Monthly water situation report: East Anglia

1 Summary - February 2024

Following approximately average rainfall for January, the rainfall for February was exceptionally high for all East Anglia. This rainfall fell over catchments with soils already at or very close to field capacity. Consequently, East Anglian rivers were highly responsive to this rainfall with most river flow monitoring sites recording exceptionally high month mean flows for February. Groundwater levels have continued to rise across the month, with current levels indicative of a very healthy recharge season. Most reservoir levels are above the respective normal operating curves.

1.1 Rainfall

February 2024 was an exceptionally wet month with nearly all hydrological areas in East Anglia recording the highest February rainfall totals on record (1871 to present) for those areas. These totals ranged from 92mm to 140mm, or were between 272% to 355% of the long term average [LTA] for February. The western half of East Anglia typically had higher rainfall month totals than the eastern half. The East Anglia area average figure for February 2024 was 114mm, which ranks as the highest February total on record for the area. The 3, 6 and 12 month rainfall totals for all hydrological areas, with the exception of South Essex, are within the exceptionally high category

1.2 Soil moisture deficit and recharge

An exceptionally wet February resulted in soils remaining at or close to field capacity across most of the area. The East Anglia soil moisture deficit [SMD] for the end of February was calculated as 1.7mm, which is considered notably low for the time of year. Recharge has continued with 23, out of 25, monitoring boreholes for which we have data showing an increase in groundwater levels compared to the levels recorded in January 2024.

1.3 River flows

With a negligible SMD throughout February, East Anglian rivers where highly responsive to the exceptionally high February rainfall totals. Most report sites recorded exceptionally high month mean flows for February. The exceptionally wet February conditions, along with high groundwater levels, has led to localised flooding in parts of the area.

Northwold gauging station, on the River Wissey, continues to record suspect flow data and has been excluded from this month’s report.

1.4 Groundwater levels

Groundwater levels have continued to rise at the majority of monitoring sites for which we have February dips or telemetered readings. The very wet autumn and winter has resulted in a very healthy recharge season. February groundwater levels within the Chalk are generally within the exceptionally high category. Available monitoring within the Oolitic limestone, Greensand and Suffolk Crag deposits indicate notably high to exceptionally high groundwater levels. Probabilistic forecasts suggest that above normal, or higher, groundwater levels are likely to persist into autumn 2024.

High groundwater levels have resulted in groundwater flooding in areas near Newmarket, Bury Saint Edmunds and Burnham Thorpe, North Norfolk.

1.5 Reservoir stocks

The majority of reservoirs showed an increase in levels across February and remain above their respective normal operating curves. Operational constraints have seen Grafham remain at 77% full across the month. Although the level at Grafham is below the normal operating curve, prospects for refill remain good due to the likelihood of sustained high baseflows in the Great Ouse catchment.

1.6 Forward look

1.6.1 Probabilistic ensemble projections for river flows at key sites

The river flow projections indicate a high likelihood of above normal to exceptionally high flows for March 2024, and a high likelihood of normal or higher flows for June 2024. This is to be expected with the healthy recharge season to date and the current catchment conditions.

1.6.2 Probabilistic ensemble projections for groundwater levels in key aquifers

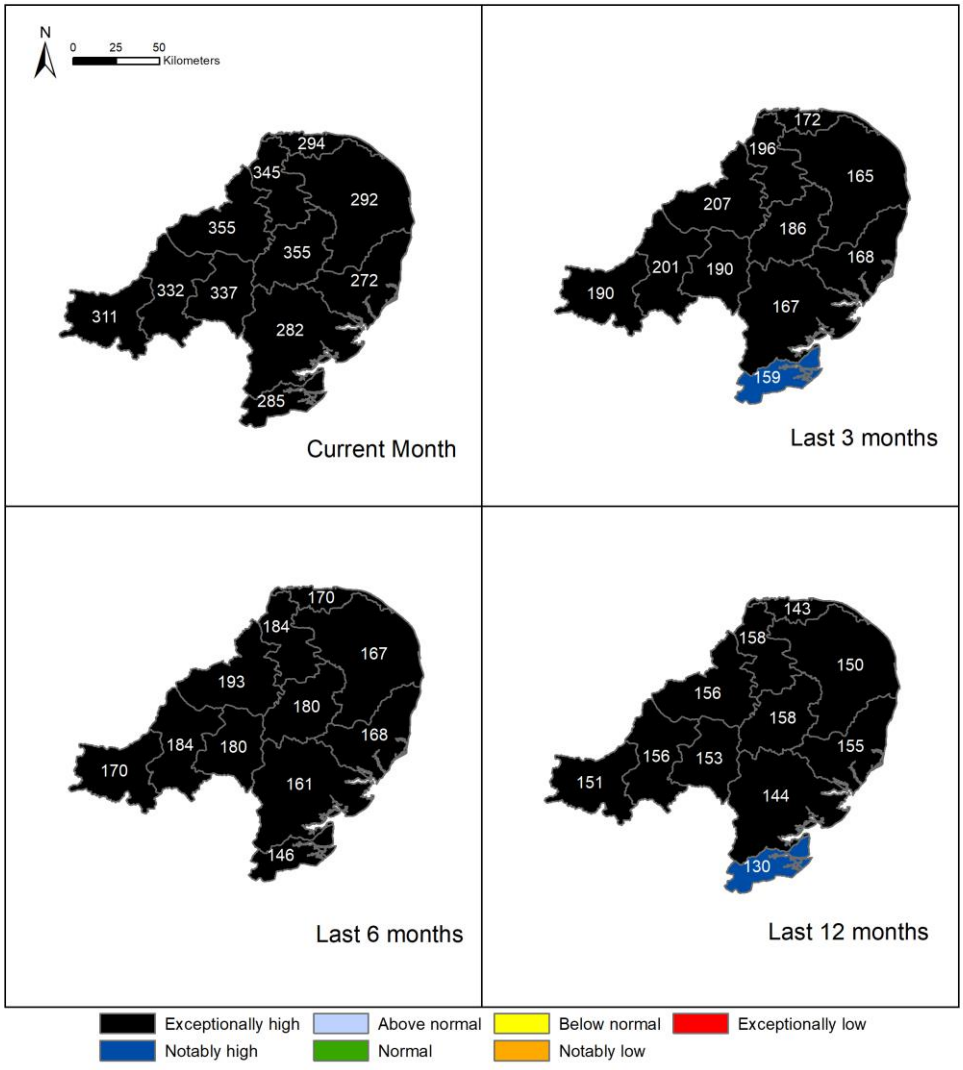
With groundwater levels typically being slower to change than river levels, there is a high likelihood of continued notably high to exceptionally high groundwater levels by the end of March 2024. As the projections go further into the future, the influence of current conditions reduces, although there remains a very high likelihood of above normal or higher groundwater conditions at all forecast sites by September 2024.

Author: Hydrology Team, hydrology-ean-and-lna@environment-agency.gov.uk

2 Rainfall

2.1 Rainfall map

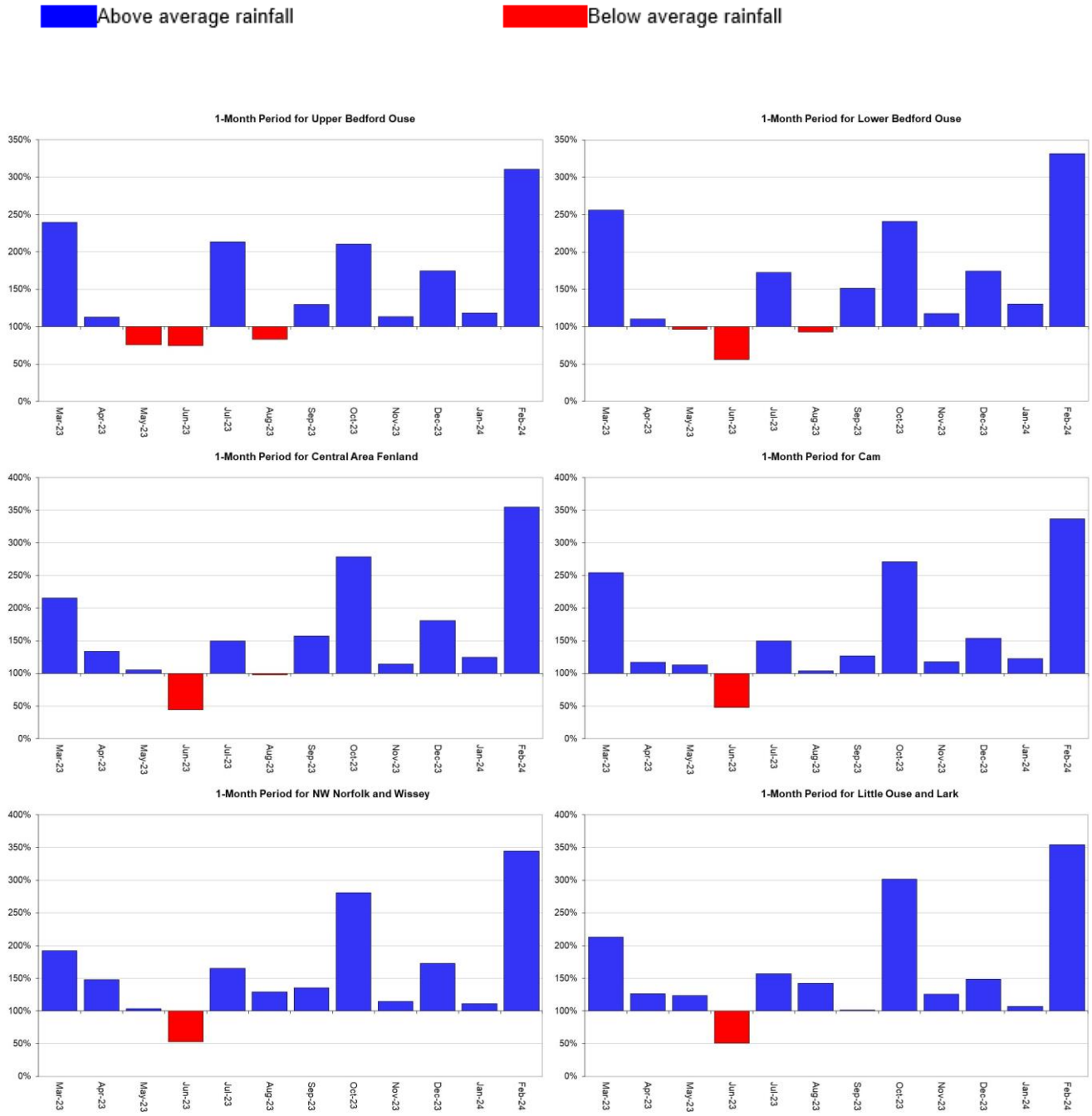
Figure 2.1: Total rainfall for hydrological areas across East Anglia, expressed as a percentage of long term average rainfall for the current month (up to 29 February 2024), the last 3 months, the last 6 months, and the last 12 months. Category classes are based on an analysis of respective historic totals. Table available in the appendices with detailed information.

