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Catchments Newsletter

Integrated Catchment Management: sharing science and stories

THE STORY OF THE SUIR

from Devil's Bit, to By Hook or by Crook...

Inside this issue

PHOTO: EMMA QUINLAN

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Inside this issue

Editorial

"The health of our waters is the principal measure of how we live on the land." Luna Leopold, Hydrologist
"A river is the report card for its watershed" Alan Levere, Connecticut Department of Environmental Protection

These quotes not only get to the core of catchment (or 'watershed', as they are called in the US) management and Water Framework Directive Implementation, but they help frame the content of this Newsletter, as does the extract from the White House Guidance on Principles and Requirements for Federal Investments in Water Resources on page 6. We are at a critical stage right now; for instance, characterisation, the cornerstone of effective integrated catchment management, is well under way; actions to protect our existing satisfactory waters and restore our unsatisfactory waters are being assessed; and a network of 12 Community Water Officers will soon be in place. While there is a lot more to do in the next 18 months to produce the River Basin Management Plans and thereafter, the main focus of this Issue is to highlight some of the progress being made, using work undertaken in the Suir catchment as the basis.

So, let us start with the 'report card' – how 'healthy' is the Suir? Jenny Deakin (page 8) provides the answer and makes some suggestions on the next steps. As the statistics show, a high proportion of the river and groundwater bodies are satisfactory. Catherine Bradley (page 14) adds to the story with information on the results of ecological monitoring. Chemical monitoring is also essential and details on this are given by Kieran Gordon (page 16). Without knowing the river flows, we cannot understand and therefore manage the catchment effectively – Conor Quinlan (page 12) provides details on the hydrometrics aspects. As all the river flow ends up in the estuary, the situation there is, as Robert Wilkes and Sorcha Ní Longphuirt point out (page 10), the 'canary' for the catchment.

But knowing the situation is not enough! What can we do about it? This Newsletter Issue is not going to provide all the answers by any means, but will illustrate the direction we are going and need to go. Local community involvement is essential; Alan Walsh illustrates progress in this area on page 6. A critical question in prioritising investment in measures is the relative nutrient (phosphorus and nitrogen) loads coming from the different pressures – Eva Mockler (page 18) gives details on a means of estimating this. Where point sources such as industrial wastewater treatment plants are contributing nutrient loads, the location is obvious, the impact can be assessed readily and engineering solutions can usually be established. However, in rural areas this is not so easy; there are as many small potential point sources such septic tank systems and farmyards, but locating the ones contributing to stream and groundwater pollution is difficult. An even greater challenge is provided by diffuse runoff of phosphorus and nitrogen off the fields into streams or by infiltration into groundwater. Unless we can locate these pressures and the pathways by which they get to water, we cannot arrive at the targeted measures needed – we cannot attain 'the right measure in the right place'. Well, we are starting to provide remedies to this challenge; on page 19, Marie Archbold outlines the role of Pollution Impact Potential Maps in helping locate what are called 'critical source areas' – these are the areas, which are usually a small proportion of any catchment, but because of the pressure on them and the natural setting are likely to be providing a disproportionate amount of pollutants compared to other areas in the catchment. However, while these maps represent significant progress in helping focus in on the areas that need attention, they are not suitable for providing the detailed answers needed at field-scale – the information on which they are based is not good enough for that. So, what do we do then? There will be some instances where either local authority or Inland Fisheries Ireland staff will know where precisely the pollution is arising from. However, in many situations this will not be the case. There is then really only one answer, although it will take time and resources; we must 'walk' the river taking various readings, noting different indicators of water quality, evaluating the surrounding land, and perhaps taking water samples. We are calling this process 'Investigative Assessment' (see article on page 20). One of the valuable techniques that we can use to help us understand the situation is measurement of electrical conductivity (see article by Ray Flynn and Jenny Deakin on page 22). Open drains on the one hand can be a pathway for nutrients to get into streams, but they can also be part of the solution as demonstrated by Mairéad Shore on page 24, and this article shows the value of the detailed field-scale research being undertaken by Teagasc. I realise in writing this (and I am putting it down before anyone thinks it!!) that there is another step in the process; we can by the various means outlined in these articles arrive at the significant pressures (the pressures causing unsatisfactory water quality and that need mitigation) and their locations, but we still have to do something about them. And, apart from Mairéad Shore's article, we haven't provided answers for what has been called the 'wicked problem' of diffuse rural pollution. That is for a future Issue.

To finish with a quote from John Muir:

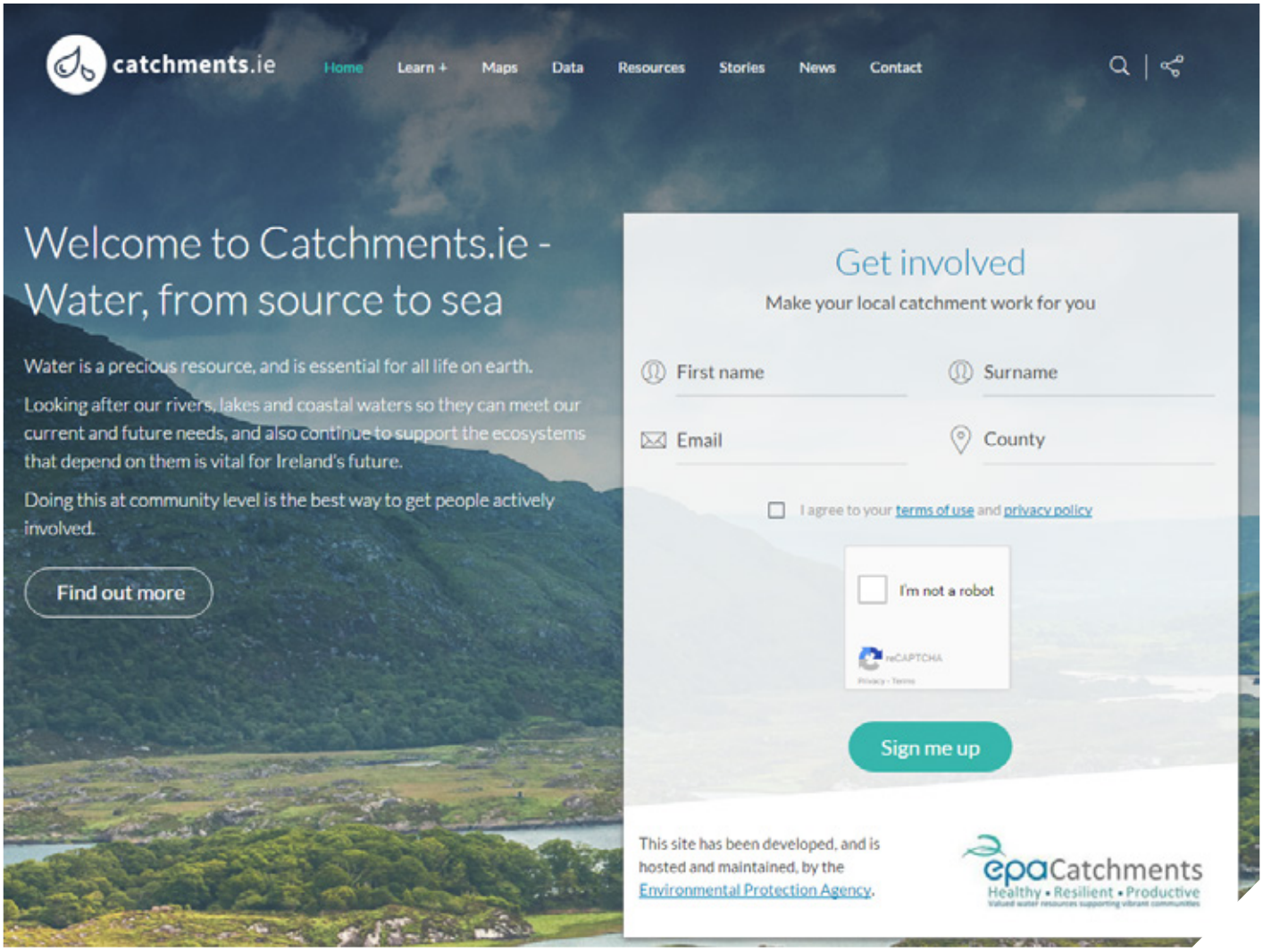
"Rivers flow not past, but through us; tingling, vibrating, exciting every cell and fiber in our bodies, making them sing and glide."

There can be few of the readers of this Newsletter that this doesn't apply to, although we mightn't have such poetic feelings. Therefore, the onus is on us to 'live on the land' in a way that keeps our waters 'healthy' as is the case already in many areas in Ireland, and to ensure that our 'unhealthy' waters are diagnosed and cured as soon as realistically possible, thereby achieving a good 'report card' for all our catchments.

See 'Extract from White House Water Guidance (2013) on P.6

Donal Daly, EPA Catchments Unit

Catchments.ie - Water, from source to sea



Catchments.ie is a brand new website that will be sharing science and stories about Integrated Catchment Management in Ireland. We'll use the stories from this newsletter, but there will also be a lot of other features. We'll be adding information about our 46 catchments, 583 subcatchments and 4829 waterbodies as the work is completed.

You can now easily sign up for the quarterly Catchments Newsletter on the website, and if you fill in your county as well, we'll email you with relevant information about anything new that starts in your area.

The website is a collaboration between the Department of Environment, Community and Local Government, the Environmental Protection Agency, and the Local Authority Waters and Communities Office. It was developed, and will be hosted and maintained, by the EPA. We've built it with Open Source software, and will be making as much of the data as we can Open Data as well, subject to agreement from all those responsible for the data we're using.

