



Ireland's National Water Framework Directive Monitoring Programme

2019 - 2021

ENVIRONMENTAL PROTECTION AGENCY

The EPA is responsible for protecting and improving the environment as a valuable asset for the people of Ireland. We are committed to protecting people and the environment from the harmful effects of radiation and pollution.

The work of the EPA can be divided into three main areas:

Regulation: *Implementing regulation and environmental compliance systems to deliver good environmental outcomes and target those who don't comply.*

Knowledge: *Providing high quality, targeted and timely environmental data, information and assessment to inform decision making.*

Advocacy: *Working with others to advocate for a clean, productive and well protected environment and for sustainable environmental practices.*

Our responsibilities include:

Licensing

- Large-scale industrial, waste and petrol storage activities;
- Urban waste water discharges;
- The contained use and controlled release of Genetically Modified Organisms;
- Sources of ionising radiation;
- Greenhouse gas emissions from industry and aviation through the EU Emissions Trading Scheme.

National Environmental Enforcement

- Audit and inspection of EPA licensed facilities;
- Drive the implementation of best practice in regulated activities and facilities;
- Oversee local authority responsibilities for environmental protection;
- Regulate the quality of public drinking water and enforce urban waste water discharge authorisations;
- Assess and report on public and private drinking water quality;
- Coordinate a network of public service organisations to support action against environmental crime;
- Prosecute those who flout environmental law and damage the environment.

Waste Management and Chemicals in the Environment

- Implement and enforce waste regulations including national enforcement issues;
- Prepare and publish national waste statistics and the National Hazardous Waste Management Plan;
- Develop and implement the National Waste Prevention Programme;
- Implement and report on legislation on the control of chemicals in the environment.

Water Management

- Engage with national and regional governance and operational structures to implement the Water Framework Directive;
- Monitor, assess and report on the quality of rivers, lakes, transitional and coastal waters, bathing waters and groundwaters, and measurement of water levels and river flows.

Climate Science & Climate Change

- Publish Ireland's greenhouse gas emission inventories and projections;
- Provide the Secretariat to the Climate Change Advisory Council and support to the National Dialogue on Climate Action;
- Support National, EU and UN Climate Science and Policy development activities.

Environmental Monitoring & Assessment

- Design and implement national environmental monitoring systems: technology, data management, analysis and forecasting;
- Produce the State of Ireland's Environment and Indicator Reports;
- Monitor air quality and implement the EU Clean Air for Europe Directive, the Convention on Long Range Transboundary Air Pollution, and the National Emissions Ceiling Directive;
- Oversee the implementation of the Environmental Noise Directive;
- Assess the impact of proposed plans and programmes on the Irish environment.

Environmental Research and Development

- Coordinate and fund national environmental research activity to identify pressures, inform policy and provide solutions;
- Collaborate with national and EU environmental research activity.

Radiological Protection

- Monitoring radiation levels and assess public exposure to ionising radiation and electromagnetic fields;
- Assist in developing national plans for emergencies arising from nuclear accidents;
- Monitor developments abroad relating to nuclear installations and radiological safety;
- Provide, or oversee the provision of, specialist radiation protection services.

Guidance, Awareness Raising, and Accessible Information

- Provide independent evidence-based reporting, advice and guidance to Government, industry and the public on environmental and radiological protection topics;
- Promote the link between health and wellbeing, the economy and a clean environment;
- Promote environmental awareness including supporting behaviours for resource efficiency and climate transition;
- Promote radon testing in homes and workplaces and encourage remediation where necessary.

Partnership and networking

- Work with international and national agencies, regional and local authorities, non-governmental organisations, representative bodies and government departments to deliver environmental and radiological protection, research coordination and science-based decision making.

Management and structure of the EPA

The EPA is managed by a full time Board, consisting of a Director General and five Directors. The work is carried out across five Offices:

- Office of Environmental Sustainability
- Office of Environmental Enforcement
- Office of Evidence and Assessment
- Office of Radiation Protection and Environmental Monitoring
- Office of Communications and Corporate Services

The EPA is assisted by advisory committees who meet regularly to discuss issues of concern and provide advice to the Board.



Ireland's National Water Framework Directive Monitoring Programme 2019–2021

ENVIRONMENTAL PROTECTION AGENCY
An Ghníomhaireacht um Chaomhnú Comhshaoil
PO Box 3000, Johnstown Castle, Co. Wexford, Ireland
Telephone: +353 53 916 0600 Fax: +353 53 916 0699
Email: info@epa.ie Website: www.epa.ie

Report published by Environmental Protection Agency, Ireland

Acknowledgements

The Environmental Protection Agency wishes to express its thanks to the following organisations who contributed material to this report: Inland Fisheries Ireland, Marine Institute, National Parks and Wildlife Service and Waterways Ireland.

Main cover photo: The river Owenass, Co. Offaly. Photo: Hugh Feeley

© Environmental Protection Agency 2021

Although every effort has been made to ensure the accuracy of the material contained in this publication, complete accuracy cannot be guaranteed. Neither the Environmental Protection Agency nor the author(s) accepts any responsibility whatsoever for loss or damage occasioned, or claimed to have been occasioned, in part or in full as a consequence of any person acting or refraining from acting, as a result of a matter contained in this publication. All or part of this publication may be reproduced without further permission, provided the source is acknowledged.

ISBN 978-1-84095-974-1

Table of Contents

1.	INTRODUCTION	7
2.	THE REVIEW PROCESS	10
3.	KEY FINDINGS	16
3.1	Providing a national picture of water status	16
3.1.1	Structure of the surveillance and operational networks	16
3.1.2	Achieving a complete national picture of water status	17
3.2	Links to the characterisation of risk and significant pressures	18
3.3	Making the programme more dynamic and responsive to environmental change	18
3.3.1	Measuring change resulting from measures	18
3.3.2	Responding to environmental change	19
3.3.3	Climate change and water status assessment	19
3.3.4	Acid sensitive area monitoring of rivers	20
3.4	Links to Catchment Assessments and Priority Areas for Action	20
3.5	Monitoring the right biological quality element in the right place	21
3.6	Monitoring of chemical and general physico-chemical elements	23
3.6.1	Priority substances Monitoring	23
3.6.2	Physico-chemical monitoring	25
3.7	Hydromorphology	29
4.	THE NATIONAL WFD MONITORING PROGRAMME 2019-2021	30
4.1	Surveillance and operational networks and subnetworks	34
4.2	Frequency and parameters of monitoring	37
4.2.1	Surface waters	37
4.2.2	Groundwaters	37
4.3	Canals	40
5.	DATA MANAGEMENT AND REPORTING	41
5.1	Quality control and quality assurance	41
5.2	Confidence and precision in classification	42
6.	INCREASE USE OF TECHNOLOGY	43
7.	RESPONSIBILITY OF PUBLIC AUTHORITIES	44
8.	COMPARISON TO MONITORING IN OTHER EU MEMBER STATES AND UK	45
9.	UPDATING THE PROGRAMME	46
10.	REFERENCES	47

List of Tables

Table 1:	List of operational subnetworks in the revised programme	18
Table 2:	Number of monitored water bodies in each water category in a Priority Area for Action	21
Table 3:	Biological assessment methods used to assess ecological status in each water category in the national WFD programme 2019-2021 (Italics indicate new method or method under development)	22
Table 4:	Priority substances and priority hazardous substances (italicised) listed in the Priority Substances Directive (2013/39/EC) together with an indication of the substances and matrices being monitored in the national WFD monitoring programme	24
Table 5:	Number of river sites monitored for biology and physico-chemical elements (and overlap) in the 2019-2021 programme	26
Table 6:	Number of water bodies in each monitoring network by water category in the national WFD monitoring programme 2019-2021	30
Table 7:	Number of water bodies in each surveillance subnetwork common to all surface water categories in the national WFD monitoring programme 2019-2021	34
Table 8:	Number of water bodies in each operational subnetwork by surface water category in the national WFD monitoring programme 2019-2021.	34
Table 9:	Frequency of monitoring for each quality element in the national surface waters WFD monitoring programme 2019-2021	38
Table 10:	Nominated authorities for elements of the surveillance and operational monitoring programmes	44

List of Maps

Map 1:	Distribution of biological and physico-chemical river monitoring stations 2019-2021	27
Map 2:	Distribution of the surface water monitoring programme 2019-2021	32
Map 3:	Distribution of the groundwater monitoring programme 2019-2021	33
Map 4:	Distribution of the surface water surveillance monitoring network 2019-2021	35
Map 5:	Distribution of the surface water operational monitoring network 2019-2021	36
Map 6:	Distribution of the canals monitoring network on the Royal and Grand Canals	40

List of Figures

Figure 1:	Distribution of risk across each of the five individual water categories	10
Figure 2:	Change in ecological status since the first river basin management cycle 2007-2009. Number of water bodies in parentheses	12
Figure 3:	Representation of national river typologies defined in the rivers monitoring programme	13
Figure 4:	Representation of risk in the rivers monitoring programme by river catchment.	14
Figure 5:	Representation of significant pressures in the rivers monitoring programme	15
Figure 6:	Comparison of Ireland's national monitoring programme for surface waters against the UK and 23 European member states. Data obtained from the EU Commissions first assessment of member states' programmes for monitoring of water status (COM (2009) 156)	45

Executive Summary

This document presents Ireland's national Water Framework Directive (WFD) monitoring programme for the period 2019-2021. The main purpose of the programme is to provide a coherent and comprehensive national overview of the ecological and chemical status of surface waters (rivers, lakes, transitional and coastal waters) and the quantitative and chemical status of groundwaters. This information is used, amongst other things, to track progress towards the achievement of the environmental objectives established in Ireland's national River Basin Management Plan (RBMP) and to assess change in the quality of Ireland's aquatic environment over time.

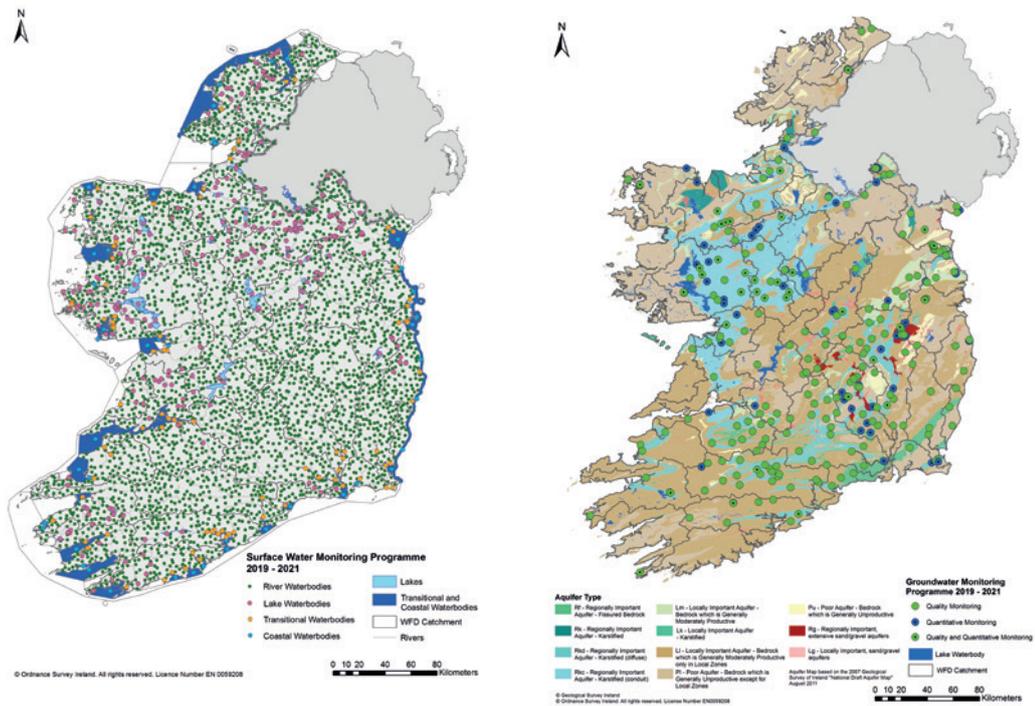
The structure and content of the 2019-2021 monitoring programme is based on a review of the existing monitoring programme which has been in place since 2006. The main changes to the programme arising from the review are set out in this document. This document provides a general description of the type of monitoring to be undertaken, the number of water bodies in each water category to be monitored and the frequency of that monitoring. Specific information on individual water bodies in terms of the environmental quality elements to be monitored and the frequency of this monitoring is provided to public authorities electronically via the Water Framework Directive Application (WFDApp).

The National Monitoring Programme 2019-2021

The national WFD monitoring programme for Ireland for the period 2019-2021 is comprised of 3,169 surface and groundwater bodies. This represents 66% of the total number of water bodies nationally (4,829). This includes 2,422 river water bodies, 224 lakes, 84 transitional water bodies, 47 coastal waters and 392 groundwater bodies. In addition, there are 159 sites used to assess groundwater quantitative status. The location nationally of monitored surface water and groundwater bodies is shown below.

The programme includes two main types of monitoring networks. A surveillance monitoring network to provide a comprehensive and long-term picture of water body status across the State and an operational network to assess the status of water bodies at risk of failing to meet their environmental objectives and to assess if a change in the status of a water body is the result of a programme of measures. There are 287 surface water bodies and 259 groundwater bodies in the surveillance monitoring network and 2418 surface water bodies and 133 groundwater bodies in the operational monitoring network. The location of surface and groundwater bodies in the national programme is shown below while the location of individual monitoring stations can be viewed on EPA Maps (<https://gis.epa.ie/EPAMaps/>).

Type of Monitoring	Rivers	Lakes	Transitional Waters	Coastal Waters	Groundwater
Surveillance	179	75	23	9	259
Operational	2243	149	61	38	133
Quantity					(159)
Total	2422	224	84	47	392



The surveillance and operational networks are further divided into subnetworks designed to meet specific monitoring objectives. For example, in the surveillance network, the long-term trend subnetwork is designed to detect trends in water status, whereas in the operational networks, a number of subnets have been specifically designed to assess if changes in water body status are a result of measures to address different significant pressures.

The surveillance network is assigned into four subnetworks common to all surface water categories as was the case in the previous programme. The operational network is assigned into 14 subnetworks: 12 of these are related to significant pressures identified in the RBMP characterisation process, one is designed to assess the effectiveness of measures to protect and restore high and good status water bodies, and one is for protected areas at risk.

The number of water bodies in each of the operational subnetworks reflects the importance of that pressure with the highest number of water bodies are in the agriculture, hydromorphology and urban waste water subnetworks. An individual water body can be represented in more than one subnet if that water body is being impacted by more than one pressure.

The number of water bodies in each of the surveillance and operational sub-networks in the national monitoring programme 2019-2021 is shown below.

Surveillance Subnet	Rivers	Lakes	Transitional Waters	Coastal Waters
1. Representative of overall status	179	75	23	9
2. Long-term trends	179	75	9	4
3. Validating the risk assessment	23	75	3	0
4. Stipulated sites in the WFD	25	56	7	0

Operational Sub network	Rivers	Lakes	Transitional	Coastal
1. Agriculture	603	75	39	8
2. Aquaculture	5	0	3	3
3. Domestic Waste Water	131	14	6	0
4. Extractive Industry	153	5	0	0
5. Forestry	215	17	0	0
6. Historically Polluted Sites	5	0	0	0
7. Hydromorphology	329	16	0	3
8. Discharges	86	3	0	1
9. Invasive Species	7	34	0	0
10. Anthropogenic Pressures Other	68	6	2	2
11. Urban Run-off	116	2	2	0
12. Urban Waste Water	244	14	24	12
13. Protected Areas At Risk	445	44	12	2
14. Protect high and good status water bodies	842	80	10	21

Quality Elements to be Monitored and Frequency

This document sets out the quality elements (biological, physico-chemical and hydromorphological) to be monitored and the frequency of this monitoring. All biological elements, with the exception of phytoplankton in rivers (not sufficiently sensitive) are being monitored, together with the majority of general physico-chemical elements and specific pollutants. Twenty-three and 36 priority substances listed in the 2013 Priority Substances Directive are being monitored in inland surface waters and marine waters, respectively. All groundwater quantitative and chemical quality elements are being monitored in the national groundwater programme. All quality elements are monitored at least at the minimum frequency recommended in the Directive.