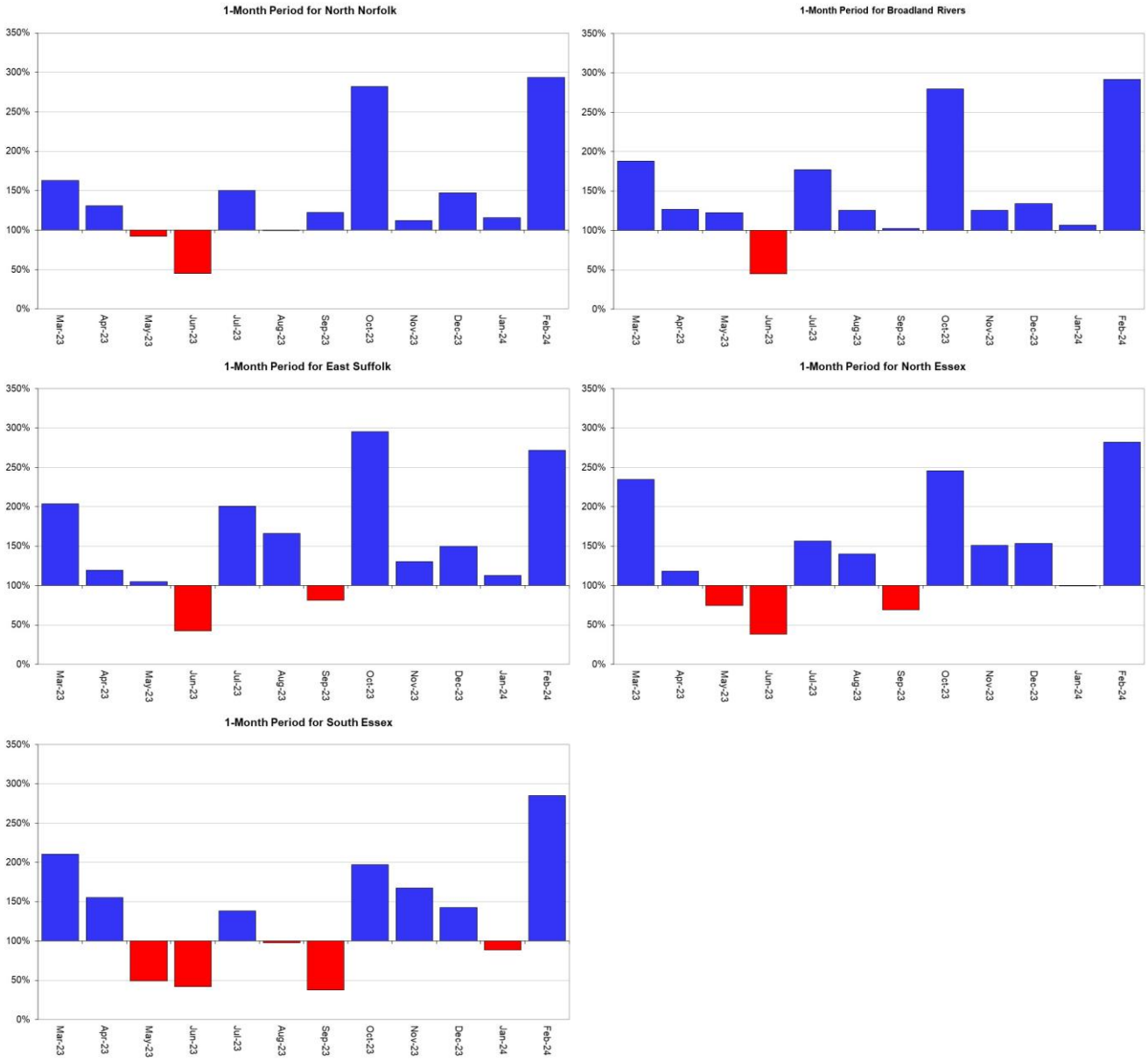


HadUK data based on the Met Office 1km gridded rainfall dataset derived from rain gauges (Source: Met Office. Crown copyright, 2024). Provisional data based on Environment Agency 1km gridded rainfall dataset derived from Environment Agency intensity rain gauges. Crown copyright. All rights reserved.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

2.2 Rainfall charts

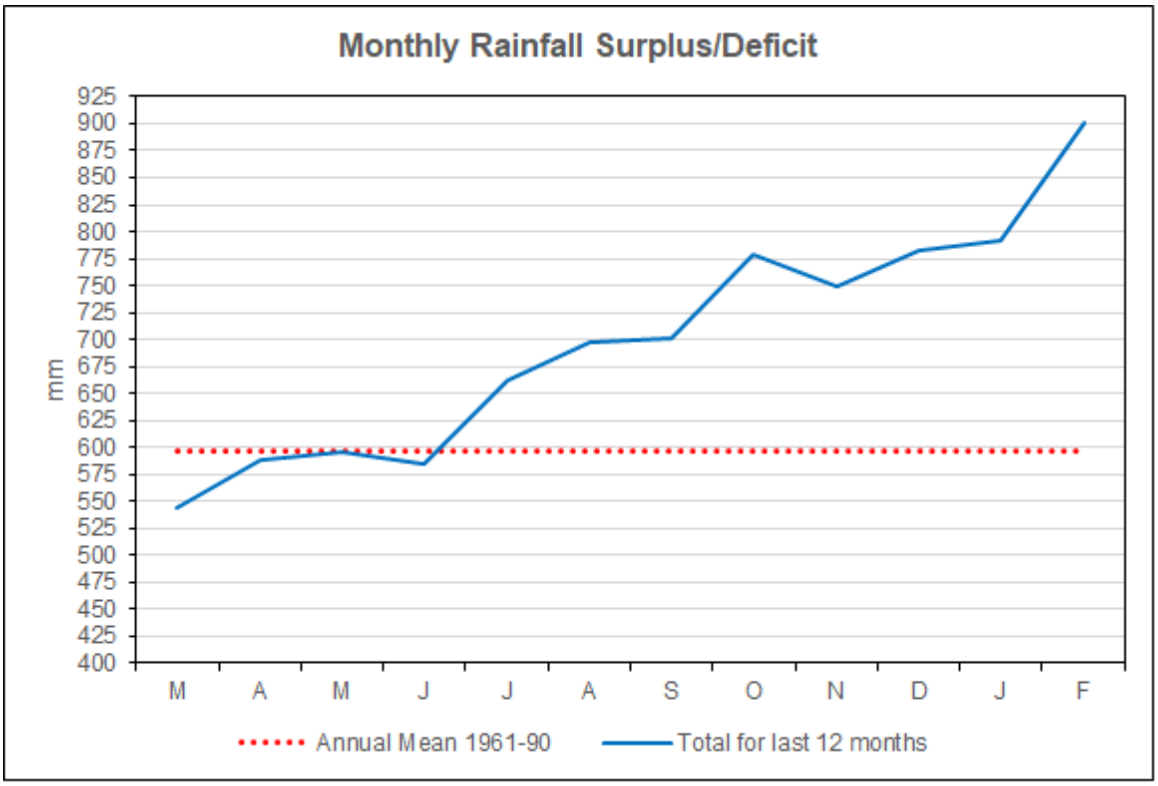
Figure 2.2: Monthly rainfall totals for the past 12 months as a percentage of the 1961 to 1990 long term average for each region and for England.





HadUK rainfall data. (Source: Met Office. Crown copyright, 2024).

2.3 Monthly rainfall surplus deficit chart

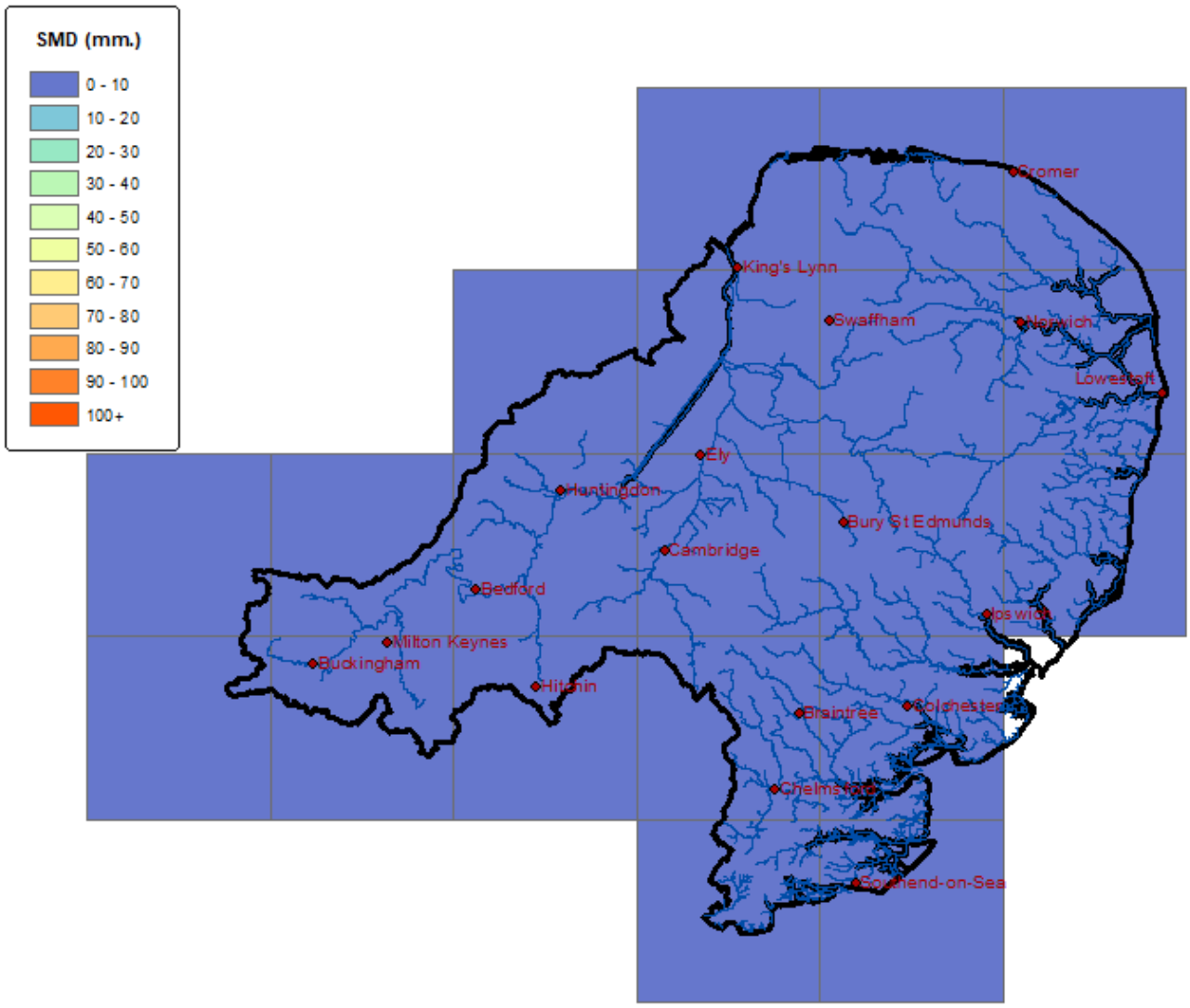


HadUK rainfall data. (Source: Met Office. Crown copyright, 2024).

