Monthly water situation report: Yorkshire Area

1 Summary - September 2024

This month, the rainfall in Yorkshire was above average overall but concentrated in the final week. The soils began the month dry but were mostly wet by the month's end. Daily mean river flows were mostly normal but became high in the last five days. Groundwater levels were normal or above at most monitoring locations and reservoir stocks remained a little below the long term average (LTA).

1.1 Rainfall

September's rainfall was above average within all catchments according to the MET Office Had-UK Grid data set. The monthly rainfall totals ranged between 132% of the LTA in the Wharfe catchment and 228% in the Esk catchment. The Esk and Hull catchments were categorised as exceptionally high, whilst all other catchments were either notably high or above normal.

Monthly rainfall recorded at our key indicator sites ranged from 65.6mm at Winestead in the Hull catchment to 179.1mm at Randy Mere in the Esk catchment.

The first and third weeks of September featured settled conditions. Moderate rain fell in the Pennine catchments from days 7 to 9. For most catchments, the majority of the rain within the month fell at the end, with day 25, 26 and 30 recording the highest totals. The heaviest storm rainfall occurred over the Don, Rother and Esk catchments. For example, at Woodhouse Mill in the Rother catchment 91% of the LTA for the month fell in one day on day 30. Randy Mere rain gauge recorded its second highest daily total in its 22-year history on day 26.

3-month cumulative rainfall totals were normal across Yorkshire, except in the Esk and Rother catchments which had totals above normal. Looking further back, the cumulative 12-month rainfall totals were exceptionally high within all catchments.

1.2 Soil moisture deficit

Within most areas in Yorkshire, soils were dry for the majority of the month particularly in the Hull and Humber and lower Ouse regions. The western Pennines however, which began the month with normal soil moisture, became wet in the first week and remained this way throughout, ending the month saturated. The rainfall within the last few days of the month reduced soil moisture deficit across the rest of Yorkshire by 50mm to 60mm. By the end of September, the North Yorks Moors and upper Don were saturated and classified as wet, central areas were

classified as normal and only the lower parts of the Don, Aire, Ouse and Hull catchments bordering the Humber remained dry.

1.3 River flows

Dry soils limited the response of rivers to rainfall during the first three weeks of September. Monthly mean flows in most catchments ranged from 70% to 136% of the LTA, classified as normal or above normal. The Rother at Whittington and the Esk at Briggswath had notably high monthly mean flows with 230% and 247% of their LTAs respectively, due to the heavy storm rainfall in those catchments in the final week.

In most catchments, daily average flows were normal, briefly increasing to above normal in the Pennine catchments around days 9 and 10 and briefly dropping to below normal around days 20 and 21. Throughout Yorkshire, including the Rye and Derwent, flows rose sharply on day 26 in response to heavy rainfall and all catchments had flows above normal and often higher. These continued in most catchments on day 27. After a brief recession, further heavy rain on day 30 produced above normal to exceptionally high daily mean flows.

The Rother showed lots of variation in its daily flows with periods of low flow in the first and third weeks. By day 22, flows became notably high and remained high. On day 30, the gauging station at Whittington recorded its sixth highest annual maximum (AMAX) flow in a 47-year record. This peak was considerably lower than in Storm Babet in October 2023 which resulted in the highest peak at this site.

The Esk at Briggswath recorded its fifth highest AMAX river level in its 32-year record on day 27.

In the chalk-fed Hull catchment flows declined slightly in the second and third weeks. There was a brief and only moderate increase in flow in response to rainfall on day 26 to 27. A similar response was observed to rain on the last day of the month.

1.4 Groundwater levels

Magnesian Limestone

The groundwater level within the Magnesian Limestone at Brick House Farm continued to decrease but remained exceptionally high for the time of year.

Millstone Grit

The groundwater level continued to decrease within the Millstone Grit at Hill Top Farm and dropped to notably low for the time year. *It should be noted that this observation borehole is*

used for water abstraction by means of a pump. Therefore, the groundwater level recorded here may be subject to the effects of this.

Sherwood Sandstone

The groundwater level in the Sherwood Sandstone increased at the two key well sites. Great Ouseburn remained exceptionally high for the time of year, with Riccall Approach Farm remaining in the normal range.

Corallian Limestone

The groundwater level increased slightly within the Corallian Limestone at Sproxton and was just above normal at the end of the month.

Chalk

The groundwater level continued to decrease at both Wetwang (northern Yorkshire Wolds chalk) and Dalton Estate (central Yorkshire Wolds chalk). Levels were in the normal range for the time of year at both key wells.

1.5 Reservoir stocks

Total reservoir stocks were between 3% and 4% lower than the LTA this month. Reservoir stocks declined during the first three weeks but were replenished by heavy rain in the final week giving no significant overall change in the month.

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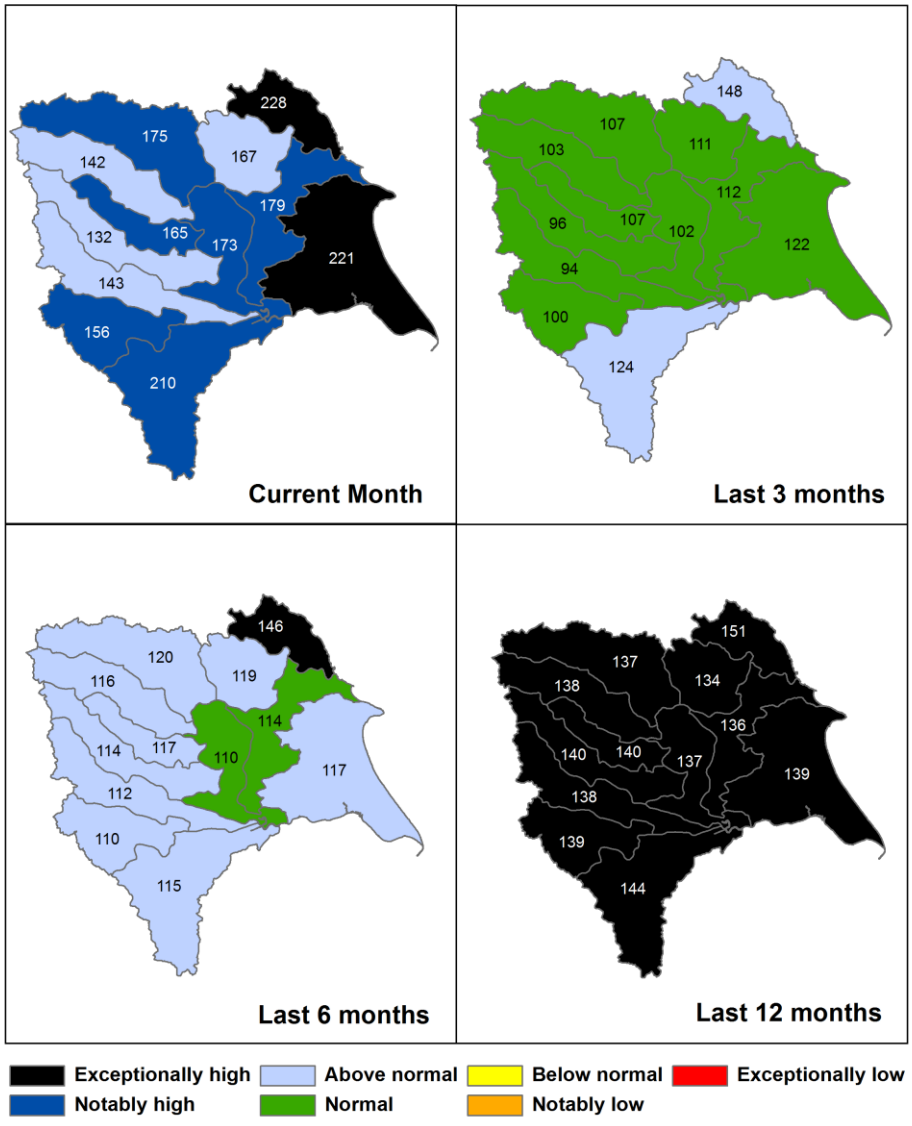
2 Rainfall

