

# **Improving Nutrient Management and Protecting Water Quality**

**A report for**



## **NUFFIELD IRELAND Farming Scholarships**

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2017 Nuffield Scholar

November 2018

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## Foreword

Growing up on a farm in the dairy heartland of Mallow in Co. Cork, I have always had a close affinity and curiosity about the natural countryside. I am always most at ease when out in the open air. Since a very young age, I have been involved in all aspects of the family farming business, always with the ambition to make my livelihood within the agriculture industry. After completing my secondary education, I went to University College Dublin to study Commerce.

During my time studying in Dublin, I was afforded the opportunity to travel to New Zealand (NZ) in 2008 as part of a student exchange programme to complete part of my degree. There were many reasons I wanted to visit NZ, primarily to learn more about the challenges faced by a growing dairy industry. My time in NZ really challenged my view of farming and our family farming business. Everything from grassland management, scale of the operations and the genetics of the cows was up for review after that trip.

On completion of my master's degree in Smurfit College, Dublin, I started working for a New Zealand farming cooperative, Livestock Improvement Corporation (LIC) as a breeding advisor in Ireland. During my time with LIC, I visited many farmers throughout Ireland and got the opportunity to return to NZ on several occasions which really helped to broaden my knowledge of dairy farming. I continued to have an active role in the family farm during this time and began implementing some of the ideas that I had picked up from farmers in Ireland and NZ.

Since the abolition of milk quotas was announced, we have been steadily increasing the dairy herd and today we are milking 220 cows on a 64 hectare milking platform, growing approximately 14.5 tonnes grass DM/hectare.

For many Irish dairy farmers, the end of the quota era has brought new opportunities to an industry that had stagnated for 30 years. However, with those new opportunities there is also new challenges to overcome. Sustainability is the new buzz word that has become increasingly mentioned in the context of the Irish dairy industry.

To my mind, there are three pillars to sustainability; economic, social and environmental. While all three are equally important, for the purposes of my Nuffield topic I decided to narrow my attention to the environmental sustainability with a particular focus on water quality and nutrient management. Many environmental challenges exist, water quality appeared to be less frequently debated and one that was considered a priority.

I saw the need to understand the potential impact on dairying in Ireland and the potential future impact of this challenge on our dairy business at home. It was important to establish where we were in Ireland in relation to water quality and determine if there were actions we, as a sector should be taking to ensure we remain environmentally sustainable in the medium to long term. There was also a need to ensure that we as farmers were fully informed and in a position to do what we could at farm level to ensure a viable farm business for the future.

As part of my research, I travelled to Brasilia in Brazil for the Nuffield Contemporary Scholars Conference. From there, I commenced my travels for the African Global Focus Programme starting in the US state of Delaware. Before leaving the US, we visited Capitol Hill in Washington DC to meet with US Agriculture policy makers. We then flew to Eastern Europe to Czech Republic, Poland and Ukraine.

Up next was 10 days travelling through Kenya learning about what Agriculture means in the African continent. The final country we visited was South Africa on a remarkable journey over 7 weeks. I also travelled to the UK, Netherlands and France which gave me the opportunity to see how the dairy sectors in these countries were addressing water quality matters and nutrient management issues.

I would have liked to have undertaken further travel to NZ and other parts of Europe but time was against me on this occasion. Finally back in Ireland, I met with numerous industry representatives covering different aspects of the water quality debate who shared their experience, knowledge and expertise in support of my Nuffield studies.

## Acknowledgments

- I would like to thank Nuffield Ireland for this fantastic opportunity to study a topic that is so relevant to the dairy industry in Ireland and to our own farming enterprise.
- A special word of thanks to John Tyrrell, Bill O’Keeffe and Geoff Dooley for their continuous advice, support and encouragement over the course of the scholarship.
- I am particularly grateful to the Nuffield sponsors for their funding and support and in particular to Joe Crockett for his invaluable assistance and advice when I started out on this journey.
- I would like to thank my mentor David Murphy for his continuous support and words of advice along the journey.
- Thank you to the many people at home and abroad who gave so kindly of their time and expertise which was essential to complete this report. Thank you to representatives from Teagasc, Agriculture Catchments Programme, DAFM, Bord Bia, IFA, Macra na Ferime, Green Party, den Eelder NL, Wessex Water, Dairy NZ, IFA, European Dairy Farmers, Fertilizer Association of Ireland, Delaware Department of Agriculture, Chesapeake Bay Program and many other members in the Agriculture Industry.
- Thank you to my fellow Nuffield Scholars both in Ireland and around the globe. I have friends for life in all of them.
- I would like to sincerely thank my family. To my parents, Tony and Margaret and my sisters, Elaine and Kate and my girlfriend Ann, thanks so much their continuous encouragement and guidance. I could not have completed this scholarship without them.

## Executive Summary

Water quality represents a challenge to which all sectors of society must respond and the Irish dairy industry is no exception. This report focuses on assessing the challenge posed to the Irish dairy industry, looking at key competitors globally to determine what lessons can be learned, investigating where the Irish dairy sector is in addressing water quality and establishing what practical actions could be taken in Ireland.

Feeding and nourishing a world population that is expected to increase by more than 2 billion by 2050, while recognising and balancing the environmental limits of the planet, is the most significant challenge facing global agriculture. While the overall outlook for the Irish dairy industry is positive with a growing and more affluent global population ensuring greater demand for dairy products, our ability to grow the industry will be defined by our custodianship of the environment.

Food Wise 2025, the successor to Food Harvest 2020, sets out a plan for further growth in the Irish dairy sector, recognising at all times, the importance of the industry committing to processes that are sustainable – economically, socially and environmentally.

Increasing farm output while meeting Nitrates and Water Framework Directive (WFD) water quality targets poses a substantial challenge for Irish farmers but also presents a fantastic opportunity. The challenge is to demonstrate that intensive, grass based, dairy farming is compatible with meeting the WFD. The opportunity lies in the potential to capitalise on Ireland's sustainable farming credentials as promoted by Bord Bia's Origin Green sustainability programme.

### The Challenge

The EU Nitrates Derogation, which allows farmers to exceed the limit of 170kg of livestock manure nitrogen per hectare set down in the Nitrates regulations up to a maximum of 250kg per hectare, is vital for intensive dairy farmers in Ireland. In December 2017, the EU Commission approved Ireland's application for a renewal of the derogation up until December 2021.

However, the derogation was granted with additional requirements for farmers to undertake to ensure environmental and water quality standards are improved. The commission will review the derogation again in 2021 with renewal dependent on demonstrable progress in terms of water quality.

### The Opportunity

Retailers and food manufacturers are increasingly looking to the supply chain, including the primary producer, to provide details of the sustainability impact associated with their products. Those that can

proactively establish strong credentials are well placed to secure long-term business relationships with leading retailers and food manufacturers.

Origin Green seeks to demonstrate those credentials at national level and showcase how we are global leaders for sustainability. Embracing sustainability has the potential to deliver a point of differentiation in what remains an extremely competitive global marketplace. The environment is a central pillar of sustainability with water quality a key component.

Over the last two decades, many Irish farmers have incorporated practices which have led to efficiency gains such as improvements in grassland and breeding management with the use of grass measuring and the Economic Breeding Index (EBI) respectively. Now, farmers need to embrace and have a better understanding of best practices for nutrient management to demonstrate true commitment, rather than simply being compliant, to achieving superior water quality.

