

# Water quality monitoring report on nitrogen and phosphorus concentrations in Irish waters 2023





# WATER QUALITY MONITORING REPORT ON NITROGEN AND PHOSPHORUS CONCENTRATIONS IN IRISH WATERS 2023

Prepared by the EPA

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## Background to this Report

Regulation 37 of the European Union (Good Agricultural Practices for the Protection of Waters) (Amendment) Regulations ([S.I. 393 of 2022](#)) requires the EPA to prepare an annual report of the results of water quality monitoring to support the assessment of the impact of the nitrates derogation as required by the [Commission Implementing Decision \(EU\) 2022/696](#).

In preparing this report, the EPA has used phosphorus and nitrate data from the national water quality monitoring programme for groundwater, rivers, lakes, estuarine and coastal waters. The assessment is based on data from monitoring stations that are representative of the impact of agriculture on water quality, i.e., monitoring stations that also reflect the impacts of predominantly urban or industrial pressures are not included.

Nitrogen results are expressed as nitrate or dissolved inorganic nitrogen and phosphorus results are measured as molybdate reactive phosphate. The results are expressed as annual means in the case of rivers, lakes, and groundwater or as winter medians for estuarine and coastal waters. The figures and tables in this report summarise the mean annual concentrations during 2023 for groundwater, rivers and lakes and the relative deviation from the threshold median concentration for 2021-2023 in transitional and coastal waters. Nitrate and phosphorus data are also presented to show the annual concentrations since 2010.

While both nitrate and phosphorus are important drivers of nutrient enrichment and pollution (eutrophication), their impact should be considered in conjunction with the overall ecological condition of our waters. The latest EPA Water Quality in Ireland [report](#), covering the period 2016-2021, provides a full assessment of the chemical and ecological water quality and ecological status of Irish waters.

Public access to the nutrient data for the sites in the water monitoring programme is available on [www.catchments.ie](http://www.catchments.ie) and the [EPA website](#).

For context, Map 1 shows the location of derogation farm holdings<sup>1</sup> in 2023. The highest densities are found in the south east, the south, and to a lesser extent in the north east.

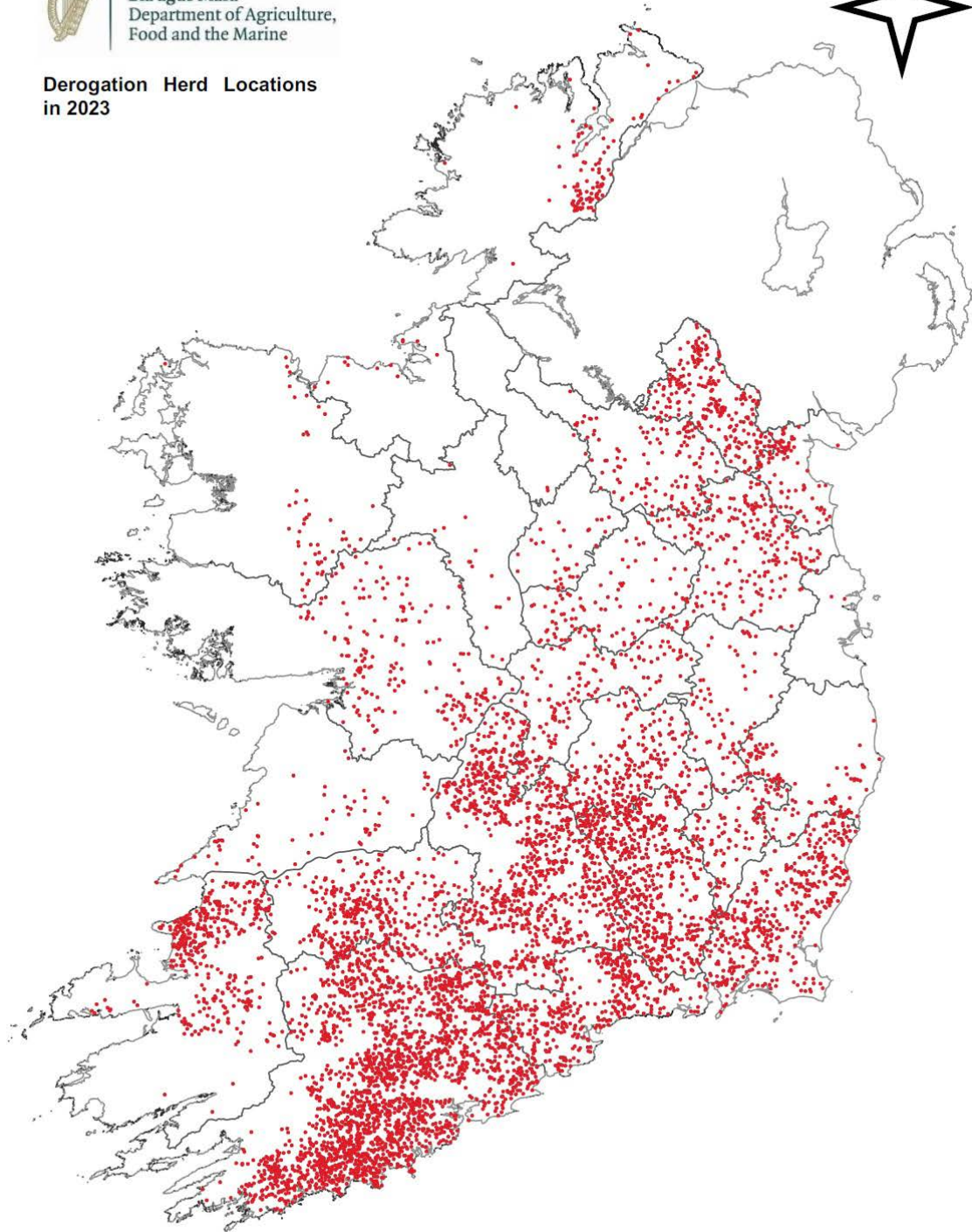
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<sup>1</sup> Derogation farms are those which have been granted a derogation from the standard limit of 170 kg nitrogen per hectare of livestock manure from grazing livestock which can be applied to the land each year on grassland farms. In 2023, farms granted derogations may apply manure up to a limit of 250 kg nitrogen per hectare (including by the animals themselves). This will change to a limit of 220 kg nitrogen per hectare in 2024.

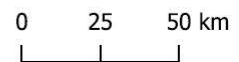


An Roinn Talmhaíochta,  
Bia agus Mara  
Department of Agriculture,  
Food and the Marine

**Derogation Herd Locations  
in 2023**



Department of Agriculture 2024



**Map 1:** National distribution of derogation herds in 2023 (Source: Department of Agriculture, Food and the Marine)



## Water Quality Summary

The latest EPA Water Quality in Ireland report ([EPA, 2022](#)), covering the period 2016-2021, found that 54% of our surface waters were in satisfactory ecological health, and that overall water quality was in decline. The picture for our estuaries is even more stark with only 36% in satisfactory ecological condition. The assessment indicated that the main problem impacting our waters was the presence of too much phosphorus and nitrogen, leading to increased eutrophication in these waters. The latest EPA Water Quality Indicators report ([EPA, 2024](#)) highlights that there was no significant change in the nutrient concentrations or in the biological quality of our rivers and lakes in 2023, and that water quality is not improving. The data in these EPA reports shows that nitrate concentrations remain too high in rivers, groundwater, and estuaries in the south east, south west and midlands & eastern regions.

This report, which is based on data from the monitoring stations that are representative of the impact of agriculture on water quality, also shows that nutrient concentrations remain too high in many parts of the country. Nationally, over the 12 months from 2022 to 2023, there has been an increase in groundwater nitrate concentrations, with little change in riverine nitrate concentrations.

In 2023, six percent of groundwater monitoring sites exceeded the regulatory groundwater threshold value of 37.5 mg/l  $\text{NO}_3$ . Twenty two percent of groundwater monitoring sites have mean nitrate concentrations greater than 25 mg/l  $\text{NO}_3$ . Mean concentrations above 25 mg/l  $\text{NO}_3$  in groundwater are of concern because they are a significant deviation from natural conditions and are approaching the threshold where drinking water quality may be compromised. Higher concentrations of nitrate in groundwater may also impact the ecological health of rivers and associated marine waters in those catchments.

In 2023, 43% of river monitoring stations had concentrations higher than 8 mg/l  $\text{NO}_3$ , which may be having a water quality impact on the ecological health of these rivers and the ecological health in the downstream marine waters.

