

## Overview

Very mild, wet and stormy, December 2023 was dominated by Atlantic low pressure systems with four named storms affecting Ireland.

The monthly average river flows for December remained high, with 59% of river flows above the long-term normal for December, while 66% of lake and turlough monitoring stations observed levels above the long-term normal range for this month also. Although average monthly groundwater levels decreased compared to November, 54% of monitoring wells recorded levels above the long-term average for December. Similarly, spring flows remained high with five of six monitoring stations in the 'above normal' range.

## Rainfall

Rainfall was above average in most places, highest in the West and Northwest. The majority of monthly rainfall totals were above their 1981-2010 Long-Term Average (LTA). Percentage of monthly rainfall values ranged from 89% (monthly rainfall total of 68.8 mm) at Phoenix Park, Co Dublin to 184% (monthly rainfall total of 214.2 mm) at Malin Head, Co Donegal. Monthly rainfall totals ranged from 68.5 mm (94% of its LTA) at Dublin Airport, Co Dublin to 293.8 mm (163% of its LTA) at Newport, Co Mayo. The highest daily rainfall total was 31.4 mm at Johnstown Castle, Co Wexford on Wednesday 27<sup>th</sup>.

The number of rain days ranged from 21 days at Dublin Airport to 31 days at Valentia Observatory, Co Kerry. The number of wet days ranged from 13 days at Phoenix Park, Co Dublin to 27 days at Belmullet, Co Mayo. The number of very wet days ranged from 1 day at both Dublin Airport and Casement Aerodrome, Co Dublin to 13 days at Newport, Co Mayo.

## River Flows

The average river flows for December increased at 57% of river monitoring stations compared to average flows observed in November. Analysis of the monthly average flows at 138 river monitoring sites identified 11 (8%) as 'particularly high', 71 (52%) as 'above normal', 54 (39%) as 'normal' and 2 (1%) were 'below normal'. Overall, there was a decrease in 'particularly high' this month, while 'above normal' and 'normal' increased.

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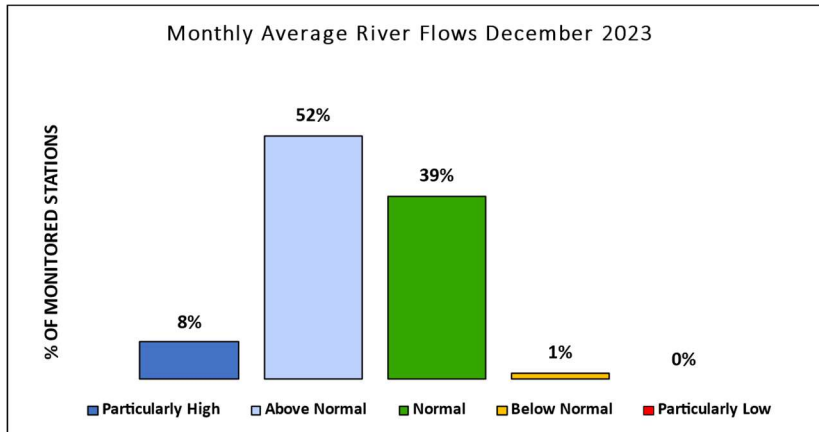


Figure 1: Percentage distribution of river flow monitoring sites within each of the percentile flow categories for December 2023.

### Lake and Turlough Levels

Average water levels for December decreased at 52% of the monitored lakes and turlough sites compared to average levels for November. Analysis of monthly average levels at 35 lakes and 4 turloughs were classified as being ‘particularly high’ at 11 (28%), ‘above normal’ at 15 (38%), ‘normal’ at 12 (31%), ‘below normal’ at 1 (3%) and none were ‘particularly low’.

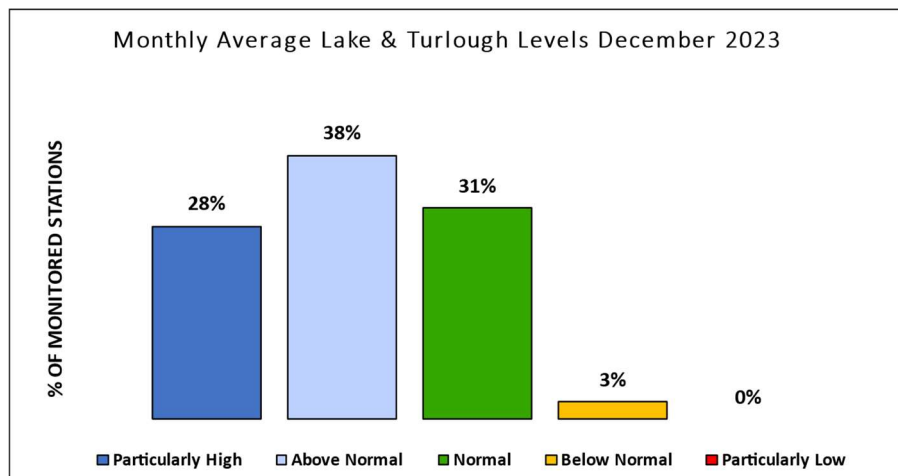


Figure 2: Percentage distribution of lake and turlough level monitoring sites within each of the percentile flow categories for December 2023.

### Groundwater Levels and Spring Flows

Average groundwater levels in December were lower at 67% of monitoring wells compared to average levels observed in November. Groundwater levels for December were classified as being ‘particularly high’ at 9 wells (24%), ‘above normal’ at 11 wells (30%), ‘normal’ at 16 wells (43%), ‘below normal’ at 1 (3%) and none were ‘particularly low’.

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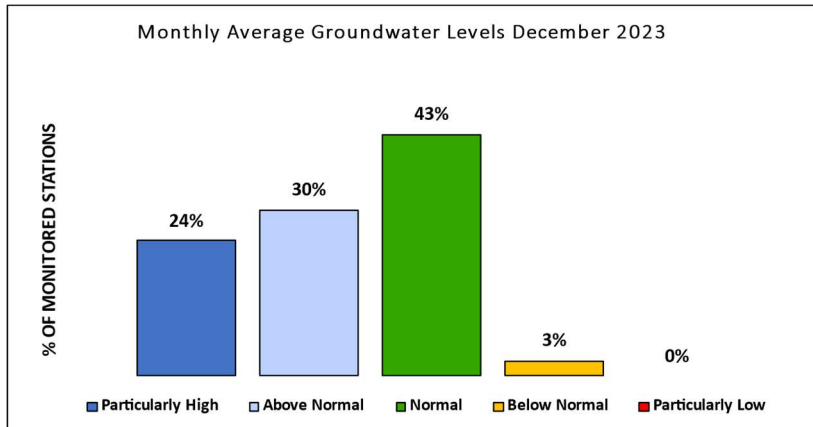


Figure 3: Percentage distribution of groundwater level sites within each of the percentile flow categories for December 2023.

Spring outflows were also monitored at 6 EPA monitoring sites for December. The outflows from these springs were compared to previously recorded December flows and were ‘particularly high’ at 1 location [Killeglan, Co. Roscommon], ‘above normal’ at 4 locations and ‘normal’ at 1 location [Kilkerrin, Co. Galway].

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## Rainfall

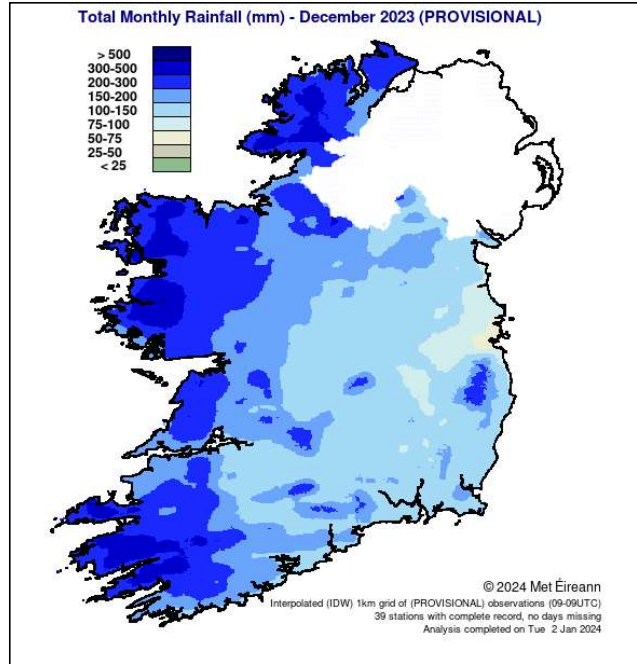


Figure 4: Rainfall map for Ireland December 2023 (Source: Met Eireann.ie).

