

Chapter 8

Environment, Health and Wellbeing



Our Environment, Our Health, Our Wellbeing

Introduction

Ireland's environment is a fundamental and high-quality national asset that provides a strong foundation for healthy and contented lives. Our most basic needs are clean air, safe drinking water and healthy food. The quality of each one of these is directly influenced by the quality of the environment. It follows that preventing damage to the environment arising from human activities also helps to protect our health and wellbeing. Recognition of the intimate interconnections between sustainable environments and healthy lives was highlighted last year by the United Nations and in the recent World Health Organization report 'Preventing Disease Through Healthy Environments' (WHO, 2016) whose Sustainable Development Goals (SDGs)¹ are designed to foster improvements in human health and wellbeing.

In this context, our "environment" is where we live, work and play – our everyday surroundings. While Ireland's environment is generally good by international standards, there are some areas where environmental degradation,

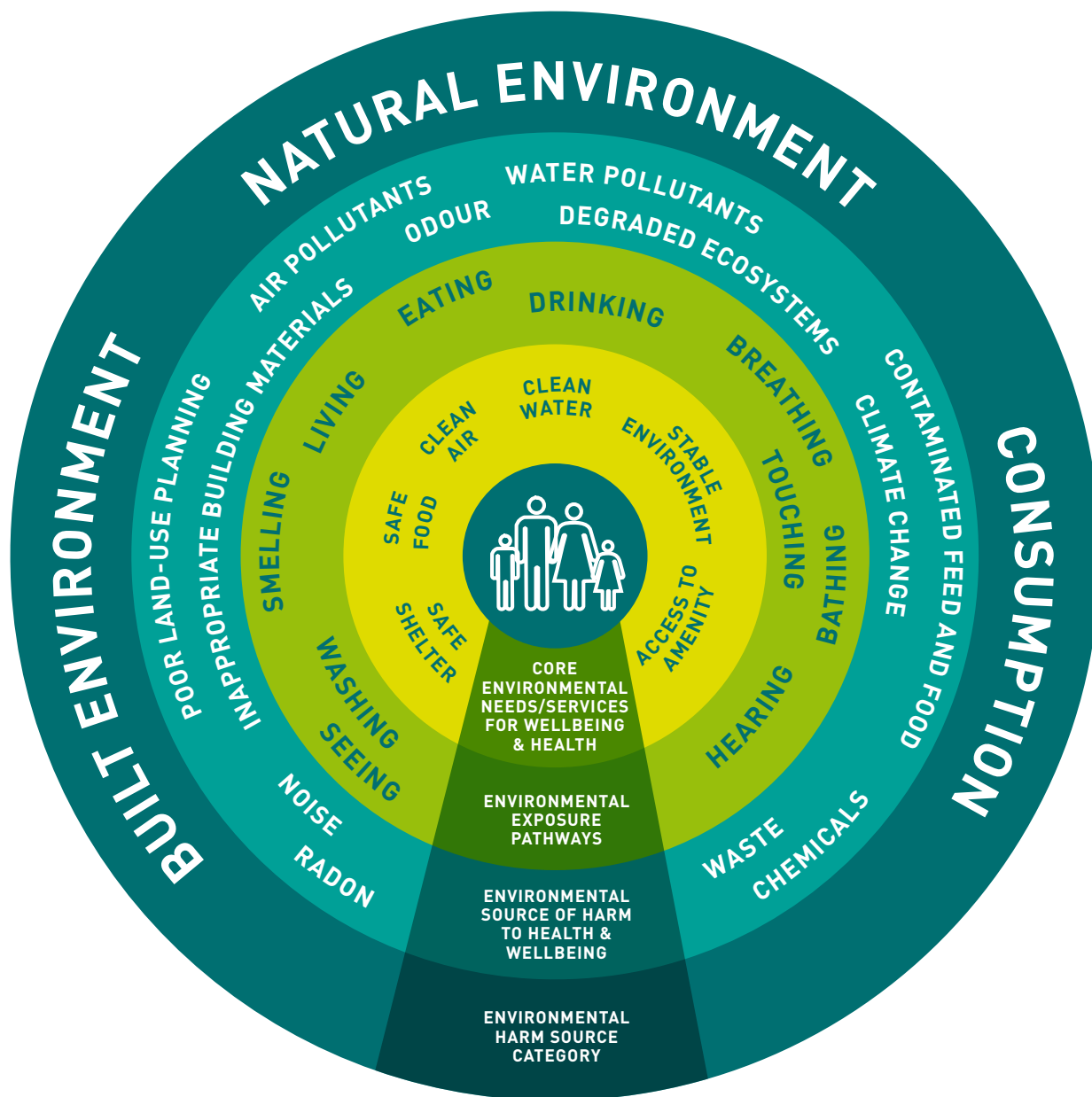
and vulnerability to extreme events, can adversely affect health and wellbeing. To formulate an effective response we first need to fully understand and address the issues. Health and wellbeing effects arising from a compromised environment can range from immediate and short-term conditions (such as stomach upsets from contaminated water) to medium-term effects (such as stress from living with noise and odour) and chronic effects that result in illness in which environmental factors have played a key role (for example, poor air quality can result in cardiovascular disease).

Environmental hazards – biological, chemical and radiological – can affect health directly through the contamination of water, air, soil and food. The work of environmental regulation involves preventing people's exposure to these hazards by minimising them or by taking action when standards are exceeded. Figure 8.1 shows the range of environmental "harms" that can affect human health and wellbeing through our built and natural environments and via our consumption practices. These harms can impact on the six core service needs for our wellbeing: clean air, clean water, access to amenity, safe food, stable environment, and safe shelter.

¹ www.un.org/sustainabledevelopment/sustainable-development-goals/



Figure 8.1 Health Model (Source: EPA)



Many of the environmental threats to our health are associated with our lifestyles and available choices. Our behaviours and consumption patterns clearly cause stress to the environment, leading to consequential poor health outcomes (for example, burning smoky fuels to heat our houses affects local air quality and people's health). A proactive approach to environmental protection, partly through regulation but also by changing how we live, will deliver a safer, healthier place for us to live now and into the future.

"...a healthy environment is a prerequisite for good health."

Dr Margaret Chan,
Director-General, World Health Organization

The European Environment Agency (EEA) estimates that poor air quality contributes to 432,000 premature deaths in Europe each year (EEA, 2015). The most significant pollutant identified by the EEA was particulate matter, which mainly arises in Ireland from traffic emissions and the burning of smoky fuels for home heating. As regards Ireland, the EEA reported that 1,200 premature deaths every year can be attributed to particulate matter exposure. The response required here is clear: policymakers, legislators and regulators need to ensure that the safest fuel and transport options are favoured and promoted to assist people in making healthier decisions. In parallel, individuals need to consider how their behaviours impact on our environment, and therefore contribute to health problems such as respiratory and heart disease in our own communities.

Threats to our environment, health and wellbeing are continually emerging. These include climate change, as, for example, extreme weather events in Ireland are likely to result in increased flooding and risks to drinking water. The EEA refers to other emerging health threats in its most recent State of the Environment report (2015a), including new chemicals and mixtures of chemicals, nanomaterials, endocrine-disrupting hormones and patterns of production and consumption.

In 2013, the Government published the Healthy Ireland framework, which aims to bring about changes to make Ireland a place where everyone has the opportunity to live a healthful life –in terms of both physical and mental health. The inclusion of “wellbeing” in the national discussion on health marks a welcome development, as it moves our ambition beyond “disease prevention” and embraces a fuller vision of people who are living well and have a general sense of satisfaction. Producing a safe, attractive environment and facilitating access for people from all social groups and cultures brings wide-ranging benefits. These benefits are both social, such as improvements in wellbeing and reductions in disease incidence; and economic, such as savings on health service provision and improving workforce health (leading to less absenteeism).



Healthy Ireland – A Framework for Improved Health and Wellbeing



Any environmental degradation has the potential to adversely impact on health. “Healthy Ireland” is a national Government framework for action to improve the health and wellbeing of the people of Ireland. Its main focus is on prevention and keeping people healthier for longer. Healthy Ireland’s goals are to:

- increase the proportion of people who are healthy at all stages of life
- reduce health inequalities
- protect the public from threats to health and wellbeing, and
- create an environment where every individual and sector of society can play their part in achieving a healthy nation.

Healthy Ireland is founded on an underlying model of “determinants of health”, which articulates a complex range of health-influencing factors that recognise the importance of environmental conditions alongside genetic, social, structural, cultural and economic factors (based on work by Dahlgren and Whitehead (1991), and Barton and Grant (2006)). The Healthy Ireland framework takes a whole-of-society approach to improving health and wellbeing and the quality of people’s lives. In recognition of the human responses to different environmental threats and opportunities, the EPA has an active part to play in government actions to achieve the Healthy Ireland goals. Visit www.healthyireland.ie to find out more.

Environment and Wellbeing

Our environment has a strong influence on human health and wellbeing.

"We benefit much more from clean air, pure water, good food and exercise and strong communities than we do from hospitals, medicines and clinics."

Professor Martin Cormican, NUI Galway

Often the terms "green spaces" and "blue spaces" are used to describe those parts of our environment that include the natural and semi-natural features. "Green spaces" include farmlands, parks and forests. "Blue spaces" include rivers, canals, lakes and coastlines. As in any system, in order for these spaces to provide a full range of benefits they must be carefully managed so that they are functioning well. For people to want to spend time in green and blue spaces, three factors must be present: they need to be safe, attractive and accessible. Accessibility is key: it can be achieved through developing guided trails and other facilities and by making arrangements to ensure that everybody can meaningfully interact with green and blue spaces, regardless of mobility or other constraints. It is important to note that once accessed, support may be needed to foster beneficial use of the green and blue spaces.

