Derwent, the Esk (Cumbria), the Kent, and the Wyre and Lune hydrological areas received less rainfall (in terms of their LTAs) and were all classed as Above normal. The Eden, and the Esk (Dumfries) hydrological areas, received the lowest amount of rainfall in terms of the LTA, and were classed as Normal. This is likely to be due to the rain shadow effect of the Cumbrian Mountains and the Southern Uplands has on the Eden, and the Esk (Dumfries) hydrological areas respectively.

The 3-month cumulative rainfall totals, which covered the same period as the meteorological winter (1 December to 29 February), displays a broadly similar trend to the February rainfall, with the Eden hydrological area (classed as Notably high), and the Esk (Dumfries) hydrological area (classed as Above normal). All other hydrological areas were classed as Exceptionally high. It is worth noting, this was the second wettest meteorological winter for GMC since 1871; the third wettest for the Esk (Cumbria), the Kent, the Mersey and Irwell, and the Douglas hydrological areas; the fourth wettest for Lancashire, the Ribble, and the Wyre and Lune hydrological areas; and the fifth wettest for North West England, Cumbria, and the Cheshire Rivers Group hydrological area.

The 6-month cumulative rainfall totals, which includes both the meteorological autumn (1 September to 30 November) and winter, shows almost all of the North West being classed as Exceptionally high, with the exception of the Esk (Dumfries) hydrological area, which was classed as Normal. The 6-month period ending in February has also been a record-breaking period, with GMC recording its wettest meteorological autumn and winter combined since 1871 at 748mm, breaking the previous record of 743mm in 2001. Similarly, the Mersey and Irwell hydrological area recorded its highest rainfall for the 6-month period with 849mm, breaking its previous record of 836mm in 2020; and also the Douglas hydrological area, which recorded 831mm, breaking its previous record of 813mm in 2001. This was also the second wettest 6-month period for North West England, Cumbria, the Esk (Cumbria), the Derwent, the Cheshire Rivers Group, the Kent, and the Wyre and Lune hydrological areas; the third wettest 6-month period for Lancashire, and the Ribble hydrological area; and the fifth wettest 6-month period for the Eden hydrological area.

The 12-month cumulative rainfall totals replicate the trend seen in the 6-month cumulative rainfall totals, with nearly all hydrological areas being classed as Exceptionally, whilst the Esk (Dumfries) was classed as Normal. The 12-month period ending in February, was also the wettest for the Esk (Cumbria) hydrological area since 1871, with a cumulative rainfall of 2303mm, which broke its previous record of 2261mm in 2016; the Kent hydrological area, at 2412mm, which broke its previous record of 2290 mm (2016) by more than 100mm; and also the Douglas hydrological area, at 1434mm, breaking its previous record of 1371mm in 2020. The 12-month period ending in February was also the second wettest for North West England, Lancashire, the Cheshire Rivers Group, the Mersey and Irwell, the Ribble, and the Wyre and Lune hydrological areas since 1871; the third wettest 12-month period for Cumbria, and the Eden hydrological area; and the fourth wettest 12-month period for the Derwent hydrological area.

1.2 Soil moisture deficit and recharge

In response to the rainfall received throughout February, soil moisture deficits (SMD) at the end of February decreased compared to the levels at the end of January. SMD levels across North West England fell within the range of 0 to 1mm, lower than expected for the time of year.

1.3 River flows

Please note that we have now increased the number of river flow sites which we report from nine to 18 sites in total. These new sites are, in alphabetical order of the gauging stations, River Ellen at Bulgill; River Esk at Cropple How; River Yarrow at Croston; River Duddon at Duddon Hall; River Hodder at Hodder Place; River Eden at Kirkby Stephen; River Alt at Kirkby; River Lune at Lunes Bridge; and River Kent at Sedgwick.

As expected, river flows in February reflected the pattern of rainfall during the month, with flows characterised by multiple peaks generated by successive low pressure systems, interspersed with short periods of drier weather. In general, monthly mean flows were higher towards the southern areas of North West England. With all rivers in Lancashire and in GMC recording higher percentages of their LTA, (ranging from 145% to 207%), compared with rivers in Cumbria, (ranging from 101% to 144%).

In addition, reflecting the rain shadow effect seen in the rainfall pattern, the lowest monthly mean river flows in terms of the LTA were recorded across the Eden valley in the Eamont catchment, in the Eden catchment at Kirkby Stephen (Upper Eden), and Sheepmount (Lower Eden), and in the Lune catchment at Lunes Bridge (Upper Lune), which were all classed as Normal, and are on the leeward side of the Cumbrian Mountains. The lowest monthly mean river flow in February in terms of the LTA was recorded in the Eden catchment at Kirkby Stephen (101% of the LTA).

Conversely, on the windward side along the Cumbrian coast, and Morecambe Bay, monthly mean river flows in the Ellen, the Derwent, the Esk, the Duddon, the Leven, the Kent catchments, as well as in the Lune catchment at Caton (Lower Lune), were all classed as Above normal.

Towards the south in central Lancashire and GMC, with the exception of the Ribble, and the Mersey catchments which were classed as Above normal, and the Weaver catchment which was classed as Exceptionally high, flows in the Wyre, the Hodder, the Yarrow, and the Alt catchments were all classed as Notably high. The highest monthly mean flow in terms of the LTA was recorded in the Weaver catchment (207%).

1.4 Groundwater levels

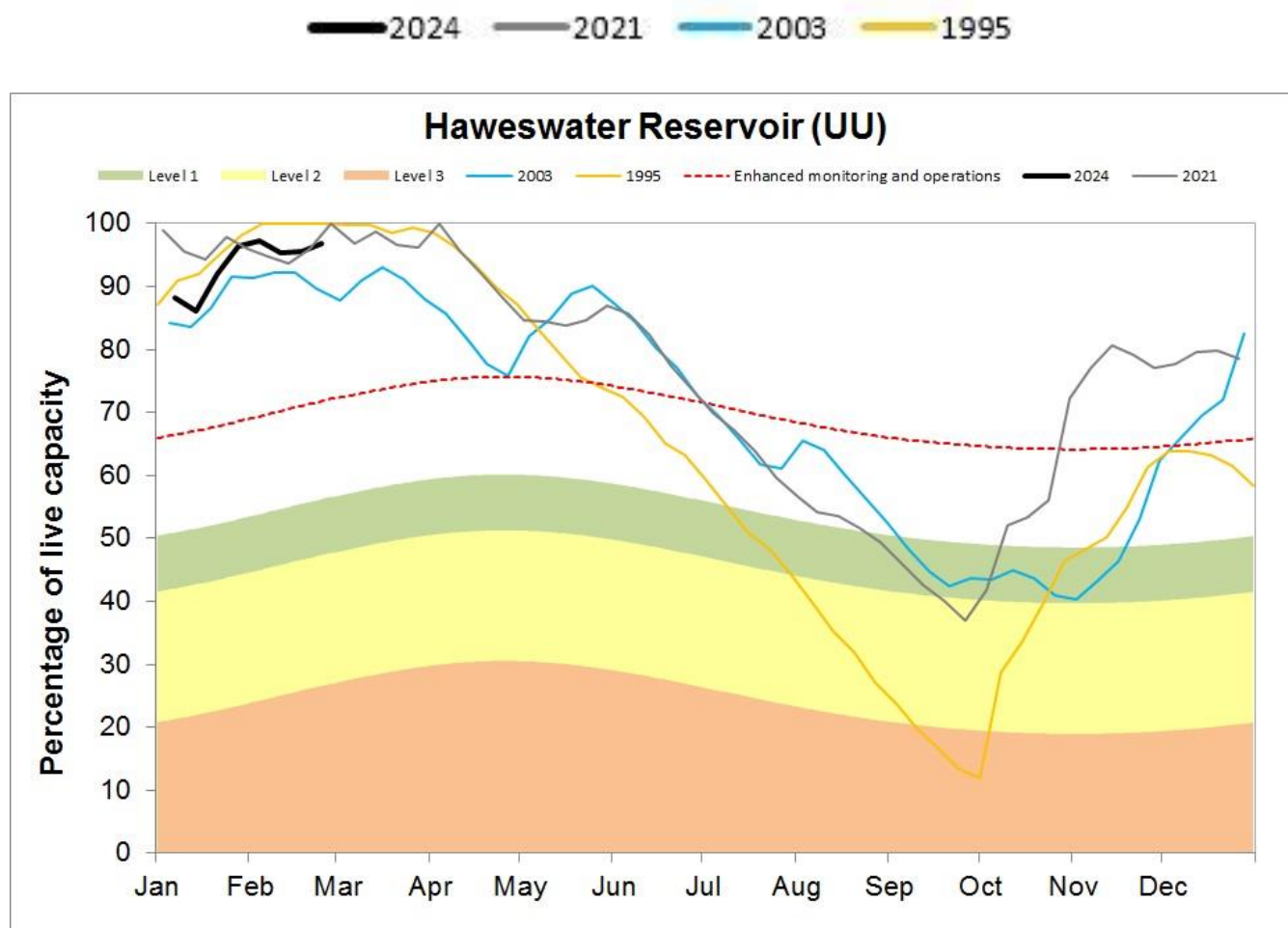
Groundwater levels for February were classed between Exceptionally high and Normal. Levels increased at Priors Heyes, from Notably high to Exceptionally high; at Lea Lane, from Below normal to Normal; and at Bruntwood Hall, from Normal to Notably high. All other indicator sites remained unchanged with Brown Bank Lay-By being classed as Above normal; Skirwith as Notably high; and Richmond Park as Exceptionally high. Levels at Priors Heyes remain high compared to historic levels because the aquifer is recovering from the effects of historically high abstractions.

