Chapter 5

Inland and Marine Waters

Inland and Marine Waters

Introduction

Ireland has abundant surface water resources, with over 70,000 km of river channel, 12,000 lakes, 850 km^2 of estuaries and 13,000 km^2 of coastal waters.[1] Groundwater is also abundant, occurring almost everywhere and supplying 20-25% of water supplies nationally.

The state of Ireland's groundwater and surface waters is assessed based on a comprehensive and representative water quality monitoring programme designed to support the implementation of the river basin planning process under the Water Framework Directive (WFD) (2000/60/EC). The network consists of over 3500 monitoring sites covering groundwater, rivers, canals, lakes, estuaries and coastal waters. The Environmental Protection Agency (EPA), local authorities, Inland Fisheries Ireland, the National Parks and Wildlife Service, Waterways Ireland and the Marine Institute are responsible for implementing the programme.

The aims of the WFD are to maintain high and good status waters where they exist, prevent any deterioration in the existing status of waters, manage water bodies based on river basins or catchments to achieve at least good status in accordance with the environmental objectives set out in River Basin Management Plans (RBMPs) and involve the public.

This will be achieved by identifying key threats to water quality on a catchment basis, improving implementation of existing directives and developing new evidence-based measures for mitigation of threats supported by national and local level schemes and initiatives.

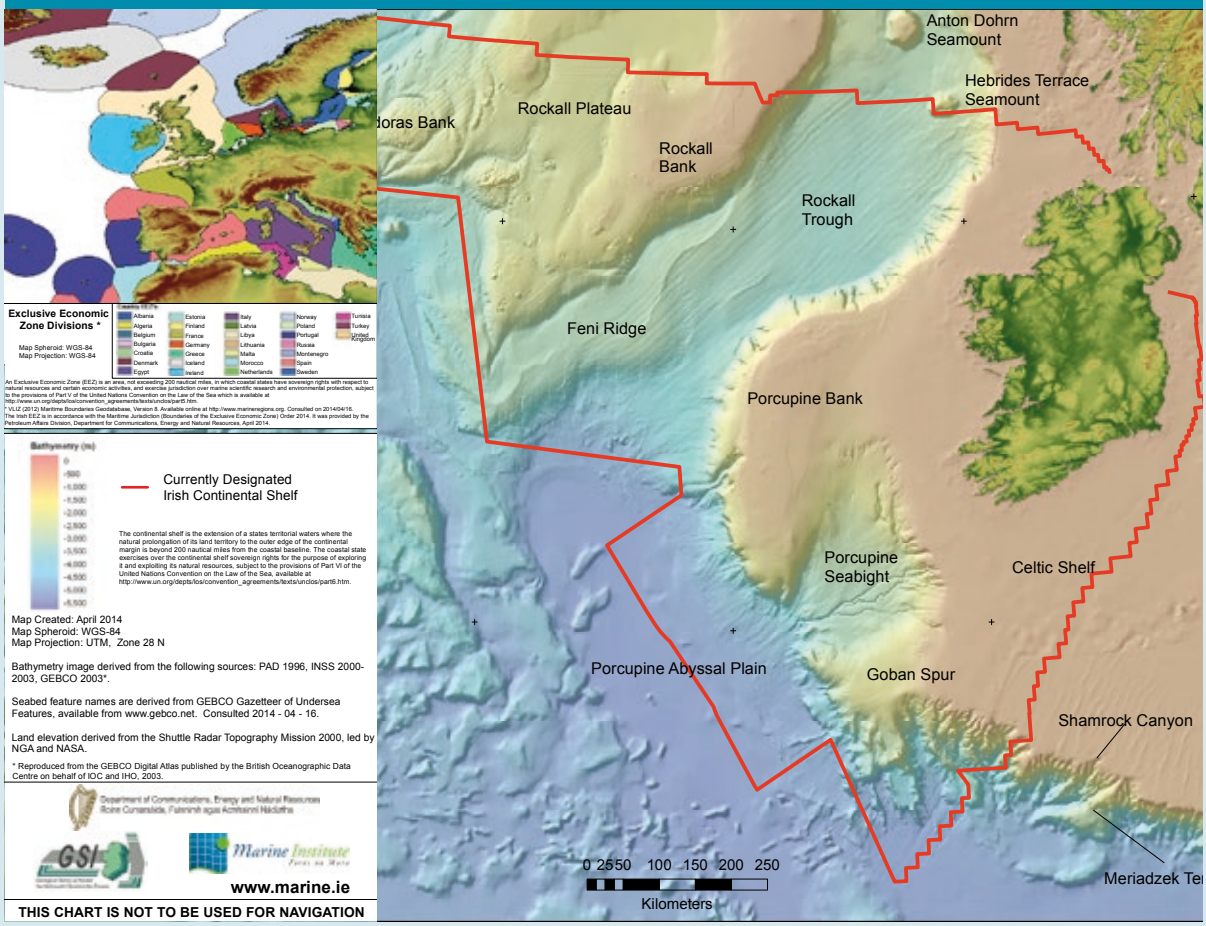
The Marine Strategy Framework Directive (MSFD) has similar aims to the WFD for the protection of the marine environment beyond the areas considered under the WFD. It requires the application of an ecosystem-based approach to the management of human activities, enabling a sustainable use of marine goods and services. It requires Ireland to describe, monitor and assess what are clean, healthy and productive seas, i.e. Good Environmental Status, and ensure that appropriate action is taken by 2020 to maintain or achieve this status. The Department of Housing, Planning, Community and Local Government is the lead body for the implementation of the MSFD and is supported by a number of other departments and state agencies, including the Marine Institute (MI).

1 Coastal waters refer to waters within 1 nautical mile of the coastline.

Ireland's Marine Environment

Ireland's marine environment is one of the largest in the European Union (EU) and is nearly 10 times its land area. The coastline is at the interface between the land and sea, with shallow estuaries that extend into the coastal zone and out to the continental shelf to the west, which plunges to depths of over 4000 metres.

Figure 5.1 The Real Map of Ireland (Source: Marine Institute)



The temperate waters that surround Ireland are highly productive and provide a sustaining foundation for a rich mosaic of marine life, including hundreds of species of invertebrates and fish, 24 species of whales and dolphins, breeding colonies of both the common and grey seal and some of the largest breeding populations of seabirds in western Europe.

Ireland's location in the Atlantic Ocean on the edge of the European continent has meant that, in comparison with many other European countries, its marine environment has remained relatively unpolluted. In recent years, however, the level of environmental stress, from both internal and external sources, has increased. Coastal development and industrialisation, particularly during the 1990s, has resulted in an increase in the range and magnitude of pressures that have the potential to impact negatively on the quality of Ireland's tidal waters.

Pressures have also come from the intensification of agriculture and commercial fishing. The application of inorganic fertilisers and changing farming practices have caused nutrient enrichment of inshore surface waters, and, in the fishing sector, the use of new technologies and larger modern trawlers has allowed the capture of unsustainable quantities of fish. The continued release of untreated sewage into the marine environment from several large towns is a major cause of concern for coastal communities and ecosystems. In addition, the impacts of climate change pose a significant and not yet fully understood threat to this environment.

In this chapter, the results from various monitoring programmes are used to assess the impact of human activities on the tidal water environment (as well as the freshwater environment). The key pressures assessed include the discharge of nutrients and other contaminants, dredging, marine litter, commercial fishing, aquaculture and the effects of climate change. Information on these specific pressures and impacts is presented to provide an overview of the general environmental status of estuarine, coastal and offshore waters around Ireland.

Current Situation

Overall assessments show significant challenges ahead in bringing all waters up to a satisfactory level and to protect waters already in good condition.

The quality of Irish groundwater and surface waters is among the best in Europe[2] (Figures 5.2 and 5.3).

Figure 5.2 Proportion of Classified Surface Water Bodies (Rivers and Lakes) in Different River Basin Districts Holding Less Than Good Ecological Status or Potential (Source: EEA, 2015)

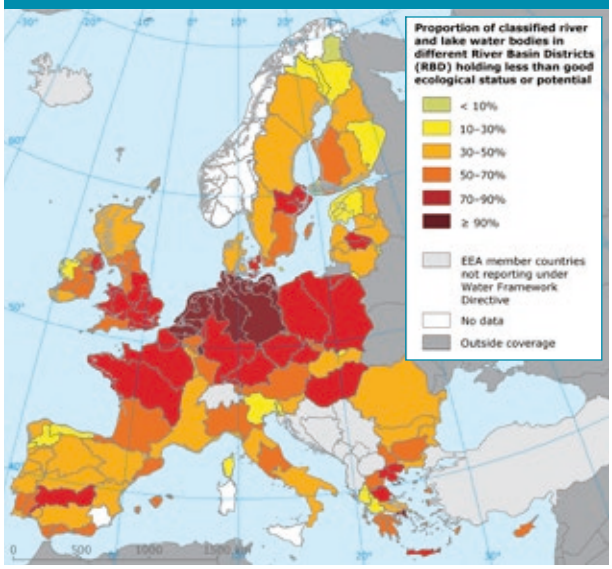
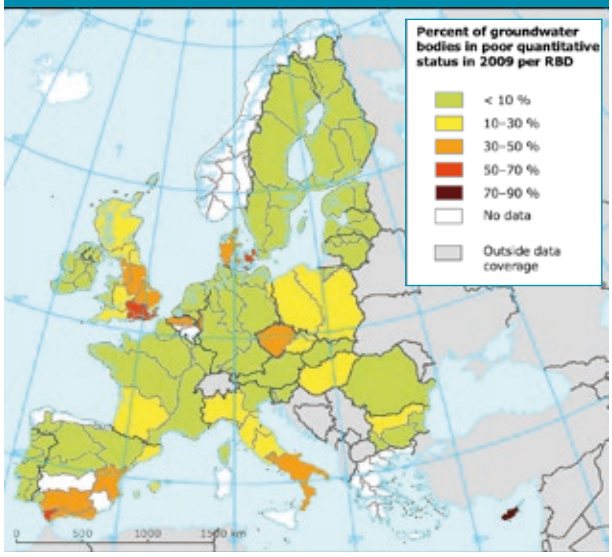


Figure 5.3 Percentage of Groundwater Bodies in Poor Quantitative Status in 2009 per River Basin District (Source:EEA, 2015)



However, there are many impacts that need to be addressed to bring all waters up to a satisfactory level and to protect waters already in good condition. Ireland is fortunate to have such good-quality waters in comparison with many of our European neighbours, and our future wealth and prosperity is very dependent on us maintaining and strengthening this position. With regard to biodiversity, species considered to be most under threat are those linked to wetlands and those that are sensitive to water pollution (see Chapter 4).