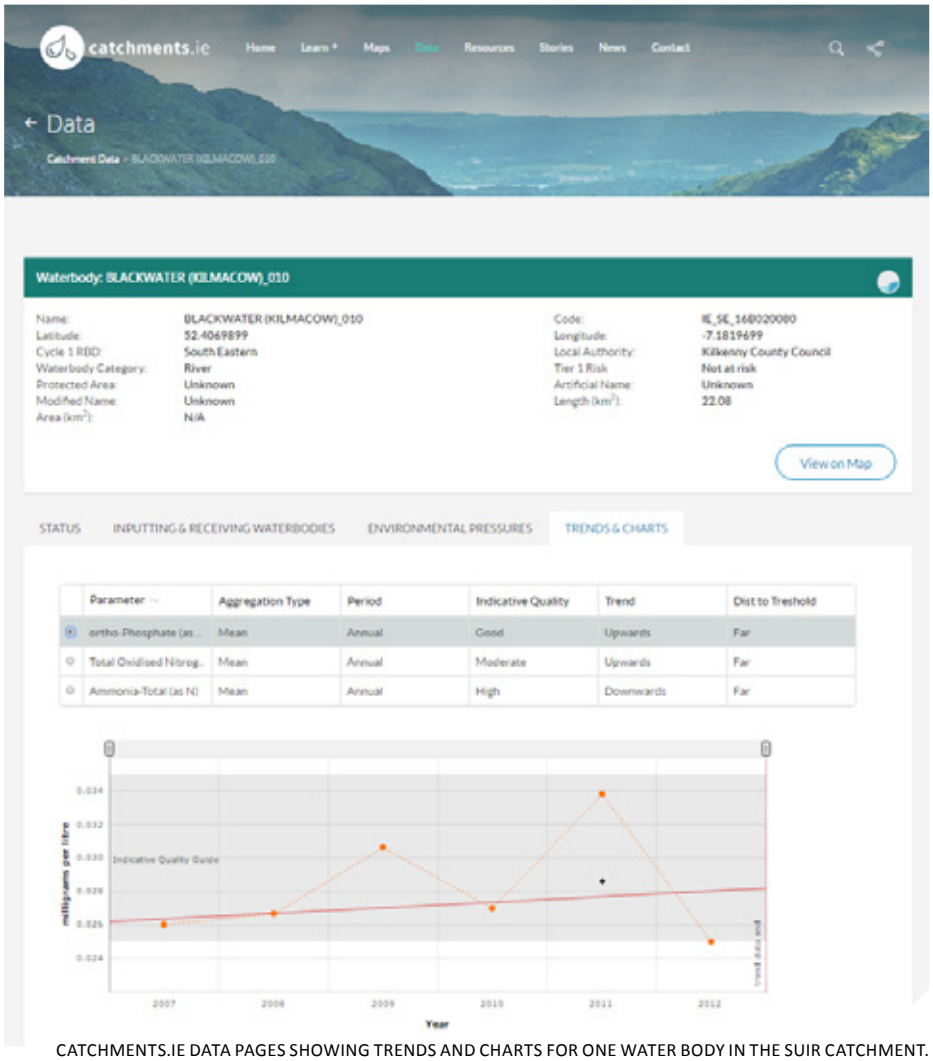
You can see how the EPA, in conjunction with all our local authorities and other public bodies around the country, is using this data if you read all the articles in 'The Story of the Suir' in this issue - it will give some idea of how much work is going on to help us understand our catchments, and the level of detail involved in identifying measures that will help improve water quality for inclusion in the next draft River Basin Management Plan, which is due for publication at the end of this year.

Lots of the data what was being used by the EPA Catchments Unit and was previously only available to public sector organisations has now been made freely available on catchments.ie. The website is currently in beta, and we would welcome any feedback you have on it - just email hello@catchments.ie

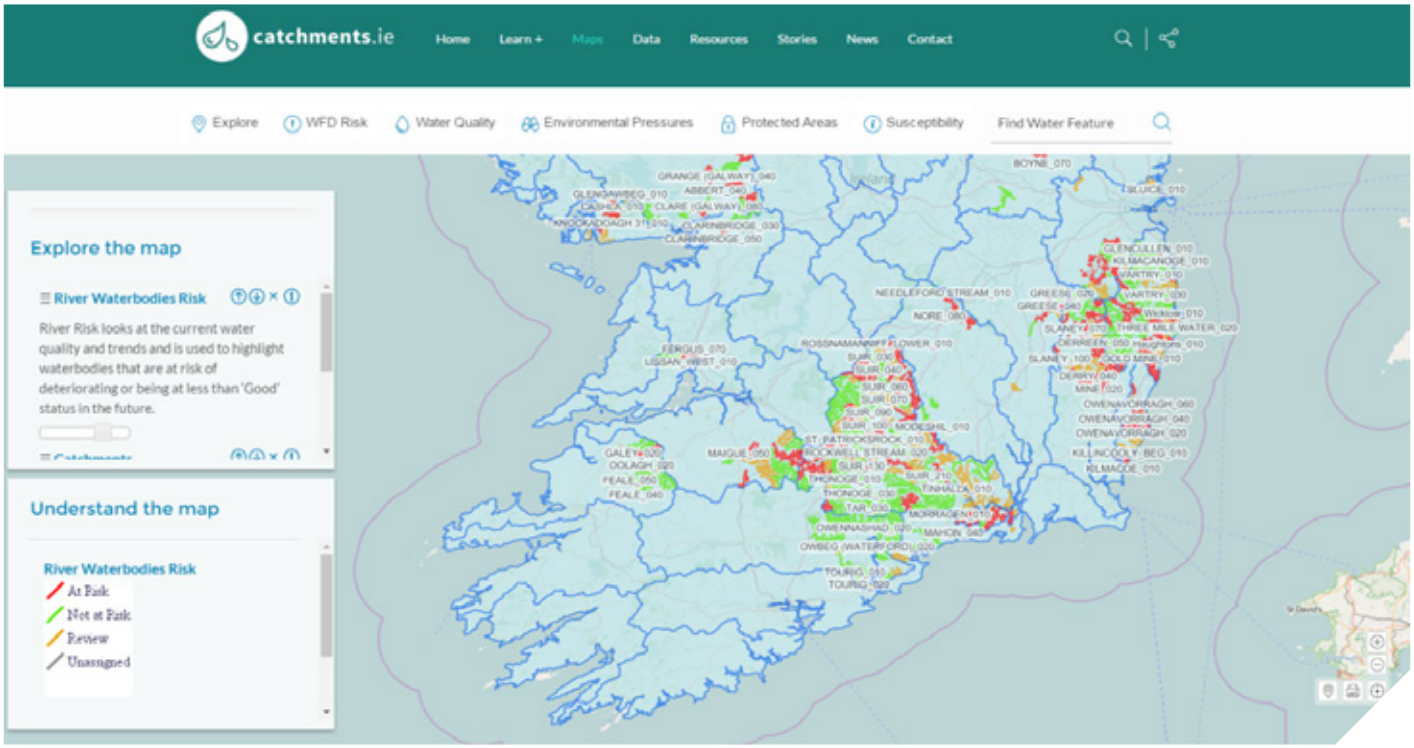
What's on the website:

- Learn - what is a catchment, why you should care, how we manage our catchments, how to get involved, and what the Water Framework Directive is, and how it can be a useful tool to help us achieve better water quality
- Maps - with over 60 layers, the Maps section has lots of information about water in Ireland, including Water Framework Directive Status and Risk, Environmental Pressures, Protected Areas and Susceptibility. These will be updated and added to over time. You can click on any water body and see available information about it on the Data page
- Data - this section is structured around catchments, subcatchments and water bodies. It shows status, pressures, and trends at water body level. More data will be added as they become available.
- Resources - this section will be a library of relevant documents from the 1st and 2nd Cycle, and will be added to over time
- Stories - case studies and examples of best practice from around Ireland, and some from further afield
- News - regular updates about all the work that is going on in Ireland, including a calendar of events

Paddy Morris, EPA Catchments Unit



CATCHMENTS.IE DATA PAGES SHOWING TRENDS AND CHARTS FOR ONE WATER BODY IN THE SUIR CATCHMENT.



CATCHMENTS.IE MAPS SHOWING APPROVED WATER FRAMEWORK DIRECTIVE RISK SCORES

Extract from White House Water Guidance (2013)

Principles and Requirements for Federal Investments in Water Resources
https://www.whitehouse.gov/administration/eop/ceq/initiatives/PandG

"Watershed Approach. A watershed[1] is a land area that drains to a common water body. A watershed approach to analysis and decision making facilitates evaluation of a more complete range of potential solutions and is more likely to identify the best means to achieve multiple goals over the entire watershed. A watershed approach facilitates the proper framing of a problem by evaluating it on a system level to identify root cause(s) and its interconnectedness to problem symptoms. The approach enables the design of solutions that considers the benefits of water resources for a wide range of stakeholders within and around the watershed. It promotes the evaluation of effects within a watershed and other interconnected systems to understand a full range of public benefits. The effects evaluated should include cumulative effects which are the impacts on the watershed that result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Finally the watershed approach allows for consideration of upstream and downstream conditions, needs and potential impacts of proposed actions.

The scope and scale of watershed assessments can vary. Watershed assessments should encompass a geographic area large enough to ensure that plans address cause and effect relationships among affected resources and activities that are pertinent to realising public benefits. The scope and degree of evaluations across watersheds should reflect the nature of these relationships. It is imperative that assessments evaluate the interaction of a potential Federal investment with other water resources projects and programs within a region or watershed."

The Story of the Suir - from Devil's Bit, to By Hook or by Crook...

The River Suir has a Green and Blue Future

The River Suir rises in the Devil's Bit mountain northwest of Templemore and carves its way through the stunning landscapes of counties Tipperary, Kilkenny and Waterford on its 185 Km journey to the sea at Waterford harbour.

Those who live near the Suir have immediate access to a wonderful resource and there are many who regularly access the river for lifestyle and recreational purposes. Tipperary County Council engaged with these communities through two INTERREG co-funded projects, each of which had a focus on waterways. One of these projects was Green and Blue Futures: The social economy and the management of green infrastructure.

This project aimed to establish a transnational European framework to mobilise the voluntary sector in the management of green infrastructure such as nature sites, parks, woodlands and waterways. It brought together seven partners from five jurisdictions across Northwest Europe: Scottish Waterways Trust and Scottish Canals (Scotland), The Canals and Rivers Trust (England), Tipperary Co Co (Ireland), Réussir en Sambre Avesnois (France) and Province du Hainaut and West Flanders (Belgium).

The partners looked at ways to combine social objectives, such as tackling unemployment and engaging disconnected youth, with environmental activities like protecting riverbanks, controlling invasive species and the productive use of green urban spaces. Social enterprise models were explored which combine a focus on positive social outcomes with a business model to generate income in order to move away from a reliance on grant funding.

PICTURE SHOWS THE GREEN AND BLUE FUTURES PROJECT PARTNERS NEXT TO THE SUIR.

The project allowed staff from a broad range of sections within the local authority to work together on a project focused on the Suir and the communities and individuals connected to it. A 56 km stretch of the river from Cahir to Carrick on Suir was chosen to focus efforts and resources given that the timeframe was July 2012 to September 2015.

The local authority had already identified the various communities and individuals connected with the Suir from a previous INTERREG project called Waterways Forward, examples of these groups are: Ardfinnan and Clonmel Canoe Clubs; Kilsheelan and Golden Tidy Towns

[1] While 'watershed' is an attractive term, it is not used in Ireland, where the equivalent word is 'catchment'.

Committees; and Cahir and Carrick on Suir River Rescue teams. As a result, a strong network of communities emerged along the river corridor and the project provided opportunities for regular communication and knowledge sharing.

Examples of project activities undertaken are:

- A surveying and mapping initiative which focused on existing access and egress points along the river between Cahir and Carick on Suir. Meetings held in council chambers provided opportunity for conversation and discussion about the river and the existing activities. Local knowledge identified 41 existing access locations which were then surveyed from both land and the river. The results of this were then presented back to the communities.
- A local authority led, but community driven, design process for improving river access points at locations used for canoeing/ kayaking, angling and triathlon events. Up to 80 people from the local communities engaged with this aspect of the project.
- A 'Youth Connect' project, which attracted 45 young people, delivered education on biodiversity and training on skills such as fly-fishing, stonework, kayaking and photography.
- Restoration of river banks using natural material such as stone, clay and willow was undertaken by the Kilsheelan Tidy Towns Committee with support from a local employment scheme. An overgrown area adjacent to an abandoned septic tank was transformed into a riverside 'Garden of Renewal' with seating, natural stone features and planting of native trees and shrubs.
- An art project with a river theme had installations along the river towpath at Kilsheelan reflecting local heritage and stories. This involved 182 participants and created a 2.5km art trail along the river and received 150 visitors over a single weekend.