The Review Findings

The main findings of the review have been incorporated into the national WFD monitoring programme for the period 2019-2021. The changes include structural changes to the operational network, increased monitoring frequencies at specified sites (high status sites at risk, Priority Areas for Action, sites damaged by pollution, etc), increased overlap between the river physico-chemical and biological monitoring networks and the addition of new water bodies and monitoring sites in Priority Areas for Action.

The main structural change to the programme is the increase in the number of operational subnets which have increased from five to 14. This change has been made to better align the operational network with the outcome of the RBMP characterisation process. Improved representation and closer alignment of the operational subnets with the significant pressures identified during characterisation will ensure that the impacts arising from these pressures are being monitored and addressed in the programme of measures.

The review has highlighted the need to make the programme more dynamic and responsive to environmental change. This has been achieved by increasing the frequency of monitoring at sites which have been damaged by pollution or are at risk of not meeting their environmental objectives. These sites include high status water bodies that are at risk of deterioration, or that have already deteriorated and water bodies that have been impacted by suspected toxic (chemical pollution) events. To make the programme more dynamic, consideration will be given to the removal of water bodies from the operational network once their objectives have been met and can be maintained and to redeploy this monitoring resource elsewhere.

The overlap between the national programme and the 190 Priority Areas for Action identified in the national RBMP has been improved by adding new water bodies and monitoring sites. The frequency and timing of monitoring has also been adapted to help assess the effectiveness of measures and to confirm if a water body has met its environmental objective by the prescribed date.

The general changes to the programme together with the specific changes for individual water categories following the outcome of the review are:

General changes

- ▲ Increase in the number of operational subnetworks from five to 14 for surface waters to better align with the significant pressures identified in the RBMP characterisation process.
- ▲ Increase in the frequency of monitoring at priority sites (i.e. high status water bodies, polluted sites, sites in Areas for Action) to detect change that may result from pressures or the implementation of measures.
- ▲ Stronger links between the monitoring programme and Priority Areas for Action through the addition of new water bodies and increase in monitoring frequency.

Specific changes

Rivers

- ▲ Increased alignment between the rivers physico-chemical and biological monitoring networks to achieve a more spatially integrated assessment of ecological status.
- ▲ Increased frequency of monitoring of high status sites at risk of not meeting their environmental objectives and those which have already deteriorated including annual monitoring at the remaining highest quality sites (Q5).
- ▲ Increased frequency of monitoring at sites suspected of being impacted by toxic events including annual monitoring until improvement in status is detected.
- ▲ Establishment of an acid sensitive area network to assess the impact of acidification.
- ▲ Establishment of a WFD specific climate change network to understand the effects of climate change on macroinvertebrate communities, reference condition and assessment.

Lakes

- ▲ The review found that the lakes monitoring programme was sufficiently robust to provide an overall national picture of lake water status.
- ▲ At the catchment-scale the review indicated the lakes programme could be more representative of certain typologies and pressures. A series of projects will be undertaken to inform a full review of the programme in time for the next river basin cycle.
- ▲ Reduced monitoring frequency of fish in lakes with slow response times.

Transitional and coastal

- ▲ The transitional and coastal waters monitoring programme was found to be generally fit for purpose.
- ▲ A number of water bodies now identified as Priority Areas for Action, but previously unmonitored, have been added to the programme (e.g. Bannow Bay).
- ▲ The boundaries of six water bodies have been adjusted to better reflect their status and the environmental drivers of status.

Groundwater

- ▲ The groundwater monitoring programme was found to be generally fit for purpose.
- ▲ Increase in the number of water bodies being monitored in the operational network. A slight decrease in the surveillance network.

Assignment of Responsibility for WFD monitoring

The monitoring programme lists the elements that each Public Authority has responsibility for and there is a statutory obligation on the nominated authority to execute the monitoring assigned to them. The assignment of a monitoring responsibility to a public authority (like in the previous programme) is based on the established responsibilities and competency of the public authority. For the biological, hydromorphological and physicochemical parameters, the assigned Public Authorities have been involved in the assessment of these parameters for several decades.

The EPA is now undertaking all the surveillance and operational freshwater chemical monitoring with local authorities undertaking the sampling for these networks. The table below sets out the nominated authorities for each element of the monitoring programme.

Nominated authorities for elements of the surveillance and operational monitoring programmes

Element	Rivers	Lakes	Transitional and Coastal	Ground Water	Canals	Data Processing	Reporting
Phytoplankton	-	LA, EPA	EPA, MI	-	-	EPA	EPA
Macrophytes	EPA	EPA	EPA	-	WI	EPA	EPA
Benthic Algae	EPA	EPA	-	-	-	EPA	EPA
Macroinvertebrates	EPA	EPA	MI	-	WI	EPA	EPA
Fish	IFI	IFI	IFI	-	IFI	IFI	EPA
Hydromorphology	EPA, OPW	EPA	EPA, MI	-	EPA, WI	EPA	EPA
Physico-Chemical	LA, EPA	LA, EPA	EPA, MI	EPA	WI	EPA	EPA
Relevant Pollutants	LA, EPA	LA, EPA	MI	EPA	-	EPA	EPA
Priority Substances	LA, EPA	LA, EPA	MI	EPA	-	EPA	EPA

(EPA: Environmental Protection Agency; LA: Local Authority; IFI: Inland Fisheries Ireland; MI: Marine Institute; OPW: Office of Public Works; WI: Waterways Ireland)

Updating the programme

The structure and content of the programme in place for the period 2019-2021 is available to view electronically via the Water Framework Directive Application (WFDApp). Any changes to the content of the programme for either operational or logistical reasons will be updated on an annual basis as necessary. Changes to the programme will be made with the full knowledge of the relevant public bodies.

The national WFD monitoring programme will be reviewed prior to the commencement of the third-cycle river basin management plan 2022-2027.

1. Introduction

The main aim of the EU Water Framework Directive is to achieve good status in both surface and groundwater bodies and the prevention of deterioration in water bodies that are already in good or better status. Surface waters include rivers, lakes, transitional waters and coastal waters. For natural waters these environmental objectives relate to achieving or maintaining good or high ecological status and good chemical status for surface waters and good chemical and quantitative status for groundwaters. For heavily modified or artificial water bodies which are incapable of achieving good ecological status without impairing an existing specified water use the environmental objective is to achieve good ecological potential.

A central component of the framework is the establishment in each member state of a national monitoring programme to provide a coherent and comprehensive assessment of water status in a river basin district. The programme is required to identify the type of monitoring (e.g. surveillance, operational or investigative) to be undertaken and the objectives under each type, the water bodies and quality elements to be monitored and the frequency of this monitoring. The specific requirements to be met are explicitly given in Annex V of the Directive.

The assessment of ecological status is based on biological quality elements as well as supporting hydromorphological, chemical and physico-chemical quality elements while chemical status is assessed against a range of environmental quality standards (EQSs) listed in the WFD and subsequent Environmental Quality Standard Directives. For groundwaters, both quantitative and chemical status is assessed. The assessment of quantitative status is based on groundwater level measurements and the assessment of chemical status is based on measurements of conductivity and concentrations of pollutants.

Ireland's national WFD monitoring programme was established in 2006 (EPA, 2006) in accordance with the requirements of the European Communities (Water Policy) Regulations, 2003. The original programme was designed to meet the specific monitoring requirements of the WFD and to support the implementation of the first river basin management cycle in Ireland. The programme was designed to provide a representative picture of water quality status in each river basin district and to assess the effectiveness of measures put in place to achieve the environmental objectives set out in each of the river basin management plans. The programme also took into consideration the monitoring requirements of other water related environmental legislation such as the Nitrates Directive.

The programme consists of two main monitoring networks: a surveillance network to provide a comprehensive and long-term picture of water status across the State and an operational network to assess the status of those waters at risk of not meeting their environmental objectives and to assess if the status of a water body changes as a result of a programme of measures. These networks are further divided into subnetworks which are designed to meet the specific requirements of the Directive. A third type of monitoring, known as investigative, is undertaken on an ad-hoc basis. The purpose of each of these networks and the subnetworks associated with them is explained in Topic Box 1.

Box 1. Structure of the national WFD monitoring programme 2006-2018

The national WFD monitoring programme for surface water was divided into three main monitoring networks, surveillance, operational and investigative, each of which were designed to meet one or more objectives of the WFD.

The **surveillance monitoring network** was established to provide information for:

- ▲ supplementing and validating the impact assessment procedure,
- ▲ the efficient and effective design of future monitoring programmes,
- ▲ the assessment of long-term changes in natural conditions, and
- ▲ the assessment of long-term changes resulting from widespread anthropogenic activity.

The purpose of **operational monitoring network** was to:

- ▲ establish the status of those bodies identified as being at risk of failing to meet their environmental objectives, and
- ▲ assess any change in the status of such bodies resulting from the programmes of measures.

Investigative monitoring is required where the reason for any exceedance is unknown or to ascertain the extent and impact of accidental pollution. IM can also be used to help select measures needed to achieve environmental objectives or to remedy the effects of accidental pollution.

For the surveillance network **four subnetworks** were established: **1.** to be representative of overall status within a catchment or sub-catchment; **2.** to detect long-term trends; **3.** to supplement and validate the risk assessment and **4.** for specific sites or water bodies stipulated in the Directive: e.g. points on large rivers where the catchment area upstream is greater than 2,500 km²).

For the operational network **five subnetworks** were established to assess the effectiveness of measures to: **1.** reduce impact on status from point sources; **2.** reduce impact on status from diffuse sources; **3.** reduce impact on status from hydromorphological pressures; **4.** to maintain good and high status water bodies; and **5.** monitor protected areas at risk.

The **groundwater quality monitoring** programme includes:

- ▲ a surveillance monitoring network to supplement and validate the risk assessment with respect to the risks of failing to achieve good chemical status and natural and anthropogenic trend assessments;
- ▲ an operational monitoring network to establish the status of at risk groundwater bodies and establish the presence of significant upward trends in the concentration of pollutants;
- ▲ appropriate monitoring to support the objectives of the Drinking Water Protected Areas and Protected Areas for species and habitats.

The **quantitative groundwater monitoring** programme is required to:

- ▲ supplement and validate the Annex II risk assessment procedure;
- ▲ determine the quantitative status of groundwater bodies;
- ▲ support the chemical status assessment and trend analysis;
- ▲ support the design and evaluation of programmes of measures.

The publication of Ireland's second-cycle River Basin Management Plan (2018-2021) provided an opportunity to review the national WFD monitoring programme. The review considered the changes required to the programme to ensure it continues to meet the requirements of the Directive and related legislation and to support the implementation of the second-cycle RBMP across Ireland's single national River Basin District.

The review was informed by the outputs of the characterisation exercise undertaken in preparation for the second-cycle RBMP and by improved knowledge of the state of Ireland's aquatic environment that has resulted from on-going monitoring, outputs from research projects and the development and use of new biological and chemical assessment methods. The review has also taken into account the 190 Priority Areas for Action identified for special attention in the RBMP.

The purpose of this document therefore is to summarise the main findings of the review and to present the structure and content of the revised national WFD monitoring programme for Ireland for the period 2019-2021. The document also specifies and reiterates the nature and extent of monitoring to be undertaken by the relevant public authorities. The programme described in this document updates and replaces the programme established by the EPA in 2006.

The specific details of the programme in terms of lists of water bodies to be monitored in each water category, the quality elements to be monitored and their frequency is provided on the WFD Application which is accessible through the Environmental Data Exchange Network (www.edenireland.ie). The location of national monitoring stations can be viewed on EPA Maps (<https://gis.epa.ie/EPAMaps/>).

2. THE REVIEW PROCESS

This section provides a description of the review process and a summary of the different types of information used. The main purpose of the review was to assess if the programme was still fit for purpose and capable of delivering the required outputs for the implementation of the second-cycle river basin management plan.

The key findings of the review (see sections 3 and 4) have been incorporated into the national WFD monitoring programme for the period 2019-2021.

The review examined the existing surveillance and operational networks and associated subnetworks to assess if they had been effective in assessing the overall national status of surface waters and groundwaters and in assessing change in water status resulting from the programmes of measures. The review also examined the extent to which the programme is aligned to the risk characterisation process completed in 2017 in preparation for the second-cycle RBMP. The extent to which the programme is aligned to the characterisation process and each of the three risk characterisation categories (at risk, not at risk, review) gives an indication of how effective the programme will be in continuing to address the significant pressures impacting on water status in Ireland. Finally, the review examined how closely the monitoring programme overlapped with the Priority Areas for Action that have been selected for special attention in the second-cycle river basin management plan.

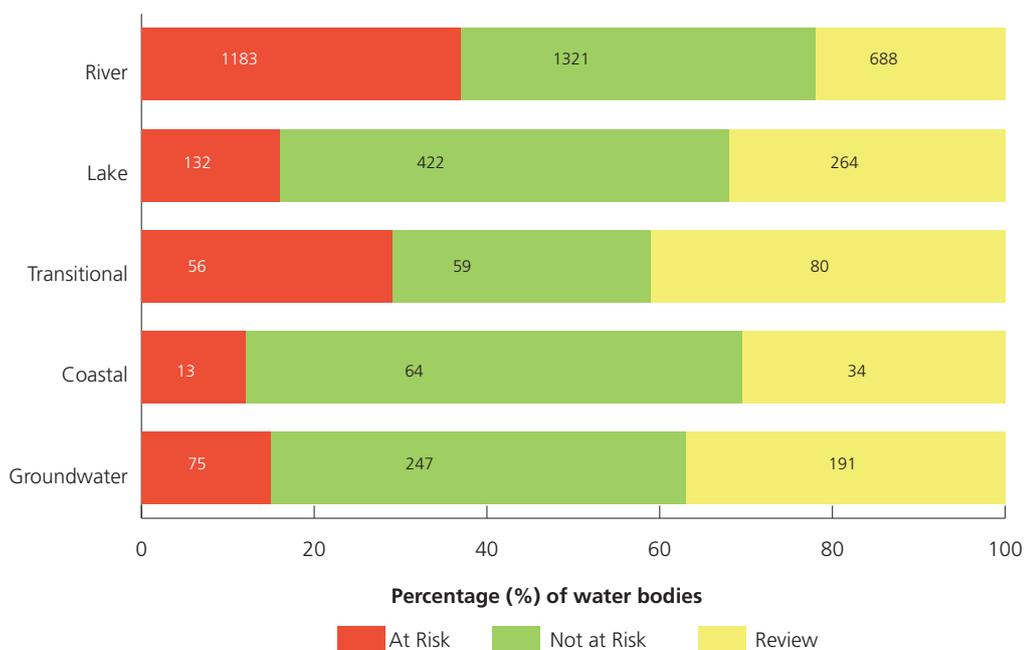


Figure 1: Distribution of risk across each of the five individual water categories

In summary, the review considered if the national programme was:

1. Effective in assessing water status (i.e. representative of water body typology, risk, significant pressures and status);
2. Responsive to environmental change (as a result of measures but also due to environmental pressures);
3. Aligned with the outcome of the characterisation process;
4. Linked to Priority Areas for Action.