1.5 Reservoir storage

Total reservoir storage for North West England increased from 91% at the end of January to 92% at the end of February, this is slightly below the average of 93% at this time of the year, but higher than this time last year when total reservoir storage was at 85%. At the end of February reservoir storage (in terms of percentage) was highest at Crummock, Ennerdale, and Lake Vyrnwy, which were all at 100% full. Storage was lowest at Longdendale (81%). The combined storage at Haweswater and Thirlmere was 98%, this is higher than the average of 91% at this time of year, and higher than the storage level this time last year (86%).

Audenshaw No.1, Torside, and Woodhead (part of the Longdendale system); Anglezarke, and High Bullough (part of the Rivington system); Dingle (part of the Bolton supply system); Harlock (part of the Poaka Beck system); Kitcliffe (part of the Piethorne Valley system); Ogden Lower (part of the Ogden (Barley) system); Alston No.2 (Longridge system), and Llyn Celyn (part of the Dee (Celyn and Brenig) system) were amongst the reservoirs being kept low for maintenance works.

Figure 1.5: Storage in Haweswater Reservoir, including the drought levels for the reservoir and storage for the current year (2024) and representative years: 1995, 2003 and 2021
(Source: United Utilities (UU)).



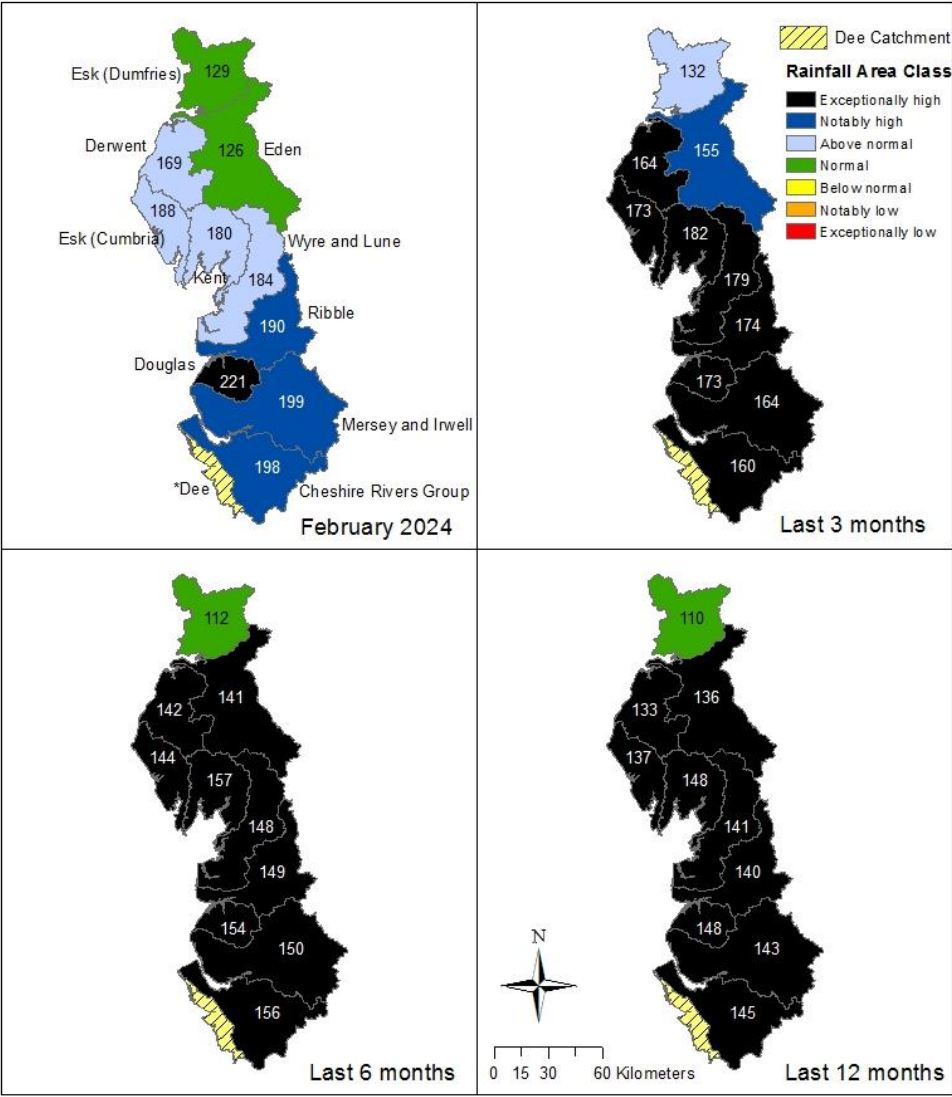
Author: Cumbria and Lancashire Hydrology Team, hydrology.CMBLNC@environment-agency.gov.uk

All data are provisional and may be subject to revision. The views expressed in this document are not necessarily those of the Environment Agency. Its officers, servants or agents accept no liability for any loss or damage arising from the interpretation or use of the information, or reliance upon views contained herein.

2 Rainfall

2.1 Rainfall map

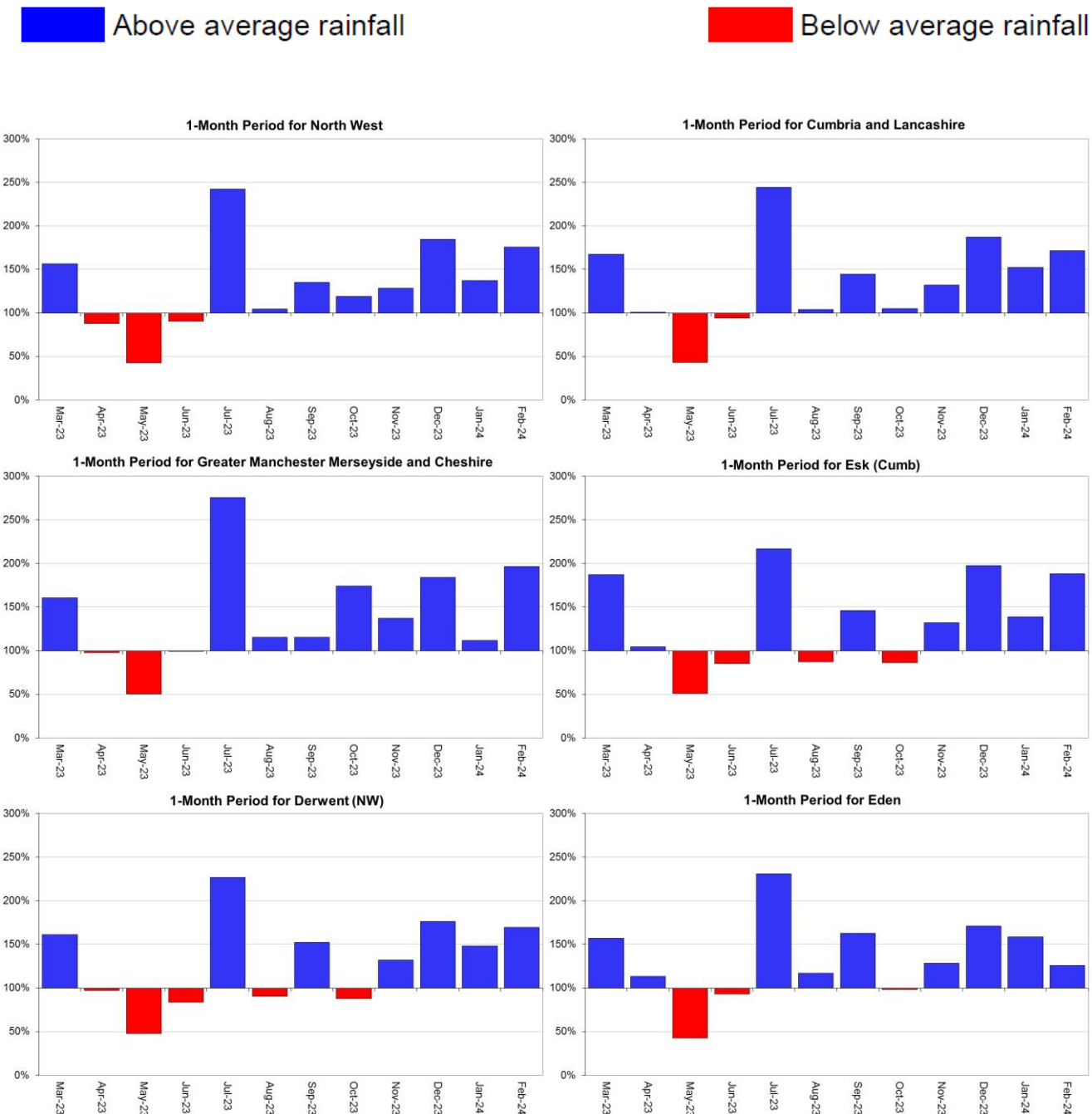
Figure 2.1: Total rainfall (as a percentage) for hydrological areas for the current month (up to 29 February 2024), the last 3 months, the last 6 months, and the last 12 months, classed relative to an analysis of respective historic totals. Table available in the appendices with detailed information.