3 Soil moisture deficit

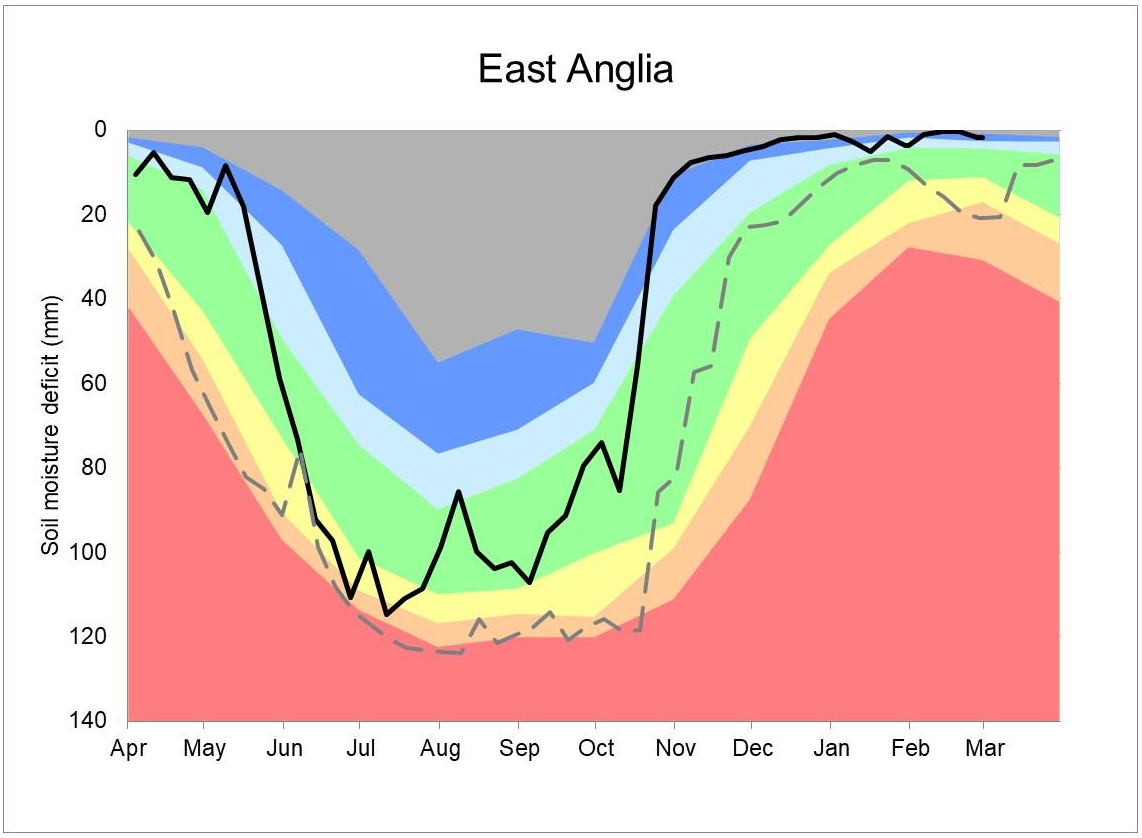
3.1 Soil moisture deficit map

Figure 3.1: Soil moisture deficit values for 29 February 2024. Values based on the weekly MORECS data for real land use.



3.2 Soil moisture deficit charts

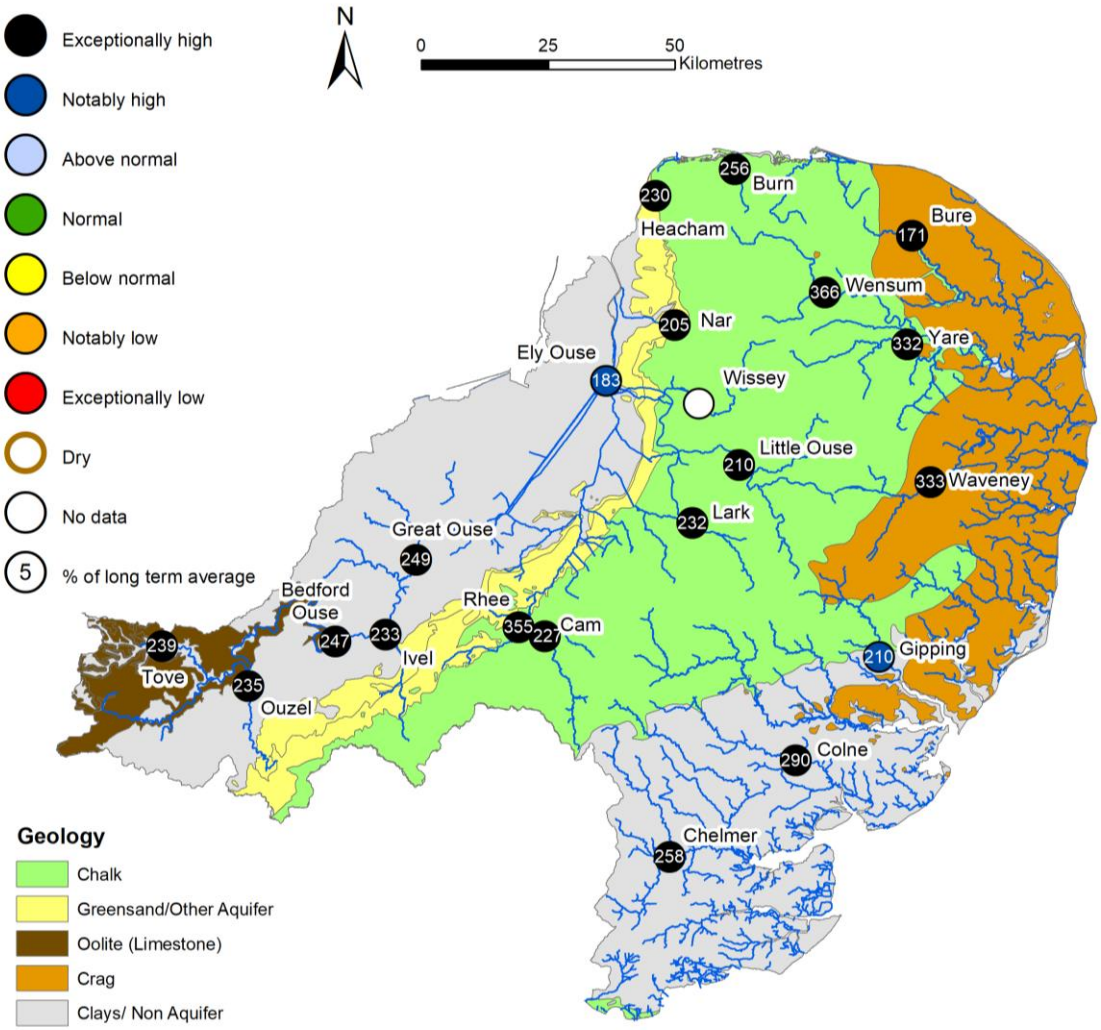
Figure 3.2: Latest soil moisture deficit compared to an analysis of historic 1961 to 1990 long term data set. Weekly MORECS data for real land use.



4 River flows

4.1 River flows map

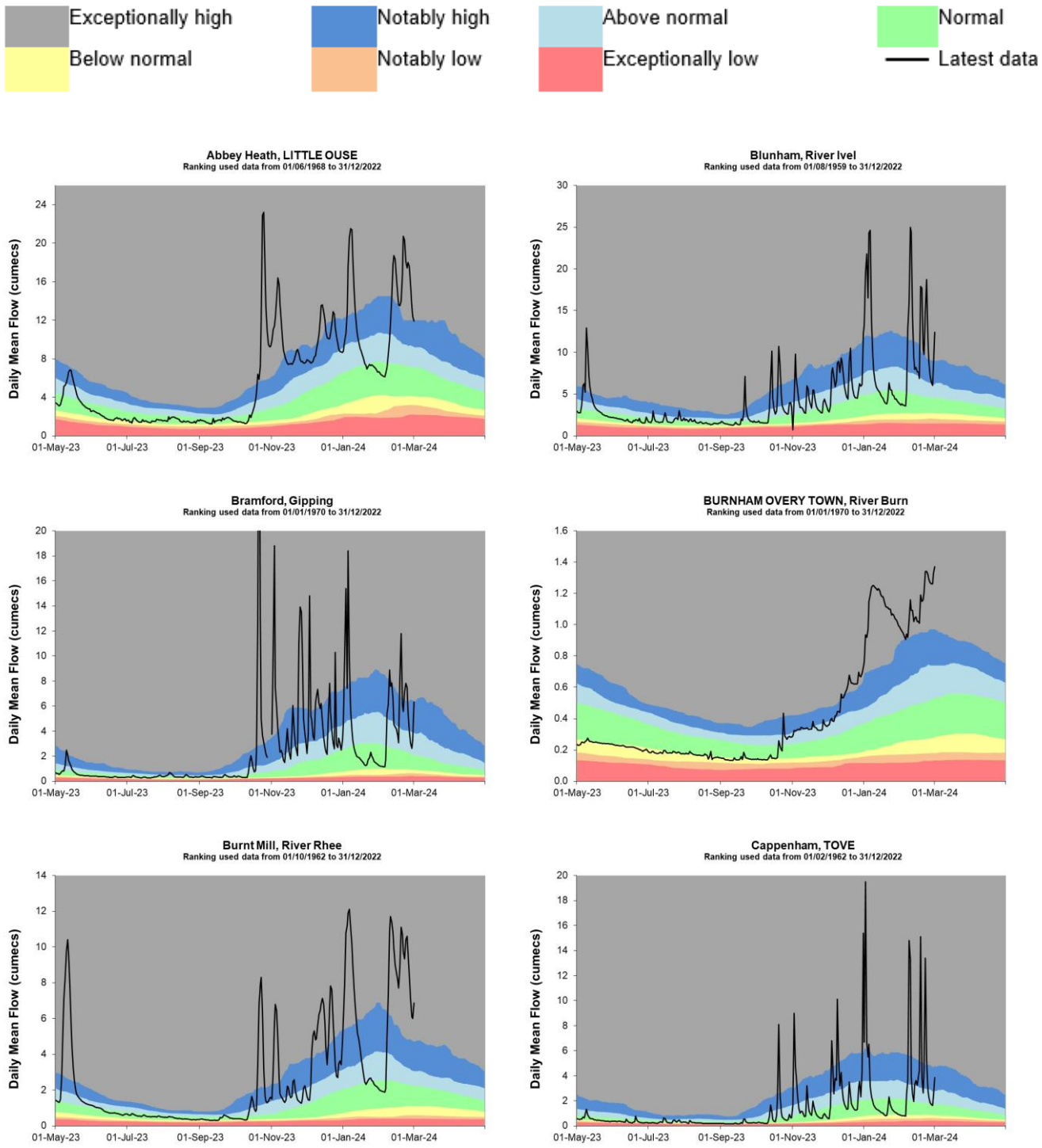
Figure 4.1: Monthly mean river flow for indicator sites for February 2024, expressed as a percentage of the respective long term average and classed relative to an analysis of historic February monthly means Table available in the appendices with detailed information.



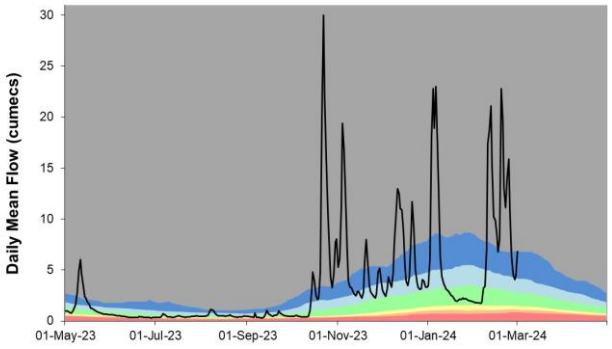
(Source: Environment Agency). Geological map reproduced with kind permission from UK Groundwater Forum, BGS copyright NERC. Crown copyright. All rights reserved. Environment Agency, 100024198, 2024.

4.2 River flow charts

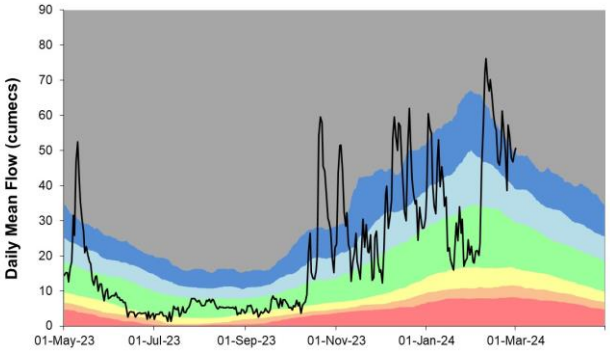
Figure 4.2: Daily mean river flow for index sites over the past year, compared to an analysis of historic daily mean flows, and long term maximum and minimum flows.



