An Taisce
The National Trust for Ireland

WFD SWMI Consultation,
Water Quality Section,
Department of the Environment,
Community and Local Government,
Newtown Road, Wexford

waterq@environ.ie

18th December, 2015

Re: Public Consultation on the Significant Water Management Issues for Ireland 2017-2021

Dear Sir/Madam,

An Taisce would like to make the following comments on the draft Significant Water Management Issues for Ireland 2017-2021 report which we request the Department take into consideration.

An Taisce participated in all stages of the public consultation on the Significant Water Management Issues for Ireland 2017-2021 report and would appreciate notification of further meetings to discuss the conclusions of this consultation.

Yours sincerely,

Fintan Kelly
Natural Environment Officer

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- Response to Consultation -

Significant Water Management Issues for Ireland 2017-2021

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Introduction

The consultation

This submission is in response to the public consultation on the Significant Water Management Issues (SWMI) for Ireland to be addressed in the second round of River Basin Management Plans, with a deadline of the 18th of December as advertised at http://www.environ.ie/en/Environment/Water/WaterQuality/News/MainBody,41920,en.htm.

These plans, which will be in place by end-2017, will set out the environmental goals to be achieved by end-2021 together with the measures needed to ensure that they are delivered in practice.

An Taisce welcomes the study and the opportunity to submit a submission.
An Taisce would like to be included as a stakeholder on further workshops or consultations on this subject.

Our organisation

Founded in 1948, An Taisce are one of Ireland's oldest and largest environmental organisations. An Taisce is a charity that works to preserve and protect Ireland's natural and built heritage. We are an independent charitable voice for the environment and for heritage issues. We are not a government body, semi-state or agency. The work of our staff is focused in three areas: Advocacy, Properties and Education.

An Taisce are one of the 26 of Ireland's environmental NGO's which form the Sustainable Water Network (SWAN). We work together to protect and enhance Ireland's aquatic resources through coordinated participation in the implementation of the Water Framework Directive (WFD), the Marine Strategy Framework Directive (MSFD) and other water-related policy and legislation.

Introduction to this submission

An Taisce have independently and as part of SWAN has been actively engaged in Water Framework Directive (WFD) and other water policy implementation consultations over previous decades. We have made numerous submissions on reports relevant to the WFD and have been engaged with this cycle of the WFD at the pre-consultation stage of the Significant Water Management Issues for Ireland report. We welcome the opportunity to have input into this important stage of the

WFD cycle. We have not been able to comment on all of the SWMI that we feel are important for this WFD cycle but we have highlighted key issues which we feel are a challenge to Ireland's ambition to achieve compliance with our legal obligations under the WFD and which may pose a threat to the protection of our natural heritage.

An Taisce have engaged in the SWMI workshop of SWAN members in Dublin on December 3rd and have made our input into the SWAN submission highlighting key concerns and giving examples of issues we have encountered over the years. We endorse the SWAN submission.

We recognise that our input into the pre-consultation phase for this report has been somewhat fruitful and that our suggestions such as the need to include the dramatic loss of High Status sites since the 1980's as a SWMI has been taken on board. Many of the changes that have been made aren't revelations and many of the issues we have highlighted have not been addressed. This draft SWMI is a backward step compared to the SWMI report for the previous cycle and even that document was not adequate. Judging from this report there is still a total unwillingness to address issues emanating from the agricultural, forestry and peat extraction sectors in a meaningful way. There is a lack of ambition and lack of clarity regarding key sectoral pressure and in particular a lack of information on pressures which have grown since the last SWMI report. The purpose of this report is to objectively set out the Significant Water Management Issues Ireland is facing in the context of achieving our obligations under the WFD by the end of the next cycle in 2021. The report lacks context in terms of the first WFD river basin planning cycle. What has worked? What has not? What has changed since the first cycle?

The report demonstrates a worryingly low level ambition. The discussion about 'Affordability and Prioritisation' has no place in a SWMI report. Again the objective of a SWMI is to objectively identify the key issues facing our compliance with the WFD. The debate on affordability is for another day. Prioritisation in the WFD can only be undertaken at the waterbody level and there are strict exemption criteria which have to be adhered to. The discussion of cost is completely meaningless unless placed in the context of the economic cost of inaction. For example what is the cost of losing another salmon river in terms of local tourism? What is the cost of closing off bathing waters on local tourism? What is the economic cost of pollution to shellfish water for the aquaculture industry? What is the economic cost of water treatment? What is the healthcare cost of waterborne disease both economic and human? What is the cost of flooding? What is the cost of legal actions taken against Ireland by the European Commission? What is the cost of restoration of water quality, ecology and waterbody morphology compared to the cost of preventing deterioration? What is the cost of transporting water from the Shannon to Dublin versus the cost of wise water management and rainwater harvesting? These are the questions that need to be asked.
An Taisce call on the Department of the Environment, Community and Local Government to carry out an economic assessment of WFD compliance versus non-compliance but not at this stage of the WFD cycle and not as part of the SWMI process.

The 'Pressures on our Water Environment' section does not go far enough in setting out the full range of sector-based pressure sources. This is a basic requirement of a SWMI and needs to be revised. The multitude of pressures exerted by agriculture, urban waste water treatment, forestry, homes and gardens, industrial discharges and invasive alien species need to be elaborated in detail.

The reporting within the document and in other recent EPA publications is overly positive and does not reflect the scale of the challenge we face in order to achieve WFD compliance by 2021. Our failure to achieve our targets by 2015 is not sufficiently addressed. This should be a natural starting point for any cycle. Instead positive trends are over emphasised. The poor situation in the 1990's means that improvements in certain parts of the country were inevitable. Ongoing deterioration in water quality in certain areas is not addressed sufficiently. The threat posed by the expansion of the agricultural sector and the forestry sector are not addressed in any meaningful way. These are major issues and a strategy to address inevitable negative impacts needs to be developed.

There is a lack of reference baseline data and there is no reference to the gap between current parameters and WFD requirements. Achieving WFD compliance is the objective so having no reference to targets does not make sense. Reporting focuses on improving impacted sites rather than absolute sites meeting/failing to meet WFD obligations. Reporting high and good status sites as one block masks the loss of high status sites and is not appropriate. There are data gaps such as the amount of P (Phosphorus) loading attributable to forestry since 1995.

In general the SWMI consultation has failed to engage with the general public. The Minister stated his desire to engage with the general public and committed to raising awareness about the consultation nationally over the past six months. To our knowledge this has not happened.

Agriculture

Context

An Taisce welcome the addition of a subsection on Agriculture in the draft SWMI. However as we have already stated in the pre-consultation phase the report still does not go far enough in describing the scale of the challenge posed by diffuse agricultural pollution or the hydrological and morphological alterations to water bodies associated with agriculture. In addition to this the SWMI report and previous EPA reports on a national and RBD scale have not gone far enough in describing the challenge posed by agricultural intensification.

The ambitious targets set for the expansion of the Irish food and drink industry and in particular the dairy sector under Food Harvest 2020 and Food Wise 2025 are the greatest threat posed to Ireland's compliance with WFD obligations. There is no reason to believe that the negative impact that agriculture is currently having on our aquatic environment will not intensify in line with increased production and stocking densities. Many water bodies have zero capacity to absorb future negative impacts if good status is to be achieved and if high status sites are to be retained. All sectors of Irish society must develop in a sustainable manner which is reflective of the finite nature of the planets resources and its capacity to withstand unsustainable land use practices. All sectors must adhere to Irish and European environmental legislation, of which the WFD is just one example.

Agriculture as a SWMI

According to the Significant water management issues in the Scotland river basin district report (2007) diffuse agricultural pollution can have the following impacts:

- Losses of nutrients from fertilisers, animal manures and slurries applied to land result in the proliferation of plant growth. This can smother rivers and estuaries while, in lochs and coastal waters, plankton reduces light penetration and affects oxygen levels.
- Organic matter from animal manures, slurries and effluent from livestock feeds (e.g. silage) depletes oxygen levels in rivers. This, together with toxic components such as ammonia, reduces the number of animals and plants that can thrive in our rivers.
- Soil erosion can have a direct physical impact by smothering gravels in rivers and lochs, and reducing light penetration in estuaries and coastal waters. It is also important in the transport of other pollutants such as pesticides, nutrients and faecal pathogens attached to soil particles.

• Livestock manures and slurries, and access to watercourses by cattle and sheep, can lead to significant losses of micro-organisms from faecal matter to bathing and shellfish waters. This can affect the amenity value of the water environment and pose a risk to human health.
• Losses of pesticides and veterinary medicines (including sheep dip) during handling, use and washdown can cause severe impacts on plants and animals in rivers and can affect the quality of drinking water. Diffuse pollution from agriculture is a significant issue for groundwater, rivers, lochs, transitional and coastal waters.

According to the EPAs Water Quality in Ireland Report 2010-2012 (2015), 47% of rivers, 58% of lakes and 55% of transitional water were not of good status for the period 2010-2012. The two most important suspected causes of pollution in rivers are agriculture and municipal sources, accounting for 53% and 34% of cases respectively. There was for example also a 5% reduction in satisfactory quality lakes (10 lakes) compared to 2007-2009 (EPA, 2015). Agriculture has been identified as the most significant pressure on water quality in the SERBD, the NWIRBD and NBIRBD (EPA, 2014[2], EPA, 2014[1]). The most widespread water quality problem in Ireland continues to be elevated nutrient concentrations. The EPA water status assessment for 2010-2012 (2015) shows that water quality problems tend to be greater in areas of intensive agriculture and where population densities are highest due to wastewater discharges to waters. The most important suspected sources of pollution is agriculture. It has been estimated, that in 2012, the relative contribution of nitrogen and phosphorus to surface waters were mainly from agriculture (88% of nitrogen and 49% of phosphorus) and wastewater discharges (5% of nitrogen and 30% of phosphorus). Nationally there is a significant ongoing trend is the increase in slight pollution (Class B) from 12 per cent in the 1987-1990 period to over 20 per cent at present. More than half of the cases of slight pollution (which typically corresponds to moderate ecological status under the Water Framework Directive assessments) was attributed to agriculture – primarily diffuse agricultural pollution causing eutrophication. Agriculture is second to Municipal Waste Treatment and Urban Activities when it comes to Moderate Pollution (EPA, 2015).

Within the SWMI report itself the matrix of links between sectors and water issues reveals that the agricultural sector is linked to Nutrient Enrichment, Health, Abstraction, Physical Modifications, and Sediment. Invasive species is the only pressure that Agriculture has not been linked to meaning that in total it is linked to 5/6 of the pressures compared to an average of 1.57 pressures for the other 7 sectors.