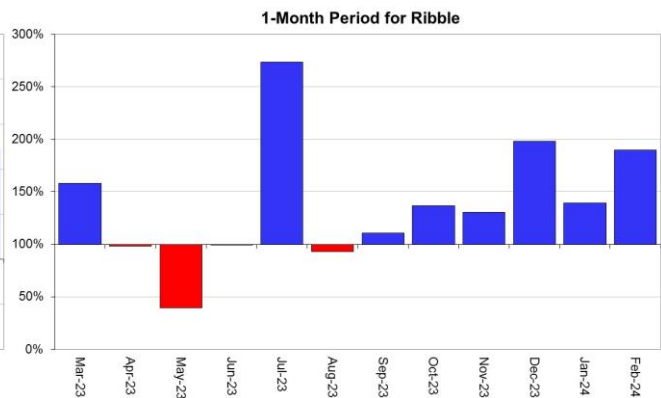
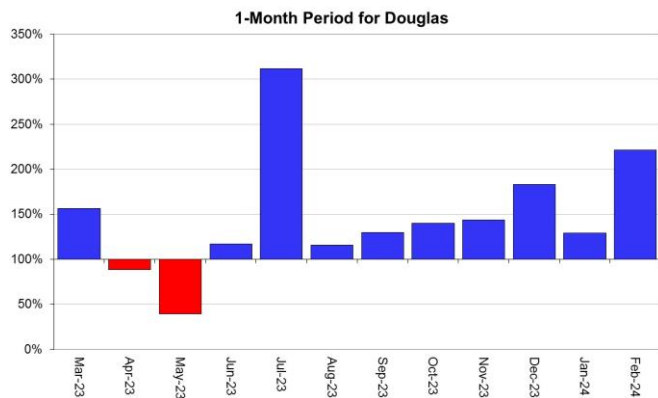
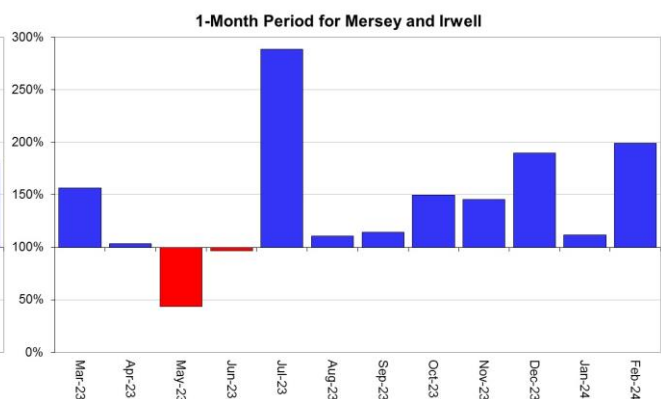
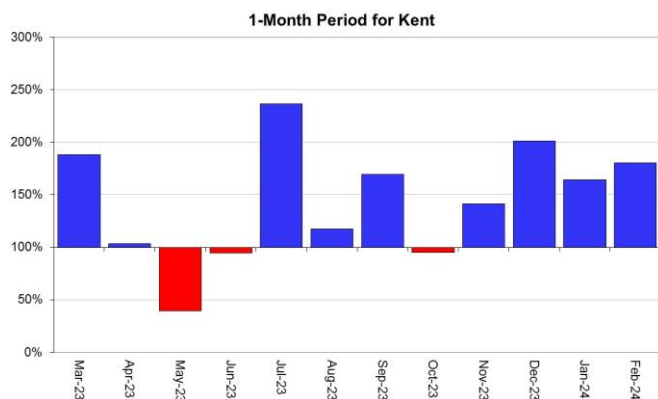
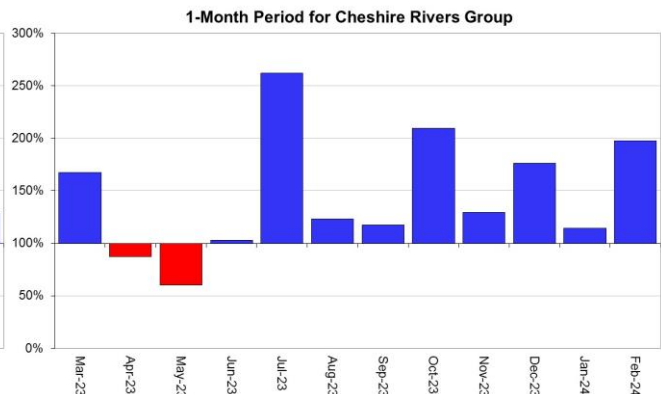
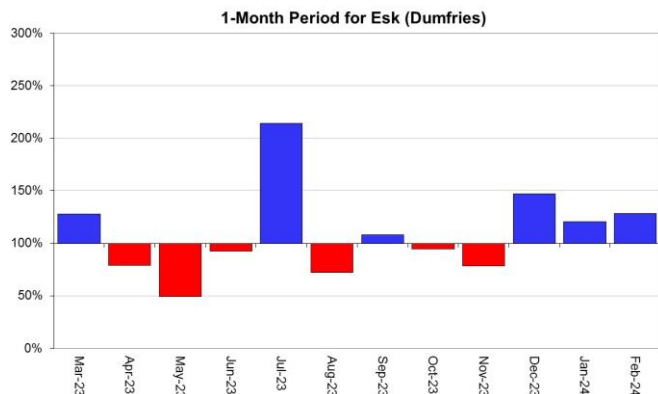


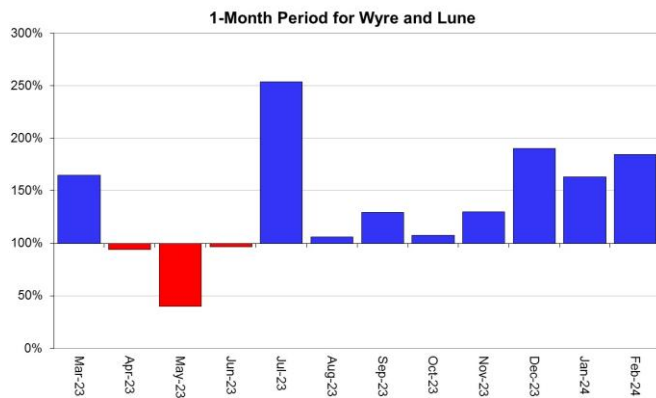
Rainfall data for 2024, extracted from Environment Agency 1km gridded rainfall dataset derived from Environment Agency intensity rain gauges. (Source: Environment Agency. Crown Copyright, 100024198, 2024). Rainfall data prior to 2023, extracted from Met Office HadUK 1km gridded rainfall dataset derived from registered rain gauges (Source: Met Office. Crown copyright, 2024).

2.2 Rainfall charts

Figure 2.2: Monthly rainfall totals for the past 12 months expressed as a percentage of the 1961 to 1990 long term average for North-west England and its hydrological areas.