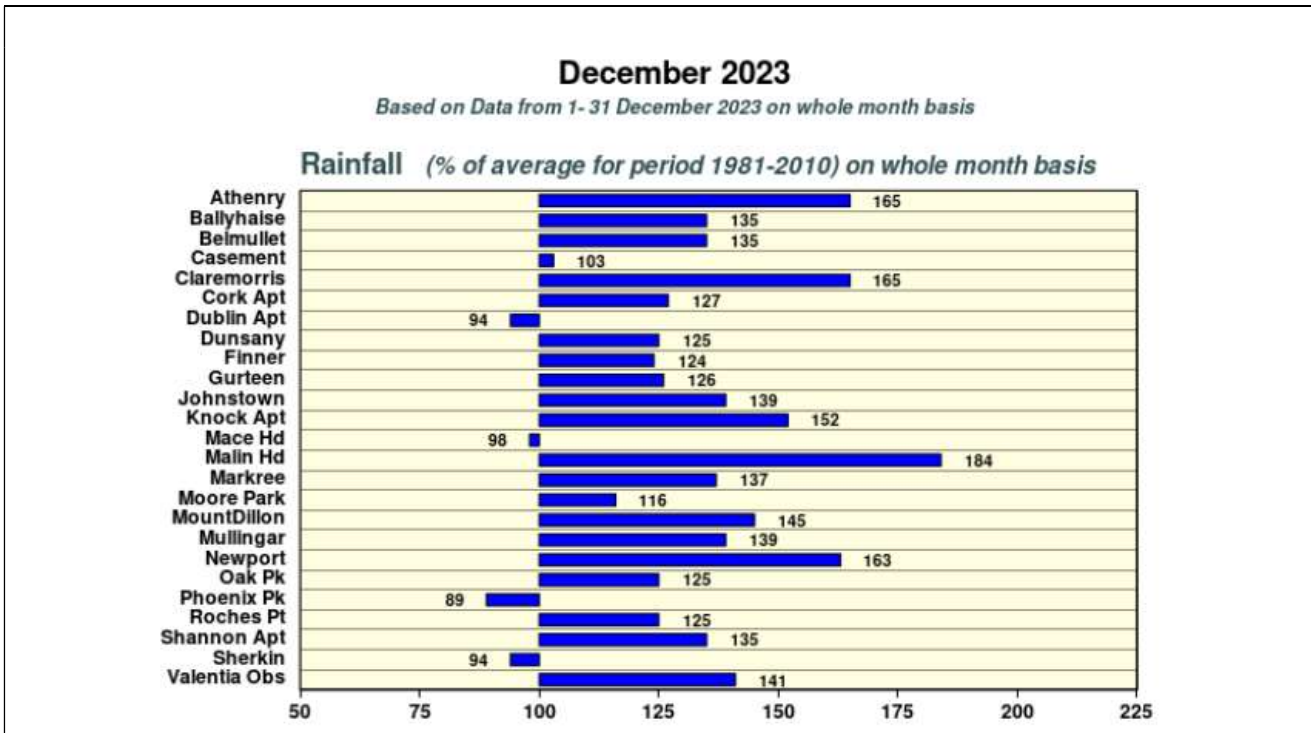


Figure 5: Summary of rainfall at synoptic stations for December 2023, figures indicate the percentage difference from the Long-Term Average rainfall for this month (Source: Met Eireann.ie).

## River Flows

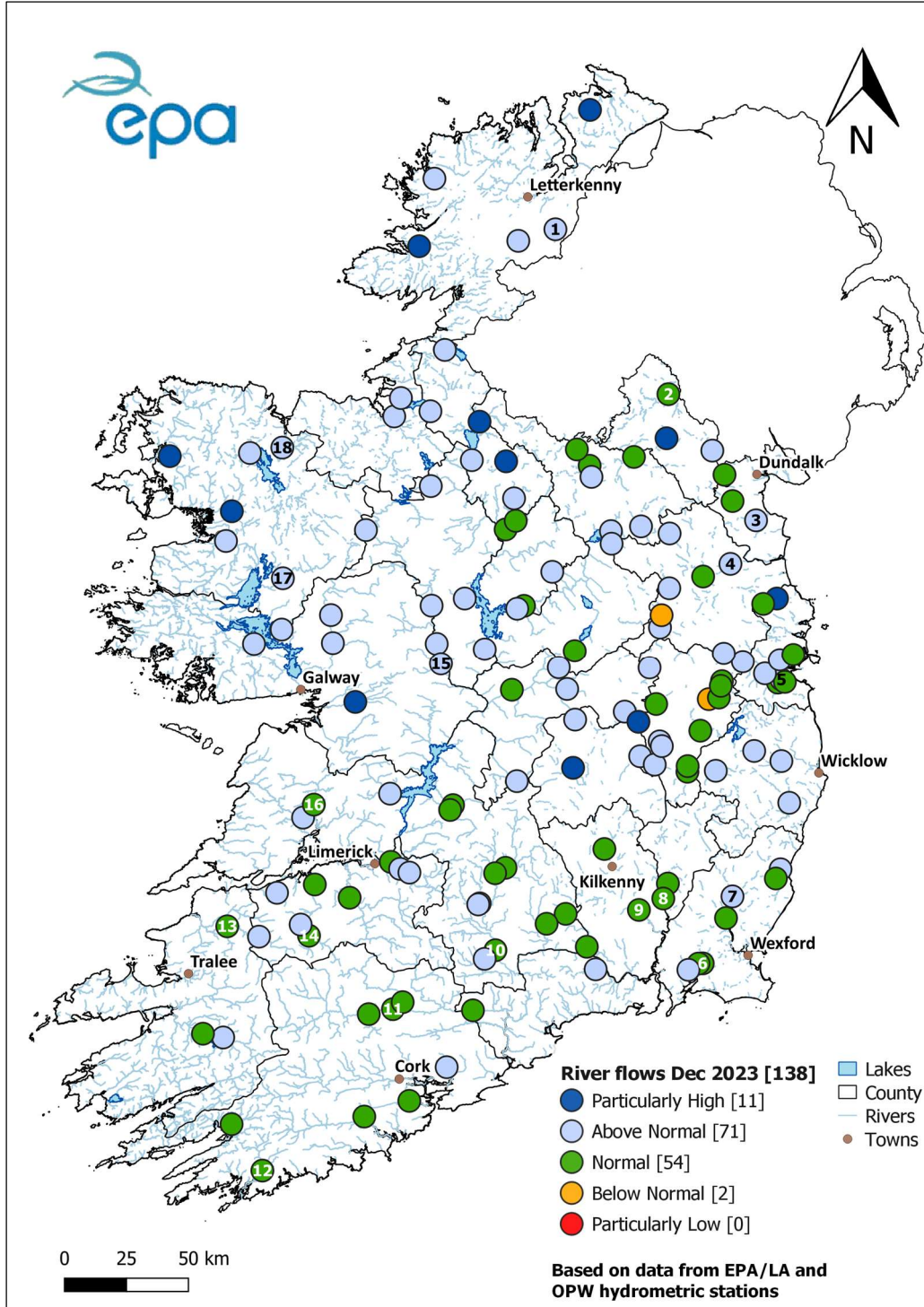


Figure 6: Monthly average river flows for December 2023 relative to historic monthly average flows expressed as percentile of the long-term values of monthly flow. Numbered sites are represented in the hydrographs below. All data are provisional and may be subject to revision (Source: EPA, OPW).