"he spent the first two minutes of his presentation waxing lyrical about an Otter he had seen climb the river bank with a fish in its mouth"

An international conference was held in Clonmel in Oct. 2013, the theme was 'Developing the socio-economic potential of waterways'. One of the speakers Tony Harvey, Head of Enterprise, Canals and Rivers Trust UK was so taken by the natural beauty of the Suir that he spent the first two minutes of his presentation waxing lyrical about an Otter he had seen climb the river bank with a fish in its mouth. This conference saw two hundred speakers and delegates discuss

KILSHEELAN TIDY TOWNS COMMITTEE'S 'GARDEN OF RENEWAL'

a broad range of topics from the protection of biodiversity and habitats to the development of recreational activities and tourism connected with waterways.

The final outcomes of the project, particularly around the cost-effective management of green & blue infrastructure, will aim to inform European policy in the area of natural resource management and the structuring of future funding programmes.

In Tipperary the Green and Blue Futures project brought about a new focus on the River Suir for both the Local Authority and the communities. The river had been viewed negatively in the past by many due to regular flooding, however flood relief schemes in the main towns and villages have acted to address this and now the focus is on more positive associations with the river. Increased activity and involvement along the river is evident today and this has resulted in more community ownership of planned future developments. For example, the development of a River Suir Blueway trail could provide a range of walking, cycling and paddling activities for local communities and visitors to the area. To compliment this a canoe/kayak activity hub in Clonmel is being driven by the local Canoe Club. Social enterprise models are being examined to provide some of the services required to establish this trail, such as canoe hire and cafés.

One thing is for certain, this project provided an opportunity to develop a new working arrangement and partnership between the local authority and local communities. The overarching vision has been to restore people's sense of place and connection with the river, to increase biodiversity by having more life in and along the river and to utilise this natural resource to promote recreational activity and economic development.

The newly established Local Authority Waters and Communities Office aims to build on positive experiences such as this throughout the entire country, and would like to hear about any similar initiatives or ventures connected with our natural waters. The office can be contacted by phone at 0761 065 262 or email to info@lawco.ie

Alan Walsh, Local Authority Waters and Communities Office.

SIMON MOLLOY EXPLAINING THE PROCESS OF BANK RESTORATION.

How healthy is the Suir Catchment?

Do we have the balance right between living and working in, and maintaining a healthy Suir catchment, and if not, what do we need to do to redress the situation?

The Suir catchment is 3500 km^2 in size, rising on the Devil's Bit Mountain and flowing out to the sea at Waterford Harbour.

The population in the catchment is approximately 200,000 spread across several major urban centres, including Thurles, Tipperary, Cashel, Clonmel and Waterford, and the rural population. Much of the catchment is freely draining with good farm land. Farming is consequently relatively intense in some areas. The density of domestic waste water treatment systems (septic tanks) is approximately 8 per km^2. There are forestry operations in the upland areas of the Galtees and the Comeraghs, and peat extraction in the lowland areas east and northeast of Thurles. There are also mines, quarries, industrial activities and wind farms. However despite this high level of human activity in the catchment, there are also significant nature conservation values and places where biodiversity is known to be relatively high. For example, the River Suir is a known salmonid fishery. The catchment also contains 3 Special Areas of Conservation (SACs) designated under the Habitats Directive to help protect rare animal and plant species, and a Special Protection Area (SPA) designated under the Birds Directive. There is even a small freshwater pearl mussel subcatchment that flows into the Suir downstream of Waterford.

So the catchment supports a wide range of livelihoods and ecosystem services, but how are the catchment's aquatic ecosystems coping with all these activities? Do we have the balance right between living and working in, and maintaining a healthy Suir catchment, and if not, what do we need to do to redress the situation?

This question is central to the Water Framework Directive river basin management planning process. Plans are made every 6 years containing actions to enhance and protect water quality and the ecosystems that depend on it. We are currently in the characterisation stage of the 2nd planning cycle which is due to culminate in our 2nd cycle plans being completed at the end of 2017, and implemented between 2018 and 2021. Characterisation of water bodies is a critical element of the work required under the Water Framework Directive, and is about understanding how our catchments work and how human activities impact on water, in order to prioritise appropriate actions that ensure that we do get that balance right.

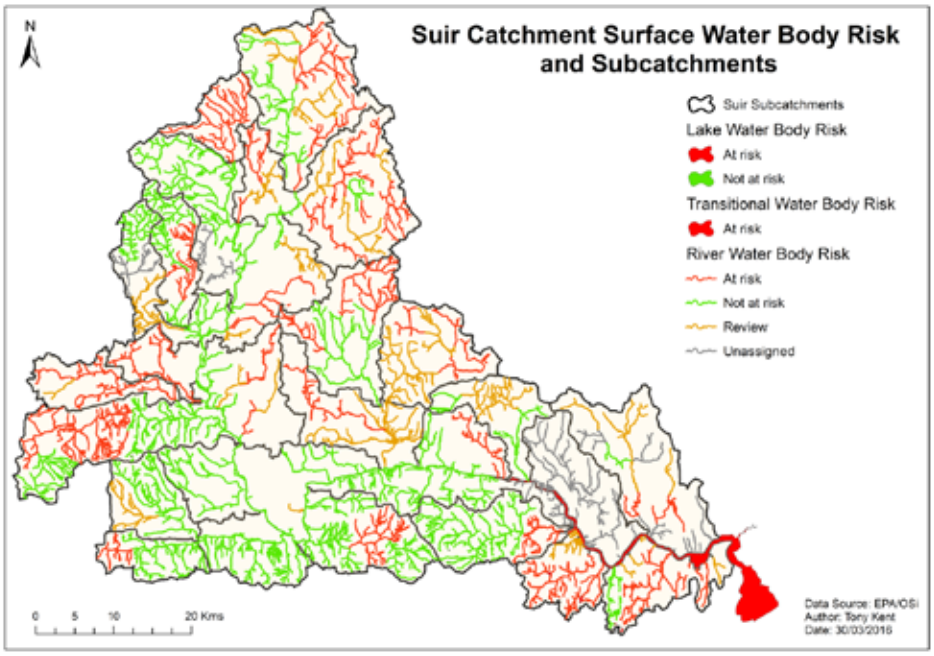
In this 2nd cycle our philosophy is about looking for 'the right measure in the right place' to achieve the best outcome, which will build on the 'one size fits all' approach of the last cycle. The EPA, with the assistance of RPS consultants, the local authorities and the Inland Fisheries Ireland officers, are currently working through characterising all of Ireland's streams, rivers, lakes, estuaries, coasts and groundwaters, one by one, to determine what and where the water quality issues are, what are the significant pressures causing those issues, and what can be done about them. All the information is being recorded in a new EPA water management system, known as the Water Framework Directive Application, which will soon be made more widely available through the catchments.ie website.

THE SUIR NEAR CARRICK-ON-SUIR BEFORE IT FLOWS OUT INTO THE ESTUARY (PHOTO: EMMA QUINLAN).

So what did we find in the Suir catchment?

In general aquatic ecosystem health in the Suir catchment is fairly good. The majority of surface water bodies were "Not at Risk" i.e. are expected to meet their Water Framework Directive objectives, meaning that no further actions are required in addition to the basic requirements of the current regulations and best practice management. Water quality trends are also generally improving across the catchment although there are some key hotspot areas where problems continue to arise. 64 (35%) surface water bodies, including the Suir estuary and 4 small groundwater bodies, were found to be At Risk and will require specific measures to achieve improved water quality outcomes. The vast majority of the water bodies containing the protected areas had also already met their objectives.

The most significant water quality issue is excess phosphorus (P) from a variety of sources including human and animal wastes and fertilisers, leading to eutrophication, which is impacting on rivers, lakes and estuaries. Groundwater provides a significant pathway for delivery of phosphorus to surface waters in some places, and is impacted by industrial sites and a landfill in the four small key areas. Poor habitat quality and excess sediment from peat extraction, forestry and channel maintenance, as well as excess ammonium from the worked peat, are also important issues in specific areas. The most widespread significant pressure in the Suir catchment, in terms of numbers of water bodies impacted, is agriculture. Agriculture is also probably one of the most challenging pressures because it is widespread, and the sources of pollution sources are diffuse, for example from fertilisers or pesticides being spread, and from faeces and urine from livestock in fields, as well as small point sources, all of which can be difficult to manage.



SUIR CATCHMENT SURFACE WATER BODY RISK, AND SUBCATCHMENTS

The next step is to use the range of tools now available to us, which are described in other articles in this edition, to help pin down exactly where and what the issues are in the problem areas we have highlighted and identify precisely what needs to be done to resolve them. We know from catchment and estuary modelling (see article page 18) that if we can reduce the losses of P from a relatively small number of river water bodies, this should also be enough to bring the P reaching the estuary back to levels that would support Good status. Twenty investigative assessments (see article page 20) have been targeted for the relevant local authorities to prioritise. These will be carried out using the pollution impact potential maps (see article page 19) to help focus the effort. The specific problems that are identified will be rectified using a mix of engagement, accessing voluntary incentive schemes and enforcement of existing regulations. In addition, Irish Water plan to deliver structural improvements to two waste water treatment plants within the Suir catchment by 2021, and a further five by 2027, which will have positive impacts for water quality overall.

A collaborative, focussed effort will be needed to tackle the significant pressures identified in the Suir catchment. It will need to involve multiple agencies, including staff from the new Waters and Communities office, and the local landholders. Such a collaborative approach will be essential to achieve that balance that will sustain a productive, yet healthy, Suir catchment for the long term.

Jenny Deakin, EPA Catchments Unit


GOOD EXAMPLE OF FENCING THE RIPARIAN MARGIN (PHOTO: EMMA QUINLAN).


NATURAL STREAM CHANNEL IN A TRIBUTARY NEAR THE SUIR HEADWATERS (PHOTO: EMMA QUINLAN).

The Suir Estuary and its catchment - what does the marine area tell us about upstream conditions?

The Suir estuary = the canary for its catchment?

The Suir and associated rivers join up to create one of the largest estuarine systems in Ireland. The tidal limits extend up the Three Sisters to Carrick on Suir on the Suir river, Saint Mullins on the Barrow, and Inishtioge on the Nore. The main channels of the Suir and the Barrow-Nore system converge at Cheekpoint and continue towards the sea past the Passage East ferry, Dunmore East, and finally at Hook Head out into the Celtic sea.

Given the importance of this estuary at a local scale and to the larger marine environment, the EPA, Inland Fisheries Ireland and Marine Institute undertake monitoring of water quality and ecology from the mouth of Waterford harbour up to the tidal limits and beyond. This information allows us to get a holistic picture of the general ecology of the estuarine area, but also allows us to use the estuary as an indicator of what things are like upstream.

SUIR ESTUARY, THE LARGEST OF THE THREE SISTERS, AT WATERFORD CITY.