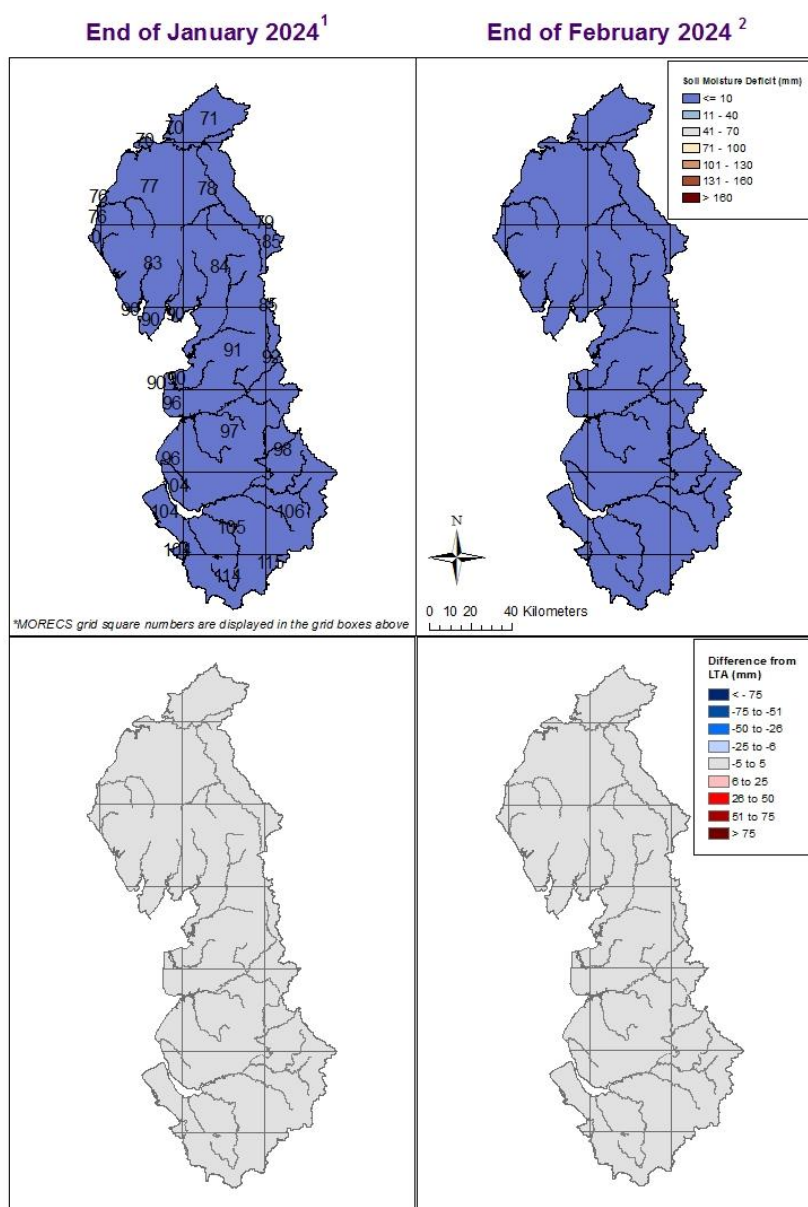


Rainfall data for 2024, extracted from Environment Agency 1km gridded rainfall dataset derived from Environment Agency intensity rain gauges. (Source: Environment Agency. Crown Copyright, 100024198, 2024). Rainfall data prior to 2023, extracted from Met Office HadUK 1km gridded rainfall dataset derived from registered rain gauges (Source: Met Office. Crown copyright, 2024).

3 Soil moisture deficit

3.1 Soil moisture deficit map

Figure 3.1: Soil moisture deficits for weeks ending 30 January 2024¹ (left panel) and 27 February 2024² (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.

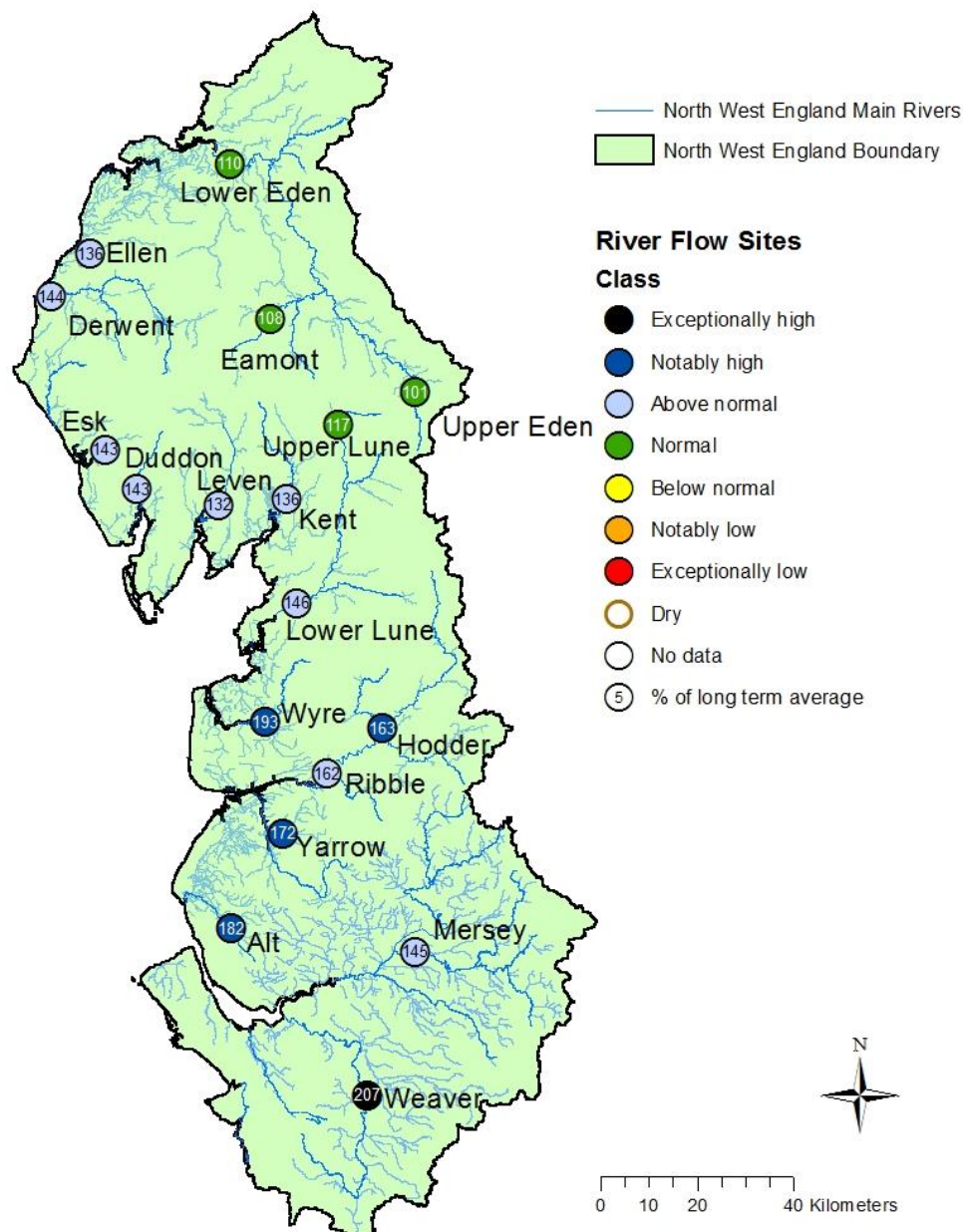


(Source: Met Office. Crown copyright, 2024). All rights reserved. Environment Agency, 100024198, 2024.

4 River flows

4.1 River flows map

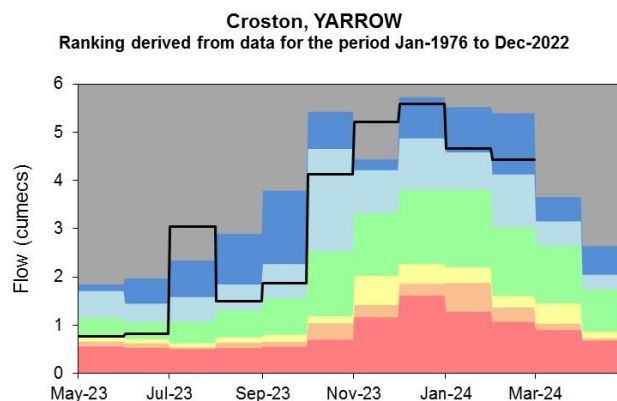
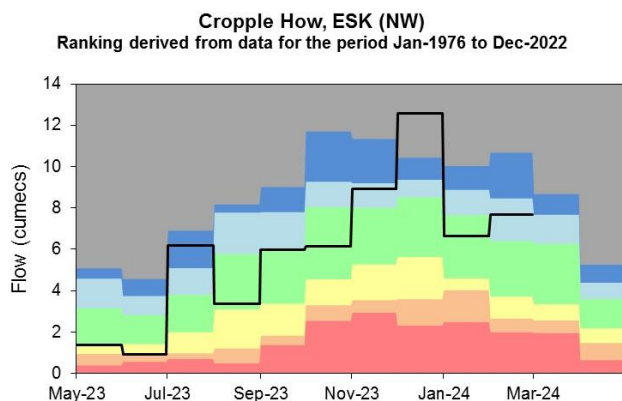
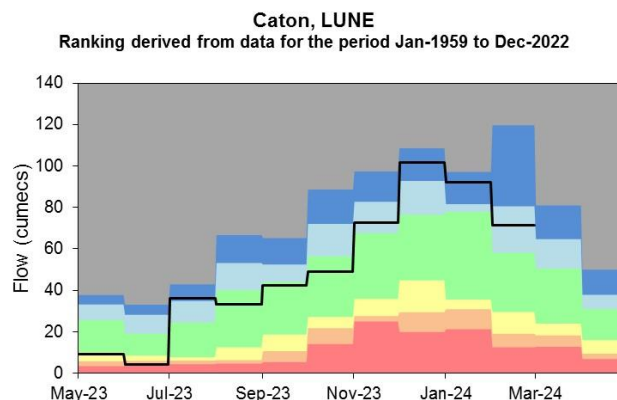
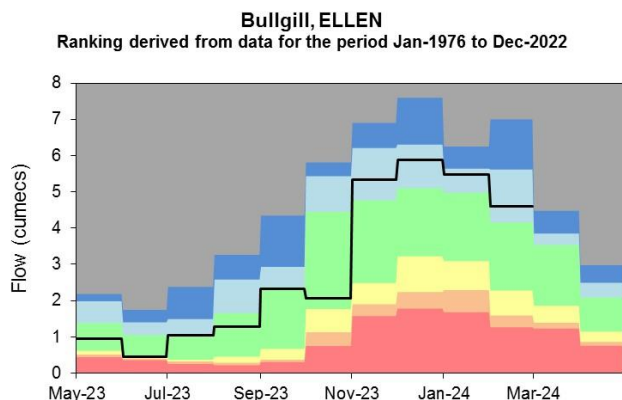
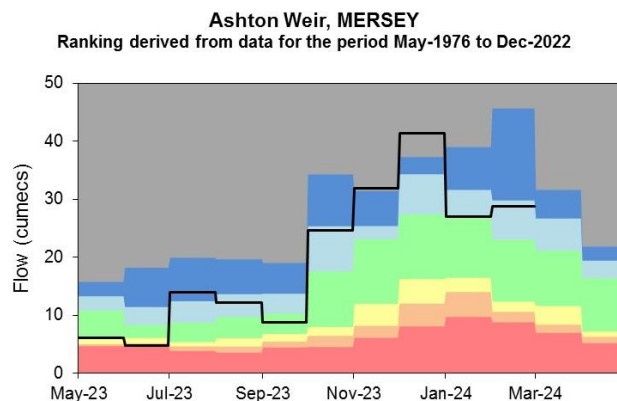
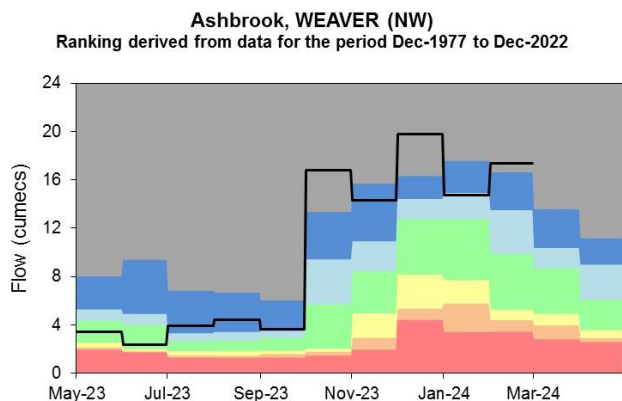
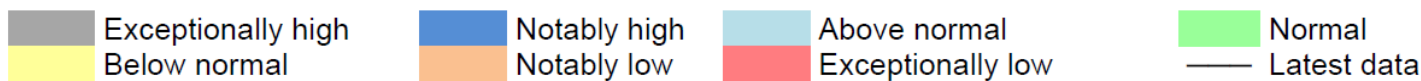
Figure 4.1: Monthly mean river flow for indicator sites for February 2024, expressed as a percentage of the respective long term average and classed relative to an analysis of historic February monthly means. Table available in the appendices with detailed information.