In 2023, 22% of river monitoring stations have phosphorus concentrations which are greater than the good status Environmental Quality Standard (0.035 mg/l P). The highest river phosphorus concentrations are in areas with poorly draining soils, and the elevated phosphorus concentrations are impacting the ecological health of these rivers and are contributing to nutrient enrichment in the downstream estuaries.

## Results of Water Quality Monitoring

The following section sets out the results of monitoring for groundwater, rivers, lakes and transitional and coastal waters. Groundwater, lake and river monitoring data are presented as an annual average for monitoring undertaken during 2023, while the estuarine and coastal data presented represents the median winter concentration averaged over 2021-2023.

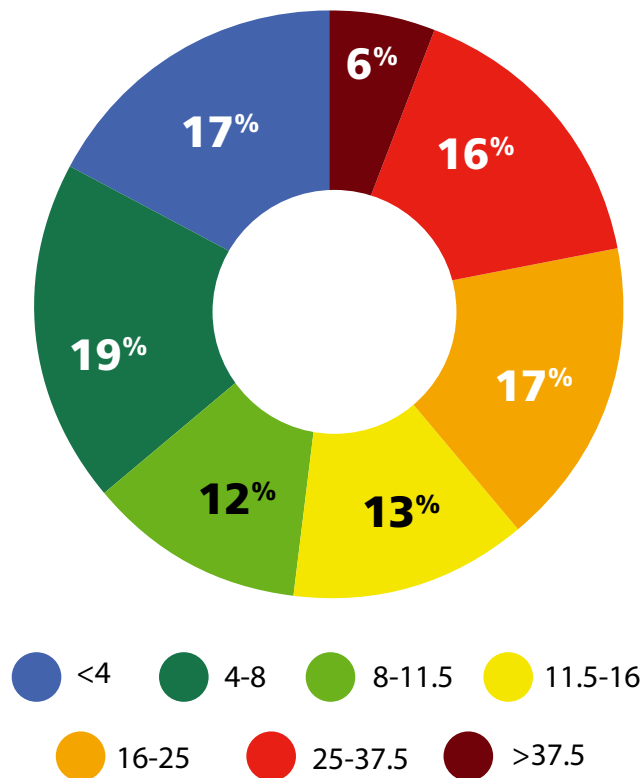
The water quality data are referenced against environmental quality standards and/or environmental limits of concern for different water types and parameters.

## Groundwater

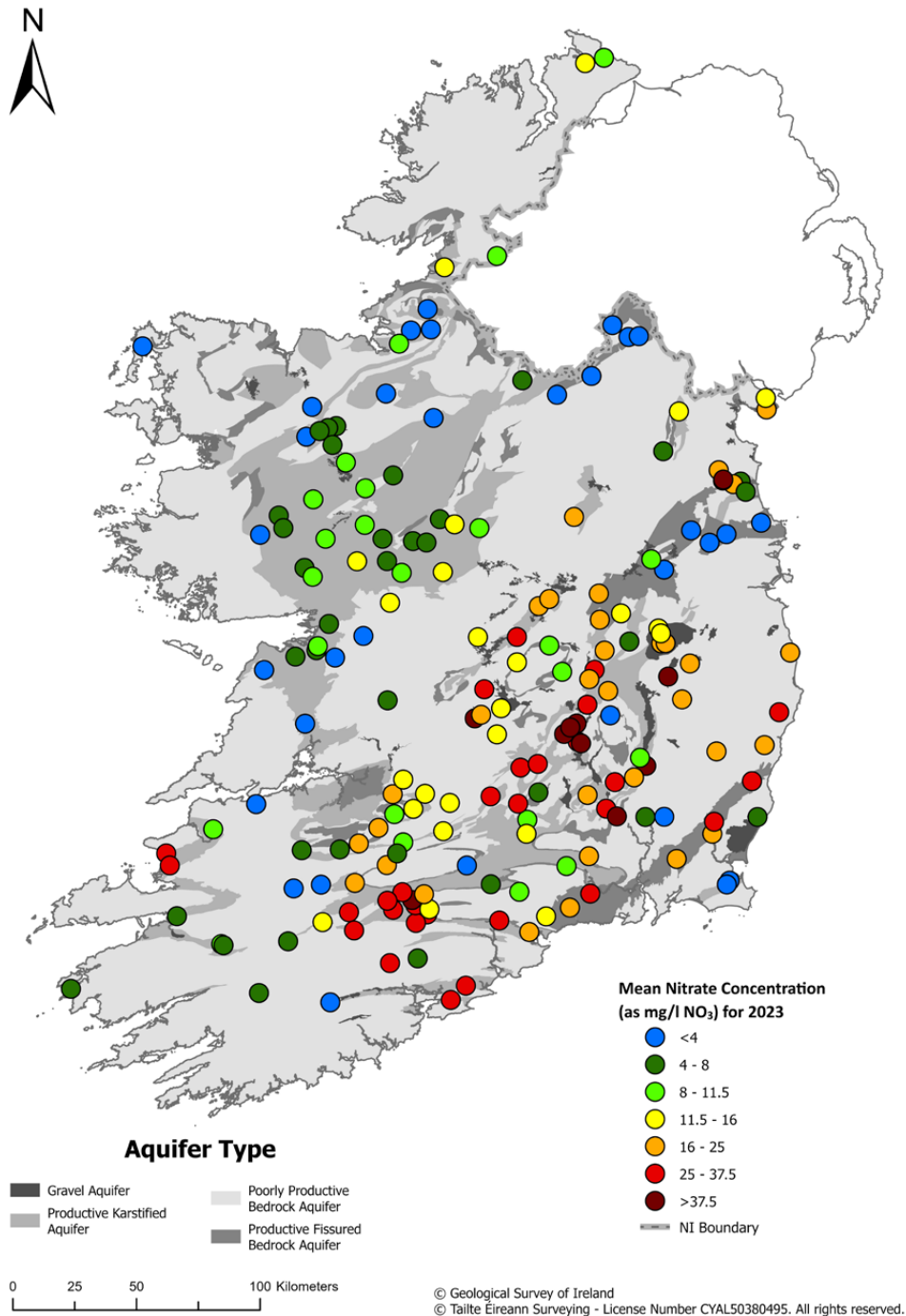
### Nitrate in Groundwater

Figure 1 summarises the mean nitrate concentrations for 186 groundwater monitoring sites monitored in 2023. Map 2 shows that most sites with concentrations greater than 25 mg/l NO<sub>3</sub> are in the river catchments draining the south east and south west regions.

Percentage of Groundwater Sites in each Nitrate Concentration (mg/l NO<sub>3</sub>) Category



