Chapter 7
Water Quality

Water Quality

1. Introduction

Water is needed to sustain life and is an important and integral part of our everyday existence. In the home, it is used to clean and cook the food we eat, while at work water is a vital raw material in numerous processes from food production to the manufacture of computer components. Water is also used for recreational purposes such as swimming and canoeing, while fishing and angling activities attract thousands of tourists to Ireland every year. Ireland's rivers, lakes, estuaries and coastal waters are home to thousands of plant and animal species ranging from tiny river insects and marine invertebrates to birds such as kingfishers and animals such as otters to name but a few. Therefore, maintaining our waters in a healthy condition is critical if we are to maintain a vibrant and healthy society and an aquatic environment that will support a rich diversity of species and habitats (see Chapter 6 on biodiversity).

Water is a hugely important national resource that provides a multitude of benefits to the people of Ireland. This resource needs to be protected to ensure that the benefits that currently arise can be enjoyed by future generations. Our waters need to be protected against a range of human activities that cause water pollution and affect the physical integrity of water bodies and habitats. These human activities, together with climate change, continue to threaten the quality and availability of water. Protecting our freshwater resources also protects the marine waters that our rivers flow into (see Chapter 8 on the marine environment). The aim of European Union (EU) and national water policy is to protect clean waters and to restore polluted waters. However, water quality in Ireland is now getting worse after a period of relative stability and improvement (EPA, 2019a). Not only are we seeing a persistent decline in the highest quality waters, but we are also seeing an increase in the number of most polluted rivers. Many of Ireland's protected water habitats also have unfavourable conservation status as a result of declining water quality (see Chapter 6 on biodiversity).

Ireland has established a National River Basin Management Plan 2018-2021, which sets out the steps to be taken to protect and improve water quality. The plan outlines the key measures that will be put in place to address water quality issues and the level of improvement expected from these measures (Government of Ireland, 2018).

This chapter presents an overview of the status of Ireland's surface water (i.e. rivers, lakes, estuaries, lagoons and nearshore coastal waters) and groundwater resources together with information on the pressures and impacts caused by various human activities. The chapter will also outline the resources and measures that are being put in place to address water pollution. Other issues that affect the broader marine environment such as overfishing, climate change and marine litter are covered in Chapter 8, while general habitat quality and species diversity in surface waters is discussed in Chapter 6. Some key water and health issues are covered in Chapter 14.

2. Current Situation

The State of Our Surface Waters

Nearly half of the surface waters in Ireland are failing to meet the legally binding water quality objectives set by the EU Water Framework Directive because of pollution and other human disturbance.

The ecological health of Ireland's rivers, lakes, canals, estuaries and nearshore coastal waters is assessed by looking at a range of different aquatic organisms whose presence, diversity and number tell us about the ability of these waters to support healthy and diverse biological communities. For example, the abundance and composition of river macroinvertebrates (tiny animals without backbones such as insects, worms and snails) is used to assess river biological quality. Information on biology and general water quality (e.g. nutrients, dissolved oxygen, pH) is used to assess ecological status, which is an expression of the ecological health of these waters.

The ecological status indicates whether a water body is being damaged by pollution, water abstraction or habitat degradation. Waters at high and good ecological status show only minor or slight changes from natural conditions, whereas waters at less than good status (i.e. moderate, poor or bad) are moderately to severely damaged by pollution or habitat degradation. Assessing the ecological status of water bodies helps guide the identification of appropriate management measures for their protection and restoration.

In the most recent assessment, based on information collected between 2013 and 2018 (Topic Box 7.1 describes the type of information collected), it was found that 53 per cent of surface waters were in satisfactory ecological status and the remaining 47 per cent of surface waters in moderate, poor or bad ecological status (Figure 7.1; EPA, 2019a). This means that nearly half of the surface water bodies in Ireland are failing to meet the objectives set by the EU Water Framework Directive (2000/60/EC) because of pollution and other human disturbance (Figure 7.3). Coastal waters had the highest percentage of waters in good or better ecological status (80%) followed by rivers (53%), lakes (50.5%) and estuaries (38%), which have the worst water quality (Figure 7.2).

Figure 7.1 Surface water overall ecological status, 2013-2018 (Source: EPA)

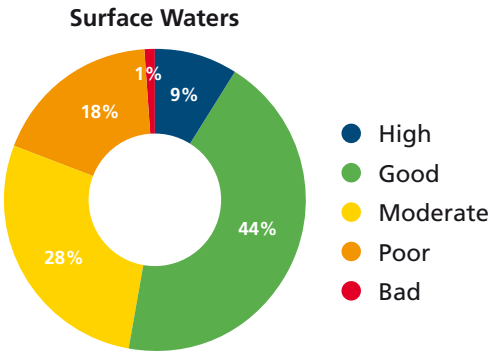


Figure 7.2 Surface water ecological status by water category, 2013-2018 (Source: EPA)

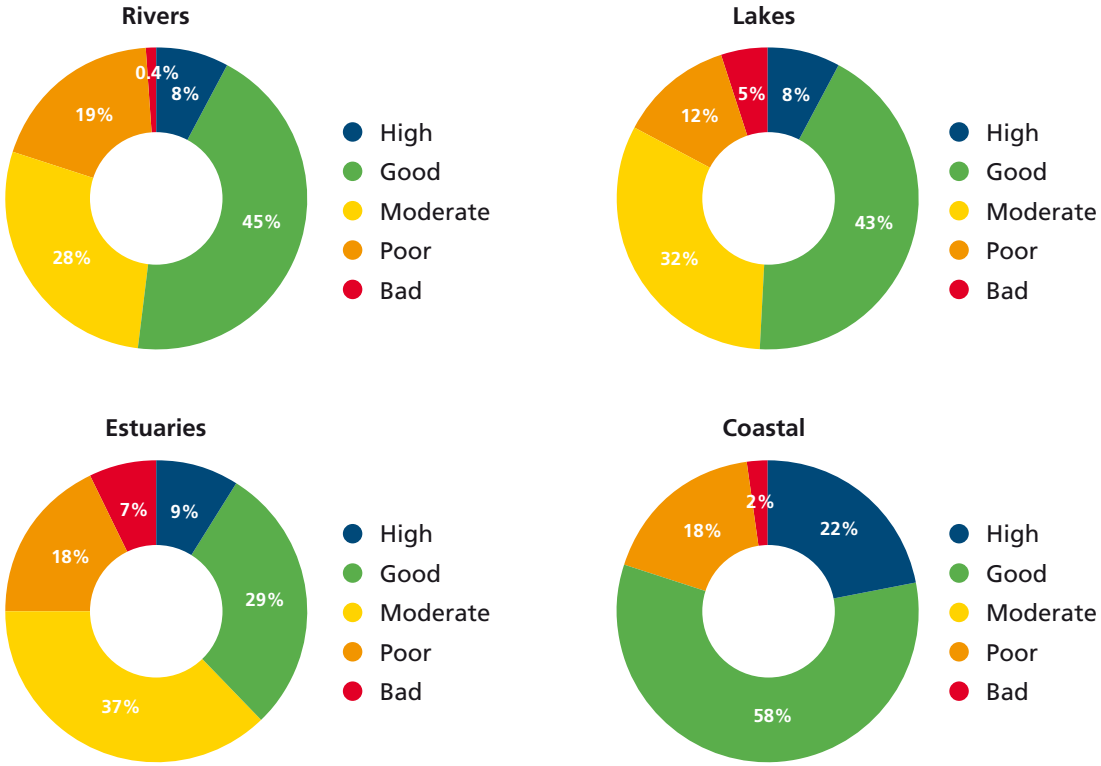
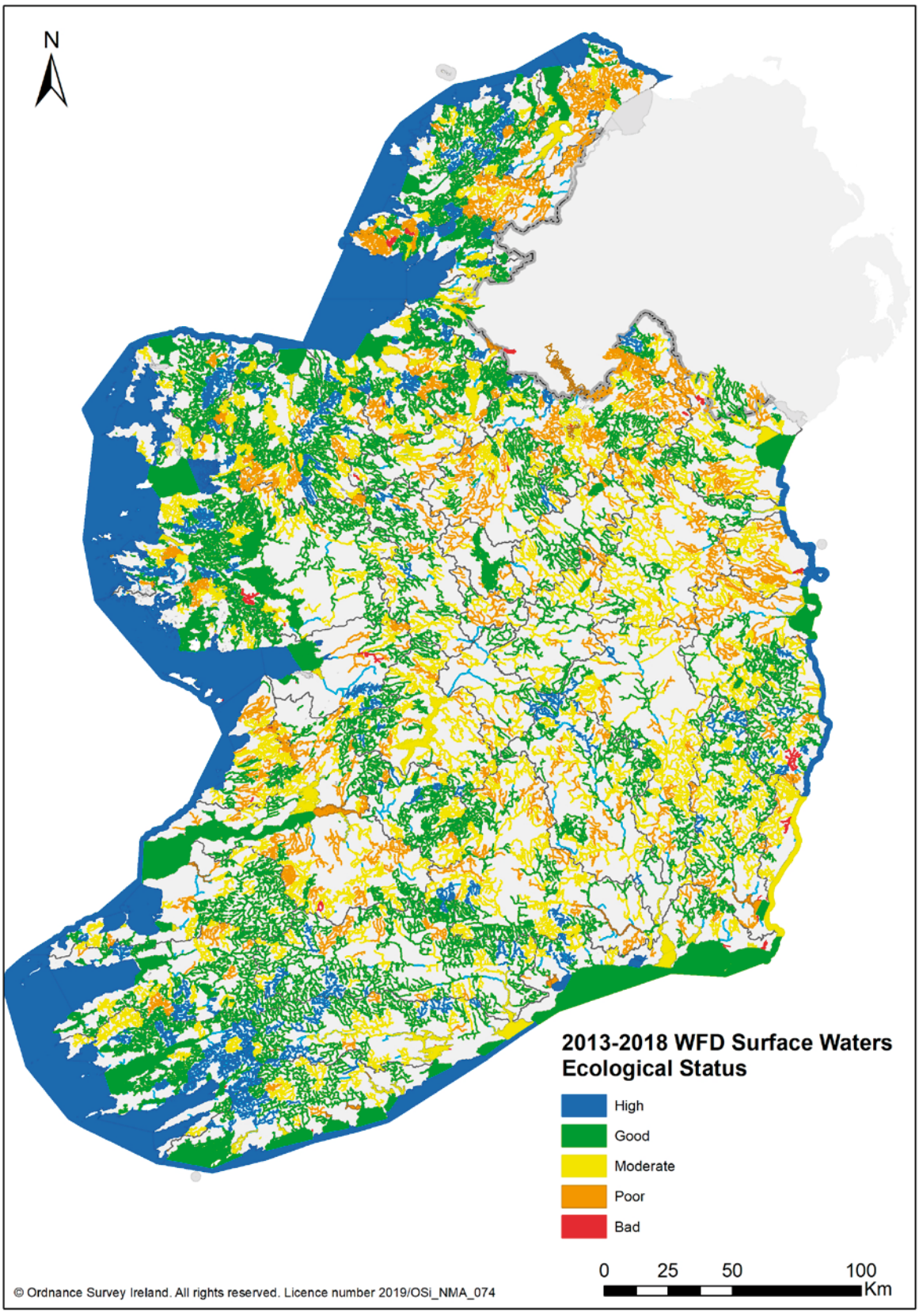


Figure 7.3 The ecological status of Ireland's surface waters under the Water Framework Directive (WFD), 2013-2018 (Source: EPA)



Topic Box 7.1 Monitoring the Aquatic Environment

Information on the presence and condition of various algal, plant and animal communities is used to assess the ecological health of Ireland's aquatic environment. Every year, hundreds of river sites and dozens of lakes are sampled by field biologists. At each river site the presence of macroinvertebrates, such as snails and worms and the larval stages of aquatic insects, that live in the river is assessed. The types and numbers of macroinvertebrates present tells us about the quality of the water.