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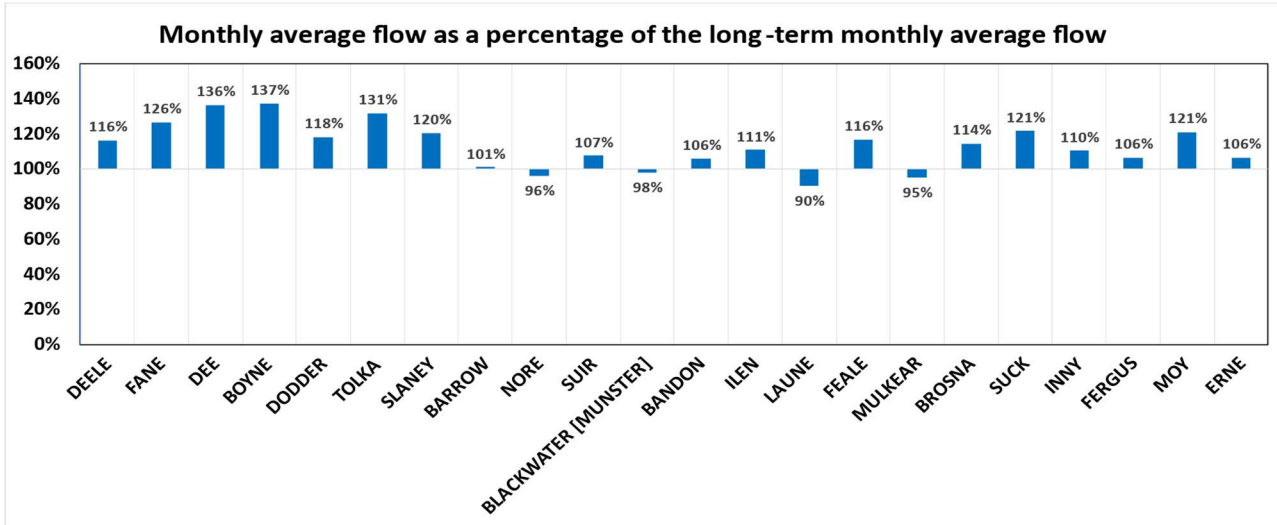
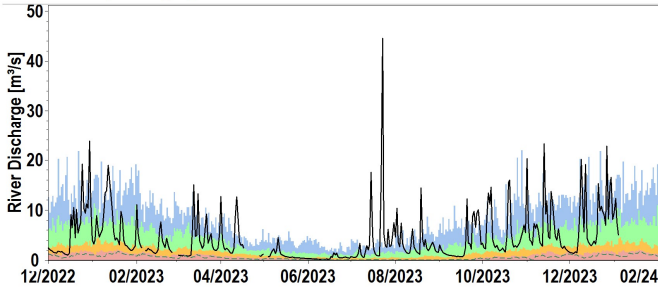


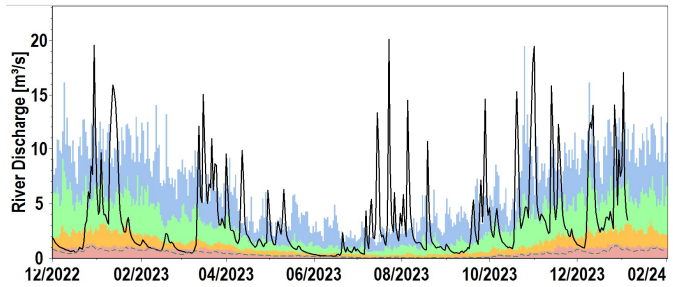
Figure 7: December 2023 average flows as a percentage of the long-term monthly average flow for this month at a selected number of stations. All data are provisional and may be subject to revision (Source: EPA, OPW).

## Flow hydrographs for selected rivers

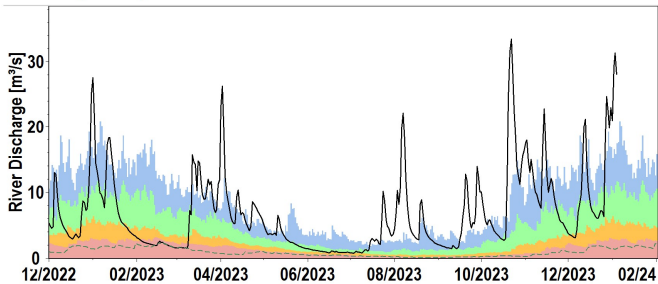
### 1. DEELE (Donegal)



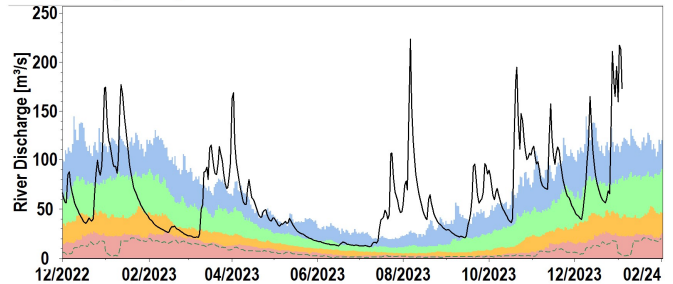
### 2. BLACKWATER [MONAGHAN]



### 3. DEE (Louth)

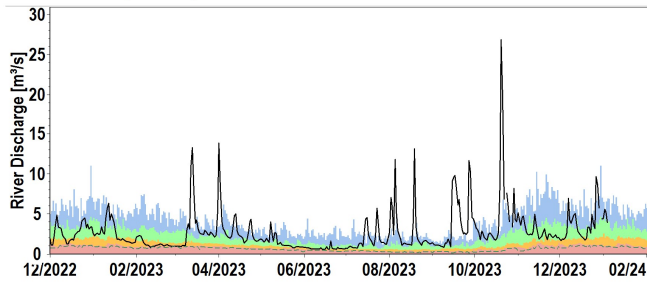


### 4. BOYNE (Meath)

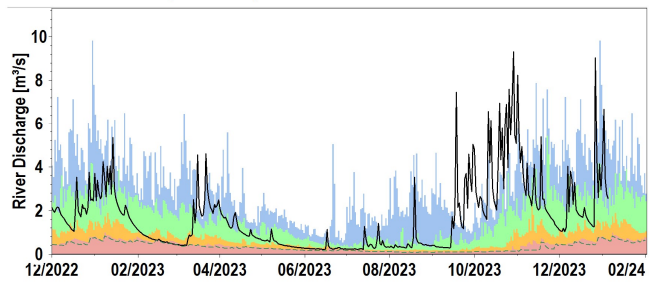


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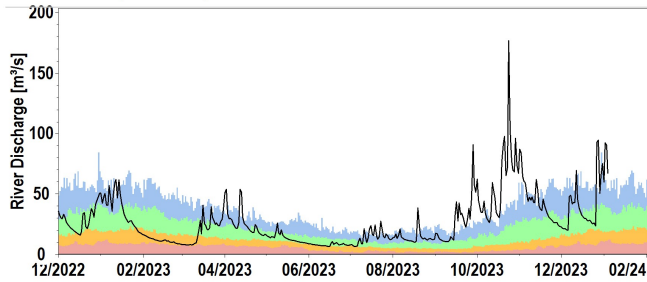
**5. DODDER (Dublin)**