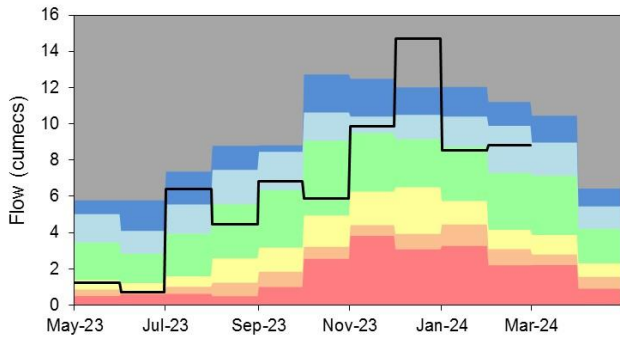
(Source: Environment Agency). Crown copyright. All rights reserved. Environment Agency, 100024198, 2024.

4.2 River flow charts

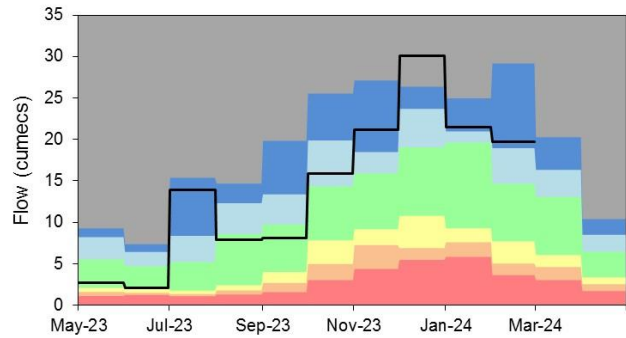
Figure 4.2: Monthly mean river flow for index sites over the past year, compared to an analysis of historic monthly mean flows.



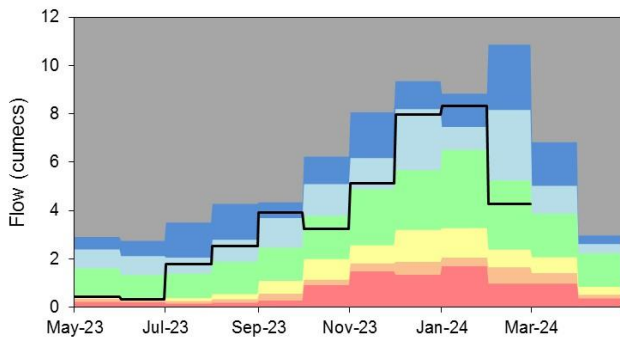
Duddon Hall, DUDDON
 Ranking derived from data for the period Mar-1968 to Dec-2022



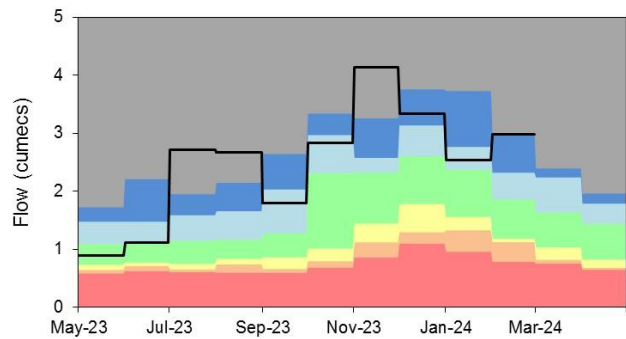
Hodder Place, RIBBLE (NW)
 Ranking derived from data for the period Jan-1976 to Dec-2022



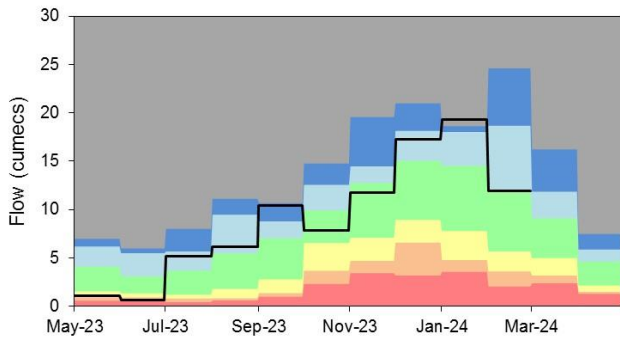
Kirkby Stephen, EDEN (NW)
 Ranking derived from data for the period Oct-1971 to Dec-2022



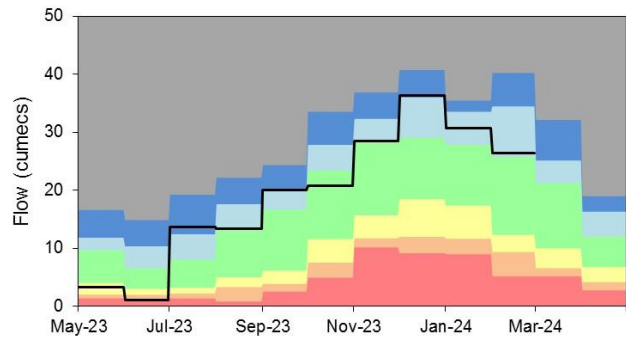
Kirkby, ALT
 Ranking derived from data for the period Oct-1977 to Dec-2022