2.1 Rainfall map

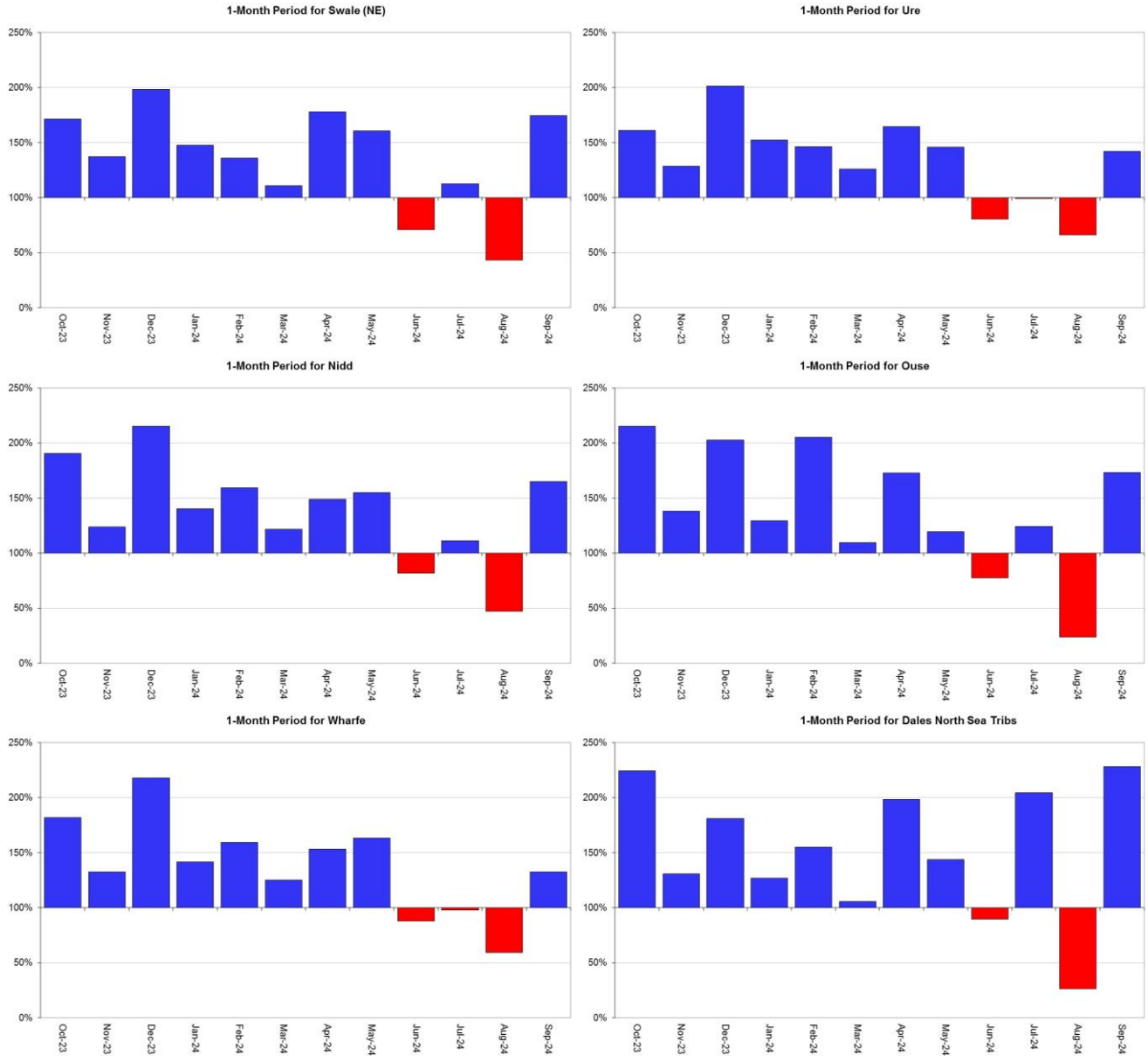
Figure 2.1: Total rainfall for hydrological areas for the current month (up to 30 September 2024), the last 3 months, the last 6 months, and the last 12 months, classed relative to an analysis of respective historic totals. Table available in the appendices with detailed information.