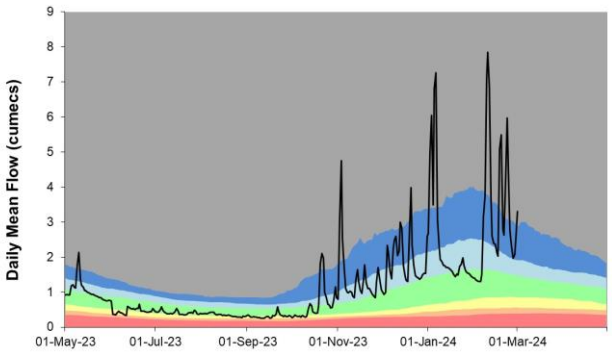
COLNEY, River Yare
Ranking used data from 01/01/1970 to 31/12/2022



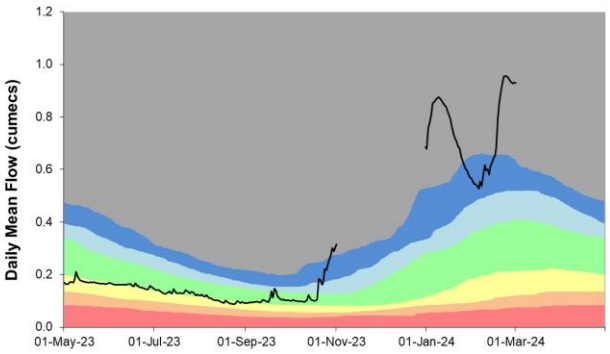
Denver, ELY OUSE
Ranking used data from 01/11/1971 to 31/12/2022



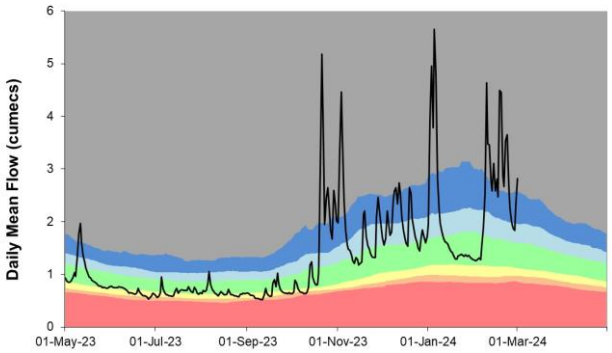
Dernford, CAM
Ranking used data from 21/02/1949 to 23/12/2022



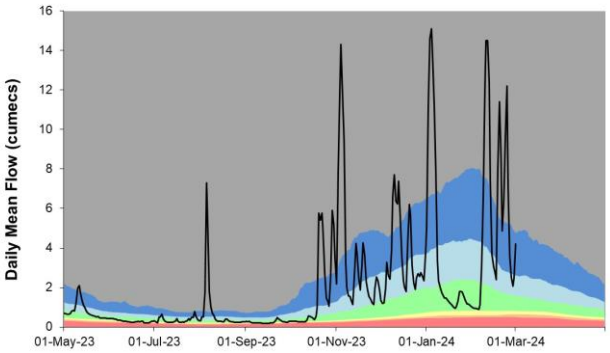
Heacham, HEACHAM
Ranking used data from 01/11/1965 to 31/12/2022



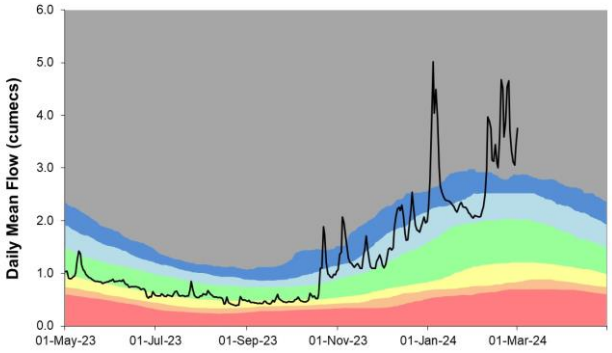
Ingworth, Bure
Ranking used data from 01/01/1970 to 31/12/2022



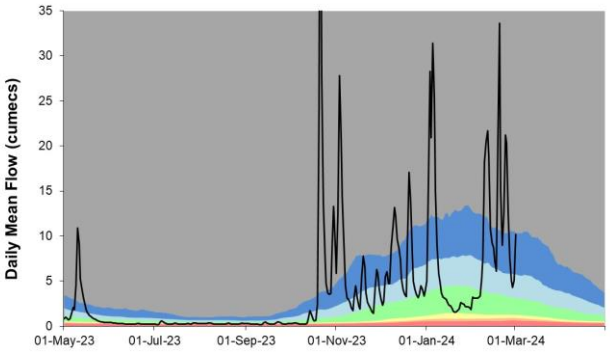
Lexden, Colne
Ranking used data from 01/01/1970 to 31/12/2022

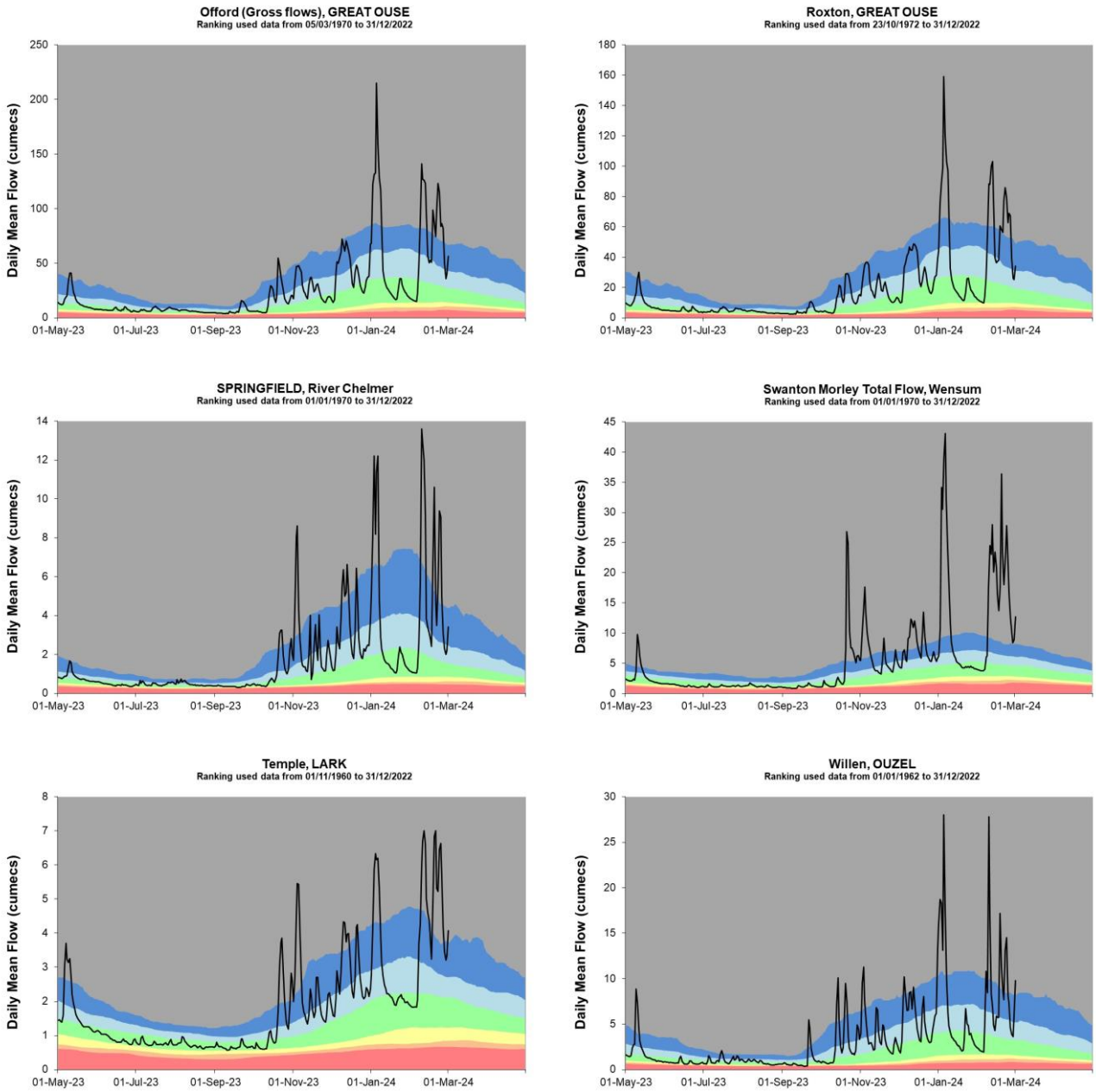


Marham, River Nar
Ranking used data from 01/09/1953 to 31/12/2022



Needham Weir Total, Waveney
Ranking used data from 01/01/1970 to 31/12/2022



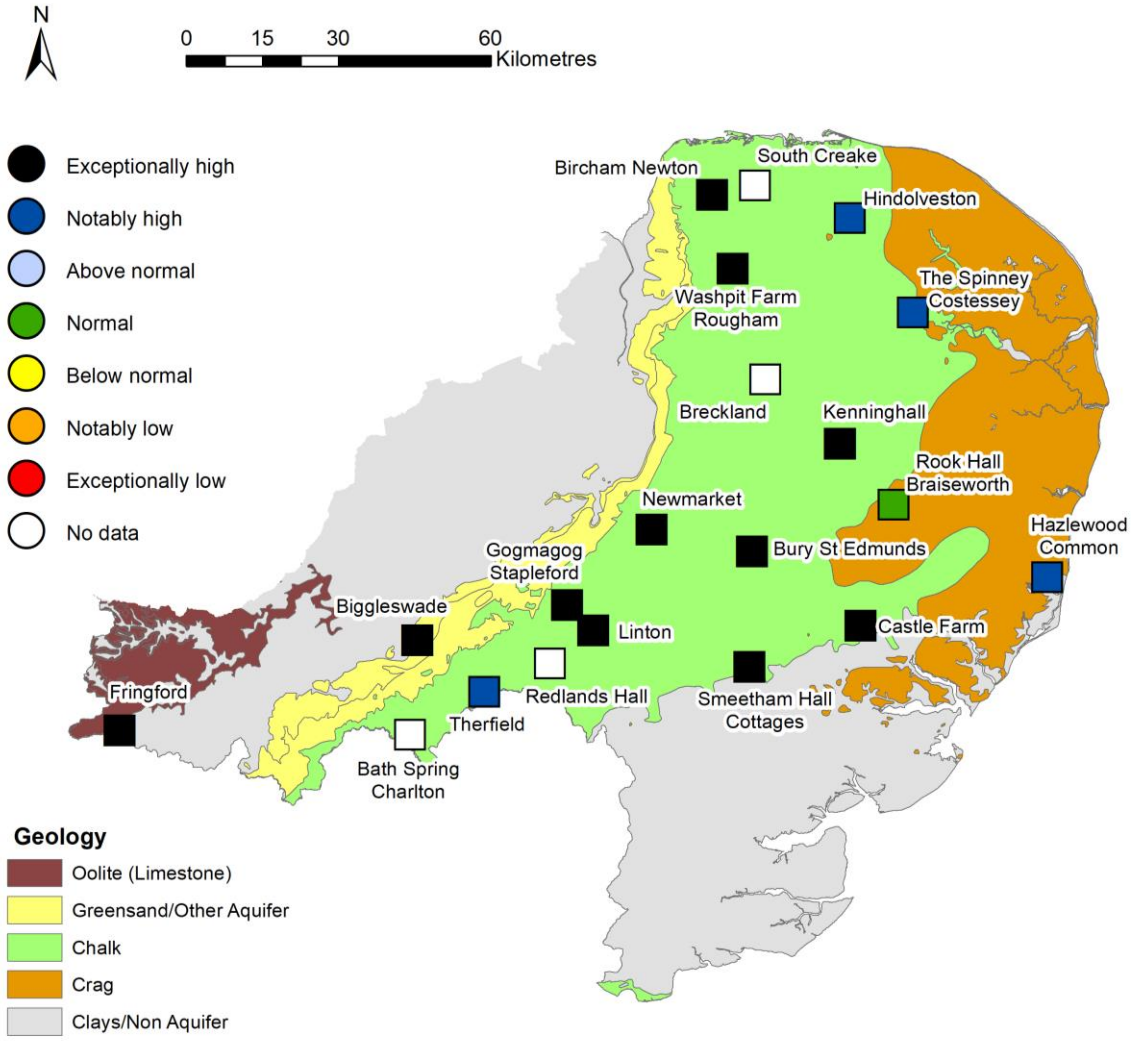


Source: Environment Agency.