There needs to be better recognition of the positive correlation that exists between efficiency, profitability and sustainable farming. The dairy industry can do more to convince a wider cohort of farmers that environmental friendly farming is in fact profitable, efficient farming.

Increasing profitability is a key goal of every dairy farmer. While grass is the cheapest feed farmers can produce for their livestock, the majority are not getting the most from grassland because of poor soil fertility. Research by Teagasc has shown that only 12% of Irish grassland farms are at peak soil fertility. If this fertility level were increased, significantly greater farm income could be achieved.

Soil fertility needs a focused approach where nutrients are applied in a targeted way rather than as done traditionally. In this way, farmers can significantly improve grass growth and consequently improve farm income. There is an added bonus that if nutrients are applied where they are most needed on the farm, they are more readily absorbed by the plant and do not end up in streams, rivers and lakes. Likewise, better farmyard management to prevent nutrient leakage and discharge will also protect clean water sources.

The core message is a simple one – better nutrient management will improve soil performance, farm profitability, protect local water sources and improve environmental performance. More farmers need to apply the approaches and recommendations in relation to soil fertility improvement and better farmyard management.



## Methodology

To establish the background of this report, a review of appropriate Irish, EU and global literature was conducted on water quality and how it relates to agriculture nationally and internationally. To gain an understanding of the international response to the challenge posed by water quality, the research included overseas travel to a variety of parts of Europe and the US.

This consisted of interviews and meetings with a wide range of people in the dairy sector representing different aspects and perspectives. In addition to this, interviews were conducted with relevant stakeholders in Ireland to get a wide-ranging view of the Irish dairy industry and wider agricultural sector to determine the Irish response to the challenge posed by water quality.

## Objectives

1. To determine the water quality challenge for Irish dairy farmers
2. To understand the significance from an environmental perspective
3. To understand the significance of water quality from an economic perspective
4. To determine what actions the Irish dairy industry need to ensure its sustainability

## Abbreviations and acronyms

ACP	Agriculture Catchments Programme
DAFM	Department of Agriculture, Food and the Marine
EPA	Environmental Protection Agency
EU	European Union
EBI	Economic Breeding Index
GES	Good Ecological Status
K	Potassium
KT	Knowledge Transfer
LIC	Livestock Improvement Corporation
MCPA	Methyl chlorophenoxyacetic acid
N	Nitrogen
NAP	National Nitrates Action Programme
NRCS	Natural Resources Conservation Service
NZ	New Zealand
P	Phosphorus
SDAS	Sustainable Dairy Assurance Scheme
WFD	Water Framework Directive

## Introduction: Value of Irish Agriculture

Agriculture in Ireland is economically, socially and culturally very important. Farming has been an essential part of Ireland's economic, social and cultural history for many generations. Nowadays, Ireland is a major meat, dairy and food exporting country, capable of feeding and nourishing 10 times the current population of the country.

Agricultural practices have shaped Ireland's countryside and landscape. Along with the production of food, farmers and farming can provide valuable ecosystem services to society such as clean, healthy water, regulation of nutrient cycles and enhancement of biodiversity as well as cultural and recreational benefits.

In recent times, the potential for agriculture and the agri-food industry to support growth in the Irish economy has been highlighted in two strategies: Food Harvest 2020 and more recently, Food Wise 2025. These have been established to increase the export and employment contribution of the sector in a way that is compatible with sustainable growth.

Food Wise 2025 has a vision for economic competitiveness and environmental sustainability being equal pillars which is a significant step towards dealing with the tensions that can exist between environmental objectives and economic goals.

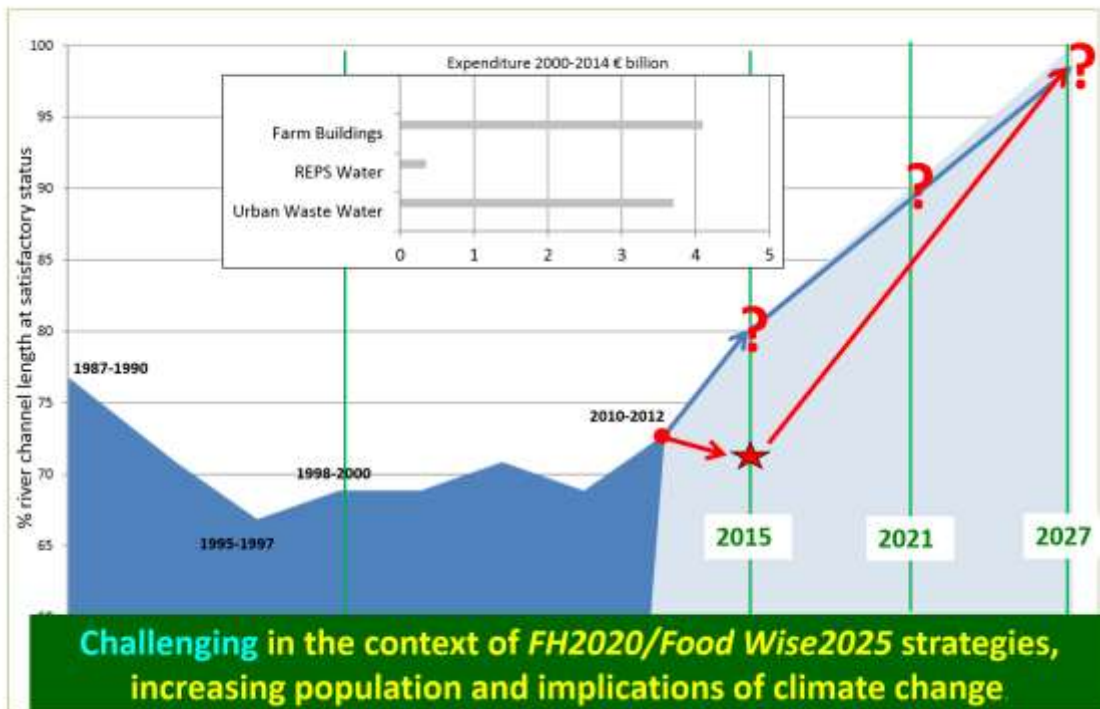
Within the environmental sustainability pillar, there are three broad areas of relevance to agriculture; air quality, bio-diversity and water quality. This report focuses on the agriculture challenges to be addressed in relation improving water quality.

## Importance of Water Quality: Regulation and Consumer Perspectives

The importance of water quality on Irish food production should not be underestimated, from both regulatory and consumer perspectives. Currently, Ireland has not achieved the aims of the EU Water Framework Directive (WFD) which are to achieve "good ecological status" (GES) for all water bodies.

While progress has been made since the introduction of the WFD in 2003, further improvement is required by 2027. Two thirds of Ireland's land is in agricultural use and therefore, has a leading role to play in ensuring we reach good status in our water bodies as part of the WFD.

## Context: River Water Quality, past, now, future?



Source: J Crockett, 2017

In addition to our EU regulatory obligations, Ireland has a food and drink export industry worth €12.6bn (Bord Bia, 2018) where we are striving to achieve global leading standards.

According to Origin Green, Ireland's food and drink sustainability programme, the vision is that Irish food and drink becomes the first choice globally because it is sustainably produced by people who care (Origin Green, 2018).



Source: Origin Green, 2018

To demonstrate that commitment to caring for our environment, which includes water quality, Irish agriculture must address the challenges and work towards a sustainable future.