Agriculture is also one of the main land uses in high status catchments and is as a result one of the most important pressures and threats on these extremely sensitive waterbodies. . The percentage number of high quality sites had almost halved in the 22 years between 1987 and 2012 (EPA, 2015). In each survey period the decline continued, from 29.6% of the total sampled in the 1987-1990 period to 16.4% in 2007-2009. Although there was a slight increase in the numbers of high status sites in the latest survey (18.3%) EPA 2010-2012 survey (EPA, 2015). Only 11.5% of

rivers, 9% of lakes and 3.6% of transitional waters were considered to be of high status for the 2010-2012 period (EPA, 2015). The smallest pressure can impact on high status. Small increases in the amount of P and N (Nitrogen) can damage the sensitive ecology associated with these sites (Ní Chatháin et., 2012). Identified pressures include land-use changes associated with agriculture such as field drainage and fertilisation, animal access to waters, and sheep dip pesticides (Ní Chatháin et., 2012). Significantly the national network of high status water bodies are clustered and high status sites a negative correlation with intensive agriculture (Irvine & Ní Chuanigh, 2010). The ongoing intensification of agriculture in areas with high status water bodies is a major concern and has been addressed (EPA, 2015; Forest-Service, 2015).

The freshwater pearl mussel (Margaritifera Margaritifera) and the Nore freshwater pearl mussel (Margaritifera durrovensis) are indicator species for pristine freshwater environments. It is very revealing that the most significant threats and pressures to this species are associated with agricultural practices and intensification. Addressing the following pressures and threats are considered to be of high importance for the survival of this threatened species:

- Restructuring agricultural land holding
- Modification of hydrographic functioning, general
- Other human induced changes in hydraulic conditions
- Restructuring agricultural land holding
- Water abstractions from groundwater
- Diffuse pollution to surface waters due to agricultural and forestry activities

Food Harvest 2020 envisages the agri-food and fisheries industry expanding from its baseline output of €24 billion per annum by increasing the value of primary production by 33%; increasing value-added outputs by 40%; and increasing exports by 42% by 2020. Food Harvest included specific sectoral growth targets to be achieved between the reference years 2007 to 2009 and 2020. These targets included a 50% volume increase in milk production; a 20% increase in value of beef output; a 50% increase in the value of pig meat production; a 20% increase in the value of sheep meat production; and a 10% increase in the value of poultry production. Food Harvest 2020 also includes recommendations for the development of the cereal; forestry and bio-energy crop; organic production; and horticulture sectors (Farrelly et al., 2014).

According to the Environmental Analysis Report for Food Harvest 2020 the overall environmental impact of Food Harvest 2020 was found to be Slight Negative pre-mitigation. These findings are based on risks associated with projected increases in input of organic and inorganic nitrogen and phosphorous fertilisers. Potential adverse impacts are primarily related to projected expansion of dairying and pig / poultry enterprises with potential loss of semi-natural habitats and ecological features; reduction in the suitability of habitats for a range of species, particularly lowland farmland birds (Farrelly et al., 2014). Food Harvest 2020 is likely to exacerbate pressures already associated with nutrient enrichment, sedimentation; and acidification of surface waters; and nitrate and phosphate leaching into

groundwater; microbiological contamination; contamination from pesticides, herbicides and farm chemicals; and abstraction pressure.

The Environmental Analysis Report for Food Harvest 2020 also makes reference to the fact that the protection of some drinking water sources is inadequate that the increased loading of nutrients predicted under Food Harvest 2020 was deemed to be a "risk factor". The overall predicted impact before mitigation was found to be slight negative for water quality. This finding nationally is based on risks associated with projected increases in inputs of organic and inorganic nitrogen and phosphorous fertilisers along with strict adherence to existing legislation and GAEC (Farrelly et al., 2014). An assessment based on strict adherence to existing legislation and GAEC is not based in reality. If legislation and the requirements of GAEC were currently adhered to we would already have met our targets under the WFD for 2015. In a real world or business as usual scenario everyone will not adhere to legislation and best practice and agriculture will continue to be a major source of slight, moderate and serious pollution across all RBDs. An increase in the threats and pressures associated with agriculture will cause a deterioration in water quality nationally and lead to the loss of good status, high status and Q5 status in breach of our WFD obligations. Ireland faces enormous challenges to bring water bodies to the "good status" required under the Water Framework Directive and to prevent further deterioration in water quality. Agriculture will have a large influence on Ireland's success in meeting water quality targets. The expanding production capacity of Irish agri-food processing companies may lead to an increase in discharges. The location of some existing processing sites could reach a limit where the assimilative capacity of receiving water is at or near capacity. Eutrophication is already a significant problem and the expansion of the national dairy herd is likely to compound this issue.

The interim report for the Agriculture Catchments project (ACP) reveals weaknesses in the current regulatory measures under current conditions. Annual average P concentrations in three of the six catchment streams regularly exceeded the Irish Environmental Quality Standard (EQS). 50-100% of sites were found to be at risk of not meeting WFD ecological standards for macroinvertebrates. Nitrate concentrations were over the EPA standard needed to support 'Good status'. The increase in N and P inputs associated with Food Harvest 2020 will exacerbate these issues.

Livestock manures and slurries, and access to watercourses by cattle and sheep, can lead to significant losses of bacteria, viruses and protozoa to drinking, bathing and shellfish waters. This can affect the amenity value of the water environment and pose a risk to human health (Mawdsley et al., 1995; SEPA, 2007). Following the application of these wastes to land the potential exists for environmental contamination. Plants, soil and ultimately water courses which may subsequently be used as catchments for public water supplies may all be affected. (Mawdsley et al., 1995; SEPA, 2007). Grazed grasslands are the main diffuse source of pathogens (Oliver et al. 2005) and the magnitude of the impact on water quality is a function of stocking density, length of grazing season and grazing practice (Ferguson et al. 2007). The increase in slurry associated with Food Harvest 2020 and Food Wise

2025 as well as the predominance of grass based bovine husbandry in Ireland means that intensification will have a negative impact on health. The health impact of agricultural expansion should also be considered as well as the associated cost implications involved in making contaminated water potable.

We recognise that there has been an improvement in the levels of pollution emanating from the agricultural sector since the 1990's. Improved awareness for example has contributed to a reduction in the amount of fish kills associated with poor agricultural practices (EPA, 2015). While we recognise that projects associated with the Agricultural Catchments Programme and the measures associated with the Nitrates Directive have reduced the levels of eutrophication associated with agriculture in many catchments it is unlikely that water quality will not deteriorate if intensification of bovine related agriculture continues without rigorous mitigation measures. The EPA themselves have highlighted that the planned expansion in the agricultural sector under Food Harvest 2020, is the single biggest threat to the modest improvements seen in recent years (EPA, 2015).

The strategy to mitigate these negative impacts is vague and is based around the assumption that we will achieve 100% compliance with environmental legislation and GAEC (good agricultural and ecological conditions), which is fanciful. The main strategy seems to be to increase monitoring. Waiting for an inevitable impact does not seem a wise or cost effective strategy in the long run as restoration and in particular ecological restoration can take time and resources. Food Harvest 2020 is not in line with our obligations to improve water quality, protect biodiversity or address climate change. The unsustainable expansion of agriculture is not sustainable or viable in the medium to long term. An Taisce question whether it can deliver on any of the three pillars of sustainability. The entire strategy needs to be seriously and urgently revaluated at the highest level.

Municipal and Urban Wastewater

Municipal and Urban Wastewater as a SWMI

According to the EPAs most recent water quality assessment the most widespread water quality problem in Ireland continues to be elevated nutrient concentrations (EPA, 2015). These water quality problems are noted to be greatest where there is intensive agriculture and where population densities are highest due to wastewater discharges to waters. The same report shows that 47% of rivers, 57% of lakes and 53% of estuarine and coastal water assessed were impacted primarily by the effects of nutrient enrichment. After agriculture, wastewater discharges to water from human settlements, including towns, villages and rural houses was the biggest source of water pollution. In 2012, the relative contribution of nitrogen and phosphorus to surface waters was 5% of nitrogen and 30% of phosphorus from wastewater discharges.

Over the 2010-2012 reporting period the EPA identified municipal wastewater as being a major cause of slight, moderate and serious pollution in Ireland's rivers and canals. Municipal sources of pollution accounted for 28% of the river and canal sites with slight pollution. The majority of these cases were due to suspected nutrient losses from municipal wastewater treatment plants. Municipal wastewater accounted for 39% of the moderate pollution in our rivers and canals. Municipal wastewater treatment plants are the suspected cause of pollution for eight of the 13 seriously polluted river sites (bad ecological status). Serious pollution resulting from urban wastewater and industrial pollution was reduced to 17 km of river channel length. This was down from 53 km in 2009. Urban wastewater treatment (UWT) also accounted for 4.9% of N and 28.7% of P in the marine environment (EPA, 2015). Wastewater discharges, emergency discharges from storm water outfalls, and drainage from domestic wastewater systems are the greatest issue for bathing water quality in Ireland. In 2014 there were 27 incidents related to sewage pollution (EPA, 2015). Waste water discharges were considered a contributing factor to the poor classification of all 7 of the 136 EU identified bathing waters which failed to comply with minimum water quality standards and were classified as 'poor' in 2014. These pollution incidences have serious impacts on the environment, human health and tourism.

URBAN WASTE WATER TREATMENT DIRECTIVE

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 European Union Urban Waste Water Treatment Directive (UWTD) of 1991 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. European Union member states are required to implement the Directive through national legislation. The main environmental objective of the Urban Wastewater Treatment Directive, is to provide specified levels of treatment based on the size of the agglomeration and the type of

water body to which the wastewater is discharged (freshwater, estuarine or coastal, sensitive or non-sensitive). The Directive also specifies mandatory effluent quality standards for discharges from larger agglomerations. In Ireland, there were 170 such larger agglomerations in 2012. The Directive requires 'appropriate treatment' at all other agglomerations, i.e. those below the threshold size of the larger agglomerations.
The national regulation which gives effect to the requirements of the UWTD are the Urban Waste Water Treatment Regulations 2001-2010. A further national measure taken in Ireland to prevent and reduce pollution by urban waste water discharges was the introduction in 2007 of a licensing and authorisation process for such discharges (EPA, 2015).

The EPA's Urban Waste Water Treatment in 2014 report (2015) provides a summary of national compliance in 2014 with requirements of the Urban Waste Water Treatment Directive, including the EPA's assessment of approximately 25,000 effluent monitoring results, which were reported to the EPA by Irish Water. The report also addresses enforcement of waste water discharge authorisations and includes an assessment of compliance with effluent standards set in the authorisations, using results from the EPA's annual effluent monitoring programme (EPA, 2015).