In addition to the beneficial effects of being active in these spaces, scientists have also linked exposure to nature to benefits in coping with mental stress and fatigue. It has been shown that the very act of getting out in nature – whether in a park, on a beach or walking on a road – can bring real benefits to our mental wellbeing. The concept of "green and blue prescriptions" is now being explored as a tool to improve community health and wellbeing. Green and blue prescriptions constitute formal written advice from a health professional to spend time in the natural environment. During 2012, a trial of so-called "green prescriptions" was conducted and found to reduce obesity and to improve physical and mental health in nine trial groups across rural and urban communities around Donegal. Along with the measurable outcomes, such as positive impacts on blood pressure, the participants reported that engagement with nature was also associated with an improvement in mental wellbeing; this was reflected in statements such as "it's very good ... to clear the mind" (HSE, 2014).

With over two-thirds of Ireland's population living in cities and suburbs, the inclusion of green and blue space in planning and management of urban development is crucially

important in terms of delivering residential areas that provide a good quality of life for our population. Equally, for rural dwellers, safe walking routes and agreed access to parkland, rivers, lakes and upland areas must be provided.

Sustainable Living

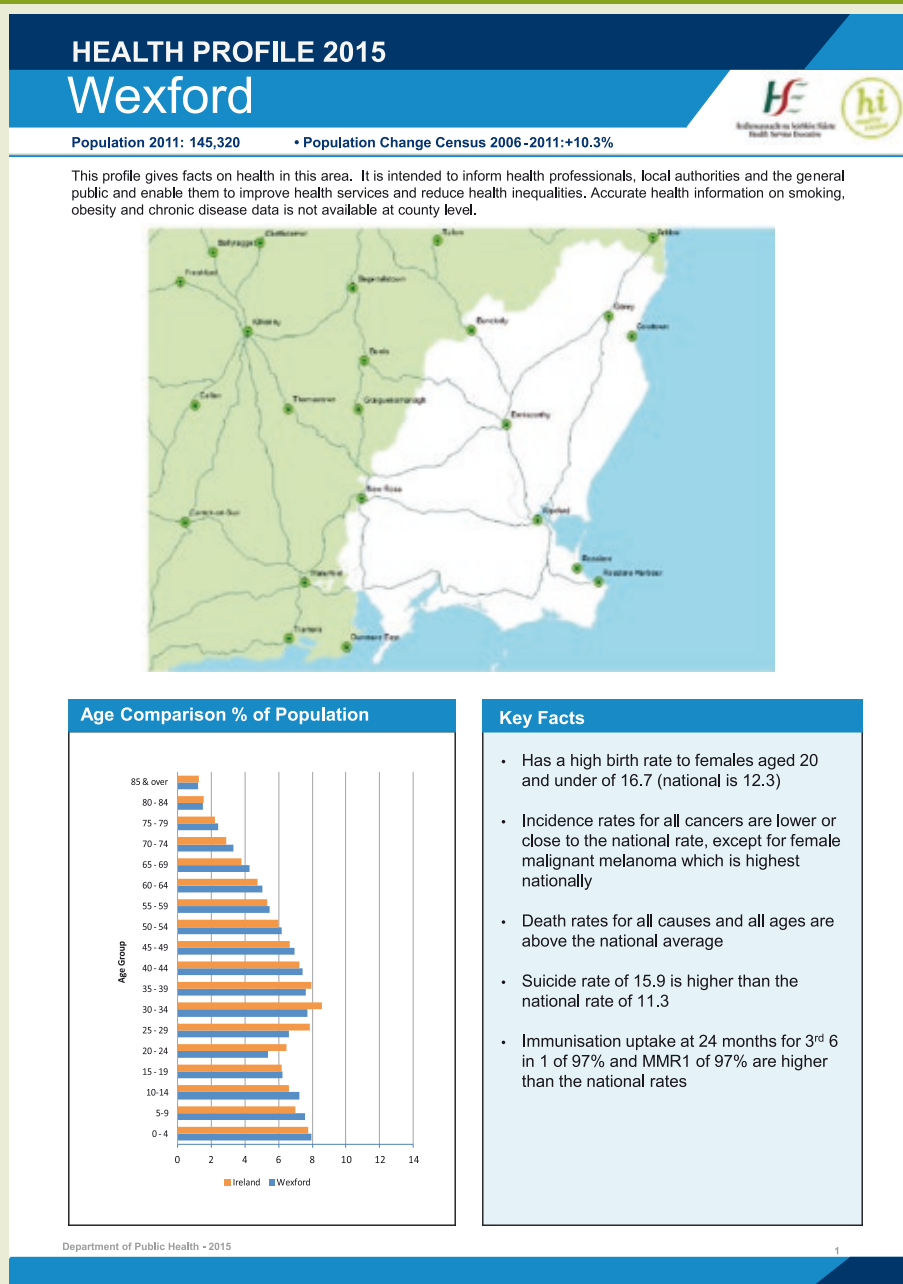
Our sustainable future sets out challenges and how we might address them to ensure that our quality of life and general wellbeing can be improved and sustained in the decades to come.

Most of the 17 Sustainable Development Goals agreed by the United Nations are clearly relevant to improving human health, reflecting a strong relationship between good health and sustainable living. Ireland's own national strategy for sustainability, *Our Sustainable Future* (Irl Gov, 2012), sets out sustainability challenges and how we might address them in order to ensure that our quality of life and general wellbeing can be improved and sustained in the decades to come. We do not live in isolation: all of us are part of a community, whether we choose to engage or not. It is in our nature to commune with each other, and we have a long history of successful public volunteerism – the bedrock of any community. In general, communities are built around residential, urban, rural, parish, business, educational, spiritual, sporting, artistic or social activities. A vibrant, inclusive and engaged community yields better health and environmental outcomes for all the residents, businesses, schools, etc. within it, i.e. outcomes are more sustainable.

Sustainability in local communities is a key objective of the recently introduced Public Participation Networks (PPNs), which aims to enhance public engagement in decision making and policymaking. PPNs are now established in every county and city across Ireland, based on three "pillars": environment, social inclusion, and community and voluntary.

The pattern of our daily lives at work and at home is largely controlled by the location of our daily activities, and this collectively shapes our urban environment and its relationship with the countryside. Through the strategic spatial organisation of these activities, our lifestyles can be healthier in terms of our personal wellbeing and also in terms of demands on resources and our environmental footprint. The Regional and County Development Plan system is the mechanism by which local authorities set out policies and site-specific land use objectives so as to direct development in a sustainable manner. The social and personal impact of a "loss of enjoyment of amenity", be it physical loss or through nuisance from odour and noise, can often be overlooked when trying to identify the major impacts from a development on a community. Although difficult to quantify, the loss of such amenities will undoubtedly result in deterioration in quality of life for a community. Appropriate regulation through land use planning and activity enforcement can mitigate this potential quality of life impact.

Figure 8.2 Health Profile 2015: Wexford (Source: HSE)



In 2016, new County Health Profiles were launched on the Health Service Executive (HSE) website². The creation of County Health Profiles is one of the key actions from the Healthy Ireland strategy, as understanding health needs at a local level enables local action and creates an environment in which every individual and sector of society can play their part. The county profiles help to identify health priorities and highlight any health inequalities that may exist. They are useful for people who work with health partners on a county basis and

are also useful for those who are interested in a short local profile, including healthcare professionals, local authorities and non-governmental organisations (NGOs).

The profiles provide a snapshot of the local demographics, health issues and wider determinants of health of that area, compared with the national picture. The data represent nationally available indicators that are available at a county/local authority level, e.g. population size, deprivation, healthcare utilisation, etc.

² www.hse.ie/eng/services/list/5/publichealth/publichealthdepts/pub/profiles.html

Individual Choices

Areas where we can take action ourselves and make healthier and more sustainable choices.

At an individual level, our choices influence our health and that of our family and neighbours. Choices such as the fuel we use, the water we drink, how we manage our waste, the chemicals we use in our homes and gardens, household ventilation, the noise we create, etc., demonstrate our values and attitudes to our environment, community, health and wellbeing. The collaborative public information resource www.LiveGreen.ie gives advice and tips on how we can take action to make healthier and more sustainable choices.



The EPA hosts an online resource called “Live Green – Small Changes, Big Difference” for householders and families, which contains tips, advice and guidance on a range of environmental and health matters across the following household themes:

- health and community projects
- water conservation
- waste prevention
- energy efficiency.

Living green means making small changes at home or in our communities. In turn, living green can make a big difference to our wellbeing, helping people to live a more sustainable lifestyle. Visit www.livegreen.ie to find out more.



Regulation and Policy

Environment, health and wellbeing is recognised as a fundamental and complex cross-cutting policy topic.

Concern for avoiding disease threats and fostering improvements in health and wellbeing has traditionally underlain much of the political priority given to environmental issues within the EU and the Member States. It is one of the primary drivers for policy actions that target air quality, water quality, soil quality and chemical use.