## Addressing the Water Quality Challenge in Agriculture

Loss of nutrients to waters from agriculture is a significant pressure on water quality in Ireland. Excessive nutrient losses, primarily nitrogen and phosphorus, to waters can lead to accelerated growth of algae and plants, significant ecological impacts and eutrophication in rivers, lakes and marine waters and is the most significant pollution issue for surface waters in Ireland.

While agriculture is not the only pressure on the water environment and farmers in Ireland have made a considerable commitment to environmental measures, it is clear that supplementary action by the agriculture sector at a local and regional level will be required to further improve water quality.

The main water quality challenges as they relate to agriculture are:

- Nitrogen leaching leading to eutrophication and drinking water quality issues
- Excess phosphorus leading to eutrophication of waterways
- Excess sediment leading to local deoxygenation and resulting in the degradation of important habitat
- Pesticide in particular, MCPA, found in drinking water sources
- Microbial contamination of drinking water, such as cryptosporidium

An intensive assessment process conducted by the Environmental Protection Agency (EPA) with support from RPS consultants, local authorities and Inland Fisheries Ireland, has shown that agriculture is a significant pressure in approximately 60% of impacted rivers and lakes. (EPA, 2018)

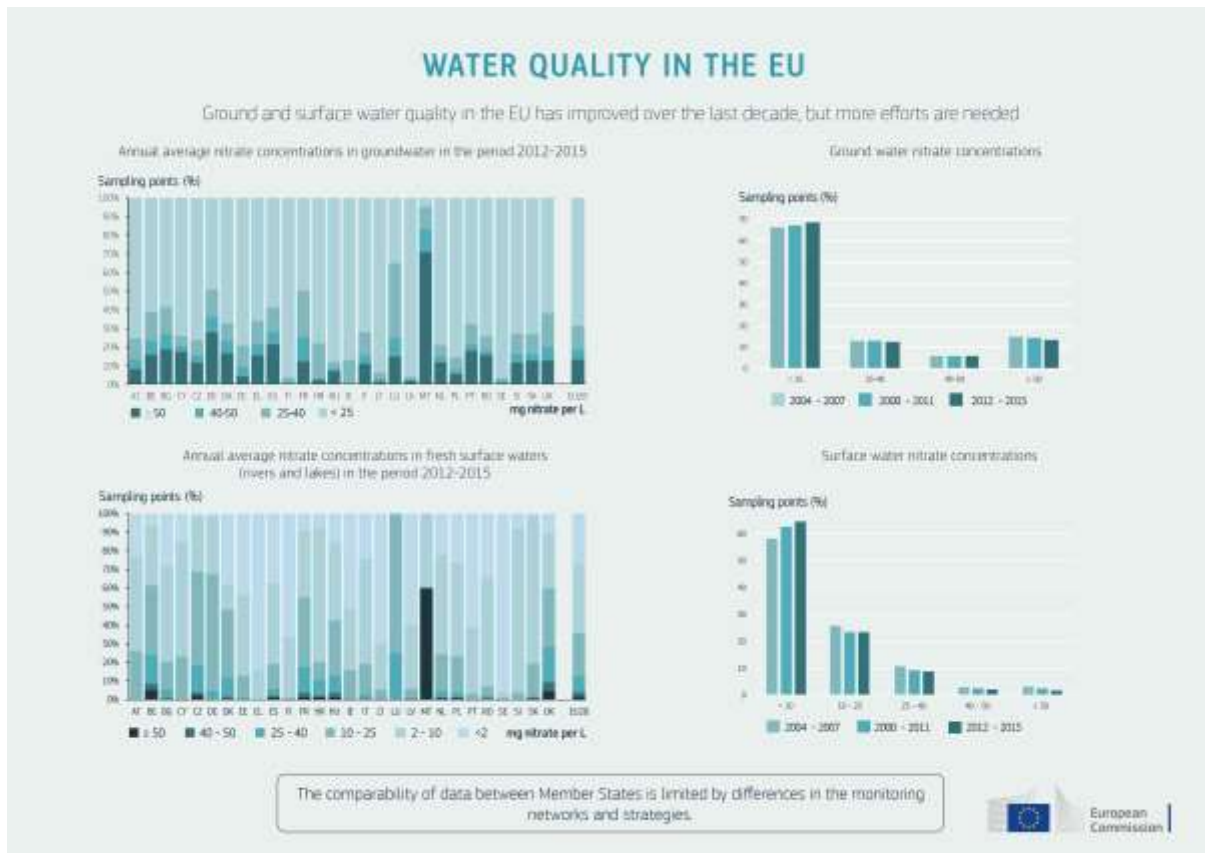
## Global Water Quality Challenge

In terms of global agriculture, water quality is becoming increasingly important. For centuries, many waterways were seen as a means of disposing of our waste which was eventually washed out to sea.

With an ever increasing world population demanding a higher standard of living meaning intensified food production, water quality globally is coming under unprecedented challenges.

While urban centres and industry are making efforts to address the challenges through new technological fixes, global mitigation in agriculture cannot be addressed through one-off technological fixes.

Rather, mitigation will require the sustained application of processes or management practices by individual farmers.



Source: EU Commission, 2018

## Dairy Industry Water Quality Challenge

Looking at water quality in relation to dairy farming, there are well established practices that can improve farm efficiency, while at the same time, reduce the impact of farm inputs on waterways. There is scope for significant improvement in most of these practices which include:

- Improve soil fertility (correct soil pH, P and K indices)
- Better timing and more precise application of inputs (avoiding runoff from rainfall and appropriate nutrient quantities applied when there is growth)
- Management of point source pollution (collection of effluent and slurry from farmyards)

Since the abolition of milk quotas in 2015, the Irish dairy industry has seen the fastest growth in milk production in Europe. Food Harvest 2020 set out an ambition for a 50% increase in production from the 2010 base by 2020.

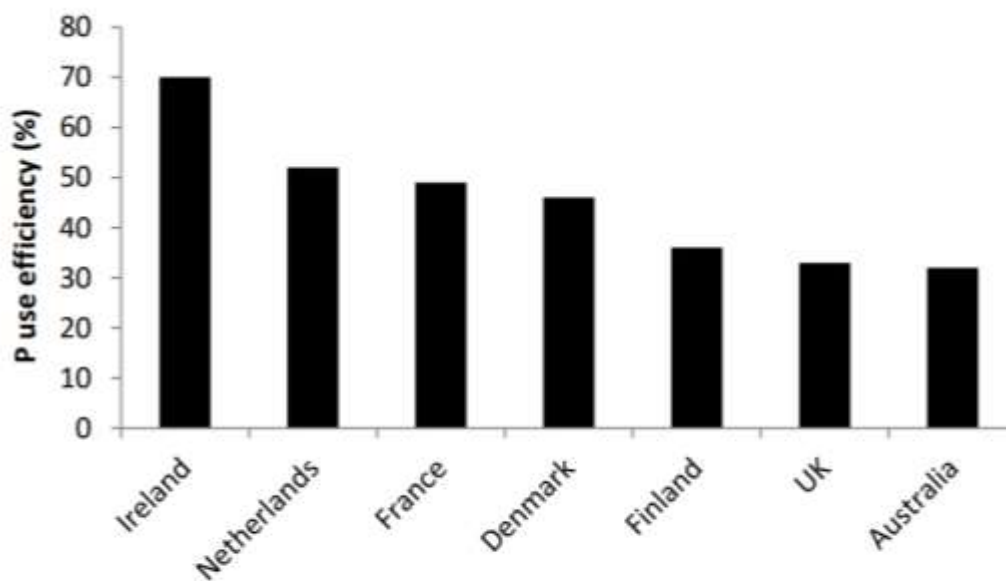
That target has been achieved 2 years in advance and the Food Wise 2025 outlook for the dairy industry would suggest a further expansion of the industry. The growing world population along with more affluence should ensure a greater demand for dairy products. However, feeding a world population that will reach 9.6 billion by 2050 while recognising the environmental limits of the planet will be a significant challenge, despite Ireland's efficient grass-based system of dairy farming.