Some of the key findings of the report were:

Infrastructure

- 12 (7%) large urban areas did not meet the European Union Directive requirement to provide secondary (biological) treatment.
- 7 large urban areas did not comply with the European Union Directive requirement to provide infrastructure to reduce nutrients and discharged effluent which did not meet nutrient quality standards.
- Untreated sewage was discharged from 45 areas, 27 of which are located in counties Cork, Donegal and Galway.

Effluent Quality

- 143 (82%) large urban areas complied with the mandatory European Union effluent quality and sampling standards.
- Just 24% of the waste water load discharged into sensitive areas from large towns and cities complied with mandatory European Union nutrient quality standards, up from 17.5% in 2013. Dublin and Cork were the major contributors to this low rate of compliance.

Water Quality

- The number of seriously polluted river sites where pollution is attributed to urban waste water discharges is down from 9 in 2009 to 1 in 2014.
- Waste water discharges contributed to poor water quality at 7 of Ireland's 136 identified bathing waters.

Incidents

- 72% of the 1,294 incidents reported to the EPA related to breaches of discharge quality standards.
- 42% of incidents were attributed to insufficient treatment capacity and 21% of incidents were attributed to operational and management practices.

Recommendations

It is clear that wastewater is one of the water quality issues in Ireland. Due to investment there have been improvements in wastewater treatment infrastructure and monitoring. However there is still significant non-compliance with the statutory timelines specified in waste water discharge licences for completion of improvement works and some important infrastructural works necessary to improve waste water discharges and comply with the European Union Directive requirements are still overdue. Approximately 46% of the improvement works due between 2009 and 2014 were reported as complete at the end of 2014, with the remainder still outstanding. Irish Water must address these matters and ensure compliance with licence requirements. Ireland's failures in relation to wastewater discharges are well documented with as case currently open in the European Court of Justice against Ireland on the UWTD and case 2013/2056.

Given the scale of the problem the level of investment being made by Irish Water into waste water treatment plants needs to continue and grow. Investment in infrastructure, monitoring 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. The targets set out in Irish Waters 25 years Water Services Strategic Plan, are not ambitious enough.

Point sources of pollution need to be eliminated. The elimination of all raw sewage discharges needs to happen as soon as possible. The discharge of poorly treated sewage is also not acceptable and needs to be addressed. All wastewater infrastructure must be in compliance with the requirements of the Urban Waste Water Treatment Directive and waste water discharge authorisations.

Sensitive areas as defined by the Urban Waste Water Treatment (Amendment) Regulations as waters that are eutrophic or may become eutrophic unless protected. The emphasis on eutrophic status is too narrow and is indicative of the fixation on the achievement of "good status". A broader environmental perspective must be considered when the need for investment is being made. The need to protect high status sites and designated aquatic habitats must be considered. Priority should also be given to waters designated under the Habitats and Birds Directives. Top priority should be given to eliminating point source discharges and wastewater discharges from important freshwater pearl mussels, Atlantic salmon and shellfish waters.

An Taisce have highlighted cases where effluent is being discharged into water bodies creating unacceptable environmental damage as well as being a serious health risk. In the past year An Taisce have notified the EPA of discharges into Dublin Bay and Baldoyle Bay SAC/NHA 004016, Baldoyle SPA 000199, County Dublin and Lough Lurgeen Bog/Glenamaddy Turlough SAC, Site Code: 000301, County Galway. In the case of the Glenamaddy discharge An Taisce sent a report to the EPA. Galway County Council have noted to the EPA noted that "the existing wastewater treatment plant would not be considered to be effective at treating the sewage generated within [Glenamaddy]...[It] is grossly undersized and may currently be significantly impacting on the [Glenamaddy] Turlough and the ground water in the region." The Council's application continued, "Ground Water Movement out of the [Glenamaddy] Turlough is toward the Lettera Spring and is potentially impacting on the quality of water used for public consumption in the [Glenamaddy] Area." In addition to presenting a potentially serious threat to drinking and bathing water in the Glenamaddy region, the sewage is believed to be impacting adversely on the turlough, which is a Special Area of Conservation under Irish law. Turloughs are one of only sixteen so-called "priority habitats" in Ireland. They are almost unique to Ireland and are hence one of our most strictly protected natural areas. Internal documents obtained by An Taisce under access to information rules reveal that a member of the public complained to the EPA's Office of Environmental Enforcement about the sewage in 2012. Following this complaint, Galway County Council's Environment Section carried out a site visit to the turlough and reported back to the EPA that they could find no sign of the complained of discharge. Yet the primitive sewage unit was only a few metres from where the Council looked and carries prominent Galway County Council signage. Moreover it is the subject of regular maintenance work by the Council and had been the subject of a licence application by the Council to the EPA itself some three years earlier.

Investigative report reveals serious human health and environmental hazard in Co. Galway.

http://www.antaisce.org/articles/investigative-report-reveals-serious-human-health-and-environmental-hazard-co-galway

Discharges that fail to meet the standards set out by the Bathing Water Regulations should be prioritised. Discharges into locations such as Bundoran, Co. Donegal pose a serious health risk given the popularity of the area for bathers and surfers.

All discharges must comply with the effluent quality and sampling standards in the Directive and the waste water discharge authorisations.

Corrective action plans need to be developed and implemented to prevent pollution and restore affected waters to good quality.

The seriousness and the scale of the task at hand are highlighted by the fact that the EPA consider the increased nutrient loadings to waters from municipal wastewater discharges due to population growth and increased numbers of connections from unsewered populations and industries to municipal wastewater

treatment plants to be the biggest threat to water quality along with Food Harvest 2020 moving forward.

Forestry

Forestry as a SWMI

Under the Water Framework Directive (WFD) (2000/60/EC), EU member states must implement the necessary measures to prevent deterioration in the status of all bodies of surface and groundwater and where necessary, restore all waters to good ecological and chemical status by 2015. As part of the initial characterization process required under the WFD, a risk assessment of the anthropogenic pressures on water resources was undertaken to identify the pressures present in each river basin and the threat they pose to the chemical and ecological status of waterbodies. This "National Characterisation Report for Ireland" (Anon, 2005) identified forestry as one of the land-use activities posing a potential risk in terms of diffuse pollution. Forestry in Ireland, along with agriculture is accepted as a major source of diffuse pollution. Forestry both directly, indirectly and cumulatively may negatively impact on water quality and represents a risk to the ecological integrity of Ireland's aquatic environment (Hutton et al., 2008). Pressures associated with forestry in the report were increased acidification from plantations in acid sensitive catchment, sedimentation from clear fell, harvesting, new plantations, road construction and erosion on steep catchments and eutrophication from fertilisation on steep catchments and forest harvesting on peat soils (Hutton et al., 2008).

Historically Irish forestry has been concentrated on agriculturally unproductive or 'marginal' land. Much of this marginal land is found in our uplands, where many Irish rivers are sourced and where many of our dwindling high status sites remain. These areas are usually characterised by highly mobile soils such as peat which are associated with a higher risk of acidification and sedimentation. The distribution of forestry nationally is not homogenous and as such it is a greater source of pollution in some catchments than others. Forestry is however a significant water quality issue in certain parts of the country due to the status of forestry as a significant land use and also due to other contributing factors such as local abiotic conditions and forestry management (Hutton et al., 2008).
According to the integrated water quality assessment for the North Western and Neagh Bann River Basin District in 2013, a total of 168 river stations in the North West International River Basin District (NWIRBD) had a biological Q value that was less than 'good' status (i.e. <4). The suspected causes of pollution at 93 or 55.4% of these stations was agriculture while 32 or 19% of pollution incidences were due to forestry. The third biggest pressure was municipal waste water which was identified as a pressure at 22 or 13.1% of stations (EPA, 2014). Similarly in the Western River Basin District (WRBD) forestry is one of the most significant suspected causes of pollution. The main causes of river station in the WRBD river stations being in unsatisfactory condition (i.e. biological classification less than Good) was 31% agriculture, 21% municipal waste water and 11% forestry (EPA, 2014).

According to the EPAs National Source Apportionment Assessment 2012 forestry is responsible for 3,014,509 N Load Kg yr^{-1} and 300,500 P Load Kg yr^{-1}. The percentage difference in N has increased a massive 44% on the 1995 assessment figures. There are no figures available for P in 1995 unfortunately to make a comparison but one can assume a similarly significant rise. Based on these figures forestry nationally is more N polluting than unsewerd houses and comparable to unsewered house in terms of P pollution (EPA, 2015).

According to the Ireland's Forestry Programme 2014-2020 the aims of Ireland's forest policy is to encourage planting by private landholders in order to achieve a forest cover of 18% by 2046. The ongoing expansion in the national forest estate will take place on private land holdings and will be driven by the provision of grants to cover the cost of afforestation, and an annual forest premium to compensate for income foregone as a result of converting farm land to forest (Forest-Service, 2015). It is likely that forestry will continue to grow in areas of the country where forestry has traditionally been a significant and growing land use such as the North Western, Western and South Western River Basin Districts as well as upland areas. These areas as typified by marginal farmland and the generous incentives for forestry are competitive with incomes derived from other traditional land uses such as extensive sheep farming. The current water quality issues associated with forestry will be exacerbated as forestry expands nationally. This will be a challenge to Ireland meeting our targets under the WFD unless changes in practice are adopted.

ACIDIFICATION

Forestry causes acidification in surface waters through its interception of atmospheric pollutants coupled with the inability, in sensitive areas, of the substrate soils and geology to buffer the acidity. Factors that influence the scale of acidification are (I) the pollutant load and (II) the percentage of catchment forest cover (Johnson et al., 2008).

Forest canopies can significantly increase the capture of sulphur and nitrogen pollutants from the atmosphere. The scavenging of natural and anthropogenic sulphur and nitrogen has been observed to be greater for conifer species due to the large surface area and aerodynamic roughness of their evergreen canopies (Forest Service UK, 2003). The extent of the pressure is likely to vary with tree species with some species, such as Sitka spruce (*P. sitchensis*), being more effective scavengers of pollutants than others (Johnson et al., 2008). This is an issue in an Irish context given that the national forestry inventory stocked forest area is made up of 68.6%, broadleaves 17.5% and mixed forests 13.9%. Of this the vast majority of the national tree species composition is made up of Sitka Spruce at 52.4% with the second most common species being Larch sp making up just 4.4% (Forest-Service, 2014).

Mature forest canopies are more efficient at intercepting aerosols and dust particles from the atmosphere due to their height and surface area. Acidification will therefore increase as trees grow and the height of the stand increases (Johnson et al., 2008).

This also worrying in an Irish context given that just under three quarters of the national forest estate consists of trees of 30 years old or less (Forest Service, 2014).