The presence of sensitive species or groups, such as stoneflies and mayflies, indicates that the river is unpolluted, whereas the presence of pollution-tolerant species, such as certain types of snails, leeches and worms, indicates that the river is polluted. In lakes the composition of aquatic plants and the depth to which they grow is used as a measure of ecological status; plants are found at greater depths in unpolluted lakes. Most of the large estuaries around the coast are also sampled on an annual basis, and here field biologists monitor the frequency of phytoplankton blooms and the occurrence of opportunistic green seaweed mats. The information collected in the field is subsequently used to assess the ecological status of these waters.

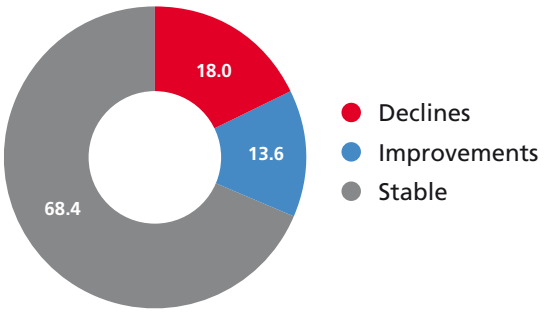
An EPA river biologist examines a kick-sample (lower right) for the presence of different macroinvertebrate indicators (top right).

Changes and Trends in Water Quality

The latest assessment of water quality in Ireland (2013-2018) shows that there is a continuing decline in high status water bodies, which is the cleanest water category, and an increase in the number of water bodies in poor ecological health. Even more stark is the dramatic reduction in the number of our most pristine rivers, which has fallen from over 500 sites to only 20 sites in 30 years.

The Water Framework Directive specifically prohibits declines in ecological status. Ireland's latest assessment of water quality shows that, while just over two-thirds of water bodies (1825) had not changed status since the last assessment (2010-2015), 483 water bodies declined in status and 368 improved (Figure 7.4). This resulted in an overall net decline in 115 surface water bodies or 4.4 per cent. This was driven mostly by the 5.5 per cent net decline in river water bodies. The only surface water categories to display a net improvement in status were coastal waters (a net improvement in two coastal water bodies) and lakes (a net improvement in 12 lakes).

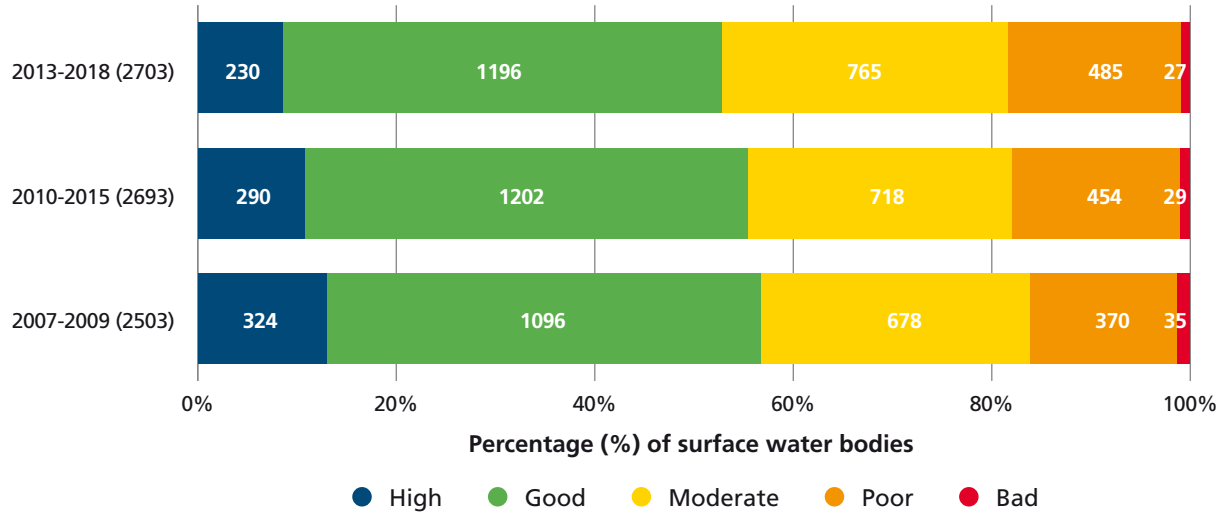
Figure 7.4 Percentage change in ecological status of surface waters between the assessment periods 2010-2015 and 2013-2018 (Source: EPA)

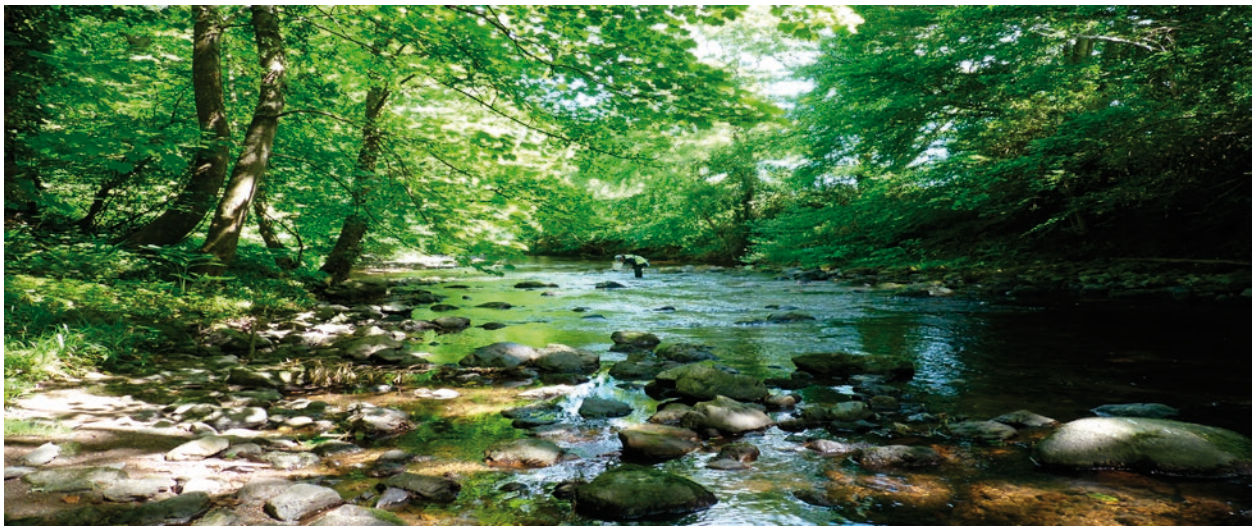


Of most concern is the continuing decline in high status water bodies and the increase in the number of water bodies in poor ecological health. The proportion of high status surface water bodies has decreased by one-third (94 water bodies) since the period 2007-2009, while the proportion of poor status surface water bodies increased by one-third (115 water bodies) over the same period (Figure 7.5). The loss of high status waters has implications for the survival of certain protected species sensitive to small changes in water quality such as the freshwater pearl mussel (*Margaritifera margaritifera*), while at the other end of the spectrum the ecology of poor status waters is so significantly altered that their ability to function normally in terms of food web dynamics and nutrient cycling is greatly diminished.

The Laney river upstream of Macroom, Co. Cork. One of the few remaining highest quality (Q5) rivers

Figure 7.5 Change in each of the five Water Framework Directive status categories over three assessment periods for all surface waters (number of water bodies in each class) (Source: EPA)





Biological monitoring by the EPA on the River Dargle.

Table 7.1 Surface water bodies with bad ecological status, 2013-2018 (Source: EPA)

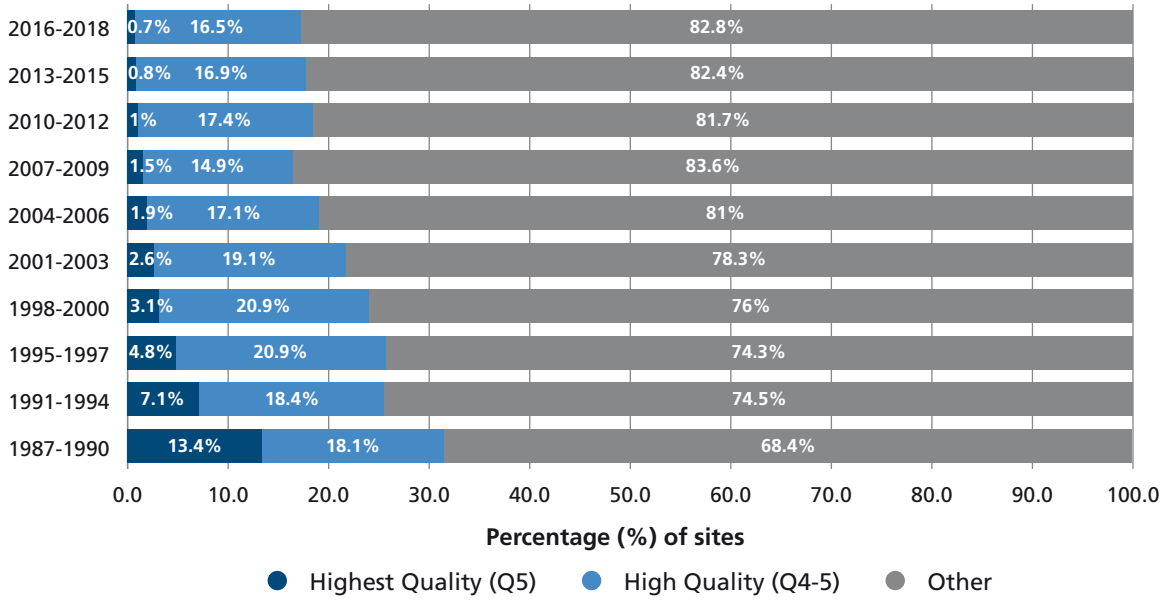
WATER BODY	ECOLOGICAL STATUS	COUNTY
Rivers		
Avoca (two sections)	Bad	Wicklow
Aughboy	Bad	Wexford
Ahavarraga stream	Bad	Limerick
Kilmihil stream	Bad	Clare
Kilgolgan	Bad	Galway
Owenriff	Bad	Galway
Ballaghdoo	Bad	Donegal
Roechrow	Bad	Donegal
Lakes		
Lough Alewnaghta	Bad	Clare and Galway
Ballyquirke lough	Bad	Galway
Corglass lough	Bad	Cavan
Lough Egish	Bad	Monaghan
Lickeen lough	Bad	Clare
Lough Macnean Lower	Bad	Cavan and Fermanagh
Lough Muckno or Blayney	Bad	Monaghan
Lough Naglack	Bad	Monaghan
Rinn lough	Bad	Leitrim
Templehouse	Bad	Sligo
Urlaur	Bad	Mayo
Estuaries and lagoons		
Lough Donnell	Bad	Clare
Cuskinny lake	Bad	Cork
Kilkerran lake	Bad	Cork
Rogerstown estuary	Bad	Dublin
Lady's Island lake	Bad	Wexford
Ballyteige channels	Bad	Wexford
Rincarna pools	Bad	Galway

The number of bad-status water bodies (the worst of the worst) has fallen marginally over each assessment period, but there are still 27 water bodies in the most polluted category. These include nine rivers, 11 lakes and seven estuarine water bodies (Table 7.1). This classification means that these water bodies are being severely damaged by pollution and other human disturbance to an extent that prevents them from supporting most types of aquatic life.