**Figure 1:** Mean nitrate concentrations in groundwater during 2023



**Map 2:** Mean nitrate concentrations in groundwater during 2023

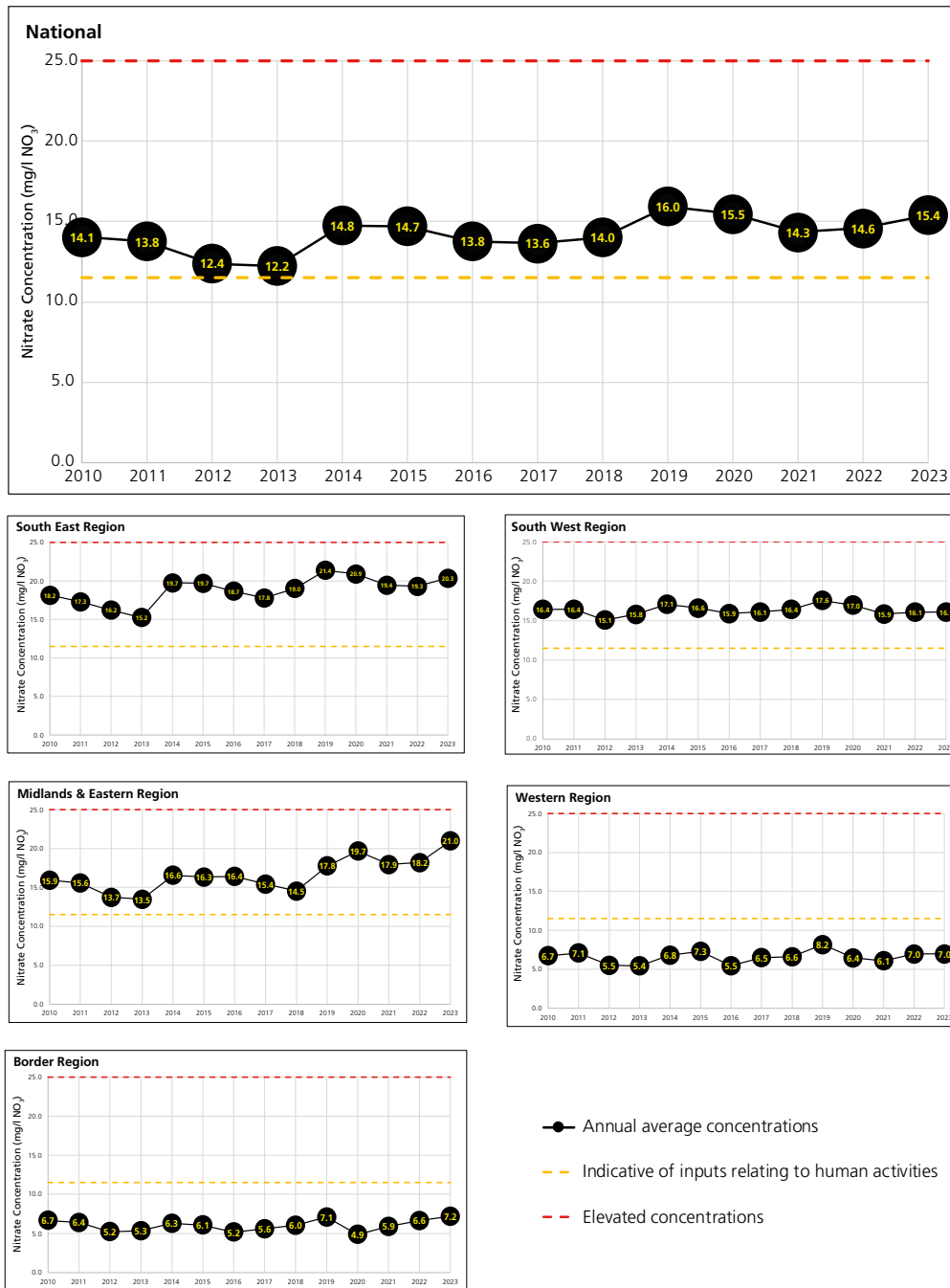


Figure 2: Mean groundwater nitrate concentrations since 2010

In 2023, 22% of groundwater monitoring sites had a mean nitrate concentration greater than 25 mg/l NO<sub>3</sub>, with mean groundwater concentrations increasing since 2022. Mean concentrations above 25 mg/l NO<sub>3</sub> in groundwater are of concern because they are a significant deviation from natural conditions and are approaching the threshold where drinking water quality may be compromised. Eleven (6%) monitoring sites exceeded the Irish Threshold Value of 37.5 mg/l NO<sub>3</sub>. Mean concentrations above the Threshold Value are an indication that there may be exceedances of the drinking water standard of 50 mg/l NO<sub>3</sub> during the year. Four of the eleven monitoring sites had a mean nitrate concentration greater than 50 mg/l NO<sub>3</sub>. This represents an additional three sites with a

mean nitrate concentration greater than 50 mg/l NO<sub>3</sub> since 2022. These sites are all used to supply drinking water, but have appropriate water treatment systems in place to ensure the provision of safe drinking water.

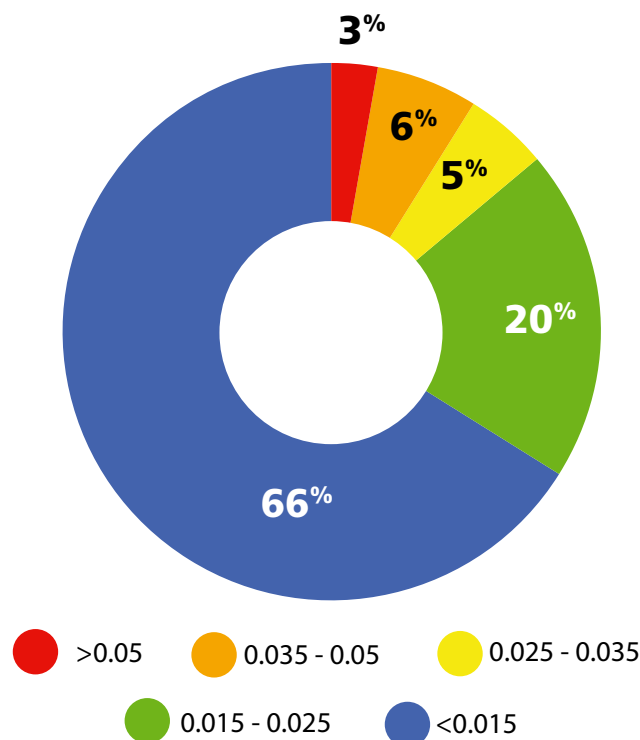
Figure 2 shows that the national average nitrate concentration in groundwater has increased in the past 12 months, with no reductions observed in any region. The increased nitrate concentration in groundwater is most notable in the south east and midlands & eastern regions.

As groundwater contributes to surface water flow across the catchment, elevated nutrient concentrations may be contributing to an increase in the growth of algae and aquatic plants in rivers and the downstream marine waters.

### Phosphorus in Groundwater

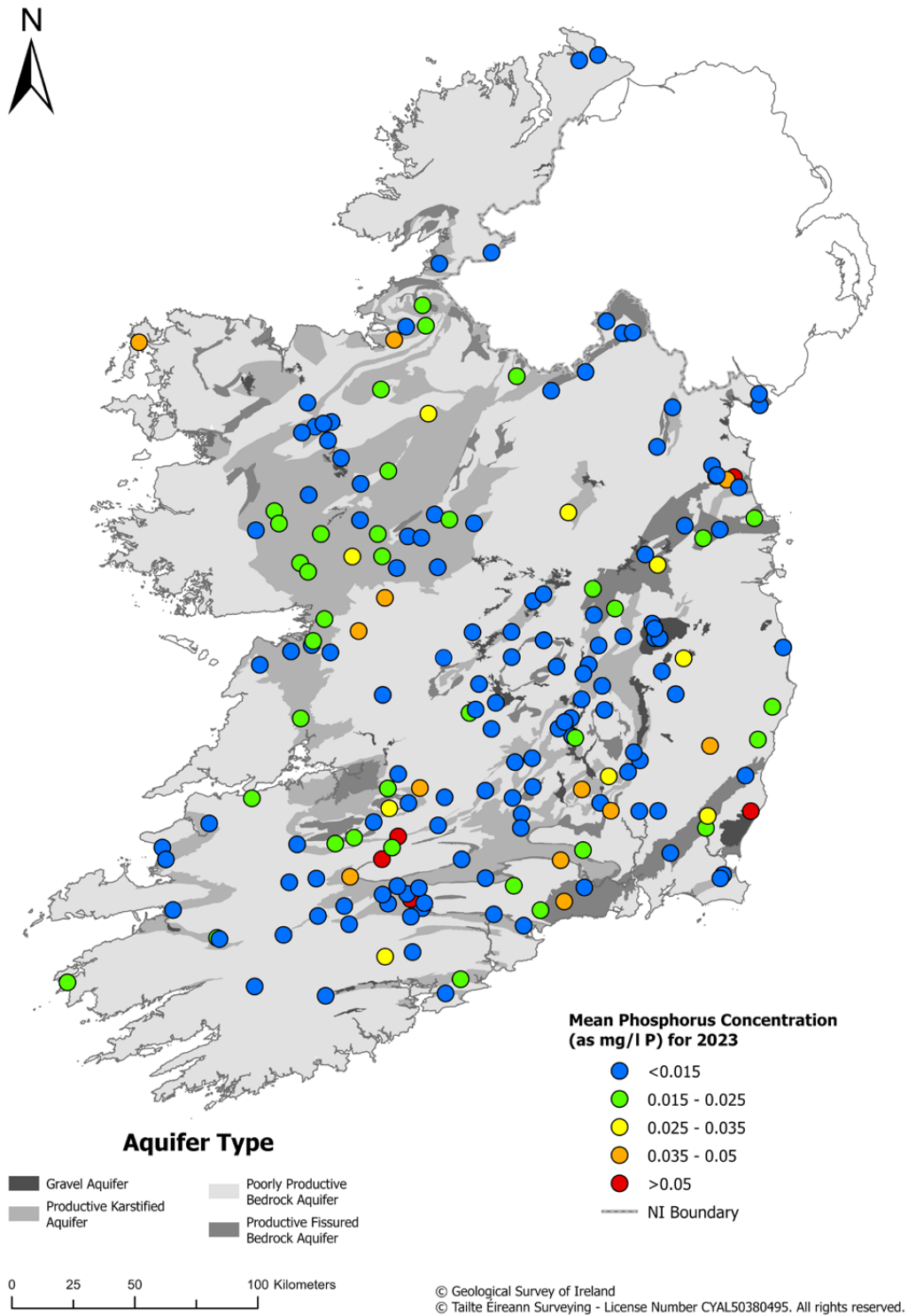
Figure 3 summarises the mean phosphorus concentrations (measured as molybdate reactive phosphorus (MRP)) for 185 sites in the national groundwater monitoring programme during 2023. Figure 3 shows that 9% of monitoring sites had mean phosphorus concentrations greater than the Irish good ecological status threshold value of 0.035<sup>2</sup> mg/l P. Groundwater phosphorus concentrations have remained relatively stable in the last decade and Map 3 indicates groundwater phosphate concentrations show significant spatial variability. This is because the soils and geological setting have a large influence on whether phosphorus applied at the land surface can reach groundwater.