Table 1. Tree Species Composition (Forest-Service, 2014)

Species Area	ha	%
Sitka spruce	334,560	52.4
Norway spruce	26,340	4.1
Scots pine	8,010	1.3
Other pine spp.	61,950	9.7
Douglas fir	10,380	1.6
Larch species	27,740	4.4
Other conifers	3,850	0.6
Pedunculate and sessile oak	16,840	2.6
Beech	9,500	1.5
Sycamore	9,250	1.5
Birch spp.	37,370	5.9
Ash	20,610	3.2
Alder spp.	15,080	2.4
Other short living broadleaves	46,220	7.3
Other long living broadleaves	9,440	1.4
Total	637,140	100

The interception of pollution also increase as altitude increases (>300 m) because of the longer duration of cloud cover and higher wind speeds. The expansion of conifer forest over a significant proportion of acidified catchments (>30%), or the restocking of existing forests above 300 m altitude, will increase surface water acidification (Forest-Service UK, 2003). The pollutant load varies from site to site and is influenced by emission levels, climatic conditions (e.g. frequency and magnitude of rainfall events, the amount of annual rainfall, prevailing wind direction) as well as

site characteristics such as elevation and aspect, tree species, stand age and structure. Clear-felling is also has an acidification effect as tree removal results in nitrogen mineralisation and nitrification. This can result in nitrate leaching and enhance acidity and aluminium solubility in waters draining some soils (Forest-Service UK, 2003).

As with any pressure which is contingent on a number of contributing factors it is difficult to make simplistic generalisations about the relationship between forest cover and acidification pressure however coniferous forestry in Ireland has been shown to depress site pH and alkalinity of surface waters (Johnson et al., 2008; Kelly-Quinn et al., 2008). Research carried out in Ireland has demonstrated that forestry on peat and podzolic/lithosoilic soils on both igneous/metamorphic and sedimentary geology and to some extent on poorly drained gleys has resulted in increased acidification of surface water. The minimum pH for both peat and podzolic/lithosolic sites on igneous/metamorphic geology began to fall below the lower limit of the control sites when forest cover exceeded values in the region of 25-30%. The same results were found on peat sites draining sedimentary geology (Kelly-Quinn et al., 2008). The impacts of acidification on the physical and chemical status of surface waters were observed to impact upon the aquatic biology within the studied sites. Biological data largely mirrored the trends for the acidity variables and several macroinvertebrate metrics (taxon richness, ephemeropteran richness, abundance of baetids, EPT richness, diversity indices), showed a strong relationship with pH, were also shown to vary significantly across the forest cover bands or to correlate with % forest cover. The fish analyses has highlighted significant differences in fish catch and density between the control and forested groups. This difference was mainly attributed to low numbers of fry (salmon and trout) in the forested streams (Kelly-Quinn et al., 2008). Acidification of surface water can result in a cascade effect down through the trophic levels in aquatic ecosystems. Observed biological impacts associated with acidification in Irish streams in Wicklow, Galway and South Mayo include 1) the reduction in or total elimination of fish populations, 2) reductions in taxon richness and elimination of some acid-sensitive macroinvertebrate groups (particularly the Ephemeroptera) and 3) changes in the quality of primary producers. The effect of acifdficiation is so pronounced in some rivers that pH has been found to be the key variable structuring biological communities (Kelly-Quinn et al., 2008).

EUTROPHICATION

Eutrophication is the process whereby a water body becomes is impacted upon by an increase in nutrients, usually nitrogen (N) and phosphorus (P). This fertilisation can result in increased growth of algae and other plant life which in turn can deplete the levels of oxygen in the water. Reduced oxygen will may negatively impact on invertebrate and fish communities (Hutton et al., 2008).
While the eutrophication impact of forestry is not as pounced as that of agriculture the impact of forestry is magnified by a number of factors. Forestry is usually located in upland areas and the eutrophication impact on headwaters and tributaries can be felt far downstream. Eutrophication on relatively pristine upland streams is

compounded downstream by a multitude of pressures. Impacts on feeder streams may impact on public and private water supply, damage important salmonid fisheries and degrade impotent high status sites (Hutton et al., 2008).
Phosphorus is a limiting nutrient in Irish freshwater ecosystems. While mineral soils are proficient at immobilising P sandy and organic/peaty soils have a reduced capacity to hold onto P and are therefore associated with P leaching. Catchments which contain soils with a poor capacity for P absorption are therefore more susceptible to P eutrophication (Hutton et al., 2008). Given that many forests have been established on peaty soils there is an increased likelihood that forestry in Ireland are contributing to the eutrophication of Ireland's aquatic environment (Hutton et al., 2008). To give an indication of the scale of peatland afforestation in Ireland the state-sponsored forestry company Coillte had 55% of its total estate on peatlands in 1999 (Table 2).

Table 2 Percent of soil types on Coillte's estate (Anon, 1999)

Soil type	**%**
Gley	20
Podsol	20
Brown Earth	11
Other Mineral	5
Virgin Blanket Bog	34
Cutover Raised Bog	4
Cutover Blanket Bog	3
Virgin Raised Bog	2
Fen	1
Total	100

Plantations which have been established on Irish blanket bogs have been observed to have surface water P concentrations which are well above Irish thresholds for the eutrophication of rivers. Elevated P concentrations were noted up to three years after felling and fertilisation took place (Renou & Cummins, 2002). This historical legacy of forestry on peat soils is further exacerbated by the fact that many of these plantations predate the Forestry and Water Quality Guidelines (2000).
Studies in Ireland have identified elevated N levels in surface waters post felling and/or fertiliser treatments (Cummins & Farrell, 2003). Increased N inputs in tandem with forest maturation may lead to the phenomenon of nitrogen saturation resulting in nitrification and nitrate leaching. Farrell et al. (2001) found that an area of first rotation sitka spruce plantation in Wicklow was suffering from N saturation.
Fertilisation is one of the main sources of eutrophication associated with forestry. Its impact will be influenced by a number of variables such as soil properties, application timing, weather, catchment size and the water bodies' characteristics (Hutton et al., 2008). In Ireland, phosphorus in the form of granulated rock phosphate is the main fertiliser used in forestry, with nitrogen and potassium occasionally used (Hutton et al., 2008). One of the main issues associated with P in an Irish context is the increased run off of P after fertilisation on peaty soils. Fertiliser-induced leaching of phosphorus from peatlands drained for forestry has been detected in Irish studies (Cummins & Farrell, 2003).

Nutrients associated with forestry may also originate from decaying organic matter, including brash, and harvest residue associated with crop thinning or felling. The release of excess nutrients in the form of decaying organic matter is further exacerbated post felling as this is the time when there is least primary production and nutrient uptake on site (Hutton et al., 2008). Nutrients are typically lost into receiving surface waters post felling following rain showers. Staggeringly brash alone may contain half the amount of phosphorus recommended in fertiliser prescriptions and double the normal nitrogen application rate (e.g. Hyvönen et al., 2000). Different elements of the brash will decay at different rates and release different nutrient loads. Foliage and fine roots and branches will decay resulting in an initial flush of nutrients while coarser less nutrient rich stumps and thick branches will decay slower releasing their nutrients over a longer period of time (Hutton et al., 2003).

Forestry is also associated with increased atmospheric deposition of N. The scavenging of atmospheric ammonium and nitrate by conifer species may lead to plantation soils reaching saturation point. Nitrogen leakage into surface water as the result of N saturation has been observed and may be accompanied by elevated concentrations of inorganic aluminium (Farrell et al., 2001).
Schulte et al. (2006) found that the annual amount of 'net rainfall' impacts on nitrate concentrations, while the risk of phosphorus loss was highest in western and northern areas of Ireland, where poorly drained soils carry water surpluses for large parts of the year and supply a pathway for P loss. This is an obvious issues for forestry in our uplands and along our western seaboard. These higher areas with high annual precipitation are also associated with peaty soils. This combination of factors means that extensive drainage systems are often present. These drainage systems and peat soils result in increased surface water runoff and transportation of pollution. This acts in combination with the poor P retention of peaty soils to increase the risk of eutrophication in some catchments.
Eutrophication is known to impact upon the composition, diversity and functional organisation of aquatic invertebrate communities. Eutrophication particularly with P can lead to an increase in primary production of algae and other flora resulting in a subsequent decrease in dissolved oxygen and elevated pH. Impacting on the chemical composition and characterises of a waterbody on such a fundamental level naturally impact every trophic level within the aquatic environment. Eutrophication is commonly one of the leading causes of fish kills (Hutton et al., 2008).
P and N compounds can be directly toxic to freshwater pearl mussels. Eutrophication can cause filamentous algae to dominate rivers. Algal growth can smother the river bed limiting the exchange of oxygen on which juvenile mussels depend for survival. Dense algal growth can reduce the levels of dissolved oxygen in the water column at night which can result in the deaths of adult mussels. Decomposing algae can also clog up the riverbeds as they decompose resulting in the death s of juvenile and adult mussels trough asphyxiation (Anon et al., 2010; Moorkens, 1999).

SEDIMENTATION

Sedimentation is the deposition of fine sediment onto the stream bed or in stream gravels. Sedimentation is one of the main Impacts of forestry on water quality. Forestry operations which cause soil disturbance and sediment runoff into waterways include cultivation, road building and harvesting. Soil is disturbed and exposed at various stages of the forest life cycle, the most important being site preparation, drainage, road/bridge construction and harvesting (Hutton et al., 2008). The risk of sedimentation is influenced by a number of local factors. Certain soils types such as peats are highly erodible while soils with a high clay content would sit on the other end of the spectrum. The extent to which soil will erode is influenced by the slope and run-off. Steep slopes are associated with rapid surface run-off and fast flow in drains, and therefore are associated with a high risk of sedimentation (Hutton et al., 2008).

The climate will influence the extent of erosion and is linked to altitude, exposure and annual rainfall. Forestry at higher altitudes experience higher levels of rainfall annually and generally greater exposure as will plantations on the west coast. These areas of high rainfall are generally characterised by peat formation in Ireland and this will act in tandem with high levels of run-off and erodible soils to create a higher risk of erosion. The vegetation on site will effect run-off and sediment entrapment. Vegetative ground cover will increase surface roughness and reduce run-off velocity and erosion (Gao et al., 2015). This is why the utilisation of appropriately spaced and vegetated aquatic buffers is such a valuable tool in preventing siltation (Hutton et al., 2008).