At the other end of the scale our best-quality, least-polluted and least impacted, high status waters are important reservoirs of aquatic biodiversity. These waters provide a home for species sensitive to pollution including river insects such as stoneflies and mayflies and the young and larval stages of salmon and trout. Their loss is a significant concern. The proportion of high-quality sites (Q5, Q4-5) has almost halved since the late 1980s declining from 31.6 per cent of rivers in 1987-1990 to just 17.2 per cent in 2013-2018 (Figure 7.6). Even more worrying is the dramatic reduction in the number of our most pristine rivers – the best of the best (Q5) – which has fallen from 573 sites to only 20 sites over the same period.

A macroalgal bloom in Rogerstown Estuary, Co. Dublin. These blooms can form extensive dense mats which can smother other animals in the sediments below them.

Figure 7.6 Change in the percentage of high ecological quality (macroinvertebrate) river sites in each survey period between 1987 and 2018 (Source: EPA)



Chemical Status of our Surface Waters

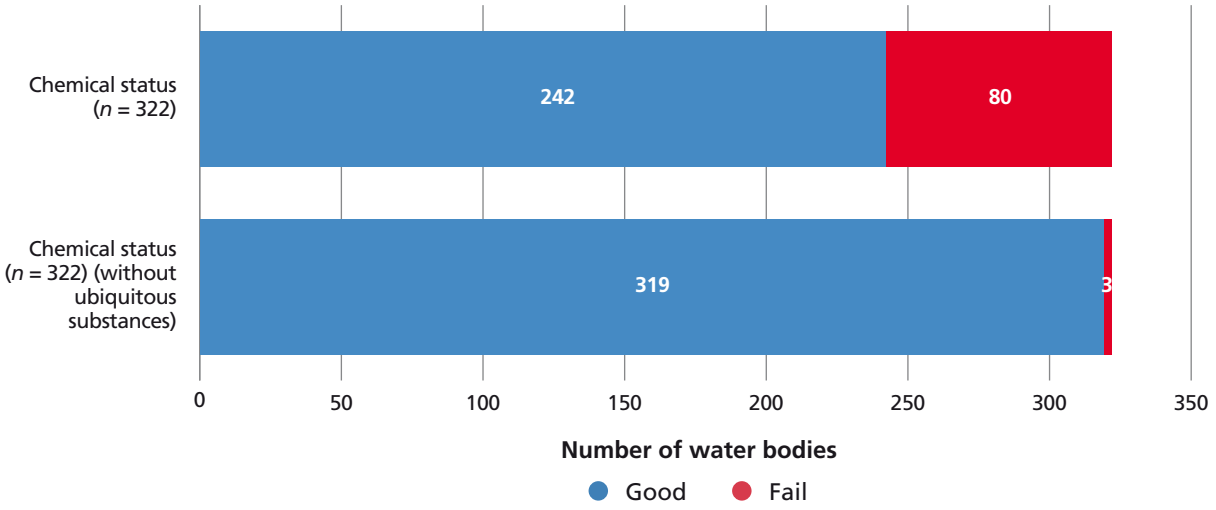
While water bodies were mostly at good chemical status, except for the presence of some ubiquitous priority substances, the presence of low levels of some herbicides in rivers was widespread.

The chemical status of waters is assessed to ensure that certain chemical substances, known as priority substances, are not causing harm to aquatic organisms or posing a risk to drinking water supplies. These substances are assessed against a range of environmental quality standards (EQSs), which have been set at levels to protect the most sensitive aquatic organisms and to ensure that these pollutants do not end up accumulating in the food chain.

Three-quarters of the 322 water bodies assessed over the period 2013-2018 are in good chemical status (EPA, 2019a) (Figure 7.7). This increases to 99 per cent of surface water bodies when ubiquitous priority substances, such as mercury and polyaromatic hydrocarbons (PAHs), which are already widely distributed in the environment, are omitted. The three water bodies that have poor chemical status when ubiquitous substances are omitted are the Owvane river, Co. Cork (which fails for hexachlorobutadiene), the Glenealo river, Co. Wicklow (for cadmium), and the Avoca estuary, Co. Wicklow (for copper, zinc and cadmium).

Because of their ability to persist in the environment and bioaccumulate, ubiquitous substances can be found in the environment many decades after international measures have been put in place to reduce or eliminate them. Many are also capable of long-range transport from their place of origin. This means that a ubiquitous substance detected in a water body is unlikely to have come from a source in that water body or even from a source in the surrounding catchment. Information on these substances is presented separately to ensure that their presence does not obscure the presence of other substances that may have arisen from local sources, which can be addressed by local measures.

Figure 7.7 Chemical status of surface water bodies, with (top) and without (bottom) ubiquitous substances, 2013-2018 (Source: EPA)



Many of the chemical substances monitored are pesticides and, while none of the pesticides assessed exceeded their environmental quality standards (where applicable), some were detected in a high proportion of monitored rivers. 2,6-dichlorobenzamide, MCPA (2-methyl-4-chlorophenoxyacetic acid) and mecoprop (methylchlorophenoxypropionic acid) were the most widely observed substances: the first two substances occurred in over half of the rivers surveyed and mecoprop was present in over one-third (EPA, 2019a). All three substances are herbicides, which are used to control weeds. MCPA is widely used in agriculture to control rushes in grassland. The presence of these substances in water can harm very sensitive aquatic wildlife such as river insects and cause problems in drinking water supplies (see Chapter 14 on health and wellbeing).

Fish Kills in Rivers, Lakes and Estuaries

The increase in the number of fish kills in 2018 may have been indirectly linked to the drought-like conditions experienced in the summer of 2018. Lower oxygen levels associated with low flows and high water temperatures are likely to have increased the vulnerability of fish populations to water pollution.

A fish kill is usually an indicator that serious pollution has occurred. There are many possible causes, but depleted oxygen levels in the water is the principle mechanism leading to fish deaths. Oxygen depletion can occur following the breakdown by bacteria of organic matter contained in algal blooms or from agricultural, municipal and industrial sources.

After declining to a historical low of 14 fish kills in 2017, the number of fish kills increased to 40 in 2018 but decreased again to 20 in 2019. The low-flow conditions and higher water temperatures (warmer water holds less oxygen) in the summer of 2018 may have contributed to the increase that year by reducing ambient oxygen concentrations and increasing the vulnerability of fish to underlying levels of pollution or to acute pollution events. This highlights the importance of water body resilience: water bodies in good ecological health are likely to be more resilient than those in poorer ecological health, and therefore in a better position to withstand the additional pressures caused by climate change.

The State of Our Groundwaters

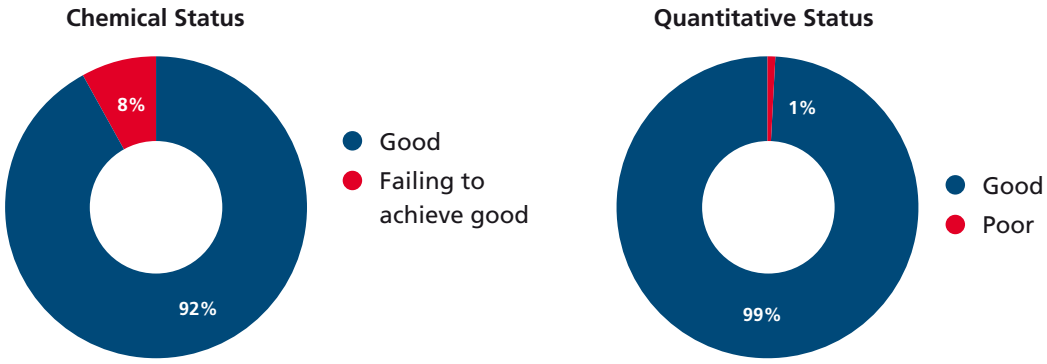
With a few localised exceptions, the quality of groundwater in Ireland is generally good. At least 92 per cent of groundwater bodies have good chemical and quantitative status, and the amount of rainfall replenishing groundwater is generally enough to sustainably support the volume of water being abstracted.

Groundwater is water located in spaces and cracks in rocks and the subsoil. It is the source of drinking water for approximately one-quarter of the population in Ireland and contributes a significant proportion of the flow in our rivers during dry weather.

The quality of groundwater in Ireland is good: 92 per cent of groundwater water bodies have good chemical status (Figure 7.8; EPA, 2019a). Water bodies that failed to meet their objectives (38 water bodies in total) are typically associated with historical contamination from industrial sites and, although significant, this pollution is generally very localised. Since 2013, nitrogen concentrations in groundwater, predominantly arising from losses to groundwater from agricultural soils, have started to increase in the southern and south-eastern parts of the country. The microbiological quality of groundwater is also an important factor in areas where wells and boreholes are used to abstract drinking water. The risks from the presence of microbial pathogens such as verocytotoxin-producing *Escherichia coli* (VTEC) needs to be considered when sourcing and using drinking water for household wells. Drinking water and VTEC is covered in Chapter 14.

Over 99 per cent of groundwater bodies have good quantitative status, i.e. the amount of rainfall replenishing groundwater is generally enough to sustainably support the volume of water being abstracted (Figure 7.7). Only two groundwater bodies failed to achieve good quantitative status. Similarly, the volume, location and operation of groundwater abstractions mean that very few groundwater abstractions deplete surface water resources. The National River Basin Management Plan highlighted that only 6 per cent of water bodies require further assessment of water abstraction pressures. Nonetheless, there is a small number of groundwater abstractions that, while not currently causing an environmental impact, may require active management to ensure that they remain environmentally sustainable in the context of a changing climate and the impact that may have on water resources. The Environmental Protection Agency (EPA) is reviewing the data gathered under the 2018 Abstraction Registration Regulations (S.I. No. 261/2018) to identify those abstractions that put significant pressure on water bodies, potentially preventing them from achieving their environmental objectives, and require measures to ensure that they are managed sustainably.

Figure 7.8 Chemical and quantitative status of groundwater, 2013-2018 (Source: EPA)



Water Quality across Europe

Ireland's rivers, lakes and estuaries that have good and high status need to be protected as nationally important ecosystems for wildlife and people

The most recent European assessment of water quality is based on data collected between 2010 and 2015 (EEA, 2018).[1] Overall, Ireland's current surface water quality compares favourably with its European neighbours (Table 7.2): 52.8 per cent of Ireland's waters have good or better ecological status compared with only 44 per cent of surface waters across Europe. However, there is no room for complacency, as Ireland, with its relatively low population density and lack of heavy industry, would be expected to have better water quality than many other parts of Europe. Furthermore, recent declines in river water quality means that fewer of our surface waters will meet their environmental objectives as set out by the EU Water Framework Directive. The challenge in Ireland is to protect waters that are still in good, or near pristine, condition and restore waters that have been allowed to deteriorate through pollution or physical modifications.

Table 7.2 Percentage of water bodies at good or high ecological status and good chemical and quantitative status in Ireland and across Europe, 2010-2015 (Source: EPA)

TYPE OF WATER BODY	IRELAND (2013-2018)	EUROPE (2010-2015)
Surface waters		
Rivers	53	42
Lakes	50.5	54
Estuaries	38	31
Coastal waters	80	54
All surface waters	52.8	44
Groundwater		
Chemical status	92	80
Quantitative status	99	86

Similarly, the percentages of Ireland's groundwater with good chemical status and quantitative status are higher than the corresponding European averages. Ireland does not have groundwater over-abstraction issues, as do many of the drier European countries, nor does it have widespread pollution from industrial activities or regular exceedances of nitrate or pesticide concentrations in groundwater, and therefore it compares favourably with its European neighbours.