THE NORE ESTUARY AT NEW ROSS

THE SHORE AT HOOK HEAD WHERE THE COMBINED INPUTS OF THE THREE LARGE ESTUARIES JOIN THE OPEN COASTAL WATERS

Estuaries as indicators

In many freshwater systems, the nutrient that is of most concern for its effects on the biological communities is phosphorus (P). Measures have been in place to reduce loading of phosphorus into our catchments and these have proved quite effective, with inputs of phosphorus from the Three Sisters into the Suir Estuary decreasing by 60 % since 2000, and concentrations of this nutrient in the estuary are now considered to be acceptable. As less emphasis is placed on nitrogen (N) reduction this nutrient has only shown a 15 % decrease in the same time frame. Not surprisingly, this nutrient is above the levels which are acceptable for Irish estuarine systems. This has resulted in more of the nitrogen in the catchment being available for plant growth. While this is not immediately obvious in the upstream freshwater areas, once this nitrogen reaches the estuary biological effects can be observed.

ROCKY SHORE IN THE OUTER SUIR ESTUARY. THE SEAWEED ON THE ROCKS CAN BE USED AS INDICATORS OF GENERAL HEALTH OF THE ECOSYSTEM.

As the ultimate receptors of all the inputs upstream, the estuarine and coastal areas can tell us a lot about what is happening in the overall catchment. We can use the biological communities to tell us about nutrients in the water, or chemical pollutants. Useful indicators to look at nutrient pressures are the seaweeds. We use the presence and abundance of certain seaweeds, such as sea lettuce, to tell us about the nutrient conditions in the estuary. In areas where nitrogen inputs increase these green seaweeds can grow in huge quantities causing an environmental impact. Other indicators of nutrient pressures are the phytoplankton communities (small plants that grow suspended in the water column) which can change depending on the balance of nutrients coming downstream. In severe cases this can result in large harmful algal blooms that can affect the other marine communities, such as shellfish or the bottom dwelling animals.

In the Suir we have seen some disturbances to the marine plants with elevated levels of phytoplankton in the water suggesting that the nutrient conditions are too high. We can use this information, along with the other data from our monitoring programmes, to work out what has to be done to improve the situation. By looking at the estuary and coastal areas we can develop an idea of the sort of changes that need to take place in the whole catchment for improvement across all our waters.

Robert Wilkes, EPA and Sorcha Ni Longphuirt, Aquafact Environmental and Hydrographic Consultants

The EPA hovercraft is used for sampling in estuaries that are otherwise inaccessible. The Hovercraft can travel over soft muds and sands allowing us to get into area that would be impossible to access on foot.

Measuring how the Suir flows, from the mountains to the sea

'Hydrometrics' is the measurement of water levels and flow - how can it help us manage the Suir Catchment?

SUIR HEADWATERS PHOTO: JOHN LUCEY

THE SUIR EXPANDING IN WIDTH AS IT FLOWS THROUGH THE CATCHMENT PHOTO: JOHN LUCEY

The River Suir drains a catchment of 3,542km². The headwaters of the Suir are located on the northern flanks of the Devil's Bit Mountain in Co. Tipperary. The river flows east and then south through a wide limestone plain, past Thurles, where the Suir is joined by the River Drish flowing off the coal bearing Slieveardagh Hills on the eastern edge of the plain, and the Tipperary Clodiagh, which drains the hills to the south and west of the Devil's Bit.

The Suir continues southward towards Cashel where it is joined by the Multeen River from the west and onwards to Cahir before which the Fidaghta, Ard and Aherlow Rivers flow into the Suir from the Golden Vale on the northern side of the Galtee Mountains. To the south of Cahir, the Suir enters the east – west aligned, limestone floored valleys which were formed by an ancient collision between the continental plates of Europe and America, and which characterise much of the landscape of southern Munster today.

Here the Suir is joined by the Thonoge and Tar Rivers which drain the karstified valley between the Galtee and Knockmealdown mountains. The Suir then turns north near the village of Newcastle, meeting the Nier River which drains the western side of the Comeragh Mountains. The Suir then turns east before reaching Clonmel, after which it is joined by the River Anner, flowing from the north and draining much of the central part of the Suir catchment and the slopes of Slievenaman. The Suir becomes tidal just before reaching Carrick-on-Suir, and is joined by a number of rivers between this point and Waterford city including the Lingaun, Portlaw Clodiagh (the only designated Freshwater Pearl Mussel subcatchment in the Suir catchment), Pil, and Kilmacow Blackwater and then makes its way to the confluence with the Nore and Barrow Rivers east of Waterford City. The Suir estuary then turns south, flowing out to sea through Waterford Harbour between Dunmore East and Hook Head.

River levels and river flows are measured on the Suir and its tributaries by the Environmental Protection Agency (EPA) in conjunction with the Local Authorities for:

- drinking water supply resource assessment,
- waste water discharge assimilative capacity[1] calculations,
- environmental monitoring,
- conservation, and
- to enable planning and development proposals to be assessed.

The Office of Public Works also measures river levels and river flows in the catchment for drainage and flood management purposes. The hydrometric gauging station networks in the catchment are complimentary, with data shared between organisations to avoid duplication of effort. The EPA maintains the National Hydrometric Register and is a member of the National Hydrometric Working Group which provides national oversight of hydrometric operations to allow for efficient operation of hydrometric data collection.

Due to the historical development of the networks, the Office of Public Works network is focused on the main channel of the Suir from Templemore in the north to Waterford City in the southeast, with a small number of stations located on larger tributaries including the Drish, Tipperary Clodiagh, Multeen, Aherlow, Nier, and Anner Rivers. As this network is focused on drainage and flood management, it contains a high proportion of stations that are only measuring river levels as opposed to river flows (i.e. the amount of water flowing in the river). There is an extensive flood risk in the Suir catchment, which is reflected in the number of hydrometric stations maintained by the OPW here. In total they maintain 19 river level only stations and 16 river flow stations in the catchment.

[1] Assimilative capacity refers to the ability of a body of water to cleanse itself; its capacity to receive waste waters or toxic substances without deleterious effects and without damage to aquatic life or humans who consume the water.

News & Articles: The story of the Suir

The hydrometric stations maintained by the Local Authorities and the EPA conversely, are located where there is a need for river flow information relating to waste water discharge assimilation capacity, water resource assessment, environmental monitoring, and conservation objectives. Therefore, these stations tend to be located away from the main channel of the Suir at the location of waste water treatment or drinking water abstraction plants (Tipperary, Ballyporeen or Ballyshonnock for example), environmental sampling locations, or environmentally sensitive locations such as the Clodiagh Freshwater Pearl Mussel catchment at Portlaw. These types of assessments require river flow data which means this network is comprised exclusively of stations that measure river flow and not simply river level only. The EPA/Local Authority hydrometric network in the Suir catchment consists of 14 river flow stations. None of these stations are located on the main channel of the Suir, which is already covered to an adequate level by the Office of Public Work's stations. Half of the EPA/Local Authority stations are located on tributaries of the Suir upstream of Carrick-on-Suir where there are specific abstraction or discharge pressures, and half of the EPA/Local Authority stations are located on rivers draining into the tidal estuarine part of the Suir, where the Office of Public Works does not maintain stations that measure river flow.

The combined network of 30 river flow monitoring stations and 19 river level only monitoring stations is one of the highest densities of any catchment in the country and provides a sound base for river flow related decision making in the Suir catchment. The EPA is currently undertaking a national review of the hydrometric network based on current and future river flow information needs. This review is based on an assessment of the known and possible pressures on the river and technological developments in river flow measurement, together with an understanding of the resource requirement relating to the collection of hydrometric data. In future, the existing, long-term strategic hydrometric network will be supplemented by a wider investigative hydrometric programme, including short-term project hydrometric stations that will provide tactical assistance to facilitate integrated catchment management on the ground in a practical manner. Combined with foreseen national developments in hydrometric modelling and estimation methods and applications, this will provide accurate river flow information for the Suir and its tributaries to inform decision making and effective management of the Suir catchment for all its residents.

THE SUIR AS IT FLOWS TOWARDS ITS ESTUARY PHOTO: JOHN LUCEY

All Hydrometic Data is available at www.epa.ie/hydronet

Conor Quinlan, EPA Hydrometric and Groundwater Section

A WEIR ON THE SUIR PHOTO: JOHN LUCEY

What's living in the Suir, how healthy are our rivers?

The various uses of rivers can involve conflicting interests and often such uses disrupt the ecology or health of the river. The fact that several of the more important beneficial uses of rivers such as drinking water abstraction, amenity uses like water sports, and waste water disposal are all dependent on biological processes is rarely appreciated.

If a river's natural self-purification process, for example, is disrupted by pollution or over-abstraction, some or all beneficial uses may be impaired or lost. It is important, therefore, to keep ecological disruption to a minimum and to maintain the aquatic ecosystem in a healthy, functional condition. Progress towards this goal can be assessed by chemical or biological means or, preferably, by a combination of both. In general it could be said that whilst physico-chemical monitoring may measure the causes of pollution i.e. the pollutants, biological monitoring is the only means whereby the ecological effects of pollution can be measured.

What do we monitor

The EPA is responsible for the implementation of the Water Framework Directive monitoring programme, assessing the results and reporting on the quality of our waters at a national and European level. Biological monitoring of Irish rivers and streams was first undertaken in the 1970's and since then has continued on a three year survey cycle. There are approximately 3,157 (2,831 biological and 1,463 chemical) monitoring sites on the national Water Framework Directive rivers monitoring programme. A total of 215 river sites are surveyed in the Suir catchment alone including 138 biological and 139 chemistry sites. Under the biological programme, the macroinvertebrate fauna (small animals without a backbone that can be seen with the naked eye) and the aquatic plants and algae residing in the river are examined, the species are identified, and their relative abundances are recorded. Using their known sensitivities and tolerances to pollution, biological indices can be applied to the observed data to summarise their ecological condition classifying the river site from satisfactory, that is High or Good condition, to unsatisfactory: Moderate, Poor or Bad conditions. Fish surveys are carried out as part of the WFD monitoring programme including the Suir catchment. For further information please visit the Inland Fisheries Ireland website http://wfdfish.ie/.

The Q value system

The aquatic macroinvertebrate fauna is the main biological group monitored and assessed by the EPA to determine the condition of Irish rivers. The fish, aquatic plant and algal communities are examined and assessed in more detail at a limited number of surveillance sites across the country. Macroinvertebrates play an important role in river ecosystems, as they feed on algae and microorganisms, break down organic matter, recycle nutrients, and are prey for fish, birds, mammals and other macroinvertebrates. The aquatic macroinvertebrates are seen as important biological indicators. Macroinvertebrates are relatively sedentary in nature, different species have life cycles spanning from one to three years. The macroinvertebrate community therefore while residing in the river bed substrata will demonstrate the effects of changing water quality conditions over time. Depending on the water chemistry composition, the river flow and available habitats, the aquatic macroinvertebrate fauna is usually represented by the larval forms and in some cases adult forms of various insect groups such as mayflies, stoneflies and caddisflies, damselflies, dragonflies, true flies, beetles, true bugs, and other groups such as snails, mussels, worms, leeches and crustacean shrimp and crayfish. Important protected macroinvertebrate species such as *Austropotamobius pallipes* (Lereboullet), the white clawed crayfish and to a lesser extent *Margaritifera margaritifera* L., the freshwater pearl mussel are known to occur in rivers across the Suir catchment.