The release of silt and sediment can smother streambeds and decreasing oxygen levels within the waterbody. A reduction in the availability of oxygen will impact on the macroinvertebrates and fish life present in the effected habitat (Hutton et al., 2008). The scale of the damage done to the aquatic environment will also vary depending on the sensitivity of the receiving water body. High status (Q4-Q5) rivers will contain species which are dependent on pristine or near pristine water quality. The negative impact of siltation usually comes under scrutiny through its impact on freshwater ecology and in particular young salmonids and freshwater pearl mussels. Sedimentation associated with forestry can however impact on every trophic level. Siltation and a resultant increase in turbidity can cause a decrease in sunlight penetration into the water column which will impact on primary productivity. This has been observed in Ireland post felling (Gallagher et al., 2000). Primary producers form the foundation of for higher trophic levels and any negative impacts on primary production due to siltation will negatively impact on invertebrate and fish communities.

The main ways in which fine sediment can impact on benthic invertebrates are by altering substrate composition and stability, by negatively impacting respiration due to the deposition of silt on respiration structures or by lowering oxygen concentrations. Siltation will also impact on filter feeders ability to forage. Reduced macroinvertebrate taxa richness (particularly of species associated with high water quality) was observed in Ireland in a study on forestry sediments (Johnson et al.,2000).

Fine sediment impacts on fish species in a number of different ways. Reducing the amount of light available for primary producers will ultimately impact on animals higher up in the food chain such as fish. It may impact on their ability to locate food due to turbidity as reduced growth rates have been observed. Fish populations have been observed to be more susceptible to disease due to siltation. In extreme cases sediment may block the fishes gill rakers resulting in mortality (Newcombe & Jensen, 1996). One of the most studied impacts of sedimentation is the smothering of salmonid spawning sites and a decrease in the amount of dissolved oxygen available for fish eggs, larvae and juveniles to develop. Large inputs of sediment will change the physical instream environment impacting on macroinvertebrates and fish. In extreme cases habitat may be lost due to infilling and migration patterns will be impacted (Hutton et al., 2008).

Sedimentation can impact on any life stage of the freshwater pearl mussel (Margaritifera margaritifera), but it is during the first five years of their lives when the juvenile mussels are buried in the sand and gravel, that they are most vulnerable. Sedimentation during this period in their lives can clogs the gaps in the riverbed, which impacts on the movement of water through the benthic environment and in doing so limits the amount of oxygen reaching the juvenile mussles. This can lead to asphyxiation. Large influxes of sediment can also agitate the adult mussels into clamping closed in order to prevent clogging of their gills. Prolonged closure has been known to lead to the death of the adults through oxygen deprivation or starvation (Anon et al., 2010; Moorkens, 2000).

PESTICIDES

Cypermethrin a Priority Substance pesticide which is highly toxic to aquatic invertebrates is widely used by Coillte. The FSC has classed cypermethrin as highly hazardous and Coillte have applied for a further derogation to continue to use it. The Environmental Pillar called for a ban on its use in its submission on the public consultation this year the continuation of the derogation. Cypermethrin is very toxic even at low concentrations (Marigoudar et al., 2009). Under various lab experiments Cypermethrin has been demonstrated to be acutely toxic to an array of freshwater invertebrates and some species of fish (Cyprinus carpio. Scardinius erythrophthalmus, Salmo gairdneri, Salmo trutta and Tilapia nilotica) (Stephenson , 1982). Cypermethrin is acutely toxic to crustaceans and reduces the abundance of abundance of rotifers, protozoans and bacteria and the chlorophyll-a concentration of planktonic and periphytic algae (Friberg-Jensen et al., 2003). The reduction in predatory crustations is likely to lead to fundamnetal chnages uin the species composition of lower trophic levels (Friberg-Jensen et al., 2003). At high doses cyperomethrin is lethal to finfish while fish exposed to sub lethal doses have exhibited erratic and darting movements with imbalanced swimming activity, which might be due to the malfunctioning of neurotransmitters, followed by hyper and hypo opercular activity, loss of equilibrium, and mucus secretion all over the body were observed (Marigoudar et al., 2009). The use of all pesticides should be reduced.

Recommendations

Forestry is already identified as a significant pressure on water quality in certain RBDs and catchments. Given that the ongoing expansion of forestry in line with national targets of increasing forest cover from 10.7% to 18% by the mid-century it is extremely likely that the threat posed by forestry to water quality and aquatic ecology will only increase with time unless proactive action is taken by the EPA and Forest Service (Forestry Service, 2015). There are a number of factors within the makeup and distribution of the national forest estate which mean that the current pressures being exerted on water quality by forestry are likely to increase.
The fact that the majority of the national forest estate predates the current Forestry and Water Quality Guidelines (2000) means that vast areas may not be compliant with the guidelines and therefore a threat/pressure on water quality. Replanted forestry must adhere to the current Forestry Service guidelines. The definition of a waterbody within the Forestry and Water Quality Guidelines (2000) is linked to whether a river featured in the old Ordinance Survey Ireland 6" map series. According to a personal communication with OSI the criteria for featuring a river in the 6" map was that the river had a name. This does not seem a reasonable basis for adjudging whether a river deserves an aquatic buffer under the Forestry and Water Quality Guidelines. The definition of a waterbody needs to be updated and a new guideline adopted which is linked to the potential of forestry to negatively impact on aquatic biodiversity. Under the Forestry Service UK Guidelines a 10m setback may be required for a river under 2m wide. Currently in Ireland set backs are not even required for large drains which flow directly into designated SAC Rivers. A review of compliance with the Forestry and Water Quality Guidelines would also be very helpful in identifying sources of pollution and in encouraging greater compliance among foresters.

All forestry must be in line with Ireland's legal requirements under the Water Framework Directive and the Habitats and Bird Directives. Any impacts should be highlighted and made public so that the direct, indirect and cumulative impacts of more forestry in these catchments can be assessed through the appropriate assessment procedure under the Article 6 (3) and (4) of the Habitats Directive (Council Directive: 92/43/EEC). An Taisce are aware that foresters regularly indicate that that the standard 10m setback will be established when in fact the greater 15m setback should be used due to the presence of highly erodible soils or a steep slope on site. Buffers that are too narrow are likely to provide inadequate protection. Buffer zones are important tools to combat the loss of P and N to the freshwater environment. The effectiveness of these buffers across different sites is however poorly understood. Models need to be developed for nutrient and sediment losses under different soil, slope, climatic conditions etc. The physical and biological factors which characterise an effective buffer zone are still poorly under stood. Over time buffer may become saturated by P and N rendering them less effective. More research is needed to ascertain whether the recommended buffer widths and riparian vegetation are effective at mitigating impacts of eutrophication and sedimentation in Irish forests.

As has been highlighted previously the predominance of coniferous species nationally and in particular of sitka spruce is an issue when it comes to acidification (Johnson et al., 2008). The age structure and the related height structure of Irish forestry nationally will also lead to greater acidification affect (Johnson et al., 2008). The location of so much forestry on soil types that are sensitive to acidification and the concentration of forestry at high altitudes is also an issue which is highlighted in the scientific literature (Johnson et al., 2008). Increasing the amount of broadleaf species nationally will reduce acidification and have obvious biodiversity benefits. Reducing the amount of forestry being planted in peaty soils and at altitude will also reduce acidification. In the UK the agreed approach is to undertake a catchment-based critical load assessment for waters failing or at risk of failing good status due to acidification (Forest Service UK, 2003). Given the ongoing loss of high status sites and the above highlighted issues it would be beneficial to carry out a catchment based assessments of pressures associated with forestry.

The opening-out of stream sides can promote biological recovery in streams showing acidification. Targeting such streams for earlier clearance of dense conifers, conversion to open, native broadleaved woodland and linking restored zones can aid the migration of fish and recolonization by invertebrates (Forest Service UK, 2003). Restructuring closed canopy conifer stands can help reduce pollutant capture and the risk of acidification by creating a more diverse forest with different aged stands, more open space, and a wider range of tree species including broadleaves. Restructuring should be prioritised in areas with - forest cover is over 50%, acid sensitive soils, areas with high-status sites or designated waterbodies (SAC/SPA/NHA/pNHA).

The impact of individual pressures on macroinvertebrate communities has been well researched but the cumulative impact of various forestry related pressures is less well understood. New bio-indicators may be needed to answer some of the questions around instream impacts moving forward.

Given the toxicity of Cypermethrin it should be completely banned in Ireland.

Sedimentation and eutrophication increase as the extent of soil disturbance increases. Limiting the area of land within a given catchment which is either being planted or harvested at any given time will limit the amount of sediment within the aquatic environment. This may be particularly beneficial in catchments with high erodible soils. Controlling the proportion of a catchment disturbed at any one time will also reduce N and P inputs (Hutton et al., 2008). The forestry service Code of Best Forest Practice – Ireland (Forest-Service, 2000b) advises that harvesting operations should take place between April and October. This is when ground conditions tend to be drier and water quality impacts associated with harvesting are therefore reduced. However the forestry service "Appropriate Assessment Procedure (AAP) requirements regarding Hen Harrier SPAs, felling and other disturbance operations" state that no disturbance operation(s) associated with the felling licence are to take place within Hen Harrier 'Red Areas' during their breeding season (1st April to 15th August, inclusive) (Forest-Service, 2012). Restricting felling and other operations associated with ground disturbance to August 16th – October increases

the likelihood of forestry associated water pollution. This is a major issue in areas where there is an overlap of Hen Harrier SPAs and Freshwater Pearl Mussel SACs. In such areas it is questionable whether current forestry practices can avoid having a significant negative impact on both protected species simultaneously. This conflict between forestry, the Habitats and Birds Directives and the Water Framework Directive must be resolved.

Despite the increased risk of P loading Ireland's uplands and western seaboard are generally associated with higher Q values and high-status sites. This is likely to be due to the lower incidences of other pressures such as intensive agriculture and municipal and urban waste water (Hutton et al., 2008). However the EPA Water Quality in Ireland 2010-2012 report (2015) highlights the ongoing decline in Irelands Q5 and high status (Q4-Q5) sites. Forestry is likely to be one of the main sources of pressures on the chemical, physical and ecological integrity of the water bodies in these sites. What is most concerning is the fact that the true impact of forestry is yet to be manifested. Given that just under three quarters of the national forest estate consists of trees of 30 years old or less a large proportion of the national forest estate will be felled within a relatively short timeframe (Forest- Service, 2014).

Peatlands

Context

In the Republic of Ireland, peatlands cover an estimated 20% of the land area and have been widely utilised over the centuries for energy production, agriculture, forestry and horticultural production (Wilson et al., 2013). Intact bogs are internationally important sites for biodiversity and significant carbon sinks (Wilson et al., 2013). The hydrological services of Irish peatlands have been highlighted in the BOGLAND report. Peatlands provide a wide range of hydrological functions. Peatlands play a water storage and filtering role. Peatlands can buffer water supplies during short droughts. Peatlands can moderate runoff and reduce the risk of flooding and the hundreds of millions worth of damage that go with it (Renou-Wilson et al., 2011). The unsustainable utilisation of our peatlands has undermined their ability to fulfil their numerous ecosystem services (Renou-Wilson et al., 2011). Current estimates suggest that only c. 15% of Irish peatlands are in a natural state, with the remainder being either moderately or severely damaged. (Douglas et al., 2008).