With regard to water quality and management, the European Commission's Environmental Implementation Review for Ireland in 2019 (EC, 2019) noted with concern the low rate of compliance with the Urban Waste Water Treatment Directive (91/271/EEC). The review pointed out that almost half of the agglomerations that are required to have more stringent treatment systems in place are not in compliance with the Directive. Other issues highlighted by the review included the lack of controls on water abstractions and of regulation of activities that may result in physical modifications to water bodies (see Chapter 14 for more on urban wastewater and Chapter 15 for the Environmental Implementation Review).

1 *See also: https://www.eea.europa.eu/data-and-maps/explore-interactive-maps/water-framework-directive-2nd-rbmp*

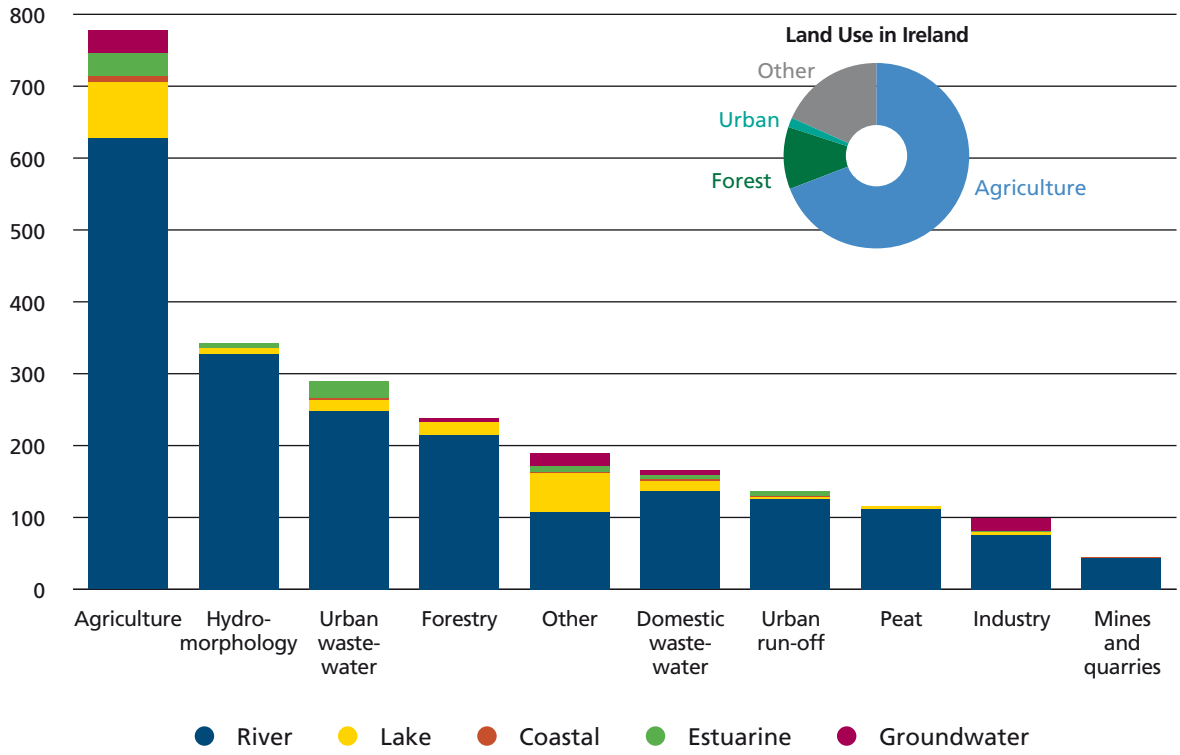
3. Drivers and Pressures

The Significant Pressures on Ireland's Aquatic Environment

The top three significant pressures on the ecological health and quality of our waters are agriculture, hydromorphology (physical changes) and urban wastewater.

Ireland's surface waters are being damaged by pressures arising from various human activities. The most significant pressures, those considered to put a water body at risk of not meeting its environmental objectives, were identified and reported in the National River Basin Management Plan 2018-2021, following a comprehensive assessment by the EPA of various human activities and their potential impact on the aquatic environment. This information is available at www.catchments.ie. The assessment showed that the most significant pressures, in terms of the number of water bodies at risk of not achieving good status, were agriculture (53% of water bodies at risk), hydromorphology (i.e. change in the shape and flow of water bodies due to physical alterations: 24%), urban wastewater (20%) and forestry (16%). The complete breakdown is shown in Figure 7.9.

Figure 7.9 Significant pressures on Ireland's aquatic environment (Source: EPA)



Significant agricultural pressures include run-off of nutrients and sediment from agricultural land and farmyards and the contamination of surface waters with pesticides. Drainage of agricultural land can also damage the physical integrity of streams and rivers and increase the loss of sediment to larger downstream rivers.

More generally, work done to protect river banks, to prevent flooding or to maintain navigation channels in rivers and estuaries may damage sensitive water habitats if the hydrology and morphology of these waters are substantially changed in character.

Discharges from wastewater treatment plants can lead to organic and nutrient enrichment with consequent effects on dissolved oxygen levels and biological communities. Poorly treated sewage can also pose a risk to public health by potentially contaminating the source of drinking water supplies with harmful bacteria and viruses. Over half (56%) of the combined sewage loading that arises in large urban areas in Ireland is discharged from plants that are not meeting the required European standard (EPA, 2020a). Furthermore, raw sewage from the equivalent of 78,000 people in 35 towns and villages is still released into the environment every day. The majority of this (from 31 of the towns and villages) is discharged directly into estuaries and coastal areas.

In relation to forestry, inappropriately sited forests and poorly managed forest operations can negatively affect water quality and aquatic habitats and species. The most common water quality problems arising from forestry in Ireland are the release of sediment and nutrients to the aquatic environment and impacts from acidification. Forestry may also give rise to modified stream flow regimes caused by associated land drainage.

Impacts of Nutrients (Nitrogen and Phosphorus) on Water Quality in Ireland

One-third of rivers and lakes and one-quarter of estuaries already have too much nutrient in their waters, and nutrient concentrations in our rivers and nutrient inputs to our marine environment are increasing.

One of the main problems damaging the quality of surface waters is nutrient pollution caused by too much nitrogen and phosphorus (see Topic Box 7.2). Nitrogen pollution in the south and south-east of the country is damaging the ecological health of many of our estuaries and nearshore coastal waters. In these areas, which have freely draining soils, nitrate seeps rapidly into groundwater, and losses are closely correlated with the intensiveness of farming: the higher the rate of application of nitrogen, the higher the nitrate concentrations in waters. Since 2013, nitrogen emissions have increased as both cattle numbers and fertiliser use have increased.

In freshwaters and in some of our more river-dominated estuaries, phosphorus is often the nutrient of most concern. Phosphorus concentrations are elevated in various parts of the country, particularly along the east coast and in parts of the south (see Figure 7.9b). Phosphorus losses come primarily from wastewater discharges and run-off from agricultural land on poorly draining soils. Diffuse phosphorus losses from agriculture are difficult to tackle, as the sources do not occur uniformly in the landscape but in 'hot spots' or critical source areas.

Topic Box 7.2 Nutrient Enrichment and Ecological Impacts

One-third of rivers and lakes and one-quarter of estuaries have too much nutrient in their waters, and there is also evidence that nutrient concentrations in our rivers and nutrient inputs to our marine environment are increasing (EPA, 2019a). At least one-quarter of river sites monitored have increasing nutrient concentrations, while nitrogen and phosphorus loads to the sea have increased by 16 per cent and 31 per cent, respectively (see Figure 7.10a and b). These nutrients cause excessive plant and algal growth in our rivers and increase the likelihood of harmful algal blooms in our lakes and estuarine waters. In rivers, for example, too much plant growth uses up oxygen, particularly during the hours of darkness. This can lower oxygen concentrations in water to levels that harm other animals such as certain species of river insects (e.g. the larval stage of stoneflies and some mayfly species), which are sensitive to low oxygen levels.

In some lakes the proliferation of phytoplankton blooms can reduce the depth to which light penetrates and this in turn can restrict the growth of bottom-dwelling lake plants. In our estuaries, nutrient enrichment can cause the extensive growth of opportunistic green seaweed mats, which can blanket intertidal areas and smother the animals living in the underlying sediments. These are just some examples of how nutrient enrichment can harm the natural balance of different categories of water and their ecological functioning.

The trend of increasing nutrient concentration in our rivers is continuing with the latest EPA assessment of data on water quality (for a water indicators report that is due out shortly) is showing that nitrate concentrations have increased in nearly half (44%) of river sites surveyed between 2013 and 2019 (EPA, 2020b). The data assessment also confirms that nitrogen loads to the sea are also continuing to rise.

A bloom of green seaweed in Youghal harbour, Co. Cork, as a result of too much nutrient in the water.

Figure 7.10a Nitrate (left) and phosphorus (right) concentrations in rivers, 2013-2018, showing trends increasing (red dots), stable (yellow dots) and decreasing (blue dots) (Source: EPA)

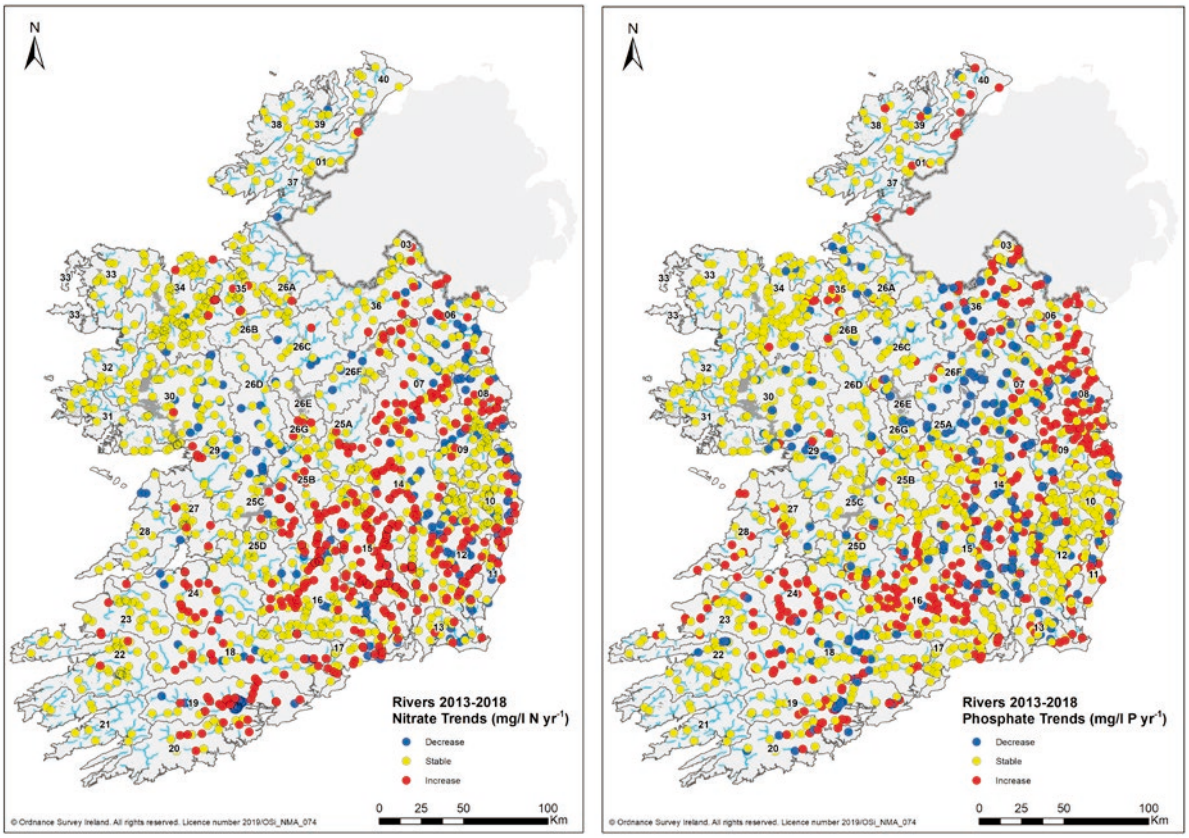
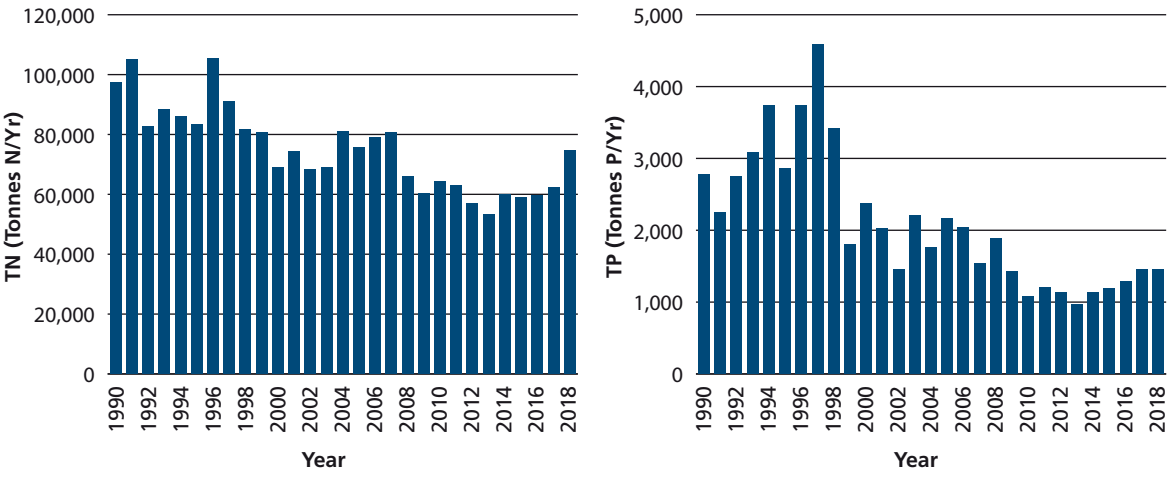