In undertaking the review the following information was taken into account:

- ▲ Any change or updates to the national **typology** of surface water and groundwaters. The typology used to group individual water bodies into types that reflect their physical character has remained mostly unchanged. A new type was added for lakes bringing the total number of types to 13. A much larger proportion of lakes have now been categorised into their national physical type. The review process has examined if all physical types are adequately represented in the programme.
- ▲ Any change to the **delineation** of water body boundaries. This was particularly relevant for rivers as all original river body boundaries were re-delineated to better align with the river monitoring network. This also required that these newly delineated river water bodies were re-typed and this has been undertaken in the review of the rivers monitoring network.
- ▲ The outcome of the **risk characterisation process** for surface water and groundwater which categorised water bodies into three categories: **not at risk**, **at risk** and **review**. Each of these risk categories have implications for the design of the monitoring programme in terms of the need for additional measures for "at risk" water bodies or the maintenance of basic measures for water bodies "not at risk" or the need for further monitoring or investigative assessments of "review" water bodies. The existing programme was reviewed against each of these categories to assess how representative the programme was of each risk category (Figure 1).
- ▲ The identification of **significant pressures** as part of the risk characterisation process which provides the means to target local measures. The review examined the effectiveness of the existing programme and the effectiveness of the operational sub-networks in assessing the impact of these pressures.
- ▲ For groundwater, updated information on hydrogeology and pollution impact potential maps for phosphorus and nitrogen.
- ▲ For groundwater, updated delineation of the area of a catchment contributing water to a groundwater monitoring point (i.e. zone of contribution).
- ▲ Development of the **catchment assessments** approach and identification of **Priority Areas for Action**.
- ▲ The setting of dates for the achievement of **environmental objectives**. The review took into consideration if monitoring would be undertaken in time to confirm if planned improvements had been achieved especially where there is a 2021 environmental objective deadline.
- ▲ The **ecological status** and **chemical status** of surface waters and groundwaters. Information on water status was used to examine the overall representativeness of the programme with change in water status used to assess the ability of the existing programme to assess long-term change as well as sudden change in ecological status (Figure 2). The review examined if the existing programme was suitable for assessing the nature and cause of these changes both in space and time. (i.e. is the frequency and spatial distribution at which some elements monitored sufficient to detect change and response to measures).

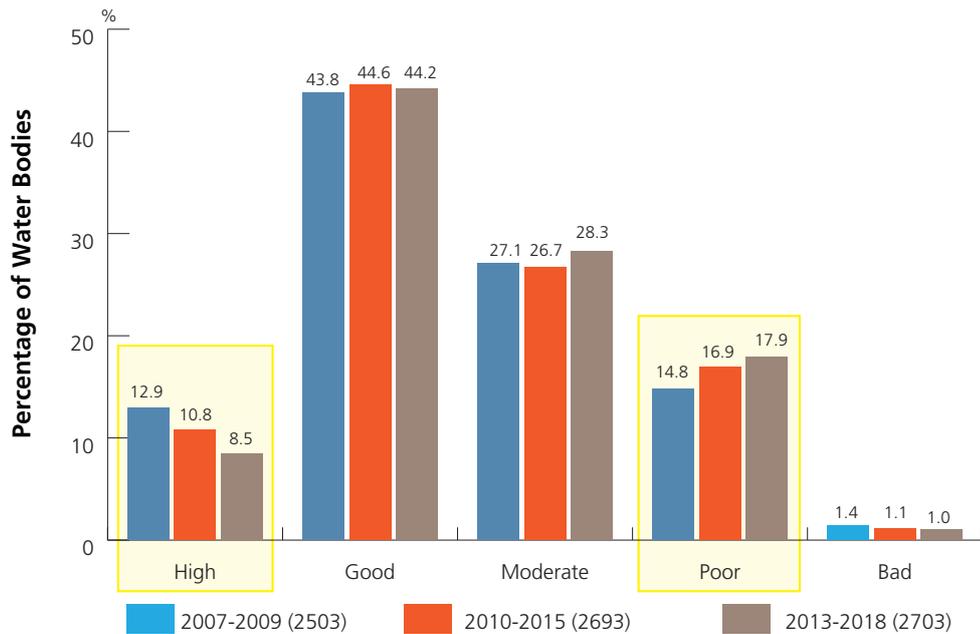


Figure 2: Change in ecological status since the first river basin management cycle 2007-2009. Number of water bodies in parentheses.

- ▲ The inclusion of new biological assessment methods and the requirement to monitor new physico-chemical parameters including newly identified priority substances and priority hazardous substances.
- ▲ The inclusion of water bodies stipulated in the text of the WFD (e.g. sites used to estimate the pollutant load to the marine environment; sites identified under the Information Exchange Network (EIONET), significant cross border water bodies).
- ▲ Integration across each of the water categories. For example, monitoring linkages between different water categories (e.g. rivers and lakes) to assess the broadscale effect of measures or indeed anthropogenic pressures.
- ▲ **Integration and synergies** with other national monitoring programmes (e.g. combining monitoring of WFD coastal water bodies with monitoring of shellfish waters, links to monitoring for Marine Strategy Framework Directive, OSPAR).
- ▲ **Practical considerations** such as site access, health and safety considerations, presence or absence of particular biological elements or habitats, etc.

This information was evaluated to answer each of the four questions outlined above. As an example of the type of analysis undertaken, Figures 3, 4 and 5 show the extent to which the national rivers monitoring network represents the range of typologies, risk and significant pressures respectively that occur across Ireland's entire rivers network. The extent to which the rivers programme represents each of these features provides an indication of how well the programme represents overall water status across this category. Other analyses were carried out to examine how responsive the programme is to environmental change, how well the programme aligns with the outcome of the risk characterisation exercise and lastly the extent of the overlap between the programme and the Priority Areas for Action. A similar exercise was carried out for each of the water categories.

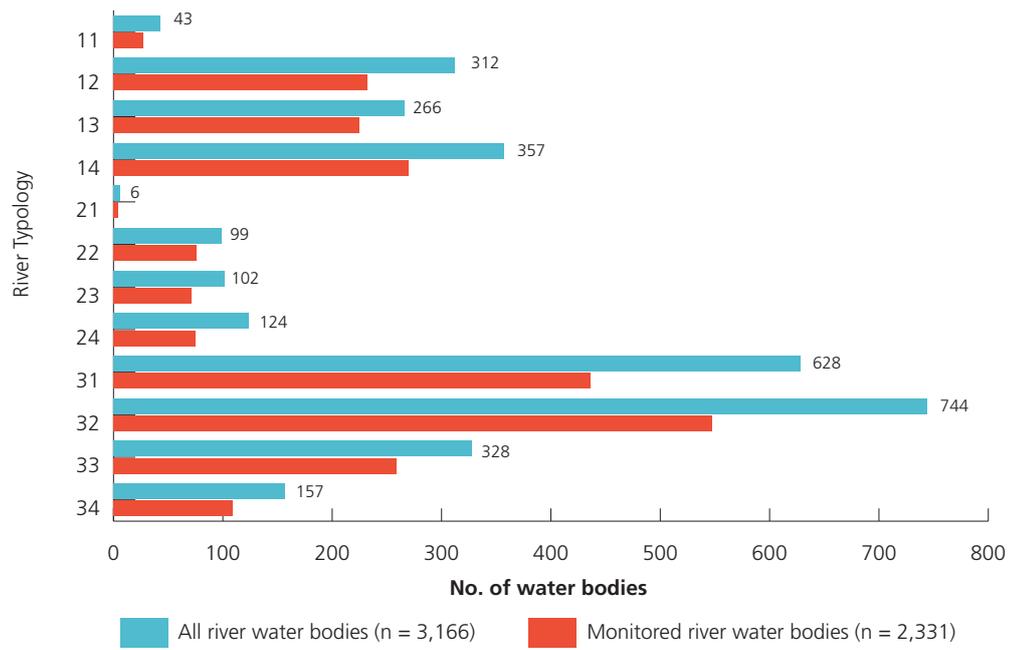


Figure 3: Representation of national river typologies defined in the rivers monitoring programme.



Figure 4: Representation of risk in the rivers monitoring programme by river catchment.

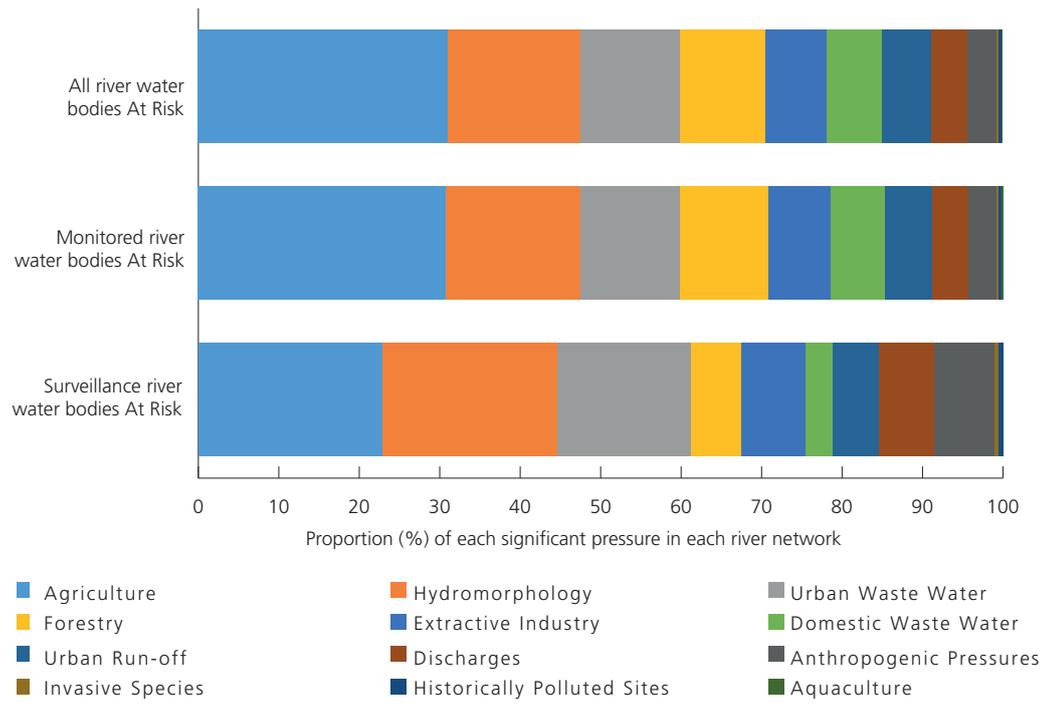


Figure 5: Representation of significant pressures in the rivers monitoring programme.

3. KEY FINDINGS

The key findings of the technical review will be summarised in the following sections. These sections will clearly indicate the changes that have been incorporated into the 2019-2021 monitoring programme. The text will also indicate further work and other changes that are likely to be made for future monitoring cycles.

3.1 Providing a national picture of water status

The main objective of the WFD national monitoring programme is to provide a national picture of water status. This is achieved by collecting information on the status of a range of biological, physico-chemical, hydromorphological and groundwater quality elements from water bodies in the surveillance and operational networks. In addition to using this information to assess water status it can also be used to provide extrapolated status to groups of unmonitored water bodies which share similar characteristics to those which are monitored. Combining status information from monitored and extrapolated water bodies provides an overall national picture of water body status.

3.1.1 Structure of the surveillance and operational networks

The review has examined the structure and content of the existing surveillance and operational networks and has concluded that these networks are generally, with some minor adjustments, fit for purpose in providing a representative picture of water status across the State. That is to say, the existing surveillance and operational networks are representative of the main typologies, pressures and risk within each water category. While the programme was found to be generally fit for purpose, the review did identify the need to re-structure the operational network, specifically the operational subnetworks, and align them to the significant pressures identified in the characterisation process. Furthermore, in the individual water categories, the review identified the need to make some adjustments by adding water bodies to address identified gaps or to adjust water body boundaries to ensure that their water status represents their true condition. It also became clear for some water categories, that further characterisation is required to inform further review of the monitoring programme.

In the rivers water category, the review has indicated that the number of surveillance water bodies should be increased to better reflect the overall national picture. The review found that the surveillance network was skewed towards water bodies at risk and at less than good status. To address this, additional sites at high and good status, will be added to the rivers surveillance network following consultation between the EPA and relevant authorities. Furthermore, additional sites will be added to represent high altitude locations (i.e. > 200 meters above sea level) and 1st order streams. In total approximately 20 additional sites will be considered by the EPA for inclusion in the river surveillance network over the period of the 2019-2021 programme.

In lakes, the review has indicated that further characterisation is required to inform the review of the surveillance and operational networks for future cycles. The technical review found that while the lake programme is representative of different types and pressures, nationally, the combination of different lake types and pressures is not sufficiently represented at smaller scales. The technical review concluded that further information is required to undertake a comprehensive review of the national lake monitoring programme. To facilitate this, projects will be undertaken between 2019 and 2021 in time for the third river basin management plan which will take effect in 2022. These projects will collect information to confirm the risk categorisation of "review" lakes to complete lake typology and to better align pressure sources

with hydrogeological pathways. This information will be analysed and used to improve both the risk characterisation process and the extrapolation methodology for lakes. In addition, a collaborative project, with the National Parks and Wildlife Service, will be undertaken to further clarify the water related qualifying interests for protected habitats and species that occur in marl and oligotrophic lakes.

In transitional and coastal waters, the review has indicated that the existing number of individual water bodies in the surveillance and operational networks are sufficient to meet the objective of those respective networks. Nevertheless, in a small number of water bodies, it became evident that changes needed to be made to some water body boundaries to ensure that their status accurately reflects their condition and not the influence and condition of an adjacent water body. This is particularly relevant in transitional waters, where impacted water bodies can influence the assessment of status in an adjacent water body if the boundaries are not positioned correctly. The boundaries of six transitional water bodies in the Suir, Munster Blackwater and Swilly estuaries have been adjusted to better reflect their ecological status and these adjusted water body boundaries are being used in the 2019-2021 monitoring programme.

For groundwaters, the review found that the existing network was still valid and only minor adjustments were required in response to updated information. The review is recommending further characterisation in a small number of areas where the conceptual understanding used in the design of the network requires development or validation. The review identified the need for a small number of new sites to replace those lost through cessation of abstractions. There will be additional consideration of the adequacy of the network as further characterisation of the groundwater bodies is carried out during the next river basin cycle, for example as additional information is gathered through the catchment assessment process.

3.1.2 Achieving a complete national picture of water status

The review has also identified the importance of grouping of water bodies, also referred to as extrapolation, in providing an accurate picture of water status across Ireland's national river basin district. Extrapolation is particularly useful for the lake and coastal water categories, where you have a large number of unmonitored water bodies that are similar in physical character and experiencing similar anthropogenic pressures to water bodies that are monitored. Status information from monitored water bodies can therefore be used to extrapolate status to unmonitored water bodies. The review has shown that the most accurate and complete picture of national water status can only be obtained by combining the results from extrapolation with those from the operational and surveillance monitoring networks.

The outcome of the extrapolation exercise is validated with supplementary data where this exists. For example, the winter nutrient data collected by the Marine Institute is used to validate the extrapolation of coastal water bodies. The EPA also anticipates that information obtained from remote sensing (e.g. from the Copernicus network of satellites) of important environmental parameters will be used in the future to validate the results of extrapolation. In addition, over the period of the 2019-2021 monitoring programme, the level of confidence in the outcome of the extrapolation exercise will be improved by basing the extrapolation exercise on the same information that is used in the risk characterisation process.