5 Groundwater levels

5.1 Groundwater levels map

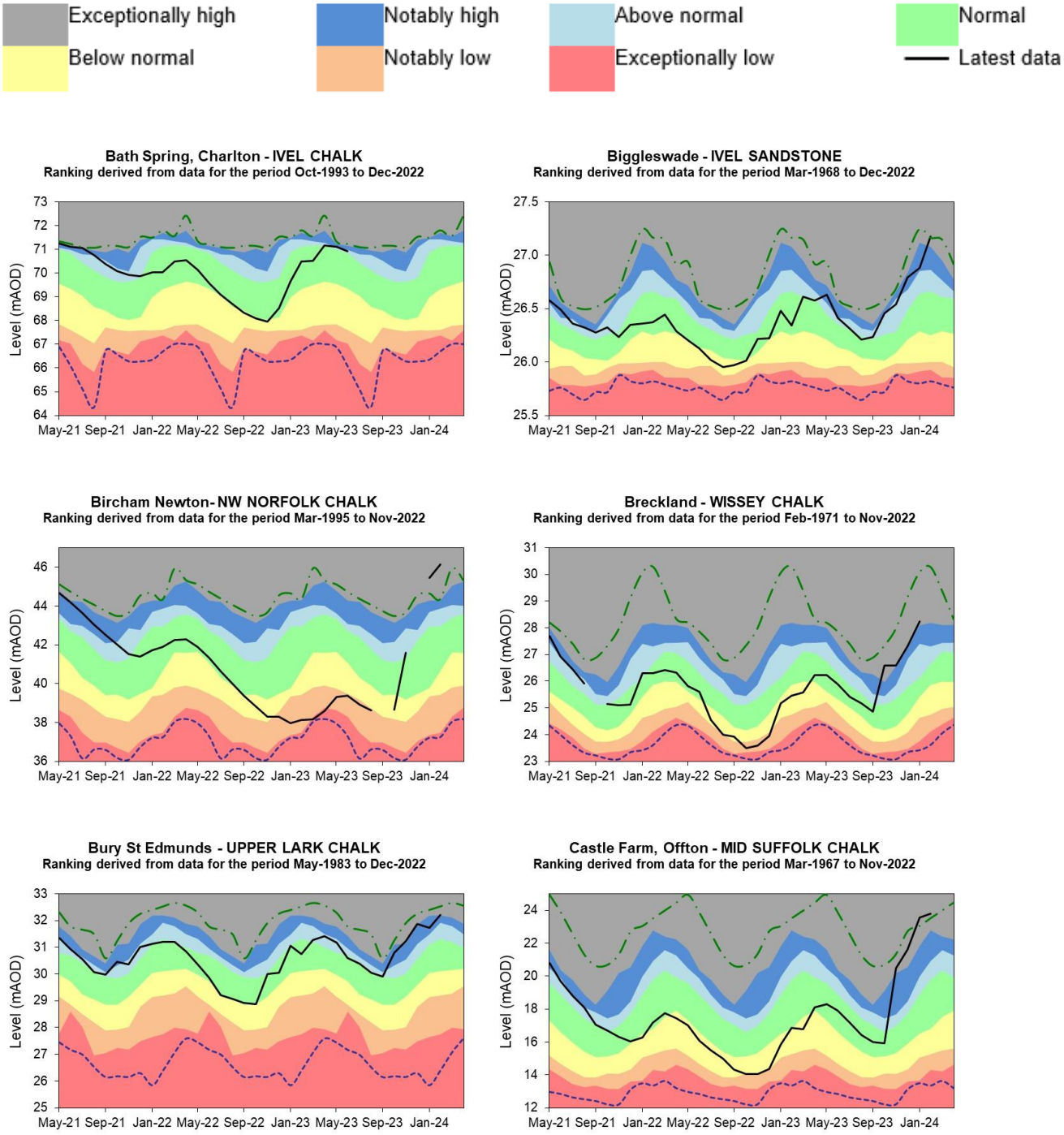
Figure 5.1: Groundwater levels for indicator sites at the end of February 2024, classed relative to an analysis of respective historic February levels. Table available in the appendices with detailed information.



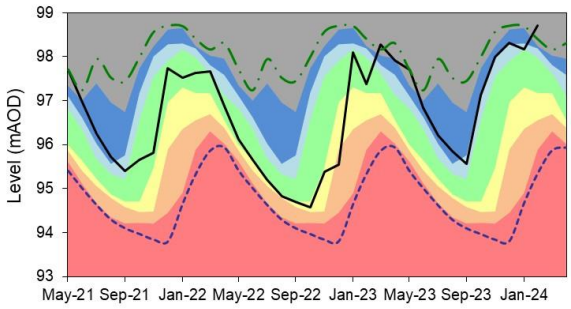
(Source: Environment Agency). Geological map reproduced with kind permission from UK Groundwater Forum, BGS copyright NERC. Crown copyright. All rights reserved. Environment Agency, 100024198, 2024.

5.2 Groundwater level charts

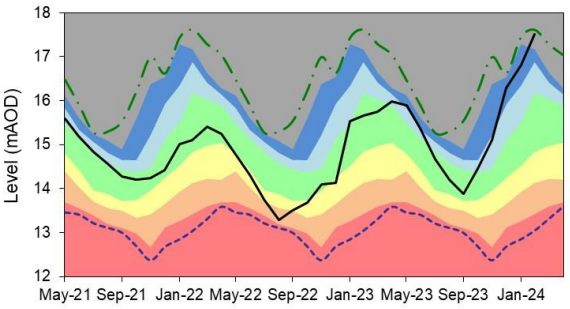
Figure 5.2: End of month groundwater levels at index groundwater level sites for major aquifers. 34 months compared to an analysis of historic end of month levels and long term maximum and minimum levels.



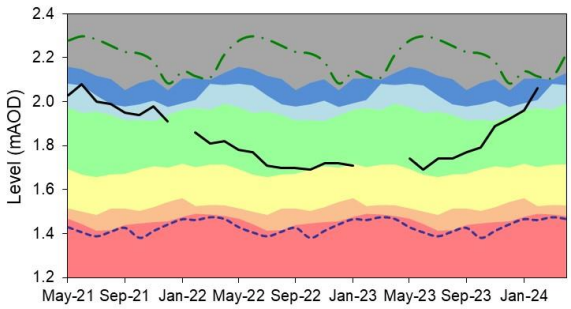
Fringford - GREAT OOLITE
Ranking derived from data for the period Sep-1980 to Dec-2022



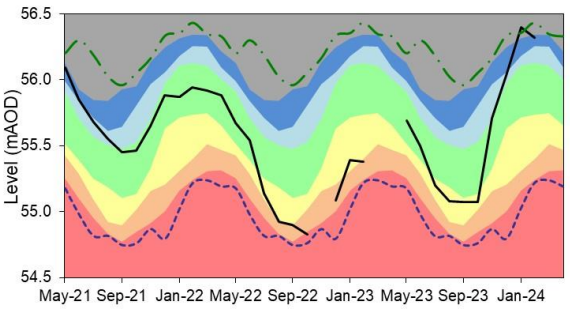
Gog Magog, Stapleford - CAM CHALK
Ranking derived from data for the period Jan-1980 to Dec-2022



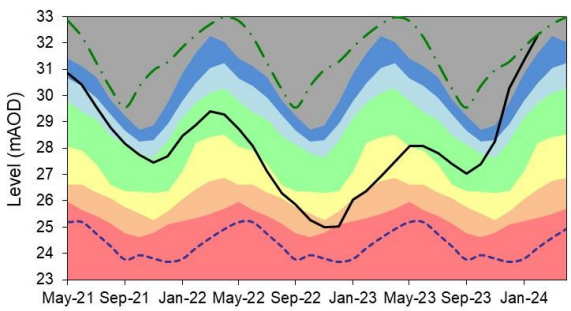
Hazlewood Common - SUFFOLK CRAG
Ranking derived from data for the period Oct-1988 to Nov-2022



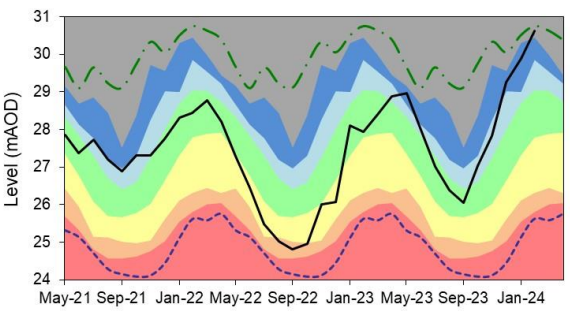
Hindolveston - NORFOLK CHALK
Ranking derived from data for the period Sep-1984 to Nov-2022



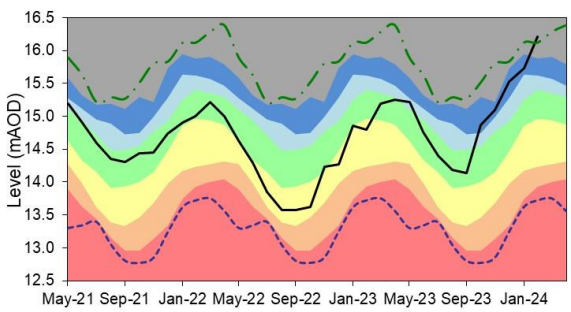
Kenninghall - LITTLE OUSE CHALK
Ranking derived from data for the period Aug-1973 to Dec-2022



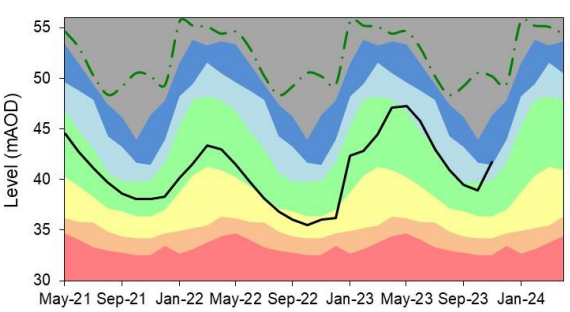
Linton- CAM CHALK
Ranking derived from data for the period Jan-1980 to Dec-2022