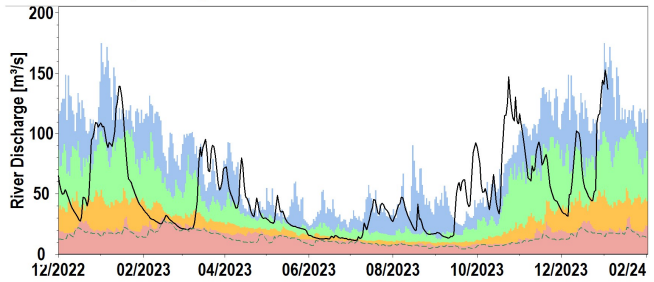
**6. MULMONTRY (Wexford)**



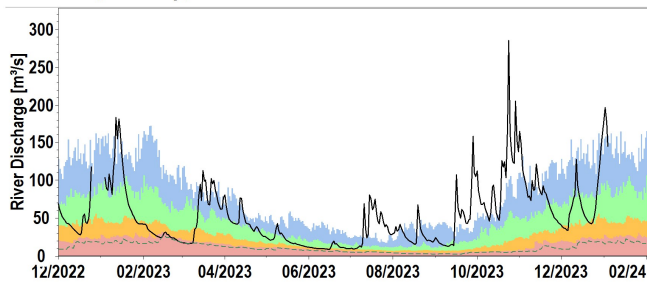
**7. SLANEY (Wexford)**



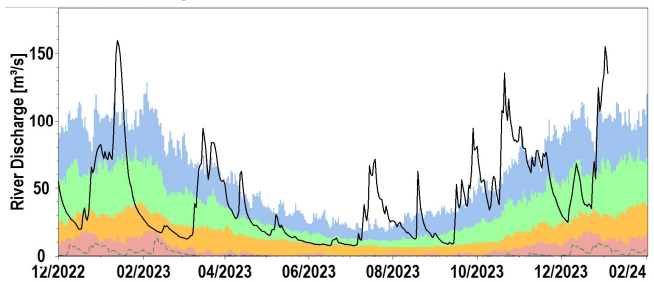
**8. BARROW (Carlow)**



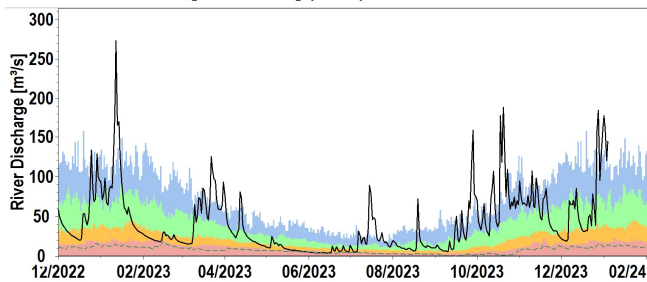
**9. NORE (Kilkenny)**



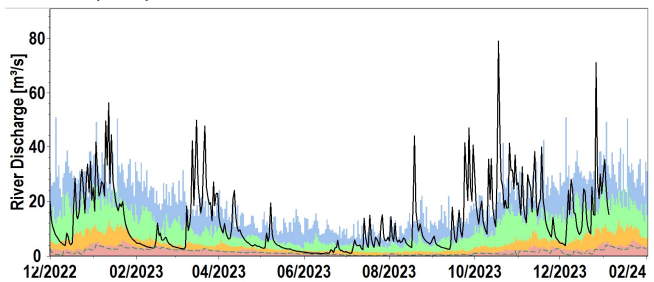
**10. SUIR (Tipperary)**



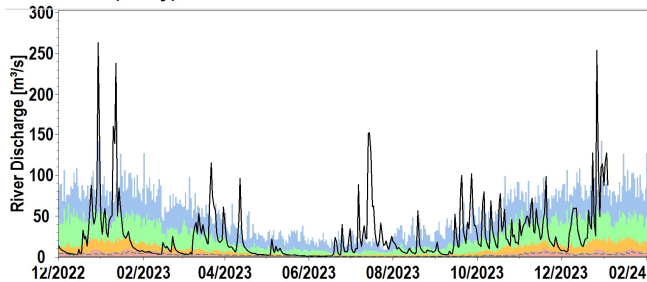
**11. BLACKWATER [MUNSTER] (Cork)**



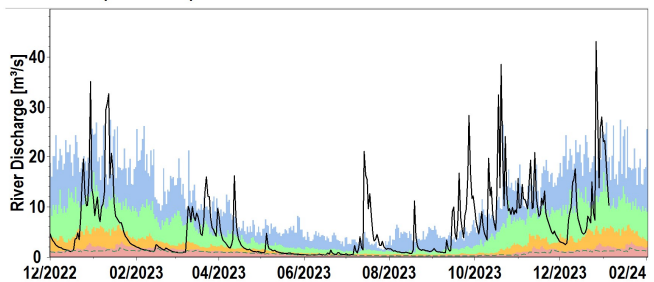
**12. ILEN (Cork)**



**13. FEALE (Kerry)**

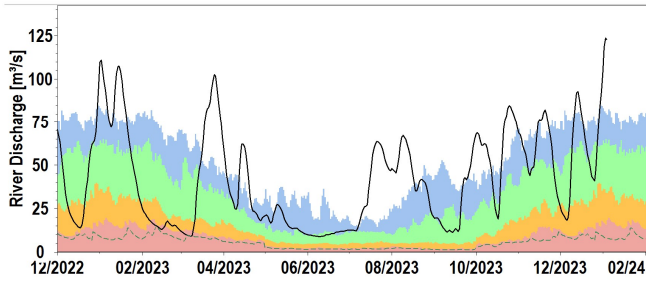


**14. DEEL (Limerick)**

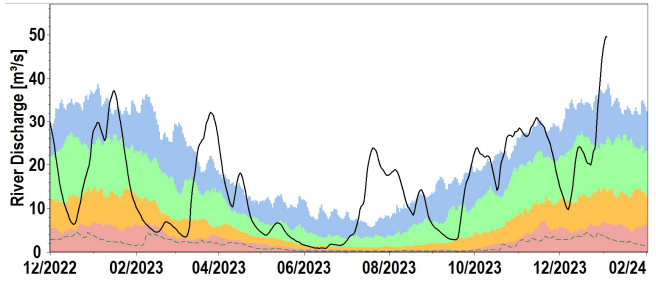


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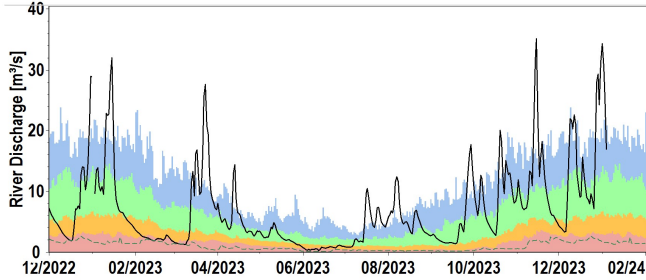
15. SUCK (Roscommon)



16. FERGUS (Clare)



17. ROBE (Mayo)



18. MOY (Mayo)

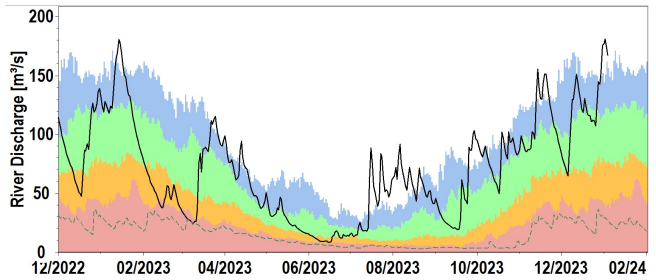
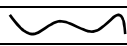



Figure 8: Daily average river flows measured in cubic metres per second relative to historic daily average flows expressed as percentile of the long-term values of each day and long-term minimum flows. All data are provisional and may be subject to revision (Source: EPA, OPW).