## Nutrient Use Efficiency

Pasture-based production on permanent grassland is a key contributor to the generally low nutrient contamination of Irish rivers and lakes. Nevertheless, Phosphorus (P) use in particular can have a negative impact on water quality and efficient use of P is important because of diminishing global reserves and increasing cost.

High reliance on grazed grass and a low proportion of concentrate in the diet of dairy cows in Ireland is a key contributor to Irish dairy farms having the highest P use efficiency in the world (see figure below). This is in sharp contrast to the situation in most other EU countries and even in Northern Ireland, where concentrate inputs are higher.

There have been substantial improvements in slurry storage, including slurry and dirty water management on Irish farms over the past decade or more, thanks in part to EU and Irish government grant aid. Paradoxically, soil deficiencies of lime, P and K have been identified as a key area for improvement because of their impact on grass growth and the economic performance of farms.



**Figure 1. P use efficiency (the ratio of P inputs to a farm that end up in products sold off the farm) on dairy farms in different countries.**

Source: Fertilizer Association of Ireland, 2018

Nitrate losses to water tend to be low under permanent grassland particularly on the heavier textured soils and high rainfall conditions that predominate in Ireland. Nevertheless, there is no room for complacency because the continuation of the nitrates derogation is conditional on improving water quality.

Furthermore, nitrogen fertilizer use on Irish dairy farms is higher than most other EU countries including the Netherlands, where there is greater reliance on maize. This is a matter for concern because not only can Nitrogen (N) impact on water quality it also contributes to greenhouse gas and ammonia emissions.

Nitrogen (N) use efficiency of Irish dairy farms ranges between 15% and 30% (J Humphreys, Teagasc Moorepark, 2018). The majority of the remainder is lost either to water or to the atmosphere with only a small proportion retained in the soil from one year to the next. While these losses are potentially damaging to the environment they also represent an economic loss to the farm.

Nitrogen (N) use efficiency can be improved on farms by good management practices such as responsible application of slurry, dirty water and chemical N in terms of rates and dates of application, applying slurry using trailing shoe, white clover and new fertilizer N formulations such as urease



inhibitor on protected urea. It is clear that there remains a large potential for improvement in N use efficiency through better management practices and newly emerging technologies.

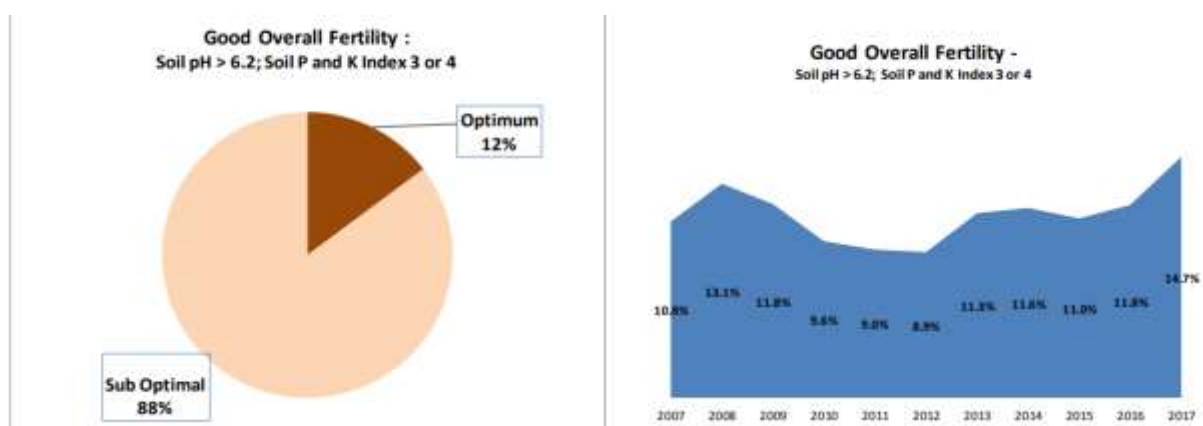
## Soil Fertility

Soil fertility is a key component of sustainable agricultural production, both from an economic and environmental perspective, for every farming enterprise and in every part of the world. For low cost, nutrient management focused, grass based livestock systems practiced on most Irish farms, soil fertility is even more important.

Maintaining or increasing grass yields through better soil fertility has the potential to help make Irish dairy farmers more resilient to milk price volatility while also ensuring more effective and targeted use of plant nutrients.

The first step towards improving anything is to measure and for soil fertility that means conducting a soil test. Over the last 10 years Teagasc have analysed approximately 38,500 soil samples each year for its farmers (Teagasc, 2018). These samples provide an insight to national soil fertility trends (soil pH, phosphorus (P) and potassium (K)) for each farming sector. The most recent grassland soil results for 2017 show that only 12% (2% improvement from 2016) of soils have optimum pH, P and K to maximise grass production.

This means that 88% of grassland soil samples tested in 2017 are sub optimal and have a requirement for lime, P or K or a combination of all three.



Source: Teagasc, 2018

Currently 64% of grassland soils have below the optimum soil pH (i.e. pH 6.3 for efficient grassland production). According to Dr David Wall, leader of the Teagasc Soil Fertility Research Programme at Johnstown Castle: “Nationally we are applying less than half the quantity of lime that was applied in the 1970’s and early 1980’s.

Applying lime to correct soil pH is the cornerstone for maintaining the productivity of our soils, something that has been largely overlooked in recent decades. Identifying fields that require lime for pH adjustment should be the first step towards correcting soil fertility.”