Preliminary results indicate that there has been no overall improvement in water quality over the first river basin planning cycle.

Rivers

Substantial loss in the number of highest quality river sites.

Under the Water Framework Directive a substantial number of chemical and biological elements are assessed to determine the overall status of waters. One of the key elements for rivers is the macroinvertebrate fauna found within the waters and this is monitored and assessed in Ireland using the EPA Q value method. The macroinvertebrate Q value method has been employed in the assessment of Irish rivers over a long period and it enables trends in the quality of river waters to be viewed over the last two decades. In the Water Quality in Ireland Report covering the period between 2010 and 2012 (EPA, 2015b) a welcome improvement was found in the length of unpolluted channel increasing by 4%. Unfortunately this improvement has not been maintained and the length of unpolluted channel has reverted to the levels found between 2007 and 2009. Despite minor variations in each monitoring period overall levels of pollution remain relatively constant since the beginning of the 1990s (see graph below). Some improvements have been made with the length of seriously polluted channel being reduced to just over 6 km in the 2013 to 2015 period compared with 17 km between 2010 and 2012 and 53 km between 2007 and 2009.

While overall the length of unpolluted river channel has remained relatively constant there has been a substantial loss in the number of sites where the highest quality river sites are found (i.e. Q value of 5). In the most recent monitoring period (2013-2015) only 21 sites were classified as the highest quality rivers (0.7% of sites) compared with 575 between 1987 and 1990 and 82 between 2001 and 2003. This is an area where substantial effort is required to protect the few remaining highest quality rivers and, where feasible, return impacted ones back to their earlier extremely high quality.

Further assessment is required to determine the overall status of river waters to take account of all other elements including other biological, chemical ones. This full assessment will be provided in the next water quality in Ireland report (covering 2013 to 2015).

2 *www.eea.europa.eu/themes/water*

Figure 5.4 Trends in the 13,300km Baseline for Rivers Nationally in the Four EPA Biological Quality Classes Based on the Macroinvertebrate Q Value Method Results (Source: EPA, 2016a)

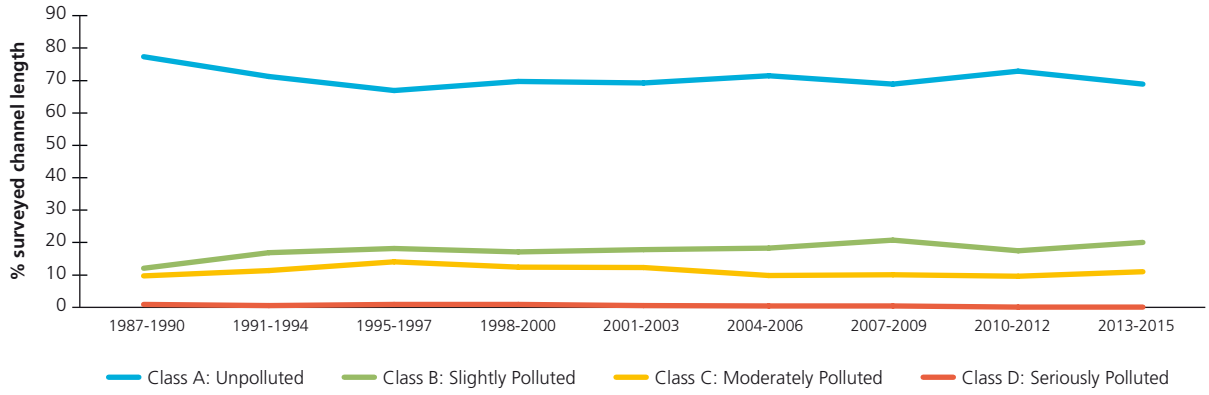
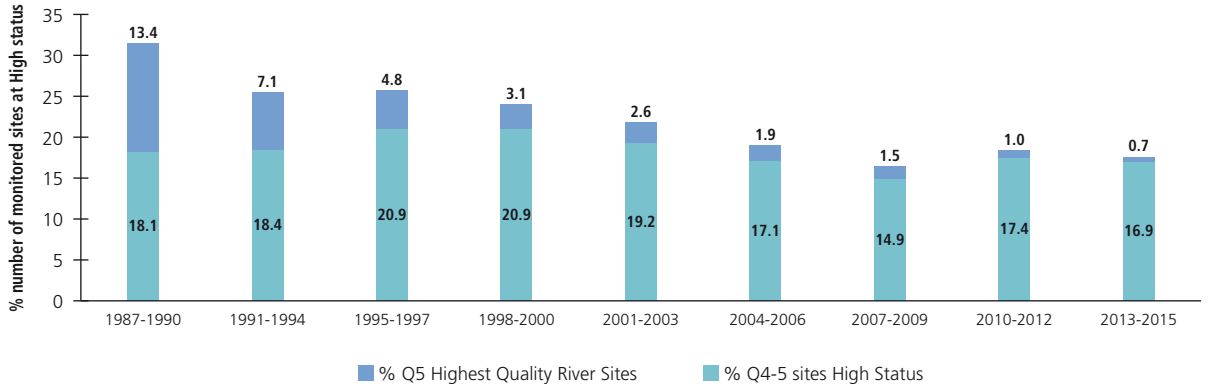


Figure 5.5 Long Term Trends (1987-2015) in the Percentage Number of High Ecological Quality (Macroinvertebrate) River Sites (Q5 and Q4-5) in Each Survey Period (Source: EPA, 2016a)



Transitional (Estuarine) and Coastal Waters

Ecological assessment covering the period between 2010 and 2015 indicate little change in the quality of our transitional (estuarine) and coastal waters.

Preliminary results from a full 6-year ecological status assessment covering the period between 2010 and 2015 indicate little change in the quality of our transitional (estuarine) and coastal waters. A preliminary assessment using information from all transitional and coastal monitored water bodies was used to extrapolate the results to unmonitored ones. For coastal waters, the number of water bodies at High or Good status has increased from 68% in 2012 to 76% in 2015 due to the recovery of certain water bodies from algal bloom impacts. In terms of surface area assessed there has been no change with 93% of coastal water area at high or good status. In transitional waters, 47% of water bodies remain at moderate or worse status which is the same as was found during the last assessment.

Lakes

An increase of 3% in the moderate or worse category for lakes.

Preliminary results for 2013-2015 water status assessment show 54% of monitored lakes are impacted (moderate or worse ecological status) (EPA, 2016a). This represents an increase of 3% in the moderate or worse category for lakes compared with the baseline of 2007-2009.

Groundwater

Only 1% of groundwater bodies have poor chemical status because of elevated phosphorus levels or historical contamination from mining activities and industrial development (EPA, 2015b).

Overview of Water Quality Findings

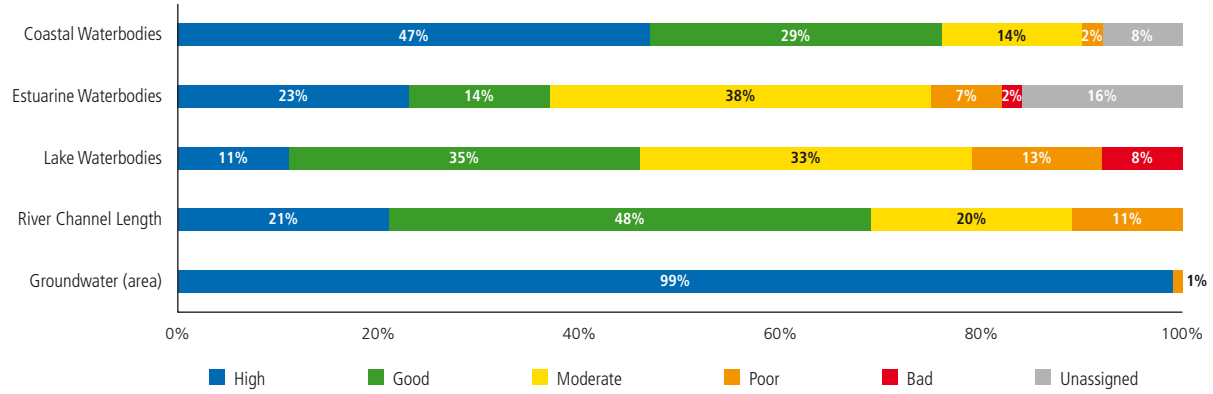
Elevated nutrient concentrations (phosphorus and nitrogen) continue to be the most widespread water quality problem in Ireland, arising primarily from human activities such as agriculture and waste water discharges to water from human settlements, including towns, villages and rural houses. The level of pollution from hazardous substances is low.