Percentage of Groundwater Sites in each Phosphorus Concentration (mg/l P) Category



**Figure 3:** Mean phosphorus concentrations in groundwater during 2023

<sup>2</sup> This groundwater Threshold Value is the WFD Good Status EQS for rivers



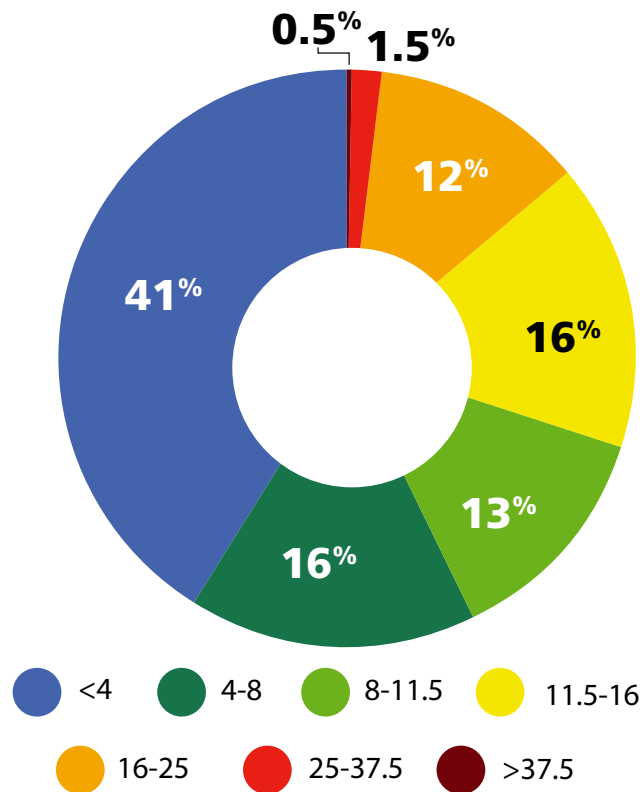
**Map 3:** Mean phosphorus concentrations in groundwater during 2023

## Rivers

### Nitrate in Rivers

Figure 4 summarises the mean nitrate concentrations at 1,030 river monitoring sites from the national river monitoring programme in 2023. The assessment is based on data from monitoring stations that are representative of the impact of agriculture on water quality, i.e., monitoring stations that also reflect the impacts of predominantly urban or industrial pressures are not included.

Percentage of Rivers in each Nitrate Concentration (mg/l NO<sub>3</sub>) Category

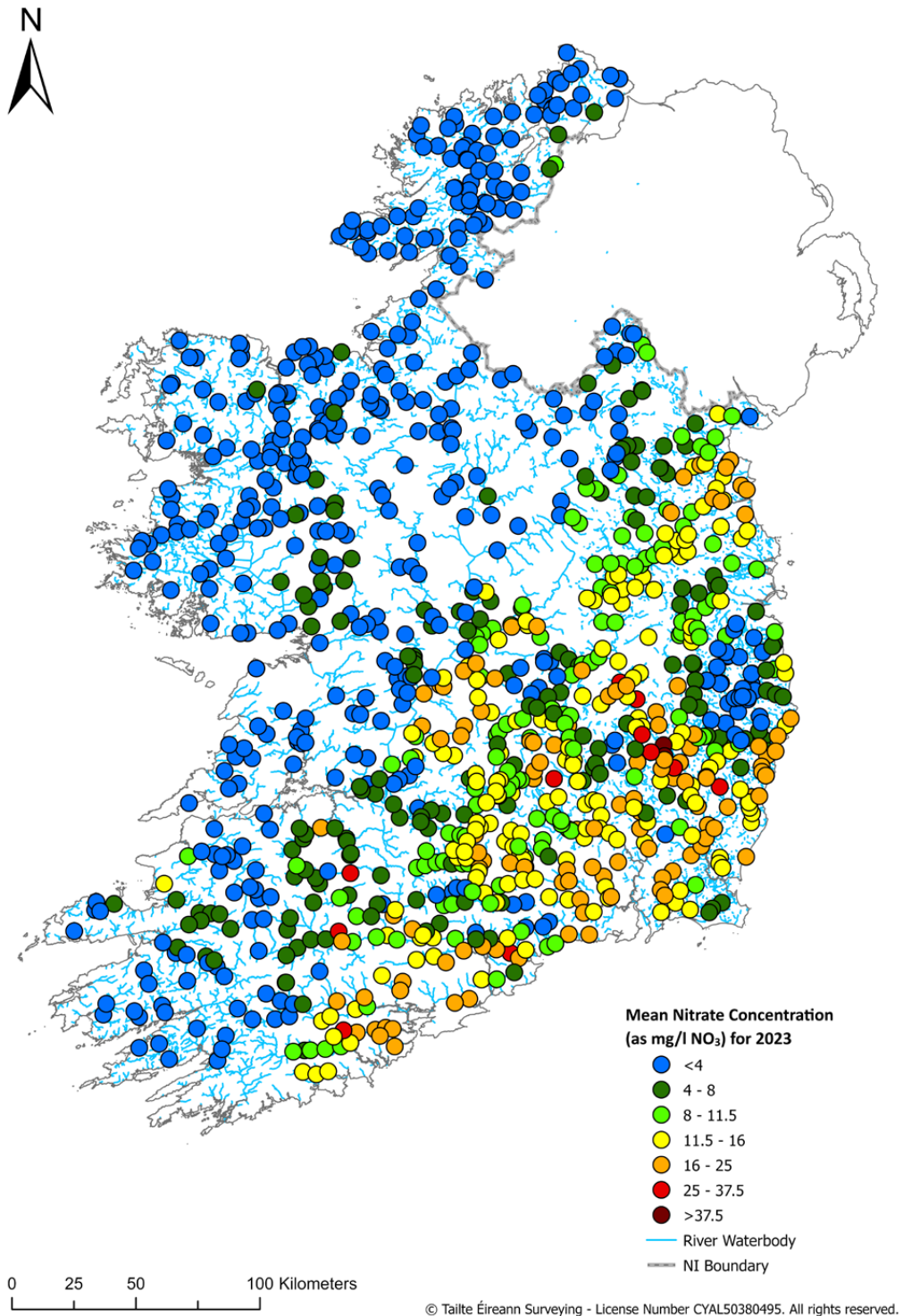


**Figure 4:** Mean nitrate concentrations at river monitoring sites in 2023

Figure 4 shows that nearly half (43%) of our rivers had mean nitrate concentrations above 8 mg/l NO<sub>3</sub> in 2023. Concentrations above 8 mg/l NO<sub>3</sub> may have a water quality impact on the ecological health of these rivers. Mean concentrations greater than 11.5 mg/l NO<sub>3</sub> may result in a breach of the marine waters EQS which could impact the ecological health of the downstream marine waters. Map 4 shows that most of the rivers in the south east and along the southern seaboard have concentrations above 11.5 mg/l NO<sub>3</sub>.