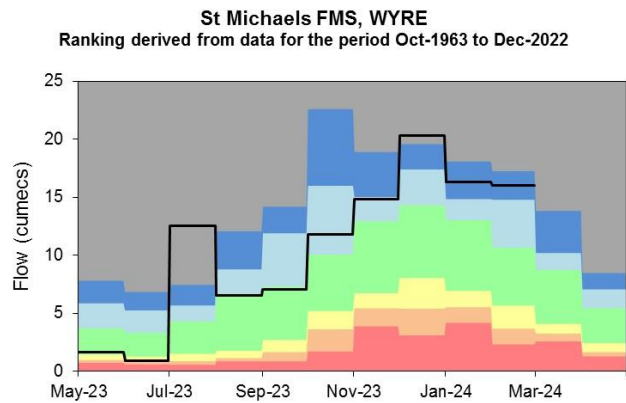
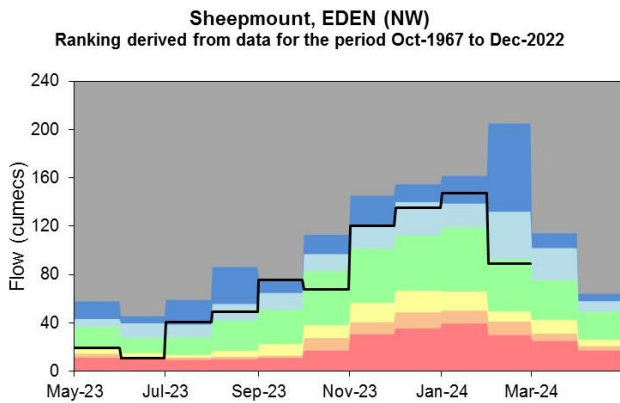
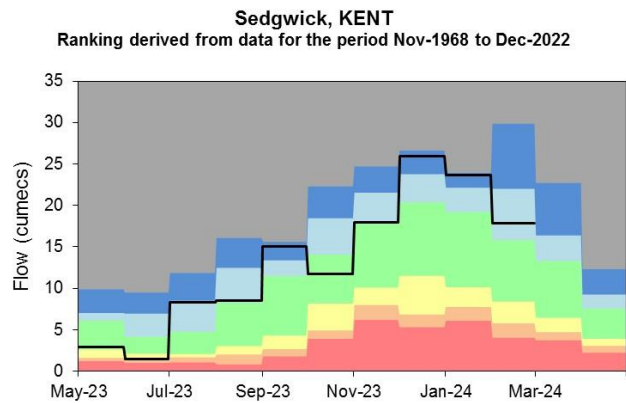
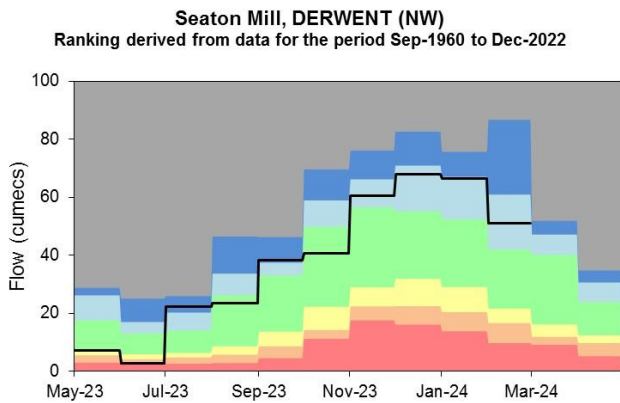
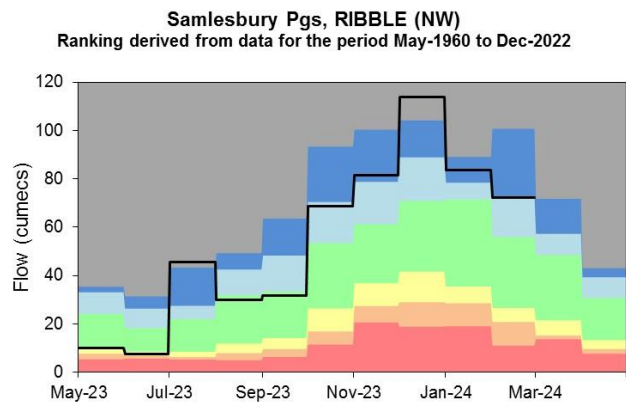
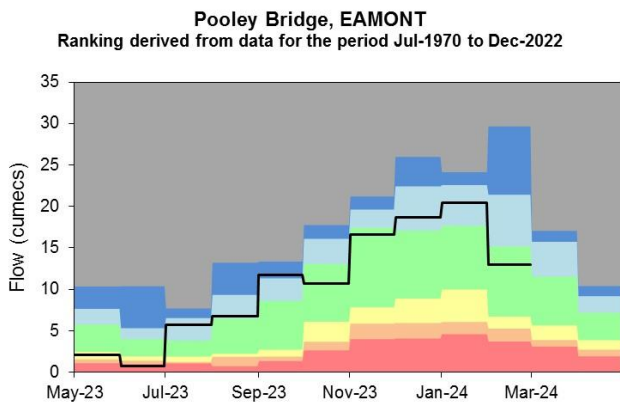


Lunes Bridge, LUNE
 Ranking derived from data for the period Dec-1979 to Dec-2022



Newby Bridge FMS, LEVEN (NW)
 Ranking derived from data for the period Jan-1972 to Dec-2022



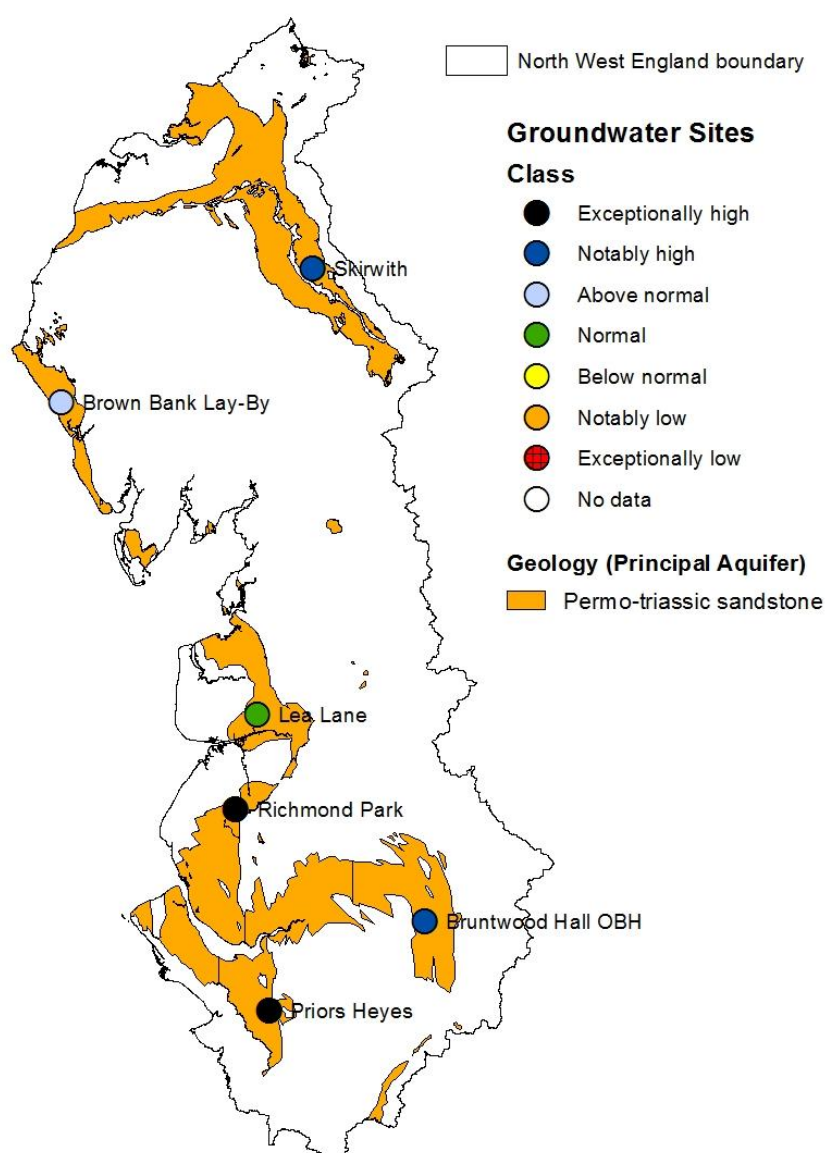


Source: Environment Agency.