In summary, based on preliminary analysis of the most recent datasets, there has been no improvement in river water quality (based on Q values) or transitional and coastal water quality over the past six years (Figure 5.6). Lake water quality has gotten slightly worse with a 3% reduction in the number of monitored lakes at satisfactory status. While a full WFD assessment will not be available until later in 2016 it is clear that insufficient progress is being made with improving Ireland's surface water quality.

Preliminary results for 2013-2015 and other key findings in the EPA water quality report (2010-2012) were:

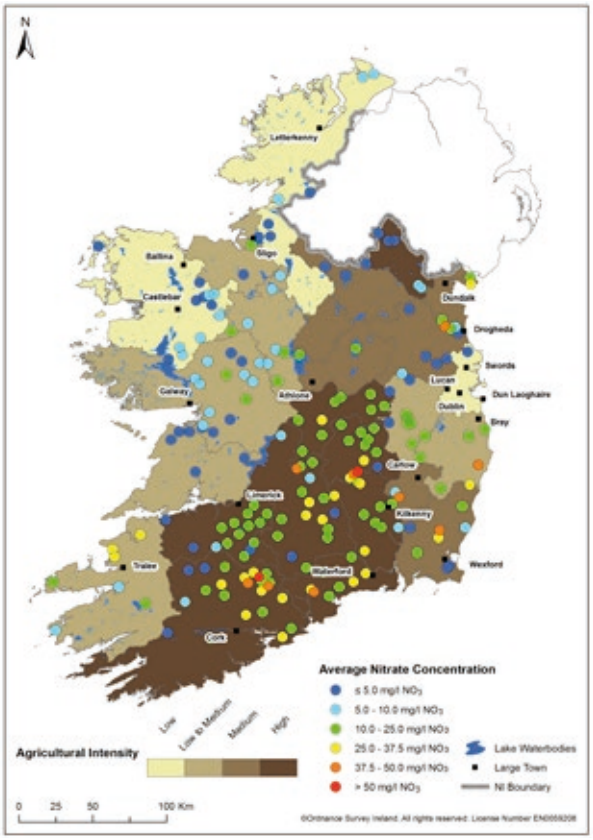
- There has been a gradual decline in high-status river sites across Ireland. Numbers halved in the 22-year period between 1987 and 2015 (Figure 5.5) with the most dramatic losses occurring in the highest quality sites (Q5 sites). These sites represent the best-quality rivers across Ireland, and therefore their continuing loss is a very significant concern.
- Seriously pollution of rivers has fallen to just over 6 km compared to 17 km in 2010-2012 and 53 km 2007-2009.
- Reported fish kills have declined to an all-time low of 70 between 2010 and 2012 (EPA, 2015b).
- Water quality in canals remains very high, with over 90% of canals rated satisfactory in 2012.
- The south and south-east of the country continue to have the largest proportion of groundwater and rivers with elevated nitrate concentrations over 10 mg/l NO_3. This contributes to eutrophication in certain downstream estuaries.
- In 2012, 18% of monitored rivers and 27% of monitored lakes were less than good status due to fish status. Preliminary assessment suggests that barriers to fish migration and physical deterioration of habitats may be partly to blame.
- In 35% of designated shellfish waters with elevated faecal contamination, additional measures to improve quality and achieve higher objectives are required.

Figure 5.6 Water Assessment for Rivers, Lakes, Estuaries Coastal Waters (2013-2015) and Groundwater (2010-2012)[3] (Source: EPA, 2016a)



3 For this figure river water quality is solely based on Q values. Lake data only covers monitored lakes.

Figure 5.7 Nitrate Concentrations in Groundwater in 2014 (Source: EPA, 2016b)



A recent assessment found that there continues to be a very clear spatial pattern of elevated nitrate and phosphorus concentrations in groundwater (Figure 5.7), rivers, lakes and estuarine waters, giving rise to water quality problems across Ireland (EPA, 2016b). Concentrations of both nitrate and phosphorus tend to be elevated in the north-east, south-east and south of the country and lower towards the west, north-west and south-west. There is a clear correlation between the areas with the highest nitrate and phosphorus concentrations in waters and areas with the most intensive agriculture and highest human population densities.

Drivers and Pressures

Eutrophication

Eutrophication caused by excessive nutrients is the main threat to the quality of our waters.

Eutrophication, which is caused by nutrient enrichment, remains the most significant issue for surface waters. Excessive nutrient concentrations can lead to eutrophication impacts, including accelerated growth of algae and plants, leading to ecological impacts in rivers, lakes and marine waters, such as reduced oxygen levels and loss of sensitive aquatic species. Phosphorus tends to drive eutrophication impacts in freshwaters, while nitrogen tends to drive eutrophication impacts in coastal waters, although there are exceptions. Eutrophication remains the most significant pollution issue for surface waters in Ireland.

Excessive loads of nitrogen and phosphorus can arise from a number of sources. The two most important suspected causes of pollution in rivers are agriculture and municipal sources, accounting for 53% and 34% of cases, respectively (EPA, 2015b).

Levels of nitrogen and phosphorus in groundwater and rivers have been mostly stable and decreasing since 2007. Riverine inputs to transitional waters and coastal waters have also shown declines. Nutrient inputs to rivers, particularly from the agriculture sector, have fallen: nitrogen levels have fallen by 18.7% and phosphorus levels by 37.7%. Anticipated increases in pressures due to human population growth and increase in agricultural output will need to be carefully managed to build on these trends.

Threats to Improving Water Quality

Improvements in water quality will not be seen if agricultural pressures are not adequately managed.

The ongoing and planned expansion in the agricultural sector under Food Harvest 2020[4] and its successor, Food Wise 2025,[5] may threaten improvements in water quality, if not adequately managed. The dairy sector has been set a target of increasing milk production by 50% by 2020. Under the expansion plans, increased application of nitrogen and phosphorus to agricultural land is likely to happen in areas of the country where the concentrations of these nutrients in water are already elevated. The challenge is to target management measures to prevent any increases in nitrate and phosphorus concentrations in waters. Both Food Harvest 2020 and Food Wise 2025 acknowledge that there is a risk to water quality if the expansion of agricultural sector is not managed in a sustainable manner.

Urban Waste Water

Our treatment of sewage and industrial waste water (water that is discharged to sewers) continues to be one of the principal pressures on water quality in Ireland.

A recent report found that urban waste water continues to be one of the principal pressures on water quality in Ireland (EPA, 2015a). With regard to the impact of receiving waters, the number of seriously polluted river sites where pollution is attributed to urban waste water discharges fell from nine in 2009 to one in 2014. Of the total number of incidents reported to the EPA, 72% related to breaches of discharge quality standards. 42% of these incidents were attributed to insufficient treatment capacity and 21% of incidents were attributed to operational and management practices. Raw sewage discharges from 45 urban areas were highlighted as a priority issue to be eliminated by 2019. By the end of 2015 the number of raw sewage discharges was reduced to 43 locations. The report concluded that continued investment in infrastructure and a reversal in the recent decline in capital expenditure are essential to provide the waste water treatment necessary to protect receiving waters and meet obligations under EPA authorisations and European Directives. Waste water discharges also contributed to poor water quality at 6 of Ireland's 137 identified bathing waters (EPA, 2016c).

Inland Fisheries Issues

Fisheries resources deliver economic and social benefits to the Irish economy.

Despite the ever-increasing pressures on our fisheries, Ireland still possesses a wealth of inland and sea fisheries resources. Apart from their innate value, these fisheries resources also deliver economic and social benefits to the Irish economy in the form of job creation, social inclusion and tourism revenue. Recreational angling in Ireland is estimated to contribute approximately €836 million to the Irish economy every year (Inland Fisheries Ireland, 2015).

The long-term conservation of our national fisheries resources requires the maintenance of healthy and ecologically viable ecosystems. There are a number of key concerns that are undermining the ecological integrity of water bodies and the national fisheries resources (King *et al.*, 2011). These include poor water quality, barriers to fish migration (particularly for a number of protected species), land management practices causing adverse physical changes to fisheries habitat (instream and bankside), changes in the quantity and dynamics of water flow caused by flow regulation and abstraction, invasive alien species that impact on native fish populations and the collapse of eel populations seen across Europe.

Marine Litter

Not only does litter spoil the beauty of our coastlines but the impact on marine life can be far more serious and insidious.

While marine litter can have a very obvious impact on the aesthetic quality of coastal amenities, the impact on marine life can be far more serious and insidious. It is estimated that plastic litter kills an estimated 100,000 marine mammals and turtles worldwide every year, including 30,000 seals, and up to one million seabirds, through either entanglement or ingestion. Litter on the Irish coast comes from a variety of sources, both land and sea.

The Department of Housing, Planning, Community and Local Government undertakes an annual longitudinal litter survey at four locations, four times every year in accordance with OSPAR methodology. Marine litter is one of the descriptors (10/11) to prove Good Environmental Status (GES) in the Marine Strategy Framework Directive (MSFD) (2008/56/EC).

According to the latest OSPAR annual report (OSPAR, 2015), over 16 beach surveys have shown no improvement in litter levels over previous years. Details of historical surveys can be viewed on the OSPAR Marine Litter Database.[6] Tackling marine litter requires an integrated response, but key to this will be solutions governing waste management practices. This is covered in more detail in Chapter 6.

4 *www.agriculture.gov.ie/publications/2011/annualreviewandoutlookforagriculturefisheriesandfood20102011/nationaldevelopments/foodharvest2020/*

5 *www.agriculture.gov.ie/foodwise2025/*

6 *www.mcsuk.org/ospar/*

Dredging of Marine Harbours and Marinas

Material that is dredged and dumped at sea has to be licensed and monitored.