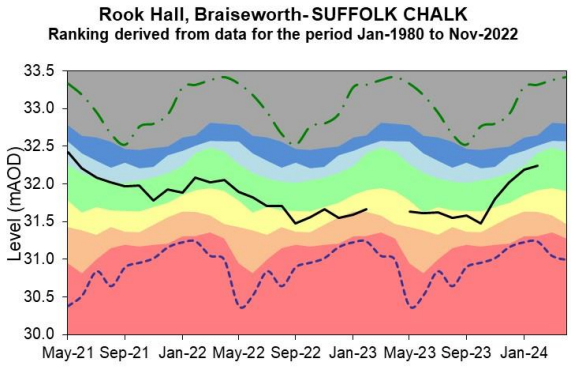


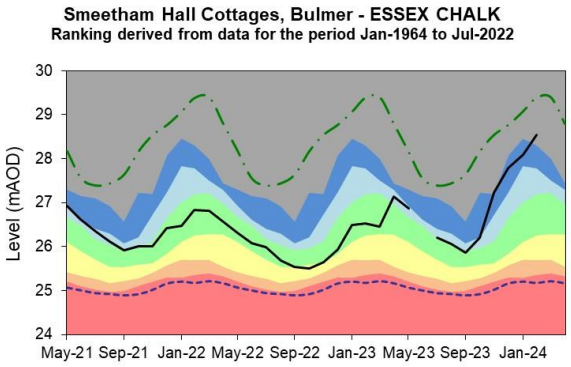
Newmarket - SNAIL CHALK
Ranking derived from data for the period Feb-1983 to Dec-2022

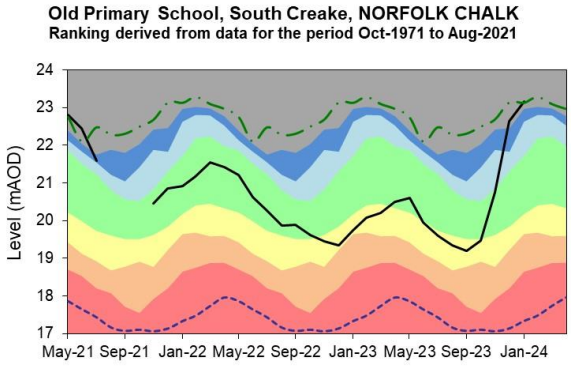


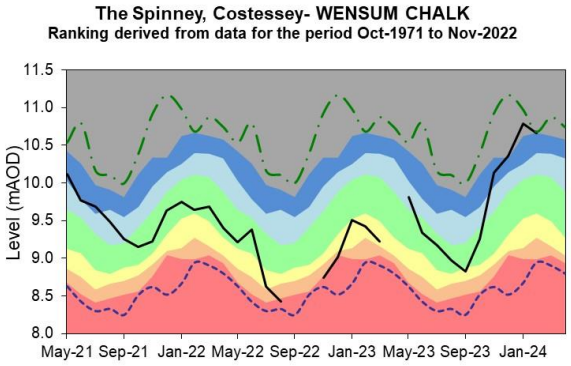
Redlands Hall, Ickleton - CAM CHALK
Ranking derived from data for the period Aug-1963 to Dec-2022

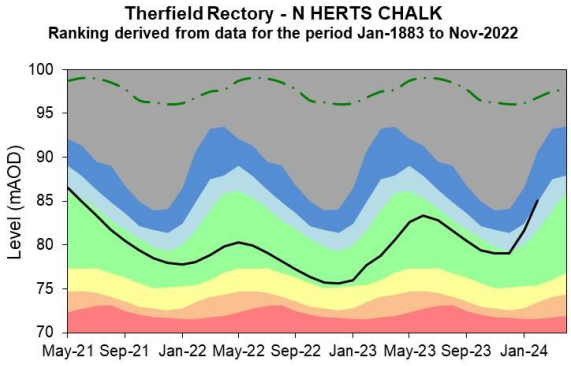


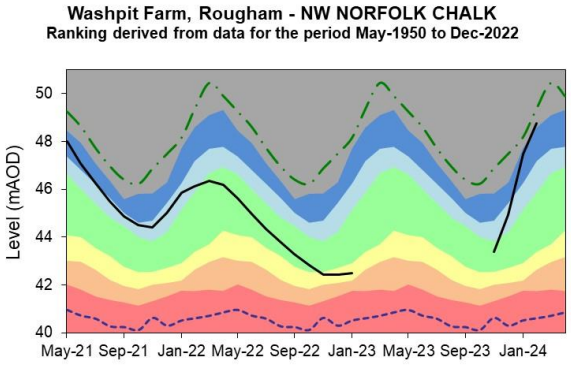








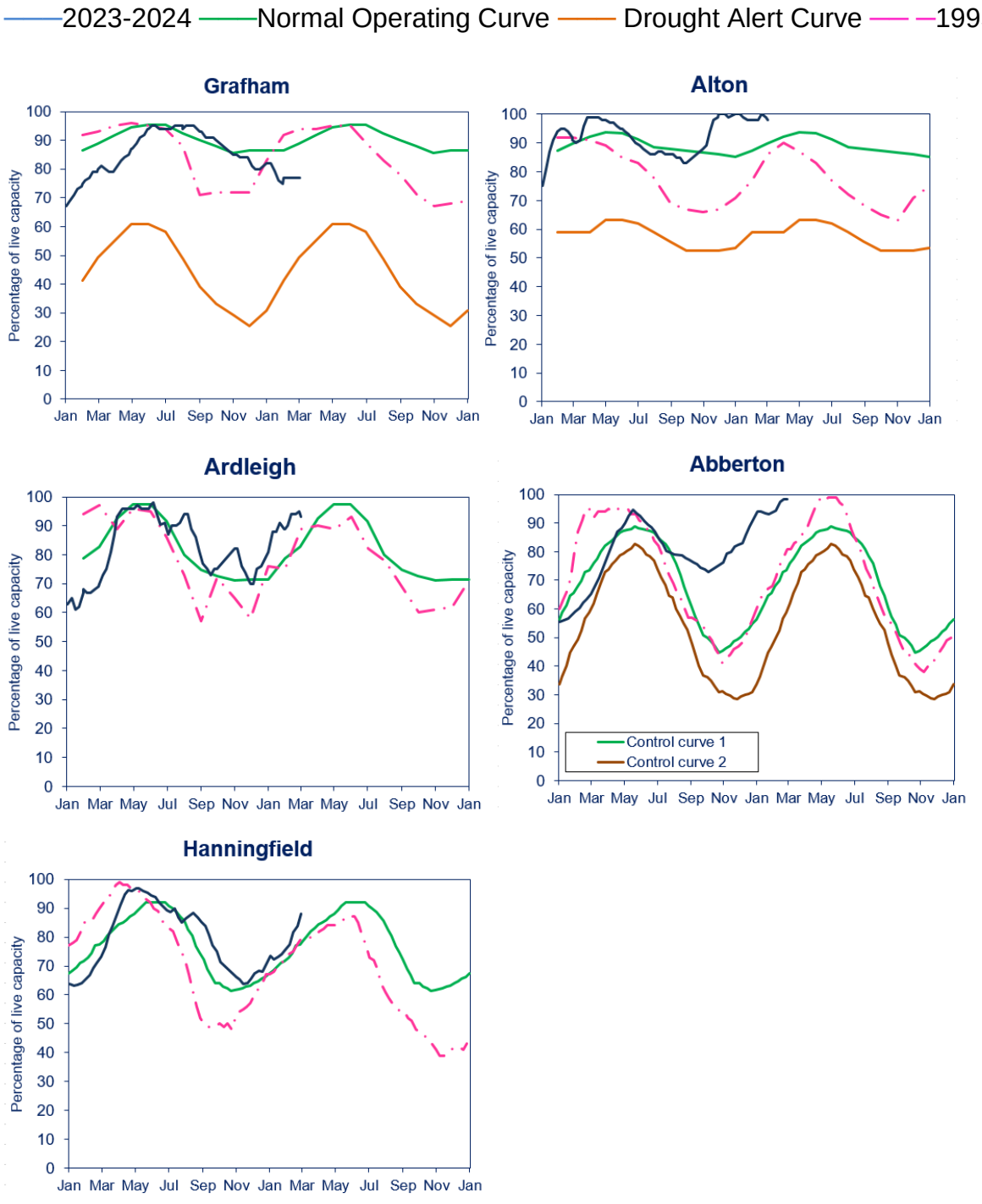




Source: Environment Agency, 2024.

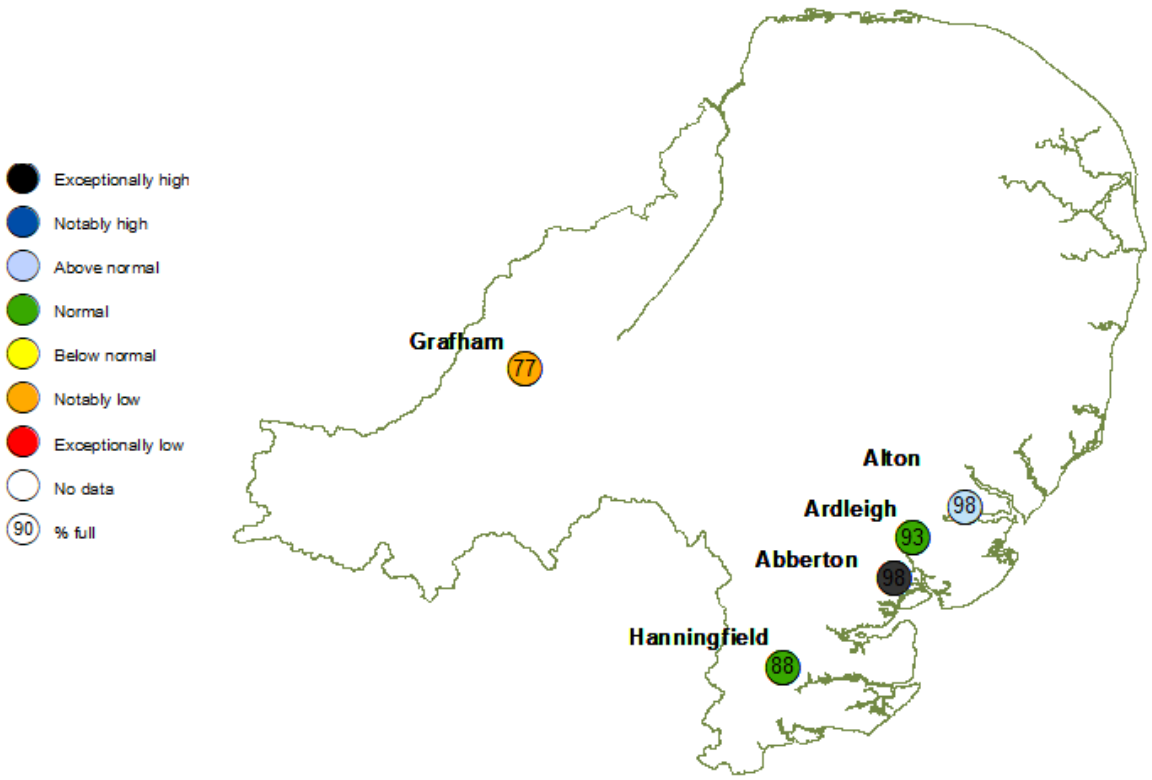
6 Reservoir stocks

Figure 6.1: End of month regional reservoir stocks compared to the normal operating curve, drought curve and dry 1995-1996 stocks. Note: Historic records of individual reservoirs and reservoir groups making up the regional values vary in length.



(Source: water companies).