Within Ireland, environment and health is an area of growing public interest and involves a large number of organisations from both health (e.g. Department of Health, HSE, the Health Research Board and the Institute of Public Health) and environmental (e.g. various government departments, the EPA, local authorities) perspectives. Under its environmental protection mandate, the EPA delivers direct and indirect benefits to human health through a number of its responsibilities. These include controlling harmful substances, as well as emissions from licensed facilities; maintaining a supervisory function with regard to the provision of safe and secure drinking water; bathing water reporting; research; and monitoring ambient air quality. The EPA's Health Advisory Committee brings representatives from public health authorities together to advise the EPA on carrying out its functions in the context of health protection.

To further strengthen health protection and foster wellbeing, the concept of health assessment has emerged as a component of Environmental Impact Assessment. Through this process, the potential health effects of a development on the local population are considered – in terms of both positive and negative impacts. Such assessments combine evidence from research and monitoring with independent expert opinion to provide a clear understanding of potential direct and indirect health impacts, and to identify adjustments to mitigate future problems.

Clean Air and Health

The air pollution problems affecting cities in Europe are resulting in premature deaths.

Across Europe (including Ireland), the most overtly problematic pollutants causing disease in humans are particulate matter (PM), ground-level ozone (O₃) and nitrogen dioxide (NO₂). However, despite considerable improvements in past decades, Europe's air pollution problem is far from solved and is still responsible for over 432,000 premature deaths each year (EEA, 2015). Worldwide, the World Health Organization (WHO)³ estimates that some 80% of outdoor air pollution-related premature deaths are due to heart disease and strokes, while 14% of deaths are due to chronic obstructive

3 www.who.int/topics/air_pollution/en/

Wellbeing of Future Generations (Wales) Act (2015)

During 2015, the Welsh Government passed a new law that aims to make the country more sustainable from both an environmental and a social point of view, while maintaining a focus on prosperity. The Wellbeing of Future Generations (Wales) Act (2015) is structured around seven “key goals”, which aim to build a prosperous country that has a resilient environment and a clear global responsibility; to support a healthy population who have equal opportunities, to foster strong communities and to promote the Welsh language. A Future Generations Commissioner has been appointed and national indicators are being developed to track progress.

A fundamental aspect of this initiative is the clear intention to make Wales a better place to live for all citizens of the country – including an unambiguous focus on environment, health and wellbeing. The “hard-wiring” of sustainable development and wellbeing into governmental decision making is a bold step, and one that could offer a model for Ireland.

pulmonary disease or acute lower respiratory infections; and 6% of deaths are due to lung cancer. The risk of heart disease, which includes heart attacks, has particularly strong and consistent associations with fine particulate pollutants in air (e.g. PM_{2.5}). During 2013, WHO further concluded that outdoor air pollution exposes humans to carcinogens, with the particulate matter component of air pollution closely associated with an increased incidence of cancer, especially lung cancer. As a result of this, WHO declared “It is now clear that the toll imposed by air pollution is much more serious than was previously understood” (WHO, 2015)

As described in detail in Chapter 2, Ireland’s air quality relative to our European counterparts is good. However, values for particulate matter and ozone were above the more stringent WHO air quality guidelines at some stations. Polycyclic aromatic hydrocarbons were also above the EEA estimated reference level. The EPA has called for movement towards the adoption of these stricter WHO guidelines, in particular for particulates and ozone, as the legal standards across Europe and in Ireland. Adherence to these new standards will deliver better health outcomes. There are some specific exposures to air pollution in Ireland – especially around cities and towns and mostly associated with traffic emissions in cities and smoke from home heating in towns – that do not benefit from current restrictions on the sale and use of smoky fuels. In order to protect the health status of vulnerable populations and locations, the planned national ban on the sale of all ‘smoky coal’ in 2018 is a welcome development.

Dioxins

Monitoring shows that dioxins remain at a consistently low level in the Irish environment.

“Dioxins” is a collective term for over 200 chemical compounds, of which 17 are considered to be of toxicological significance. The toxic responses resulting from exposure include skin effects, immunotoxicity and carcinogenicity, as well as reproductive and developmental toxicity. These compounds arise mainly as unintentional by-products of incomplete or poorly controlled combustion (e.g. backyard burning of waste) and from certain chemical processes.

To maintain surveillance of dioxins, the EPA conducts surveys based on levels found in cows’ milk. This is considered to be a particularly suitable matrix for assessing dioxin presence in the environment, since cows tend to graze over relatively large areas and these compounds will, if present, concentrate in the fat content of the milk. The most recent survey was undertaken in summer 2014 and follows previous studies carried out since 1995. These studies have shown that concentrations of dioxins remain at a consistently low level in the Irish environment.

As in earlier surveys, testing for dioxin-like polychlorinated biphenyls (PCBs) was also included in this programme, and some “marker” non-dioxin-like PCBs were added in 2012. All dioxin levels recorded in this survey are well below legislative limits and compare favourably with those from previous surveys and from other EU countries (EPA, 2015a). Considering that there is strict regulation of industrial combustion activities, one of the most significant risk factors for elevated dioxin levels in Ireland is illegal burning of waste in fields, gardens and domestic fireplaces (EPA, 2014).

Noise

According to WHO, noise is the second greatest environmental cause of health problems (after air quality).

Excessive noise can seriously harm human health, including mental health, and interfere with people’s daily activities at school, at work, at home and during leisure time. It can disturb sleep, cause cardiovascular and psychophysiological effects, reduce performance and provoke annoyance responses and changes in social behaviour. According to WHO, noise is the second greatest environmental cause of health problems after air quality. A study commissioned by the European Commission on the health implications of road, railway and aircraft noise in the European Union (RIVM, 2014) found that exposure to noise in Europe contributes to:

- about 910,000 additional prevalent cases of hypertension
- 43,000 hospital admissions per year
- at least 10,000 premature deaths per year related to coronary heart disease and stroke.



In Ireland, noise issues are typically considered across three categories: neighbourhood noise, environmental noise, and noise from EPA- and local authority-regulated sites. Local noise issues, including those from neighbours and local commercial facilities, represent by far the largest source of noise complaints in this country, and are dealt with by local authorities. The EPA, with these local authorities, is currently developing a standardised national guidance document to be used in the management of noise complaints (expected to publish in 2017).

Environmental noise from major infrastructure including roads, railways and airports is governed by the EU's Environmental Noise Directive (2002/49/EC). The preparation of strategic noise maps is a major task associated with this directive and this is currently under way in Ireland.

Following completion of the noise maps, the relevant Action Planning Authorities will prepare noise action plans. The action plans are designed to act as a means of managing environmental noise through land use planning, traffic management and control of noise sources.

Finally, noise issues can arise at facilities regulated by the EPA and local authorities and, in 2014, 149 noise complaints were received in relation to EPA-licensed sites, compared with 143 in 2013. Nearly 80% of all such complaints related to just five licensed sites. In addition, just two sectors accounted for 90% of complaints: 64% related to the food and drink sector and 26% to the non-hazardous waste transfer stations sector. This information enables targeted enforcement action to be taken against priority sites, where additional resources are then focused.

Quiet Areas

It is important to identify and protect quiet areas.

In addition to controlling excess noise, it is also important to identify and protect those areas which are substantially unaffected by man-made noise. Accessibility to quietness is highly important to the health of both wildlife and humans. This is particularly so in urban environments, leading to the concept of Relatively Quiet Areas. These are areas, such as local parks, green and blue areas, which are characterised by their proximity to areas with high noise levels, and are

valued by the public as a perceived area of tranquillity. Using both quantitative and qualitative assessments, eight Relatively Quiet Areas have been designated within Dublin (Dublin City Council, 2013), and areas in other parts of Ireland will be identified in consultation with the public. A recent report from the EEA on quiet areas in Europe provides a first assessment of potential quiet areas in Europe's open country (EEA, 2016a). The key messages from the report are that noise pollution is having a major adverse impact on human health across Europe, and that protecting those areas that are not yet affected by noise will bring significant health and wellbeing benefits.

Odours

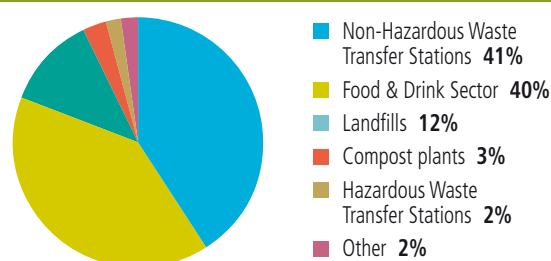
The EPA receives more complaints about odours than any other environmental issue.

Odours are caused by compounds in the air, and can be pleasant, such as the smell of baking bread, or foul, such as the stench from rotting waste. Most of the chemicals that can cause health problems can be detected by people at concentrations below the level in air that is toxic to humans. However, in some cases concentrated odours can cause health problems including headaches and nausea. In addition, ongoing exposure to odour, even at very low levels, can bring on other wellbeing effects such as stress and anxiety.

Although the activities in Ireland that have most potential to cause odour are regulated, there are nonetheless ongoing occurrences, with odours representing a significant source of complaints to the EPA, particularly related to waste transfer stations, landfills, composting facilities and rendering plants. The EPA continues to target facilities that fail to comply with their licences and hold them responsible for their actions in line with its enforcement policy.