Figure 7.10b Annual loads of total nitrogen (TN; left) and total phosphorus (TP; right) from rivers to the sea, 1990-2018. Loads of TN and TP have increased by 8800 (16%) tonnes and 326 (31%) tonnes, respectively, since 2012-2014 (Source: EPA)



Hydromorphological Alterations and Their Impacts on Surface Water

Barriers, such as weirs and dams, can prevent the movement of fish and can be severely detrimental to migratory fish species. Other modifications, such as land drainage and channelisation can also impact surface water ecology.

Hydromorphological alterations (i.e. physical changes) associated with agricultural drainage, land reclamation, channelisation, flood protection work and navigational dredging, among others, can damage the morphology and hydrology of surface water bodies and can prevent waters from reaching good ecological status. For example, the presence of physical barriers, such as weirs, dams and channel diversions, can damage river habitats and prevent the movement of fish and can be extremely detrimental to migratory fish species such as salmon, sea trout and lamprey (see Topic Box 7.3). Changes in hydrological flow as a result of physical morphological changes can also increase sedimentation rates and alter the composition of river and lake substrates, which in turn can affect bottom-dwelling organisms. For example, increased sedimentation is known to be one of the main environmental factors affecting the critically endangered freshwater pearl mussel in Irish rivers (Moorkens, 1999).

Furthermore, over-abstraction of water can reduce river flows and lake levels to an extent that can damage their ecology. In general, abstractions in Ireland are not considered to be a widespread significant pressure on surface water or groundwater resources. During drier periods, however, such as the 2018 drought (see Topic Box 7.4), some abstractions require active management to ensure that they do not have a negative impact on waters.

In early June 2020 Irish Water brought into effect a national hosepipe ban lasting until 21 July 2020. This was legally backed up by a National Water Conservation Order. The reason for the order was an increased demand for water and widespread drought conditions. In bringing in the ban, the utility company noted that Met Éireann had confirmed that May 2020 had been the driest May since 1850. Irish Water reported that 27 of its drinking water schemes were in drought and 50 were at risk of going into drought (Irish Water, 2020).

River Clodiagh (Portlaw), an example of good hydromorphological conditions.

Topic Box 7.3 River Barriers

Removing barriers improves river continuity for fish passage.

Barriers have been installed in rivers from the earliest of times and have served many purposes from aiding navigation (e.g. locks) and harnessing river power (e.g. water mills and electricity generation) to creating reservoirs and amenities for water sports. The presence of a physical barrier across a river can prevent the movement of both biological organisms and sediment. Barriers can prevent the movement of migrating fish trying to get to their spawning grounds and the transport downstream of sediment needed to replenish lower reaches. In some cases, in summer, water trapped behind a barrier can reach temperatures that can harm aquatic organisms.

Conservation monitoring of protected species such as salmon, shad, lamprey and the European eel show the damage caused by barriers impeding the upstream migration of these species. Such barriers are a major impediment to achieving the conservation objectives for shad and migratory lamprey in Irish rivers designated special areas of conservation under the Habitats Directive.

In many cases, the ideal solution would be their complete removal. However, the social and economic benefits provided by barriers does not always permit this, and before a barrier can be removed an assessment is required to understand the full impact of removal. There may also be environmental reasons for not removing a barrier. In some situations, for instance, the presence of a barrier may prevent the spread upstream of invasive species. For example, the presence of natural and artificial barriers is considered important in protecting some Arctic char populations in Irish lakes from the impact of invasive fish species (Connor *et al.*, 2019).

Several nationally and EU-funded research projects are looking at barriers and how various mitigation measures can be used to improve river continuity and the functioning of natural processes such as fish migration and sediment transport (e.g. the EU Horizon 2020 project AMBER – Adaptive Management of Barriers in European Rivers; the EPA-funded Reconnect barriers project; and the Interreg-funded Catchment CARE project.

Inland Fisheries Ireland is undertaking studies to identify and locate barriers and develop guidance on mitigation strategies that can be examined and implemented. A selection of these barriers will be prioritised for a national mitigation programme under the next National River Basin Management Plan (2022-2027).

A barrier that has been ameliorated by the construction of a fish passage

The importance of free-flowing rivers has been recognised in the European Commission's recently adopted Biodiversity Strategy for 2030, which has set a target of restoring at least 25,000 km of rivers as free-flowing watercourses by 2030 through the removal of obsolete barriers and the restoration of floodplains and wetlands.

Topic Box 7.4 The 2018 Drought

The impact of the drought in 2018 on river flows and lake water levels was severe, particularly in July, but it was neither as prolonged a national phenomenon as the 1975-1976 drought nor as severe as the 1995 drought in the Midlands and Western regions.

The dry weather resulted in a large soil moisture deficit, and almost two-thirds of all rivers fell below their 95th percentile flow (i.e. very low flow conditions). The main impact was on the provision of drinking water, and restrictions on water use were in place for several weeks between July and September. Inland Fisheries Ireland reported an increase in fish kills during 2018 (EPA, 2019a), and the low flows may have both directly and indirectly contributed to this rise by increasing the vulnerability of fish to pollution events (i.e. increased water temperature, depressed oxygen concentration).

Low flow levels encountered in the Owenbrin river, Co. Mayo, during the summer of 2018.

Our lake, reservoir and groundwater levels were buffered by the elevated precipitation and snow melt early in 2018, and, although their levels dropped, they did not fall to the same critical levels observed in approximately half of the rivers in the country. By November 2018, river flow and lake, reservoir and groundwater levels had returned to 'normal', except for a few lakes in the Midland region.

Overall, the drought highlighted the vulnerability of certain water supplies in Ireland, because when these water supplies were first built, they were designed to cater for a smaller population and therefore supply lower volumes of water. This vulnerability may be magnified by the impacts of climate change and highlights the need for robust water supply and water resource management to ensure a safe and secure water supply in the future.

Invasive Species

The introduction of invasive species can also cause damage by displacing native species and affecting the functioning of aquatic ecosystems. In Ireland, the most invasive aquatic species include the zebra mussel (*Dreissena polymorpha*), the Asian clam (*Corbicula fluminea*) and plants such as the curly waterweed (*Lagarisiphon major*) and Nuttall's waterweed (*Elodea nuttallii*). Other invasive species that occur along rivers such as Japanese knotweed (*Fallopia japonica*) and Himalayan balsam (*Impatiens glandulifera*) can destabilise river banks increasing erosion. Invasive species can also be vectors of disease or a direct cause of disease. For example, crayfish plague (caused by *Aphanomyces astaci*), a fungal disease introduced to Europe most probably on American crayfish imported for aquaculture, has devastated river populations of Ireland's native crayfish species (see Chapter 6).

The National Biodiversity Data Centre maintains the National Invasive Species Database, which provides information on the distribution of invasive species. This work aims to facilitate the updating of risk assessments undertaken by Invasive Species Ireland and establishes an early warning system to alert us to new arrivals on the island of Ireland. This is covered further in Chapter 6.

4. Responses

The National River Basin Management Plan 2018-2021 is the main policy response to improve water quality.

Water management in Ireland in the last two decades has focused on implementing the EU Water Framework Directive. In broad terms, the objectives of the Directive are to protect, enhance and restore all bodies of water, with the aim of achieving at least good status, and to comply with the water-related requirements for protected areas such as designated bathing waters, shellfish-growing areas, areas protected for the conservation of species and habitats and areas protected for the abstraction of drinking water. The objectives, and the measures required to achieve them, are set out in national river basin management plans. The government published Ireland's second National River Basin Management Plan (RBMP) 2018-2021 in April 2018, and this will be followed by a third plan covering the period 2022-2027.

The current RBMP identified water bodies that are under significant pressure and prioritised a range of measures to address the impacts on them. Overall, 1460 individual water bodies (30% of the total number) were identified as being at risk of not achieving their environmental objectives because of the damage being caused by significant pressures.

Some of the key measures set out in the plan include:

- establishing the Local Authority Waters Programme (LAWPRO) to carry out local catchment assessments to identify water quality issues and potential associated sources and to promote the implementation of mitigation measures to improve water quality at a local level
- setting up the Agricultural Sustainability Support and Advisory Programme (ASSAP), which is run by Teagasc and the dairy cooperatives and will provide advice to the farming community on appropriate measures to address water quality issues while working closely with LAWPRO.
- establishing the Blue Dot Catchments Programme to ensure the protection of our remaining high status waters and restoration of those whose status has declined
- Irish Water investing €1.7 billion in wastewater projects, programmes and asset maintenance.

The RBMP includes specific measures for each of the key sectors that are putting pressure on the aquatic environment. These are summarised in Table 7.3.