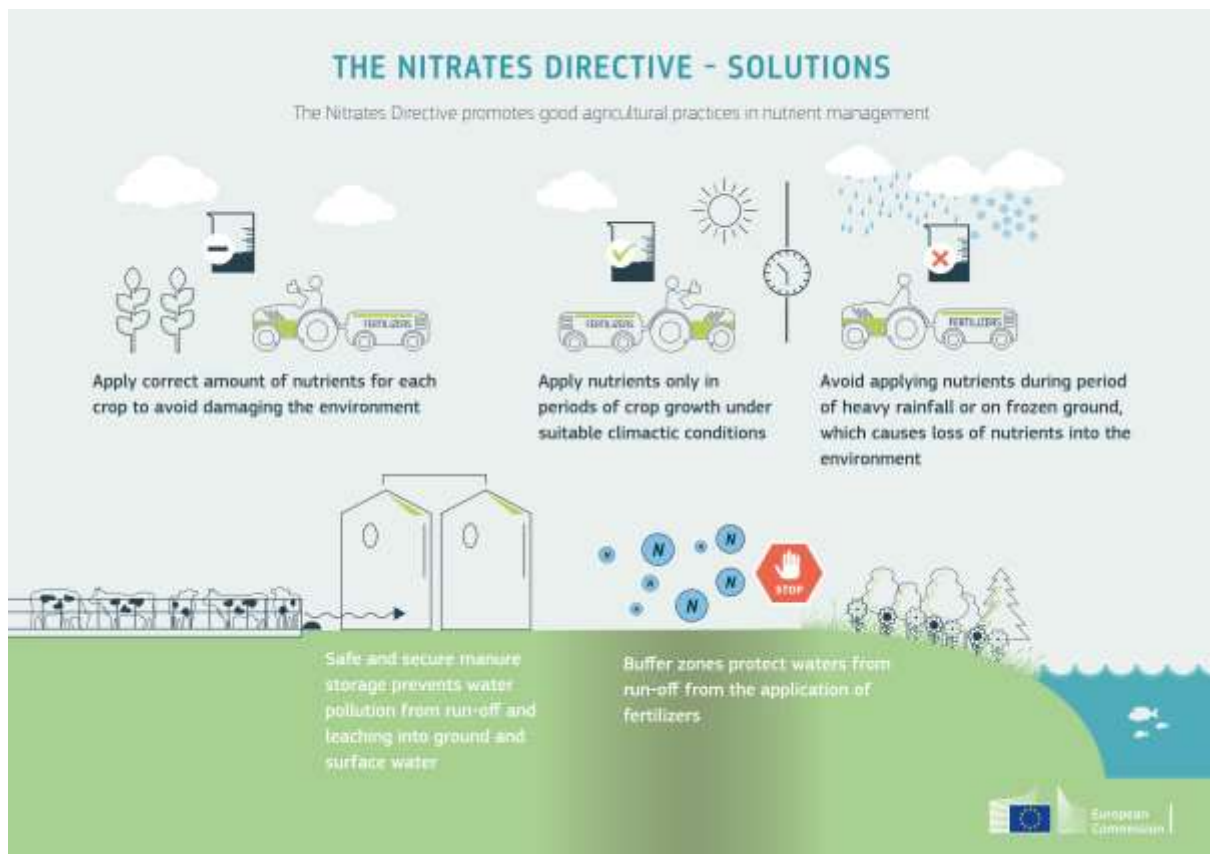
In referring to the almost 90% of soil samples that are sub optimal, Mark Plunkett, Teagasc Soil and Plant Nutrition Specialist said: “This is a serious limitation to the production potential of our soils and limits our ability to maximise our most competitive advantage in the market place, which is our ability to grow high yields of quality grass.”

A major concern emerging from these soil test data is the continuous decline in soil P levels over the last decade with the majority of grassland (61%) farms having suboptimal P fertility (i.e. P index 1 or 2). Although fertiliser P usage has recovered somewhat from its lowest level in 2008-09, it appears that the levels of current usage are not balanced with P off-takes on many farms.

Approximately 50 % of grassland soils have low K fertility levels. However, soil K trends show a gradual improvement over the last 5 years. This may be due to better distribution of manures on grassland farms.

## Nitrates Directive

The Nitrates Directive has been in place since 1991. It aims to protect water quality from pollution by agricultural sources and to promote the use of good farming practice. All EU Member States are required to prepare National Nitrates Action Programmes (NAP) that outline the rules for the management and application of livestock manures and other fertilisers.



Source: EU Commission, 2018

Ireland's Nitrates Action Programme is designed to prevent pollution of surface waters and ground water from agricultural sources and to protect and improve water quality. It's reviewed every 4 years. The 4th review of the NAP recently came into law on the 1st January 2018 and will run until Dec 2021.

The main changes to the latest review can be broken down into four areas;

- Firstly, there are new strengthened water protections measures which focuses on capturing and breaking nutrient transport pathways which prevents sediment and nutrient losses to watercourses and dry drains. Farmers are required not to poach land which could result in run off
- Secondly, the new regulations are directed towards improved soil fertility to achieve sustainable intensification objectives. The main changes here are to soil sampling where the maximum area per sample is reduced to 5ha. This applies to soil samples received in laboratories since 1st January 2018 and these samples are now valid for four years. There is

also the option for farmers stocked above 130Kg organic N/Ha to avail of higher phosphorus build up rates. These higher rates are available for four years and farmers availing of these rates must participate in a Nutrient Management training course.

- Thirdly, there is simplification of the regulations to improve implementation. The calculation of Nitrogen (N) and Phosphorus (P) allowance are now simpler due to the removal of the requirement to deduct N and P in grazing livestock manures in the storage period.
- Fourthly, new strengthened water protection measures will be applicable from the 1st January 2021. On farms stocked above 170Kg organic N /Ha cattle will have to be excluded from watercourses and this will involve fencing at least 1.5 metres from the top of river or stream banks. Livestock drinking troughs will also have to be at least 20 metres from watercourses. All farmers will also be required to prevent direct run off from farm roadways to watercourses or drains and this may involve changing the camber of farm roadways.

The main changes for farmers in derogation involve ensuring that half of all slurry must be applied before 15th June each year. After that date slurry may only be spread using low emissions slurry equipment. Farmers applying for a derogation must have adequate slurry storage for all animals on the holding during the previous winter period.

## River Basin Management Plan 2018-2021

In 2018, the government published the River Basin Management Plan for Ireland 2018-2021. The plan sets out the actions that Ireland will take to improve water quality and achieve 'good ecological status' in water bodies by 2027. Ireland is required to produce a river basin management plan under the Water Framework Directive (WFD). The River Basin Management Plan outlines the new approach that Ireland will take to protect our waters over the period to 2021.

It builds on lessons learned from the first planning cycle in a number of areas. One of those areas is the newly-established Local Authority Waters and Communities Office which will help people to get involved in improving water quality at a local level. An Fóram Uisce (National Water Forum), also newly established, is a forum for stakeholders, community groups and sectoral representatives, including representatives from the farming organisations. This group will analyse and raise awareness of water issues.

Among the main actions that relate to the dairy industry are a new collaborative Sustainability and Advisory Support Programme. This partnership between the state and the dairy industry, consisting of 30 Sustainability Advisers, will promote best farming practice in 190 areas chosen for action, for up to 5,000 farmers. These are all positive steps for helping farmers play their part in protecting Irish water bodies.

## Teagasc Agricultural Catchments Programme

The Teagasc Agricultural Catchments Programme (ACP) integrates research with farm advice to support the development of an environmentally and economically sustainable agri-food sector. The programme is built on a partnership with 300 farmers in six intensively farmed catchments across a range of soil and landscape settings.

The Department of Agriculture, Food and the Marine (DAFM) funds the programme which is central to meeting Ireland's obligations under the Nitrates Directive. It is operated by Teagasc which spreads the programme's outputs to a national and international audience through its dissemination network. The programme is designed to evaluate the effectiveness of the nitrates regulations and the role of farming in ensuring that Ireland meets its water quality objectives.

By using the latest technologies and capturing accurate data, the programme has developed a unique capability to develop a deeper understanding of not just the science but also the economic and social interactions in agricultural catchments. Advisors in each catchment work one-on-one with the local farmers and this combined with scientific research at national level means all stakeholders play an active role in the direction and operation of the programme.

The first four year phase of the ACP was completed at the end of 2011 with the main objective being to evaluate the effectiveness of the package of measures implemented in Ireland's first National Action Programme (NAP) under the EU Nitrates Directive. Phase one was about establishing an environmental baseline from which the programme could measure the effectiveness of the actions introduced in the first NAP. The evaluation included an investigation of the effectiveness of the initial derogation secured for Ireland in 2005.