Over 1,000 air-related complaints were received by the EPA from the public in 2014 (EPA, 2015b). Odour accounted for 788 of these, with nearly 70% of them related to just 10 sites. Odour control in parts of the waste management and food and drinks sectors needs to improve. More recent data for 2015 shows that these sectors accounted for approximately 98% of all odour complaints made to the

Figure 8.3 Breakdown of Odour Complaints by Sector in 2014 (Source: EPA, 2015b)



EPA about odour during 2015, with 10 sites accounting for 75% of all complaints. While the numbers of complaints are unacceptable, it should be noted that this figure has decreased significantly in recent years.

Bioaerosols

There is sufficient evidence to support a precautionary approach for regulatory purposes.

Bioaerosols are airborne particles consisting of microorganisms and other small biological particles suspended in the air which are generated through both natural and industrial processes. The health risks associated with bioaerosols can be a cause of public concern, especially for people living close to waste composting facilities. Composting is a microbial process and the agitation of compost during turning and screening produces bioaerosols, in particular the allergenic fungus *Aspergillus fumigatus*. Research has found that the general population is not at risk of infection resulting from exposure to bioaerosols; however, immunocompromised individuals are at an increased risk, along with individuals who suffer from asthma or allergies (Prasad, 2004). In a recent study of bioaerosol exposure and health outcomes by Pearson *et al.* (2015), it was concluded that “the evidence base on health effects of bioaerosol emissions from composting facilities is still limited, although there is sufficient evidence to support a precautionary approach for regulatory purposes. While data to date are suggestive of possible respiratory effects, further study is needed to confirm this and to explore other health outcomes.”

Composting facilities are subject to regulatory control by the EPA and local authorities, which ensures that their operation does not have an adverse effect on human health and the environment. Health-related exposure limits are needed, especially in approval procedures of industrial facilities such as composting plants or livestock farms emitting bioaerosols.

Clean Water and Health

Drinking water investment is critical to provide safe and secure supplies.

Safe drinking water is essential to public health, and therefore water must not contain microorganisms and substances at concentrations that could endanger health, such as pathogenic parasites or chemical contaminants. Most public tap water in Ireland is drawn from surface water sources, i.e. rivers and lakes (82%), with the remainder originating from groundwater (11%) and springs (7%). The breakdown of drinking water supply types in Ireland is shown in Table 8.1. It shows that there are 973 public water supplies, which is a relatively large number for our population but is reflective of our dispersed settlement patterns (EPA, 2015c).

Drinking water supplies must meet specific legislative requirements, the objective of which is to protect human health by ensuring that water intended for human consumption is wholesome and clean, and to specify quality standards for water at the consumer's tap.

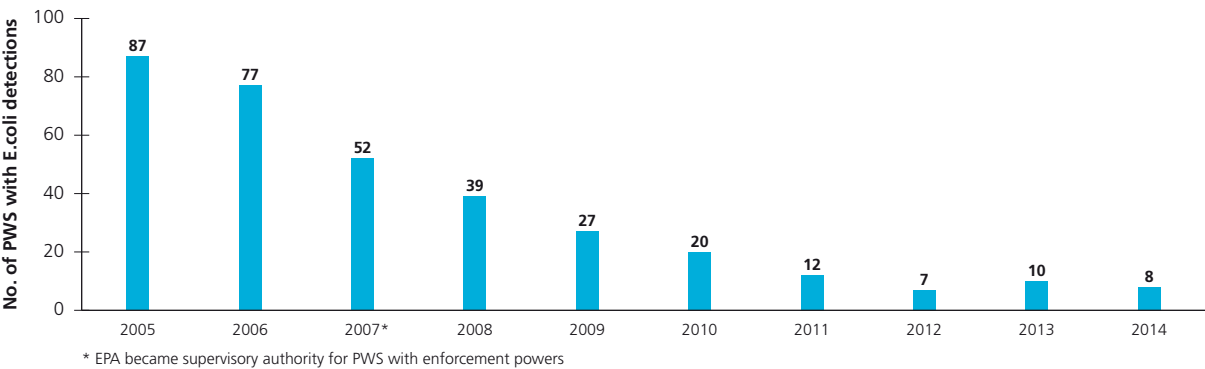
The results of the 2014 drinking water monitoring programme for public water supplies show 99.9% compliance with microbiological standards and 99.4% compliance with chemical standards, based on 175,498 sample results (EPA, 2015c). While this indicates that the majority of public water supplies are safe, further improvements are necessary to improve the security of supplies and avoid long-term Boil Water Notices in the future. In particular, the EPA has identified 119 supplies (as at April 2016) on a Remedial Action List which are in need of upgrade, replacement or improved operational control. The overall compliance figures also mask poor results for a few individual parameters, notably trihalomethanes (THMs) (90.7%, which is very low compared with other European countries) and lead (95.7%). Enforcement actions continue to be taken by the EPA to ensure compliance with drinking water standards.

Table 8.1 Drinking Water Supply Types in Ireland (Source: EPA)

Supply Type	Supplier/Supplying	No. of Supplies	Population (%)	Supervisory Authority
Public Water Supplies	Irish Water	973	81.9	EPA
Public Group Schemes	Local Group	512	1.9	Local Authorities
Private Group Schemes	Local Group	421	4.2	Local Authorities
Small Private Supplies	Commercial/public activity	1,758	0.9	Local Authorities
Exempted Supplies	Individual supplier	170,000*	11.1	Exempted

*estimated number of private wells or boreholes

Figure 8.4 Number of Public Water Supplies in which *E. coli* was Detected in Compliance Monitoring, 2005-2014 (Source: EPA, 2015c)



The most important health indicators of drinking water are the microbiological parameters, in particular *Escherichia coli* (*E. coli*) bacteria. The presence of *E. coli* in drinking water indicates either that the disinfection process at the water treatment plant is not operating adequately or that faecal contamination has entered the water distribution system after treatment. As shown in Figure 8.4, the incidence of *E. coli* in public water supplies in Ireland continues to decrease. However, the microbiological quality of private water supplies remains inferior to public supplies, with a significant number of *E. coli* detections in small private supplies and private group water schemes. Furthermore, it is estimated that up to 30% of the 170,000 unregulated private wells in the country are contaminated with *E. coli*, which presents a health risk for those consuming the water (EPA, 2015c).

There have been cases of faecal-derived *Cryptosporidium* contamination of public water supplies in Ireland leading to illness in the community, e.g. Galway City in 2007 and Westport in 2015. These outbreaks highlight the risks to health associated with the abstraction of drinking water from poorly protected sources, and the need for modern and well-managed water treatment systems. Figure 8.5

shows the number of cases of cryptosporidiosis reported in Ireland between 2004 and 2015 (HPSC, 2015). There were 439 cases of cryptosporidiosis in 2015, 10 of which were definitively associated with drinking water supplies (eight confirmed cases in a general outbreak in Westport and two confirmed cases in a family outbreak linked to a private well).

The winter storms in late 2015/early 2016 resulted in a considerable increase in the number of consumers on Boil Water Notices across the country as a result of a number of supplies becoming contaminated with *Cryptosporidium* because of inadequate barriers at water treatment plants.

As guided by the EPA, Irish Water is adopting the Water Safety Plan approach to managing drinking water supplies. This involves a holistic process to identify, reduce and manage risk, and thereby improve the resilience of water supplies. This should result in a reduced risk to public health of drinking water contamination.

Figure 8.5 Annual Number of Cryptosporidiosis Cases in Ireland, 2004-2015 (Source: HPSC, 2015)

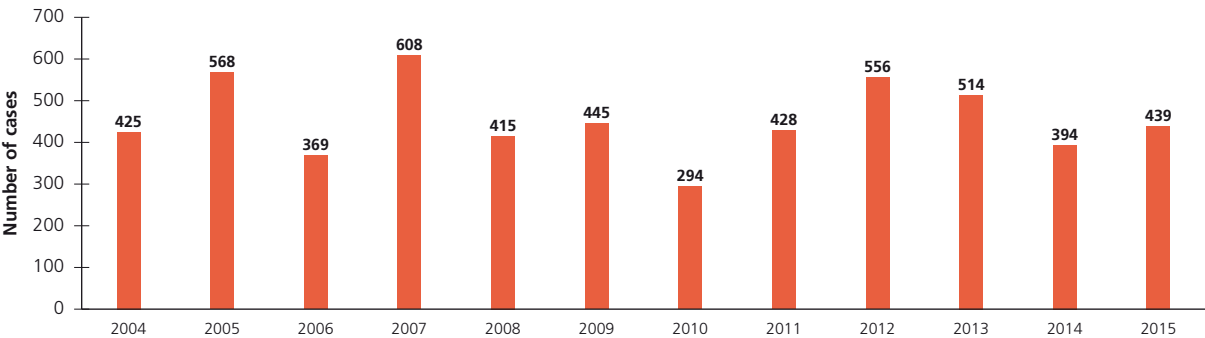


Table 8.2 Chemical Contamination of Drinking Water – Risks and Intervention (Source: EPA, 2015c)

Chemical Contaminant	Source	Risk/Impact	Action/Intervention
Trihalomethanes (THMs)	By-product of the disinfection process, formed by the reaction of chlorine (disinfectant) with natural organic matter in the water	Possible associations with cancer – uncertain in terms of causality	Water supplier should aim to minimise THMs by providing appropriate treatment while not compromising disinfection
Lead	Lead piping in distribution systems and household plumbing	Classified as “probably carcinogenic”. Long-term exposure can affect brain development of infants, young children and babies in the womb	Replacement of lead piping and interim mitigation measures under the National Lead Strategy (June 2015) and Irish Water’s Lead in Drinking Water Mitigation Plan
Pesticides	Agricultural, commercial and domestic use	Potential harmful health effects depend on the toxicology of the individual pesticide	Protection of drinking water sources from pesticide contamination using catchment-based engagement efforts

Private Wells

Private wells used for drinking water in Ireland remain at risk of contamination.