Connecting a community with their catchment, a guided nature walk along the Cunnigar sand spit, a natural feature that extends from An Rinn into Dungarvan Harbour, Waterford. (LAWPRO)

Table 7.3 Summary of the main measures in the National River Basin Management Plan 2018-2021

SECTOR/PRESSURE	MEASURE
All pressures	■ Establishment of the Local Authority Waters Programme (LAWPRO) to undertake water catchment assessments and develop action plans for priority areas for action.
Agriculture	■ Establishment of an Agricultural Sustainability Support and Advisory Programme (ASSAP) to undertake farm assessments and provide advice to farmers on what measures to take to address water quality issues. ■ Implementation of agri-environment schemes through the Rural Development Programme. ■ Implementation of the enhanced Nitrates Action Programme for 2018-2021 and the associated inspection regime. ■ Knowledge-transfer programmes to promote, among other things, better nutrient management and point-source pollution management.
Hydromorphology	■ Introduction of improved assessment methods and knowledge of hydromorphological impacts. ■ Evaluation and removal of barriers to fish migration. ■ Implementation of mitigation measures to reduce the impact of river channelisation.
Urban wastewater treatment	■ Investment by Irish Water of €1.7 billion in wastewater projects, programmes and asset maintenance.
Forestry	■ Realignment and full implementation of forestry regulations and policy to contribute to achieving water quality objectives. ■ Promotion and strategic deployment of forestry funding schemes and other resources to protect and improve water quality.
Domestic wastewater treatment	■ 1000 inspections of domestic wastewater systems to be carried out nationally by local authorities each year using a risk-based approach.
Water abstraction	■ Risk assessment of water abstractions and licensing of large abstractions and those that put significant pressure on water resources.
Other pressures	■ Other significant pressures including industry, peat extraction and mining are also addressed in the plan, which is available to download (see https://www.housing.gov.ie/water/water-quality/river-basin-management-plans/river-basin-management-plan-2018-2021).

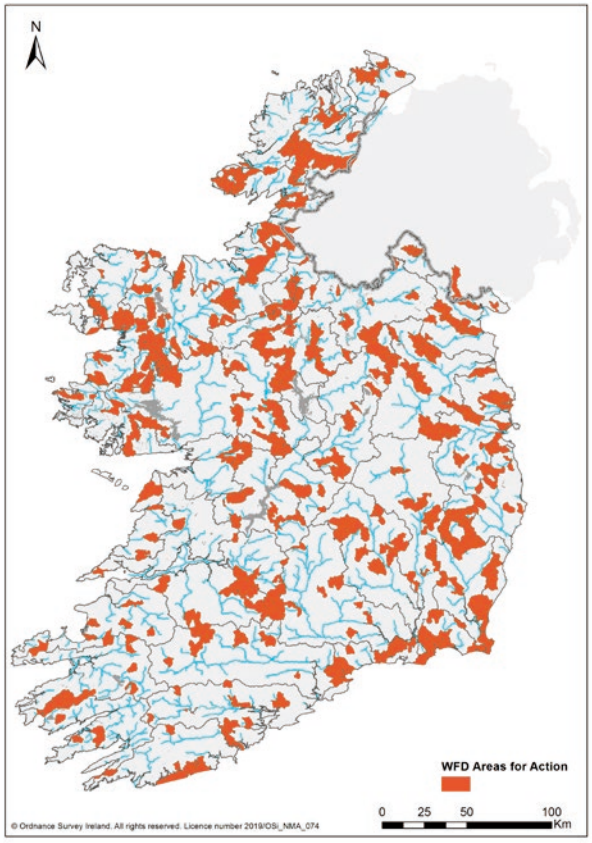
Implementing the Integrated Catchment Management Approach

The integrated catchment-based approach has prioritised a total of 190 areas for action under the National River Basin Management Plan 2018-2021.

One of the key strategies in implementing the RBMP has been the adoption of an integrated catchment-based approach. This is being led by LAWPRO, which is undertaking local catchment assessments in areas that have been prioritised for action in the RBMP. Each assessment includes a detailed desk study, field investigations and catchment walks. Public meetings are held in advance of any field work to inform the local community about the planned assessments and to seek its input. The purpose of the local catchment assessments is to determine what the water quality issues are and then to identify the activities and pressures causing them. Once these are known, the right measure can be put in place to address the water quality issue identified. When an action to improve water quality is identified, LAWPRO refers it to the relevant implementing body for follow-up. In total, 190 priority areas for action (PAAs) have been identified (see Figure 7.11). By the end of 2019, LAWPRO had progressed local catchment assessments in 90 of the 190 PAAs and identified referrals and action plans for 46 of them.

The objective set out in the RBMP is to deliver water quality improvements (e.g. a change in nutrient trends) in 726 water bodies located within the 190 PAAs and for 152 of these to have improved sufficiently to achieve good or high ecological status. The RBMP envisages that water bodies outside PAAs will benefit from existing and newly introduced measures such as the adoption of good agricultural practices and the provision of new and improved municipal wastewater treatment infrastructure.

Figure 7.11 Location of the areas for action prioritised in Ireland's River Basin Management Plan 2018-2021 (Source: EPA)



The Blue Dot Catchments Programme – Protecting our High status Waters

The Blue Dot Catchments Programme was established to improve the protection and restoration of high status water bodies whose status is declining more than that of other water bodies.

One of the most concerning water quality trends in recent years has been the continued loss of the highest quality (best of the best) river sites, which have suffered a tenfold decline since the late 1980s. These near-pristine unpolluted waters are important reservoirs of aquatic biodiversity and provide an important refuge for species sensitive to pollution. Over half are failing to meet their high status objective and over one-fifth of high status objective river water bodies have declined since 2015 (EPA, 2019a). The picture is even worse for lake and estuarine waters with one-quarter of high status objective lakes and just under half of high status objective estuaries having declined in status since 2015. The level of decline in high status objective water bodies is much greater than the 4.4 per cent decline in status seen nationally across all water bodies.

The Blue Dot Catchments Programme was established in 2019 under the RBMP specifically to improve the protection and restoration of these precious water bodies. A significant collaborative effort is now required from all stakeholders to ensure that the loss of these high status waters is halted and, where possible, reversed. A work programme has been developed by the newly established Blue Dot Catchments Programme to begin the process of developing strengthened actions in these catchments. The work of LAWPRO in PAAs will guide the level of local catchment assessment and actions required in these catchments.

The recently approved Water of Life integrated project, co-funded by the Irish Government and the European Commission, aims to support the implementation of measures to protect and enhance high status waters and thus support the work of the Blue Dot Catchments Programme. The project will act as a catchment-scale demonstration project to test and validate the effectiveness of implementing locally tailored, best practice measures across a range of land uses typically seen in the catchments of high status waters.

Agricultural Measures to Improve Water Quality and Reduce Nutrient Loss

Agriculture is the most common pressure affecting water quality and a significant response is required from this sector to reduce its impact.

Agriculture covers over 67.6 per cent of the land area of Ireland and is the most common significant pressure on water bodies that are failing to meet their environmental objectives.

Ireland's Nitrates Action Programme is designed to prevent pollution of surface waters and groundwater from agricultural sources and to protect and improve water quality. Ireland's fourth programme came into operation in 2017 and will be reviewed in 2021. The measures, which relate to livestock stocking densities, periods when land spreading of livestock manure is prohibited and setting levels for the storage of livestock manure, are given legal effect by the Good Agricultural Practice for Protection of Waters Regulations (S.I. No. 605 of 2017, S.I. No. 65 of 2018 and S.I. No. 40 of 2020).

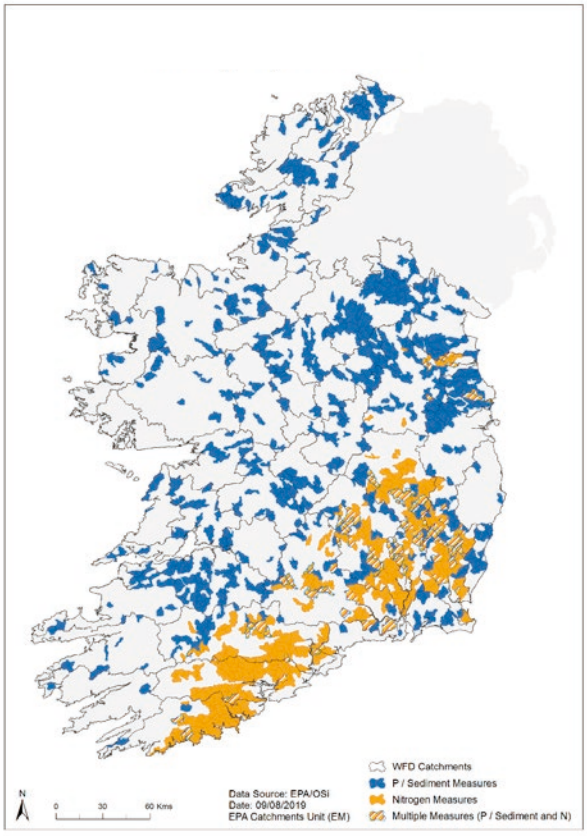
Under these Regulations, local authorities carry out approximately 3500 farm inspections every year while the Department of Agriculture Food and Marine (DAFM) carry out approximately 1600 under an agreement with Department of Housing, Local Government and Heritage. Among the group of farms selected for inspection by DAFM based on risk, over 21 per cent were found to have breached the regulations each year between 2016 and 2018. Of the breaches found in 2018, 56 per cent were due to the poor management of livestock manures and other organic fertilisers, 16 per cent were due to failure to minimise soiled water contamination and 12 per cent were due to structural defects in manure storage facilities. There is clearly room for improvement in the management of manures and organic fertilisers, while breaches for poor management of soiled waters can be solved by reasonably straightforward changes in the management of farmyards.

When LAWPRO identifies a water quality issue related to agriculture they notify ASSAP, which in turn works with the local farming community to identify where improvements in water quality can be made. This can involve a whole-farm assessment, which focuses on the significant water quality issue identified by LAWPRO. In this way, LAWPRO and ASSAP teams facilitate a highly targeted approach in terms of delivering the right measure in the right place to improve water quality. At the end of 2019, ASSAP had undertaken 1168 farm assessments in 68 PAAs.

The EPA is supporting these teams by providing the science-based evidence needed to target their efforts to get the best environmental outcomes. Information on hydrological setting and nutrient pathways has been used to identify where measures to reduce nitrogen and phosphorus losses from farmland need to be targeted (Figure 7.12).

Agri-environment schemes, such as the Green Low Carbon Agri-Environment Scheme (GLAS), and other initiatives, such as the dairy sustainability initiative, have the potential to reduce the loss of nutrients by increasing knowledge exchange on field-based nutrient management and the management of farmyard point sources. Finally, structural changes to the Common Agricultural Policy (CAP) and its greater emphasis on environmental sustainability is likely to lead to more sustainable farming practices. Furthermore, the recently adopted European Commission Farm to Fork strategy means that Member States will need to take into account the targets set in the strategy when preparing their CAP strategic plans. These targets include a reduction in nutrient losses from agricultural land of 50 per cent, a reduction in the use of artificial fertilisers by at least 20 per cent and a reduction in the use of chemical pesticides by 50 per cent, all by 2030. Furthermore, at least 25 per cent of the EU's agricultural land must be organically farmed by 2030. The role of agriculture in water quality and measures needed to address pressures from this sector are also covered in Chapter 13.

Figure 7.12 Locations where agricultural measures are needed to target nitrogen (N) and phosphorus (P) losses from farmland (Source: EPA)



Hydromorphology (Physical Alterations to Water Bodies and Habitats)

Methods are needed to assess the impacts that physical structures and changes to water bodies have on their ecology; solutions will also need to be implemented to address significant pressures.

Hydromorphological alterations that can affect the flow and structure of water bodies is the second most common pressure in at-risk water bodies (24%). As acknowledged in the RBMP, the effects of hydromorphological alterations on the ecology of surface waters needs to be better understood before effective management measures can be put in place.

One of the important steps in bridging this gap is the development of tools to assess the hydromorphological condition of surface waters, and good progress is being made in this regard with the development of assessment indices for both rivers and estuarine and coastal waters [e.g. River Morphological Quality Index (MQI) and TraC Hydromorphological Quality Index]. These indices provide a measure of hydromorphological change that will provide a basis for better understanding the impact of these changes on ecology. A knowledge of the relationship between ecology and hydromorphology will be required to develop environmental quality standards to help regulate activities that cause physical modifications and to select measures that will deliver ecological benefits to aquatic systems. These and other work packages, including the designation of heavily modified water bodies (and matching objectives) and the development of a monitoring programme, form part of the National Hydromorphology Work Programme led by the EPA.