**Explanation - Classes**

Explanation - Classes						
Particularly Low	Below Normal	Normal	Above Normal	Particularly High	Daily Mean Flow	Lowest Daily Mean Flow
<95%tile daily average flow	>95%tile <70%tile daily average flow	>70 %tile <30%tile daily average flow	>30%tile 10%tile daily average flow	>10%tile daily average flow		



## Lake and Turlough Levels

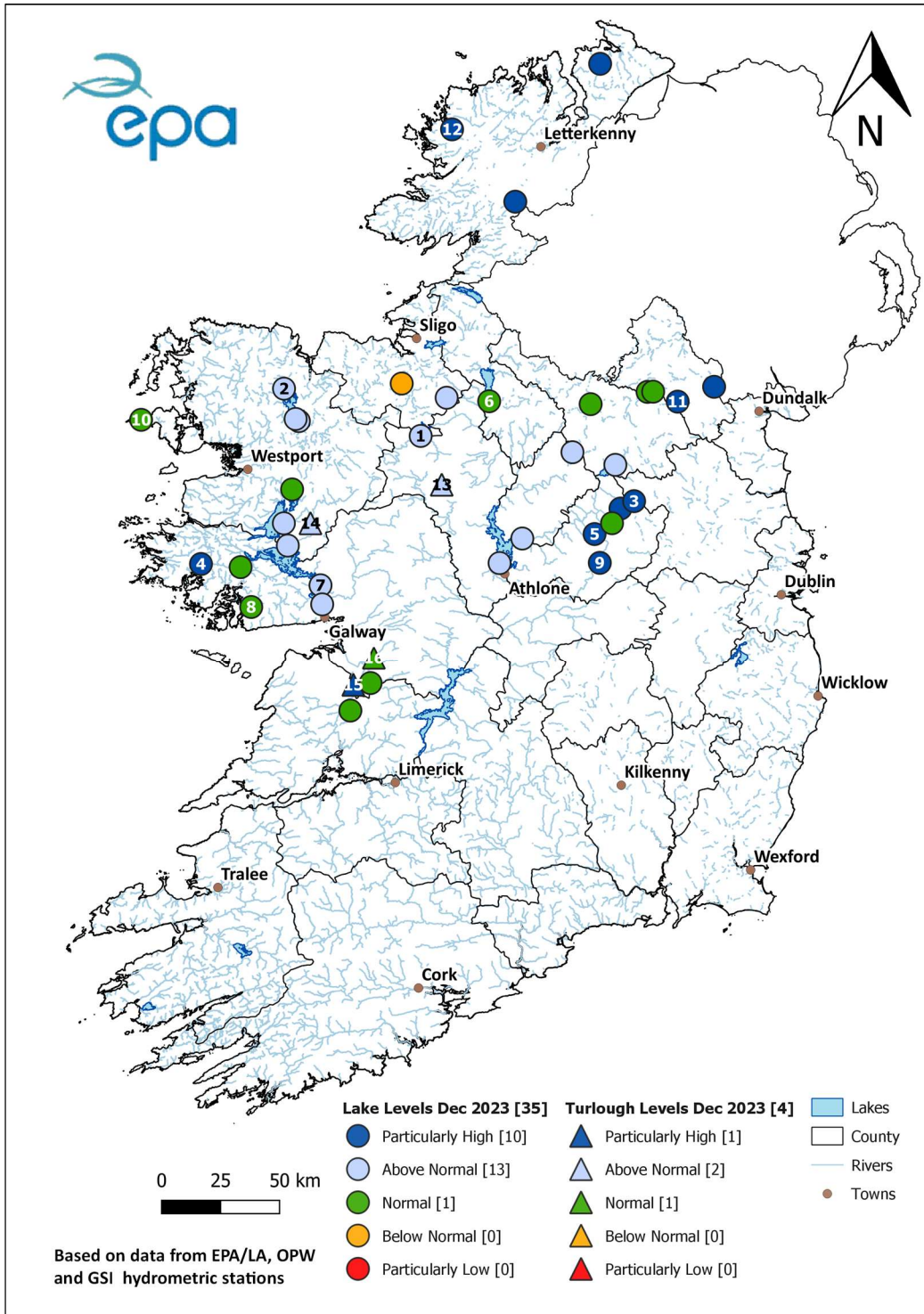
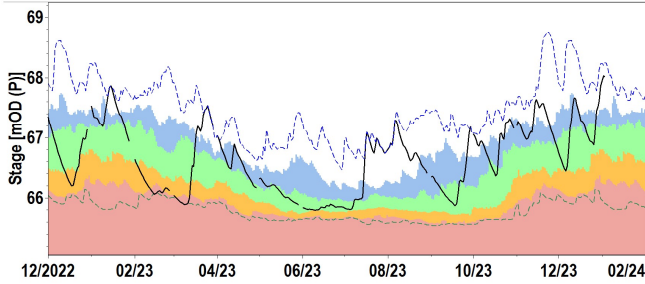


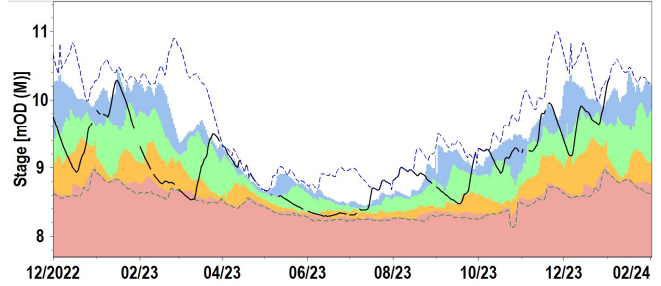
Figure 9: Monthly average lake & turlough levels for December 2023 relative to historic monthly average levels expressed as percentile of the long-term values for this month. Numbered sites are represented in the hydrographs below. All data are provisional and may be subject to revision (Source: EPA, OPW and GSI).

## Water level hydrographs for selected lakes and turloughs

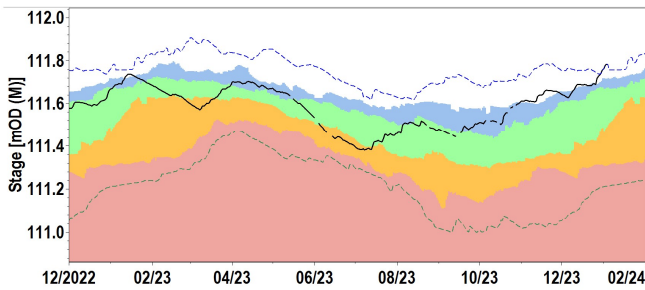
1. L. GARA (Sligo)



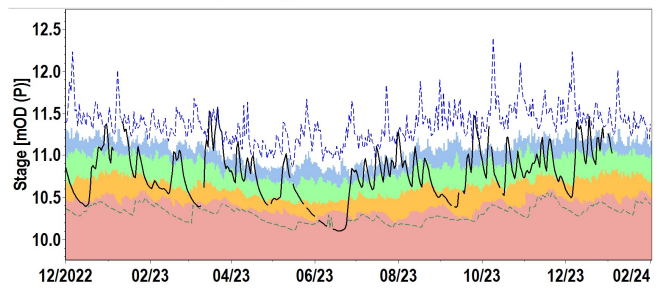
2. L.CONN (Mayo)



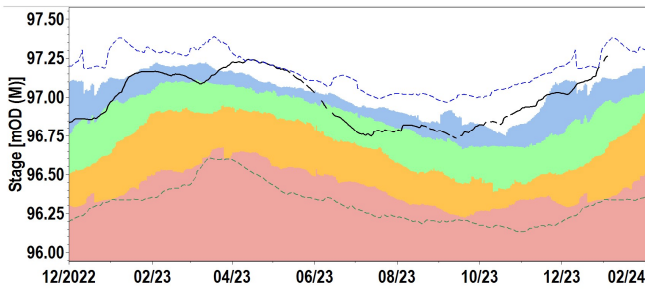
3. L. BANE (Meath)



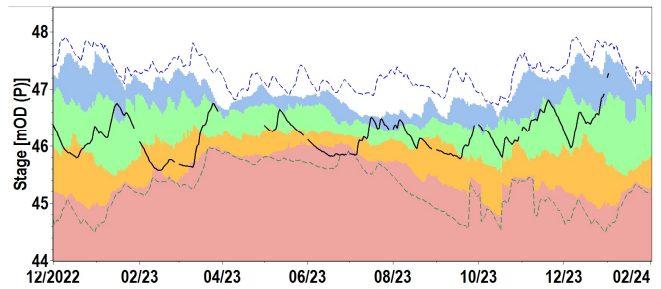
4. DERRYCLARE L. (Galway)