Figure 5 shows that there has been little change in river nitrate concentrations in all regions over the 12 months from 2022 to 2023. Overall, nitrate concentrations in the south east and midlands & eastern regions remain too high. The south east region has consistently had the highest nitrate concentrations over time; the annual averages in this region exceed concentrations that are likely to have a negative impact on marine water quality. The western and border regions have the lowest overall river nitrate concentrations.





**Map 4:** Mean nitrate concentrations in rivers during 2023

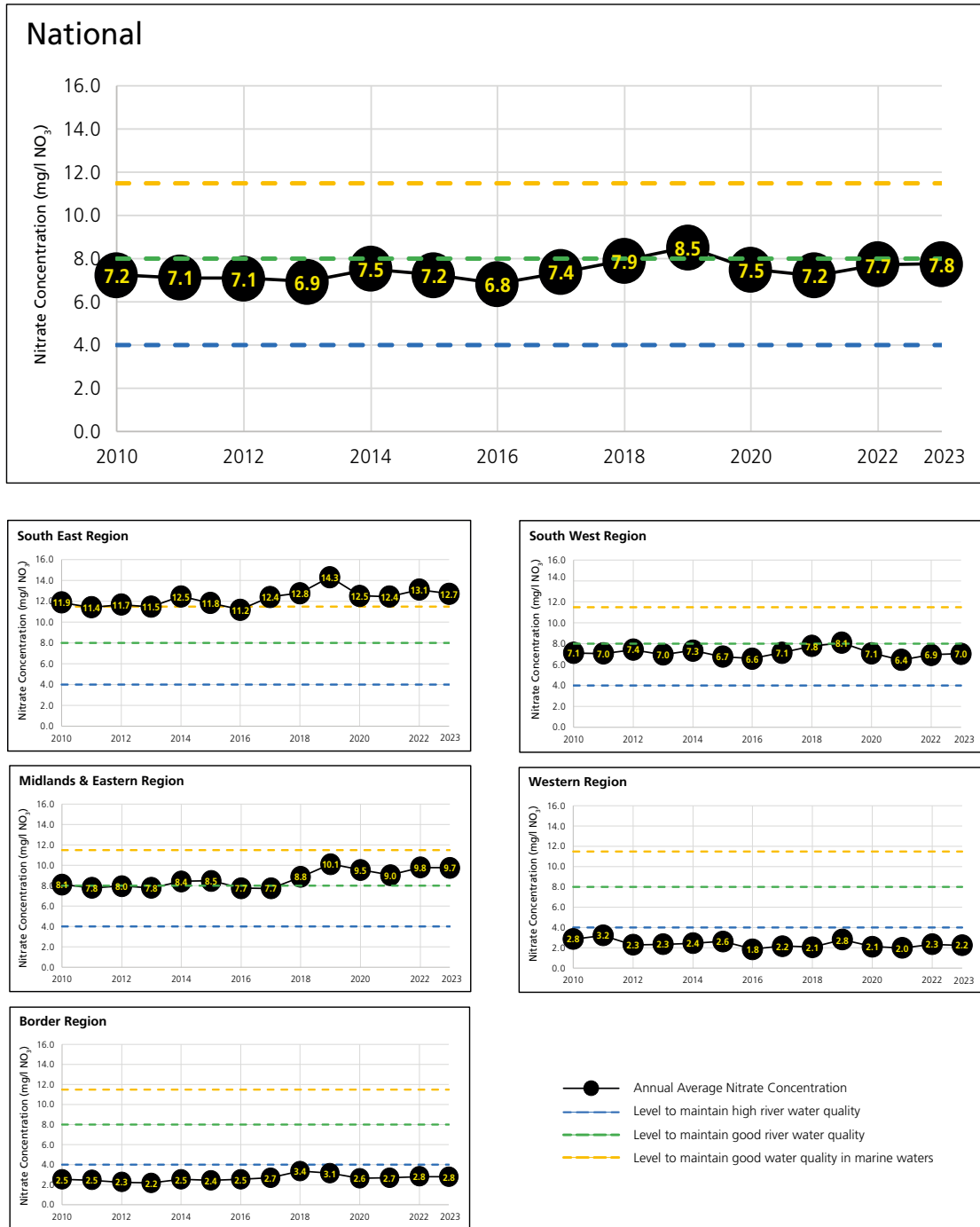


Figure 5: Mean riverine nitrate concentrations since 2010

## Phosphorus in Rivers

Figure 6 summarises the mean phosphorous concentrations at 1,029 river monitoring sites from the national river monitoring programme for 2023.

During 2023, mean river concentrations were greater than the good status EQS (0.035 mg/l P) in 22% of rivers. Map 5 shows that the highest phosphorus concentrations i.e., greater than 0.05 mg/l P, are found in areas that have a high proportion of poorly draining soils e.g., Limerick, Monaghan, the area north west of Dublin and Wexford.

Percentage of Rivers in each Phosphorus Concentration (mg/l P) Category

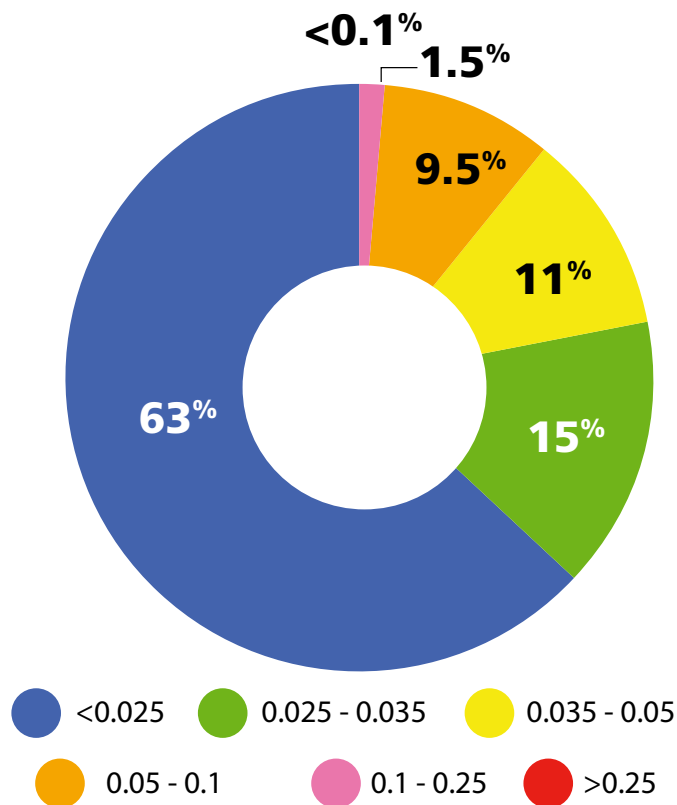
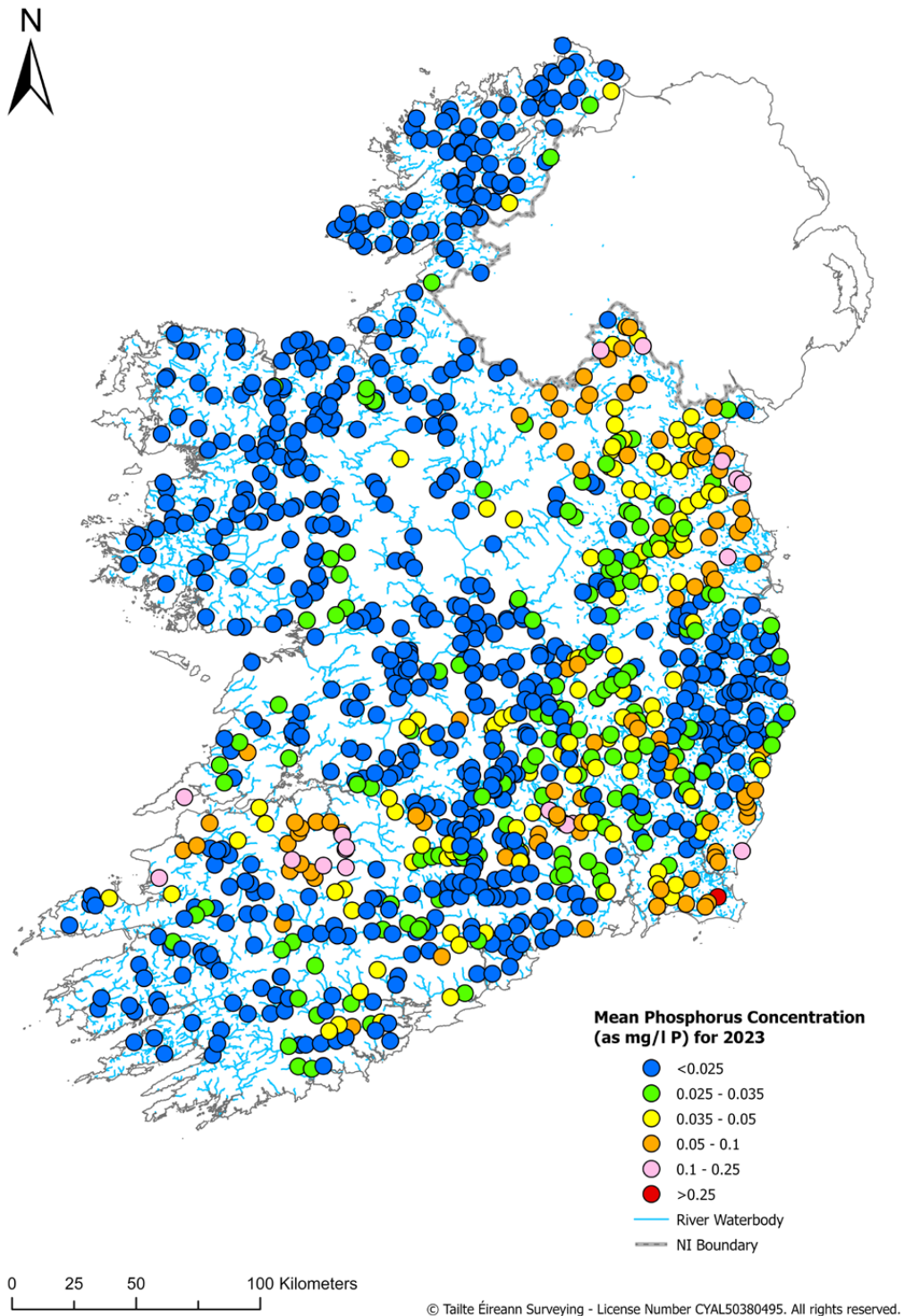