There are approximately 170,000 private wells in Ireland, of which at least 30% are estimated to be contaminated by *E. coli* (EPA, 2015c; Hynds, 2012). Private wells are not regulated under the European Communities (Drinking Water) Regulations 2014 and are classified as “exempted supplies”. This means that there is no requirement to monitor such supplies, nor is there any regulatory supervision of such supplies. In effect, this means that the well owner is solely responsible for the quality of the well water.

Many private wells are at risk of contamination from sources such as septic tanks, landspreading of slurry, animals grazing near the wellhead, chemical storage and fuel storage tanks. Private wells need to be properly sited, constructed and maintained in order to reduce the risk of contamination.

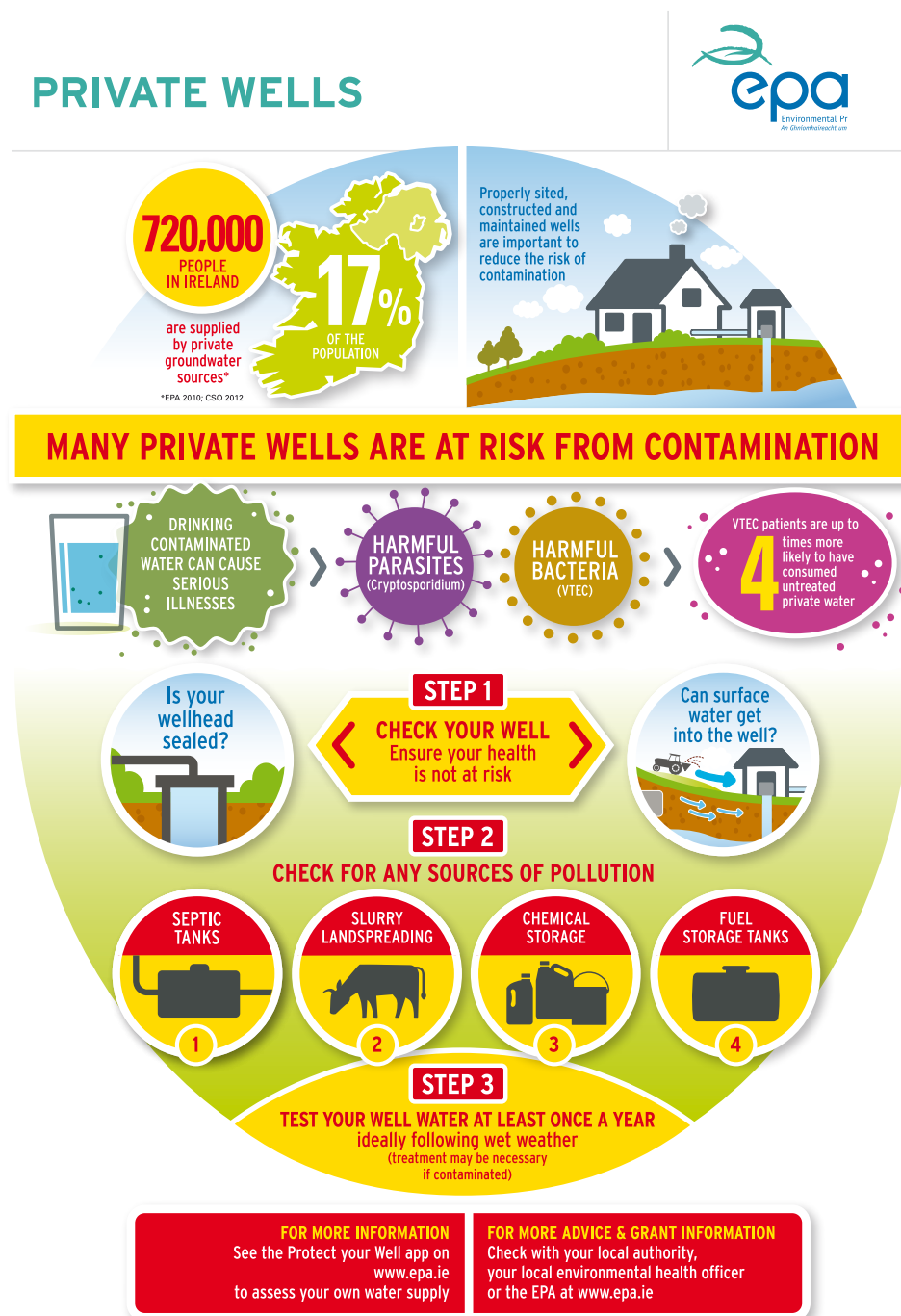
30% of private wells are estimated to be contaminated by E. coli.

Urban Waste Water

The effective management and treatment of our waste waters is critical to the health of our waters, our economy and our population.

Urban waste water is one of the principal pressures on water quality in Ireland (EPA, 2015d) and also poses a threat to human health. Sewage and other waste waters contain microbiological and chemical substances that can be harmful to health. Waste water collected in urban areas must be treated in order to remove these contaminants, prior to being discharged into receiving water bodies. The treatment and disposal of waste water in an environmentally sound manner is important not only for human health but also for Ireland’s social and economic development. Pollution from waste water treatment plants arises where there is inadequate treatment; storm water overflows operating incorrectly; or direct discharges of untreated waste water.

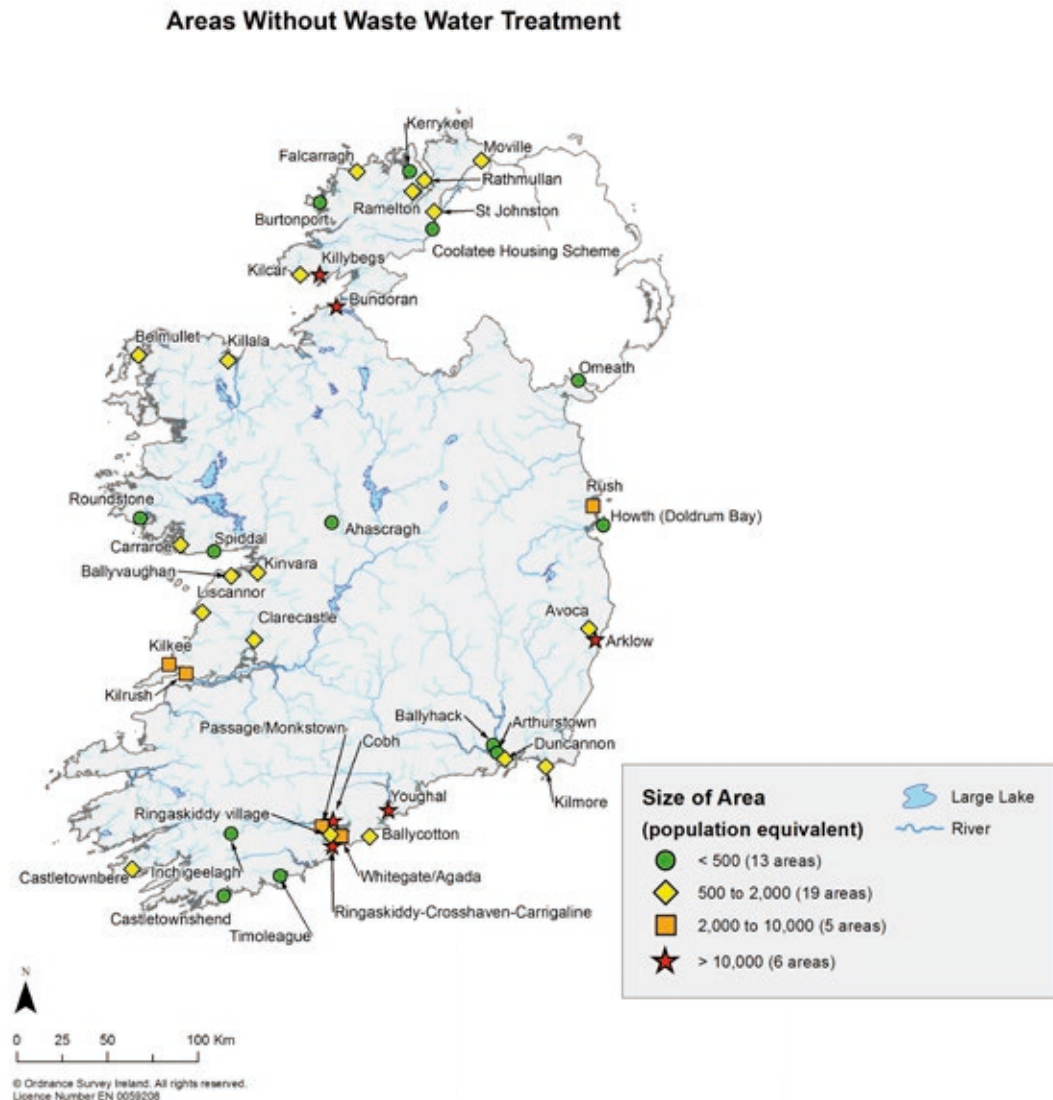
Figure 8.6 Private Wells Infographic (Source: EPA)



Ireland has the highest rate of VTEC (verotoxigenic *E. coli*) in Europe (EFSA, 2016). VTEC is a particular type of the bacterium *E. coli*. VTEC infection causes a wide range of illnesses from mild diarrhoea to haemolytic-uraemic syndrome, a form of kidney failure. In recent years, all reported VTEC outbreaks associated with drinking water have been linked to private water supplies, with the majority of cases affecting children, many of whom have been hospitalised (HPSC, 2013a).