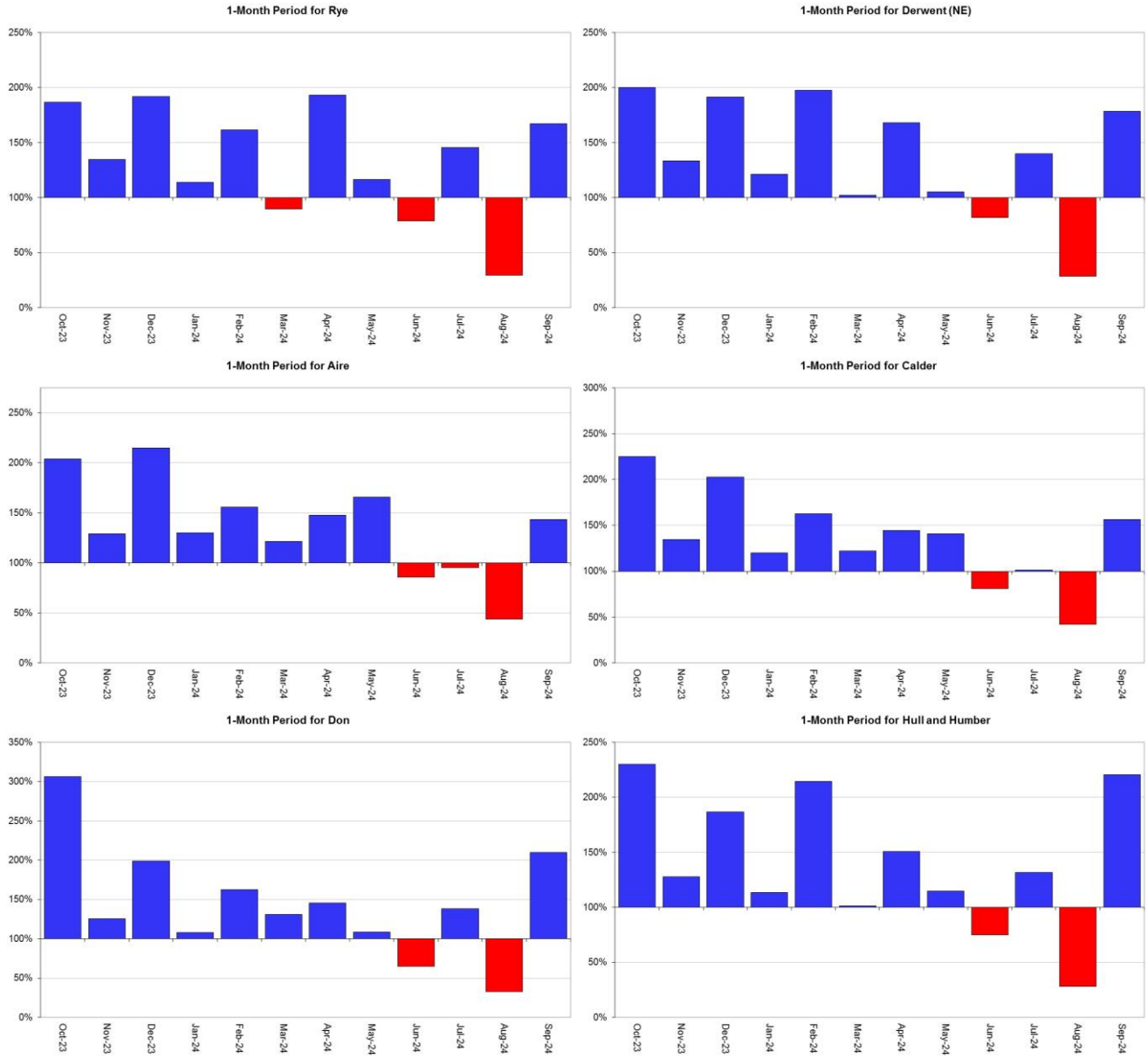


HadUK data based on the Met Office 1km gridded rainfall dataset derived from rain gauges (Source: Met Office. Crown copyright, 2024). Provisional data based on Environment Agency 1km gridded rainfall dataset derived from Environment Agency intensity rain gauges. Crown copyright. All rights reserved. Environment Agency, 100024198, 2024.

2.2 Rainfall charts

Figure 2.2: Monthly rainfall totals for the past 24 months as a percentage of the 1961 to 1990 long term average for each catchment.



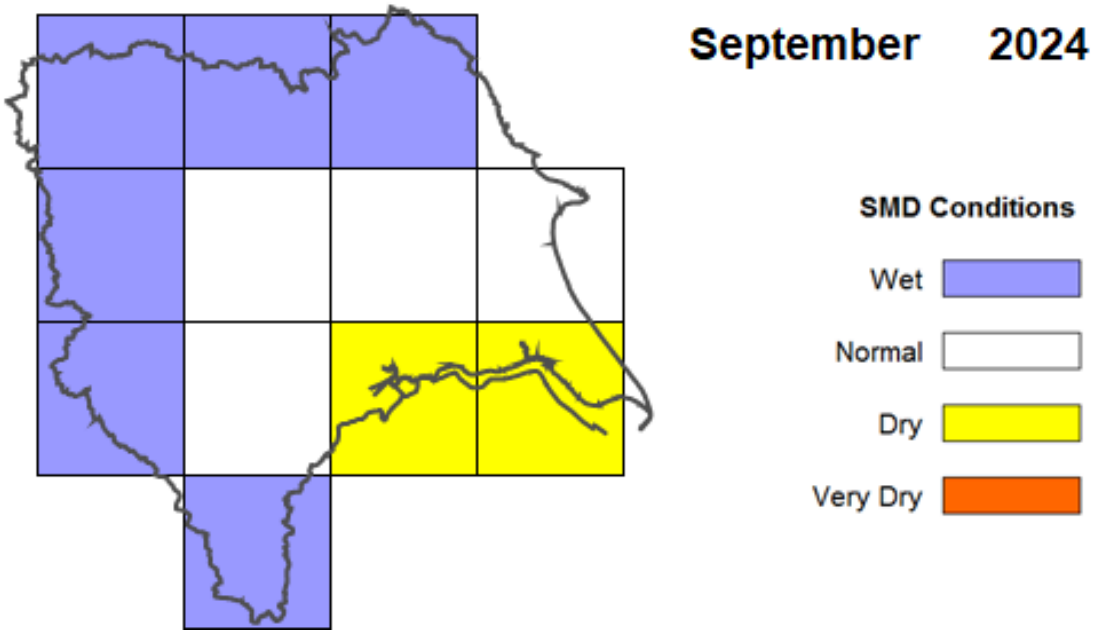


Rainfall data for 2023 and 2024, extracted from Environment Agency 1km gridded rainfall dataset derived from Environment Agency intensity rain gauges. (Source: Environment Agency. Crown Copyright, 100024198, 2024). Rainfall data prior to 2023, extracted from Met Office HadUK 1km gridded rainfall dataset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