Degraded peatlands as a SWMI

Afforestation of peatlands negatively impacts upon their hydrology and carbon cycling with resulting impacts on water quality via the water draining from the afforested areas (Renou-Wilson et al., 2011). The impacts of peat mobilisation on water chemistry and ecology due to peatland afforestation has been covered in the forestry section and does not need repeating. Similar impacts result from of

degraded water quality in peatland catchments arise from overgrazing due to peat erosion (Renou-Wilson et al., 2011).

The removal of large expanses of peatlands by mechanical excavation has inevitably had a major impact on the environment. Both domestic and industrial scale utilisation of peat required that extensive drains be dug to drain these wetlands. Drainage leads to the lowering of the water table and, by exposing the upper layers to the air, results in the drying out of the peat and alters the vegetation it supports (EPA, 2008). The channels left by machine cutting also act as drains, further increasing water removal from the ecosystem. The drainage of peatlands has serious impacts on water quality. The main impacts of peatland drainage on water quality are related to the loss of particulate peat into the aquatic environment. This is associated with sedimentation and discolouration associated with dissolved and particulate organic carbon (Armstrong et al., 2010).. This loss of large amounts of organic material is associated with elevated levels of nutrients such as N but particularly P. U.V. radiation from sunlight on silt deposits, contained in the shallow waters of the rivers, causes the release of organically bound and bio available orthophosphate to the waters. This will increase the amount of eutrophication in the water (EPA, 2008).

The impacts of sedimentation and eutrophication on freshwater biodiversity have been covered in detail in the forestry section of this submission. The negative impacts of sedimentation as described in the forestry section such as impacts on primary production, fish reproduction, decreased hunting success and mortality through the clogging up gills rakers and reduced dissolved oxygen content have been documented in relation to peat silt (EPA, 2008). The negative impacts associated with river drainage, channelization and alteration to river morphology are often associated with industrial peat extraction (EPA, 2008). The EPA have identified peat harvesting as a one of the leading causes of siltation nationally. Sensitive species, including the Freshwater Pearl Mussel and fish, can be affected by the smothering effects of inert or organic silt such as peat (EPA, 2015). In addition to water quality issues, the peat extraction activities in these catchments may produce morphological pressures due to intensification of land use and artificial channelisation of natural streams and rivers (EPA, 2008).

In the EPA 2010-2012 Water Quality in Ireland report peat harvesting was associated with 1% of slight pollution and 2 % of moderate pollution in river sites nationally (EPA, 2015). Peatlands are responsible for 1.2% N and 5% of P nationally. This makes peat the greatest source of P nationally outside of agriculture and waste water treatment. Since previous reporting periods sources of phosphorus from forestry, peatlands, urban areas and unsewered populations have increased. Likewise sources of nitrogen from urban wastewater, forestry, peatlands and urban areas have also increased. According to the EPAs National Source Apportionment Assessment 2012 peatlands are responsible for 2,131,174 N Load Kg yr^{-1} and 327,343 P Load Kg yr^{-1}. Increasing by 10.5% and 10% respectively on the 1995 assessment figures. The increasing impact of peat on water quality is concerning. Considering the impact of peat on a national scale as has been done in many of the EPA reports does fully reflect the intensity of the impact that peat extraction is

having in certain catchments. Other major sources of nutrients such as agriculture and wastewater discharges are ubiquitous pressures found in every corner of the country. Peat soils cover 20.6% of Irelands terrestrial land area (Renou-Wilson et al., 2011). Only a fraction of these will be deep peatlands such as raised bogs and blanket bogs which are suitable for peat extraction and obviously not all deep peatland habitat are currently being harvested for peat. Therefore the fact that peat extraction and peatland degradation can register on a national scale as a major source of nutrients and sediment highlights just how polluting peatland mismanagement is for the aquatic environment.

Peat excavation is a locally significant water management issue in the Shannon International River Basin District (ShIRBD) in terms of being an important land use giving rise to potentially high nutrient (particularly phosphorus) and suspended solids export into streams and rivers, with subsequent effects on water quality (EPA, 2008). Data indicates that the amount of phosphorus loading from the worked bogs in Ireland varies greatly but is significant in all cases. An EPA study in the Lough Derg catchment revealed losses from worked bogs of 1.6 tonnes TP (EPA, 2008). A Bowman, et al (1993) study on eutrophication causes in Lough Derg estimated phosphorus load from worked bogs ranges from 2.8 to 5.6 tonnes TP. Figures from the Lough Derg & Lough Ree Catchment Monitoring and Management System Report (2001) indicated annual load estimates of circa 5.4 tonnes of TP.
In compliance with the Water Framework Directive, a characterisation assessment of pressures and their impacts was carried out for peatlands in the Shannon International River Basin District. The report focused on the impact on water quality of peat extraction in Bord na Móna bogs in the Blackwater, Boora and Mountdillon group of bogs (EPA, 2008). According to the EPA the results of the Pressures and Impacts assessment in the WFD Article 5 Characterisation Report indicate that river water bodies in the peatlands are affected by diffuse pollution. An assessment of the biological quality within these catchments by the EPA indicate that if the status quo is maintained, these water bodies will fail to meet the objectives of the Water Framework Directive by 2015. Although there is no link to a specific pollution source, the excavation of peat is the predominant activity in these catchments and would be expected to be the main pressure. Although Bord na Móna silt ponds that are cleaned, managed and have a defined locatable outlet can technically be described as point sources, these occur in areas with significant private peat production that have unpiped unknown discharges. The combined pressure in certain areas can, therefore, be best described as diffuse (EPA, 2008).

Recommendations

Certain recommendations can be made regarding the management of milled peat operations, as it is clear that these activities affect water quality.
Private peat producers with excavation of peat in areas >50 hectares should be brought into the IPPC licensing system by the EPA.
The majority of turf cutting plots are individually too small to surpass the IPCC threshold of 50 ha. Collectively however they are much greater than the 50 ha threshold. Unregulated domestic peat extraction is a significant source of water

pollution (EPA, 2008). Indeed many plots are not managed individually as contractors will harvest multiple sites on an individual bog over the summer. Domestic peat production needs to be regulated and strict controls placed on its impact on water quality. Discharges from smaller private enterprises, into catchments with less than good water status, or with high status sites or sensitive water bodies less than the threshold currently required for IPPC licensing should at least be licensed under the Water Pollution Acts by the relevant Local Authority.
The BOGLAND project has demonstrated the compelling evidence of the importance of Ireland's peatland resource in terms of biodiversity, climate, landscape, culture, spiritual, heritage and water quality and watershed management (Renou-Wilson et al., 2011). Peatland are wetlands that are intrinsically linked to the surrounding freshwater environment. There wise management should be linked to the WFD. An Taisce support the recommendation of the BOGLAND report that a National Peatland Strategy is developed to implement the sustainable management of peatlands. The ensuing National Peatland Policy should be integrated into other government policies, such as the Water Framework Directive (Renou-Wilson et al., 2011).
Peat is a finite resource and one that is quickly diminishing. Given the multitude of negative impacts that peat extraction and combustion is having on the environment we must now act to stop the degradation of our peatlands and restore them wherever possible. An Taisce call on the EPA and other relevant government bodies to carry out a full economic assessment of peatlands in Ireland in terms of water quality, watershed management and carbon sequestration. Peatlands and high carbon soils should be at the heart of our national approach to Land Use Land Use Change and Forestry (Wilson et al., 2013). Peatlands are a source of between 1.3–4.7 Mt C yr^{-1}. Mitigation measures to reduce national emissions from peatlands should include: (1) a stronger enforcement approach to protect and enhance the C store in natural peatlands, (2) the rewetting / restoration of degraded peatlands to reduce emissions and create suitable conditions for C sequestration and (3) the use of alternative non-peat sources for energy production and horticulture use (Renou-Wilson et al., 2013). Their exclusion from our national approach to LULUCF and Climaet Smart Agriculture is political, short sighted and not fact based. Peatlands should be managed in order to maintain water storage, water control and water supply in catchments and so that they can continue their natural role in watershed management, river basin management and flood control schemes. The ability of peatlands in the ShIRBD to ease flooding events has been proposed already (Renou-Wilson et al., 2011). An economic assessment of such a strategy should be carried out taking into account the economic cost of flooding in the ShIRBD this Winter (2015) and in past years such as 2009.
An Taisce support the following management of peatlands for water (MPW) recommendations made in the BOGLAND report (Renou-Wilson et al., 2011).
It should be ensured that peatlands (including cutaway peatlands) are fully included in the development of River Basin Management Plans and that they are appropriately assessed in Strategic Environmental Assessment of County Council Development Plans.
The enhancement of cutaway peatlands for flood storage and attenuation should be investigated.

High Status Sites

Context

The absence of a dedicated section on high status sites under the Water Framework Directive was an omission which An Taisce highlighted during the SWMI pre-consultation phase. It is positive that our comments and the comments of the broader environmental community have been taken on board. However much greater emphasis must be placed on the conservation and restoration of these sites. They are extremely important from an ecological perspective. There conservation and appropriate management is also a legal obligation under the Water Framework Directive.

The Water Framework Directive (WFD; 2000/60/EC) requires all EU Member States to categorise their water bodies according to their ecological status as high, good, moderate, poor and bad. The WFD also requires that Member States identify water bodies that have been minimally impaired by anthropogenic pressures (Irvine & Ní Chuanigh, 2010). In comparison to other EU Member States and certainly in comparison to other countries in Western Europe Ireland retains a large number of high status water bodies. This due to the low historical intensity of land use in many areas and low density human population (Irvine & Ní Chuanigh, 2010). There has however been a dramatic decline in the number of high status river sites since 1987. The percentage number of high quality sites had almost halved in the 22 years between 1987 and 2012 (EPA, 2015). In each survey period the decline continued, from 29.6% of the total sampled in the 1987-1990 period to 16.4% in 2007-2009 (Figure 1). Although there was a slight increase in the numbers of high status sites in the latest survey (18.3%) EPA 2010-2012 survey (EPA, 2015). Only 11.5% of rivers, 9% of lakes and 3.6% of transitional waters were considered to be of high status for the 2010-2012 period (EPA, 2015).