Figure 6: Mean phosphorus concentrations at river monitoring sites in 2023



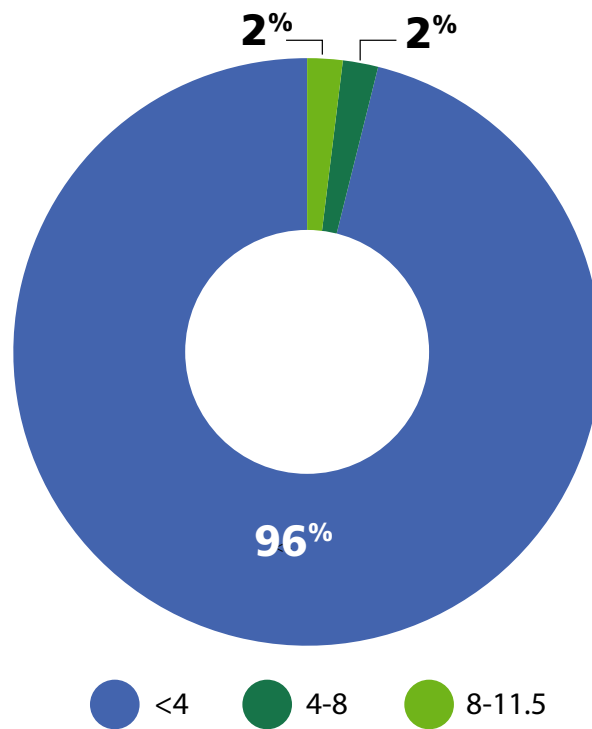
**Map 5:** Mean phosphorus concentrations in rivers during 2023

## Lakes

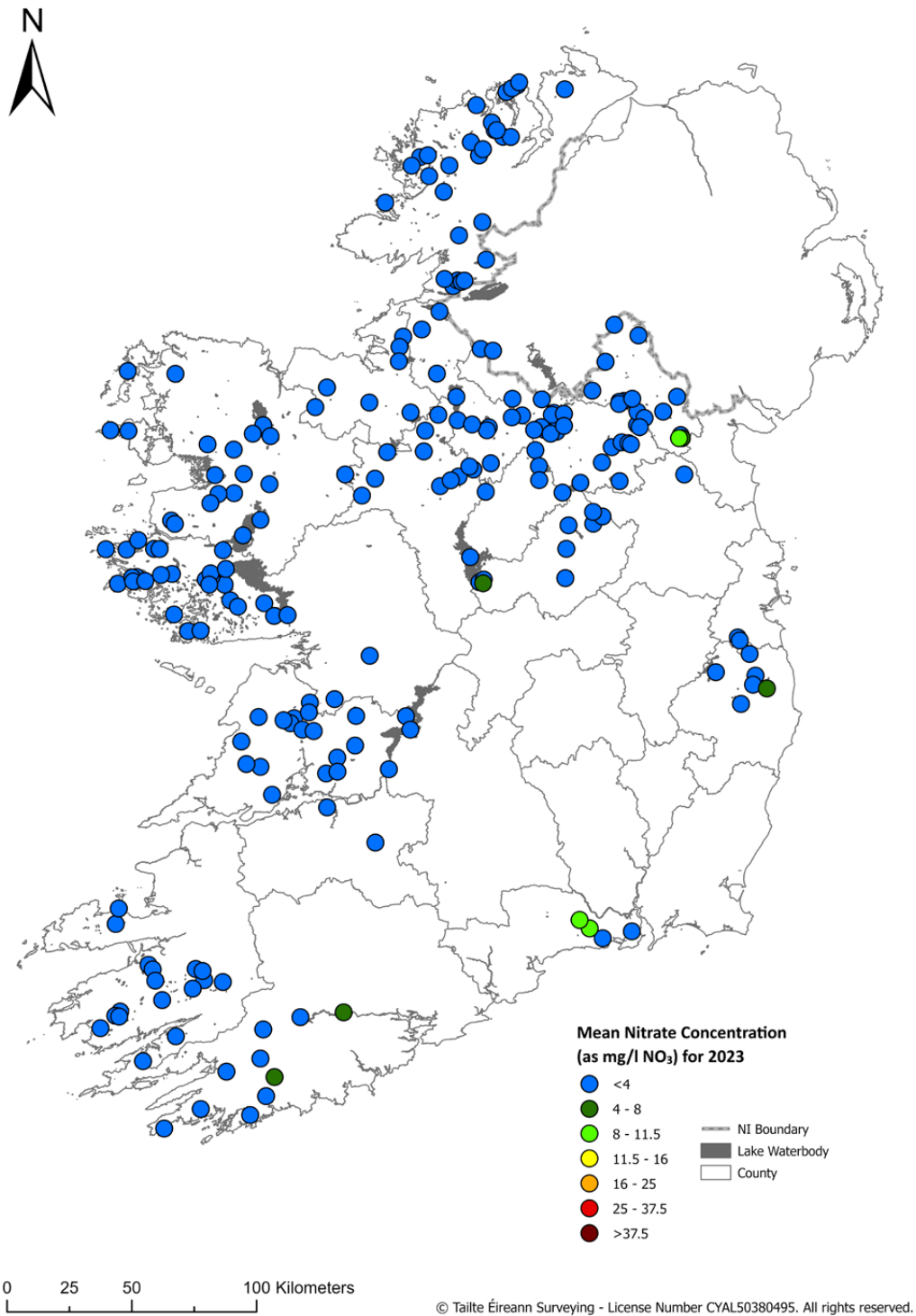
### Nitrate in Lakes

Figure 7 summarises the mean nitrate concentrations from the national lake monitoring programme for 2023. Data were available for a total of 223 lakes. In summary, Figure 7 and Map 6 show that mean nitrate concentrations in lakes remain low, with the highest concentrations observed in the lakes of the south east and south.