3 Soil moisture deficit

3.1 Soil moisture deficit map

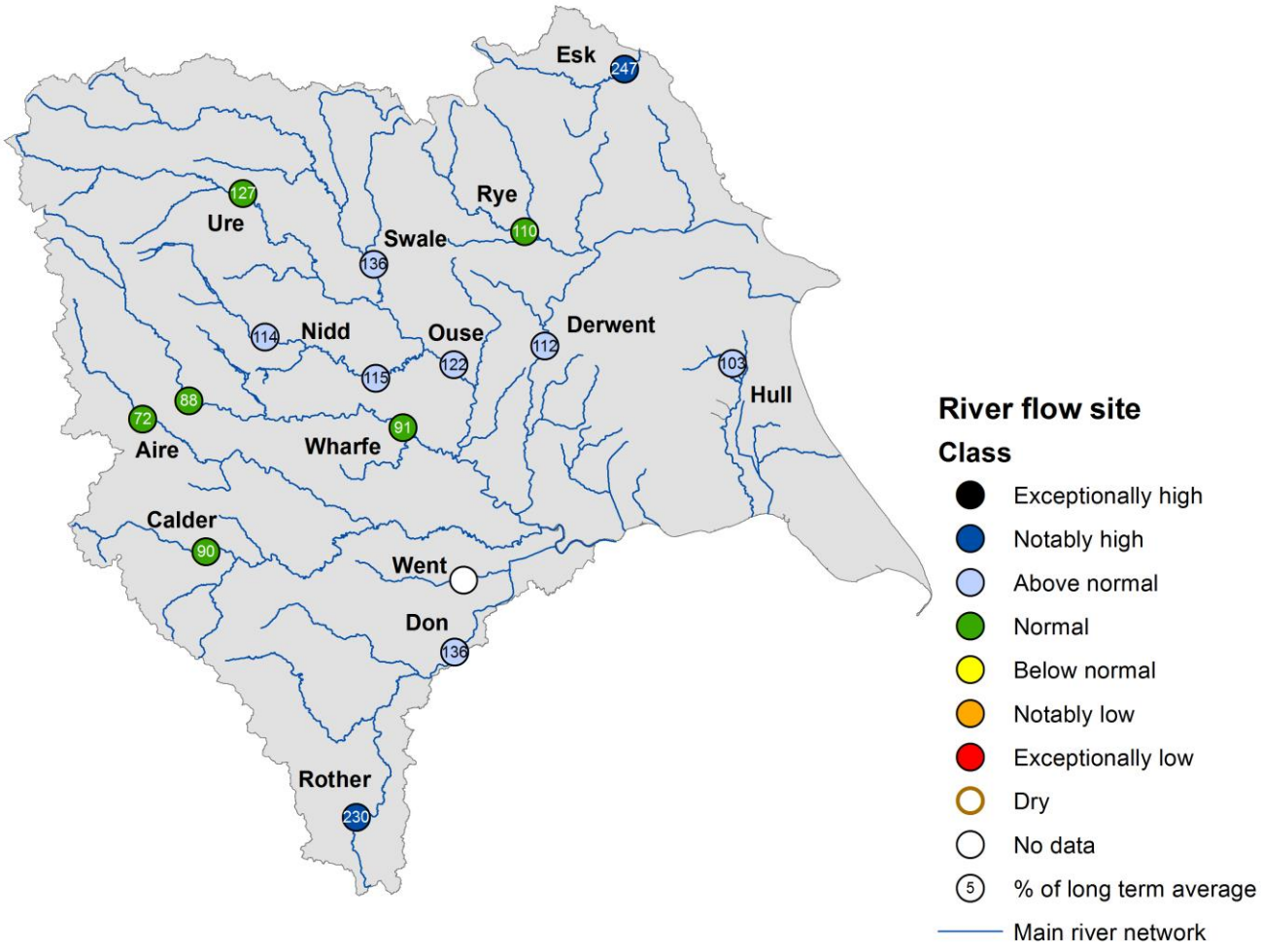
Figure 3.1: Soil moisture deficits for weeks ending 30 September 2024. Shows the difference (mm) of the actual soil moisture deficit from the 1961 to 1990 long term average soil moisture deficits. MORECS data for real land use.