5 Groundwater levels

5.1 Groundwater levels map

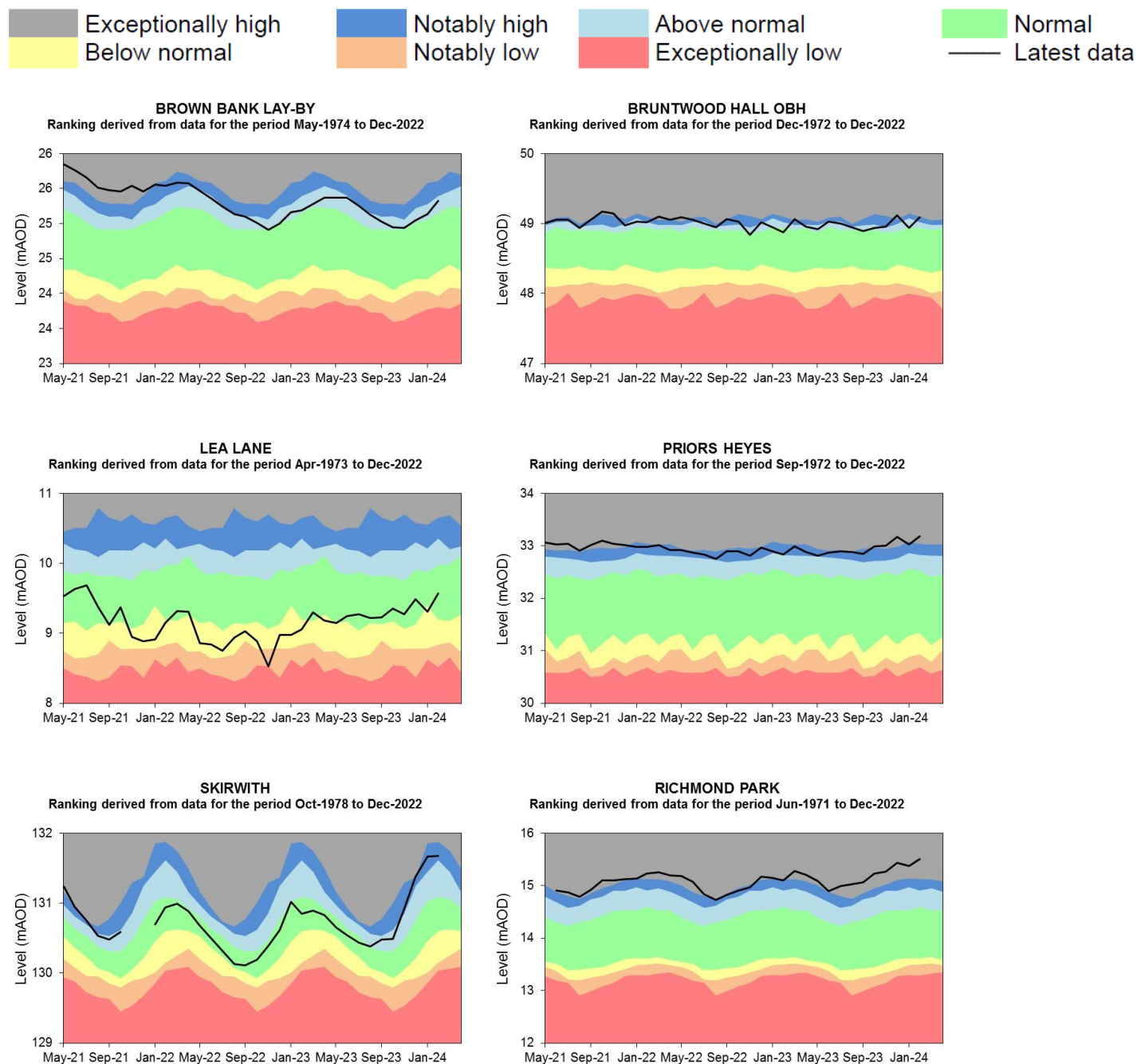
Figure 5.1: Groundwater levels for indicator sites at the end of February 2024, classed relative to an analysis of respective historic February levels. Table available in the appendices with detailed information.



(Source: Environment Agency). Geological map reproduced with kind permission from UK Groundwater Forum, BGS copyright NERC. Crown copyright. All rights reserved. Environment Agency, 100024198, 2024.

5.2 Groundwater level charts

Figure 5.2: End of month groundwater levels at index groundwater level sites for major aquifers. 34 months compared to an analysis of historic end of month levels and long term maximum and minimum levels.



Source: Environment Agency, 2024.

6 Reservoir storage

Figure 6.1: The location of reservoirs that comprise the supply districts across North-west England and selected individual reservoirs.

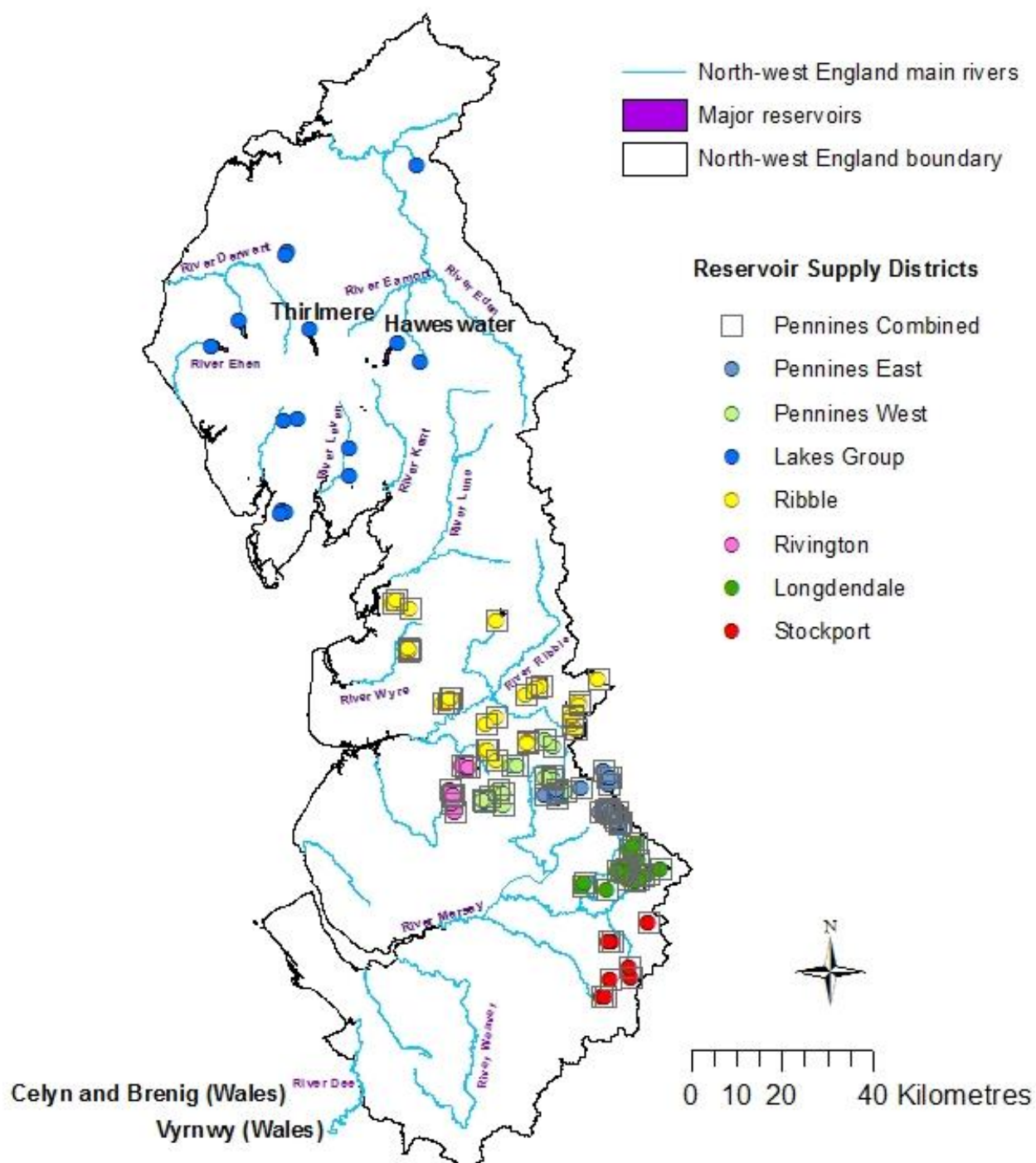
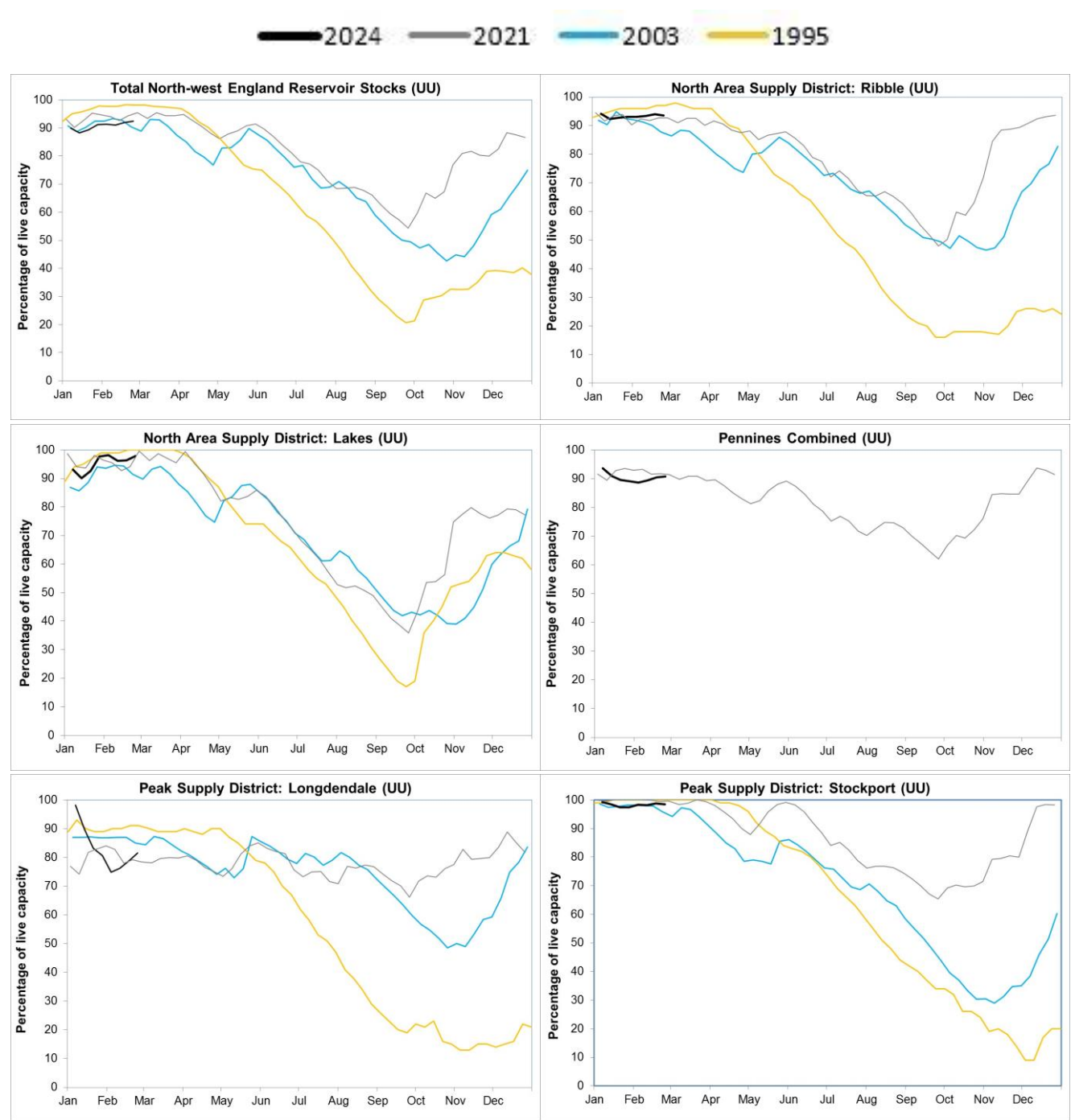
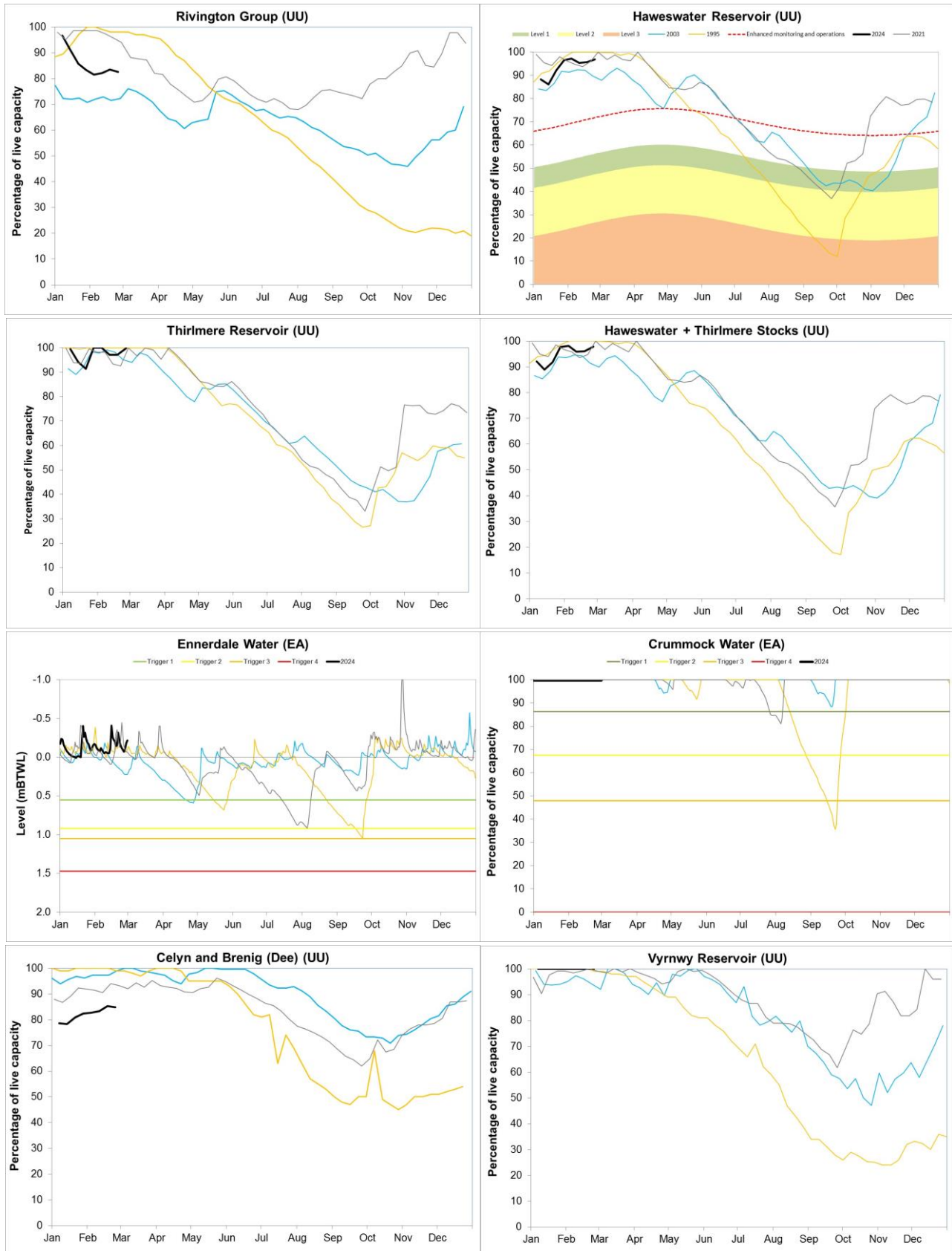