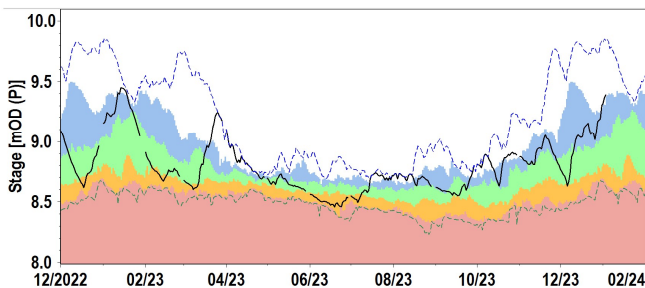
5. L. OWEL (Westmeath)



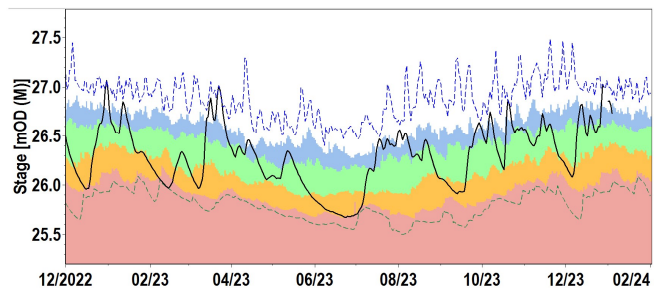
6. L.ALLEN (Leitrim)



7. L.CORRIB (Galway)

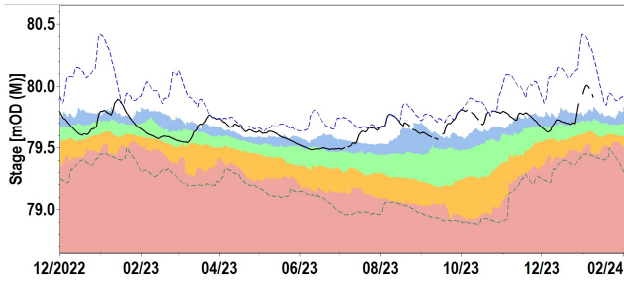


8. GLENICMURRIN LAKE (Galway)

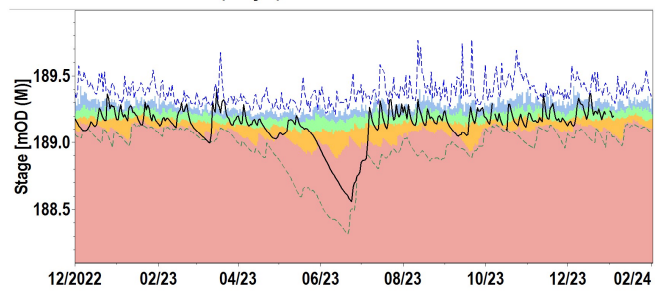


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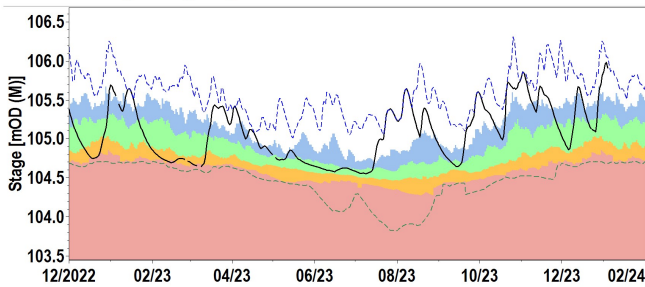
9. L.ENNELL (Westmeath)



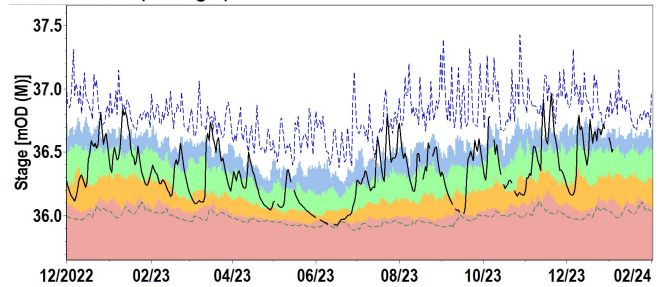
10. L. ACCORMORE (Mayo)



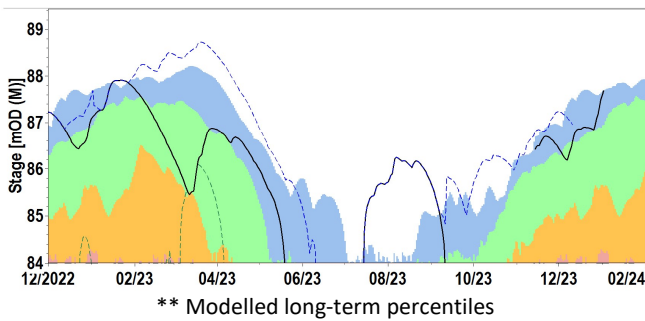
11. L.BAWN (Monaghan)



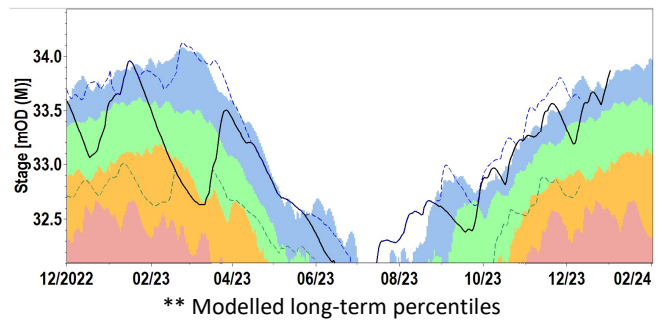
12. L.ANURE (Donegal)



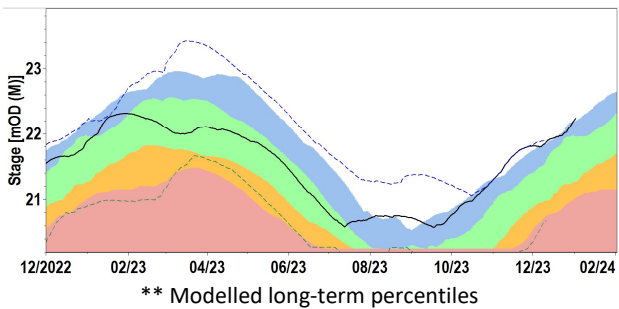
13. CASTLEPLUNKET TURLOUGH (Roscommon)



14. SKEALOGHAN TURLOUGH (Mayo)



15. TERMON SOUTH TURLOUGH (Galway)



16. BLACKROCK TURLOUGH (Galway)

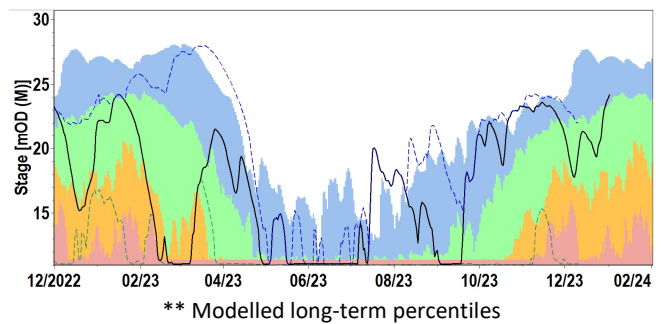
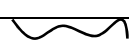
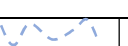



Figure 10: Observed daily mean lake and turlough levels (black trace) measured in meters above ordnance datum compared to the 10%tile, 30%tile, 70%tile and 95%tile for each month for the period of record and observed long-term maximum and minimum levels. Note historic percentiles for turloughs are based on modelled data. All data are provisional and may be subject to revision (Source: EPA, OPW, GSI, TCD, IT Carlow).