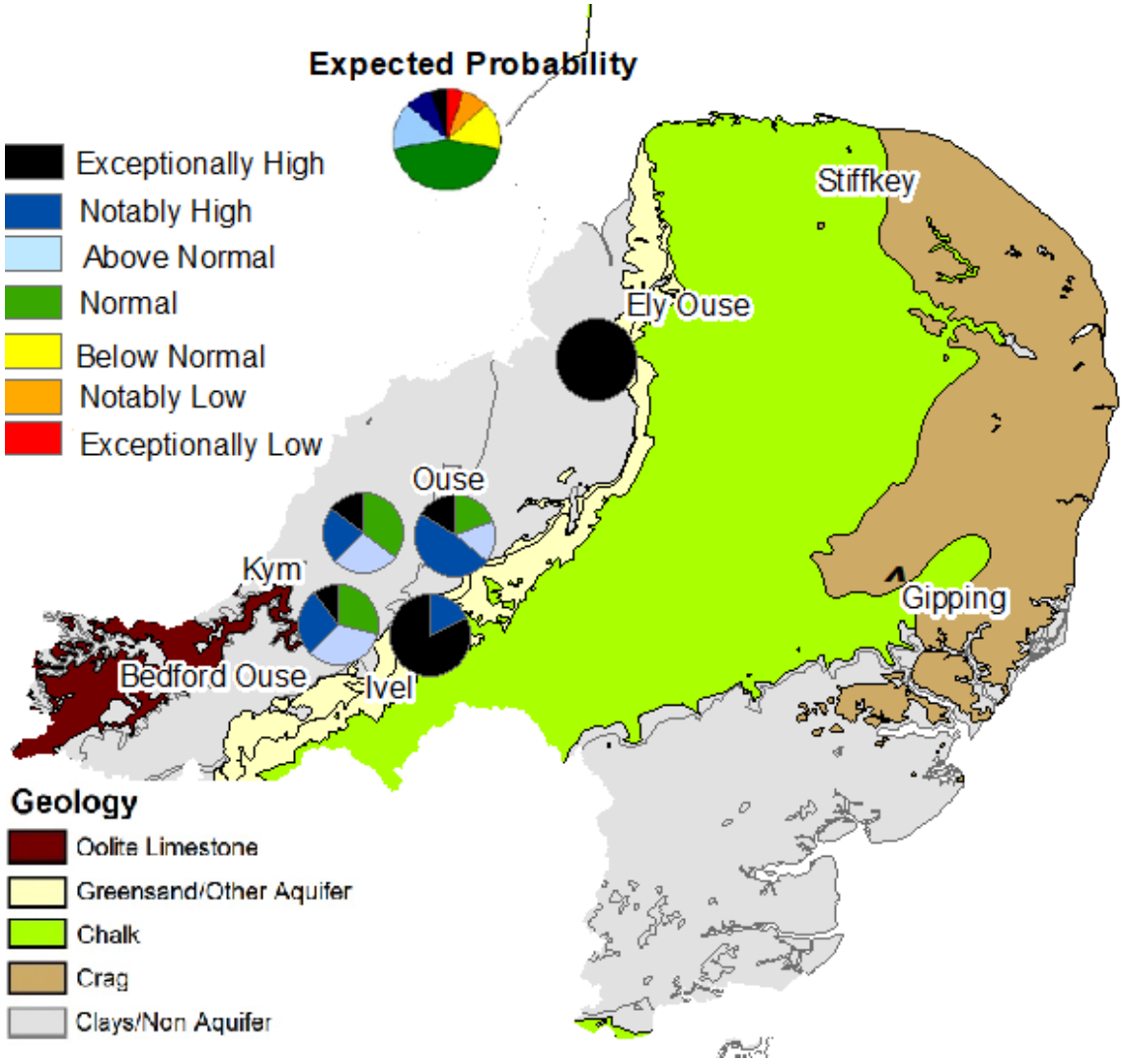
6.1 Reservoir stocks map



7 Forward look

7.1 Probabilistic ensemble projection of river flows at key sites in March 2024

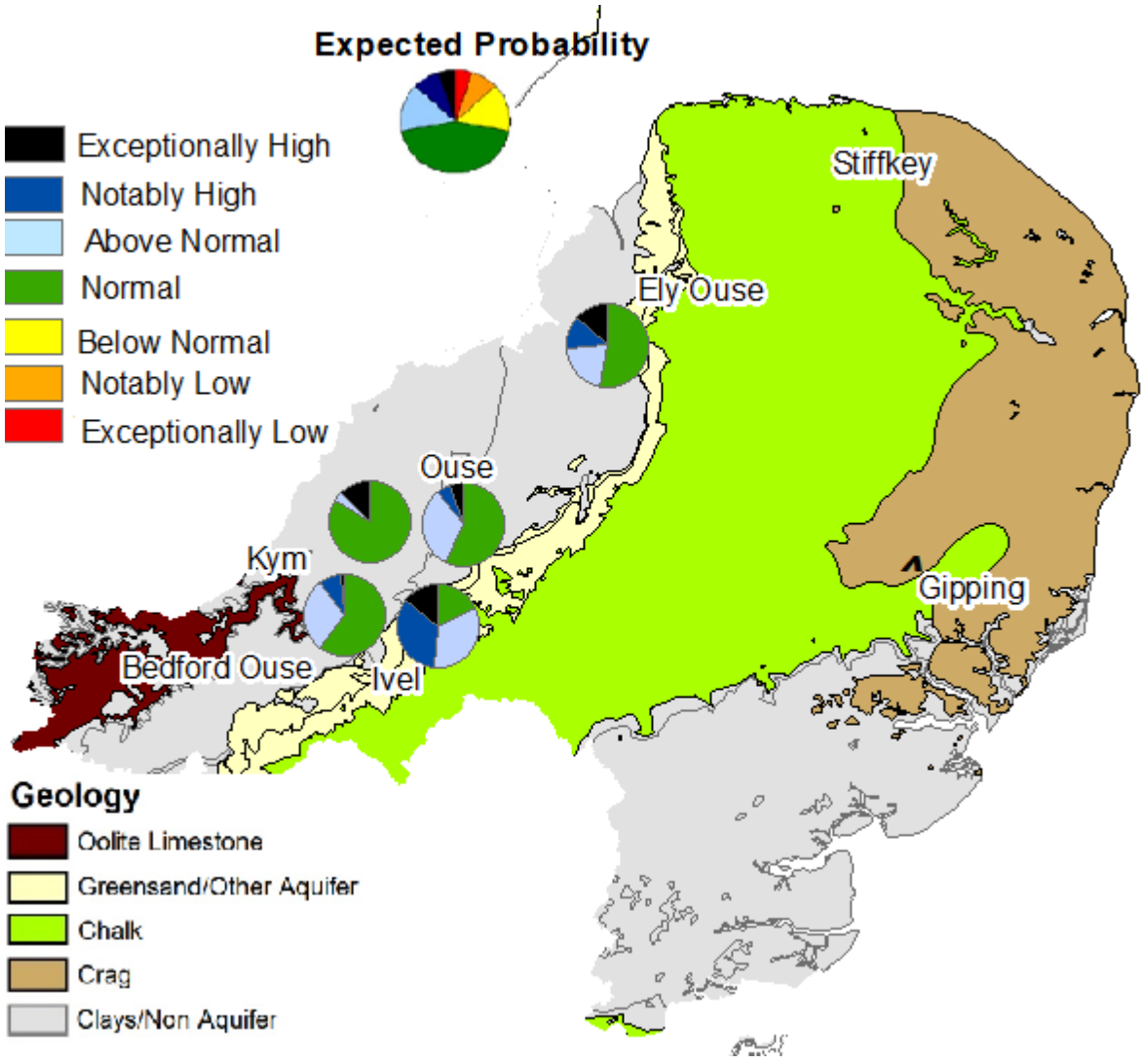
Table available in the appendices with detailed information. Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are those which would typically occur 44% of the time within the historic record.



Pie charts indicate probability, based on climatology, of the surface water flow at each site being, for example, exceptionally low for the time of year. (Source: Centre for Ecology and Hydrology, Environment Agency) Geological map reproduced with kind permission from UK Groundwater Forum, BGS © NERC. Crown copyright. All rights reserved. Environment Agency, 100026380, 2024.

7.2 Probabilistic ensemble projection of river flows at key sites in June 2024

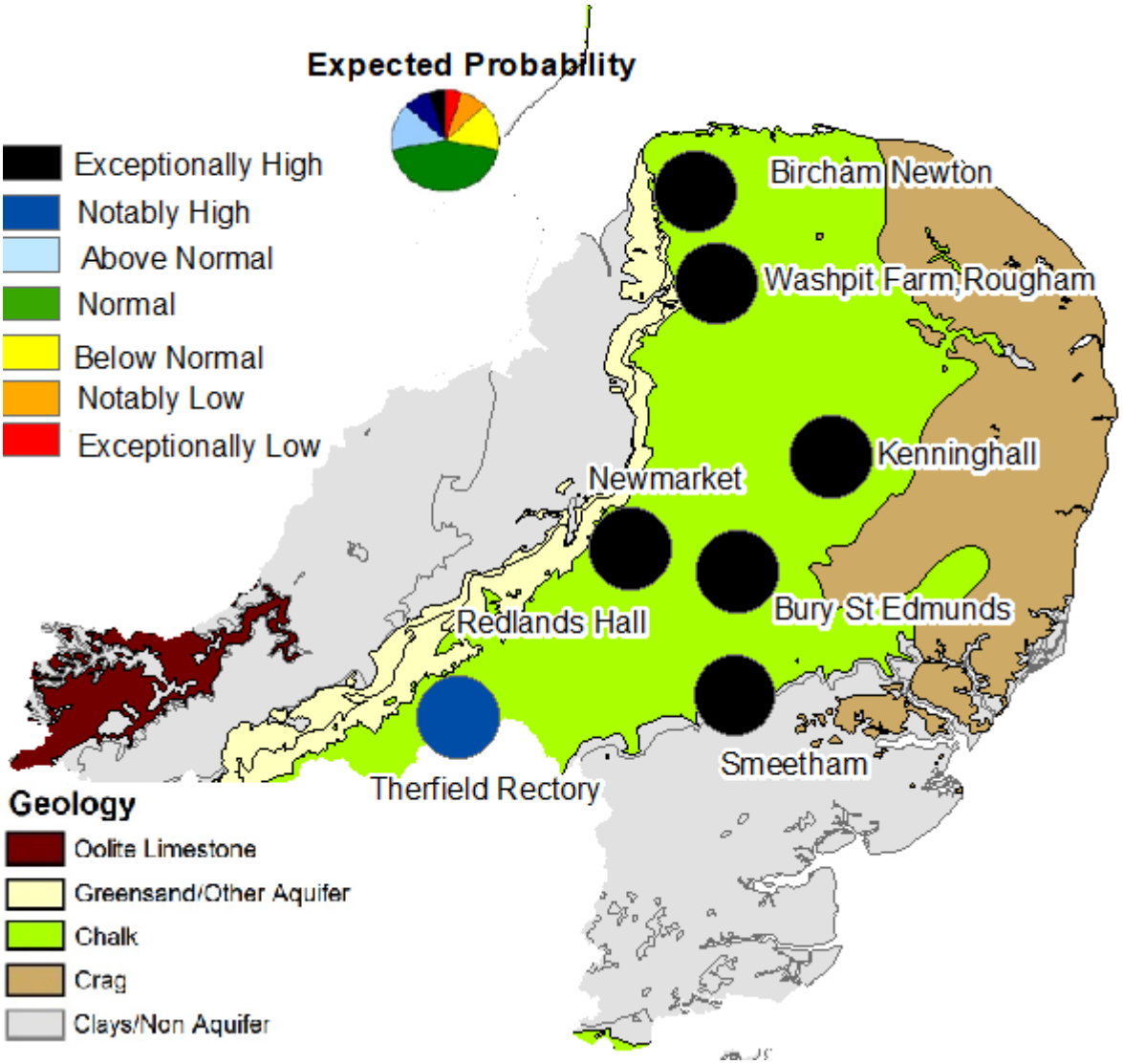
Table available in the appendices with detailed information. Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are those which would typically occur 44% of the time within the historic record.