The removal of seabed material for maintenance and navigational purposes is a common occurrence in harbours and marinas around Ireland. In 2013, approximately 350,000 tonnes (dry weight) of material was dredged and deposited at four licensed disposal sites around the Irish coast (OSPAR, 2015). As part of the licensing process, sediment chemistry of dredged material must be analysed to ensure that release of harmful contaminants at the disposal site is minimised. The quantity of dredged material dumped at sea each year is reported to the OSPAR Commission by the Marine Institute.

Marine Fisheries and Aquaculture

An important sector for the economy in Ireland, but there are a number of key environmental pressures to resolve to ensure sustainability.

In 2014, the value of commercial fish and shellfish landings was just under €346 million, with landings of demersal (bottom feeders) and pelagic (openwater feeders) species contributing just over €250 million of the total (Source: SFPA[7]). In the aquaculture sector, the value of production in 2014 was €116 million; this is less than the peak value of €131 million achieved in 2012.

The most obvious pressure on the environment from fishing is the harvesting of target species and the unintentional catching of non-target fish species and other species such as cetaceans, seals, seabirds and benthic organisms. Fishing activities such as trawling and dredging can injure or kill benthic organisms and can result in damage to and destruction of habitats.

The main issues in relation to aquaculture are the effects of discharges of uneaten fish-food material and fish waste from fish farms, the introduction and spread of disease and parasites and the use of chemotherapeutics and anti-fouling agents. Other issues include the introduction of alien species, the impact of escaped farmed salmon on the genetic integrity of wild stocks and the visual impact of aquaculture facilities on the aesthetic quality of the environment.

Impacts of Commercial Fishing

It is estimated that 36% of commercial fish stocks are sustainably fished, but 26% of stocks are overfished.

Fishing impacts are assessed every year in the Marine Institute's annual Stock Book.[8] This collates information on fishing pressures and the biological state of commercially exploited species.

The 2015 Stock Book reports that, of 72 commercial stocks, 36% are considered to be sustainably fished. Overfished stocks have declined to 26%, and 38% remain at an unknown status. Nineteen per cent of commercial species are considered to have been depleted.

The International Council for the Exploration of the Seas (ICES) recently published (Source ICES, 2016[9]) an ecosystem overview of the Celtic Sea, which includes a large part of the Irish Exclusive Economic Zone (EEZ) (see Figure 5.1). It found that:

- Overall fishing pressure on the commercial fish and shellfish stocks in the Celtic Sea ecoregion has decreased since its peak in 1998.
- Overall biomass of commercial fish and shellfish stocks in the Celtic Sea has increased since the late 1990s.
- The fishing footprint and the average number of times the seabed is trawled per year have reduced.

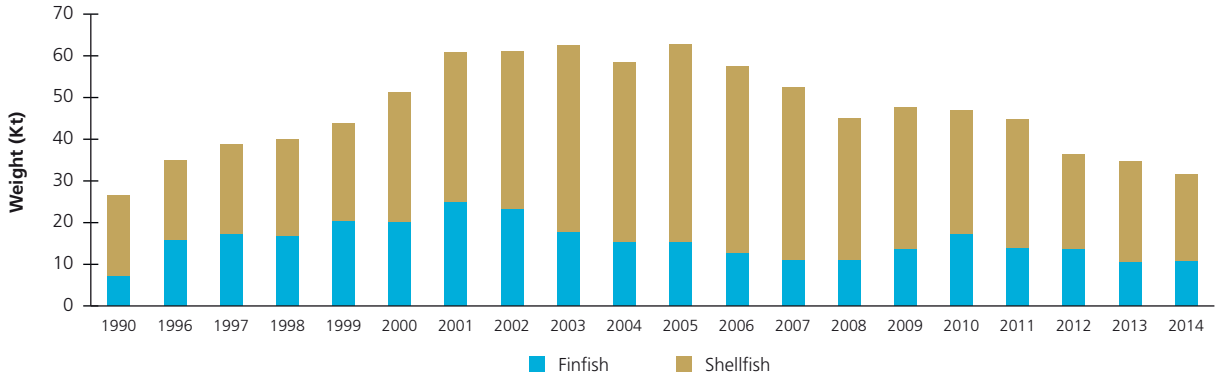
However, there are still a number of species with very low spawning stocks in some areas, particularly cod, whiting, sole and herring. According to the ICES ecosystem overview: "Several fish species have been depleted by fishing in the past and are now on the OSPAR list of threatened and declining species, including spurdog *Squallus acanthias*, common skate complex *Dipturus* spp., angel shark *Squatina squatina*, porbeagle *Lamna nasus*,

7 *www.sfpa.ie/Sea-FisheriesConservation/FisheriesStatisticsandQuotaUptake/AnnualLandingStatistics.aspx*

8 *oar.marine.ie/handle/10793/1121*

9 *www.ices.dk/sites/pub/Publication%20Reports/Advice/2016/2016/Celtic_Sea_Ecoregion-Ecosystem_overview.pdf*

Figure 5.8 Aquaculture Production Between 1990 and 2014 (Source: BIM)



and some deep-water sharks. Although there are zero Total Allowable Catches or prohibited listings for these species, several of them remain vulnerable to existing fisheries."

Sea Fishing By-catch

New controls are in place to try to end the practice of discarding fish back into the sea.

The landing obligation was introduced under the Common Fisheries Policy (CFP) to try to end the practice of discarding fish back into the sea if they are too small or are not the targeted species or if the fisherman had no quota for them. This was put in place for pelagic species in 2015 and, since January 2016, this obligation is being phased in for certain demersal fisheries, including Norway lobster (Nephrops), hake, cod, haddock, whiting and saithe, common sole and plaice, each subject to catch limits.

Once a stock falls under the landing obligation, all catches must be landed and counted against quota. Catches of fish below minimum size cannot be sold for direct human consumption, but may be sold for other purposes, such as bait or fish meal, and are still deducted from quota. Here the intention is to discourage the catches of such fish in the first instance through improved selectivity or avoidance.

Impacts of Marine Aquaculture

Protecting wild fisheries and preventing pollution of the seafloor and associated impacts on benthic communities near fish cages are two key environmental challenges facing the sector.

In 2014, aquaculture production of shellfish and finfish species was 34,469 tonnes and had a value of €116 million (Source: BIM[10]). Ongoing development and an increase in production are key parts of the Food Harvest 2020[11] strategy, and potential increases in aquaculture production volumes of 78% have been estimated. Inputs to the aquatic environment associated with this industry include feedstuffs, veterinary medicines and anti-fouling agents. A certain portion of these may be lost to the waters and sediments in the vicinity of the fish farms.

One of the most contentious issues in relation to the aquaculture of salmonids is the suggested link between the production of sea lice (*Lepeophtheirus salmonis*) on fish farms and the decline in wild sea trout populations in the west of Ireland. Research carried out in Ireland and Scotland suggests that sea lice from salmon farms are a major contributory factor in the collapse of wild sea trout populations (McKibben and Hay, 2002; Penstan *et al.*, 2002; Gargan *et al.*, 2003).

The initiation of sea lice monitoring and the adoption of a number of measures (e.g. annual fallowing of sites, synchronous treatment) based on a single bay management (SBM) approach saw an initial downwards trend in the levels of sea lice on salmon farms between 1991 and 2001. This trend was reversed between 2002 and 2007, before levels declined sharply again between 2008 and 2013, with lice levels in 2013 being the lowest on record (O'Donoghoe *et al.*, 2015). In 2014, levels increased substantially, but it is not possible to comment on the significance of an increase based on the findings in just one year.

The release of organic material in the form of fish waste and uneaten foodstuffs from fish farms in shallow-water environments has been shown to have an impact on the benthos in the vicinity of cage structures. While low levels of organic loading can encourage increased benthic productivity, the high levels associated with fish farming can result in reduced biodiversity and a proliferation of bacterial growth. Increased bacterial activity can lead

10 *www.bim.ie/media/bim/content/publications/BIM%20Aquaculture%20Survey%202014.pdf*

11 *www.agriculture.gov.ie/publications/2011/annualreviewandoutlookforagriculturefisheriesandfood20102011/nationaldevelopments/foodharvest2020/*

to hypoxic (low oxygen) or even anoxic (no oxygen) conditions directly below the cages. Of the licensed marine finfish sites surveyed during 2012, 2013 and 2014, 79%, 88% and 66%, respectively, were considered compliant with the environmental standards identified in the benthic monitoring protocol[12] for the status of the seafloor and benthic communities in the vicinity of finfish operations (F. O'Beirn, Marine Institute, June 2016, personal communication).

Responses

River Catchment Planning

Implementation of locally based river catchment planning is the key to protecting water quality.

A key theme identified by the Blueprint to Safeguard Europe's Water Resources was the need for those responsible for managing water resources to improve governance (EC, 2012). There is general acceptance that the governance arrangements put in place in Ireland to deliver the first cycle of RBMPs were not effective. Arrangements were overly complex and responsibilities were poorly defined, with no single body having overall responsibility for developing the plans and overseeing delivery of the programmes of measures.

This has been remedied by a new three-tier governance structure[13] (Figure 5.9), the merging of the River Basin Districts through legislation to form one national River Basin District and a single national approach for the development of RBMPs for the second cycle (Figure 5.10). In relation to the North Western and Neagh Bann International River Basin Districts, a single administrative area is being established in the south for the purpose of co-ordinating water management with authorities in Northern Ireland. A Local Authority Water & Community Office (LAWCO) has now been established operating from three regional locations. Key to delivery is a focus on local level action centred on catchments.