Percentage of Lakes in each  
Nitrate Concentration (mg/l NO<sub>3</sub>) Category



**Figure 7:** Mean nitrate concentrations in lakes during 2023



**Map 6:** Mean nitrate concentrations in lakes during 2023

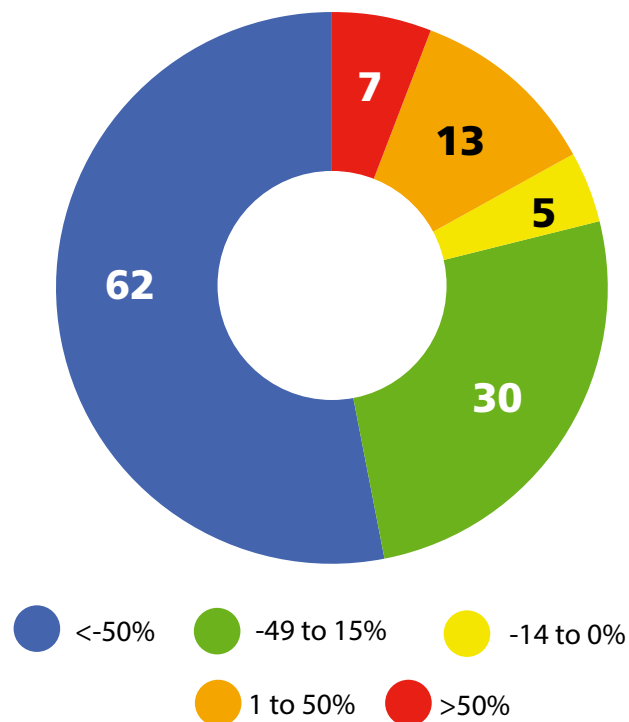
## Estuarine and Coastal Waters

### Nitrogen in Estuarine and Coastal Waters

Figure 8 summarises the relative percentage deviation from the median winter nitrogen threshold<sup>3</sup> from the national transitional and coastal monitoring programme during 2021 to 2023. The median winter nitrogen concentration in marine waters is measured as dissolved inorganic nitrogen (DIN) and it is assumed that all measured nitrogen is present as nitrate. The concentration of DIN is expected to be at its highest in winter because of the absence of any significant plant or algal growth at that time of year; therefore, less nitrogen is used up and remains in the water. The most recent assessment was carried out on 117 estuarine and coastal water bodies. Twenty of the 117 (17%) estuarine and coastal water bodies assessed were in unsatisfactory condition for DIN.

Map 7 shows that the marine waters with the highest concentrations above the assessment thresholds for DIN were in the south and south east of the country, which are the areas with the highest groundwater and river nitrate concentrations.

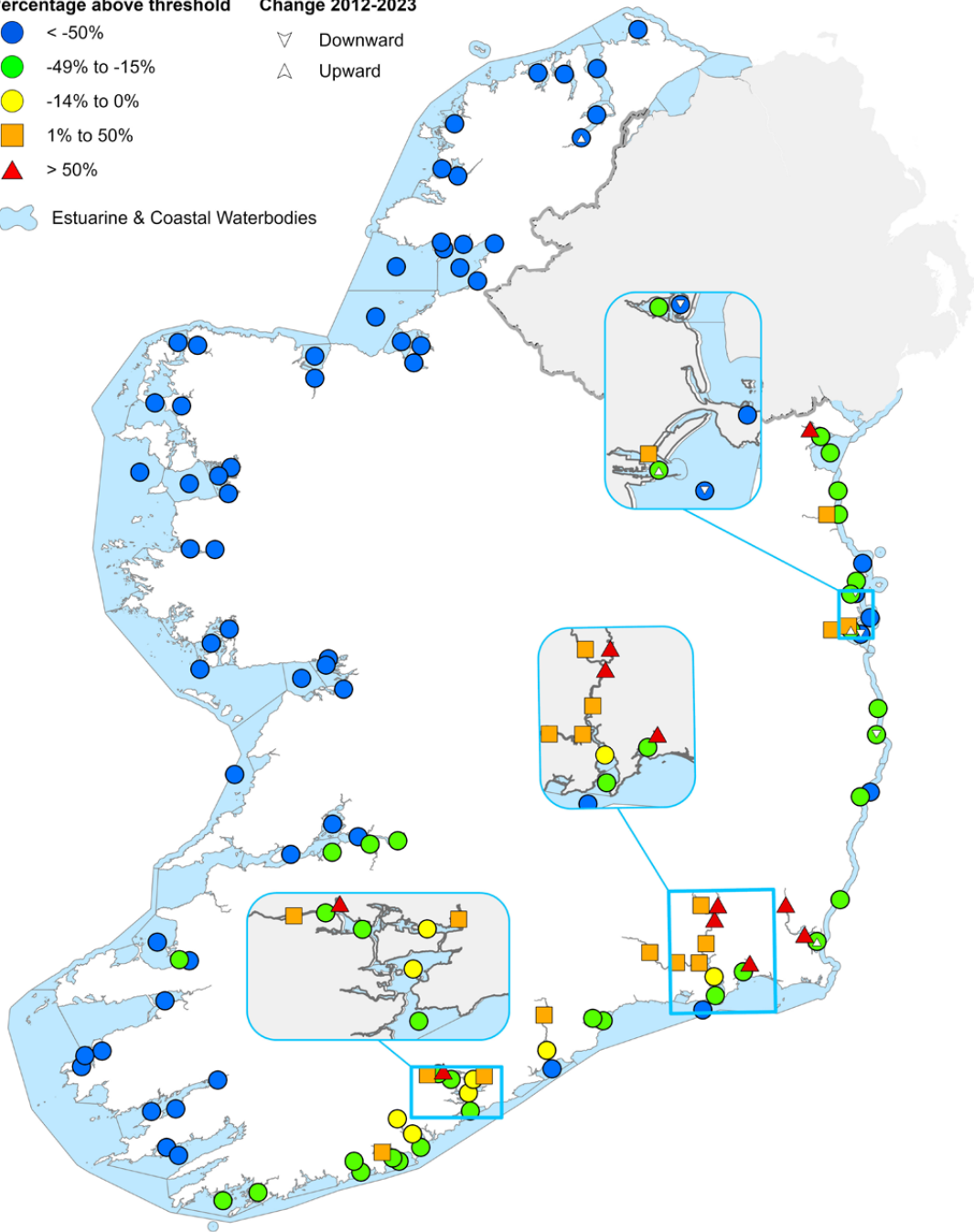
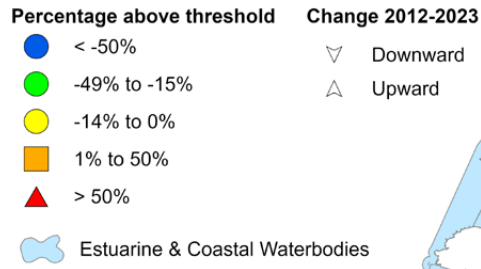
Number of estuarine and coastal waters and their relative percentage deviation from the median winter nitrogen threshold



**Figure 8:** Number of estuarine and coastal waters and their relative percentage deviation from the median winter nitrogen threshold during 2021-2023

<sup>3</sup> For marine waters, the percentage deviation from the median winter nitrogen threshold is used because the nitrogen threshold varies with the salinity of the waters. The thresholds range from 2.6 mg/l N in freshwater to 0.25 mg/l N in fully saline waters. DIN concentrations (exceedances) above these thresholds can indicate pollution.

**Estuarine and Coastal Water Winter  
Dissolved Inorganic Nitrogen 2021 - 2023**



CYAL50380495 © Tailte Eireann –Surveying

**Map 7:** Relative percentage deviation from the median winter nitrogen threshold in marine waters during 2021-2023



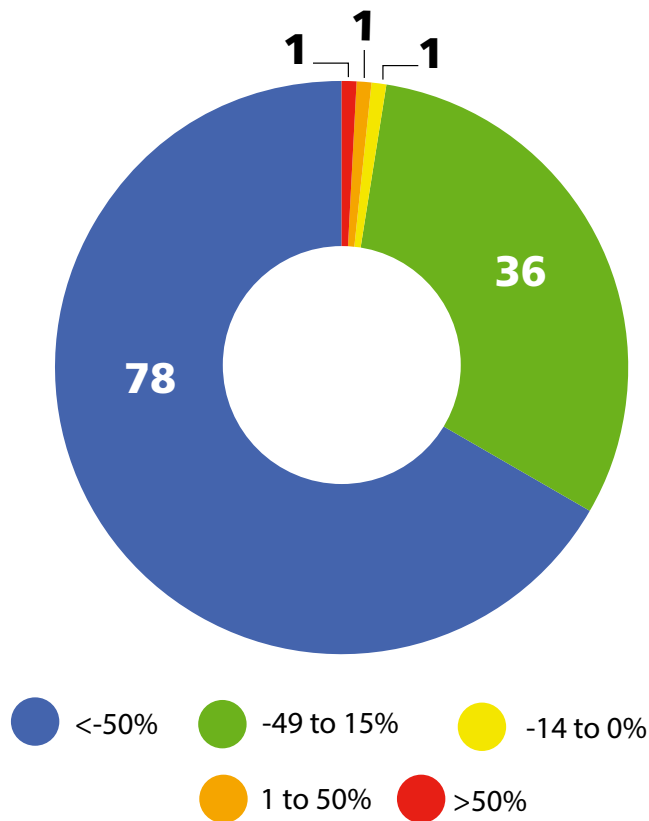
## Phosphorus in Estuarine and Coastal Waters

Figure 9 summarises the relative percentage deviation from the median winter phosphorus threshold for 117 estuaries and coastal waters in the national monitoring programme for 2021 to 2023. In winter the concentration of phosphate is expected to be at its highest due to the absence of any significant plant or algal growth.