Explanation - Classes							
Particularly Low	Below Normal	Normal	Above Normal	Particularly High			
<95%tile daily average level	>95%tile <70%tile daily average level	>70 %tile <30%tile daily average level	>30%tile <10%tile daily average level	>10%tile daily average level	Daily Mean Level mOD	Highest Daily Mean Level mOD	Lowest Daily Mean Level mOD

## Groundwater Levels and Spring Flows

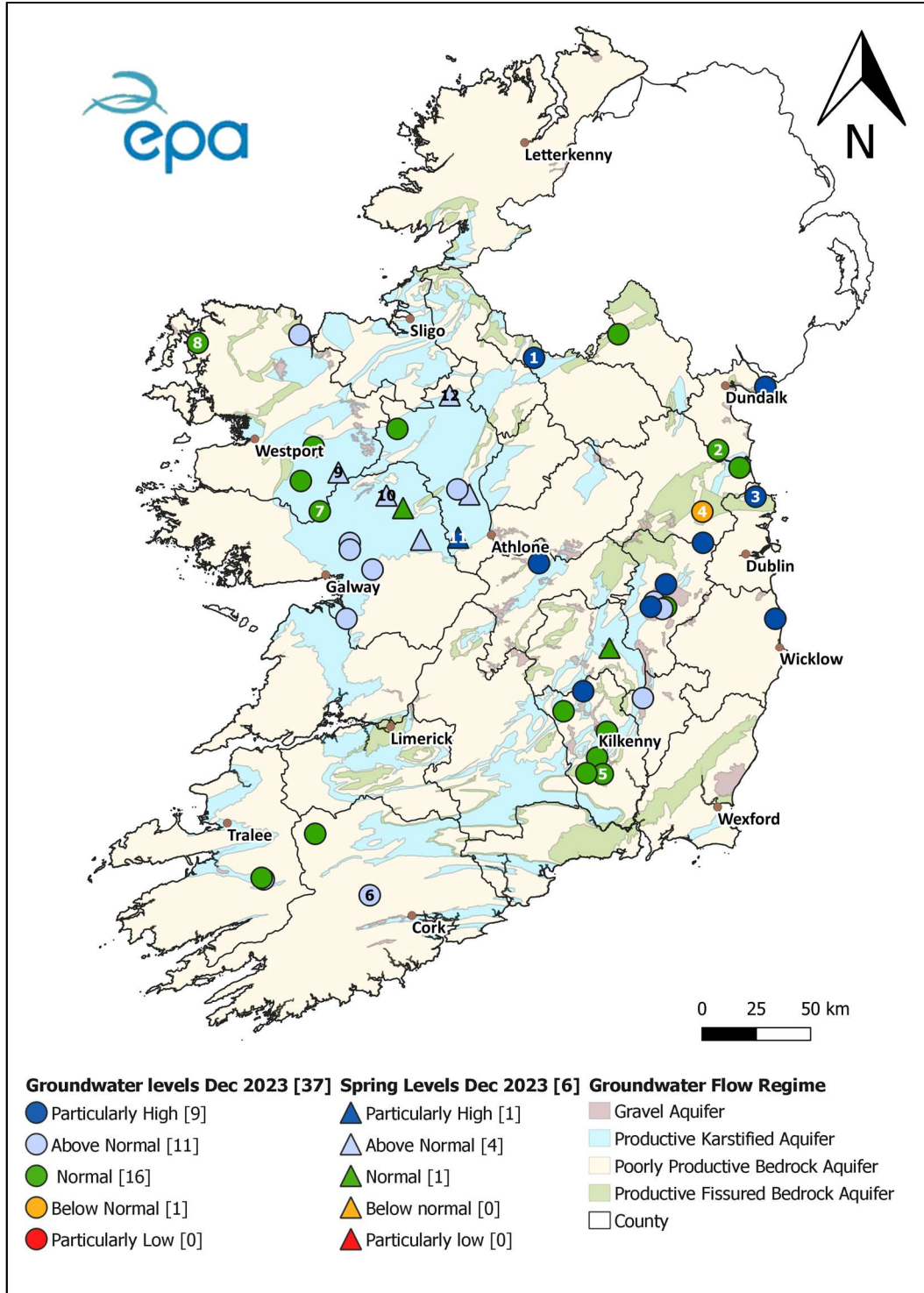
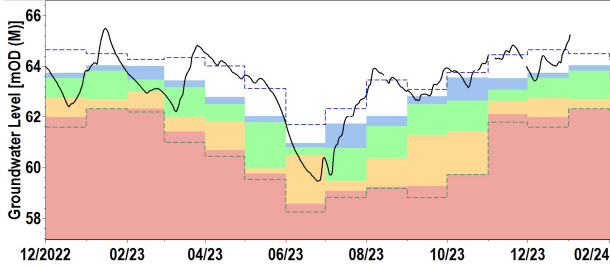


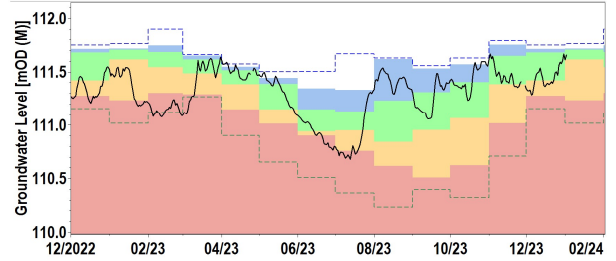
Figure 11: Groundwater level and Spring Flow status for December 2023, relative to historic monthly groundwater levels. Numbered sites are represented in the hydrographs below. All data are provisional and may be subject to revision (Source: EPA).

## Groundwater and spring hydrographs

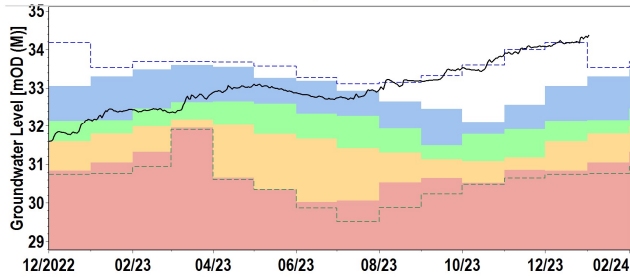
1. BAWN BOY WORKHOUSE (Cavan)



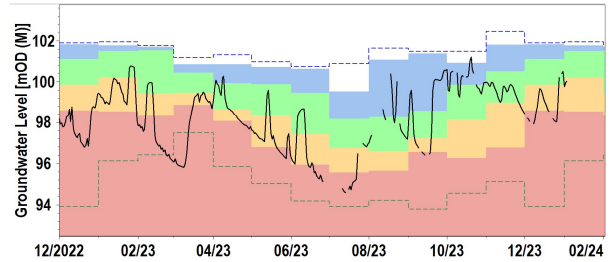
2. Mattock MK1 Deep (Meath)



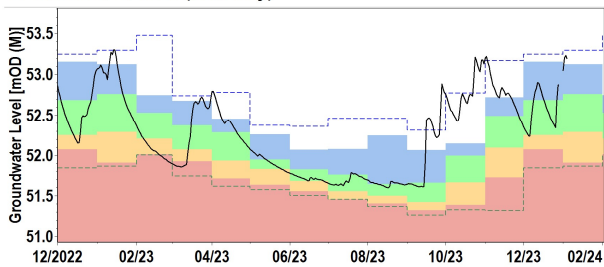
3. BOG OF THE RING OW3D (Fingal)