Underpinning the new water governance arrangements for managing water is the integrated catchment management approach, which complements the river basin planning process. It approaches sustainable resource management from a catchment perspective, in contrast to a piecemeal approach that artificially separates land management from water management. Other supporting initiatives include the establishment of a National Implementation Group, a Water Policy Advisory Committee and a Catchment Management Network to promote information sharing and collaboration across all organisational bodies and consistent implementation of the plans.

Figure 5.9 New Governance Structure for Managing Water Resource in Ireland[14]

Tier 1: National Management and Oversight

- Led by the Department of Housing, Planning, Community and Local Government
- Policy, regulations and resources
- Sign-off of River Basin Management Plans

Tier 2: National Technical Implementation and Reporting

- Led by EPA
- Monitoring, assessment and reporting
- Evaluation and implementation of measures
- Template for River Basin Management Plans
- Monitoring of enforcement tasks and environmental outcomes

Tier 3: Regional Implementation via Water Networks

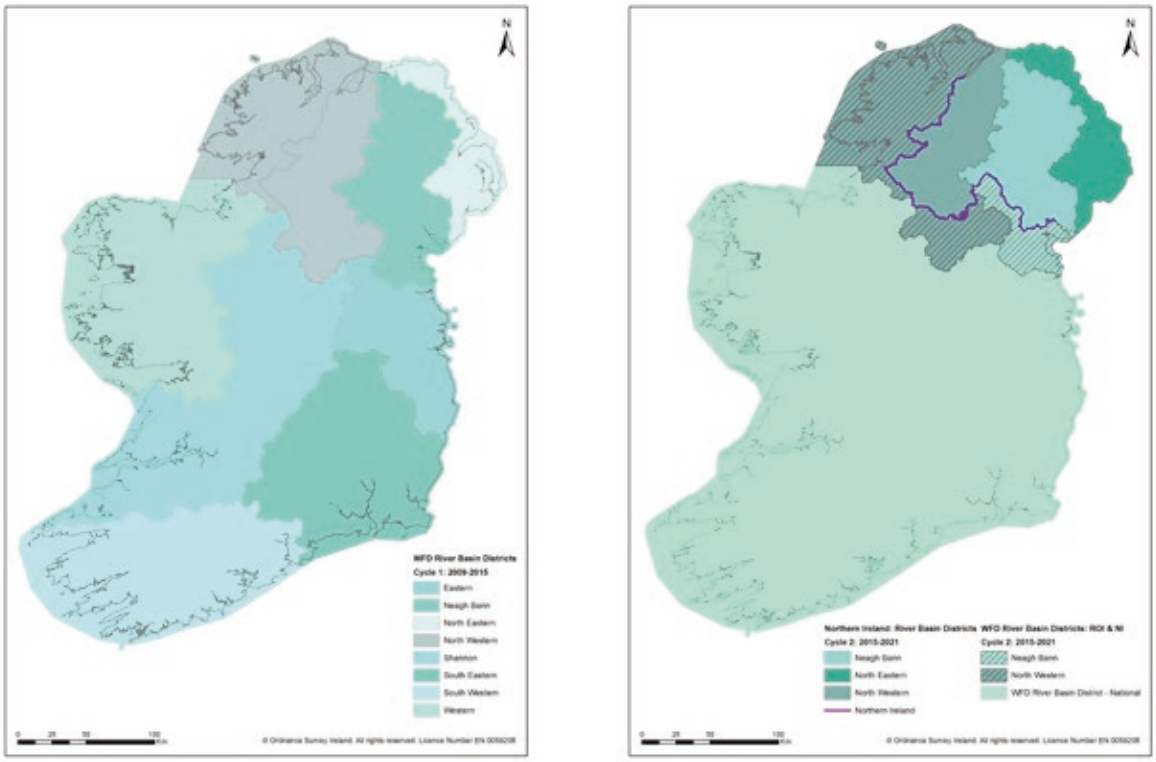
- Led by the lead Coordinating Authority
- Local authority monitoring, licensing and enforcement actions
- Detailed River Basin Management Plans
- Implementation of Programme of Measures by relevant public bodies, tracking and reporting, in consultation with EPA

12 *www.agriculture.gov.ie/media/migration/seafood/aquacultureforeshoremanagement/marinefinfishprotocols/Benthic%20Monitoring.pdf*

13 The Minister for Housing, Planning, Community and Local Government has now established a new three-tier governance structure, the basis of which is set out in statute in the European Union (Water Policy) Regulations 2014 (SI 350 of 2015).

14 Environ.ie – *www.environ.ie/water/water-quality/water-framework-directive/water-framework-directive*

Figure 5.10 Changes in the Number of River Basin Districts in the Republic of Ireland Between (a) Cycle 1 (2009-2015) and (b) Cycle 2 (2016-2021) (Source: EPA)



Tackling Diffuse Pollution

Diffuse Pollution

Diffuse pollution is pollution that arises from a variety of non-point sources.

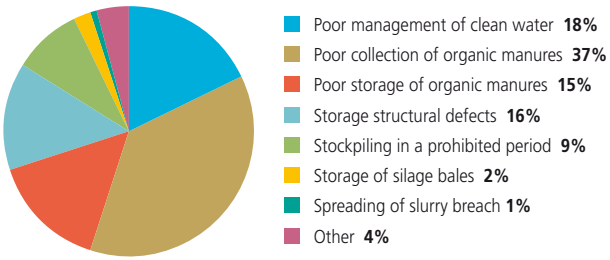
Diffuse pollution occurs when potentially polluting substances leach into surface waters and groundwater as a result of rainfall, soil infiltration and surface runoff. The source of this pollution, usually a result of recent or past activity on land, is the widespread input of diverse types of contaminants. Typical examples of diffuse pollution include the use of fertiliser in agriculture and forestry, pesticides from a wide range of land uses, contaminants from roads and paved areas and atmospheric deposition of contaminants arising from industry.

Agriculture

Farm inspections highlight key areas in need of improvement to protect water quality.

In 2012, 53% of suspected cases of pollution in rivers were attributed to agriculture (EPA, 2015b). Farm inspections carried out by, or on behalf of, local authorities under the good agricultural practices regulations have fluctuated around 3500 per year between 2007 and 2014. Among farms selected for inspection based on risk, over 30% each year were found to have breached the good agricultural practice regulations. In comparison, a random sample found breaches in between 18% and 21% over this period. Of the breaches found in 2014, 52% were due to the poor management of livestock manures and other organic fertilisers (Figure 5.11), while 16% were due to manure storage structural defects. Based on these figures, there is clearly room for improvement in the management of manures and organic fertilisers on a significant proportion of farms. A further 18% of breaches were simply due to poor management of clean waters. Many of these issues can be solved by reasonably straightforward changes in the management of farmyards.

Figure 5.11 Reasons for Breaches of The Good Agricultural Practices Regulations in 2014 (Source: Agricultural Inspections Working Group)



Assessing the Impact of Cattle Access to Streams

Cattle access to riparian areas and watercourses is often considered a pressure which can increase both nutrient and sediment input to streams (Figure 5.12). There is increasing evidence that siltation of river beds is a significant contributor to deterioration in the ecology of rivers in Ireland. Fenced riparian buffer measures to exclude cattle have been included in most European Agri-Environmental Schemes, including the Green Low-Carbon Agri-Environment Scheme (GLAS) in Ireland (see below). However, although riparian mitigation measures (including fencing) are commonly implemented, few studies have evaluated their effectiveness. The EPA has commissioned the research project Cosaint to investigate the issue. The aim of this project is to assess the environmental, ecological and socio-economic impact of existing and potential measures that prevent cattle access to watercourses.

The Agricultural Catchments Programme (ACP)[15] led by Teagasc has been operating since 2007. Its purpose is to provide a scientific evaluation of the effectiveness of the EU Nitrates Directive National Action Programme measures and underpin the basis for any modifications of the measures that might be required to achieve water quality objectives. It will continue to run at least until 2019.

Rural Development Programmes

Rural development programmes are an important means to address specific water protection issues.

Three schemes or initiatives with the potential to contribute to the protection and enhancement of water quality are the new national agri-environmental scheme, GLAS,[16] the new national LEADER initiative (2014-2020) for the protection and sustainable use of water resources and the planned introduction of Locally Led Agri-Environment Schemes (LLAES).

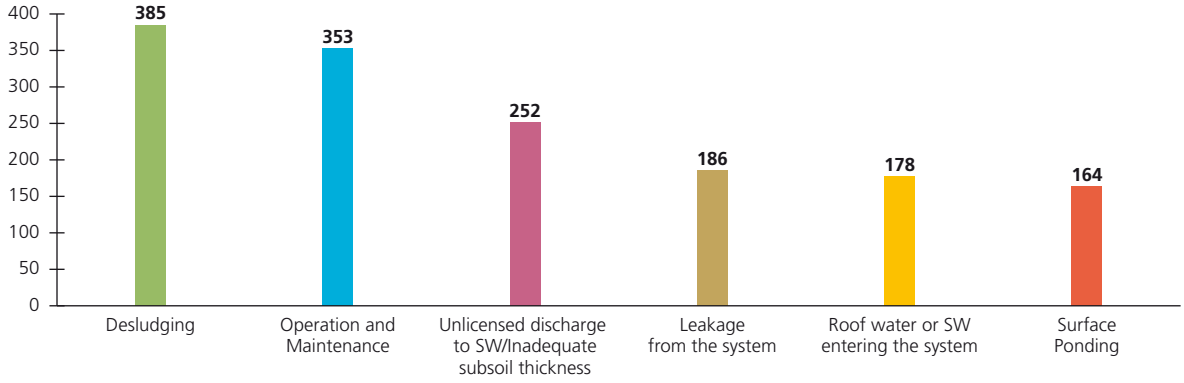
GLAS promotes agricultural actions which introduce or continue to apply agricultural production methods that aim to address issues including water quality (Chapter 12). Key to its design is the identification of a number of Priority Environmental Assets (PEAs), including high-quality watercourses. The presence of one or more of these assets on any farm guarantees priority access to the new scheme but, in return, all required actions to protect and enhance these assets must be undertaken.