Figure 6.2: End of month reservoir storage for supply districts across North-west England and selected individual reservoirs for current year (2024) and representative years: 1995, 2003 and 2021. Note: Historic records of individual reservoirs and reservoir groups making up the regional values vary in length.





Source: (UU) United Utilities, (EA) The Environment Agency.

7 Glossary

7.1 Terminology

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 and 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, usually based on the period 1961 to 1990. However, the period used may vary by parameter being reported on (see figure captions for details).

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 by 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 (for example, 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).

7.2 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.

8 Appendices

8.1 Rainfall table

Hydrological area	Feb 2024 rainfall % of long term average 1961 to 1990	Feb 2024 band	Dec 2023 to February cumulative band	Sep 2023 to February cumulative band	Mar 2023 to February cumulative band
Cheshire Rivers Group	198	Notably High	Exceptionally high	Exceptionally high	Exceptionally high
Derwent (NW)	170	Above Normal	Exceptionally high	Exceptionally high	Exceptionally high
Douglas	221	Exceptionally High	Exceptionally high	Exceptionally high	Exceptionally high
Eden	126	Normal	Notably high	Exceptionally high	Exceptionally high
Esk (Cumbria)	188	Above Normal	Exceptionally high	Exceptionally high	Exceptionally high
Esk (Dumfries)	129	Normal	Above normal	Normal	Normal
Kent	181	Above Normal	Exceptionally high	Exceptionally high	Exceptionally high
Mersey And Irwell	199	Notably High	Exceptionally high	Exceptionally high	Exceptionally high
Ribble	190	Notably High	Exceptionally high	Exceptionally high	Exceptionally high
Wyre And Lune	184	Above Normal	Exceptionally high	Exceptionally high	Exceptionally high

North West	176	Above Normal	Exceptionally high	Exceptionally high	Exceptionally high
------------	-----	-----------------	-----------------------	-----------------------	-----------------------

8.2 River flows table

Site name	River	Catchment	Feb 2024 band	Jan 2024 band
Ashbrook	Weaver (NW)	Weaver Upper	Exceptionally high	Above normal
Ashton Weir	Mersey	Mersey Non Tidal	Above normal	Above normal
Bullgill	Ellen	Ellen Lower	Above normal	Above normal
Caton	Lune	Lune Lower Tidal	Above normal	Notably high
Cropple How	Esk (NW)	Esk (South West Lakes)	Above normal	Normal
Croston	Yarrow	Yarrow Lower	Notably high	Notably high
Duddon Hall	Duddon	Duddon	Above normal	Normal
Hodder Place	Hodder	Hodder Lower	Notably high	Notably high
Kirkby	Alt	Alt	Notably high	Above normal
Kirkby Stephen	Eden (NW)	Eden Cumbria Upper	Normal	Notably high
Lunes Bridge	Lune	Lune Upper	Normal	Exceptionally high
Newby Bridge Fms	Leven (NW)	Leven Cumbria	Above normal	Above normal
Pooley Bridge	Eamont	Eamont	Normal	Above normal
Samlesbury Pgs	Ribble (NW)	Ribble Lower	Above normal	Notably high

Seaton Mill	Derwent (NW)	Derwent Cumbria Lower	Above normal	Above normal
Sedgwick	Kent	Levens Bridge	Above normal	Notably high
Sheepmount	Eden (NW)	Eden Cumbria Lower	Normal	Notably high
St Michaels Fms	Wyre	Brock	Notably high	Notably high

8.3 Groundwater table

Site name	Aquifer	End of Feb 2024 band	End of Jan 2024 band
Brown Bank Lay-by	West Cumbria Permo-triassic Sandstone	Above normal	Above normal
Bruntwood Hall Obh	East Cheshire Permo-triassic Sandstone	Notably high	Normal
Lea Lane	Fylde Permo-triassic Sandstone	Normal	Below normal
Priors Heyes	West Cheshire Permo-triassic Sandstone	Exceptionally high	Notably high
Richmond Park	Rufford Permo-triassic Sandstone	Exceptionally high	Exceptionally high
Skirwith	Carlisle Basin Permo-triassic Sandstone	Notably high	Notably high