In February 2017, the Phase 2 report of the ACP was published and this covers the 2nd four year period from January 2012 to December 2015. DAFM continues to fund the programme into Phase 3 which will run until the end of 2019. The ACP and its research findings were pivotal in the 2017 review of Ireland's NAP and derogation application.



**Ireland is one of six EU member states with a Nitrates derogation aimed at protecting our waterways.**

The scientific findings from the ACP have helped provide the monitoring and reporting requirements under the EU Nitrates Directive and the EU Water Framework Directive. In addition, the findings support key agri environmental policies and strategies, including:

- The review of Ireland’s Nitrates Regulations, including the nitrates derogation in 2017.
- The 2nd cycle of River Basin District Planning under the Water Framework Directive.
- Food Wise 2025 and scientific verification that Irish farmers are producing milk, meat and crops in an environmentally and economically sustainable manner.
- Origin Green and water quality in the context of marketing the sustainability of Irish food production on world markets.

The good news from Irish farmers’ perspective is that the main conclusion of the ACP’s work to date is that the application of the Nitrates Regulations by Irish farmers has improved water protection against pollution caused by nitrogen (N) and phosphorus (P) from agricultural sources. Further improving nutrient management on Irish farms by supporting farmers’ nutrient management decisions has the greatest potential to help farmers protect and improve water quality. In addition to this, better nutrient management can also deliver better economic returns to the farmer by increasing the efficiency with which farmers use nutrients, i.e. producing more output for the same, or less,

nutrient input. Win-win mitigation measures, such as this, that reduce risk to the environment while also increasing economic returns are the most likely to be voluntarily taken up by farmers.

## UK – Wessex Water

Wessex Water is responsible for providing drinking water to approximately 1.3 million people in the south west of England. About 80% of the water supplied comes from groundwater sources in Dorset and Wiltshire which is filtered through rock such as limestone, chalk and sandstone. The soils are predominately free draining which poses particular challenges for water quality from an agricultural perspective. While they do operate some water treatment plants, this method of dealing with poor quality water is both expensive to build and operate, and has a large carbon footprint.

Since 2005, Wessex Water has been taking an alternative approach by setting up a water catchment programme which involves working with local farmers and landowners within the catchment areas of public water supply boreholes and reservoirs. The aim of the initiative is to implement a cost effective safeguard for the quality of ground water and surface waters which are supplying the drinking water to the public.

Wessex Water's catchment management objective is to stabilise and then reduce the levels of containment at each source so no additional treatment is required. They work in partnership with local farmers which allows them to influence and implement changes in agricultural land use and practice to reduce the levels of nitrate and pesticide entering the ground and surface water environments.

Tim Stephens, who is employed by Wessex Water as a catchment advisor, is trained to offer agronomic advice to farmers. Tim and other advisers make direct contact with farmers, in particular in areas of high risk, and discuss the issues and raise awareness of the problems, be that nitrates or pesticide residue. The majority of farmers appreciate working with the catchment programme and recognise the service catchments advisers provide to them. Besides being better for the environment, farmers also see that there is the additional benefit of efficiency gains if they can avoid unnecessary loss of both fertilizer nutrients and spray usage. From speaking with farmers in the catchment areas, it would appear they have a very good working relationship with their catchment adviser. They spoke of finding the process thought provoking and the results have been informative for helping them farm more effectively and efficiently.

Wessex Water measure reductions at their sources through regular supply sampling and online nitrate monitors. The monitoring is extensive and can involve up to 9,000 water samples and 1,500 soil samples per year across all the catchments with the analysis fed back to farmers. This data is vital in understating the movement of potential pollutants. It provides information for farmers to update their fertilizer plans and timing of applications.



**Wessex Water in the UK work in collaboration with farmers to improve water quality**

The catchment management programme has worked well in addressing particular water source problems and for the catchment farmers, in terms of optimised and reduced use of nutrients and pesticides. Working in partnership between those who know how to manage water resources and those who know how to manage the land is more sustainable and cost effective than installing a treatment plant and has much better environmental outcomes.

Some of the initiatives that have been implemented include calibration of fertilizer spreaders, altering drilling dates of autumn sown crops, using winter cover crops to avoid bare ground over the winter and avoiding excessive out wintering of animals. Wessex Water have assisted financial with addressing these issues and have provided funding to farmers on a case by case basis where necessary.



It was very impressive to see the practical approach taken by both farmers and the advisors when it came to finding a solution to a particular problem. The approach was results driven rather than just for the sake of compliance.

Farmers, and in particular British farmers, have an aversion to rules and regulations imposed upon them from either National or EU governments. Using a carrot rather than a stick approach has proven to be very successful in terms of improving drinking water quality.

## EnTrade

Wessex Water has developed an innovative means of improving water quality through its spin out EnTrade. The trading platform has been developed for environmental catchment intervention and has a disruptive, innovative business model. The trading platform offered by EnTrade is adapted to pursue a specific environmental outcome, such as reducing the amount of nitrogen or phosphorus in a catchment. Through their work with farmers, catchment specialists are able to establish how a range of actions undertaken by farmers in a catchment affect the outcome - e.g. how a particular area of cover crops planted relates to the amount of nutrients removed.

The buyer of the environmental services (e.g the water company) sets a figure for the outcome it wants to achieve and then during a set, pre-advertised window, farmers and land managers can place bids for how much they would need to be paid to carry out these actions. The market price for the environmental actions goes down as more bids come in. At the end of the period the most competitively priced bids win and the money is paid once the land owner has demonstrated that the action has been undertaken.

While catchment interventions have been shown to be effective at improving the water environment, the question of who pays for them has always been a limiting factor and the market approach embodied by EnTrade could provide part of the answer. It's an innovative market driven solution to improving water quality that could easily be applicable in Ireland to incentivise farmers in particularly sensitive catchments to reduce the nutrient load.

## USA - Chesapeake Bay

More than 83,000 farms make up a \$10 billion agricultural industry in the Chesapeake Bay catchment – the largest estuary in North America.

Since 2009, targeted agricultural conservation investments of nearly \$1 billion are putting the agricultural industry on its way toward meeting or exceeding key goals for cleaner water and a healthier ecosystem. Independent reports show positive trends for water quality, habitat and key aquatic species including crabs and oysters.

In addition to this, modelled results and monitoring stations show declines in nitrates and phosphorous along with a reduction in sediment loads to the bay.

To improve the health of the water catchment, farmers are using conservation systems that are reducing nutrient and sediment runoff by keeping soil in place and making working land more efficient and productive. The United States Department of Agriculture's Natural Resources Conservation Service (NRCS) has developed a systems approach for designing and installing conservation activities on farms to protect and improve water quality.

The core part of this approach are conservation activities that avoid, control and trap potential nutrient and sediment losses from agriculture land. NRCS estimate that targeting conservation on the most vulnerable soils and in priority water catchments increases the per acre conservation benefit by 70% for sediment losses, 30% for nitrogen losses and 40% for phosphorus losses as compared to no targeting.

From an Irish perspective, this approach of targeting the most vulnerable soils and the priority water catchments with specific actions suitable to each particular area would deliver more effective results. Analysis of both ground and surface water results would indicate that there are certain soil types and topography which are more prone to nutrient and sediment loss than others.