3.2 Links to the characterisation of risk and significant pressures

The characterisation exercise undertaken in preparation for the second-cycle RBMP was far more detailed than previous characterisation exercises. Due to the availability of a far more extensive dataset the characterisation exercise was able to identify the specific pressures impacting on individual water bodies at risk of failing to meet their environmental objectives. In total, 12 individual significant pressures were identified.

Each of these significant pressures has been allocated a separate operational subnetwork. This will facilitate the tracking of improvements in status as a result of measures being taken. This adjustment means that these subnetworks are aligned with the individual significant pressures identified during the characterisation exercise.

This has resulted in the original number of operational subnetworks increasing from 5 to 12. In addition, two further subnetworks have been added: one to assess the effectiveness of measures to protect and restore high and good status water bodies; and one for protected areas at risk. This brings the number of operational subnetworks to 14 (Table 1).

The operational subnetwork to protect and restore high and good status water bodies speaks to one of the main aims of the WFD which is to prevent further deterioration in water quality and the need to apply measures to prevent deterioration in this important group of water bodies.

Table 1: List of operational subnetworks in the revised programme.

Operational subnetwork	
1: Agriculture At risk	8: Discharges At risk
2: Aquaculture At risk	9: Invasive Species At risk
3: Domestic waste water at risk	10: Anthropogenic Pressures At risk
4: Extractive Industry At risk	11: Urban Run-off At risk
5: Forestry At risk	12: Urban Waste Water At risk
6: Historically Polluted Sites At risk	13: Protected Areas At risk
7: Hydromorphology At risk	14: Protect High and Good Status

3.3 Making the programme more dynamic and responsive to environmental change

3.3.1 Measuring change resulting from measures

The review has indicated that the operational network needs to be more dynamic in measuring change that may result from measures. This has been achieved by increasing the frequency of monitoring to allow for more timely assessment of improvements as they occur. For example, in the 2019-2021 monitoring programme the frequency of river monitoring has been increased in a number of Priority Areas for Action (see below). Similarly, monitoring has been increased at sites which are recovering from pollution events, which is currently the case for seriously polluted river sites (i.e. Red Dots) which are monitored on an annual basis until quality improves.

Indeed, if measures have resulted in the environmental objectives of a water body being met then consideration will be given in future iterations of the programme to remove that water body from the operational network or extending the frequency of monitoring from

three to six years. If an operational site is to be dropped, then evidence is needed that the improvements observed have become well established and are not temporary. This could be verified by re-sampling the site the following year or in the following three-year cycle. If the improvements are confirmed and the water body is not at risk, then the water body could be removed from the operational network or the frequency of monitoring could be reduced.

3.3.2 Responding to environmental change

The results of the monitoring programme have indicated that significant changes in the quality of Ireland's environment have occurred in recent years. Some of these changes have been positive, for example in rivers, there has been a substantial reduction in the number of bad ecological status water bodies. Unfortunately, some of these changes have been negative, such as the very worrying ten-fold decline in the number of highest quality river sites (a subset of high status sites), down from over 500 sites in the late 1980s to only 20 presently (EPA, 2019). In response, a national Blue Dot Catchments programme has been established to support the protection and restoration of high status sites across all surface water categories. In total, 319 high status objective river water bodies, 37 lakes, 12 transitional waters and 16 coastal waters have been identified.

To support the protection and restoration of high status objective river water bodies the frequency of monitoring for macroinvertebrates has been increased in the 2019-2021 monitoring programme to every year or every other year for those high status objective sites that are at risk of deterioration or for previous high status sites that have already deteriorated. In addition, the remaining highest quality river sites (Q5 sites) are now being monitored on an annual basis. Once high status sites are considered no longer at risk or for those sites that have improved in status, and are no longer at risk, the frequency of monitoring can be returned to normal levels following review. This additional monitoring effort will support the national Blue Dot Catchment programme and the Priority Areas for Action.

Significant acute ecological impacts on river biology have also been detected by the programme. In recent years, the occurrence of suspected toxic events has been steadily increasing most notably in the north-west region of the country. This has been noted mainly in the significant decline in macroinvertebrate species diversity and abundances at these sites. It is suspected that the impacts observed are due to chemical pollution. Nationally, 63 sites have suspected toxic-like impacts between the period 2013-2016 and most of these (51) are in the north-west of the country. In the 2019-2021 monitoring programme the frequency of monitoring at a subset of these locations has been increased from the current once every three years to twice every year. Sampling will be undertaken in spring and summer to assess if the toxic impacts are displaying any seasonal pattern. Additional monitoring of priority substances has also been put in place at a number of these sites with the aim of better characterising the nature of the chemical impact.

This increased level of monitoring will help characterise the nature of the biological impacts and their recovery. This work will also closely align with the Catchment Assessment work as several Priority Areas for Action are in this region.

3.3.3 Climate change and water status assessment

The need to understand the impact of climate change on the functioning of aquatic systems and on the interpretation of water status has increased since the monitoring programme was first put in place in 2006. Predictions of more extreme weather events, increasing water flows and temperature fluctuations have the potential to impact on aquatic ecosystems through

changes to species diversity, composition and function. In turn these changes may alter reference conditions which may need to be readjusted to ensure status assessments reflect the impact of local pressures which can be managed locally rather than broader climate change effects.

A representative number of river sites in the long-term trends surveillance subnetwork will be selected over the period of this monitoring programme. These sites will be used to investigate the effects of changing climate on river macroinvertebrate communities. The sites to be selected by the EPA in consultation with relevant agencies will be those where the level of local anthropogenic pressure is low so changes brought about by climate change can be more easily detected. Sites will also be selected based on the availability of long-term data sets. The methodology to detect climate change impacts on benthic invertebrate communities will also need to be developed. This is likely to include the analysis of macroinvertebrate species which are considered most sensitive to the changes being brought about by climate change.

3.3.4 Acid sensitive area monitoring of rivers

The review has identified the need to establish a defined acid-sensitive monitoring network for rivers which is specifically designed to assess the potential impact of acidification pressures on river water bodies. A total of 49 sites have been included in the current monitoring programme 2019-2021. The sites in the acid network are located in low alkalinity areas where acidification is suspected of impacting on biological quality and includes river sites considered at risk from forestry operations and those at risk or suspected of episodically low pH (<5.5). Sites have also been selected to ensure representation of the acidification gradient to complement, where possible, the existing lakes acid-sensitive network. The biological assessment being used to assess the impact of acidification on river water bodies is the Acid Water Indicator Community (AWIC) index which requires surveys to be undertaken annually in spring (March-May) and a higher level of taxonomic identification of macroinvertebrates. Additional chemical parameters are also being measured at these sites (i.e. dissolved organic carbon, pH, alkalinity, aluminium).

3.4 Links to Catchment Assessments and Priority Areas for Action

One of the main developments in the implementation of the WFD in Ireland has been the establishment of the Local Authority Waters Programme (LAWPRO). The programme is a shared service working with Local Authorities and state agencies on key aspects of river basin management plan implementation. One of LAWPRO's key tasks is to undertake local catchment assessments to identify water quality issues and the pressures causing them and also to promote the implementation of measures. Catchment assessments are to be undertaken in the Priority Areas for Action which have been prioritised for special attention in Ireland's second-cycle RBMP. These areas are comprised of 726 water bodies.

As part of the catchment assessments, investigative monitoring is being undertaken to determine the pressure causing a water body to be characterised at risk of failing to meet its environmental objective and to assess the condition of water bodies in review to determine if they are at risk or not at risk. The outcome of the catchment assessments undertaken between 2018 and 2021 has been and will be the identification of measures in at risk water bodies to mitigate current impacts and a reduction in the number of review water bodies. The EPA will work with the shared service and local authorities to capture this information. Water bodies which are no longer in review and have been re-characterised as being at risk will be considered for inclusion in the national monitoring programme from 2022.

As can be seen from Table 2 there is significant overlap between the Priority Areas for Action and the national monitoring programme for 2019-2021 – 570 water bodies out of the 726 water bodies in Priority Areas for Action are being monitored. Additional water bodies have been added to the programme to improve the coverage of Priority Areas for Action. For example, Bannow Bay, which was selected as a Priority Area for Action has been added to the 2019-2021 monitoring programme. In addition, the frequency of monitoring at selected river sites in Priority Areas for Action has been increased to annual monitoring to provide more timely information to assess the effectiveness of measures. As actions are implemented it should be possible to detect change in ecological status in response to these actions. This direct link between management actions on the ground and the operational monitoring network should provide clearer evidence of the effectiveness of measures. This important link was missing during the first river basin management cycle.

In terms of timing, the date by which the environmental objectives for each of the water bodies in the Priority Areas for Action has been set. A total of 152 water bodies have been given a date of 2021, 568 a date of 2027, and the remaining 26 water bodies a date beyond 2027. This information has been used to ensure that river sites which are expected to show improvements by 2021 are re-sampled in time during the 2019-2021 programme to confirm if a water body has achieved its environmental objective.

Table 2: Number of monitored water bodies in each water category in a Priority Area for Action.

	Water bodies	Priority Areas for Action
Rivers	504	176
Lakes	45	34
Transitional	12	11
Coastal	9	7
Total	570	228

*Different water categories can occur in the same Priority Areas for Action which explains why the total is greater than 190.

3.5 Monitoring the right biological quality element in the right place

The 15 biological assessment methods used in the programme to assess ecological status will continue to be used in the 2019-2021 programme (Table 3). In addition, three new biological assessment methods will be added to the programme. These include two methods to assess the impact of acidification on river and lake macroinvertebrates (Acid Water Indicator Community Score and the Lake Acidification Macroinvertebrate Metric) and a method to assess the condition of river macrophytes (either Mean Trophic Rank or LEAFPACS depending on suitability).

The knowledge gained in applying biological assessment methods has been used to ensure that the right biological element is being monitored in the right place. This is particularly important in the operational programme which focuses on the biological element most sensitive to the pressure impacting on status. In rivers, for example, the most frequently used biological quality element in the operational programme are macroinvertebrates which are sensitive to organic and nutrient enrichment.

In the surveillance network all biological quality elements in each surveillance water body are monitored where possible. However, this has not always been feasible, or appropriate, due either to the natural absence of that element from a water body or the suitability of that element to detect environmental change. For example, in coastal waters, benthic invertebrates could not be sampled due to the absence of soft sediments, while phytoplankton in rivers often fail to respond to nutrient enrichment due to the short residence times of Irish rivers. Furthermore, the assessment of the fish biological quality element in rivers has also proved challenging due to the mobile and wide distribution of many different fish species. Sampling at discrete sites for this element does not always provide sufficient information to assess the condition of this element more broadly within a catchment or sub-catchment. To address this, Inland Fisheries Ireland and the EPA are working together to select a representative series of index catchments that will deliver the monitoring requirements of the WFD and other related monitoring and assessment needs as they arise. These index catchments will be put in place in time for the next 3-year monitoring cycle which will run from 2022-2024.

As a general point, it has become clear that the response of a biological element may not necessarily be due to impaired water quality or altered hydromorphology but to other factors which fall outside the specific environmental objectives of the Water Framework Directive. For example, it is becoming clearer that the status of some fish communities is being influenced by other factors such as food web interactions rather than local pressures impacting on water quality or hydromorphology. In such cases, the overall ecological status of the water body may need to be adjusted to ensure the status assessment reflects the impact of local pressures that can be managed rather than broader ecosystem effects which may be outside the remit of the WFD.

Table 3: Biological assessment methods used to assess ecological status in each water category in the national WFD programme 2019-2021 (Italics indicate new method or method under development).

Biological quality elements (BQE)	Water Category			
	Rivers	Lakes	Transitional	Coastal
Macroinvertebrates	Quality Rating System (Q-value) <i>AWICS (Acidification)</i>	LAMM (acidification)	Infaunal Quality Index (IQI)	Infaunal Quality Index (IQI)
Aquatic Plants	<i>Mean Trophic Rank (MTR)</i> <i>LEAFPACS</i>	Free Macrophyte Index	Intertidal Seagrass tool Saltmarsh Angiosperm Assessment Tool for Ireland (SMAATIE)	Intertidal Seagrass tool Saltmarsh Angiosperm Assessment Tool for Ireland (SMAATIE)

Biological quality elements (BQE)	Water Category			
	Rivers	Lakes	Transitional	Coastal
Macroalgae	<i>Mean Trophic Rank (MTR)</i> <i>LEAFPACS</i>	Not applicable	Opportunistic Green Macroalgal Abundance (OGA Tool)	Opportunistic Green Macroalgal Abundance (OGA Tool) RSL - Rocky Shore reduced species List
Phytoplankton	Not applicable	Lake Phytoplankton Index Phytoplankton biomass (chlorophyll)	Phytoplankton biomass (chlorophyll) Phytoplankton composition	Phytoplankton biomass (chlorophyll) Phytoplankton composition
Phytobenthos	Trophic diatom Index (TDI)	Lake Trophic Diatom Index	Not applicable	Not applicable
Fish	Fish Classification Scheme 2 Ireland (FCS2)	Fish in lakes 2 (FIL2)	Transitional Fish Classification Index (TFCI) Estuarine Multi-metric Fish Index (EMFI)	Not applicable

3.6 Monitoring of chemical and general physico-chemical elements

3.6.1 Priority substances Monitoring

Monitoring of priority substances and priority hazardous substances in the surveillance network is undertaken on a 6-year cycle. Of the 45 substances listed in Directive 2013/39/EC (amending Directive 2008/105/EC), 23 substances are being monitored in rivers and lakes and 36 substances are being monitored in transitional and coastal waters. The substances to be monitored and the matrix (i.e. water, sediment or biota) is shown in Table 4. The substances were selected based on scoping studies and risk assessments.

Eight substances are required to be monitored and analysed in fish. Three of these substances (hexachlorobenzene (HCB), hexachlorobutadiene (HCBD), mercury) have been monitored in fish since 2012 and the monitoring of the remaining five substances commenced in 2019. Two further substances, benzo(a)pyrene and fluoranthene, are required to be monitored in molluscs and crustaceans, respectively. This aspect of the programme has not yet commenced.

The EU has also established a Watch List of emerging pollutants and other substances where additional information is required to assess the risk posed by these substances to the environment. The first watch list established in 2015 contained ten substances or groups of substances (in total comprising of 17 individual substances). In Ireland, monitoring of substances on the watch list commenced in 2016 and the information gathered on these

substances is reviewed every two years. Periodic reviews of the list by EU member states will ensure that substances are not monitored longer than necessary, and that those proved to be of significant risk are identified as quickly as possible.

Table 4: Priority substances and priority hazardous substances (italicised) listed in the Priority Substances Directive (2013/39/EC) together with an indication of the substances and matrices being monitored in the national WFD monitoring programme.