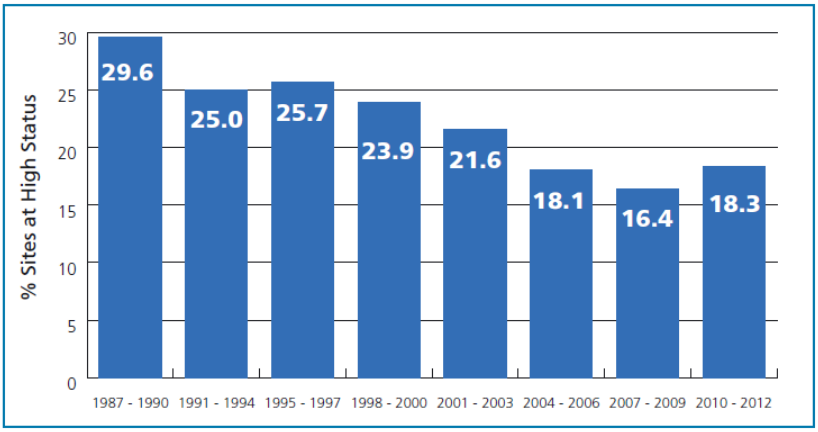


Figure 1: Long-term trends in the percentage number of high ecological quality (macroinvertebrate) river sites (1987 – 2012). EPA Water Quality Report 2010-2012 (EPA, 2015).

High Status Rivers equate to an EPA river monitoring score of Q4 or Q5 (EPA, 2015). The number of sites assigned Q5 high status reference condition continues to decline in the latest survey (38 sites (2007-2009) to 27 (2010-2012)).
Figure 2 shows the distribution of remaining 507 high status sites across the country (EPA, 2015). While Ireland still retains a large number of high status sites this ongoing numeric decline is very concerning. Such extensive and long-term monitoring is not available for other water bodies, although less than 30% of 35 putative reference lakes identified by the EPA were confirmed as such by palaeolimnology (Irvine & Ní Chuanigh, 2010).

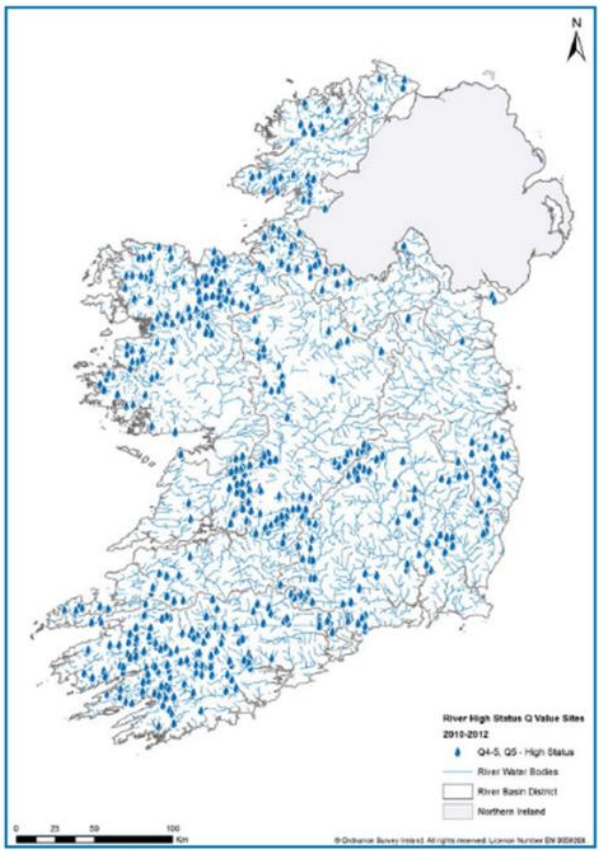


Figure 2: Map showing the location of the 507 high status Q value (Q4-5, Q5) sites across the country. EPA Water Quality Report 2010-2012 (EPA, 2015).

High status sites are indicators of largely undisturbed conditions and reflect natural background status or only minor distortion by anthropogenic influences (Ní Chatháin et., 2012). These are the reference sites from which all other sites are compared in order to estimate an Ecological Quality Ratio (EQR) based on observed state compared with reference. High status sites are important in this regard in that they provide a baseline against which monitored sites can be compared (Irvine & Ní Chuanigh, 2010). The majority of Ireland's habitats, including water and wetland habitats that are listed under the Habitats Directive are reported to be of poor or bad conservation status. Only 7% of listed habitats are considered to be in a favourable state. In Ireland 61% of species listed under the Habitats Directive are in an un-favourable state. Species particularly of wetland and freshwater environments are reported to be of poor or bad conservation status, including the Atlantic salmon, and the freshwater pearl mussel (NPWS, 2013a; NPWS, 2013b). High status sites are integral for the maintenance of biodiversity, ecological integrity and as refugia

for sensitive and often endangered species. These refugia will hopefully play a pivotal role on the recolonization of restored sites in the future (Ní Chatháin et., 2012). These maintenance of these refugia is also important given that the multiplicity of pressures exerted by factors such as climate change will only intensify moving forward.

Legal Context

The maintenance of high status water bodies is a fundamental element of the legislation within the WFD (2000/60/EC). Article 4.7 of the WFD clearly states:
Member States will not be in breach of this Directive when failure to prevent deterioration from high status to good status of a body of surface water is the result of new sustainable human development activities and all the following conditions are met:
(a) all practicable steps are taken to mitigate the adverse impact on the status of the body of water;

(b) the reasons for those modifications or alterations are specifically set out and explained in the river basin management plan required under Article 13 and the objectives are reviewed every six years;

(c) the reasons for those modifications or alterations are of overriding public interest and/or the benefits to the environment and to society of achieving the objectives set out in paragraph 1 are outweighed by the benefits of the new modifications or alterations to human health, to the maintenance of human safety or to sustainable development;
(d) the beneficial objectives served by those modifications or alterations of the water body cannot for reasons of technical feasibility or disproportionate cost be achieved by other means, which are a significantly better environmental option; and exemption for activities that prevent the future achievement of good status through restoration activities have been defined.

There is also a direct overlap between our legal obligations to meet Ireland's conservation objectives for designated aquatic species under the Habitats Directive and our Water Framework Directive obligations. The WFDs programme of measures to achieve its environmental objectives are linked to measures specified under 11 named Directives, including the Habitats Directive. Likewise the conservation objectives for species such as the freshwater pearl mussel are linked to the maintenance of high status under the WFD (Ní Chatháin et., 2012). Sub-basin plans and environmental objectives established for freshwater pearl mussel populations designated under the Habitats Directive are also part of the Water Framework Directive's river basin programme of measures. They form part of the Basic Measures and the objectives for these protected areas must be achieved by 2015 and beyond (Anon et al., 2010).

The locations of high status sites overlap with the locations of protected areas on the Register of Protected Areas under the WFD (Ní Chatháin et., 2012).

These included:
• Candidate Special Areas of Conservation (cSACs) designated under the Habitats Directive;
• Freshwater pearl mussel cSAC catchments designated under the Habitats Directive;
• Special Protection Areas (SPAs) designated under the Birds Directive;
• National Heritage Areas (NHAs) and proposed NHAs under the Wildlife Act;
• Shellfish-designated waters designated under the Shellfish Directive;
• Recreational bathing waters designated under the Bathing Water Directive;
• Designated drinking waters under the Drinking Water Directive; and
• Nutrient-sensitive areas under the Urban Waste Water Treatment Directive.

Given the overlapping network of legislation, management plans and structures in place to protect high status sites and their ecological components you would assume that they would be well protected. This is not the case unfortunately as to date, the key focus in the implementation of the WFD has largely been on the objective that all water bodies meet at least good status by 2015. The WFD environmental objectives have received far less attention (Ní Chatháin et., 2012). Many high status sites also lie outside of designated sites under the Habitats and Birds Directives and are not covered by the aforementioned legislation (Ní Chatháin et., 2012).

Pressures and Threats

If we are to address the ongoing decline in high status sites then we must tackle the principal threats and pressures causing the damage. Efforts to achieve good status have often focused on identifying point sources of pollution. However the situation with high status sites is more complicated in that given their pristine status even relatively low intensity activities such as an increase in diffuse pollution at catchment scale can cause the loss of Q4 and Q5 status (Ní Chatháin et., 2012). The smallest pressure can impact on high status. Small increases in the amount of P and N can damage the sensitive ecology associated with these sites (Ní Chatháin et., 2012). Likewise small changes in acidity, siltation, hydromorphological pressures or priority substances will have a disproportionate impact on a high status system relative to the impact of the same input to an already degraded system (Ní Chatháin et., 2012). Identified pressures include land-use changes such as field drainage and fertilisation, one-off housing, forestry activities, wind farms, animal access to waters, and sheep dip pesticides (Ní Chatháin et., 2012). Significantly the national network of high status water bodies are clustered and high status sites a negative correlation with intensive agriculture (Irvine & Ní Chuanigh, 2010). The ongoing intensification of agriculture and the expansion of forestry in areas with high status water bodies is a major concern and has been addressed in the relevant sections of this document (EPA, 2015; Forest-Service, 2015).

Given that the freshwater pearl mussel (Margaritifera Margaritifera) and the nore freshwater pearl mussel (Margaritifera durrovensis) are associated with high status/near pristine water quality, the threats and pressures they are currently experiencing are indicative of the pressures being exerted on high status sites in general. According to the NPWS (2013) report on "The Status of EU Protected

Habitats and Species in Ireland" both species have are of bad conservation status with an overall declining trend in conservation status. The pressures and threats identified by the NPWS are:

PRESSURES

Modification of hydrographic functioning, general - high importance
Other human induced changes in hydraulic conditions - high importance
Restructuring agricultural land holding - high importance
Water abstractions from groundwater - high importance
Diffuse pollution to surface waters due to agricultural and forestry activities - high importance
Pollution to surface waters by industrial plants - medium importance
Diffuse pollution to surface waters due to other sources not listed - medium importance
Pollution to surface waters by storm overflows - medium importance
Other point source pollution to surface water - medium importance
Diffuse pollution to surface waters due to household sewage and waste waters - medium importance
Surface water abstractions for public water supply - medium importance
Collapse of terrain, landslide - low importance
Dredging/ removal of limnic sediments - low importance
Other outdoor sports and leisure activities - low importance

THREATS

Modification of hydrographic functioning, general - high importance
Other human induced changes in hydraulic conditions - high importance
Restructuring agricultural land holding - high importance
Water abstractions from groundwater - high importance
Diffuse pollution to surface waters due to agricultural and forestry activities - high importance
Pollution to surface waters by industrial plants - medium importance
Diffuse pollution to surface waters due to other sources not listed - medium importance
Pollution to surface waters by storm overflows - medium importance
Other point source pollution to surface water - medium importance
Diffuse pollution to surface waters due to household sewage and waste waters - medium importance
Surface water abstractions for public water supply - medium importance
Collapse of terrain, landslide - low importance
Dredging/ removal of limnic sediments - low importance
Other outdoor sports and leisure activities - low importance
Changes in abiotic conditions - low importance

Recommendations

An Taisce support the findings/recommendations and the key strategies proposed by the EPA in their "Management Strategies for the Protection of High Status Water Bodies" report (Ní Chatháin et., 2012).