4 River flows

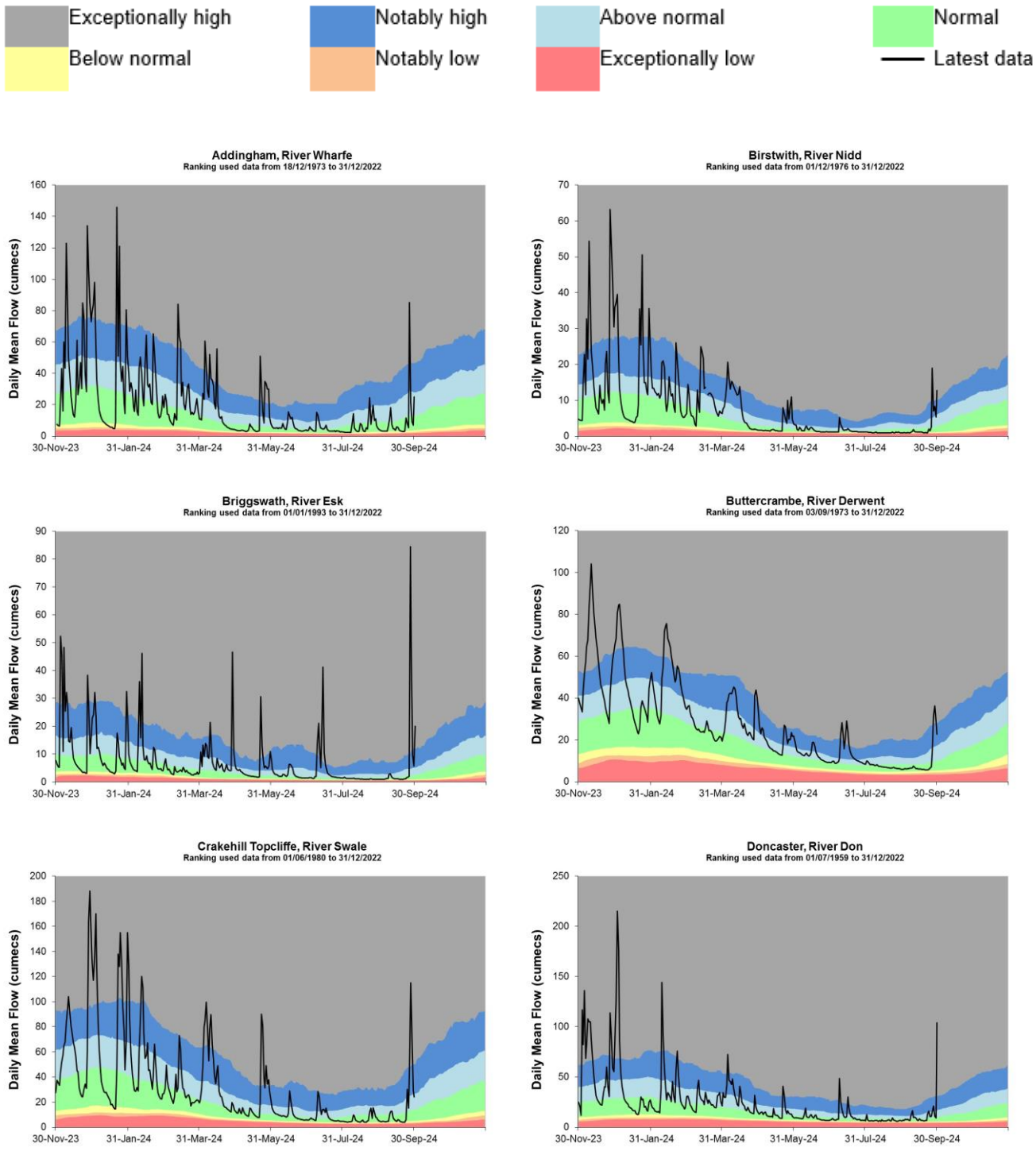
4.1 River flows map

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

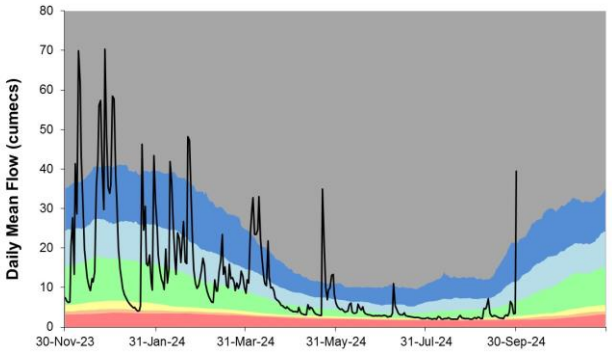


4.2 River flow charts

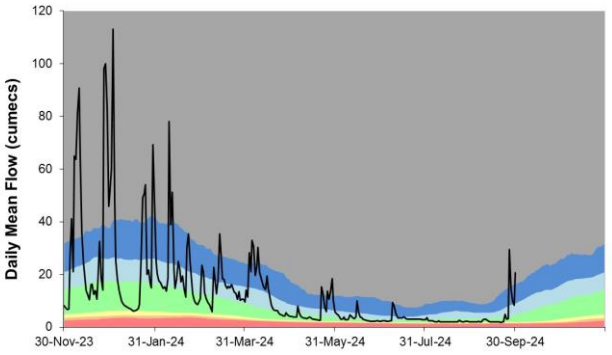
Figure 4.2: Daily mean river flow for index sites over the past year, compared to an analysis of historic daily mean flows.



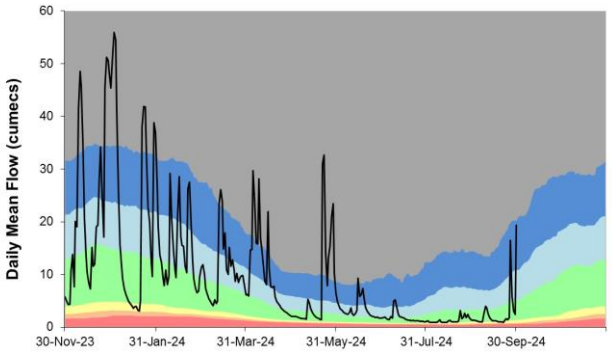
Elland, River Calder
Ranking used data from 01/07/1971 to 31/12/2022



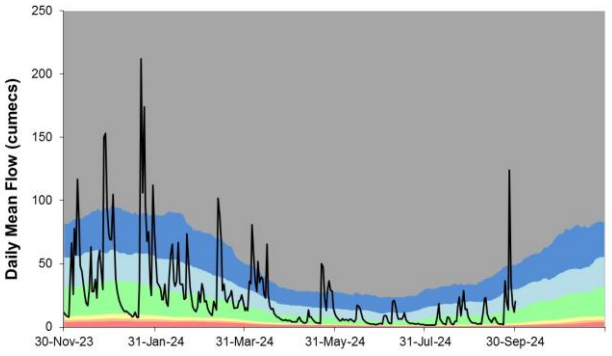
Hunsingore, River Nidd
Ranking used data from 01/10/1968 to 31/12/2022



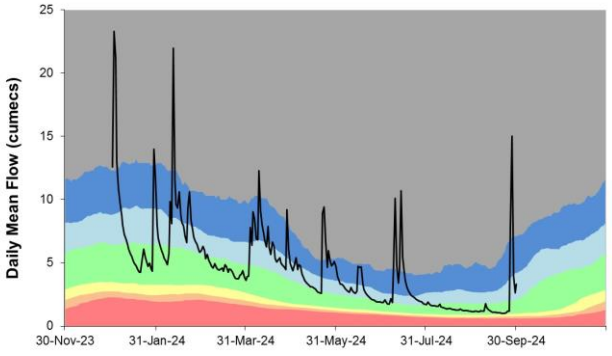
Kildwick, River Aire
Ranking used data from 01/08/1971 to 31/12/2022



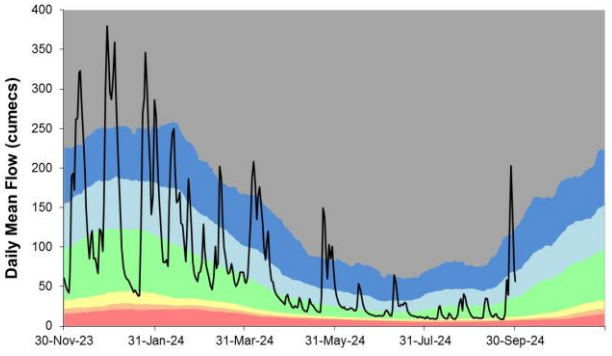
Kilgram Bridge, River Ure
Ranking used data from 01/08/1971 to 31/12/2022