Therefore, a "one-size-fits-all" approach is not necessarily the best approach. Some farmers in particularly vulnerable local catchments may be need to apply different nutrient management than farmers in less vulnerable areas.

## New Zealand Dairy Industry

The New Zealand dairy industry has many similarities to its Irish counterpart in terms of the grass based, seasonal system of production. Unlike Ireland though, the NZ dairy industry has been through

a sustained period of expansion for several decades which has created problems that the industry is struggling to deal with in an effective manner.

Water quality has become a major issue in New Zealand with dairy farming contributing to problems such as sediment run off, effluent entering water ways, poaching of the soil during the winter period from out wintering stock and nitrates leaching into the water. In addition, large scale irrigation is significantly lowering the water levels in many rivers.

Action has been taken to address the problem with the introduction of the Sustainable Dairying: Water Accord which was signed by the leading participants in the dairy industry in 2014. Dairy NZ have been leading the way in terms of promoting best practices on farm to maintain healthy waterways and to also protect the international reputation of the NZ dairy industry.

The tag line “dirty dairying” has become an unfortunate moniker for the industry as a result of numerous environmental issues which have garnered a lot of unwelcome public attention in NZ. There has been numerous high profile cases before the courts where dairy farmers have been prosecuted for releasing effluent into water ways and for non-compliance with environmental rules.

In the run up to the 2017 general election in NZ, one of the mostly hotly contested debates during the campaign was in relation to water royalty charges which the Labour party proposed to introduce. The idea behind this tax on irrigators was to use the cash generated to help clean up the rivers.

Ultimately, the policy did not get the go ahead as originally proposed because the Labour party’s coalition partner didn’t support the measures but it did bring the spotlight on the topic of water quality and dairy farming.

The problem for the NZ dairy industry is that the tag of “Dirty Dairying” is proving rather difficult to shake off. A Dairy NZ survey in 2017 found that 59 per cent of New Zealanders thought dairy farmers were doing a good job except when it came to water quality.

The findings showed that water quality is perceived as New Zealand’s most significant environmental issue and that intensive agriculture is perceived to be the primary cause of the problem.

According to former NZ Primary Industries Minister Nathan Guy, the environment is going to be the main limiting factor to further dairy expansion.

From an Irish perspective, we need to ensure we protect our good reputation by being proactive rather than reactive when it comes to water quality. Our industry is going through a similar expansion and intensification phase. It can’t be at the expense of the environment, especially in the minds of the general public.

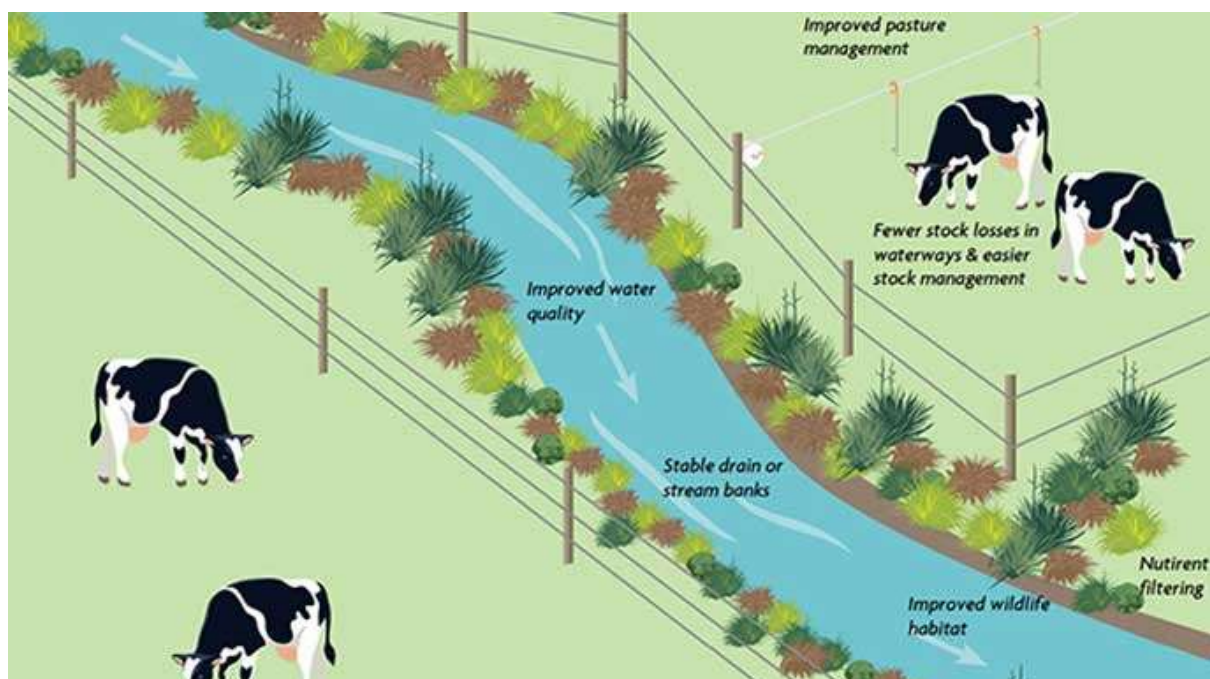
## Advisory Service

Agricultural advisors are a vital part of Irish dairy farming and support farmers through the sharing of advice and knowledge on a variety of agricultural matters. There are well qualified independent advisors in addition to the advisors who are part of the extension service in Teagasc.

Within the context of responding to water quality, agricultural advisors can assist dairy farmers through education and supporting initiatives designed to address it.

## Sustainability Support and Advisory Programme

The Sustainability Support and Advisory Programme is a new approach to achieving improvement in water quality involving the establishment of a resource of 30 Agricultural Sustainability Advisors. The Programme will be jointly funded by both the department of Agriculture and the Department of Housing, Planning and Local Government, Teagasc, local authorities and the Dairy Co-ops on a trial basis for four years to 2021.



Source: Glanbia Connect, 2018

The programme supports the goals of the Food Wise 2025 strategy, facilitating increased productivity along with a more sustainable sector. This sustainability and efficiency will be achieved through improved nutrient management with more targeted use of fertiliser, better farmyard practice, more widespread use of sustainability approaches developed by Teagasc and the development of new approaches in critical source areas.

Professor Gerry Boyle of Teagasc commented that the objective of this new approach is to encourage and support behavioural change, facilitate knowledge transfer and achieve better on-farm environmental outcomes. These features are regarded as cornerstones of the drive towards better farming practices. Under the programme, staff being employed will have an advisory rather than a regulatory role, and the intention will be to get farmers to take ownership of the programme at local level. This is an excellent initiative that pulls together the various stakeholders and it is important that this service is fully rolled out to support farmers.

## Effective Communication to farmers

How do you get farmers to be more conscious of water quality and become more efficient with nutrient management? There is a perception amongst farmers that nutrient management planning and the nitrates regulations are enforced upon them by EU bureaucrats. Such regulations are sometimes referred to as “calendar farming” whereby farmers have to cease the application of organic and chemical fertilizer during the closed period.

This can be somewhat frustrating for farmers when having to deal with significant variation in Irish weather. In addition, the Bord Bia dairy quality assurance scheme is viewed by some as unnecessary paperwork and further intrusion into their daily working lives with very little reward to show for it. The attitude can at times be described as compliant rather than committed. That attitude needs to change.