Pie charts indicate probability, based on climatology, of the surface water flow at each site being, for example, exceptionally low for the time of year. (Source: Centre for Ecology and Hydrology, Environment Agency) Geological map reproduced with kind permission from UK Groundwater Forum, BGS © NERC. Crown copyright. All rights reserved. Environment Agency, 100026380, 2024

7.3 Probabilistic ensemble projection of groundwater levels at key sites in March 2024

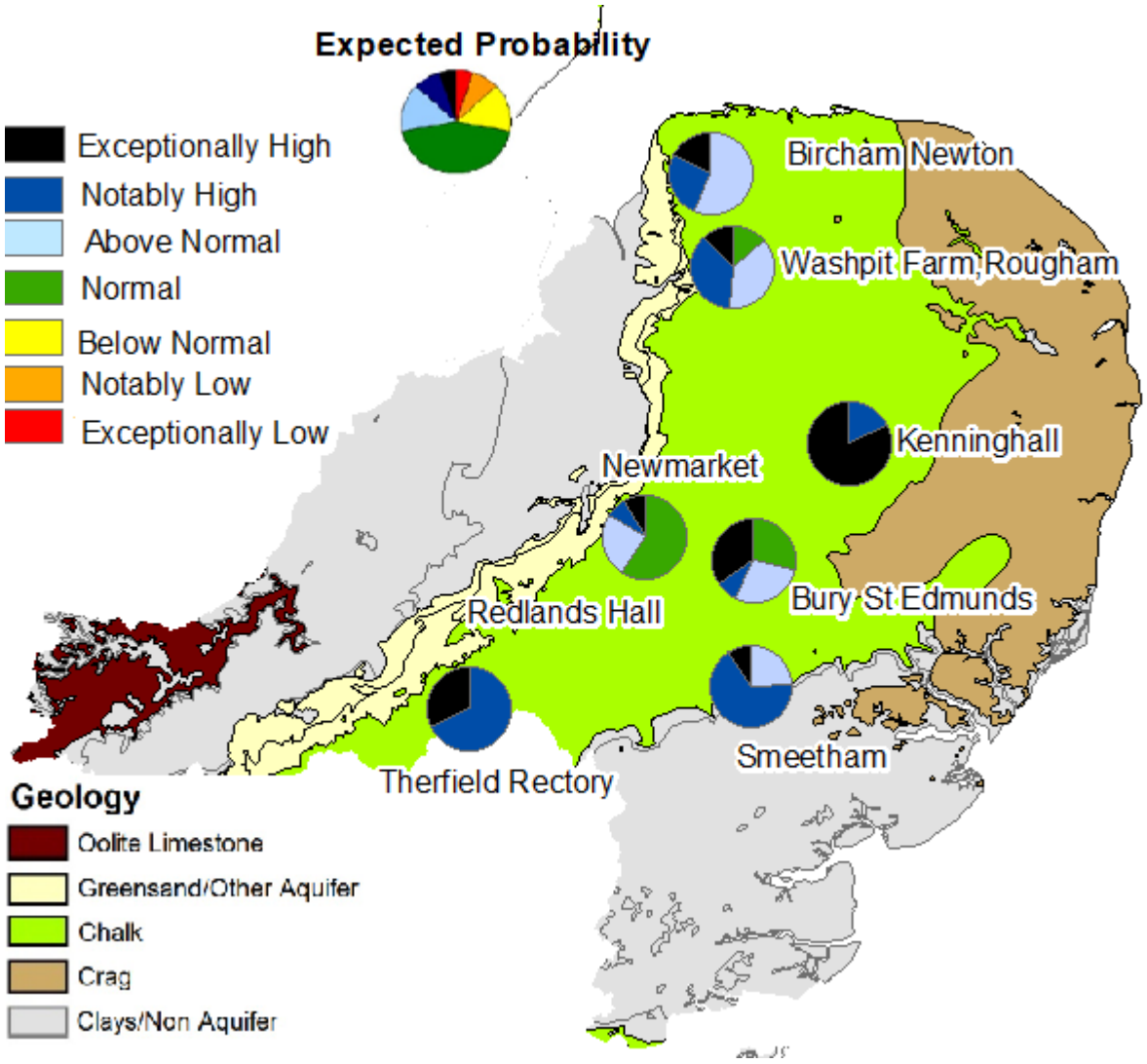
Table available in the appendices with detailed information. Exceptionally high or low levels are those which would typically occur 5% of the time within the historic record. Notably high or low levels are those which would typically occur 8% of the time. Above normal or below normal levels are those which would typically occur 15% of the time. Normal levels are those which would typically occur 44% of the time within the historic record.



Pie charts indicate probability, based on climatology, of the groundwater level at each site being, for example, exceptionally low for the time of year. (Source: Environment Agency)

7.4 Probabilistic ensemble projection of groundwater levels at key sites in September 2024

Table available in the appendices with detailed information. 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.



Pie charts indicate probability, based on climatology, of the groundwater level at each site being, for example, exceptionally low for the time of year. (Source: Environment Agency)

8 Glossary

8.1 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).

8.2 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.

9 Appendices

9.1 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
Broadland Rivers	292	Exceptionally High	Exceptionally high	Exceptionally high	Exceptionally high
Cam	337	Exceptionally High	Exceptionally high	Exceptionally high	Exceptionally high
Central Area Fenland	355	Exceptionally High	Exceptionally high	Exceptionally high	Exceptionally high
East Suffolk	272	Exceptionally High	Exceptionally high	Exceptionally high	Exceptionally high
Little Ouse And Lark	355	Exceptionally High	Exceptionally high	Exceptionally high	Exceptionally high
Lower Bedford Ouse	332	Exceptionally High	Exceptionally high	Exceptionally high	Exceptionally high
North Essex	282	Exceptionally High	Exceptionally high	Exceptionally high	Exceptionally high
North Norfolk	294	Exceptionally High	Exceptionally high	Exceptionally high	Exceptionally high
Nw Norfolk And Wissey	345	Exceptionally High	Exceptionally high	Exceptionally high	Exceptionally high

South Essex	285	Exceptionally High	Notably high	Exceptionally high	Notably high
Upper Bedford Ouse	311	Exceptionally High	Exceptionally high	Exceptionally high	Exceptionally high

9.2 River flows table

Site name	River	Catchment	Feb 2024 band	Jan 2024 band
Abbey Heath	Little Ouse	Little Ouse	Exceptionally high	Notably high
Blunham	Ivel	Ivel	Exceptionally high	Notably high
Bramford	Gipping	Gipping	Notably high	Exceptionally high
Burnham Overy	Burn	Burn	Exceptionally high	Exceptionally high
Burnt Mill	Rhee	Rhee	Exceptionally high	Exceptionally high
Cappenham	Tove	Tove	Exceptionally high	Above normal
Colney	Yare	Yare	Exceptionally high	Notably high
Denver	Ely Ouse	Cutoff and Renew Channel	Notably high	Above normal
Dernford	Cam	Cam	Exceptionally high	Notably high
Heacham	Heacham	Heacham	Exceptionally high	Suspect Data
Ingworth	Bure	Bure	Exceptionally high	Above normal

Lexden	Colne	Colne Essex	Exceptionally high	Above normal
Marham	Nar	Nar	Exceptionally high	Notably high
Needham Weir Total	Waveney (lower)	Waveney	Exceptionally high	Notably high
Northwold Total	Wissey	Wissey	Suspect Data	Suspect Data
Offord (gross Flows)	Great Ouse	Ouse Beds	Exceptionally high	Notably high
Roxton	Great Ouse	Ivel	Exceptionally high	Notably high
Springfield	Chelmer	Chelmer Upper	Exceptionally high	Above normal
Swanton Morley Total	Wensum	Wensum	Exceptionally high	Exceptionally high
Temple	Lark	Lark	Exceptionally high	Notably high
Willen	Ouzel	Ouzel	Exceptionally high	Notably high

9.3 Groundwater table

Site name	Aquifer	End of Feb 2024 band	End of Jan 2024 band
Biggleswade	Ivel Woburn Sands	Exceptionally high	Notably high
Bircham Newton	North West Norfolk Chalk	Exceptionally high	Exceptionally high
Breckland	Wissey Chalk	No Data	Exceptionally high
Bury St Edmunds	Upper Lark Chalk	Exceptionally high	Notably high
Castle Farm, Offton	East Suffolk Chalk	Exceptionally high	Exceptionally high
Gog Magog, Stapleford	Cam Chalk	Exceptionally high	Notably high
Hazlewood Common	East Suffolk Crag	Notably high	Normal
Hindolveston	Norfolk Chalk	Notably high	Exceptionally high
Kenninghall	Little Ouse Chalk	Exceptionally high	Exceptionally high
Linton	Cam Chalk	Exceptionally high	Notably high
Newmarket	Snail Chalk	Exceptionally high	Notably high

Old Primary School, South Creake	North Norfolk Chalk	No Data	Exceptionally high
Redlands Hall, Ickleton	Cam Chalk	No Data	No Data
Rook Hall, Braiseworth	East Suffolk Chalk	Normal	Normal
Smeetham Hall Cottages, Bulmer	North Essex Chalk	Exceptionally high	Notably high
The Spinney, Costessey	Wensum Chalk	Notably high	Exceptionally high
Washpit Farm, Rougham	North West Norfolk Chalk	Exceptionally high	Notably high
Therfield Rectory	Upper Lee Chalk	Notably high	Above normal
Fringford P.s.	Upper Bedford Ouse Oolitic Limestone (great)	Exceptionally high	Normal

9.4 Ensemble projections tables

9.4.1 Probabilistic ensemble projection of river flows at key sites in March 2024

Percentage of pie chart for each band

Site	Bedford Ouse	Kym	Ivel	Ouse	Ely Ouse
Exceptionally low	0	0	0	0	0
Notably low	0	0	0	0	0
Below normal	0	0	0	0	0
Normal	29	36	0	20	0
Above normal	34	27	0	16	0
Notably high	27	23	18	48	0
Exceptionally high	11	14	82	16	100

9.4.2 Probabilistic ensemble projection of river flows at key sites in June 2024

Percentage of pie chart for each band

Site	Bedford Ouse	Kym	Ivel	Ouse	Ely Ouse
Exceptionally low	0	0	0	0	0
Notably low	0	0	0	0	0
Below normal	0	0	0	0	0
Normal	61	84	18	57	53
Above normal	29	4	34	32	21
Notably high	9	0	34	5	13
Exceptionally high	2	13	14	5	13

9.4.3 Probabilistic ensemble projection of groundwater levels at key sites in March 2024

Percentage of pie chart for each band

Site	Therfield Rectory	Newmarket	Washpit Farm	Bircham Newton	Kenninghall	Bury St Edmunds	Smeetham
Exceptionally low	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Notably low	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Below normal	0.0	0.0	87.5	0.0	0.0	0.0	0.0
Normal	0.0	0.0	12.5	0.0	0.0	0.0	0.0
Above normal	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Notably high	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Exceptionally high	0.0	100.0	0.0	100.0	100.0	100.0	100.0

9.4.4 Probabilistic ensemble projection of groundwater levels at key sites in September 2024

Percentage of pie chart for each band

Site	Therfield Rectory	Newmarket	Washpit Farm	Bircham Newton	Kenninghall	Bury St Edmunds	Smeetham
Exceptionally low	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Notably low	0.0	0.0	12.5	0.0	0.0	0.0	0.0
Below normal	0.0	0.0	12.5	0.0	0.0	0.0	0.0
Normal	0.0	59.5	59.4	0.0	0.0	28.6	0.0
Above normal	0.0	24.3	3.1	56.5	0.0	28.6	24.1
Notably high	67.9	8.1	9.4	26.1	17.8	8.6	66.7
Exceptionally high	32.1	8.1	3.1	17.4	82.2	34.3	9.3