The EPA Q-Value System is based on the well-established sensitivities, abundance and diversity of macroinvertebrates and their relation to water quality. The Q Value system has been used to assess the quality of Irish rivers since the 1970's. It has a nine point scale ranging from Q5 indicating high quality to Q1 bad quality. The scheme mainly reflects the effects of organic pollution i.e. deoxygenation and eutrophication i.e. nutrient enrichment,

DAMSELFLY – *CALOPTERYX SPLENDENS* - BANDED DEMOISELLE PHOTO: CATHERINE BRADLEY

but can also reflect the effects of toxic chemical pollution e.g. pesticides, and general habitat degradation. Biological macroinvertebrate surveys are usually undertaken in the most sensitive time of the year, summer to early autumn period, when flows are likely to be relatively low, water temperatures are higher and any stresses on aquatic ecosystems are expected to be at a maximum. Biological material for examination is obtained by kick-sampling, a method used to disturb the river bed substrate and dislodge the resident macroinvertebrates living in the shallower, faster-flowing areas (riffles) into a standard pond net. The sample is then transferred to a white tray and the assessment of water quality is completed on the river bank.

STONEFLIES & MAYFLIES (PHOTO: RUTH LITTLE)

ECDYONURUS – POLLUTION SENSITIVE MAYFLY (PHOTO: WAYNE TRODD)

PERLA BIPUNCTATA - POLLUTION SENSITIVE STONEFLY (PHOTO: RUTH LITTLE)

What is ecological monitoring telling us?

In 2014, 138 macroinvertebrate Q value surveys were carried out across the Suir catchment, the macroinvertebrate Q value results indicated that 88 of the 138 sites or 71% of the river channel length surveyed was at high or good (Q4 or greater) ecological condition while 50 sites indicated unsatisfactory ecological condition (less than Q4). This unfortunately represents a decline in quality on the 2010-2012 survey period when approximately 78% of the river channel length surveyed was considered to be at satisfactory ecological condition (Figures 1 & 2).

Once the macroinvertebrate Q value survey is completed, the results are provided by the EPA as online maps and published in Interim Reports on River Quality http://www.epa.ie/QValue/webusers/. These results are then used in combination with other available information, for example chemical monitoring results and fish monitoring results, to assess the WFD ecological status for each of the country's monitored river water bodies.

The Q value survey results are the main source of information employed to highlight where an ecological impact from pollution or activities in the catchment is occurring on a river system. The results inform catchment managers of where the pressure is impacting, and where programmes of measures will need to be targeted in order for river quality to improve. The monitoring programme results also provide important updates to demonstrate when the implemented measures are working.

Catherine Bradley, Rivers Section, EPA
Ecological Monitoring and Assessment Unit

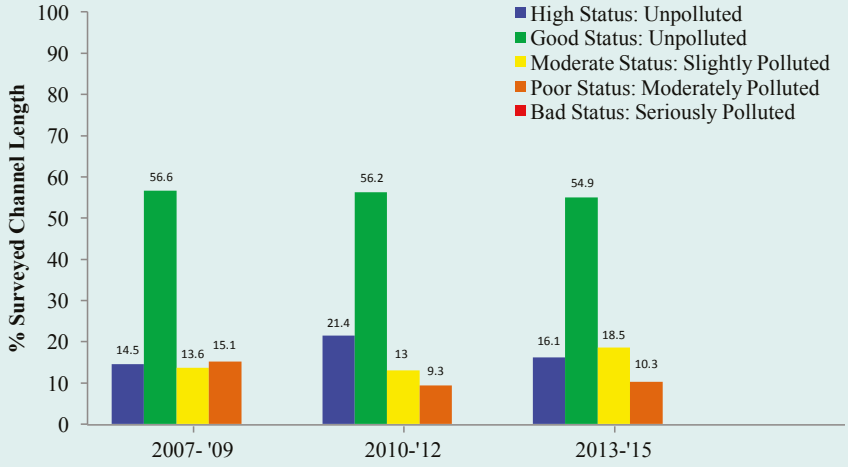


FIGURE 1: TREND SHOWING THE PERCENTAGE OF SURVEYED CHANNEL LENGTH IN HYDROMETRIC AREA 16 (SUIR CATCHMENT) ACROSS THE FIVE WFD QUALITY CLASSES SINCE WFD MONITORING COMMENCED IN 2008.

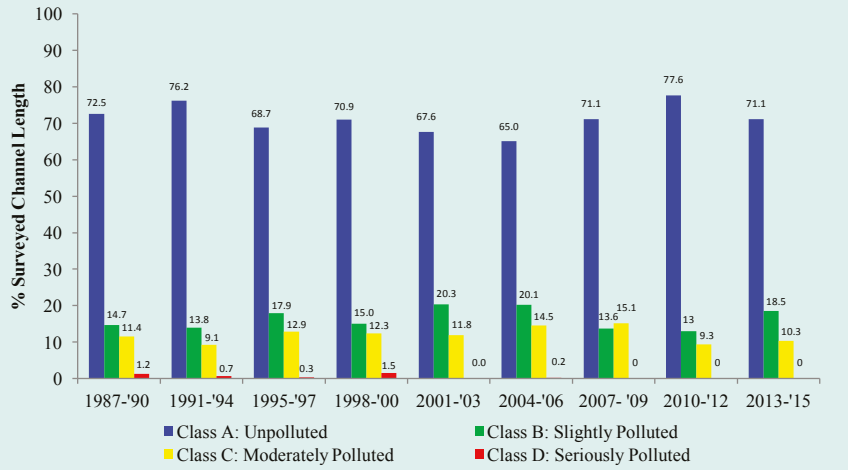
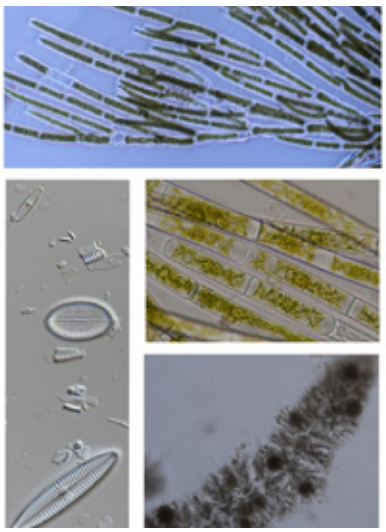


FIGURE 2: TREND SHOWING THE PERCENTAGE OF SURVEYED CHANNEL LENGTH IN HYDROMETRIC AREA 16 (SUIR CATCHMENT) ACROSS THE FOUR QUALITY CLASSES OVER TIME.

KILSHEELAN BRIDGE SHOWING INSTREAM PLANTS AND MACROALGAE (PHOTO: BRYAN KENNEDY)

MARLFIELD (PHOTO: PASCAL SWEENEY)



EXAMPLES OF COMMON ALGAE AND DIATOM SPECIES THAT OCCUR IN RIVER SUIR. PHOTO: BRYAN KENNEDY

How chemical monitoring of our rivers can help us understand their story – why, what, where and when.

Why Monitor?

Water does not exist in its pure form in the natural environment, it is truly reflective of its surroundings, influenced by where it originates, what it flows over and percolates through. Under natural conditions the chemical characteristics of our water bodies originate from a variety of sources, including leaching of soils, weathering of minerals and atmospheric inputs. These chemicals, in both dissolved and particulate forms, reach the water body via a number of pathways, and in the case of surface water have resulted in a natural background level of chemical constituents in which aquatic biota have developed.

Water quality monitoring is fundamental in the management of water resources that support healthy and productive aquatic ecosystems as well as sustainable and healthy water supplies and chemistry monitoring is an integral part of any water monitoring programme. Analysis of chemical parameters in water bodies allows for the identification of substances that are present in the aquatic environment above their natural levels, as well as the existence and concentrations of synthetic compounds. Chemical monitoring of water bodies in Ireland is undertaken by a number of different organisations.

Monitoring for identified chemical compounds highlights any significant changes or trends that may be evident in water bodies over a period of time. Trending of monitoring data facilitates the identification of pressures placed on the aquatic system that may be resultant of long or short term developments. Focused monitoring programmes can help target the source of a pressure and help inform the measures that require implementation to reduce concentrations to levels that no longer impact on water quality. Review of chemical monitoring data can also be used to determine the relative success of applied measures.

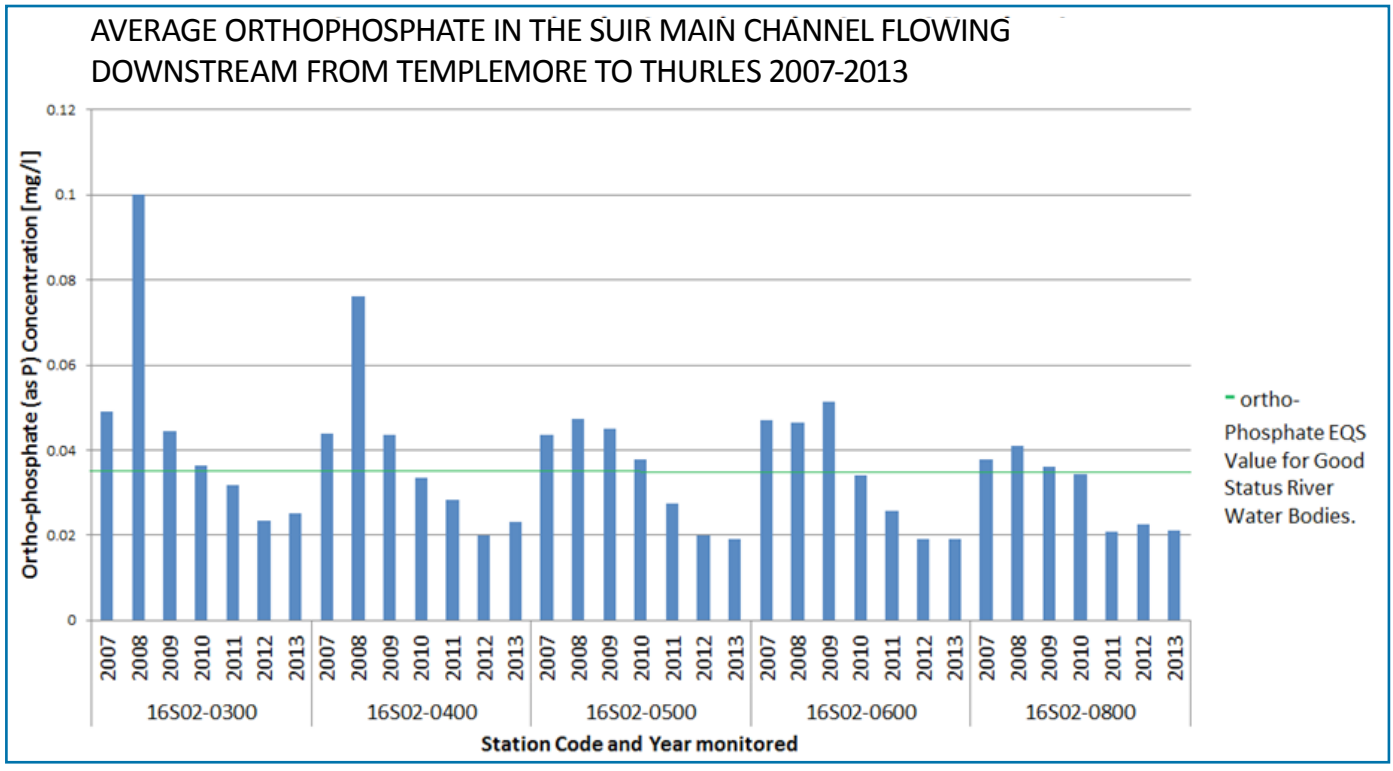
What is monitored?