In relation to river barriers, Inland Fisheries Ireland's National Barrier Programme has catalogued 73,055 structures nationally as potential barriers to fish passage. To date 15,700 of these potential barriers have been assessed and 2054 have been identified as barriers to fish passage. Since 2010 Inland Fisheries Ireland has instigated 50 large-scale barrier remedial works, removing 14 barriers, installing 29 fish passage solutions and creating three bypass channels to allow fish to pass.

Investment to Improve the Collection and Treatment of Urban Wastewater

There has been slow progress in addressing areas where wastewater has been identified as a significant pressure preventing water bodies from meeting their environmental objectives and in areas where untreated sewage is still being discharged into the environment.

Wastewater from urban treatment systems (including storm water overflows) is the third most significant pressure on at-risk water bodies (20%). Over the period 2017-2021, Irish Water committed to investing approximately €1.7 billion in wastewater projects, programmes and asset maintenance. This was to include investment in 255 wastewater treatment projects (to be completed by the year 2025), improvements in collection systems in 41 urban areas, and further investment and upgrades to existing plants. In devising its capital infrastructure plan, Irish Water has considered the objectives and priorities set out in the national RBMP. These include supporting the protection of protected areas (special areas of conservation, special protection areas, shellfish and bathing waters), supporting high status waters and preventing deterioration in the status of water bodies that are already meeting their objectives.

Progress in delivering these projects has been mixed. Of the 255 wastewater treatment projects identified for investment, 108 were completed by the end of 2019, a further 98 are scheduled to be completed by the end of 2024 and 48 are likely to extend to 2025 or beyond. As of 2019, Irish Water had yet to identify and schedule the improvements required to address almost half (23 of 48) of the areas where addressing wastewater is a priority for achieving water quality objectives. Repeated delays in completing essential work to eliminate discharges of raw sewage mean that it will continue to be released into the environment from 33 towns and villages beyond 2021.

Irish Water must reduce the time taken to put in place the required improvements and to eliminate the discharge of raw sewage to the environment. Extending the time to eliminate discharges of untreated wastewater prolongs the risks to the environment and public health. It is important to provide the outstanding infrastructure to end discharges of untreated wastewater without further delay. Irish Water must also complete the improvements needed to ensure that wastewater does not prevent receiving waters from meeting their environmental objectives.

Forestry Measures to Protect Water Quality

Forestry is the predominant pressure affecting high status water bodies, and further improvements in the sector are needed to reduce pressures on these nationally important water bodies.

Forestry is the fourth most common pressure in at-risk water bodies, affecting 238 water bodies or 16 per cent of the 1460 water bodies at risk. Furthermore, forestry is the predominant pressure affecting at-risk high status objective water bodies, which are typically located in the upper areas of catchments where forestry activities take place.

The Forest Service of the DAFM is responsible for consenting forestry activities in the state. The DAFM document *Forests and Water: Achieving Objectives under Ireland's River Basin Management Plan 2018-2021* outlines the principal forestry-related legislative, policy, regulatory and promotional elements now in place to address the challenges and opportunities for forestry set out in the RBMP. The aims of these measures are to safeguard water during all forestry operations, to restructure existing forests to protect water quality and to situate and design new forests, particularly native woodlands, in a way that contributes to achieving the environmental objectives set out in the plan.

The environmental enhancement of forests to support Water Framework Directive objectives is being supported through a number of policies, requirements and procedures, including the Land Types for Afforestation procedure, Environmental Requirements for Afforestation procedure, Acid Sensitivity Protocol, Felling and Reforestation Policy and most recently, Interim Standards for Felling and Reforestation (October 2019). Support schemes of relevance to water include the Native Woodland Establishment and Conservation Schemes, the Continuous Cover Forestry Scheme and the Agro-Forestry Scheme. Initiatives such as the Woodland for Water model and the Woodland Environmental Fund are also highly relevant: the former provides a vision for using new native woodland to protect water, and the latter encourages major businesses and public bodies to become involved in encouraging private landowners to create new native woodland under the Native Woodland Establishment Scheme.

Lough Ouler, Co, Wicklow

In practical terms, measures include restructuring of conifer forests at the clearfell/reforestation stage to include larger water setbacks, the direct conversion of existing conifer stands into native woodland (where appropriate), the creation of new native woodlands and agro-forests on sites adjoining watercourses, and a stronger focus on unplanted setbacks alongside important watercourses. Through the Land Types for Afforestation procedure, afforestation has been redirected away from the more marginal upland water-sensitive sites that would have been planted in the past. Restrictions on operations such as on-site drainage and cultivation, herbicide and fertiliser application, temporary and permanent crossings, and the on-site location of potentially hazardous material have been clarified and strengthened, as have the use of other measures to reduce flow velocities and to aid the retention of silt and nutrients on site. In addition, the operation of the Forestry Appeals Committee, independently of the DAFM, enables referral bodies and third parties to appeal an approval before work commences, while the application of an internal procedure is helping to ensure a rapid and targeted Department response to any ongoing incident creating concerns for water quality.

Domestic Wastewater Treatment

The high failure rate encountered in septic tank inspections by local authorities (as high as 48% in 2016) indicates that significant improvements are required to reduce pollution from these systems.

Domestic wastewater treatment systems used by rural householders to treat sewage are a significant pressure for 11 per cent of at-risk water bodies. There are nearly 500,000 septic tank systems nationally serving a population equivalent of 1.4 million people. In 2017 and 2018, as part of the National Inspection Plan, 2371 septic tank inspections were carried out by local authorities in areas that are considered to be at greater risk of pollution from these systems (see Chapter 14). Nearly half (1135) of the septic tanks inspected failed to meet the required standard (EPA, 2019b), indicating that significant improvements are required to reduce pollution from these systems.

The EPA has advised householders that they should ensure that their systems are properly built and maintained, fix systems that fail inspections (nearly one-third of systems that had previously failed inspection remain unfixed) and ensure that their sewage does not pollute their well. Local authorities must continue to complete their inspections under the National Inspection Plan and have an effective enforcement system in place to ensure that householders fix systems that fail inspection.

A grant scheme has been in place since 2013 to support householders to undertake remedial work on septic tanks that fail inspection under the National Inspection Plan. The scheme has been expanded to support the water quality objectives set out in the RBMP. This includes households with defective septic tanks located within high status objective catchment areas and households in PAAs where LAWPRO teams have identified their systems through their catchment assessments as potential pollution sources.

Improving Governance and Public Participation

Citizen science and river trusts are being promoted as means to engage with communities in protecting water quality.

In addition to the measures addressing significant pressures, the governance structures for implementing the Water Framework Directive have been reformed through the creation of a three-tiered structure comprising government departments, national agencies and local authorities. The RBMP also places significant emphasis on public engagement, and several initiatives have been put in place including the appointment of community water officers (put in place in 2016) in LAWPRO, the creation of a Community Water Development Fund (in 2018) and the establishment of An Fóram Uisce – the Water Forum (in 2018) – a national platform for public engagement on all matters relating to Ireland's water resource.

Other initiatives include actively encouraging the participation of volunteers and citizen scientists. For example, there are now a number of rivers trust charities stretching from Donegal to Wexford (e.g. Slaney Rivers Trust, Nore Suir Rivers Trust, Blackwater Rivers Trust, Waterville Lakes and Rivers Trust, Maigue Rivers Trust, Moy Rivers Trust, Erne Rivers Trust and Inishowen Rivers Trust). Local volunteers are involved in projects ranging from looking at the effectiveness of natural water retention measures (Inishowen Rivers Trust) to tackling the impact of invasive species (e.g. giant hogweed on the River Maigue) and working with landowners to reduce river bank erosion as a result of livestock access (Moy Rivers Trust). Further information on the Rivers Trust network in Ireland and the UK can be found at https://www.theriverstrust.org/

Citizen science projects include the Dragonfly Ireland 2019-2024 project, which is seeking volunteers to record sightings of dragonflies and damselflies along our waters, and the Explore Your Shore project, which is looking for volunteers to identify the different types of animals and plants found in seashore rockpools. These citizen science projects are being led by the National Biodiversity Data Centre and funded by the EPA. Further information on the two projects is available at www.biodiversityireland.ie[2] and www.ExploreYourShore.ie

Work being carried out to monitor and protect Ireland's water quality also links closely with Goal 6 of the United Nations Sustainable Development Goals and its targets and indicators covering water quality and integrated water resource management.

2 *https://www.biodiversityireland.ie/projects/monitoring-scheme-initiatives/dragonfly-ireland-2019-2024/*

Water Research

Research is helping to inform measures to protect water quality.

Since 2016, the EPA has funded 65 new research projects relevant to the Water area; an investment of €15.4 million. These were funded mostly under the Water Pillar of the EPA Research Programme 2014-2020. The topics covered included the evaluation of ecosystem services (ESManage), managing invasive alien species, assessing the extent of barriers on river connectivity (ReConnect), assessing the use of Earth observation to assess lake water quality (Infer), the use of drones to take lake water samples and *in situ* measurements (DroPLEts), the detection and monitoring of contaminants of emerging concern (IMPACT), assessing the benefits of natural water retention measures in the Irish landscape (SLOWWATERS), guidelines to encourage better operation of septic tanks, use of biophysical models to improve water quality forecasts in lakes (PROGNOS) and along the freshwater-marine continuum (Land2Sea), and finding measures to restore water bodies and water habitats (Macro-Man, CLEAR, SWAMP).

During 2020 several new EPA research reports have been published that are relevant to the topics covered in this chapter. They include the research reports below which are available on the EPA research publications webpage: https://www.epa.ie/pubs/reports/research/water/

Research 330: COSAINT: Cattle Exclusion from Watercourses: Environmental and Socio-economic Implications http://www.epa.ie/researchandeducation/research/researchpublications/researchreports/research330.html

Research 312: Incorporation of Ecosystem Services Values in the Integrated Management of Irish Freshwater Resources: ESManage https://www.epa.ie/pubs/reports/research/water/research312.html

This research helps to identify the main pressures damaging the health of the aquatic environment and the solutions needed to address these pressures. Further information is available at http://www.epa.ie/researchandeducation/research/ and water-related EPA research reports are available at http://www.epa.ie/pubs/reports/research/water/

Several projects co-funded by the Irish Government and the EU are working with farmers and other local stakeholders to improve water quality in their catchments. A number of EU co-funded European Innovation Partnership (EIP) projects, such as Mulkear EIP, Duncannon EIP and Duhallow EIP, are supporting local farmers to work collaboratively with other stakeholders to develop catchment-sensitive farming practices to improve local water quality. The Duhallow EIP has a focus on protecting and restoring high ecological status waters of the Allow river catchment, while the Duncannon EIP is specifically looking at measures to help restore the blue flag status at Duncannon beach. The Freshwater Pearl Mussel (EIP) project is incentivising farmers to adopt good land management practices to help protect the freshwater pearl mussel. The amount that farmers are paid is linked to the nature quality of their farm. The higher the nature value of their farm, the higher the payment. Further information on these projects can be found on the respective project websites. Although these projects are operating in local catchments on specific issues, the important thing will be to ensure that the lessons learned from them help to inform the selection of measures needed to protect and restore water quality across the country.