LEADER is a method of mobilising and delivering rural development in local rural communities. LEADER uses a bottom-up or community-led local development approach to rural development. One of the LLAES under consideration is for the protection of designated freshwater pearl mussel populations, which are under significant threat.

15 *www.teagasc.ie/agcatchments/*

16 Green Low Carbon Agri Environment Scheme

Figure 5.12 Reasons for Failures of Inspections of Domestic Waste Water Treatment Systems (July 2013 to December 2014) (Source: EPA)



Domestic Waste Water Treatment Systems

A national inspection programme for septic tanks highlights room for significant improvement in how people manage domestic waste water treatment systems.

Following the introduction of legislation dealing with the registration and inspection of septic tanks in 2012 a national inspection plan has been implemented [Water Services (Amendment) Act, 2012]. By the end of 2014, a total of 1,559 inspections had been carried out (EPA, 2015c). One of the main findings from the inspections is the lack of general routine maintenance of systems. The low level of de-sludging of tanks and issues surrounding the operation and maintenance of systems were the main reasons for inspection failures (Figure 5.12). A reversal of this trend in many cases requires simple actions by homeowners rather than a structural change to the waste water treatment system. Of relevance to water protection is that 16% of all systems inspected failed because either they were unlicensed discharges to surface water or because they had inadequate soil thickness for attenuating pollutants. These types of situations are difficult and/or expensive to correct.

Tackling Point Source Pollution

Urban Waste Water Treatment

Despite ongoing improvements in urban waste water treatment plants and the effluent discharged is not up to standard in many locations.

Waste water must be treated prior to being released back into the environment in order to remove contaminants that could otherwise pose a risk to the environment or public health. The EU Urban Waste Water Treatment Directive of 1991 (91/271/EEC) sets out requirements for the collection, treatment and discharge of urban waste water, with the objective of protecting the environment from the adverse effects of waste water discharges.

The EPA is the environmental regulator responsible for the licensing, authorisation and enforcement of urban waste water discharges. The EPA has issued over 1,000 waste water discharge authorisations to date[17]. Irish Water/Uisce Éireann is the national water utility responsible for the provision and development of water services, including the collection, treatment and discharge of urban waste water. These responsibilities, together with duties to comply with the requirements of all waste water discharge authorisations issued by the EPA, were transferred from the local authorities to Irish Water at the beginning of 2014.

17 EPA Licence or Permit Document Search Facility: EPA: Environmental Protection Agency, Ireland

In 2014, a total of 12 (7%) large urban areas did not meet the Urban Waste Water Treatment Directive requirement to provide secondary (biological) treatment (EPA, 2015a). Seven large urban areas did not comply with the Directive's requirement to provide infrastructure to reduce nutrients and discharged effluent that did not meet nutrient quality standards. Untreated sewage was discharged from 45 areas, mostly estuaries or coastal areas. Twenty-seven of these are located in counties Cork, Donegal and Galway. Three of these raw sewage discharges were treated by the end of 2015, but one extra location was added to the list. In terms of effluent quality, 143 (82%) large urban areas complied with the mandatory EU effluent quality and sampling standards. Just 24% of the waste water load discharged into sensitive areas from large towns and cities complied with mandatory EU nutrient quality standards, up from 17.5% in 2013. This is well below the EU average of 88% compliance for nutrients (EC, 2016). Dublin and Cork were the major contributors to this low rate of compliance.

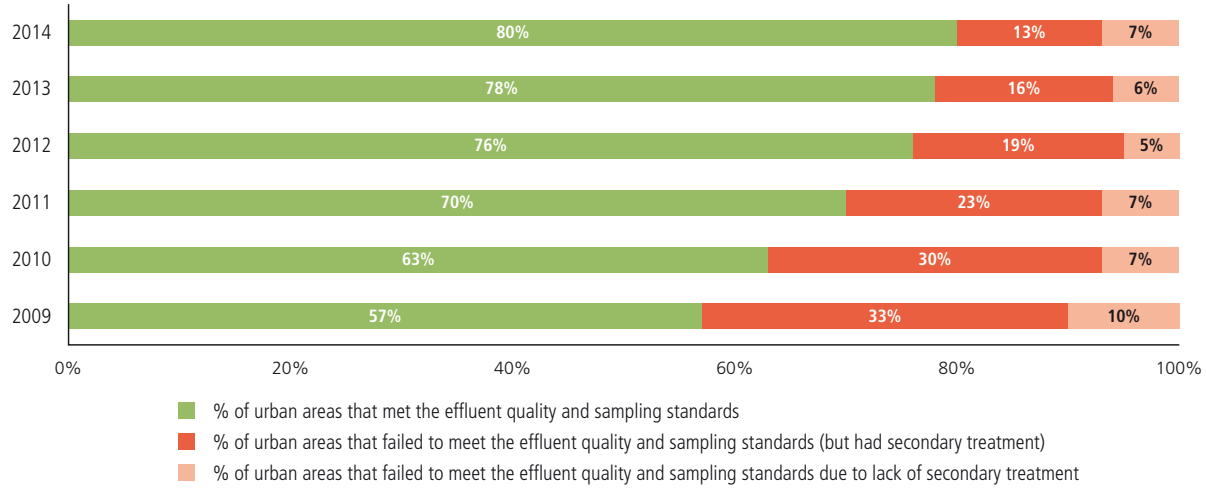
Although BOD (biological oxygen demand), COD (chemical oxygen demand) and TSS (total suspended solids) are still far from compliance with effluent quality and sampling standards in the Directive, the recent trend of improving compliance continued in 2014, as illustrated in Figure 5.13, which shows national compliance rates at large urban areas for the years 2009 to 2014.

When the performance of waste treatment plants is examined, it is apparent that treatment of waste water at coastal and estuarine locations needs improvement, as investment in these areas has lagged behind discharges to freshwater surface waters. Updated data for 2015 shows that 36 of the urban areas discharging untreated sewage and 10 large towns or cities (with some type of treatment) that failed the Directive's effluent quality standards discharge to estuarine or coastal locations (EPA, 2016d).

EPA Water Research Programme

The EPA Water Research programme has a strong focus on policy and has been driven by national regulations and European directives. A sustained Water Research Programme is an essential component of Ireland's role in protecting its water resources and meeting its

Figure 5.13 Compliance of 174 Large Urban Areas with BOD, COD and TSS (Source: EPA)



requirements under water-related EU directives and national policies. The EPA has funded over 100 research projects with a total commitment of approximately €20 million for 2007-2015 under its Water Research Pillar, which covers groundwater, surface water, and transitional and coastal water, as well as waste water, drinking water, bathing water and shellfish waters.

Ireland is funding emerging policy and implementation research in relation to the WFD, as well as marine research, to support the formulation and implementation of policies. More details are available online on the EPA website.[18]

Key Achievements

- Novel methodologies have been developed for the characterisation of water bodies in accordance with the WFD and determination of reference baseline conditions.
- Ireland's Ocean Noise Register and the related monitoring protocol have been established.
- Scientific data have been provided to support appropriate measures or actions for use in the implementation of national policy for reducing phosphorus and nitrogen losses to waters from agricultural sources.
- A state-of-the-art experimental waste water treatment plant at Tuam, Co. Galway, has been established through EPA funding with the co-operation of the National University of Ireland, Galway and Galway County Council. The facility is advancing the development of environmental protection measures nationally and facilitating the testing of novel technologies and practice-based training and education.
- Increased knowledge on the transport and attenuation of pollutants through the landscape (PATHWAYS project) has led to the development of Catchment Support Management Tools (CSMTs), which are now informing the second cycle of WFD characterisation of water bodies and the tailoring of appropriate programmes of measures.
- A national Water Research Coordination Group has been established, with the aim of enhancing synergies and collaboration with other national funders and avoiding duplication.
- An output from this inter-agency collaboration is the DROPLET interactive interface, which provides a database of water-related research funded nationally (i.e. covering awards from other agencies).
- The EPA co-chairs the prestigious EU Joint Programme Initiative on Water "Challenges for a Changing World" and has been successful in three project applications with our European partners in the past 3 years.[19]

18 *www.epa.ie/researchandeducation/research/researchpillars/water/*

19 *www.waterjpi.eu*

Outlook

Progress with Water Framework Targets

The slow progress in improving the ecological status of surface waters means that new approaches are needed.

The target of 13.6% improvement in ecological status for surface waters from the 2009 baseline by 2015 included in the first cycle RBMPs has not been achieved (EPA, 2015b, 2016a). Instead, the overall situation has not changed during the first river basin planning cycle. A radically different approach is required to target management measures to where they are needed. There is an opportunity to improve implementation under the new water governance structures recently put in place and by using the integrated catchment management approach supported by better evidence and science.

Agricultural Policy and Water Protection

It is doubtful whether current agricultural initiatives will offer the solutions needed unless adjustments are made.

The reform of the Common Agricultural Policy (CAP), particularly the greening aspect and link to payments, is welcome. However, there has been some criticism that the policy proposals from the Commission were weakened extensively during negotiations and do not effectively meet the standards necessary to combat environmental degradation by the agricultural sector (Hart *et al*., 2016). The effectiveness of the reform will need to be monitored and further reform may be necessary following the next review.