The Water Framework Directive has identified the necessity for all of our water bodies, rivers, lakes, estuaries and coastal waters, ground waters, and protected areas to be treated equally in terms of attaining at least 'Good' status for all, and maintaining 'High' status where it exists. This consolidated approach has ensured that water quality is of integral importance in current practices and future developments.

Evidence-based metrics have been developed to determine the current status of water bodies and whether a water body is at risk of not achieving 'Good' status. In the case of surface waters these metrics or Environmental Quality Standards specify an absolute concentration or range for a water quality element. In terms of chemical parameters these standards fall into one of three classes:

1. **Physico-Chemical conditions supporting biological elements**

   This group includes chemical properties such as pH (acidity/alkalinity), Dissolved Oxygen and Nutrients, the natural levels of which may be adversely impacted upon by human activities.



TREND FROM 2007-2013 IN ORTHO PHOSPHATE ALONG THE SUIR MAIN CHANNEL FROM TEMPLEMORE TO THURLES.

2. **Specific Relevant Pollutants**

   This group of compounds are defined as substances that can have a harmful effect on biological quality which are identified as being discharged in significant quantities into Irish waters.

3. **Priority Substances**

   These substances are identified by the Water Framework Directive as substances that present a significant general risk to, or via the aquatic environment, and include chemicals, certain metals, biocides, plant protection products and dioxins. Specific measures must be implemented for the progressive reduction of discharges, emissions and losses of these substances. This group of compounds includes a subset of Priority Hazardous Substances for which measures must be taken to stop or phase out discharges, emissions and losses.

In the case of 1 and 2 above the Environmental Quality Standards are derived and applied at a member state level, so Ireland sets a standard for water bodies here based on the best available science, and compliance with these standards is a determinant in the assessment of Ecological Status. These standards can be supplemented and amended as required nationally. In the case of the Priority Substances, the Environmental Quality Standards are identified and reviewed under European Directive and are transposed into individual member state legislation, and compliance with these standards is used in the determination of Chemical Status. A combination of both Ecological Status and Chemical Status is used to determine the overall Water Framework Directive status that is applied to a water body. All chemical Environmental Quality Standards for surface waters in Ireland are set out in European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2015.

Chemical analysis of our water bodies also has a role to play in the determining the environmental occurrence of Emerging Pollutants. These are chemical compounds that are not subject to Water Framework Directive regulations but have the potential to enter the aquatic environment and are suspected or known to have adverse ecological and/or human health effects. These compounds can originate from a number of different sectors such as municipal/domestic waste waters, agriculture and industrial emissions. The Water Framework Directive mechanism by which these emerging pollutants are assessed is via a 'Watch List' whereby compounds are identified to be included in a member state wide monitoring programme to assess the occurrence and prevalence of these compounds in surface waters. This monitoring programme will determine whether the compounds included in the Watch List need to be added as Priority Substances and an Environmental Quality Standard determined. The First Watch List includes compounds such as estrogens, herbicides, pesticides, anti-inflammatory drugs, a sunscreen ingredient and an anti-oxidant.

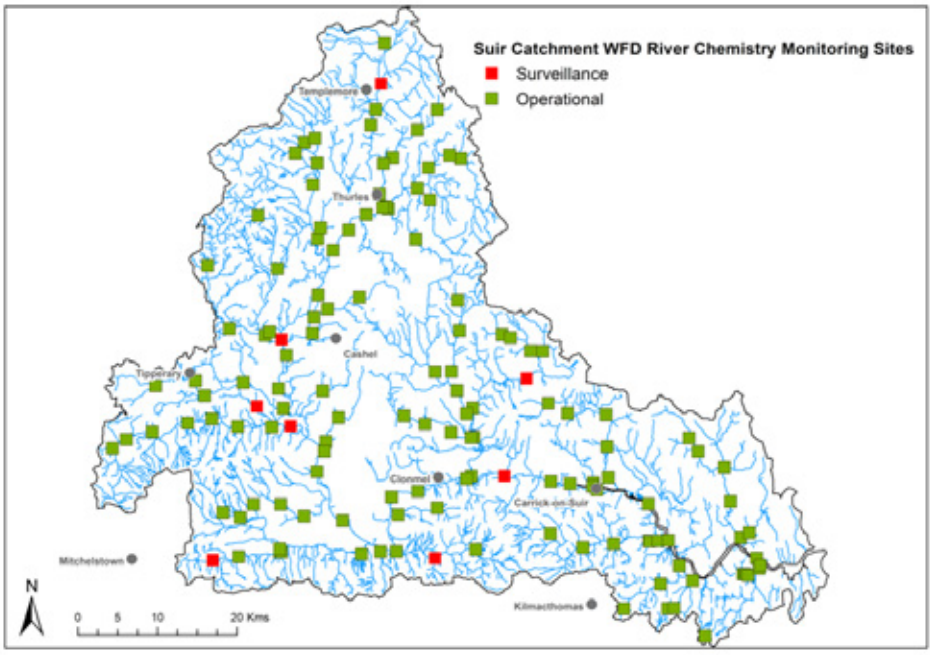
Where and when are rivers monitored?

Chemical analysis included in the Water Framework Directive monitoring programme is based on a network of operational and surveillance monitoring locations which also include provision for the monitoring of river sites identified under the OSPAR Convention[1] and Freshwater Fish Directive. Operational monitoring is used to determine pressures and apply status at a water body level. Surveillance monitoring locations also inform at a water body level, but due to their spatial distribution nationally can be used in the efficient and effective design of future monitoring programmes, the assessment of long-term changes in natural conditions and the assessment of long-term changes resulting from widespread human activity.

Chemical analysis of operational monitoring locations consists of the general physico-chemical parameters and is carried out at least once a quarter on an annual basis. Monitoring of surveillance locations includes the analysis of the general physico-chemical parameters on a monthly basis and one year in the river basin management plan cycle (i.e. one year out of six) will also be monitored monthly for Priority Substances and Specific Relevant Pollutants. Supplemental monitoring and analysis in the form of investigative monitoring may also be undertaken to ascertain the magnitude and impacts of accidental pollution events, as well as helping pinpoint the causes and likely sources of longer term pollution problems. The national river monitoring network consists of 1461 operational and 180 surveillance monitoring stations, with some rivers incorporating multiple stations. In the case of the Suir catchment there are 145 Operational and 8 Surveillance River Chemistry monitoring sites as shown below.

In conclusion, chemical monitoring of our rivers is a vital tool in assessing the current state of these water bodies, as well as helping to identify pressures that may be impacting on the water quality. Chemical monitoring of rivers is not a rigid instrument of assessment, it is flexible and influenced by the often changing pressures impacting on water bodies. Quality Standards, monitoring locations and chemicals monitored are routinely reviewed and adjusted where technically feasible, in line with the best available science, to ensure the best assessment of our river waters.

Kieran Gordon, EPA Catchments Unit



THE SUIR'S 145 OPERATIONAL AND 8 SURVEILLANCE RIVER CHEMISTRY MONITORING SITES

1. The Convention for the Protection of the Marine Environment of the North-East Atlantic (the 'OSPAR Convention')

What's flowing into the Suir? Results from nutrient load apportionment modelling

Imagine you are out for a walk along the river Suir, and stop for tea and a delicious slice of pie. Later that week you try to recreate the pie at home. You think you know the ingredients, but how do you know what amounts of each to use? And what if you miss a key ingredient?

In a similar manner, we can monitor the nutrients in the river, but it is not so easy to determine exactly where they came from. Some sources are easy to identify, such as discharges from waste water treatment plants and industry that are piped into the water. Other sources of nutrients may be less visible, and reach the river via groundwater. Even if the possible sources are identified, how can we tell what proportions they contributed to the total quantities found in the river? Previously, methods have calculated the piped, or 'point', discharges, and estimated that the remaining nutrient are from 'diffuse' sources, typically agriculture. The issue with this approach is that the total in-stream load is actually an estimate which can have errors and, importantly, there may be other unknown point or diffuse sources contributing nutrients.

To overcome this, a data-driven model has been developed for predicting the sources of nutrient loads (phosphorus and nitrogen) to water by the EPA CatchmentTools Project. The Source Loading Apportionment Model (SLAM) uses the best national data and research to quantify nutrient losses from both point discharges (urban waste water, industry and septic tank systems) and diffuse sources (pasture, arable, forestry, peatlands etc.). This model integrates catchment data and pressure information to enable characterisation of Source-Pathway-Receptor relationships. Hydro(geo)logical controls have a strong impact on nutrient fluxes, particularly in agricultural catchments, and have been incorporated into the diffuse agricultural models.

Results show that the variation in the sources of phosphorus across the Suir generally reflects the locations of populated areas. Urban waste water accounts for between 1% to 90% of phosphorus in subcatchments of the Suir. Pasture is the other main source of phosphorus (see the other pieces of the pies below). There is a lot less variation in the sources of nitrogen, with pasture being the dominant source across all sub-catchments in the Suir.