Nearly all (98%) estuaries and coastal waters assessed were in satisfactory condition for phosphate. Only two waterbodies were in unsatisfactory condition, having exceeded the relevant threshold<sup>4</sup>.

Map 8 shows that the Deel and Mague estuaries (Shannon) remain in an unsatisfactory condition due to median winter phosphorus exceedances. Castletown estuary in the north east has returned to satisfactory condition for phosphate.

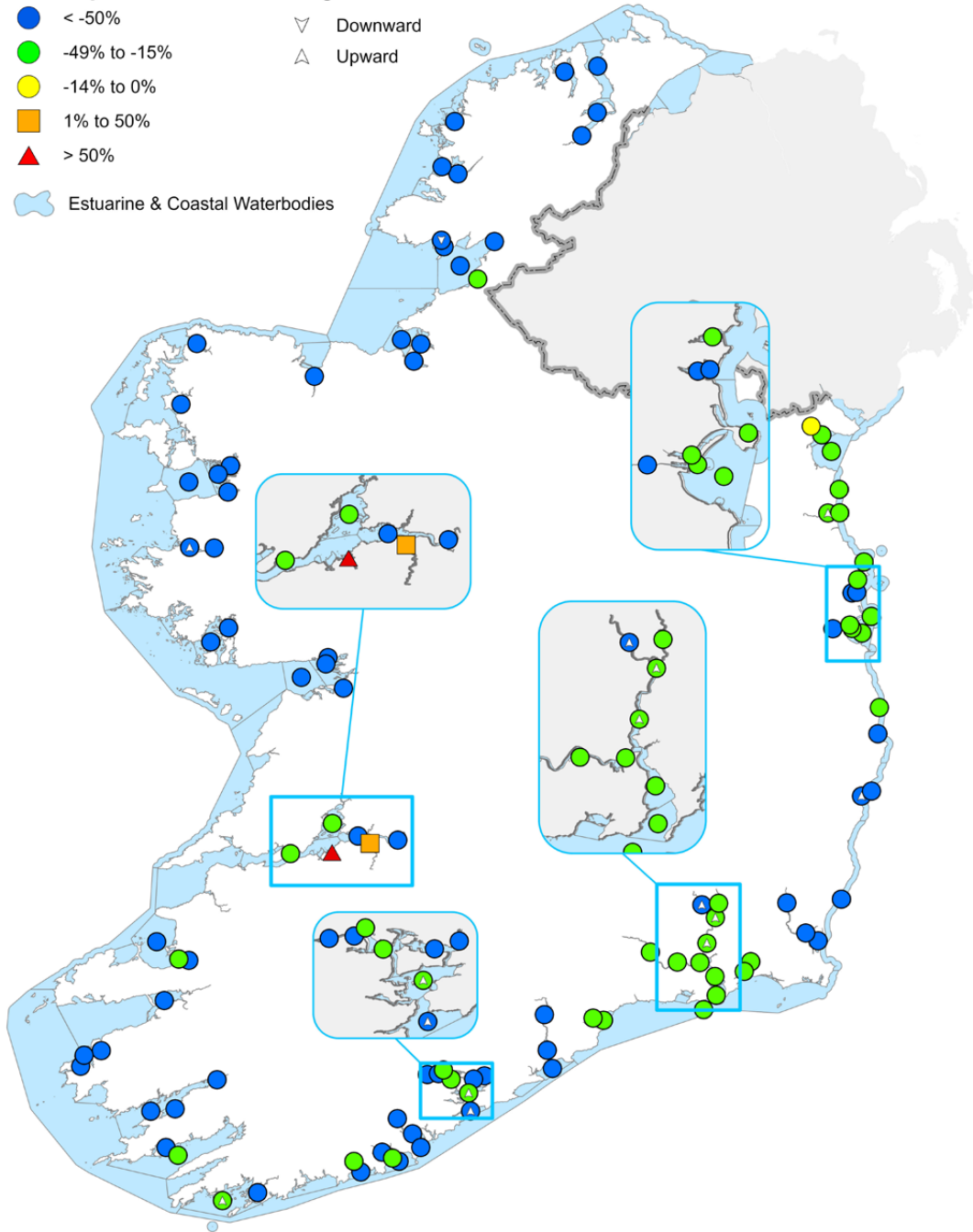
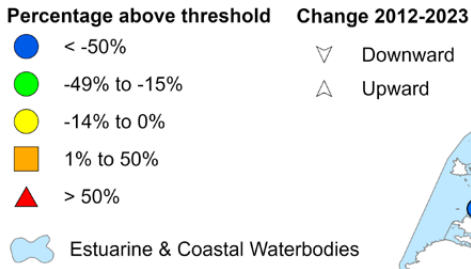
Number of estuarine and coastal waters and their relative percentage deviation from the median winter Phosphate threshold



**Figure 9:** Number of estuarine and coastal waters and their relative percentage deviation from the median winter phosphorus threshold during 2021-2023

<sup>4</sup> Salinity related thresholds have been defined for phosphate in estuaries and coastal waters. The thresholds range from 0.060 mg/l P for fresh and intermediate salinity waters to 0.040 mg/l P for fully saline waters. Phosphate concentrations above these thresholds can indicate pollution.

### Estuarine and Coastal Water Winter Molybdate Reactivate Phosphorus 2021 - 2023



CYAL50380495 © Tailte Eireann –Surveying

**Map 8:** Relative percentage deviation from the median winter phosphorus threshold in marine waters during 2021-2023

## Summary

Nutrient losses from agriculture are one of the significant drivers for waters not meeting their environmental objectives under the Water Framework Directive (WFD).

The most recent ecological status assessment (2016-21) indicates that just over half of our rivers and lakes and only 36% of our estuaries were in satisfactory ecological health, and overall water quality was in decline.

This report finds that nitrate concentrations remain too high in rivers, groundwater and estuaries in the south east and along the southern seaboard. Nationally, there has been an increase in nitrate concentrations in groundwater, with little change in riverine nitrate concentrations, over the 12 months from 2022 to 2023. Forty three percent of our rivers had nitrate concentrations higher than 8 mg/l  $\text{NO}_3$  in 2023, which may have a water quality impact on the ecological health in the downstream marine waters. Twenty two percent of groundwater monitoring sites had a mean nitrate concentration greater than 25 mg/l  $\text{NO}_3$ , which is of concern because they are a significant deviation from natural conditions and are approaching the threshold where drinking water may be compromised. Six percent of groundwater monitoring sites exceeded the groundwater threshold value of 37.5 mg/l  $\text{NO}_3$  in 2023.

Phosphorus concentrations are above the good status environmental quality standard in 22% of rivers, typically in areas associated with poorly draining soils. Elevated phosphorus concentrations are impacting the ecological health of these rivers and may be contributing to nutrient enrichment in the downstream estuaries.

Overall, to deliver improvements in ecological status and to achieve the WFD objectives, nutrient losses to water need to reduce. Mitigation measures need to be targeted to the water quality issues and physical settings where they occur, i.e., the critical source areas within sub-catchments. Within a catchment, the critical source areas for phosphorus and nitrate frequently occur in different locations because they are driven by the hydrological properties of the soils. Measures to reduce phosphorus losses need to focus on breaking the pathway for run off over land and measures to reduce nitrogen losses need to focus on reducing the nitrogen surplus.

## References

Environmental Protection Agency (2022) *Water Quality in Ireland 2016-21*. Environmental Protection Agency, Wexford, Ireland.

Environmental Protection Agency (2024) *Water Quality in 2023: An Indicators Report*. Environmental Protection Agency, Wexford, Ireland.





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