Farmers need to take ownership of the matter because compliance alone will not be sufficient in terms of meeting the WFD which has a significant bearing on the ability of Ireland to secure a nitrates derogation nor will it be adequate to establish our credentials as the global leaders in sustainability which Origin Green is seeking to do.

There is a lack of awareness at farm level of the challenge posed by water quality and the potential consequences for intensive farming. Farmers are focused on addressing the tangible environmental challenges facing them and although efficient, the water quality challenge is not as noticeable and therefore not considered as an immediate threat.

There is an on-going need to communicate on the challenge posed by improving water quality as well as the recommended measures to address it. More attention and debate in various media outlets, targeted advisory support, a specific water quality and nutrient management Knowledge Transfer (KT) group and milk processor communication will facilitate this. The dairy industry must collectively deliver the message on better nutrient management to farmers by all available means.

Profitable, efficient and sustainable farming are mutually supportive and there is the opportunity for progressive farmers to more regularly talk and articulate about the correlation between efficient farming, nutrient management, water quality and farm profitability to build awareness of the challenge posed by water quality among the farming community. This message needs to be delivered clearly by all stakeholders in the dairy industry.

## Conclusions

This report focused on determining the challenge facing the Irish dairy industry, looking at international examples to ascertain what lessons could be learned, investigating how the Irish dairy industry is addressing water quality and establishing what meaningful actions could be taken in Ireland as it strives towards sustainable intensification and EU Water Framework Directive compliance.

The Irish dairy sector does not want to see a scenario where by it is inhibited as a result of unnecessary environmental regulations having to be imposed or the tarnishing of the Irish brand, therefore action is required. Commitment, effective communication, measurement and focus on incremental improvement will benefit the industry as a whole.

- Water Quality is an important issue for our environmental sustainability and it is vital agriculture plays its part to protect water quality. The EU is playing an active role in addressing the challenge of water quality. As a Member State of the EU, Ireland has challenging targets to meet the WFD and it is taking the challenge very seriously.

The Irish target is for all water bodies to reach “good ecological” status by the year 2027. In April 2018, the Irish government published the River Basin Management plan 2018-2021 which sets out the actions needed to achieve the WFD targets. A major part of that plan is the newly-established Local Authority Waters and Communities Office which will help people to get involved in improving water quality at a local level, particularly focusing on working with farmers in each community.

An Fóram Uisce (National Water Forum), also newly established in 2017, is a forum for stakeholders, community groups and sectoral representatives including the farming organisations. These new initiatives are to be welcomed and indicate Ireland’s commitment to protecting water quality.

- The Dutch and Danish dairy industries have had to tackle issues in relation to phosphorus which has impacted on their ability to secure a derogation from the EU. The dairy sector in both countries is based upon an intensive, high input, high output model that has proven to be difficult to demonstrate its sustainability in an environmental context.
- New Zealand has a similar grass-based dairy production system to Ireland which is supported by an excellent research and development infrastructure. The severe criticism they have received in relation to environmental concerns, particularly in the context of water quality, has made the NZ dairy industry focus on introducing the necessary reforms to clean up its

image. They have looked to Ireland for guidance as to how they go about implementing the reforms.

- Ireland has a green image and an efficient dairy farming model. To validate its sustainability credentials it has the opportunity to demonstrate its commitment to action, evaluation and on-going improvement when addressing the water quality challenge.
- Origin Green is proactive in promoting Ireland's green credentials. SDAS, as part of Origin Green is a globally unique framework upon which to build a more comprehensive programme to address environmental matters, including water quality and nutrient management in Irish dairying.
- Support on the ground for farmers is critical. The ACP has done excellent work in the six catchments in terms of research and advisory assistance in those catchments but there is an opportunity to roll out the research and advisory at a national level. The newly established Agriculture Sustainability Support and Advisory Service programme has the potential to disseminate the key learnings from ACP at a national level.
- There is a lack of awareness of the consequences for the dairy industry if water quality and nutrient management aren't improved upon at farm level. More discussion and debate among farmers through discussion groups can help grow awareness.
- Efficiency, profitability and sustainability are mutually supportive and the dairy industry can do more to convince farmers of this very important message.
- To date, Irish agriculture has been relatively successful in implementing the Nitrates Directive with good initial success but there is a need to do more to ensure no potential restrictions are imposed at EU level. Origin Green, including the SDAS is making good progress establishing itself as a global leader in sustainability but dairy farmers will need to see the real reward in terms of a premium for dairy produce to ensure continued true commitment to its objectives.



- The key concerns are that satisfactory water quality, as outlined in the Water Framework Directive objectives, will not be achieved quickly enough; there will be European Court of Justice cases against Ireland over water quality; the nitrates derogation could be compromised; and Food Harvest 2020 and Food Wise 2025 objectives will not be achieved.

## Recommendations

This report makes a number of recommendations to address the challenge posed by water quality in Irish dairying. The core message is a simple one – stick to what we do best, growing grass. Better nutrient management will improve soil performance, and farm profitability protect local water sources and improve environmental performance.

- The Agriculture Catchments Programme has continuously developed and established itself as a unique asset in meeting Irish farming’s sustainable intensification challenge. Having credible, independent, science based research is vital for advocating for the Irish Nitrates Derogation from the EU. The next phase of programme needs to deliver an enhanced knowledge exchange and dissemination programme in collaboration with Teagasc colleagues. The programme should focus primarily on getting key messages from the ACP to a wider cohort of farmers mainly through the existing Teagasc structures, but also through the Sustainability and Advisory Support Programme. In addition, the ACP should also look to disseminate the messages to a wider audience of policy makers, regulators, environmental scientists and the general public through popular media.
  
- Dairy Sustainability Ireland has begun rolling out the National Dairy Sustainability Initiative. This proactive initiative by the various stakeholders is to be applauded. It needs to act as governors for the environmental agenda in Irish dairying. Requirements of the plan:
  - The body should ensure it continues to be all-inclusive so that all relevant stakeholders can participate, influence and drive this initiative.
  - Strong governance will be required to develop and then implement the necessary actions required for the Irish dairy industry.
  - Water quality and nutrient management need to be included in the action plan which should set out an integrated framework for all stakeholders to address the challenge posed by water quality at dairy farm level
  
- The Irish dairy industry must improve the communication of its message and actions to Irish society, customers, farmers and all other relevant national stakeholder groups. A communications plan should form part of the overall action plan. It should include:
  - Constructive communication with environmental communities.

- Communication with customers and society to protect the industries social licence
  - Communication with farmers via all available channels including dialogue with high profile, progressive farmers.
- 
- To facilitate on-farm action, additional and continuous support for dairy farmers should be sought as part of the water quality action plan. This support should be through:
    - Recruitment of additional agricultural advisors to support farmers on the ground
    - Continuous up-skilling of existing advisors on nutrient management.
    - Knowledge transfer group with a specific nutrient management focus.
    - Provision of government incentives when deemed cost beneficial to national agenda.
    - Pre-audit support to farmers from milk processors.
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- Bord Bia's Origin Green is a unique asset to Irish agriculture. From the dairy industry perspective, it needs to deliver a strong evidence base to build the substance of the Origin Green brand internationally so that evidence will form the platform to demonstrate the sustainability credentials of the Irish dairy industry in the marketplace. Ultimately, Irish dairy farms need to reap the dividends of implementing the highest global standards in terms of environment sustainability.

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