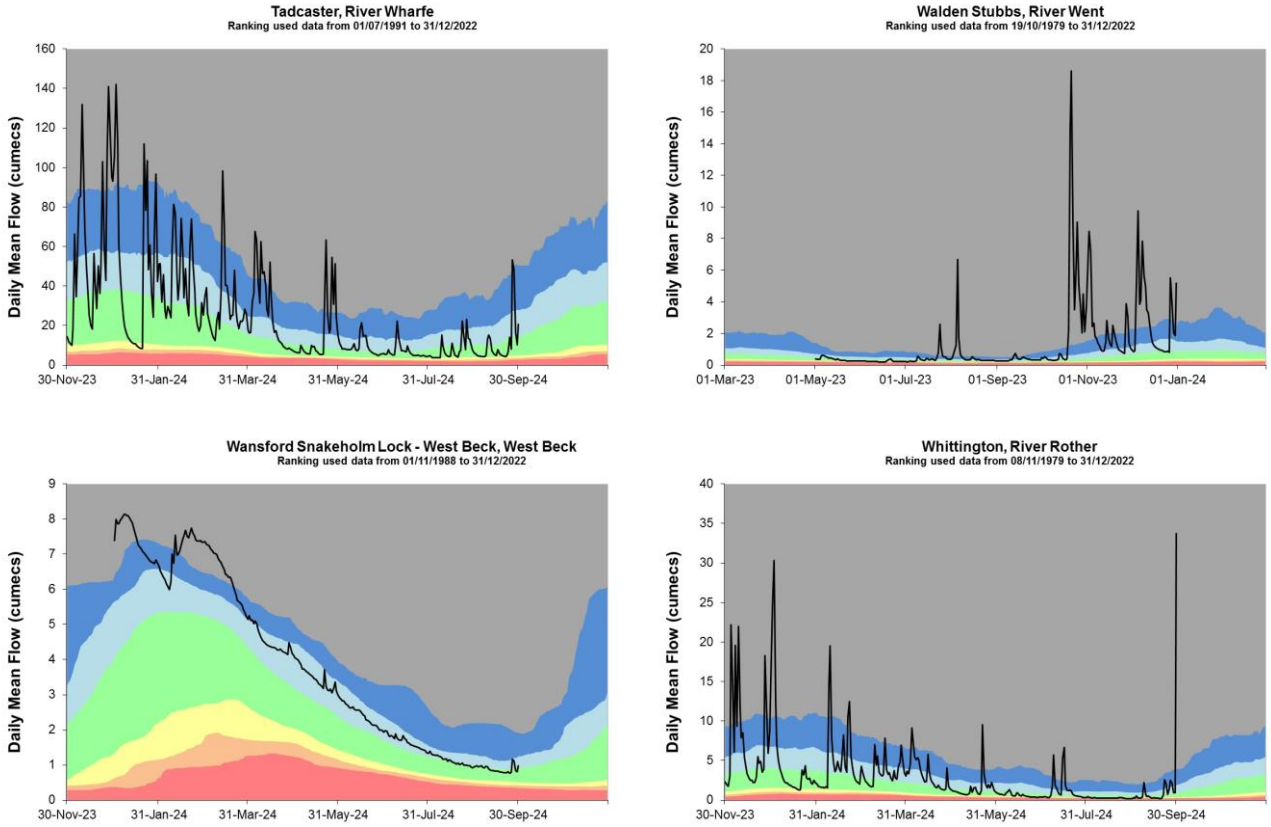


Ness, River Rye
Ranking used data from 01/09/1974 to 31/12/2022



Skelton, River Ouse
Ranking used data from 18/09/1969 to 31/12/2022

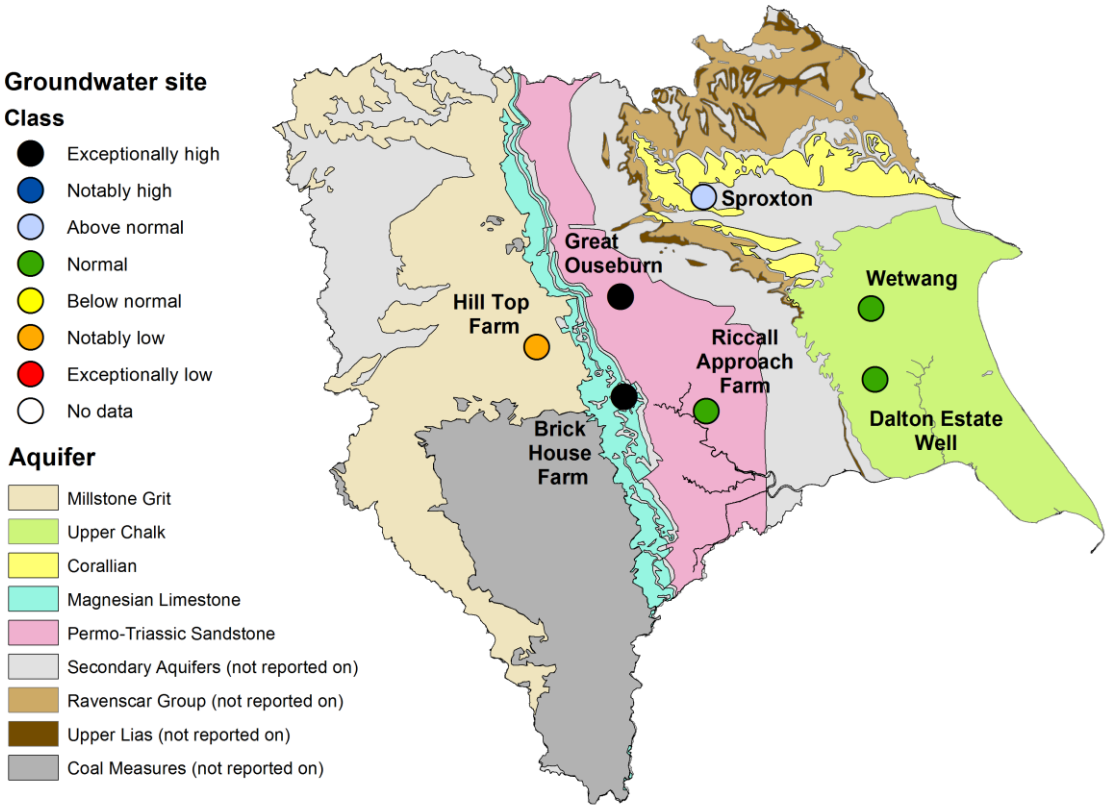




5 Groundwater levels

5.1 Groundwater levels map

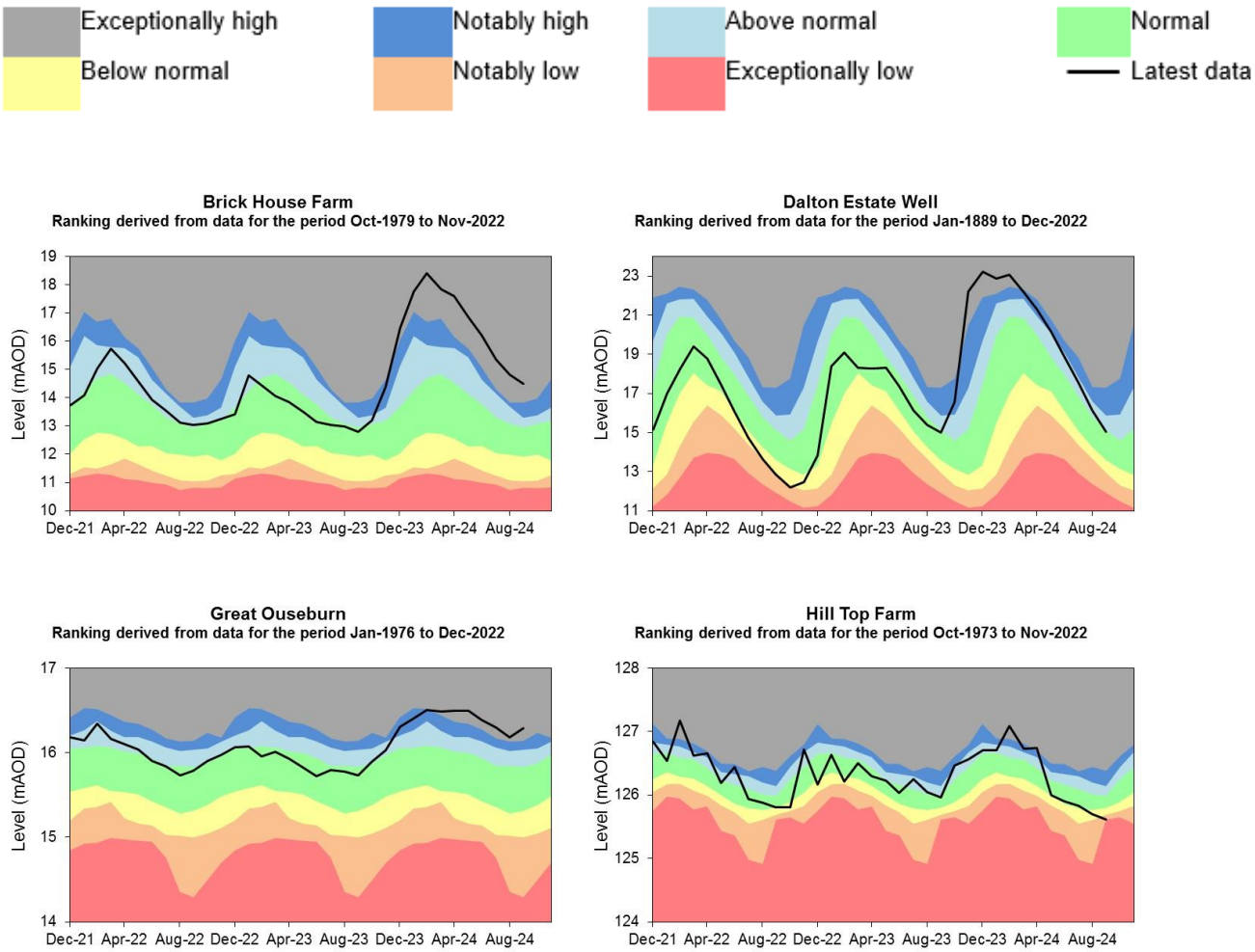
Figure 5.1: Groundwater levels for indicator sites at the end of September 2024, classed relative to an analysis of respective historic September levels. Table available in the appendices with detailed information.