The EPA recommends that well owners should proactively manage the quality of their own water to minimise health risks to everyone in the home. This includes checking that there are no sources of pollution entering the well and getting the water tested at least once a year, ideally following heavy rainfall, when the well is most at risk of contamination. The EPA has developed a *Protect your Well* app (available on www.epa.ie) for well owners to assess their own water supply and to identify contamination risks.

Figure 8.7 Areas Without Waste Water Treatment (Source: EPA)



Raw sewage is being discharged into 43 rivers, lakes and coastal areas around Ireland.

Since 2007, the EPA has issued over 1,000 Waste Water Discharge Authorisations for towns and villages across Ireland.

Recent EPA findings show significant infrastructural deficits; for example, the 2014 report highlighted that untreated sewage was discharged from 45 areas (now 43 locations), 12 treatment plants failed to provide secondary

(biological) treatment and a further seven treatment plants failed to meet nutrient removal standards (EPA, 2015e).

Monitoring data show that 82% of large urban areas complied with the mandatory effluent quality standards in 2014. However, where waste water is being discharged into nutrient-sensitive areas, only 24% of the load discharged complied with the more stringent effluent quality standards that apply in these areas. Dublin and Cork were the major contributors to this low rate of compliance. Waste water discharges also contributed to poor water quality at 6 of Ireland's 137 identified bathing waters (EPA, 2016).

Significant investment has gone into improving Ireland's waste water infrastructure since 2000. As a result, the proportion of waste water receiving secondary (biological) treatment increased nationally from 29% in 2001 to 94%

in 2014, with the proportion of waste water receiving little or no treatment reduced to under 5% in 2014 (EPA, 2015e). Nonetheless, further investment in infrastructure is necessary in order to eliminate the discharge of raw sewage, comply with the Urban Waste Water Treatment Directive (91/271/EEC) and the Water Framework Directive (2000/60/EC), and meet obligations of EPA waste water discharge authorisations.

Domestic Waste Water Treatment Systems

Household septic tanks can threaten public health and water quality if they are poorly constructed or fail to operate satisfactorily.

There are an estimated 500,000 domestic waste water treatment systems (DWWTS), i.e. septic tanks and treatment systems, in Ireland treating waste water from houses not connected to a public sewer system. The Water Services (Amendment) Act, 2012 was introduced to control discharges from these systems by the registration and inspection of septic tanks to ensure that they meet certain standards. The legislation also required the EPA to put in place a National Inspection Plan in conjunction with the local authorities to reduce the potential threat to human health and the environment.

DWWTS that are properly designed, installed and maintained can provide long-term, effective treatment of domestic waste water. However, DWWTS can threaten public health and water quality if they are poorly constructed or fail to operate satisfactorily; for example, if the waste water cannot discharge through the percolation area, it can form stagnant pools on the ground surface. Through such failures, humans can come in contact with the waste water and be exposed to pathogens, e.g. *E. coli* bacteria and faecal coliforms, and foul odour. Owners of DWWTS are required to operate and maintain their systems so that they do not pose a risk to human health or the environment.

The EPA Inspection Data Report for the period 1 January



to 31 December 2015 (EPA, in press), details the results of 1,097 first-time inspections. 33% of all systems inspected also had a private well on site, of which 42% failed the inspection.

The inspection findings show significant failure rates for reasons that are related to the behaviour of the householder rather than faults with the treatment system. In many cases, simple actions are required by the homeowners rather than structural changes to the treatment system. The non-compliance rate decreased from 53% in 2013 to 45% for the 2015 reporting period.

Bathing Water

Good-quality bathing water is a highly desirable natural resource for recreational use as well as being an important economic factor for tourism.

Our modern lifestyle presents continuing challenges to bathing water quality, such as impacts of pollution from urban runoff, waste water discharges and from agricultural sources, especially after heavy rain, which are a continuing threat, particularly in built-up areas. If beaches are closed there are also knock-on effects for people's behaviour (i.e. they don't go to the beach) which then play out as health effects (less exercise, increased anxiety).

There are 137 identified bathing areas in Ireland, comprising 128 seawater and nine freshwater locations. Overall, the quality of Ireland's bathing waters remains very high, with 93% meeting the minimum EU standards and achieving at least "sufficient" water quality status (EPA, 2016). In addition, 83% have met the "excellent" or "good" standards. However, six bathing waters failed to meet sufficient quality, which means they were required – for health risk reasons – to have either an "Advice against Bathing" or a "Bathing Prohibition" restriction in place for the 2016 bathing season. Members of the public can find out about bathing water quality on the EPA's Splash website (www.bathingwater.ie), on bathing water notice boards at the beaches or from the relevant local authorities.

At European level, Ireland is ranked 18th out of 30 countries and below the EU average in a comparison of bathing water quality for 2015 (EEA, 2016b). Ireland is also one of only four countries, along with the United Kingdom, the Netherlands and Bulgaria, where more than 3% of bathing water sites were of poor quality in 2015. Risks to bathing waters are one of the key criteria in EPA enforcement led recommendations for prioritisation of urban waste water treatment plant compliance and remedial actions (EPA, 2015e).

As well as the 137 designated bathing sites, there are 73 other waters around the country which are being monitored by local authorities because bathing is known to take place there. Of these "other monitored waters"

just two, Stradbally and Ballyvooney – both in Co. Waterford – are likely to be of “poor” quality at times due to impacts from nearby waste water discharges.

Shellfish

Strict shellfish monitoring regimes are in place to ensure that consumption of Irish shellfish poses little risk to public health.

Irish coastal waters provide ideal conditions for shellfish growth. In order to support shellfish life and growth and to contribute to the high quality of directly edible shellfish products, the Quality of Shellfish Waters Regulations (SI No. 268 of 2006, as amended) required the development of Pollution Reduction Programmes for designated shellfish areas.

Norovirus is a leading cause of gastroenteritis in humans and is found in high concentrations in municipal waste water. Bivalve molluscan shellfish such as oysters are filter-feeders and can become contaminated with human pathogens including norovirus when grown in areas impacted by municipal waste water discharges. Waste water treatment is a critical control to reduce the extent of pathogen discharge into aquatic environments. The EPA recently funded research on norovirus in waste water and shellfisheries, to examine the survival of norovirus through waste water treatment, in the aquatic environment and subsequent uptake in oysters (Doré *et al.*, 2013). The research found that a risk-based management approach is required to control risk associated with norovirus-contaminated oysters, and guidelines to this effect should be developed by the Food Safety Authority of Ireland in collaboration with the Sea Fisheries Protection Authority.

Live bivalve molluscs, such as mussels, can be harvested only from shellfish production areas that meet the classification requirements for human consumption. Production areas are classified by the Sea Fisheries Protection Authority according to the quality of the waters. To protect against illness, the Food Safety Authority of Ireland operates a shellfish monitoring regime, in co-operation with the Sea Fisheries Protection Authority and the Marine Institute, with shellfish samples being checked before harvesting is allowed. The controls are such that consumption of Irish shellfish poses little risk to public health.

However, illegal shellfish harvesting can present a risk to public health if contaminated shellfish makes it into the food chain. In July 2015, the Sea Fisheries Protection Authority seized 5 tonnes of mussels which had been harvested illegally in the East Ferry area of Cork Harbour. This area was closed for the harvesting of mussels at that time owing to the presence of paralytic shellfish poisoning toxins, which can cause serious illness. Consumers and food businesses should purchase live bivalve molluscs

only from suppliers that are approved by the Sea Fisheries Protection Authority to place live shellfish on the market for human consumption.

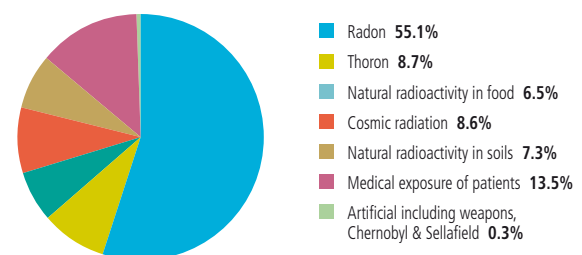
Radioactivity in the Environment

Levels of radioactivity in the ambient Irish environment do not pose a significant risk to public health.

Natural radioactivity in the environment has two principal components: cosmic and geological. Cosmic rays, originating in outer space, strike the Earth's atmosphere; geological radioactivity comes from long-lived radionuclides present from the time of the formation of the Earth. The most significant contribution to human exposure comes from radon.

Artificial radiation is mainly associated with the routine operation of medical diagnostics and treatment as well as from nuclear installations such as nuclear power plants and reprocessing plants. Past accidents at nuclear installations and atmospheric nuclear weapons tests are also sources of artificial radionuclides in the environment. The most significant source of artificial radionuclides to the Irish marine environment is the Sellafield nuclear fuel reprocessing plant in Cumbria; however, the radiation exposure from Sellafield represents only a very small fraction of the overall average annual dose to a person in Ireland, as shown in Figure 8.8 (EPA, 2015f).