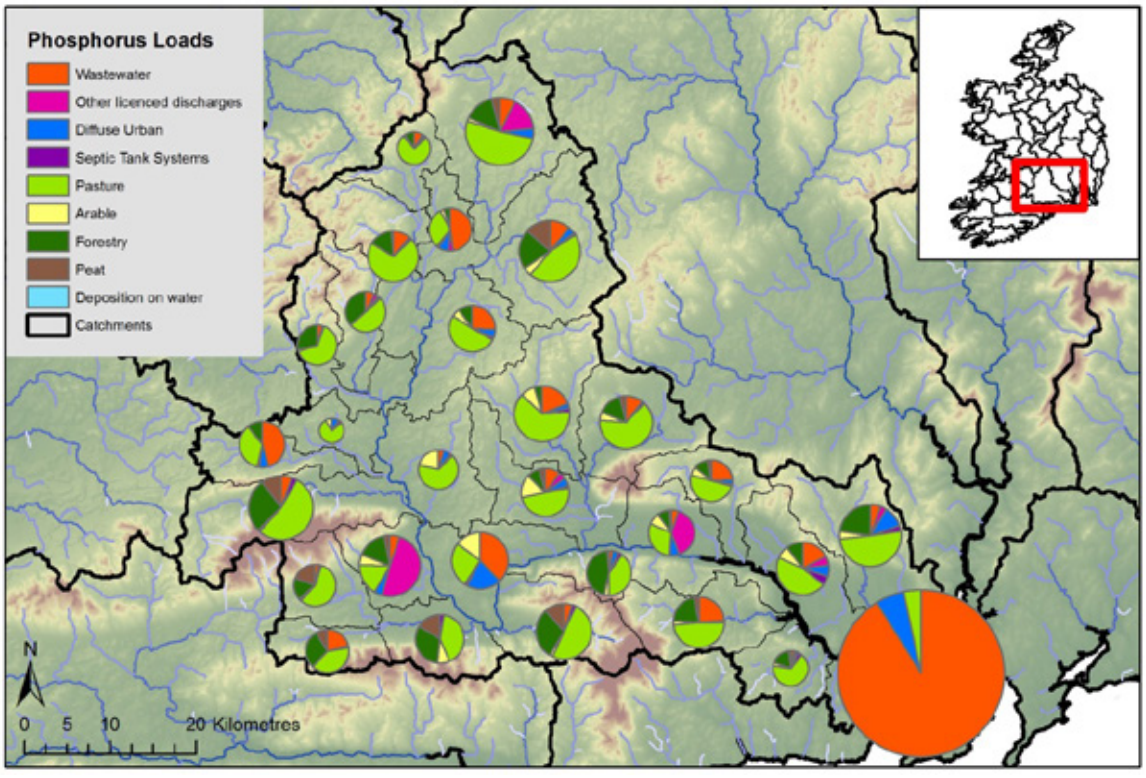
Where rivers and lakes are impacted by excess nutrients, we need to understand the sources of those nutrients before mitigation measures can be selected. In these areas, modelling can be used in conjunction with knowledge from local authorities and investigative assessments to identify significant pressures that contribute excessive nutrients to surface waters. In the Suir catchment, only a relatively small proportion of the catchment requires a reduction in phosphorus emissions to achieve Good Status. Modelling future scenarios can support catchment scientists and managers in identifying appropriate options for measures.

PIE PHOTO: WIKICOMMONS

Just as pie making isn't an exact science, modelling the sources of river nutrients can have errors and unknowns. Nonetheless, we can use these results to help support decision making and the integrated catchment management process and, ultimately, to improve our ecosystems and environment.

Further information on the EPA CatchmentTools Project can be found at cwrr.ucd.ie/cmst

Eva Mockler, UCD Research Fellow



SOURCES OF PHOSPHORUS IN THE SUIR SUB-CATCHMENTS.

Water Quality and Agriculture: Pollution Impact Potential Maps – A tool to guide resources into areas for further investigation

Currently the EPA is evaluating the sources of pollution or pressures (called 'significant pressures') causing unsatisfactory water quality as a means of identifying mitigation measures and environmental objectives for inclusion in the next Water Framework Directive River Basin Management Plans. The EPA Water Quality in Ireland (2010-12) Report highlighted that 53% of suspected causes of pollution in rivers are from agriculture while 34% are from municipal sources. In the Suir catchment, significant pressures have been identified in 66 (34%) of the surface water bodies, with agriculture a significant pressure in 36 (19%) of the water bodies. Agricultural pressures can arise from point sources, for example, farmyards, or diffuse sources most often associated with land spreading of fertilizers (organic and inorganic). While farmyards (and septic tank systems) are easy to identify as potential pressures, diffuse sources are much more difficult to locate.

As the philosophy being followed to improve our water quality where needed is "the right measure in the right place", investigative assessments are being recommended as the means of locating the significant pressures (see article page 20), including from diffuse sources. To help reduce the amount of investigative assessments required and therefore the time and resources needed, a Catchment Characterisation Tool has been developed to produce Pollution Impact Potential (PIP) maps that show the potential critical source areas for agricultural diffuse nutrients in our water bodies and subcatchments. The Pollution Impact Potential maps rank the relative risk areas for diffuse phosphorus to surface water and diffuse nitrogen to surface and groundwater. These maps are now available to all public bodies on the WFD Application.

What are Critical Source Areas?

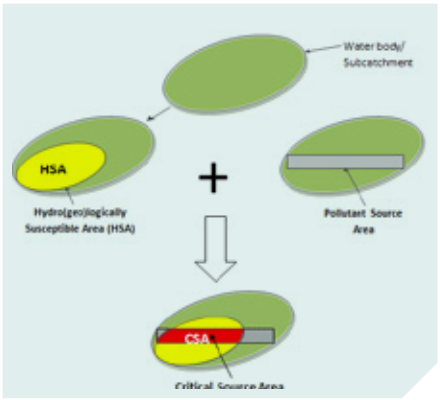
Critical sources areas are areas that deliver a disproportionally high amount of pollutants compared to other areas of a water body or subcatchment, and represent the areas with the highest risk of impacting a water body. In order to determine where critical source areas are located, we need to determine the hydro(geo) logical susceptibility of the water body and also the nutrient loadings applied to that water body.

Susceptibility Maps

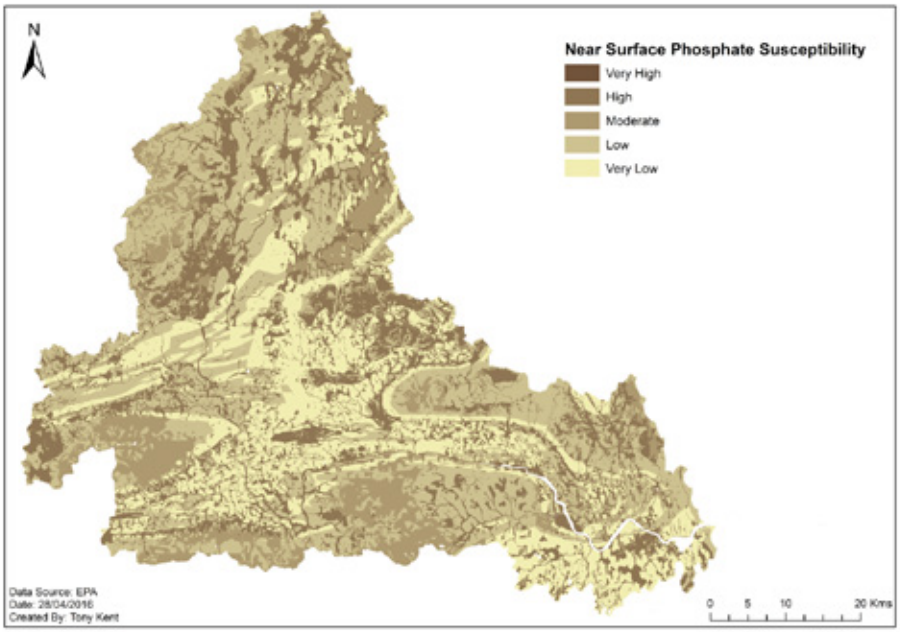
High hydro(geo)logically susceptible areas are areas from which nutrients have a high probability of reaching a water body of interest due to the underlying hydrogeological conditions, that is the areas that have significant pathway linkages from the source of pollution or pressure to surface water or groundwater receptors. Susceptibility maps are generated by linking data on soils, subsoils, groundwater vulnerability and aquifer types with nutrient attenuation and transport factors. These maps are now available for phosphate along the near surface pathway, and for nitrate along the near surface and groundwater pathways. The map below shows the susceptibility map for phosphate along the near surface pathway for the Suir Catchment. The darker areas (or Very High and High categories) are areas that are most susceptible to transporting phosphate along the near surface water pathway to rivers and lakes. You can find national susceptibility maps on catchments.ie.

Pollution Impact Potential Maps

The susceptibility maps are combined with nutrient loadings data provided by the Department of Agriculture, Food and the Marine and the Central Statistics Office to produce Pollutant Impact Potential maps. The Pollutant Impact Potential map for phosphate to surface water for the Suir Catchment is shown below. The darkest blue areas (PIP rank 1) are the critical sources areas (or the highest risk areas) and all areas are ranked relative to this area. These high risk areas for phosphate to surface water coincide with poorly drained areas, meaning that in these areas phosphate is more likely to flow overland to surface waters rather than being retained in the soil and subsoil. Similar maps are available for nitrate in surface water and groundwater.



CRITICAL SOURCE AREA CONCEPTUAL MODEL

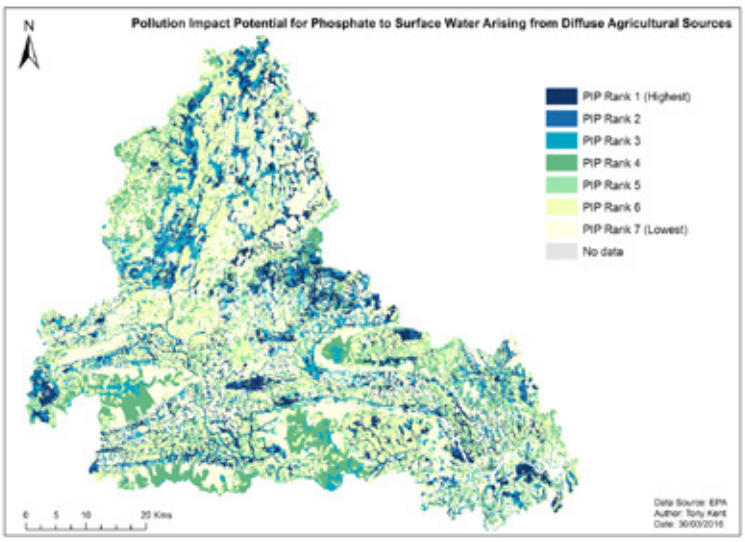


MAP SHOWING THE PHOSPHATE SUSCEPTIBILITY RANKING ALONG THE NEAR SURFACE PATHWAY FOR THE SUIR CATCHMENT

How should Pollution Impact Potential maps be used?

In the catchment areas of water bodies with unsatisfactory water quality, Pollution Impact Potential maps have been developed to help focus on the areas and sources that might be causing the impacts. They act as a first step in the characterisation process by targeting areas for further Investigative Assessment at a water body and subcatchment scale. They are available at a maximum scale of 1:20,000 (e.g. water body scale) and are not designed or suitable to be used on their own as a basis for decisions at a farm or field scale.

Where diffuse agriculture is considered to be a significant pressure, Investigative Assessment enabling site and field-based assessment should be focused initially in the high risk (Pollution Impact Potential rank) areas i.e. the critical source areas. The maps act as a signpost to where there is a potential critical source area. However, the location of farmland in critical source areas does not necessarily mean that they are a significant pressure, as best management practices may already be in place. For phosphate, point sources are more likely to be an issue in high risk areas (PIP Rank 1-3) as these areas are likely to have a higher density of drains and ditches acting as a pathway from farmyards to water bodies. The public bodies responsible for Investigative Assessments will 'ground truth' the maps and liaise with farmers and agricultural advisors to further refine the locations of the diffuse sources using farm scale information such as nutrient management plans. The outcome of this process will inform where mitigation measures are required, and what the most appropriate measure is likely to be.