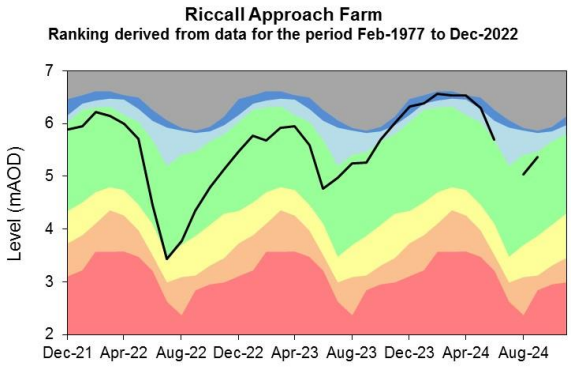


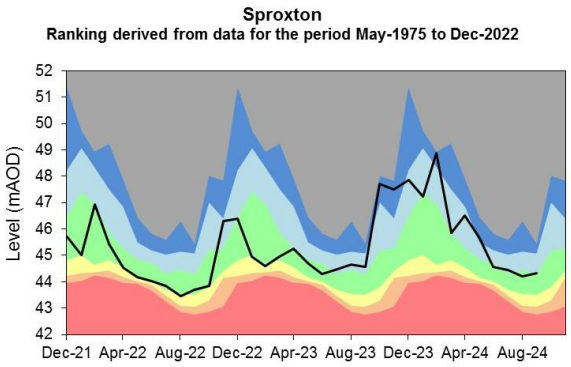
(Source: Environment Agency). Geological map reproduced with kind permission from UK Groundwater Forum, BGS copyright NERC. Crown copyright. All rights reserved. Environment Agency, 100024198, 2024.

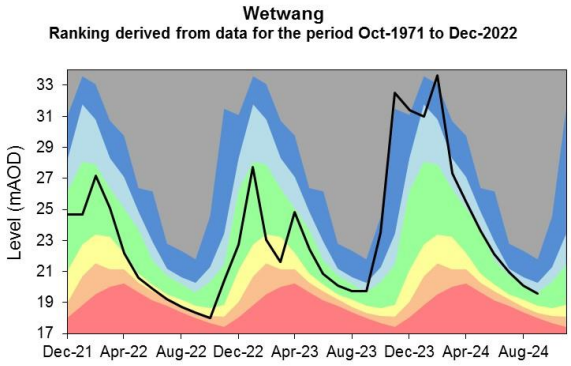
5.2 Groundwater level charts

Figure 5.2: End of month groundwater levels at index groundwater level sites for major aquifers. 22 months compared to an analysis of historic end of month.