No.	Name of substance	Inland surface waters	TraC surface waters
1	Alachlor	No	No
2	<i>Anthracene</i>	Yes (water)	Yes (water & biota)
3	Atrazine	Yes (water)	Yes (water)
4	Benzene	No	Yes (water)
5	Brominated diphenylethers	Yes (biota)	Yes (sediment & biota)
6	<i>Cadmium and its compounds</i>	Yes (water)	Yes (water, sediment & biota)
7	<i>Chloroalkanes, C10-13</i>	No	No
8	Chlorfenvinphos	No	No
9	Chlorpyrifos (Chlorpyrifos-ethyl)	No	No
10	1,2-dichloroethane	No	Yes (water)
11	Dichloromethane	No	Yes (water)
12	<i>Di(2-ethylhexyl)phthalate (DEHP)</i>	No	Yes (water)
13	Diuron	Yes (water)	Yes (water)
14	<i>Endosulfan</i>	No	Yes (biota)
15	Fluoranthene	Yes (water & biota)	Yes (water, sediment & biota)
16	<i>Hexachlorobenzene</i>	Yes (biota)	Yes (sediment)
17	<i>Hexachlorobutadiene</i>	Yes (biota)	Yes (biota)
18	<i>Hexachlorocyclohexane</i>	No	Yes (sediment & biota)
19	Isoproturon	Yes (water)	Yes (water)
20	Lead and its compounds	Yes (water)	Yes (water, sediment & biota)
21	<i>Mercury and its compounds</i>	Yes (water & biota)	Yes (water, sediment & biota)
22	Naphthalene	No	Yes (water, sediment)
23	Nickel and its compounds	Yes (water)	Yes (water, sediment & biota)

No.	Name of substance	Inland surface waters	TraC surface waters
24	<i>Nonylphenols</i>	No	Yes (water)
25	Octylphenols (6)	No	Yes (water)
26	<i>Pentachlorobenzene</i>	No	No
27	Pentachlorophenol	No	No
28	Polyaromatic hydrocarbons (PAH)	Yes (water & biota)	Yes (water, sediment & biota)
29	Simazine	Yes (water)	Yes (water)
30	<i>Tributyltin compounds</i>	No	Yes (water)
31	Trichlorobenzenes	No	Yes (water)
32	Trichloromethane (chloroform)	No	No
33	<i>Trifluralin</i>	No	No
34	<i>Dicofol</i>	Yes (water)	Yes (water)
35	<i>Perfluorooctane sulfonic acid and its derivatives (PFOS)</i>	Yes (water & biota)	Yes (water & biota)
36	<i>Quinoxifen</i>	No	Yes (water)
37	<i>Dioxins and dioxin-like compounds</i>	Yes (biota)	No
38	Aclonifen	No	Yes (water)
39	Bifenox	Yes (water)	Yes (water)
40	Cybutryne	Yes (water)	Yes (water)
41	Cypermethrin (10)	Yes (water)	Yes (water)
42	Dichlorvos	No	Yes (water)
43	<i>Hexabromocyclododecanes (HBCDD)</i>	Yes (water & biota)	Yes (water)
44	<i>Heptachlor and heptachlor epoxide</i>	Yes (biota)	Yes (biota)
45	Terbutryn	Yes (water)	Yes (water)

3.6.2 Physico-chemical monitoring

Physico-chemical elements such as nutrients, dissolved oxygen, salinity, pH, etc. are measured to provide an indication of how these elements support the achievement of good or better ecological status. The primary focus of this review has been on the rivers physico-chemical network with the aim to increase the level of integration between this network and the biology network. In the period 2016-2018, 2,834 sites were monitored for biology and 1,460 sites were monitored for physico-chemistry. However, only 70% of the physico-chemistry sites (1,065) were also monitored for biology.

Several factors were considered in reviewing the suitability of the rivers physico-chemical network such as its ability to represent different typologies, risk, status, stream order and spatial density (sites per 100 km²). The usefulness of long-term monitoring stations for trend analysis and reporting (WISE reporting, Nitrates Directive) was also considered. In reviewing

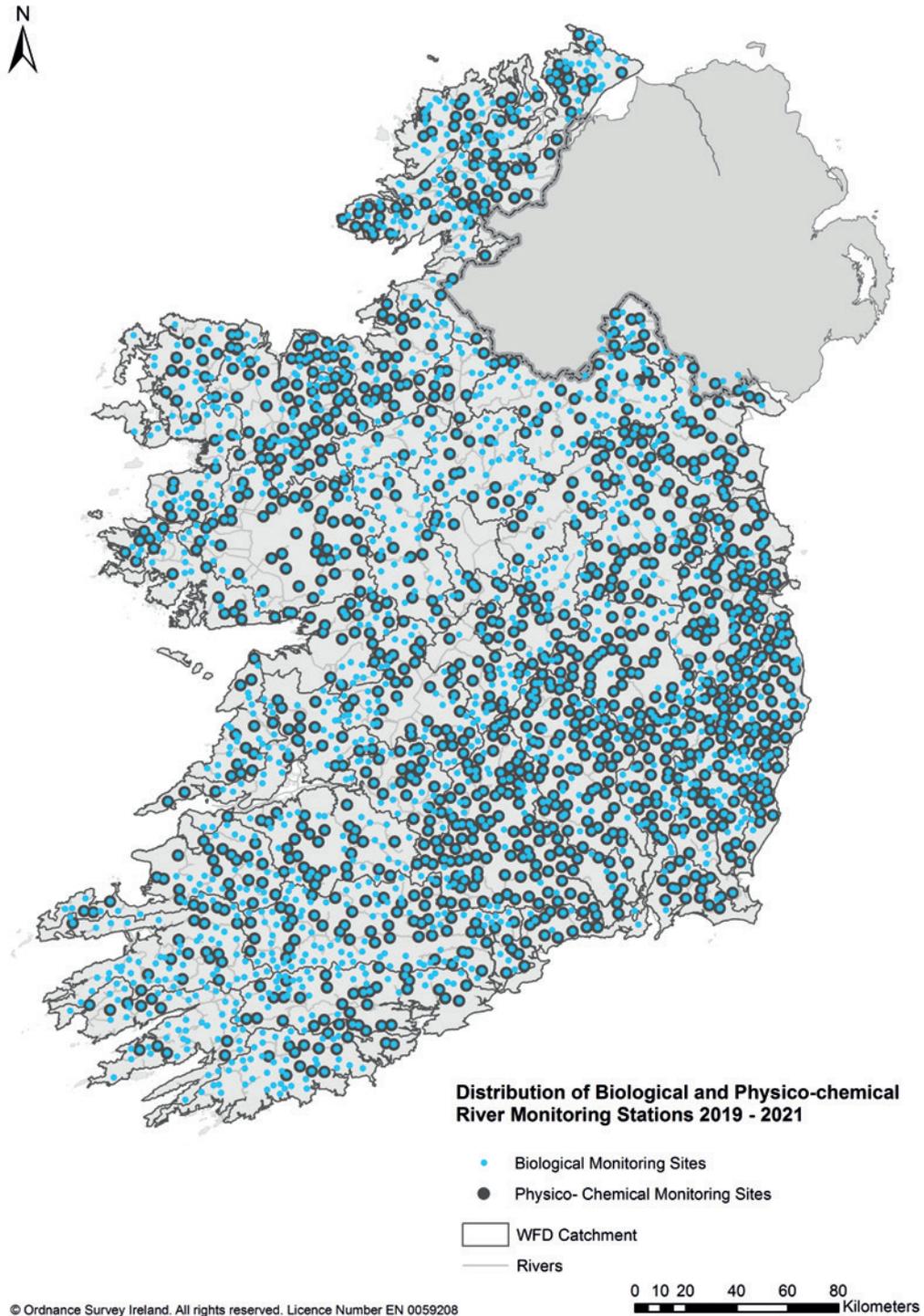
the network, there was also a goal to optimise the programme for the assessment of ecological status by increasing the number of sites where both biology and physico-chemistry is monitored.

The outcome of the review is shown in Table 5. The total number of physico-chemical sites with both biology and chemistry has increased to 84% (1,266 out of 1,500 sites), an increase of just over 10% from the previous programme. The number of sites being monitored for physico-chemistry has also increased from 1,460 to 1500 sites for the period 2019-2021. The spatial overlap between biology sites and physico-chemistry sites is shown in Map 1.

On a catchment basis, the greatest increase in physico-chemical sites is in the northwest region with an additional 56 sites. This region has the largest number of river water bodies at less than 'good' status and the highest number of river water bodies at risk but one of the lowest site densities. As such, the previous network in this region was not deemed sufficient to inform the characterisation process and to track the effectiveness of measures. These additional sites will also double the number of sites that overlap with the biology programme (49 to 102 sites). This brings the density of physico-chemical sites in the northwest region up to 2.2 sites per 100 km² which is more in line with the national average of 2.3 sites per 100 km².

Table 5: Number of river sites monitored for biology and physico-chemical elements (and overlap) in the 2019-2021 programme.

Sites	Programme 2019-2021	Programme 2016-2018	Change between Programmes
Monitored	3,130	3,156	-26
Biology	2,896	2,834	62
Physico-chemical	1,500	1,460	40
Biology & physico-chemical	1,266	1,065	201



Map 1: Distribution of biological and physico-chemical river monitoring stations 2019-2021

The review has also provided an opportunity to clarify with the monitoring authorities the situation in relation to the monitoring being undertaken for the Freshwater Fish Directive (FFD) which was revoked in 2013 by the Water Framework Directive. Notwithstanding this, there remains an obligation to ensure the protected areas designated by the Freshwater Fish Directive receive the same level of environmental protection under the WFD that they received under the FFD. The protected areas for salmonid species are comprised of 34 salmonid rivers, tributaries and lakes listed in the Salmonid Regulations (SI No. 293 of 1988). In principle, achieving the WFD objectives of 'good' ecological status and 'no deterioration' will offer the same level of environmental protection as the replaced Directive.

All 128 salmonid sites previously monitored for the FFD are monitored as either operational or surveillance sites in the national WFD monitoring programme. Twenty-seven of the sites are surveillance and 101 are operational. For salmonid sites that are either surveillance or OSPAR sites, the sampling frequency will remain at 12-times per year as is required by OSPAR guidance for these sites. For other salmonid sites, which are operational sites, the frequency of sampling has been reduced to 5-times per year in the 2019-2021 monitoring programme to bring it in line with the sampling frequency used for this type of site. An analysis of the data undertaken by the EPA indicates that reducing the frequency at operational sites is likely to have little effect on the overall level of compliance detected. Analysis of historic data (nitrite was chosen as it was deemed to be representative of other parameters) showed that reducing sampling frequency from 10-12 times per year to 4-6 times per year provides an equivalent level of assurance that a standard is being met. This indicates that the reduced level of sampling should provide comparable levels of environmental protection.

Apart from the parameters copper, zinc and suspended solids the remaining parameters specified in the national regulation implementing the FFD are included in the national WFD monitoring programme. Copper and zinc will continue to be monitored as part of the metals analysis carried out at priority sites at surveillance stations (one year in six). For suspended solids, given the low level of exceedance, sampling of this parameter will be restricted to surveillance sites and to sites where this standard has been previously exceeded. In addition, suspended solids will continue to be monitored at OSPAR riverine input sites as this is a required parameter of the OSPAR programme. The EPA anticipates that electronic measurement of turbidity, validated against field measurements, will be more widely used in the programme in the future.

In conclusion, the extent, frequency and nature of monitoring to be carried out in the new programme offers the same level of environmental protection as the previous Directive, in terms of assessing the environmental status of these waters and identifying any required actions needed to either protect or restore status.

3.7 Hydromorphology

In rivers and lakes, hydromorphological status of all surveillance and high status sites will continue to be assessed using the River Hydromorphological Assessment Technique (RHAT) and the lake Morphological Impact Assessment System (MImAS), respectively. RHAT will also continue to be used at sites where hydromorphological pressures are suspected of impacting on ecology. In transitional and coastal waters, the new Hydromorphological Quality Index (Keogh et al., 2020) will be used to assess the hydromorphological condition of all surveillance water bodies and operational water bodies identified as being at risk from hydromorphological pressures.

The results of these assessments are used, amongst other things, to assess if the hydromorphology supports high biological status. Only sites that are at high status based on other ecological quality elements may be downgraded to good status based on the hydromorphological assessment failing to reach high status. As the rules of the Directive currently stand, this is the only scenario where hydromorphology can be used in classification. The role of hydromorphological assessment in water body classification is currently a topic of discussion at the European level. Ecostat, the European working group which discusses issues to do with classification is currently reviewing the broader application of hydromorphology in water body classification.

4. THE NATIONAL WFD MONITORING PROGRAMME 2019-2021

The content of the national WFD monitoring programme for the period 2019-2021 is presented in the following sections. The general changes to the programme together with the specific changes for individual water categories following the review is summarised in Topic Box 2. The following sections provide further detail on the number of water bodies in each water category, monitoring network and associated subnetwork. The specific details in terms of lists of water bodies to be monitored in each water category, the quality elements to be monitored and their frequency is provided on the WFD Application which is accessible through the Environmental Data Exchange Network (www.edenireland.ie). The location of surface water and groundwater monitoring locations is shown in Map 2 and Map 3, respectively. The location of individual monitoring stations associated with the surface and groundwater networks can also be viewed electronically on EPA Maps (<https://gis.epa.ie/EPAMaps/>).

The national WFD monitoring programme for Ireland for the period 2019-2021 is comprised of 3,169 surface and groundwater bodies (Table 6). This represents 66% of the total number of water bodies nationally (4,829). This includes 2,422 river water bodies, 225 lakes, 84 transitional water bodies, 47 coastal waters and 392 groundwater bodies. In addition, there are 159 sites used to assess groundwater quantitative status.

Table 6: Number of water bodies in each monitoring network by water category in the national WFD monitoring programme 2019-2021.

Type of Monitoring	Rivers	Lakes	Transitional	Coastal	Groundwater
Surveillance	179	75	23	9	259
Operational	2243	149	61	38	133
Quantity					(159)
Water Category Total	2422	224	84	47	392
Surface Water Total	2777				
Groundwater Total	392				
Overall Total	3169				

General and water category specific changes following the review are:

General changes

- ▲ Increase in the number of operational subnetworks from 5 to 14 for surface waters to better align with the significant pressures identified in the RBMP characterisation process.
- ▲ Increase in the frequency of monitoring at priority sites (i.e. high status water bodies, polluted sites, sites in Areas for Action) to detect change that may result from pressures or the implementation of measures.
- ▲ Stronger links between the monitoring programme and Priority Areas for Action through the addition of new water bodies and increase in monitoring frequency.

Specific changes

Rivers

- ▲ Increased alignment between the rivers physico-chemical and biological monitoring networks to achieve a more spatially integrated assessment of ecological status.
- ▲ Increased frequency of monitoring of high status sites at risk of not meeting their environmental objectives and those which have already deteriorated including annual monitoring at the remaining highest quality sites (Q5).
- ▲ Increased frequency of monitoring at sites suspected of being impacted by toxic events including annual monitoring until improvement in status is detected.
- ▲ Establishment of an acid sensitive area network to assess the impact of acidification.
- ▲ Establishment of a WFD specific climate change network to understand the effects of climate change on macroinvertebrate communities, reference condition and assessment.