Findings/Recommnedations:
(i) Planning and development in high status catchments is an environmental issue;
(ii) High status catchments provide valuable ecosystem services;
(iii) High status catchments have little to no capacity for further intensification;
(iv) High status catchments and protected areas require similar protection strategies; and
(v) County Development Plans and all plans and policies should reflect the sensitivity of high status water bodies.

The key strategies proposed are:
(i) High status catchment delineation and prioritisation for protection measures;
(ii) Establishment of a spatial network of high status waters;
(iii) Establishment of a 'blue dot' monitoring system by the EPA;
(iv) Potential additional measures under the WFD over and above European Directive requirements;
(v) Assessment of potential impacts, and consideration of the risk of failing to meet high status;
(vi) Planning/Licensing control and assessment of cumulative impacts;
(vii) Centralised GIS database, or activities database;
(viii) Integrated monitoring and protection;
(ix) Unregulated activities – where control mechanisms are required; and
(x) Public awareness campaigns.

Agricultural intensification and forestry are two major driver of biodiversity loss in both the terrestrial and freshwater environment. There is a strong overlap with high status sites and many of our upland areas of high biodiversity value. Many of these areas are managed for conservation or are part of High Nature Value farming systems. Under the current RDP several schemes will be introduced under Pillar II in the form of Locally Led Agri-Environment Schemes. These schemes will include a freshwater pearl mussel scheme, a hen harrier scheme and an upland scheme. These schemes will also to complemented by the by the Green Low Carbon Agri-Environment Scheme (GLAS). Given the spatial overlap between the areas involved in these schemes and high status catchments it may be beneficial to incorporate measures that protect high status sites and water framework directive objectives into the programme moving forward.

While it is true that 'The Department of Agriculture, Food and the Marine is giving priority access to the GLAS agri environmental scheme to farmers in areas with high status waters' there do not appear to be any nutrient input restrictions beyond current regulations (GAPP regs) and low emission slurry spreading is optional. Also while the scheme does have water protection measures e.g. Protection of

Watercourse from Bovines, it was designed with minimal input from catchment or aquatic scientists / ecologists and its exact water quality and water status targets are unclear in relation to controlling nutrient and other pollution in high status catchments. It is therefore difficult to assess how successful this scheme will be in preventing the deterioration of further high status sites.
Ultimately the polluter pays principle must be embraced by all sectors of society. Our aquatic environment is a shared resource and no one should have the right to degrade this resource for personal profit. Measures to achieve WFD targets must be integrated into Pillar I payments under the CAP. The ongoing greening of CAP must integrate water quality issues.

The need to review forestry practices, forestry consent and the appropriate assessment procedure and the forestry and water quality guidelines has been covered in detail in the forestry section. Pressures exerted by forestry such as eutrophication, sedimentation and acidification will all negatively impact upon high status sites. These pressures will only increase as forest cover expands nationally. Peat excavation has a number of negative impacts on water quality, wetland and freshwater ecology and river and wetland morphology. Peat extraction eutrophication, sedimentation and acidification. High concentrations of peat silt in surface waters can kill fish by clogging up gills and or making it impossible for the fish to feed. It can also clog up spawning gravels such that spawning will not be possible and it also reduces primary productivity in rivers there by affecting the quantities of fish food being produced (EPA, 2008). In addition to water quality impacts peat extraction can water quality issues, the peat extraction activities in these catchments may produce morphological pressures due to intensification of land use and artificial channelisation of natural streams and rivers (EPA, 2008). Illegal and unregulated turf cutting must stop. Appropriate controls and environmental impact assessments must be carried out for peat extraction in high status catchments.

The Planning and Development (Amendment) Act 2010 has strengthened the relationship with the WFD, providing a clearer requirement for local authorities to consider potential impacts on high status water bodies. While better planning for development including one-off housing and associated water treatment is required it does not address low level and localised impact from land use. The 'Precautionary Approach' must be implemented and approval should not be given in the absence of evidence demonstrating that a site has the capacity to absorb the impacts of a new development. More stringent planning requirements should be introduced for catchments of 'high status', pristine rivers and lakes, and these areas should be mapped and included in local authority development plans. Local authority guidelines on high status sites should be reviewed. An AA style screening approach could be adopted for high status catchments, to improve the assessment of cumulative impacts within these catchments, and to trigger the requirements for EcIA or EIA (Ní Chatháin et., 2012).

High status sites should be afforded the same level of protection as protected habitats, under the habitats and birds directives with the same approach to planning and appropriate assessment. High status sites should be connected and be part of a

conservation strategy on a landscape scale. A national network of aquatic buffers and riparian habitat would protect aquatic biodiversity as well as providing habitat and corridors for terrestrial wildlife.

The protection of high status sites needs co-ordination at national level and RBD level by all local and public authorities. A detailed, of threats and pressures, within individual high status catchments will inform remediation efforts and inform the screening for potential impacts by local and public authorities and to trigger impact assessments, which may be required of applicants. Policies and objectives within CDPs will provide a focus for protection and restoration of these sensitive catchments (Ní Chatháin et., 2012). The protection of high status waters requires an effective policy framework and protection mechanisms. It also requires locally focussed stakeholder engagement and a redirection of funding targeted to be fit for purpose. Relying on current policies and structures to protect high status water bodies is unlikely to be effective. (Irvine & Ní Chuanigh, 2010).

Climate Change

Climate Change as a SWMI

Climatic changes in the coming decades will create a spectrum of impacts with huge implications for water management. Ireland, as a mid-latitude country, has so far mirrored global average temperature increase and is projected to continue to do so. This will result in increasingly drier summers with increased risk of water shortages and wetter winters with increased risk of seasonal flooding. Changes in frequency, magnitude and intensity of extreme weather events are expected which will put pressure on our water resources and infrastructure (McElwain and Sweeney 2003; McGrath and Lynch, 2008; Sweeney et al., 2008).
A recent study by Fischer and Knutti (2015) shows that at the present-day warming, about 18% of the moderate daily precipitation extremes and 75% of the moderate daily hot extremes over land globally are attributable to human-induced global warming since pre-industrial times. It has been estimated that global average temperature will have risen by 2°C (compared with pre-industrial levels) by mid-century on our current trajectory. At 2°C the proportion of precipitation extremes attributable to human impact rises to about 40%. Research carried out by Oxford University and KNMI, currently going through peer-review, suggests that the intensity of Storm Desmond was made 40% more likely by climate change but that exposure and vulnerability to flooding (flood defences) factor hugely in the impact such events have. Preparedness for these new extremes and adaptability in terms of water management in Ireland is thus essential. The reform of water management required by the Water Framework Directive presents the ideal opportunity to build resilience to climate change and protect our water resources.

Key issues of concern:

- Flooding: Average annual national rainfall is increasing with the west, southwest and north of the country experiencing more frequent and intense rainfall. Winter rainfall is projected to increase by 10% by 2050 leading to a rise in river flow. Many densely populated areas of high economic activity are located in floodplains. These will be increasingly exposed to flooding, resulting in higher damages and re-construction costs

- Decline in water quality & quantity: Increased winter rainfall leading to increased run-off will cause soil erosion and washing of pollutants from farming and forestry into rivers and lakes. Flood run-off from urban areas and more frequent overflows of drainage systems will cause pollution if raw sewage overflows from sewage treatment plants. Incursion by seawater into groundwater reserves due to sea level rise will also be a threat.

- Increasing temperatures will mean warmer summers, which in turn will increase water demand, leading to higher water extraction pressure during periods of low water levels. This along with a projected decrease in summer rainfall (12-17% by 2050) and a substantial reduction in run-off, in particular in the east of the country, will lead to water shortages. Lower water levels and higher water temperatures will result in reduced dissolved oxygen in water, with associated algal blooms and increased concentrations of pollutants and bacterial content. The warming of lake and river waters may also endanger species that require cooler water such as salmon and Arctic Char.

- Conservation status of protected species: Atlantic salmon is legally protected under the EU Habitats Directive and is classed as vulnerable in Ireland under the ICUN Red List of species. Climate change effects on Atlantic salmon are: reduced marine survival because of food chain effects, reduced survival and growth in summer because of poorer feeding conditions resulting from increased summer temperatures and reduced flows, possible adult migration delays due to reduced flows and increased temperatures and decreased spawning success because of increased sedimentation and scouring'.

- Climate change driven extreme weather is also likely to threaten the quality of drinking water supplies, resulting in increased rates of water-borne illnesses (e.g. Cryptosporidium) and pushing up the costs of water treatment.

- Coastal areas: The waters around Ireland are rising by 3.5cm per decade and studies have predicted a rise in global sea levels of up to 60cms by the end of the 21st century. The flood impacts of this will be most felt in the major coastal cities of Cork, Dublin, Galway and Limerick along with other low-lying areas. Increased temperatures may result in algal blooms in coastal bays and on beaches and pollution will affect wildlife and a range of economic and leisure activities such as bathing, angling, water-sports and aquaculture.

- Invasive species: Climate change is likely to trigger species migration across the globe. As an island, Ireland's ecosystems are particularly vulnerable to an

influx of alien species and pathogens which can rapidly invade aquatic ecosystems, destabilising habitats and threatening human economic activity.

Recommendations

Considering the unprecedented pressure our current water-related infrastructure will come under, the standard of planning for the 100-year flood-return period, based on historical records, may leave public and private investments at risk. It has been suggested that maintaining only a reactive adaptation strategy or mopping up the damage caused to infrastructure and private property by extreme weather events, will "limit Ireland's ability to function effectively alongside its competitors in a changing climate milieu".

Proactive adaptation, which prepares in advance for projected impacts occurring and integrates policies and actions among different levels of government and public bodies, will give Ireland a far stronger position in the coming decades in terms of managing our water resource. Adaptation is not limited to planning for climate change, but rather adaptation is an accumulation of actions, motivated by a complex set of perceptions of changed risk" (Ref JS).

Investment in water management infrastructure is typically expensive and has long term implications for adaptability given longevity of the infrastructure. Therefore it is critically important that a full impact assessment that accounts for the full range of hydrological and modelling uncertainties (including CRR model parameter and structure) be conducted where decisions are made to adapt water management practices for climate change. In this way policy and planning can be robust to uncertainty. The integrated catchment management approach, suggested in the reform of water management required by the Water Framework Directive (WFD) presents us with an ideal opportunity t integrate this approach.

An Taisce
The National Trust for Ireland

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