Figure 8.8 Sources of Radiation in Ireland
(Source: EPA, 2015f)



Levels of radioactivity in the Irish environment have been routinely monitored since 1982. In 2015, EPA reported on comprehensive measurements of radioactivity in air, drinking water, marine environmental samples and a range of foods (EPA, 2015f). The data presented in the report confirmed that, although the levels of artificial radionuclides in the Irish environment are detectable, they are low and do not pose a significant risk to the health of the Irish population.

In general, levels of artificial radioactivity in the Irish environment remain fairly constant and are broadly consistent with levels reported previously. It must be emphasised that the levels of radioactive contamination

present in the marine environment do not warrant any modification of the daily habits of people in Ireland, either in their consumption of seafood or in any other use of the amenities of the marine environment.

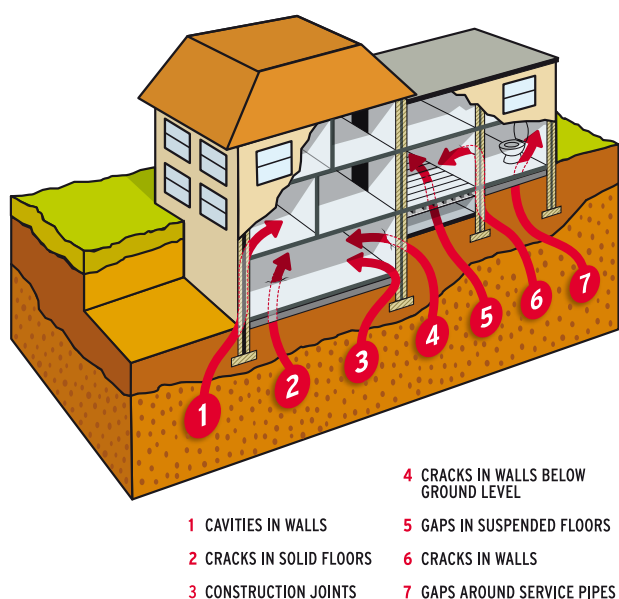
Radon

Indoor radon exposure remains a significant public health concern.

Radon is a naturally occurring radioactive gas formed in the ground by the radioactive decay of uranium, which is present in all rocks and soils. It is the greatest source of exposure to ionising radiation for the general public in Ireland and the leading cause of lung cancer after smoking. It is estimated that exposure to radon accounts for approximately 13% of all lung cancers in Ireland, which equates to some 250 lung cancer cases each year.

High radon concentrations can be found in any part of the country; however, the EPA has identified certain areas which are more prone to radon as High Radon Areas. The EPA regularly runs local awareness campaigns in High Radon Areas in order to raise awareness of the risks from radon and to encourage homeowners to test their homes. To date, only 60,000 homes have been tested, of which almost 8,400 were found to be above the national reference level of 200 Bq/m³. Figure 8.9 shows the routes of entry for radon into buildings.

Figure 8.9 Radon Entry Points
(Source: EPA, www.radon.ie)



Recognising the scale of the radon problem in Ireland, the Government published the 4-year National Radon

Control Strategy in February 2014, which contains recommendations on a broad range of measures aimed at reducing the risk from radon to people living in Ireland. These recommendations are set out in six thematic areas as follows:

- radon prevention in new buildings;
- use of property transactions (sales and rental) to drive action on radon;
- raising radon awareness and encouraging individual action on radon;
- advice and guidance for individual householders and employers with high radon results;
- promoting confidence in radon services; and
- addressing radon in workplaces and public buildings.

The results of the 2015 National Radon Survey show that mean indoor radon concentration has fallen to 77 Bq/m³ (from 89 Bq/m³ in 2002). Furthermore, a significant reduction in radon levels was found in homes built since 1998, when radon preventative measures were introduced under the Building Regulations, as compared with those homes built before then. This gives a strong indication that the required radon preventative measures in new homes are having a beneficial effect on indoor radon levels. In addition, further work to tackle radon in workplaces will be carried out through the implementation of EU Council Directive 2013/59/Euratom, which lays down basic safety standards for protection against the dangers arising from exposure to ionising radiation.

Non-ionising Radiation

Non-ionising radiation is the term used to describe the part of the electromagnetic spectrum covering two main regions, namely optical radiation (ultraviolet, visible and infrared) and electromagnetic fields (power frequencies, microwaves and radio frequencies).

Electromagnetic fields (EMFs) are associated with electricity flows, and both electric and magnetic fields exist close to power lines, and close to appliances. Since the 1970s, research has been under way to examine if exposure to EMFs has adverse health consequences. In 2015, an EU scientific committee published a Final Opinion on the potential health effects of exposure to EMFs (SCENIHR, 2015). It concluded that there are no evident adverse health effects associated with EMF if exposure remains below the levels recommended by EU legislation (EC, 2015). The findings of this committee were echoed in a study carried out by the Dutch National Institute for Public Health and the Environment, which looked at EMFs in the Irish context and also investigated how different Member States differ in how they deal with European exposure limits (RIVM, 2015).

Advice from the DECLG to those living in close proximity to telecommunications masts or base stations is that there is no scientific basis for, or evidence of, adverse health effects in children or adults as a result of exposure to EMFs below guideline levels. ComReg, the licensing authority for the telecommunications industry, verifies that operators are in compliance with their licence conditions relating to emission limits for non-ionising radiation. Compliance with guidelines is good, and results from the emission measurements have shown values well below limits (DECLG, 2016).

Other Environmental and Health Issues

While this section has so far examined the major environmental and health considerations around air and water, there is also a wide range of issues that can influence our health – some of these are well established and some classed as “emerging”.

Climate Change, Health and Wellbeing

Climate change is likely to alter risks to public health and wellbeing in Ireland.

The health and wellbeing of human populations is sensitive to shifts in climate in three ways: (1) directly through changes in the character and frequency of extreme weather events including heat, drought and heavy rain; (2) indirectly through natural systems, for example disease vectors, waterborne diseases and population displacement; and (3) through human systems, for example occupational impacts, under-nutrition and mental stress (Smith *et al.*, 2014).

Globally, there has been increased heat-related mortality and decreased cold-related mortality in some regions as a result of warming. Local changes in temperature and rainfall have altered the distribution of some waterborne illnesses and disease vectors. Throughout the 21st century, climate change is expected to lead to increases in ill health in many regions (IPCC, 2014). In Europe, the impacts of climate change on human health and wellbeing include flooding, extreme temperatures, air pollution, vector-borne disease and waterborne and food-borne diseases. These impacts are projected to change in the future; for example, where precipitation or extreme flooding is projected to increase in Europe, the risk of food-borne and waterborne illness could increase.

Climate change is likely to alter risks to public health and wellbeing in Ireland (Pascal *et al.*, 2013). The key climate change-related exposures of importance to human health are likely to be increases in heatwave-related health impacts, decreases in cold-related health impacts, increases in flood-related health impacts, changes in patterns of food-borne disease, an increase in the burden

of waterborne disease and an increase in the frequency of respiratory diseases due to changes in pollen and pollutant distributions (temporal and spatial).

Although all of the population will be exposed to climate change, health effects will depend largely on the vulnerability of individual population groups. For Europe, vulnerability to weather and climate change depends on people's personal characteristics (e.g. age, income, education, health status), their broader social and environmental context, their access to resources (e.g. health services) and their level of exposure to climate change (WHO, 2008). Those population groups considered most vulnerable include the elderly and children, the urban poor, traditional societies and subsistence farmers, and coastal populations.

The risks of climate change for the health sector are intrinsically linked to risks in other sectors (e.g. ecosystems, water supply and sanitation, agriculture, infrastructure, energy and transportation, land use management) that play an important part in determining the risks of disease and injury resulting from climate change (Smith *et al.*, 2014). For example, climate-related impacts on water quality will clearly have knock-on effects for public health. In addition, extreme weather events (such as storms and flooding), causing disruption for communications, power generation and public transport, will have an effect on the delivery of public health services.

In 2015, the second Lancet Commission on Climate Change and Health noted that threat to human health from climate change is so great that it could undermine the last fifty years of gains in development and global health (Wang and Horton, 2015). The commission also focussed on this issue from a different viewpoint and concluded that *tackling climate change* could be the greatest global health opportunity of the 21st century. This is based on evidence compiled by the commission which shows that many efforts to mitigate and adapt to climate change, such as phasing-out coal from the global energy mix, also have strongly positive health effects.

Genetically Modified Organisms

Genetically modified organisms (GMOs) are defined as bacteria, viruses, fungi, plant and animal cells, plants and animals capable of replication or of transferring genetic material whose genetic material has been altered in a way that does not occur naturally by mating or natural recombination.

In the past 40 years, the development and use of genetic engineering technology has brought many useful applications in healthcare, in the form of new pharmaceuticals, vaccines and methods of diagnosing disease. This technology is also making a major impact in the investigation of crime, in waste treatment,

environmental clean-up and in other areas. However, there is significant public concern regarding the possible risks to human health and the environment through the introduction and use of GMOs in our ecosystem.

The EPA is the competent authority in Ireland for the implementation of the Genetically Modified Organisms Regulations on the contained use, the deliberate release into the environment and the transboundary movement of GMOs. As part of its regulatory function, the EPA has established a register of GMO users in Ireland. As of December 2015, there were 587 entries on this register. Over 95% of these are contained users, the majority of which are third-level research laboratories classified as being of negligible risk. The remainder are deliberate release users (small-scale field trials and clinical trials).