Lakes

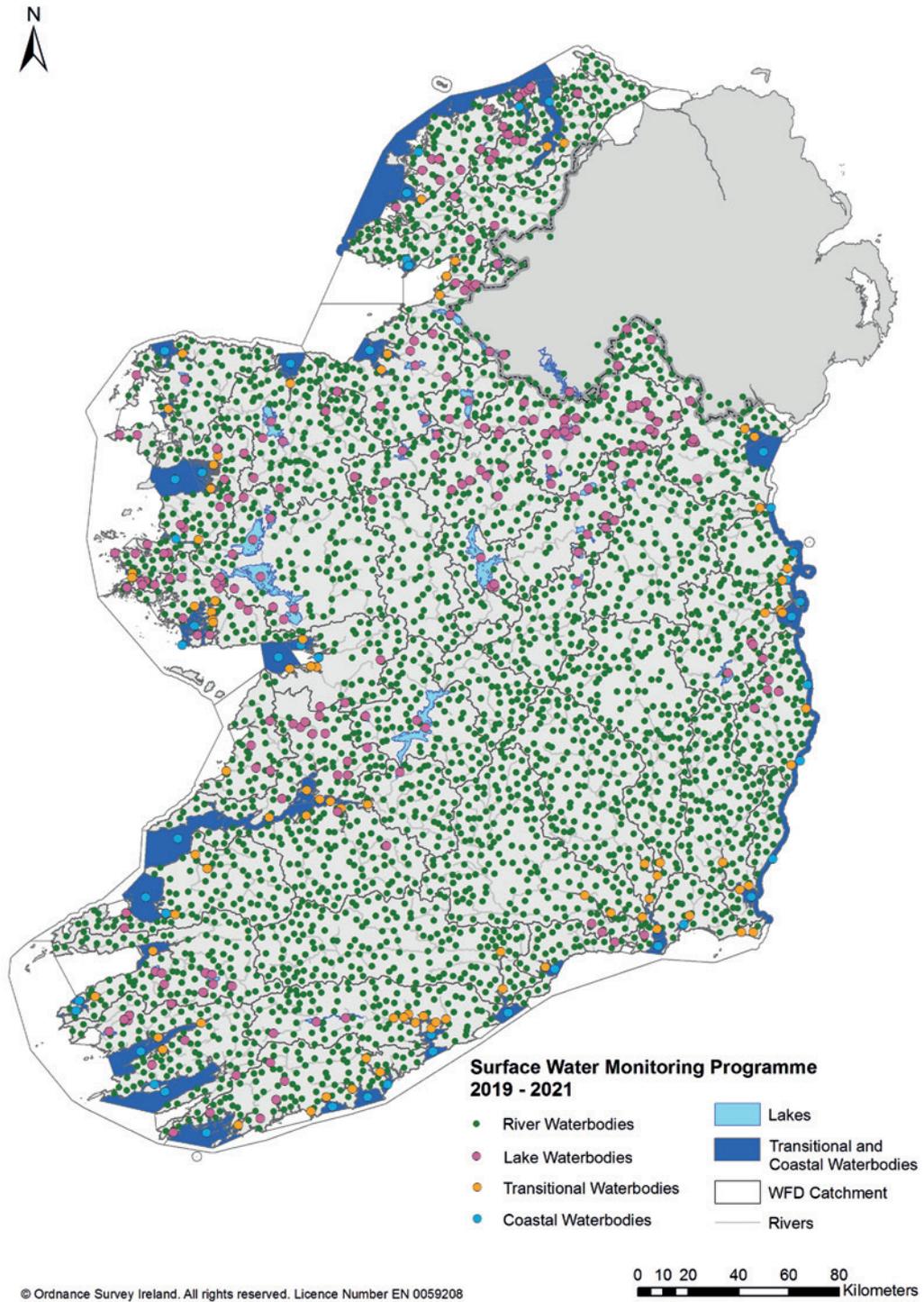
- ▲ The review found that the lakes monitoring programme was sufficiently robust to provide an overall national picture of lake water status.
- ▲ At the catchment-scale the review indicated the lakes programme could be more representative of certain typologies and pressures. A series of projects will be undertaken to inform a full review of the programme in time for the next river basin cycle.
- ▲ Reduced monitoring frequency of fish in lakes with slow response times.

Transitional and coastal

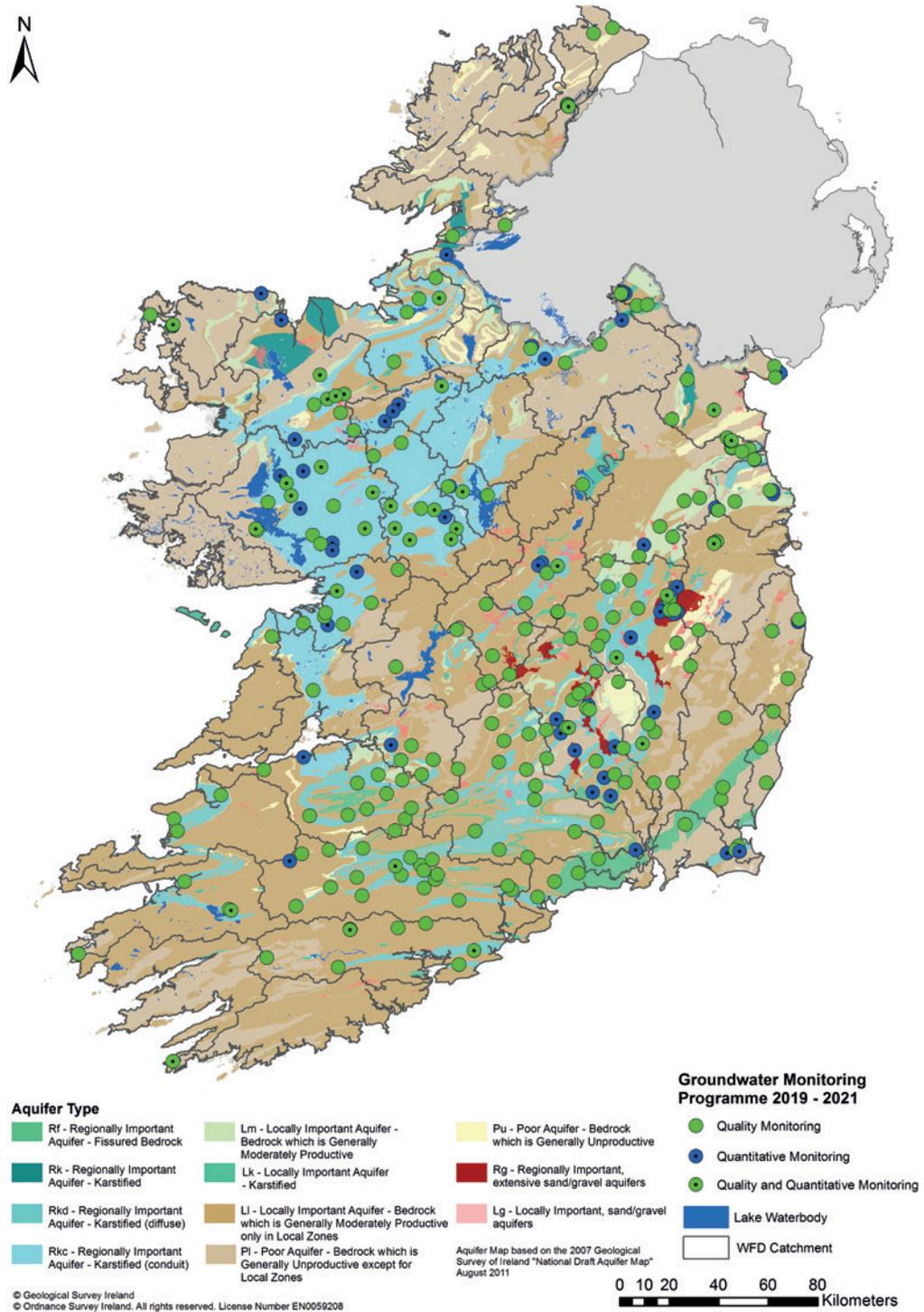
- ▲ The transitional and coastal waters monitoring programme was found to be generally fit for purpose.
- ▲ A number of water bodies now identified as Priority Areas for Action, but previously unmonitored, have been added to the programme (e.g. Bannow Bay).
- ▲ The boundaries of six water bodies have been adjusted to better reflect their status and the environmental drivers of that status.

Groundwater

- ▲ The groundwater monitoring programme was found to be generally fit for purpose.
- ▲ Increase in the number of water bodies being monitored in the operational network. A slight decrease in the surveillance network



Map 2: Distribution of the surface water monitoring programme 2019-2021



Map 3: Distribution of the groundwater monitoring programme 2019-2021

4.1 Surveillance and operational networks and subnetworks

The distribution of water bodies in the national surface water surveillance and operational networks is shown in Map 4 and Map 5. Each network has been further divided into subnetworks designed to meet the specific monitoring requirements of the Directive. The surveillance network was divided into four subnetworks common to all surface water categories as was the case in the previous programme (Table 7). The operational network was divided into 14 subnetworks; 12 of these are related to significant pressures identified in the characterisation process, one is designed to assess the effectiveness of measures to protect and restore high and good status water bodies and one for protected areas at risk.

Table 7: Number of water bodies in each surveillance subnetwork common to all surface water categories in the national WFD monitoring programme 2019-2021.

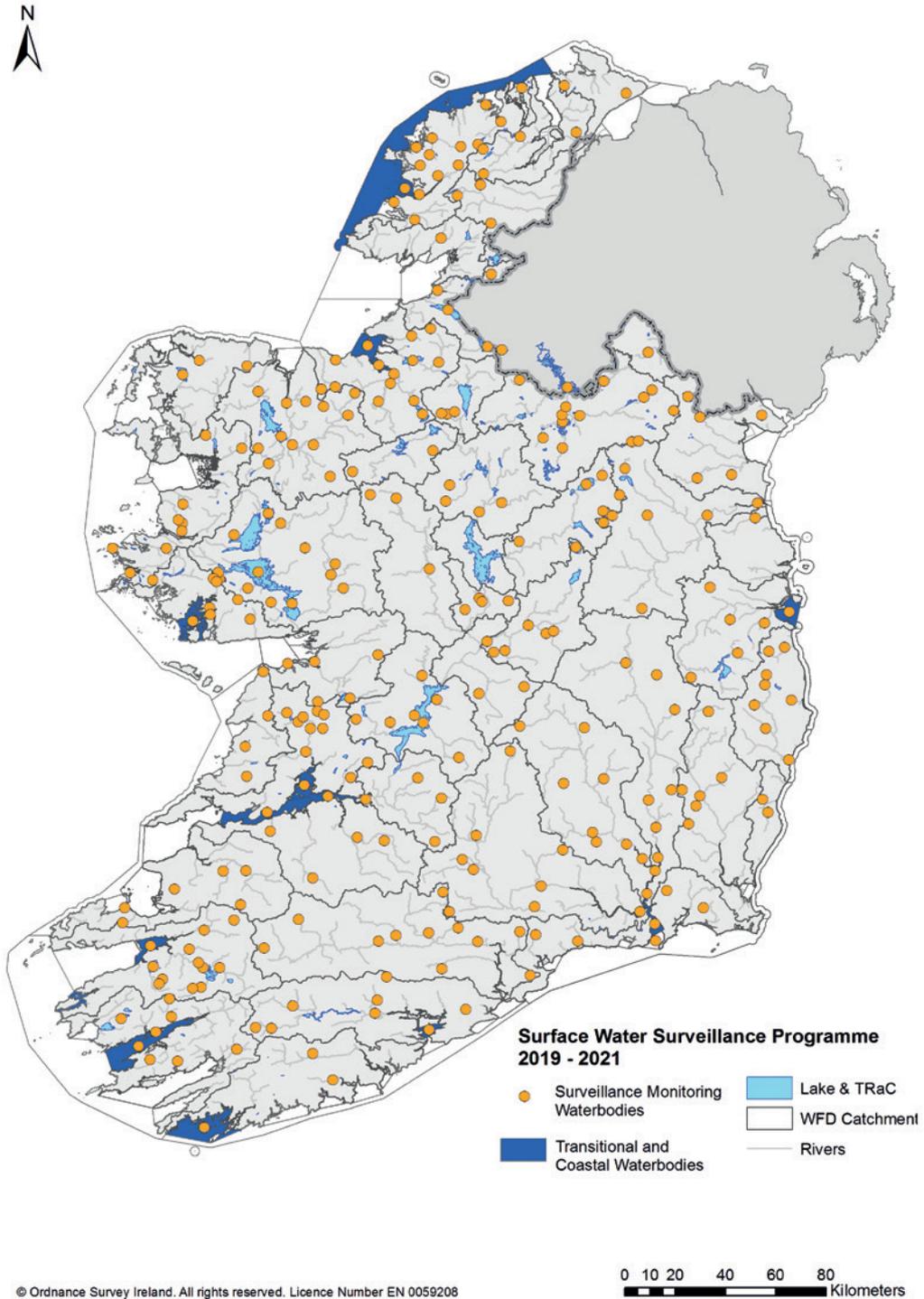
Surveillance Sub network	Rivers	Lakes	Transitional	Coastal
SM1: Representative of overall status	179	75	23	9
SM2: Long-term trends	179	75	9	4
SM3: Validating the risk assessment	23	75	3	0
SM4: Stipulated sites	25	56	7	0

The number of water bodies in each of the operational subnetworks (Table 8) reflects the importance of that pressure with the highest number of water bodies in the agriculture, hydromorphology and urban waste water subnetworks. The forestry operational subnet is important for the rivers and lakes water categories but of less importance for the transitional and coastal water categories, while the discharge from industry is of greatest importance to the river water category. It is important to point out that an individual water body can be included in more than one subnet if that water body is being impacted by more than one significant pressure.

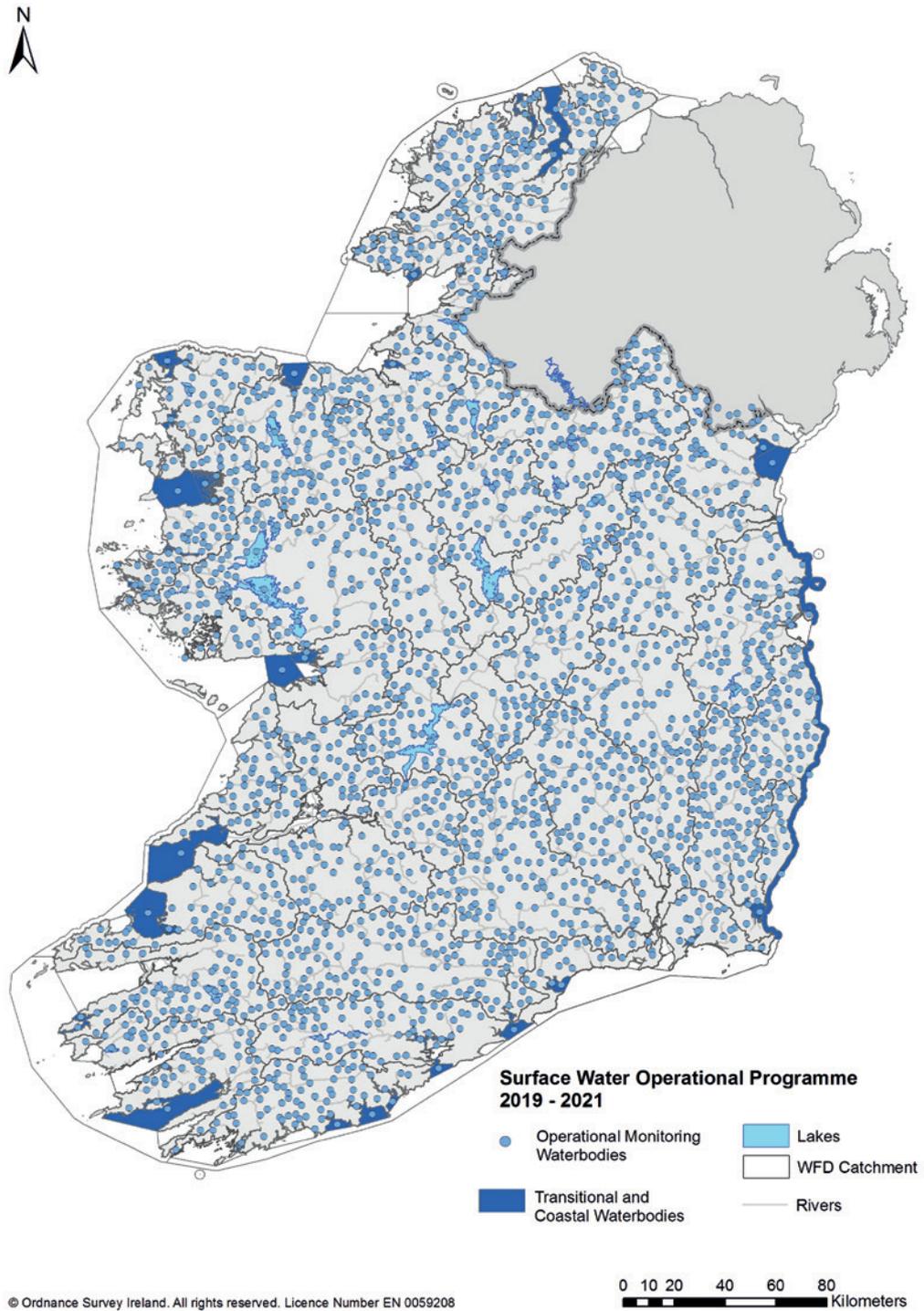
Table 8: Number of water bodies in each operational subnetwork by surface water category in the national WFD monitoring programme 2019-2021.