The national farm inspection regime is currently focussed on the farmyard. However, a significant proportion of pollution can arise from agricultural land. The new risk-based approach to identifying potential Critical Source Areas (CSA) of pollution, which is being promoted by the EPA, will greatly assist in focusing management measures where they will be most effective. This will be particularly critical to ensuring that agricultural expansion plans under Food Wise 2025 are achieved in an environmentally sustainable manner and not at the expense of water quality.

The National Action Programme under the Nitrates Directive is due to be reviewed again in 2017. This will provide an opportunity to evaluate the need to amend existing farm management measures under the programme. Critical inputs to informing this review will come from, among others, the ACP led by Teagasc, the environmental risk assessments currently being undertaken and led by the EPA and the findings of the Cosaint research project investigating the impact of cattle access to waters.

Local Community Initiatives

Community involvement has the potential to contribute significantly towards effective catchment management.

The approach to catchment management to date has consisted largely of top-down regulation. To deliver significant improvements in the condition of waters it will be important to generate and harness bottom-up community involvement and ownership of the environmental issues, for example through the formation of River Trusts. The Sustainable Water Network (SWAN) has called for action at local level as well as a stakeholder forum at national level – a National Stakeholder Forum that would facilitate policy input.[20] Funding available under the new sub-theme "Protection and Sustainable use of Water Resources" under LEADER will potentially provide one valuable means of kick-starting communities to initiate local catchment projects. Local authorities in the context of their revised role in the new water governance arrangements are tasked with providing support and advice to communities through a team of water community officers to be established in 2016.

Local community initiatives, with the support of the LAWCO, have the potential to tackle threats to water protection and restoration more effectively by examining the risks and developing tailored solutions at a local level.

Domestic Waste Water

Initiatives to improve the stock of septic tanks and sludge management need to continue.

A recent research project highlighted the management of domestic waste water sludge and, in particular, the inadequate infrastructural provision as significant issues of concern (EPA, 2014b). These issues need to be addressed by policymakers and in Irish Water's Capital Investment Programme, through its Water Services Strategic Plan and the Strategic Sludge Management Plan.

Urban Waste Water

Investment and operational improvements in urban waste water are needed.

With regard to the auditing and monitoring of urban waste water discharges, the EPA carried out over 300 audits and found that a programme for maintenance and operation of all plant and equipment was not in place in 26 of the areas audited. The EPA also conducted independent effluent monitoring at 263 treatment plants, and found that 71 failed to comply with effluent quality standards set in EPA licences. Clearly, in order to protect water quality, improvements in these areas are needed, as well as in the more obvious areas where raw sewage is being discharged without treatment.

20 *www.swanireland.ie/download/SWMI%20consultation%20SWAN%20Response.pdf*

Environmental Quality Standards for Hazardous Substances

Targeted investigative monitoring is needed to detect hazardous substances which may be of concern in the aquatic environment.

Overall, the level of non-compliance with Environmental Quality Standards for hazardous substances (e.g. pesticides, endocrine disrupters and other synthetic chemicals) is low in groundwater, rivers, lakes, estuarine and coastal waters apart from two ubiquitous persistent, bioaccumulative and toxic substances (PBTs) (mercury and PAHs) (EPA, 2015b). A number of pesticides, including Mecoprop, MCPA and 2,4-D, have also been detected at low levels in a significant number of rivers (26–56%) during routine monitoring. These require further investigation to establish and eliminate the source. Further candidate priority substances/priority hazardous substances are currently being considered in a review at EU level including a number of pharmaceuticals. The likely presence and level of these substances in Irish waters needs to be established.

Marine Waters

Key Developments for the Protection of Marine Waters include the implementation of the Marine Strategy Framework Directive

The Marine Strategy Framework Directive, in conjunction with the WFD in estuaries and near-shore coastal waters, is the main legal instrument in place to ensure that the marine environment is sufficiently protected and the ecosystem goods and services provided by the marine environment are being used sustainably. This Directive aims to achieve good ecological status (GES) of the EU's marine waters by 2020 and to protect the resources on which marine-related economic and social activities depend. In order to achieve GES by 2020, each Member State is required to develop a strategy for its marine waters. As mentioned in the Chapter 4, there is room for further co-ordination between the water directives (WFD, MSFD and Floods Directive) and the directives that protect biodiversity.

In terms of implementation, Ireland has already reported on the state of the marine environment,[21] what it considers to be GES and on the targets and objectives that must be met to reach GES by 2020. Ireland has also established a national monitoring programme to assess GES and is currently in the process of developing measures that must be put in place to achieve GES by 2020.

A reformed Common Fisheries Policy came into effect in January 2014 with the main objective to restore and maintain harvested stocks above levels that can produce maximum sustainable yield. The maximum sustainable yield exploitation rate shall be achieved for all stocks by 2020. This aligns with the objectives of the MSFD, one of which is that marine waters of the EU are at GES within the same timeframe.

Another important piece of new legislation in this area is the Maritime Spatial Planning Directive (2014/89/EU), adopted by the EU in 2014. The main purpose of the Directive is to develop maritime spatial plans that promote sustainable development and identify the most suitable maritime space for the operation of different human activities. These activities include the installation of renewable energy devices, oil and gas exploration, maritime shipping, commercial fishing, conservation of habitats and species, tourism and aquaculture. The plans should provide an integrated management approach that aims to reduce conflicts in the use of maritime space while, at the same time, encouraging multi-purpose uses. The plans should also have due regard to the significant pressures associated with the various activities to ensure that the ecosystem services provided by marine waters are not degraded. This legislation is currently being transposed into Irish law in line with the deadline in the Directive of September 2016.

21 *www.environ.ie/water/water-quality/marine-strategy/marine-strategy-framework-directive-msfd*

Impacts of Climate Change on the Water Environment

Rising sea temperatures, ocean acidification, ocean deoxygenation and rising sea levels have been identified as four of the key stressors impacting on the world's oceans and coastal environments.

The key impacts of climate change for Ireland are described in Chapter 3. With regard to inland water ecosystems, the most obvious and direct impacts predicted include changes in river flows. Robust increases are expected in winter and spring, in the order of 20% in winter by the mid to late twenty-first century, while reductions in the summer and autumn months of over 40% are likely in many catchments. Flood events are likely to become more frequent with extreme flood events, currently expected once in every 50 years, likely to occur once every 10 years by the second half of this century (Murphy and Fealy, 2010; Coll and Sweeney, 2013).

With regard to marine waters, rising sea temperatures, ocean acidification, ocean deoxygenation and rising sea levels have been identified as four of the key stressors impacting on the state of the world's oceans and coastal environments (EPA, 2003; Devoy, 2008; Diaz and Rosenberg, 2008; O'Boyle *et al*., 2009, 2013; Gruber, 2011; Dwyer, 2012; Duarte *et al*., 2013; IPPC, 2013; Bates *et al*., 2014; ICES, 2014; Wallace *et al*., 2014; Bradley *et al*., 2015; McGrath *et al*., 2015).

Coastal erosion along the Atlantic coast of Europe was particularly severe and extensive during the 2013/2014 winter period owing to extreme storm conditions. Storms of this severity had not been experienced since 1948 (Masselink *et al*., 2016). These factors have the potential to seriously affect the functioning of marine and coastal ecosystems, and Irish waters are not immune from these global effects. Increases in water temperature have already been observed and, although these are partially attributable to natural cycles, the rate of change is of concern. Ocean acidification effects are being observed in our offshore surface waters (ICES, 2014) and these changes in ocean chemistry could potentially be very damaging to marine organisms, particularly to those with carbonaceous structures, such as corals, crustaceans, certain species of plankton and seaweeds, such as the coccolithophorids, which often bloom in Irish waters (Figure 5.14). The milky turquoise swirls off the south and west coasts of Ireland, visible from space, are made up of a large bloom of phytoplankton. These harmless microscopic plants are members of a group of plankton known as 'coccolithophorids'. Each tiny cell is covered in chalky plates and when the conditions are favourable the large blooms of these species turn the sea a milky white colour. These blooms are part of the natural marine food web but are susceptible to environmental disturbance such as ocean acidification.

Figure 5.14 Coccolithophorid bloom[22] (Source: © ESA)

Impacts of Climate Change in the Marine Environment

The example of Coastal Erosion

Masselink *et al*. (2016) reported that studies of coastal vulnerability due to climate change tend to focus on the consequences of sea-level rise, rather than on the complex coastal responses resulting from changes to the extreme wave climate. The 2013/2014 winter wave conditions that severely affected the Atlantic coast of Europe were investigated and it was found that this winter was the most energetic along most of the Atlantic coast of Europe since at least 1948. Along exposed open-coast sites, extensive beach and dune erosion occurred as a result of offshore sediment transport. More sheltered sites experienced less erosion, and one of the sites even experienced accretion as a result of beach rotation induced by alongshore sediment transport. Storm wave conditions such as were encountered during the 2013/2014 winter have the potential to dramatically change the equilibrium state (beach gradient, coastal alignment and nearshore bar position) of beaches along the Atlantic coast of Europe.

22 *www.esa.int/var/esa/storage/images/esa_multimedia/images/2012/10/algal_bloom_off_ireland/11888154-3-eng-GB/Algal_bloom_off_Ireland.tif*

Seaweed Harvesting

The proposals for large-scale seaweed harvesting will require careful scrutiny and regulation to prevent damage to intertidal biodiversity, to maintain sustainability and to protect the marine environment.