In July 2012, the EPA granted consent to Teagasc Oak Park to carry out field trials on a GM potato line with improved resistance to late potato blight fungus for a 4-year period until the end of 2016, with post-trial monitoring continuing until 2020. There is currently no commercial cultivation of GM crops in Ireland.

Any health and environmental issues concerning the use of GM ingredients in food and feed are considered by the Food Safety Authority of Ireland and the Department of Agriculture, Food and the Marine, which are the competent authorities in this area.

Heavy Metals

Heavy metals occur naturally in the environment, and low concentrations of some of these are essential to human health and wellbeing. However, elevated concentrations of many heavy metals are directly toxic to humans, and also to animals and plants, which in turn can accumulate these substances, offering a further threat to humans eating contaminated foodstuffs. Sources of heavy metals include materials such as paints, batteries and piping, and industrial activities including mining and coal-burning electricity generation. Ongoing monitoring of water and air indicates that heavy metal pollution does not pose a significant threat to health in Ireland.

In 2015, the EEA examined emissions of heavy metals and reported an improving situation in Ireland with trends between 1990 and 2013 showing emissions for cadmium down 36.7%, mercury down 37.7% and lead down 88.6%. This downwards trend is mirrored across Europe and is attributed to improvements in abatement technologies, coupled with the effect of EU directives and regulations mandating reductions, and limits on heavy metal emissions. The very large decrease in lead emissions is largely associated with the phase-out of leaded petrol.

Pharmaceuticals in the Environment

Pharmaceutical drugs are contaminants of emerging concern in the aquatic environment.

The amount of pharmaceutical production, consumption and ultimately discharge into the aquatic environment is steadily increasing (EPA, 2015g). Human actions, termed as “involuntary” (pharmaceutical excretion through the body or washing of topical medicines down the drain) and “purposeful” (disposal of unused or out of date medicines), are primarily responsible for the release of pharmaceuticals into the environment (Daughton, 2007).

The unnecessary and excessive use of antimicrobial agents, such as antibiotics, has significantly contributed to the development and spread of antimicrobial resistance (AMR) worldwide across the human population, agriculture and the wider environment. The European Centre for Disease Prevention and Control estimates that AMR results in 25,000 deaths annually in Europe, plus related costs, resulting from healthcare expenses and productivity losses, of over €1.5 billion. The issue is one of such great concern that AMR is listed in the Department of the Taoiseach's National Risk Assessment, which identifies risks that may have an adverse impact on Ireland's wellbeing (Department of the Taoiseach, 2015). In 2016, an EPA-funded research project found high levels of bacteria resistant to all antibiotics in urban sewage from hospitals and from the general city sewage. The researchers also noted that the hospital effluent was different, in that there were high levels of bacteria resistant to a number of newer antibiotics (Morris *et al.*, 2016). The number of antibiotic-resistant bacteria present was greatly reduced by effective waste water treatment, but some antibiotic-resistant bacteria survive and are discharged into rivers and seawater.

Whilst inappropriate prescribing and dispensing of antimicrobials for human therapeutic use is a significant contributor to the AMR problem, use in the agriculture and food production sector is as substantial. In terms of environmental impact from human therapeutic use of antimicrobials, a significant quantity of the antimicrobials given to patients is shed into the toilet in urine or faeces, in a form that is still biologically active. Added to this is the large number of antibiotic-resistant bacteria, which may reside in the gut of humans, passed into the toilet every day. Urban waste water treatment plants and domestic waste water treatment systems are unable to effectively remove all antimicrobials or antibiotic-resistant bacteria, meaning that the resultant “active” effluent is released into the environment, causing subsequent exposure and thereby contributing to the growing problem of AMR.

In the case of the agriculture and food production sector, antimicrobials are not only used therapeutically for treating infection but, in some instances, are also used in healthy animals for growth promotion and prophylactically to avoid the development of infection within a herd or flock. Not only does prolonged use create ideal conditions for the development of AMR but, similar to the healthcare situation, a significant quantity of active antimicrobials is excreted in urine and manure, entering the surface and groundwater and, possibly, potable water sources. Moreover, manure spread across land could contain antimicrobial residues, which, in turn, could be absorbed by food crops, thereby further contributing to exposure to, and persistence of, these contaminants (Graham *et al.*, 2016).

Following a major review of evidence, Huijbers *et al.* (2015) concluded that the extent to which the environment contributes to human exposure is simply not known, though the authors state that transmission this way seems “plausible”. Encouragingly, progress is beginning to be made in this regard both nationally and internationally. The EPA, along with other EU research organisations, is funding a joint programme of research looking at the emerging threat of AMR to the environment.

Endocrine disruptors are a diverse group of chemicals that affect hormonal function and include some pesticides, PCBs, dioxins, some synthetic pharmaceuticals and industrial chemicals. Research funded by the EPA indicates that, although some endocrine-disrupting compounds were detected in the Irish environment, levels are generally low and not regarded as a significant risk (EPA, 2015h).

Healthy Food

A clean environment is essential to healthy food production.

Much is written about “healthy food”, but from an environmental and human health point of view this concept is largely concerned with ensuring that foods are free from contamination associated with chemical or biological pollution. Careful regulation is necessary to ensure that food-growing areas are not adversely impacted by, for example, poorly treated waste water, landspread wastes, contaminated fertilisers, badly managed farm chemicals or air pollutants. International agreements such as the Convention on Long-range Transboundary Air Pollution also have a role to play by reducing the threat of airborne heavy metals coming across our borders and settling on land.

Care is also required around the reintroduction of by-products into the food chain to avoid unintended contamination. Some recent incidents involving Irish producers have shown that monitoring and response systems are working well; however, the goal is clearly to avoid these circumstances arising.



Environment and Health Research

Environment and health is recognised as a fundamental and cross-cutting topic in the national environmental research programme that is managed by the EPA. The aims of the research are (1) to develop national capacity in key areas; (2) to generate data and make assessments of priority issues for Ireland; and (3) to mobilise this knowledge for use in environment and health protection. Overall, the desired outcomes are to identify, characterise and manage threats from the environment to health and wellbeing, and also to recognise opportunities to use the environment to foster improvements in our health and wellbeing.

Since 2007, the EPA has funded over 50 research projects on environment and health issues representing a total commitment of approximately €10 million. Through this research programme, the EPA addresses a broad range of environmental health issues including those that lie beyond its regulatory remit such as indoor air quality. Recently, the EPA established a number of projects with a focus on health and wellbeing which are being co-funded with the Health Service Executive; these include Ecosystem Benefits of Greenspace for Health, and Nature and Environment to Attain and Restore Health.

The key research areas include:

- ecosystem benefits for health
- safe water for drinking, food production and recreation
- clean air and noise
- chemicals and other threats.

Key Achievements

- Researchers have developed new research capability and have provided timely knowledge and assistance to local and health authorities in dealing with significant health scares and outbreaks.
- Researchers have developed baseline information on emerging issues such as antimicrobial resistance, nanoparticles, and endocrine disruptors. This knowledge has been used by operators, regulators and policymakers in support of policy formation and implementation.
- An HSE-led research project concluded that no adverse health impacts were experienced following the operation of an incinerator at an EPA-licensed industrial facility.

Priority Areas

- Understanding environment–health interactions, including risks from emerging chemicals and novel materials (e.g. microplastics, nanomaterials), while highlighting the benefits to human health of a clean and well-managed environment.
- GIS-delivered solutions to understanding integrated impacts of various environmental threats. For example, overlaying maps for air pollution, traffic density, radon exposure, meteorology with pulmonary morbidity.

Conclusion

A high-quality environment provides the foundation for healthy living.

As evidenced in this report, Ireland's environment is generally good, and it can be concluded that, on the whole, Ireland does present a clean, safe environment to live in. The availability of green spaces (parks, woods, countryside) and blue spaces (ponds, riverbanks, lake shores and seashores), along with clean, fresh air and breathtaking landscapes, provides an enviable resource which should be valued and enjoyed.

In common with countries across Europe, key high-level environment and health issues include climate change, antimicrobial resistance and chemical pollution. In addition there are a number of national issues that require action, such as health impacts associated with localised air pollution and drinking water contamination. Many government bodies are actively working to address these issues and, while much has been achieved, there is clearly still work to

be done. Some of the key challenges facing Ireland from an environment, health and wellbeing point of view are:

- on-site waste water treatment systems (such as septic tanks) and urban waste water discharges impacting on water quality and amenities
- urban air quality in cities and towns
- nuisance and amenity impact from noise and odour
- radon in homes.

In addition, from an emerging risks perspective, we need to be vigilant in relation to:

- climate change-induced health risks
- antimicrobial resistance
- new chemicals and substances.

While some existing and emerging challenges exist, on the whole Ireland's environment provides an excellent basis for maintaining and improving our health and wellbeing. To capitalise on this, we must foster a new awareness of the

enormous importance of the environment to all aspects of our lives – physical and mental health, social life, economic prosperity and sustainable food and water – by ensuring that people are offered good access to green and blue spaces, and that the Government, businesses and individuals play their part in protecting and sustaining our environment.

What is clear from international work cited herein is that a clean, protected and accessible environment contributes significantly to the status of our health and quality of life, to reducing healthcare costs, and to the successful delivery of national public health policy. Accordingly, Ireland must put in place the necessary measures to ensure that our natural environment is protected and enhanced so that we can derive the associated wellbeing and life expectancy benefits.

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