Operational Sub network	Rivers	Lakes	Transitional	Coastal
OM 2: Aquaculture	5	0	3	3
OM 1: Agriculture	603	75	39	8
OM 3: Domestic Waste Water	131	14	6	0
OM 4: Extractive Industry	153	5	0	0
OM 5: Forestry	215	17	0	0
OM 6: Historically Polluted Sites	5	0	0	0
OM 7: Hydromorphology	329	16	0	3
OM 8: Discharges	86	3	0	1
OM 9: Invasive Species	7	34	0	0
OM 10: Anthropogenic Pressures Other	68	6	2	2
OM 11: Diffuse Run-off	116	2	2	0

Operational Sub network	Rivers	Lakes	Transitional	Coastal
OM 12: Urban Waste Water	244	14	24	12
OM 13: Species and habitats at risk	445	44	12	2
OM 14: Protect & Restore High and good status water bodies	842	80	10	21



Map 4: Distribution of the surface water surveillance monitoring network 2019-2021.



Map 5: Distribution of the surface water operational monitoring network 2019-2021.

4.2 Frequency and parameters of monitoring

4.2.1 Surface waters

In terms of monitoring frequency all surface water quality elements (biological, physico-chemical, hydromorphological, specific pollutants and priority substances) are being monitored at the minimum frequency recommended in Annex V of the Directive (Table 9). In some cases, the frequency is higher, to take into account greater natural variation associated with some quality elements (e.g. phytoplankton in coastal waters). The frequency of biological monitoring has also been increased at certain priority sites (e.g. high status, suspected toxic events, priority areas for action and acid-sensitive).

General physio-chemical quality elements (i.e. nutrients, dissolved oxygen) are monitored at least four-times per annum in each water category. In rivers, the frequency is higher at five-times per annum in the operational programme and 12-times per annum in the surveillance programme. In the lakes surveillance programme, general physio-chemical parameters are monitored 12-times per annum every three years and a minimum of four-times per annum in the intervening years. In addition, for lakes, that are used for the abstraction of water for human consumption the frequency of monitoring is determined by the size of the human population served.

Priority substances and specific pollutants will continue to be monitored monthly during one year of each river basin management plan cycle. Specific pollutants are monitored monthly during one year of the river basin management plan cycle in rivers and lakes and quarterly in transitional and coastal waters.

In some circumstances if the status of a surface water body is stable and unlikely to change due to the absence of any significant pressure the frequency of monitoring has been decreased. For example, in this monitoring period the frequency of fish monitoring has been reduced from once every three years to once every cycle for lakes where status is unlikely to change due to the absence of significant anthropogenic pressures. Similarly, if the status of a water body is less than good and is unlikely to improve due to the absence of mitigation measures, the frequency of monitoring may also be extended beyond what is being recommended.

4.2.2 Groundwaters

Physico-chemical parameters in groundwater are monitored at a frequency of three samples per year, annually, in both the operational and surveillance programmes. Priority substances and relevant pollutants are monitored during one year of the river basin management plan cycle or as dictated by risk. Data collected from all surveillance groundwater sites is used to establish the presence of significant upward, or downward, trends in the concentration of pollutants.

Data loggers have been installed at all quantitative monitoring locations to allow sub-hourly monitoring of changes in groundwater levels. The frequency of water level measurements may change as knowledge of the aquifer response and behaviour improves, or if there are significant changes in pressures on the groundwater body.

Table 9: Frequency of monitoring for each quality element in the national surface waters WFD monitoring programme 2019-2021.

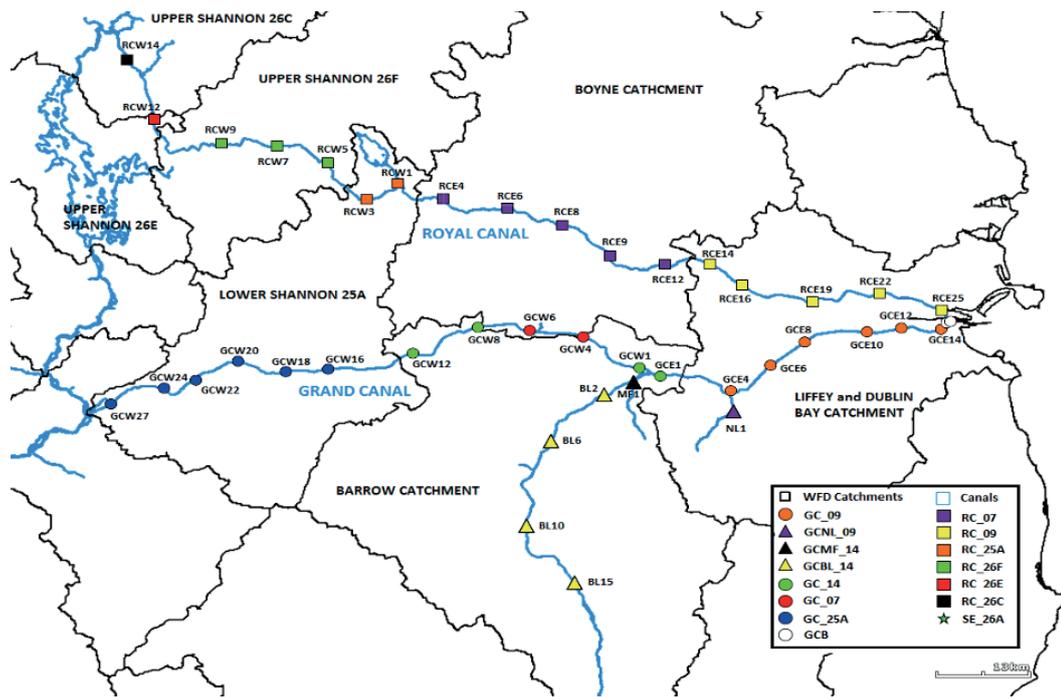
Quality element	Water Category			
	Rivers	Lakes	Transitional	Coastal
Biological				
Macroinvertebrates	Every 3 years (Annual monitoring in priority areas and acid-sensitive areas)	Every 3 years	Every 3 years	Every 3 years
Aquatic Plants	Every 3 years	Every 3 years (SM and acid sensitive lakes)	Every 3 years (seagrass) Every 6 years (saltmarsh)	Every 3 years (seagrass) Every 6 years (saltmarsh)
Macroalgae			Every year (opportunistic algae)	Every year (opportunistic algae) Every 3 years (RSL)
Phytoplankton	Not applicable	Twice per annum for taxonomic composition (SM) As per physico-chemical for chlorophyll a	4 times per annum	12times per annum
Phytobenthos	Once per annum (SM)	Twice per annum every 3 years (SM)	Not applicable	Not applicable
Fish	Every 3 years	Every 3 years	Every 3 years	Not applicable
Hydromorphological Conditions				
	Every 6 years	Every 6 years	Every 6 years	Every 6 years
Physico-chemical				
Nutrient Conditions	5 times per annum (OM) 12 times per annum (SM)	4, 6 or 8 times per annum* (OM) 12 times per annum every three years and as per OM frequency in the other years (SM)	4 times per annum with a minimum of 3 years in 6	4 times per annum with a minimum of 3 years in 6

Quality element	Water Category			
	Rivers	Lakes	Transitional	Coastal
Oxygen conditions	5 times per annum (OM) 12 times per annum (SM)	4, 6 or 8 times per annum* (OM) 12 times per annum every three years and 6 times per annum in the other years (SM)	4 times per annum with a minimum of 3 years in 6	4 times per annum with a minimum of 3 years in 6
Acidification conditions	5 times per annum (OM) 12 times per annum (SM)	4, 6 or 8 times per annum* (OM) 12 times per annum every three years and as per OM frequency in the other years (SM)	Not applicable	Not applicable
Specific pollutants	12 times per annum every 6 years	12 times per annum every 6 years	4 times per annum every 6 years	4 times per annum every 6 years
Priority substances				
	12 times per annum every 6 years	12 times per annum every 6 years	12 times per annum every 6 years	12 times per annum every 6 years

4.3 Canals

The national WFD monitoring programme for canals has been in place since 2006. A review of this programme was undertaken by Waterways Ireland in tandem with the risk characterisation process for canals in 2017. This review concluded that the existing programme for canals was substantially fit for purpose; however, some amendments were required to the delineation of canal water bodies and to the sampling methodology. The current WFD monitoring programme for canals includes 44 monitoring sites in 15 Artificial Water Bodies (Map 6).

A number of water quality elements are assessed under the WFD to classify each canal water body according to its ecological potential. Biological quality elements such as aquatic plants and invertebrates are sampled annually while physico-chemical parameters are sampled four-times per annum.



Map 6: Distribution of the canals monitoring network on the Royal and Grand Canals.

5. DATA MANAGEMENT AND REPORTING

Systems have been put in place to improve the sharing and reporting of environmental data collected by the various organisations involved in the national WFD monitoring programme. These systems form part of an environmental data exchange network known as EDEN which facilitates the timely web-based reporting of WFD monitoring results. Local authorities and other organisations have used EDEN since 2008 to report and share data. This data together with the data generated by the EPA is assessed and quality controlled before being reported to Europe.

The data collected in the national monitoring programme can be viewed and analysed within the WFD Application. The WFD App, for short, provides a single point of access not only to monitoring data but to a database of GIS referenced catchment layers. The Application is accessible through EDEN <https://wfd.edenireland.ie/> and is available to EPA staff and EPA-funded researchers, as well as staff in other public agencies. The information in the App can be used for a wide range of catchment science and management purposes, not just those that are specific to the WFD. The WFD Application is being revised to collect summary information from local catchment assessments being undertaken by the Local Authority Waters Programme. The WFD Application also captures and tracks summary information on measures. Having this information accessible through the WFD App will assist in the assessment of changes in water status resulting from implemented measures.

The specific details in terms of lists of water bodies to be monitored in each water category, the quality elements to be monitored and their frequency is also provided on the WFD Application while the location of national surface and groundwater monitoring stations can be viewed on EPA Maps (<https://gis.epa.ie/EPAMaps/>).

5.1 Quality control and quality assurance

A comprehensive Quality Control/Quality Assurance system has been put in place to ensure that the data generated by the national monitoring programme is reliable and of sufficient accuracy and precision.

Each laboratory facility involved in WFD monitoring has put in place a documented Quality Assurance programme covering sample collection, transportation and analysis. Laboratories are required to develop systems capable of meeting the requirements of the current version of I.S. EN ISO 17025 "General requirements for the competence of testing and calibration laboratories". The Irish National Accreditation Board (INAB) undertakes assessment to this standard.

The technical specifications for chemical analysis and monitoring of water status are followed where methods allow (Directive 2009/90/EC). The minimum performance criteria, in terms of level of uncertainty and limit of quantification, have been established for a large range of chemical substances that are routinely monitored in the national priority substances programme.

5.2 Confidence and precision in classification

In addition to providing confidence in the accuracy and precision of laboratory results, the confidence and precision in the classification of water status into one of the five WFD classes (i.e. high, good, moderate, poor and bad) must also be assessed. Statistical tools now exist to provide information on the level of confidence that can be associated with the status classification for the majority of individual quality elements assessed in each of the water categories. The EPA have produced a document which explains how confidence in assessment was assessed for the purposes of reporting water status nationally and to Europe.

6. INCREASE USE OF TECHNOLOGY

In recent years, a number of new monitoring technologies have been trialled in the national monitoring programme. These include the use of an in situ ultraviolet nitrate sensor in transitional waters, the deployment of in situ monitoring buoys, the use of satellite imagery and the use of passive samplers for the detection of chemical substances. These technologies have shown potential, but further work is required to make these technologies an operational component of the programme. Research has already commenced or has been completed on enhancing the use of satellite imagery (Copernicus) to assess the condition of lakes and nearshore coastal waters and a feasibility study to evaluate the use of drones to sample lakes. The outputs from this research and other research relevant to the national monitoring programme are available on the EPA website at the following address: <https://www.epa.ie/pubs/reports/research/water/>.

The greatest use of technology to date in the programme has been the use of Information Technology to capture data in the field and to make this data available in various formats to relevant stakeholders. Since 2014, work has commenced on allowing all biological data collected for rivers, lakes, transitional and coastal water bodies to be collected electronically using a mobile platform (RESCO) and stored on a CRM database server centrally in the EPA. In the future, these platforms could be further developed to improve the level of connectivity and sharing with databases maintained by other public bodies involved in the national monitoring programme (i.e. Marine Institute, Inland Fisheries Ireland, Waterways Ireland and even the Northern Irish Environment Agency).

7. RESPONSIBILITY OF PUBLIC AUTHORITIES

The programme lists the specified authorities to implement the monitoring programme and there is a statutory obligation on the nominated authorities to undertake the monitoring assigned to them. The principal rationale determining the assignment of a monitoring responsibility to a public authority was the established expertise, competency and capacity of the public authority to perform the task. For the biological, hydromorphological and physicochemical parameters, the assigned Public Authorities have been involved in the assessment of these parameters for several decades.

The EPA is now undertaking all the surveillance and operational freshwater chemical monitoring with local authorities undertaking the sampling for these networks. The Central Fisheries Board and regional fisheries boards have been constituted as a national body - Inland Fisheries Ireland (IFI). The table below sets out the current nominated authorities for each element of the monitoring programme.

Table 10: Nominated authorities for elements of the surveillance and operational monitoring programmes

Element	Rivers	Lakes	Transitional and Coastal	Ground Water	Canals	Data Processing	Reporting
Phytoplankton	-	LA, EPA	EPA, MI	-		EPA	EPA
Macrophytes	EPA	EPA	EPA	-	WI	EPA	EPA
Benthic Algae	EPA	EPA	-	-		EPA	EPA
Macro-invertebrates	EPA	EPA	MI	-	WI	EPA	EPA
Fish	IFI	IFI	IFI	-	IFI	IFI	EPA
Hydro-morphology	EPA, OPW	EPA	EPA, MI	-	EPA, WI	EPA	EPA
Physico-Chemical	LA, EPA	LA, EPA	EPA, MI	EPA	WI	EPA	EPA
Relevant Pollutants	LA, EPA	LA, EPA	MI	EPA		EPA	EPA
Priority Substances	LA, EPA	LA, EPA	MI	EPA		EPA	EPA

(EPA: Environmental Protection Agency; LA: Local Authority; IFI: Inland Fisheries Ireland; OPW: Office of Public Works; WI: Waterways Ireland)

8. COMPARISON TO MONITORING IN OTHER EU MEMBER STATES AND UK

While it can be difficult to directly compare programmes in different countries due to differences in natural characteristics, human population densities, water use and pressures exerted, it is still informative to have a general indication of how Ireland's revised national WFD monitoring programme compares to programmes in other EU member States.