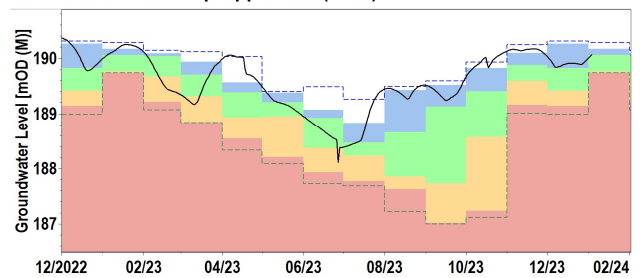
4. DUNSHAUGHLIN PW6 (Meath)



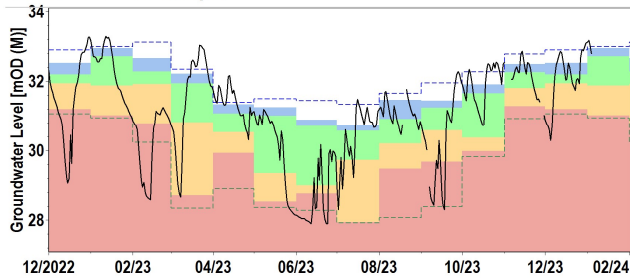
5. KNOCKTOPHER (Kilkenny)



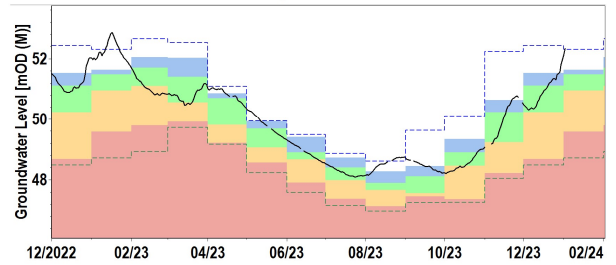
6. DRIPSEY DR1 Deep Upper Site (Cork)



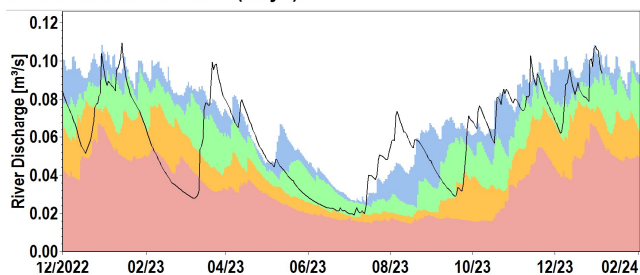
7. SHRULE GWL (Mayo)



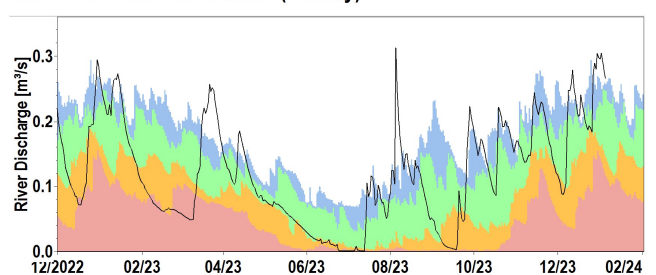
8. Glencastle - (GC1 Deep) (Mayo)



9. BALLINDINE SPRING (Mayo)

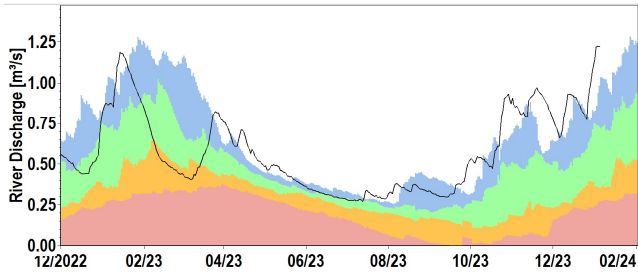


10. GORTGARROW SPRING (Galway)



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11. KILLEGLAN SPRING (Roscommon)



12. ROCKINGHAM (Roscommon)

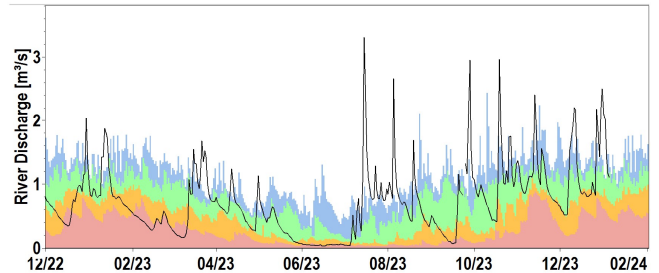
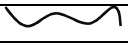




Figure 12: Daily mean groundwater levels (black trace) measured in meters above ordnance datum compared to the 10%tile, 30%tile, 70%tile and 95%tile for each month for the period of record and long-term maximum and minimum levels. All data are provisional and may be subject to revision (Source: EPA).

Explanation - Classes							
							
<b>Particularly Low</b>	<b>Below Normal</b>	<b>Normal</b>	<b>Above Normal</b>	<b>Particularly High</b>	<b>Daily Mean Level mOD</b>	<b>Highest Month Mean Level mOD</b>	<b>Lowest Month Mean Level mOD</b>
<95%tile monthly average level	>95%tile <70%tile monthly average level	>70 %tile <30%tile monthly average level	>30%tile <10%tile monthly average level	>10%tile monthly average level			

## Glossary of terms

Aquifer Type	An aquifer is an underground body of water bearing rock or unconsolidated materials (gravel or sand) from which groundwater can be extracted in useful amounts. For the purposes of this report they have been grouped into four aquifer categories as follows: <ul style="list-style-type: none"> <li>➤ Karstic (Rk and Lk) aquifers;</li> <li>➤ Gravel (Rg and Lg) aquifers;</li> <li>➤ Productive fractured bedrock (Rf and Lm) aquifers;</li> <li>➤ Poorly productive bedrock (LI, PI and Pu) aquifers.</li> </ul>
Dry spell	A dry spell is a period of 15 or more consecutive days to none of which is credited 1.0 mm or more of precipitation (i.e. daily tot < 1.0 mm).
Long term average (LTA)	The arithmetic mean calculated from historic record. For rainfall, the period 1981 to 2010 is used. For other parameters, such as groundwater levels, lake levels and river flow the period may vary according to data availability.
mOD (M or P)	Groundwater levels or lake levels above ordnance datum. In most cases this is relative to mean sea level at Malin (M) but in some cases is relative to Poolbeg (P).
Long-term monthly average	The arithmetic mean calculated from historic record of all monthly averages.
Percentile Level/Flow	Level or flow that is equalled or exceeded the stated percent of the time, e.g. 30%tile is the level or flow that is equalled or exceeded 30 percent of the time.
Very Wet Days	A very wet day is a day with 10.0 mm or more of rainfall.
Wet Days	A wet day is a day with 1.0 mm or more of rainfall.
Dry Spell	A dry spell is a period of 15 or more consecutive days to none of which is credited 1.0mm or more of precipitation (i.e. daily tot < 1.0 mm).
Absolute Drought	An absolute drought is a period of 15 or more consecutive days to none of which is credited 0.2 mm or more of precipitation.
Partial Drought	A partial drought is a period of at least 29 consecutive days, the mean daily rainfall of which does not exceed 0.2 mm

## Description of flow and level percentile classifications

Particularly High	>10%tile exceedance	Monthly level or flow that can occur 10% of the time
Above Normal	>30%tile <10%tile exceedance	Monthly level or flow that can occur 20% of the time
Normal	>70%tile <30%tile exceedance	Monthly level or flow that can occur 40% of the time
Below Normal	>95%tile <70%tile exceedance	Monthly level or flow that can occur 20% of the time
Particularly Low	<95%tile exceedance	Monthly level or flow that can occur 5% of the time

## Useful links

Access to EPA/LA Hydrometric data on [HydroNet](#)

Access to provisional water level only data from OPW hydrometric stations on [waterLevel.ie](#)

Access to archived water level and flow data from OPW hydrometric stations on [HydroData](#)

Access to turlough and borehole level data from GSI hydrometric stations on [gwlevel.ie](#)

Access to this month's Met Éireann and historic [weather statements](#).