5. Outlook

Significant Progress Is Needed to Reach the Environmental Objectives and Legal Requirements of the Water Framework Directive

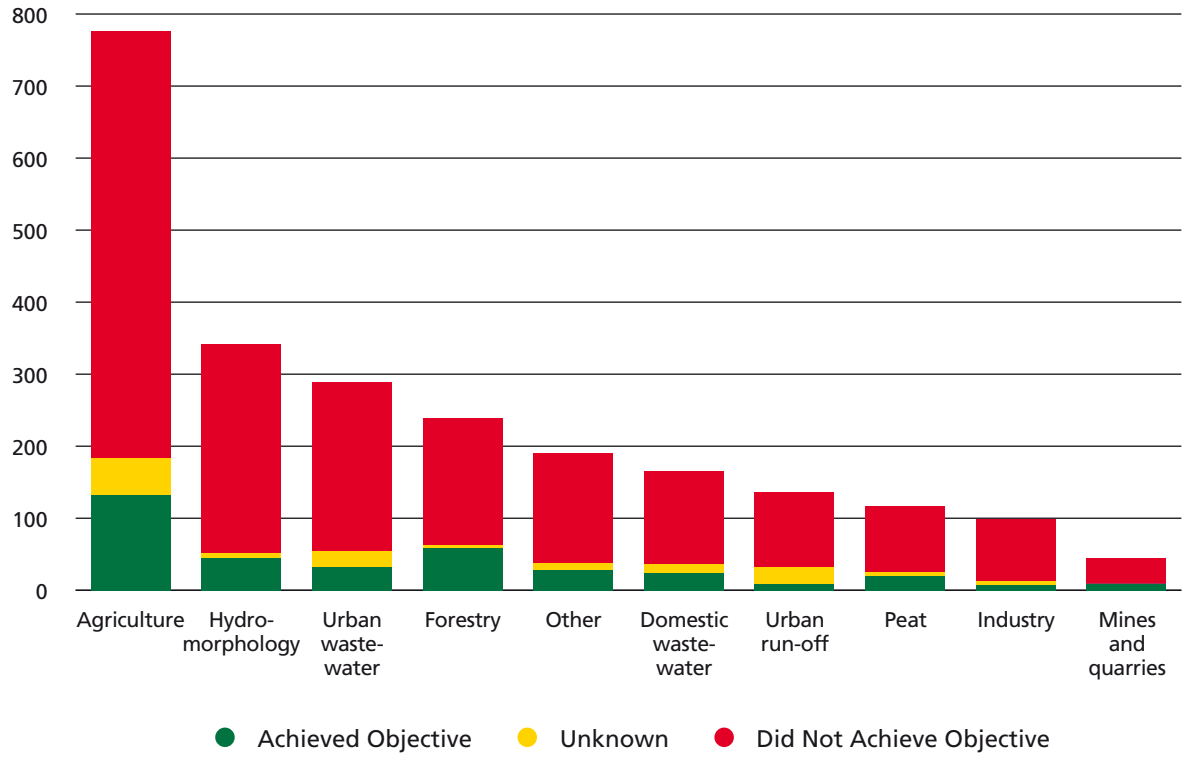
While overall water quality has deteriorated nationally, in the most recent assessment undertaken by the EPA there were some positive signs in the prioritised areas for action.

The river basin management planning process identified 1460 water bodies as being at risk of not meeting their water quality objectives because of the damage being caused by significant pressures. The most recent assessment of the condition of these waters shows that 16.5 per cent (242) of these water bodies are now meeting their environmental objectives and are no longer considered to be at risk (EPA, 2019a). However, the significant proportion of water bodies still at risk highlights the magnitude of the challenge that remains (Figure 7.13).

While overall water quality deteriorated nationally in the most recent assessment undertaken by the EPA (EPA, 2019a) there was an overall net improvement in river water quality in the PAAs in the RBMP. This suggests that when action is taken to improve water quality it delivers results. The current plan runs to 2021, so there will be another year's worth of monitoring data to determine the overall impact of these measures in this second RBMP cycle. Many of these improvements have been achieved as a result of the ongoing efforts of local authorities and other public bodies in these areas. Further improvements are expected as the LAWPRO and ASSAP programmes mature.

The challenge now must be to learn from the successes seen in PAAs and apply them nationally to reverse the negative trends we are seeing in water quality. We must also ensure that the knowledge gathered in water-related research projects and EIPs, as outlined above, is used more widely to provide solutions to water quality problems and to inform policy development in this area.

Figure 7.13 Progress made in each sector since 2016 in addressing the significant pressures on Ireland's aquatic environment (Source: EPA)



Targeted Approaches and Existing Legislation Must Be Fully Implemented to Reduce Pressures on Water Bodies

Nutrients inputs from different sectors need to be reduced across the board to improve water quality.

Managing the additional pressures that are likely to come with the expansion in certain sectors (e.g. Food Wise 2025 and Food Strategy 2030 in the agriculture sector and planned expansion in forestry) will be difficult when existing pressures are already causing a net decline in the quality of our surface waters.

In agriculture, the current expansion in the size of the national herd means that additional measures are required to reduce nutrient pollution from this sector. The nature of these measures will depend on the nutrient in question and the landscape setting. For nitrogen, the riskiest areas are the freely draining soils, and the approach must be to reduce the loss of nitrogen from source, for example by reducing the use of artificial fertiliser. This can be achieved by improving soil fertility and better nutrient management planning. For phosphorus, the riskiest areas are the poorly draining soils, and in these areas measures are needed to break the pathway between the source of phosphorus and the receiving water body. For example, strategically located buffer zones can prevent pollutants from entering waterways. These, and other approaches can be used to ensure that the right measures are being applied in the right place. These measures can also have multiple benefits for other environmental objectives. For example, reducing the use of chemical nitrogen fertiliser can have benefits for greenhouse gas reduction and improvement of air quality, while buffer zones to intercept phosphorus can also have benefits for biodiversity. In parts of the country with different soil types and physical settings, however, these measures may be less effective in preventing water pollution. It may not always be possible to put measures in place to intercept surface flows of phosphorus or prevent nitrogen from seeping into groundwaters and reaching sensitive downstream water bodies. This means that some areas of the country are more vulnerable to nutrient pollution and less suitable for agricultural intensification.

In addition to nutrient pollution, changes to the physical nature of water bodies and water habitats through direct physical modifications or as a result of excessive sedimentation must also be addressed. While progress is being made in assessing the hydromorphological condition of surface waters, further work is required to better understand what measures are required to address hydromorphological impacts and to inform the development of regulatory systems for activities that physically modify water bodies.

There are still too many areas where discharges of inadequately treated sewage from urban wastewater treatment systems are harming the environment and putting public health at risk. Progress has been slow in addressing areas where wastewater from urban treatment systems has been identified as a significant pressure preventing water bodies from meeting their environmental objectives and in areas where untreated sewage is still being discharged into the environment. The rate at which wastewater treatment infrastructure is being delivered must improve and must target those areas that would benefit the most in terms of protecting the environment and public health.

In forestry, the greater awareness of water-related issues being displayed by the sector is encouraging. The challenge now is to ensure that the environmental conditions stipulated in forestry licenses are being adhered too while at the same time encouraging and supporting the uptake of forestry-related environmental schemes such as the Native Woodland Establishment Scheme and Forestry for Water Measure.

The EPA is undertaking the next round of characterisation in preparation for Ireland's third RBMP Plan 2022-2027. This information will be used to identify the water bodies at risk from significant pressures and the measures needed to address these pressures over the period of the next plan.

Buffer zone to prevent pollution from entering the river

6. Conclusions

Water Quality under Significant Pressure

The findings presented in this chapter indicate that the quality of Ireland's surface water resource is under significant pressure from human activities. Overall, just over half (52.8%) of its surface waters are in good or better ecological health, which means that just under half (47.2%) are failing to meet their environmental objectives. An analysis of the pressures has found that the main activities affecting the quality of Ireland's surface water and groundwater resource are agriculture, hydromorphological alterations, discharges from urban wastewater treatment plants and forestry.

Continued Decline in Ecology of Water Bodies

These activities are damaging the ecological health of our rivers, lakes and estuaries. Of most concern is the increase in the number of water bodies with poor ecological status, which have increased by one-third since 2009, and the continuing loss of our high status river water bodies, which have declined by one-third since 2009. The loss of our high status waters continues the unwelcome longer term trend seen in the loss of our most pristine river waters, whose sites have declined tenfold since the late 1980s. Currently there are only 20 such sites left in the country.

Climate Change likely to Exacerbate the Damage caused to Rivers and Estuaries by Water Pollution

The continuing decline in the ecological health of our surface waters, and in particular our rivers and estuaries, is associated with impacts from various human activities. Both water categories are being damaged by increasing nutrient levels and physical alterations, while our rivers are being further affected by siltation and pesticides. The combined effects of these different stressors mean that these waters are not as clean or healthy as they should be and, as a result, their capacity, or resilience, to recover from further pollution impacts or external shocks is greatly reduced. These shocks will intensify in the context of climate change as more extreme weather brings extremes in water temperatures and water flows, which are likely to exacerbate the damage caused by underlying water pollution.

Reduce Nutrient Inputs to Protect Water Quality

The challenge now is to ensure that our waters are as clean, healthy and resilient as they can be. This can be achieved by reducing nutrient inputs from agriculture and wastewater treatment and delivering on the key objectives of the Water Framework Directive. We need effective action as part of the River Basin Management Plans to ensure that the current decline in water quality is halted and that the condition of our most polluted waters is improved. We must continue to focus on the protection of our remaining high status waters and prioritise the restoration of water bodies that have recently declined to poor and bad status. This can be achieved by ensuring that the right measures are put in place to address the significant pressures damaging the quality of our waters.

Water Catchment-based Approaches

The establishment of the Local Authority Waters Programme (LAWPRO) and the adoption of a catchment-based approach to managing water resources are now the main platforms for dealing with water quality issues. The efforts of LAWPRO, working in collaboration with the Agricultural Sustainability Support and Advisory Programme (ASSAP) and other public bodies, including the EPA, now means that we are developing a comprehensive understanding of where and what the problems are and how to address them.

Fully Implement River Basin Management Plan

Actions are being taken across all pressure types and sectors, but significant work in all sectors remains. The challenge now is to ensure that the actions set out in Ireland's national River Basin Management Plan 2018-2021 are fully implemented. This will deliver not only benefits for water quality but also multiple benefits for human health and the broader environment in terms of drinking water quality, biodiversity and climate change.

Chapter Highlights for Water Quality

Ireland has seen a continuing decline in high status water bodies and an increase in the number of water bodies in poor ecological health. Even more stark is the dramatic reduction in the number of our most pristine rivers, which have fallen in 30 years from over 500 sites in 1990 to only 20 sites in 2020. Rapid action is needed to protect our remaining pristine sites before they are lost. More urgent focus also needs to be given to protecting our estuaries, as these water bodies have the worst status overall and specific measures for their improvement and protection should be identified and implemented.

The decline in river water quality is being driven primarily by nutrient pollution coming from agriculture and wastewater systems. Fertiliser spreading, slurry spreading and other nutrient losses that are causing pollution need to be covered by tighter measures in the next River Basin Management Plan and Nitrates Action Programme. Irish Water must ensure that the necessary wastewater infrastructure is in place and is not causing pollution, as legally required in EPA authorisations.

Overall, water quality has declined in Ireland, despite the actions taken to date to reverse this trend. Continued targeted action at local water catchment level that is based on science is key to improving water quality. The Local Authority Waters Programme and Agricultural Sustainability Support and Advisory Programme have key roles in implementing this targeted action and providing guidance at water catchment and farm levels to improve water quality. There also needs to be a national focus on measures to deliver solutions that protect and restore all water bodies.

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