As can be seen from Figure 6 the total number of surface water bodies in Ireland's revised national programme (2,777) is close to the EU 24 (plus UK) average (2,267) and the number of surveillance river and lake water bodies monitored per unit area in Ireland is similar to the EU average (4 in Ireland versus 5.3 in the EU). However, in terms of operational monitoring, Ireland has the second highest density in Europe at 38 sites per 1000 km². This is mostly accounted for by the high density of the rivers network which is only second to that of the United Kingdom.

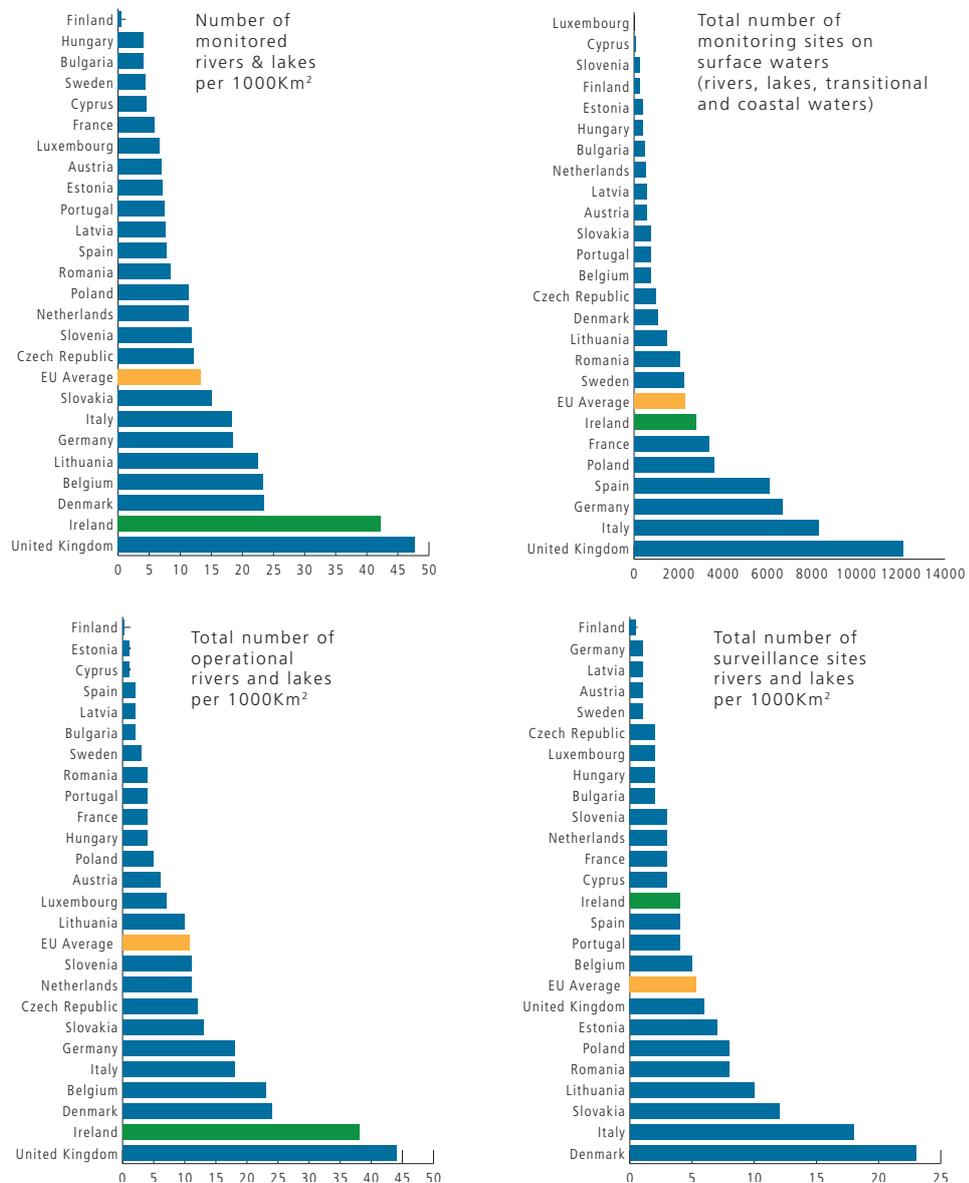


Figure 6: Comparison of Ireland's national monitoring programme for surface waters against the UK and 23 European member states. Data obtained from the EU Commissions first assessment of member states' programmes for monitoring of water status (COM (2009) 156)

9. UPDATING THE PROGRAMME

The national WFD monitoring programme 2019-2021 for surface water and groundwater is available through the WFD Application which is accessible through EDEN <https://wfd.edenireland.ie/> The content of this programme, in terms of individual stations and elements monitored, may be subject to periodic change, but will continue to be in keeping with the overall structure, frequency and extent of the programme as set out following this review. Changes to the programme will be made known to the relevant public bodies and interested parties and these changes will be updated via the WFD App.

The programme will be reviewed in time for the next WFD river basin management cycle which commences in 2022. The review will be primarily informed by the next characterisation exercise which is being undertaken to inform the preparation of Ireland's third-cycle river basin management plan.

10. REFERENCES

EPA (Environmental Protection Agency), 2006. Water Framework Directive Monitoring Programme. EPA, Wexford, Ireland.

EPA (Environmental Protection Agency), 2019. Water Quality in Ireland 2013-2018. EPA, Wexford, Ireland.

Government of Ireland, 2018. National River Basin Management Plan 2018-2021. Available online: <https://www.gov.ie/en/publication/429a79-river-basin-management-plan-2018-2021/?referrer=http://www.housing.gov.ie/water/water-quality/river-basin-management-plans/river-basin-management-plan-2018-2021>

John Keogh, Robert Wilkes, Shane O'Boyle. 2020. A new index for the assessment of hydromorphology in transitional and coastal waters around Ireland. Marine Pollution Bulletin, Volume 151.

AN GHNÍOMHAIREACHT UM CHAOMHNÚ COMHSHAOIL

Tá an GCC freagrach as an gcomhshaol a chosaint agus a fheabhsú, mar shócmhainn luachmhar do mhuintir na hÉireann. Táimid tiomanta do dhaoine agus don chomhshaol a chosaint ar thionchar díobhálach na radaíochta agus an truaillithe.

Is féidir obair na Gníomhaireachta a roinnt ina trí phríomhréimse:

Rialáil: Rialáil agus córais chomhlíonta comhshaoil éifeachtacha a chur i bhfeidhm, chun dea-thorthaí comhshaoil a bhaint amach agus díriú orthu siúd nach mbíonn ag cloí leo.

Eolas: Sonraí, eolas agus measúnú ardchaighdeán, spriocdhírthe agus tráthúil a chur ar fáil i leith an chomhshaoil chun bonn eolais a chur faoin gcinnteoireacht.

Abhcóideacht: Ag obair le daoine eile ar son timpeallachta glaine, táirgiúla agus dea-chosanta agus ar son cleachtas inbhuanaithe i dtaobh an chomhshaoil.

I measc ár gcuid freagrachtaí tá:

Ceadúnú

- Gníomhaíochtaí tionscail, dramhaíola agus stórála peitрил ar scála mór;
- Sceitheadh fuíolluisce uirbhig;
- Úsáid shrianta agus scaoileadh rialaithe Orgánach Géinmhodhnaithe;
- Foinsí radaíochta ianúcháin;
- Astaíochtaí gás ceaptha teasa ó thionscal agus ón eitlíocht trí Scéim an AE um Thrádáil Astaíochtaí.

Forfheidhmiú Náisiúnta i leith Cúrsaí Comhshaoil

- Iniúchadh agus cigireacht ar shaoráidí a bhfuil ceadúnas acu ón GCC;
- Cur i bhfeidhm an dea-chleachtais a stiúradh i ngníomhaíochtaí agus i saoráidí rialáilte;
- Maoirseacht a dhéanamh ar fhreagrachtaí an údaráis áitiúil as cosaint an chomhshaoil;
- Caighdeán an uisce óil phoiblí a rialáil agus údaruithe um sceitheadh fuíolluisce uirbhig a fhorfheidhmiú
- Caighdeán an uisce óil phoiblí agus phríobháidigh a mheasúnú agus tuairiscíú air;
- Comhordú a dhéanamh ar líonra d'eagraíochtaí seirbhíse poiblí chun tacú le gníomhú i gcoinne coireachta comhshaoil;
- An dlí a chur orthu siúd a bhriseann dlí an chomhshaoil agus a dhéanann dochar don chomhshaol.

Bainistíocht Dramhaíola agus Ceimiceáin sa Chomhshaol

- Rialacháin dramhaíola a chur i bhfeidhm agus a fhorfheidhmiú lena n-áirítear saincheisteanna forfheidhmithe náisiúnta;
- Staitisticí dramhaíola náisiúnta a ullmhú agus a fhoilsiú chomh maith leis an bPlean Náisiúnta um Bainistíocht Dramhaíola Guaisí;
- An Clár Náisiúnta um Chosc Dramhaíola a fhorbairt agus a chur i bhfeidhm;
- Reachtaíocht ar rialú ceimiceáin sa timpeallacht a chur i bhfeidhm agus tuairiscíú ar an reachtaíocht sin.

Bainistíocht Uisce

- Plé le struchtúir náisiúnta agus réigiúnacha rialachais agus oibriúcháin chun an Chreat-treoir Uisce a chur i bhfeidhm;
- Monatóireacht, measúnú agus tuairiscíú a dhéanamh ar chaighdeán aibhneacha, lochanna, uiscí idirchreasa agus cósta, uiscí snámha agus screamhuisce chomh maith le tomhas ar leibhéil uisce agus sreabhadh abhann.

Eolaíocht Aeráide & Athrú Aeráide

- Fardaíl agus réamh-mheastacháin a fhoilsiú um astaíochtaí gás ceaptha teasa na hÉireann;

- Rúnaíocht a chur ar fáil don Chomhairle Chomhairleach ar Athrú Aeráide agus tacaíocht a thabhairt don Idirphlé Náisiúnta ar Gníomhú ar son na hAeráide;

- Tacú le gníomhaíochtaí forbartha Náisiúnta, AE agus NA um Eolaíocht agus Beartas Aeráide.

Monatóireacht & Measúnú ar an gComhshaol

- Córais náisiúnta um monatóireacht an chomhshaoil a cheapadh agus a chur i bhfeidhm: teicneolaíocht, bainistíocht sonraí, anailís agus réamhaisnéisiú;
- Tuairiscí ar Staid Thimpeallacht na hÉireann agus ar Tháscairí a chur ar fáil;
- Monatóireacht a dhéanamh ar chaighdeán an aeir agus Treoir an AE i leith Aeir Ghlain don Eoraip a chur i bhfeidhm chomh maith leis an gCoinbhinsiún ar Aerthruaillíú Fadraoin Trasteorann, agus an Treoir i leith na Teorann Náisiúnta Astaíochtaí;
- Maoirseacht a dhéanamh ar chur i bhfeidhm na Treorach i leith Toráin Timpeallachta;
- Measúnú a dhéanamh ar thionchar pleananna agus clár beartaithe ar chomhshaol na hÉireann.

Taighde agus Forbairt Comhshaoil

- Comhordú a dhéanamh ar gníomhaíochtaí taighde comhshaoil agus iad a mhaoiniú chun brú a aithint, bonn eolais a chur faoin mbeartas agus réitigh a chur ar fáil;
- Comhoibriú le gníomhaíocht náisiúnta agus AE um thaighde comhshaoil.

Cosaint Raideolaíoch

- Monatóireacht a dhéanamh ar leibhéil radaíochta agus nochtadh an phobail do radaíocht ianúcháin agus do réimsí leictreamaighnéadacha a mheas;
- Cabhrú le pleananna náisiúnta a fhorbairt le haghaidh éigeandálaí ag eascairt as taismí núicléacha;
- Monatóireacht a dhéanamh ar fhorbairtí thar lear a bhaineann le saoráidí núicléacha agus leis an tsábháilteacht raideolaíochta;
- Sainseirbhísí um chosaint ar an radaíocht a sholáthar, nó maoirsiú a dhéanamh ar sholáthar na seirbhísí sin.

Treoir, Ardú Feasachta agus Faisnéis Inrochtana

- Tuairiscíú, comhairle agus treoir neamhspleách, fianaise-bhunaithe a chur ar fáil don Rialtas, don tionscal agus don phobal ar ábhair maidir le cosaint comhshaoil agus raideolaíoch;
- An nasc idir sláinte agus folláine, an geilleagar agus timpeallacht ghlan a chur chun cinn;
- Feasacht comhshaoil a chur chun cinn lena n-áirítear tacú le hiompraíocht um éifeachtúlacht acmhainní agus aistriú aeráide;
- Tástáil radóin a chur chun cinn i dtithe agus in ionaid oibre agus feabhsúchán a mholadh áit is gá.

Comhpháirtíocht agus líonrú

- Oibriú le gníomhaireachtaí idirnáisiúnta agus náisiúnta, údaráis réigiúnacha agus áitiúla, eagraíochtaí neamhrialtais, comhlachtaí ionadaíocha agus ranna rialtais chun cosaint comhshaoil agus raideolaíoch a chur ar fáil, chomh maith le taighde, comhordú agus cinnteoireacht bunaithe ar an eolaíocht.

Bainistíocht agus struchtúr na Gníomhaireachta um Chaomhnú Comhshaoil

Tá an GCC á bainistiú ag Bord lánaimseartha, ar a bhfuil Ard-Stiúrthóir agus cúigear Stiúrthóir. Déantar an obair ar fud cúig cinn d'Oifigí:

- An Oifig um Inbhunaitheacht i leith Cúrsaí Comhshaoil
- An Oifig Forfheidhmithe i leith Cúrsaí Comhshaoil
- An Oifig um Fhianaise agus Measúnú
- An Oifig um Chosaint ar Radaíocht agus Monatóireacht Comhshaoil
- An Oifig Cumarsáide agus Seirbhísí Corparáideacha

Tugann coistí comhairleacha cabhair don Gníomhaireacht agus tagann siad le chéile go rialta le plé a dhéanamh ar ábhair inní agus le comhairle a chur ar an mBord.



Environmental Protection Agency
An Ghníomhaireacht um Chaomhnú Comhshaoil

Headquarters

**PO Box 3000,
Johnstown Castle Estate
County Wexford, Ireland**

**T: +353 53 916 0600
F: +353 53 916 0699
E: info@epa.ie
W: www.epa.ie
LoCall: 1890 33 55 99**

Regional Inspectorate

McCumiskey House,
Richview, Clonskeagh Road,
Dublin 14, Ireland

T: +353 1 268 0100
F: +353 1 268 0199

Regional Inspectorate

Inniscarra, County Cork,
Ireland

T: +353 21 487 5540
F: +353 21 487 5545

Regional Inspectorate

Seville Lodge, Callan Road,
Kilkenny, Ireland

T +353 56 779 6700
F +353 56 779 6798

Regional Inspectorate

John Moore Road, Castlebar
County Mayo, Ireland

T +353 94 904 8400
F +353 94 902 1934

Regional Inspectorate

The Glen, Monaghan, Ireland

T +353 47 77600
F +353 47 84987

Regional Offices

The Civic Centre
Church St., Athlone
Co. Westmeath, Ireland
T +353 906 475722

Room 3, Raheen Conference Centre,
Pearse House, Pearse Road
Raheen Business Park, Limerick,
Ireland

T +353 61 224764