Current proposals for a review of the licensing of activities on the foreshore have the potential to impact on the use of coastal marine resources. Traditional seaweed harvesting has generally fallen into a legal grey area, with the rights of coastal landowners and the state's claim to the foreshore sometimes in conflict.[23]

A number of applications for large-scale seaweed harvesting rights have brought these issues to the fore, and a recent Oireachtais committee review suggested that a thorough review of the licensing regime needs to be undertaken (Oireachtas, 2015). Given the importance of the intertidal seaweed communities for biodiversity and coastal protection and as nursery grounds for a wide variety of marine life, any future development in this area needs to be well regulated to ensure maximum sustainability and protection of the marine environment.

Catchment and Ecosystem Services

Raising awareness of the benefits and services to society from water catchments will assist in their management.

The benefits received by ecosystems and humans from resources and processes which are supplied by water catchments have been termed "catchment services" (Daly, 2015). These include ecosystem services (the benefits that are derived from ecosystems), geosystem services (the values and services associated with geodiversity) and human–social system services (social and cultural services that contribute to the life environment). These benefits include the provision of water for consumption and agriculture use, the assimilation and purification of pollutants, flood regulation and water based recreation and tourism.[24] Raising awareness of the services that catchments and marine ecosystems provide for society will assist in managing water catchments.

The ESManage[25] project, which runs until 2018 and is funded by the EPA, aims to harness the knowledge and tools required to embed the ecosystem services approach into policymaking and decision making for sustainable management of water resources, as required by the WFD. The Department of Arts, Heritage, Regional, Ruraland Gaeltacht Affairs has commissioned ecosystem services mapping and assessment for an initial suite of prioritised ecosystem services in Ireland. This project is due for completion in 2016. It is developing Irish indicators for potential ecosystem services mapping, based on available national data, using methods developed in the UK and the EU. A follow-up project will look at how to operationalise the ecosystem services concept in Ireland through policy and legislation.

Economic Policy Instruments

Economic policy instruments can play a role in achieving water policy goals.

There is growing appreciation globally of the importance of natural capital, including catchment services, to our economy (see Chapter 4) (CIMA, 2013). Recent research suggests that people in Ireland do value water-related ecosystem services and are willing to pay to achieve good water quality in rivers (EPA, 2014a, 2014c).

Many of the environmental problems with water ecosystems (e.g. pollution, overabstraction and physical damage) stem from the fact that water in the environment is an open access resource, and often there are few restrictions on its use (e.g. abstractions and pollutant discharges). Sectors often use water in the environment without paying the full cost of environmental impact that their activities cause.

23 *www.nuigalway.ie/research/seaweed_centre/documents/Seaweedforum_Report2000.pdf*

24 *www.teagasc.ie*

25 *www.ucd.ie/esmanage/*

The WFD makes explicit provision for the use of Economic Policy Instruments (EPIs), in combination with other measures, for the purpose of achieving environmental policy objectives (Lago *et al*., 2015). Economic measures can help society to avoid water-related investments that are economically inefficient and environmentally damaging. They can also help to manage an increasingly scarce resource in ways that are both fair and efficient (Convery, 2013).

What are Economic Policy Instruments?

"EPIs are incentives designed and implemented with the purpose of adapting individual decisions to collectively agreed goals. They include incentive pricing, trading schemes, co-operation (e.g. payment for environmental services) and risk management schemes. EPIs can significantly improve an existing policy framework by incentivising, rather than commanding, behavioural changes that may lead to environmental improvements. They can have a number of additional benefits, such as creating a permanent incentive for technological innovation, stimulating the efficient allocation of water services, promoting water use efficiency, etc."

Lago. et al. (2015).

Conclusions and Future Challenges

The Current Condition of Inland and Marine Waters and the Pressures Acting on Them

In summary, based on preliminary analysis of the most recent datasets, there has been no improvement in river water quality (based on Q values) or transitional and coastal water quality over the past six years (EPA, 2016a). Overall, lake water quality has got slightly worse with a 3% reduction in the number of monitored lakes at satisfactory status. A full water framework directive assessment covering the period 2013 to 2015 will be available towards the end of 2016. However, it is already clear that insufficient progress is being made with improving Ireland's surface water quality.

While overall the length of unpolluted river channel has remained relatively constant there has been a substantial loss in the number of sites where highest quality river sites are found (i.e. Q value of 5). In the most recent monitoring period (2013-2015) only 21 sites were classified as the highest quality rivers (0.7% of sites) compared with 575 between 1987 and 1990 and 82 between 2001 and

2003. This is an area where substantial effort is required to protect the few remaining highest quality rivers and return impacted ones back to their earlier extremely high quality.

Eutrophication, which is caused by excessive nutrient inputs (generally phosphorus in the case of inland waters and nitrogen in the case of marine waters), remains the most significant environmental issue for surface waters. The two most important suspected causes of pollution are agriculture and municipal sources, accounting for 53% and 34% of cases, respectively, in the case of rivers, for example. Nutrient inputs, particularly from the agriculture sector, have fallen, with reductions of 18.7% and 37.7% in nitrogen and phosphorus sources, respectively. There is increasing evidence that the physical condition (hydromorphology) of surface waters may be as important to maintaining healthy ecosystems as the quality of the water sustaining them. Excessive siltation in particular is a cause for concern. Some physical barriers in river catchments, such as impassable weirs, are preventing certain protected fish species from migrating and consequently affecting the health of these populations. Work is ongoing to investigate these further.

Anticipated increases in environmental pressures on waters due to human population growth and agricultural output as a result of the planned expansion in production under Harvest 2020 and its successor, Food Wise 2025, will need to be carefully managed to ensure that not only deterioration is prevented but that water quality improvements take place. More targeted management measures are needed in the agricultural sector to accelerate the improvements required to achieve environmental targets set for waters.

Untreated urban waste water discharges continue to be a concern and impact on both the aquatic ecosystems themselves and their amenity value. Continued investment in infrastructure and a reversal in the recent decline in capital expenditure are essential to provide the waste water treatment necessary to protect receiving waters.

Ocean acidification, as a result of climate change, is a cause of concern worldwide and the effects are now being seen in Irish waters. Coastal erosion as a result of extreme storm events has also become a prominent issue in recent years. While 36% of commercial fish stocks are being fished sustainably, 26% remain overfished. While changes introduced under the CFP have reduced the risks of overfishing, further efforts are needed to protect species that are still under threat.

Why is Progress So Slow and What Steps Are Needed to Accelerate Change?

The target established for Ireland of 13.6% improvement in the ecological status of surface waters from the 2009 baseline to be achieved by 2015, which was included in the first cycle of RBMPs, has not been achieved. In spite of our best efforts, satisfactory progress towards achieving sustainable water resource management is not being achieved.

As well as the WFD, there are several directives in place which relate to the quality and condition of the water environment, including those covering urban waste water, agricultural practices impacting on waters and protected habitats and species, yet we are not seeing significant improvements. It is evident that a multi-party partnership approach involving government, state agencies, industrial sectors, non-governmental organisations and local communities is required to enable significant synergies to be realised. To be effective, the approach will require the pooling of knowledge, resources and efforts and the targeting of tailored management measures based on the best available scientific evidence. Inevitably, this type of approach is challenging, and it will take time to develop and build capacity, but ultimately it should deliver environmental objectives that are ambitious, achievable and acceptable to all sectors.

Weaknesses in governance arrangements were identified as an impediment to implementing the WFD during first river basin management cycle. Changes to the governance arrangements have now been made; as a result there is greater clarity on the roles and responsibilities of public bodies and improved implementation can be expected in the future. In the case of the marine environment, the MSFD is in the process of being implemented and the Marine Spatial Planning Directive is in the process of being transposed into national legislation. Strong and clear governance structures will be essential to achieving the goals of these marine directives.

There is certainly room for improvement in the implementation and enforcement of environmental regulations to increase the level of compliance. Improved environmental regulation leading to better compliance, in combination with other policy tools such as bottom-up community-based catchment initiatives and the use of EPIs, is needed to achieve environmental objectives.

A particular challenge in managing water resources effectively and sustainably into the future is incorporating the value of these resources effectively into economic decision making. Until the real environmental cost of using water resources is internalised into the decision-making processes within all sectors that use the resource, overuse and misuse are highly likely to escalate into the future as demands for catchment services increase. In order to put a value on these resources, sectors must first understand and be aware of the services that catchments provide them with and the value that they obtain from these services. Therefore, the immediate task ahead for environmental authorities is to communicate and raise awareness of the services gained by society from catchments. The ongoing mapping of ecosystem services across the EU, including Ireland, should help to inform this awareness raising.

The recent controversy in Ireland over domestic water charges serves to highlight the need for a mature and rational public debate with regard to how we want to manage our national water resources for future generations, not just from the narrow perspective of domestic drinking water and waste water treatment provision, but taking into account all services that are gained by all sectors. Some of the key questions to be debated include:

- What services do we obtain from catchment and marine ecosystems?
- Who benefits from these services?
- Who should pay the environmental costs taking into account the polluter/user pays principle, affordability and fairness across sectors? and, ultimately,
- How should these environmental costs be paid for?

Underpinning the new river basin water governance arrangements for managing waters and the bottom-up community initiatives is the integrated catchment management approach, which complements the river basin planning process. It approaches sustainable resource management from a catchment perspective, rather than taking a piecemeal approach that artificially separates land management from water management. Details are available on the new "Catchments.ie – Water from Source to Sea" website[26] which provides details on local catchments, how to get involved and work on the WFD.

The promotion of community action at a local level is critical to engaging and securing ownership of the problems at play and generating tailored solutions that work for all sectors. These types of initiatives are important for raising awareness of the value of catchment services to society. To be effective they require the support and technical advice of the environmental authorities.

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