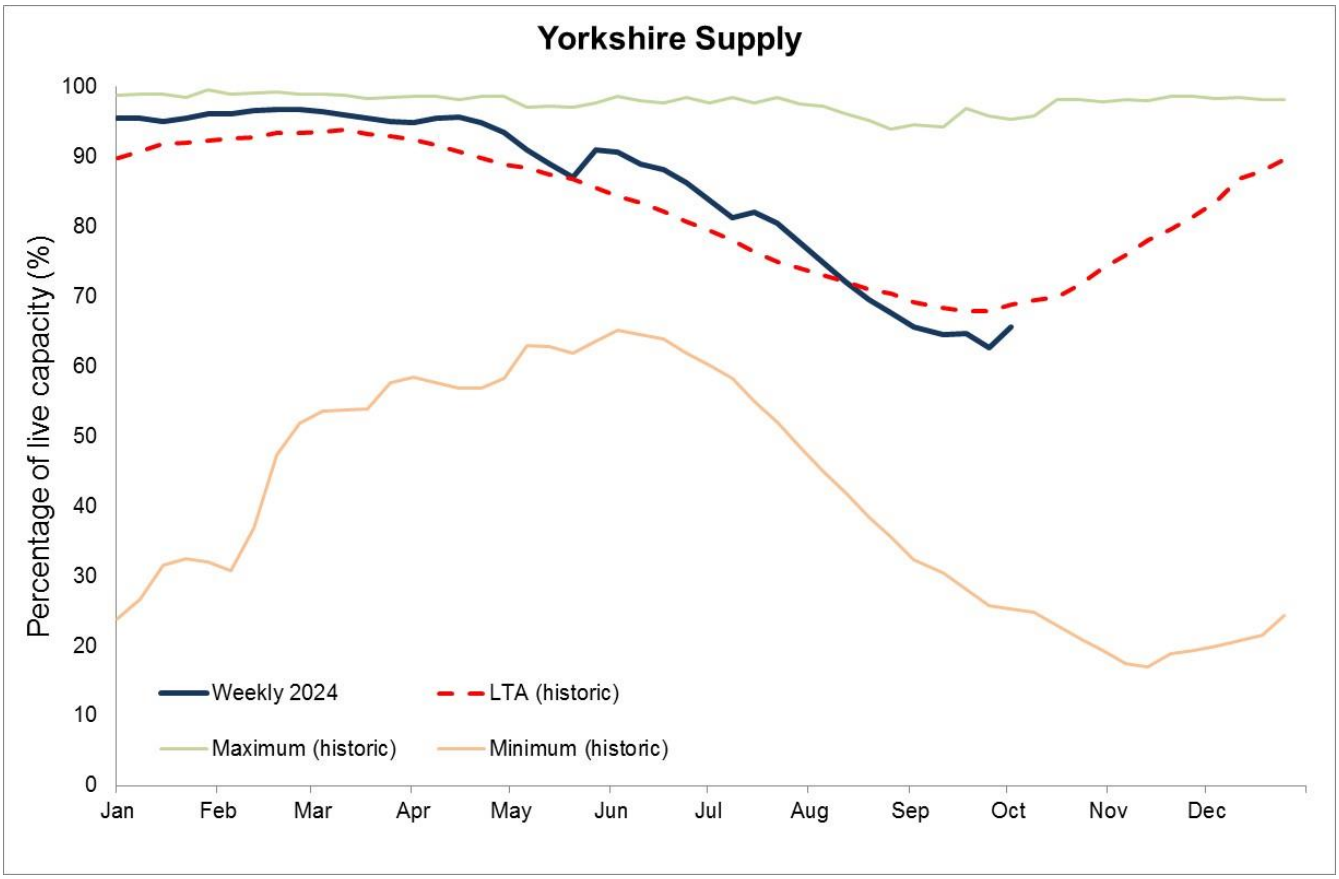




 N.B. Hill Top Farm observation borehole is used for abstraction. Therefore the groundwater level record will be directly affected by pumping

6 Reservoir stocks

Figure 6.1: End of month regional reservoir stocks compared to long term maximum, minimum and average stocks. Note: Historic records of individual reservoirs and reservoir groups making up the regional values vary in length.



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	Sep 2024 rainfall % of long term average 1961 to 1990	Sep 2024 band	Jul 2024 to September cumulative band	Apr 2024 to September cumulative band	Oct 2023 to September cumulative band
Aire	143	Above normal	Normal	Above normal	Exceptionally high
Calder	156	Notably high	Normal	Above normal	Exceptionally high
Dales North Sea Tribs	228	Exceptionally high	Above normal	Exceptionally high	Exceptionally high
Derwent (ne)	179	Notably high	Normal	Normal	Exceptionally high
Don	210	Notably high	Above normal	Above normal	Exceptionally high
Hull and Humber	221	Exceptionally high	Normal	Above normal	Exceptionally high
Nidd	165	Notably high	Normal	Above normal	Exceptionally high
Ouse	173	Notably high	Normal	Normal	Exceptionally high
Rye	167	Above normal	Normal	Above normal	Exceptionally high

Swale (ne)	175	Notably high	Normal	Above normal	Exceptionally high
Ure	142	Above normal	Normal	Above normal	Exceptionally high
Wharfe	132	Above normal	Normal	Above normal	Exceptionally high

8.2 River flows table

Site name	River	Catchment	Sep 2024 band	Aug 2024 band
Addingham	Wharfe	Wharfe Middle	Normal	Normal
Birstwith	Nidd	Nidd Middle	Above normal	Below normal
Briggswath	Esk	Esk Yorks	Notably high	Normal
Buttercrambe	Derwent	Derwent Yorks Middle	Above normal	Normal
Crakehill Topcliffe	Swale	Swale Lower	Above normal	Normal
Doncaster	Don	Don Lower	Above normal	Below normal
Elland	Calder	Calder Yorks Upper	Normal	Below normal
Hunsingore	Nidd	Nidd Lower	Above normal	Normal
Kildwick	Aire	Aire Upper	Normal	Normal
Kilgram Bridge	Ure	Ure Middle	Normal	Normal
Ness	Rye	Rye	Normal	Normal
Skelton	Ouse	Ouse Yorks	Above normal	Normal
Tadcaster	Wharfe	Wharfe Lower	Normal	Normal
Walden Stubbs	Went	Don Lower		

Wansford Snakeholm Lock	West Beck	Hull Upper	Above normal	Normal
Whittington	Rother	Rother Yorks	Notably high	Exceptionally low

8.3 Groundwater table

Site name	Aquifer	End of Sep 2024 band	End of Aug 2024 band
Brick House Fm	Wharfe Magnesian Limestone	Exceptionally high	Exceptionally high
Dalton Estate Well	Hull and East Riding Chalk	Normal	Above normal
Great Ouseburn	Sherwood Sandstone	Exceptionally high	Exceptionally high
Hill Top Fm	Millstone Grit and Carboniferous Limestone	Notably low	Below normal
Riccall Approach Farm	Sherwood Sandstone	Normal	Normal
Sproxton	Sherwood Sandstone	Above normal	Normal
Wetwang	Hull and East Riding Chalk	Normal	Normal