PHOSPHATE POLLUTION IMPACT POTENTIAL MAPS FOR THE SUIR

Marie Archbold, EPA Catchments Unit

"What exactly is the situation?" – Investigative Assessments can provide the answer

So .....we know that a rural stream is polluted (e.g. Ecological Quality value = 3-4; mean phosphate concentrations = 0.05 and therefore above the Environmental Quality Standard of 0.035 mg/l); we know that the only potential sources are farming (diffuse and farmyards) and septic tanks systems; the Source Load Apportionment Model (see article page 18) indicates that 'diffuse' sources are a major pressure; the Pollution Impact Potential map (see article page 19) indicates significant areas of Very High and High Pollution Impact Potential in the catchment area; but we don't know the precise pressure type and location in order to decide on mitigation measures to improve the water quality. What do we need to do?

The answer may be simple in theory, but can be difficult in practice – we walk the stream, putting on our detective's hat, and look for clues using a variety of techniques from different relevant disciplines. We can then pin down the issue(s) of concern, and conclude on what might be done about it. It might be asked, if the answer is that simple, has it not been done before? Well, it has, but resources have not always been available to do all that was needed, using all possible techniques. Also, the background information needed – on the physical setting, hydrochemistry, land-use, etc. – was not readily available until recently with the development of the EPA Water Framework Application (see article in Issue 2 of the Catchments Newsletter).

The Starting Point – Water Framework Directive Characterisation

The WFD characterisation process being undertaken by the EPA in collaboration with local authorities involves three tiers of assessment:

1. Preliminary water body risk screening.
2. Initial subcatchment and catchment characterisation.
3. Further characterisation.

The first two tiers are desk-based using:

i) a broad range of ecological, hydrochemical and hydrogeological maps and data;

ii) information on pressures, e.g. Urban Waste Water Treatment Plants, farming, septic tank systems, forestry;

iii) results from load apportionment modelling;

iv) pollution impact potential maps; and

v) results of previous investigative monitoring and inspections undertaken by local authorities.

Preliminary risk screening is undertaken nationally and identifies the water bodies that are At Risk or Not at Risk, based mainly on the available monitoring data, including assessments of status, trends and distance to threshold. The initial characterisation process then confirms this identification, and focuses on water bodies that are At Risk (i.e. those requiring additional mitigation measures to be undertaken) and provides conclusions on the main issues, the significant pressures, and the proposed environmental objectives and associated measures. However, while large point sources, such as waste water discharges, can be located and assessed readily, it is frequently not possible to locate and evaluate the significant pressures impinging on water quality in rural areas at this stage of characterisation. In these instances, further characterisation is necessary; without this, rectifying water quality problems is not feasible. This is where Investigative Assessments fit into the process of managing our water resources effectively.

Further Characterisation: The Investigative Assessment Approach

There are two overriding principles:

- Investigative Assessments follow the Source (or pressure)-Pathway-Receptor (S-P-R) model for environmental management. (These are easy words to write down, but visualising each component, and the connections between them in a 3D landscape, is essential).
- The level of investigation is proportional to the risk posed.

Three levels of assessment are proposed:

1. Desk study, based on existing information, such as in the WFD Application, Google Earth and websites such as www.gsi.ie, www.opw.ie and http://gis.epa.ie/Envision.
2. Field-based assessment, mainly by local authority staff.
3. Specialist input, such as from hydrogeologists, agricultural scientists and biologists.

In this brief article, I will concentrate on the field-based assessment in At Risk stream catchments, although a desk-based assessment should always be undertaken prior to a catchment walk. As a hydrogeologist, I admit that I inevitably 'see' this work through 'groundwater/geologist' eyes, so make allowances! But, wearing my detective's hat as well, I start by asking myself what field techniques from the various relevant disciplines – e.g., hydrogeology, hydrology, agricultural science, hydromorphology, engineering, biology, hydrochemistry, social science – would be relevant.

Based on my own limited experience and input from colleagues in the Catchments Unit, the following information can be readily collected as part of a stream Investigative Assessment:

- Information and views of farmers and other householders.
- Location and description of potential point pollution sources, such as farmyards, septic tank systems, rural industries.
- Information on land-use, as a means of assessing potential 'diffuse' or non-point pressures.
- Clear buffer zones, riparian areas and, in the case of arable land, uncultivated setback areas alongside streams.
- Presence/absence of fences and hedges alongside streams.
- Indicators of water movement, such as drains/ditches, drainage density, poaching by farm animals, slope, evidence of land drains, and vegetation indicators such as rushes.
- Rock outcrops and relevant details derived from soil/subsoil exposures.
- Observation of hydromorphological issues, including new land reclamation, drainage, silting and stream channel maintenance.
- Field measurements of water conductivity, temp, Dissolved Oxygen and pH (acidity/alkalinity) – see article page 22.
- Small Stream Risk Score assessments.
- Soil sampling and testing results, with nutrient management planning evaluation.
- Physico-chemical and chemical sampling, and subsequent analyses.
- Tracing to check connections with potential pollution sources and receptors (e.g., with dye).
- Taking soil samples by hand augering and trial pitting, as relevant, as a means of checking the soil and subsoil characteristics, and depth to bedrock.

This information can then be used to tell the 'story' of the stream in sufficient detail to enable a 3D understanding of water and contaminant movement and attenuation in the site/area, followed by ideas and proposals to mitigate the pressures on the stream.

On the face of it, this all seems obvious and simple. But, in my view, it isn't! Few people, including myself, have the broad range of expertise and experience to undertake all the above adequately as an integrated and holistic process.

For instance, I don't have sufficient basic biological knowledge, and I am conscious in writing this that there are biological indicators not mentioned above because I don't know what they are precisely, but that with some brief training a non-specialist like myself could use.

Investigative Assessments – The Future

The Catchments Unit, in consultation with the Environment Section of Tipperary County Council, has developed draft guidance on Investigative Assessments. In addition, we have produced an Excel spreadsheet to enable local authorities to estimate the staff resources needed to undertake Investigative Assessments in their county. For instance, the estimated resources that would be needed by Tipperary County Council to undertake Investigative Assessments is three person-years. This guidance is a 'work in progress', and is unlikely to be completed until early 2017. In recent days, the EPA's Ecological Monitoring & Assessment Unit has provided practical guidance for sampling lakes. Guidance on Investigative Assessments for towns/urban areas and high status water bodies are being developed; Investigative Assessment guidance for the zones of contribution of impacted wells and springs will be developed in the coming months, as will some techniques for assessing biological indicators. We also need to produce practical guidance on assessing the pathways for water and potential associated contaminants on land close to streams and ditches, particularly in poorly draining areas, and on the role of ditches themselves (see article on page 24). However, guidance on its own won't be enough – the resources to undertake Investigative Assessments will be essential.

In conclusion, we need to be able to tell 'what exactly the situation is' - general statements on the problems are inadequate. Where the answer isn't known, Investigative Assessments are needed to provide it.

If you would like a copy of the current draft of the Guidance and/or would like to contribute views and information, please email catchments@epa.ie

Donal Daly, EPA Catchments Unit

Technical Note: Electrical Conductivity - A useful tool for investigating catchment hydrology.

As environmental hydrology continues to grow in importance, both researchers and practitioners remain on the look-out for investigative techniques to help better understand where aquatic pollutants come from and how they reach water courses. Despite being routinely employed in some disciplines, Specific Electrical Conductance (SEC) remains a relatively underutilised tool for Irish hydrological investigations. This is unfortunate, as the method has been shown to provide a rapid and inexpensive, yet reliable means of measuring water quality in the field, provided certain constraints are taken into consideration. The following short article is the first of two presented in the Catchments Newsletter that examines the utility of SEC for Irish hydrological studies.

Before undertaking SEC surveys, certain technical matters need to be considered to ensure that maximum benefit can be obtained from data collected. Readings are typically taken in the field using a handheld electrical conductivity meter, of which there are many brands on the market of contrasting quality and reliability. In general the maxim "you get what you pay for" applies, with those models at the upper end of the price range typically proving more resistant to instrument drift. However, regardless of what meter is employed, routine calibration is essential. This should typically be done at least once a day, using standards having SECs approaching those anticipated in a survey area; it is generally considered good practice to calibrate immediately before and immediately after a survey each day to ensure instrument reliability.

Once the above precautions are considered, measurements in the field can provide a valuable insight into hydrological processes, particularly when data are collected in a catchment under contrasting hydrological regimes and/or at different times of the year. However, as electrical conductivity is temperature dependent, variations in how warm (or cold) different water samples are need to be accounted for; this is achieved by standardising all measurements to 25 degrees C to give Specific Electrical Conductance (SEC). Note that not all models of conductivity meter provide an SEC readout, under these circumstances temperature must be recorded and corrections to yield SEC retrospectively applied. Indeed, even where SEC is provided, it is generally considered good practice to measure temperature, as it can provide valuable supplemental information about hydrological processes, such as the location of upwelling groundwater.

In the natural environment the SEC of water can vary enormously, from values around 5 microsiemens per cm (mS/cm) encountered in some rainwater samples, to levels one million times higher in saline waters. In unpolluted freshwater systems, SEC reflects the presence of substances present in the soils, subsoils and bedrock that water encounters along hydrological flow paths which form ions when dissolved. These can vary dramatically from one geological setting to another. For geological units typically encountered in Ireland, SECs can range from 10s of mS/cm in water samples collected from poorly decomposed raised bog peats to values over an order of magnitude higher in samples collected from units such as calcareous subsoils and carbonate bedrock. (Natural SECs above 1000mS/cm are rare in Irish freshwaters).

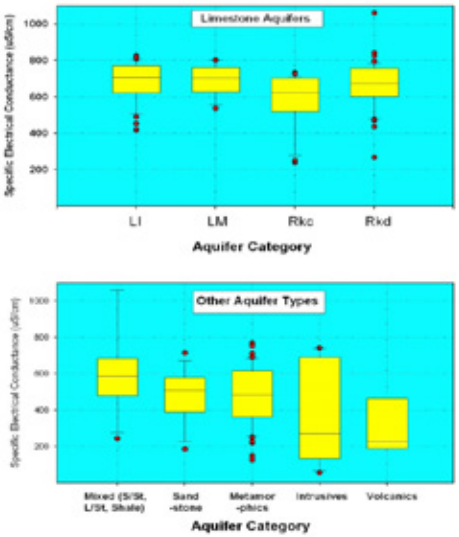


Figure 1: Box and Whisker plot of median specific electrical conductances for major Irish bedrock types, analysed as part of the EPA's groundwater monitoring programme. (Above) Limestone aquifers, (Below) Non-carbonate and mixed aquifer types. (Data provided by Anthony Mannix, EPA)

Box and whisker plots contained in Figure 1 summarise the SEC of bedrock groundwater samples contained in the EPA's Groundwater Quality Monitoring Database. The plots provide an idea of anticipated ranges for each aquifer type and demonstrate more consistent median SECs in limestone aquifers, compared to non-carbonate and mixed aquifer types. The slightly lower median SEC and greater range of variation observed in non-carbonate aquifers partially reflects the influence of geochemistry. These aquifers are typically less reactive than limestones, giving lower SECs. However, their signature may be overprinted by carbonates present in the overburden, which then dominate ionic content in underlying aquifers, particularly in units with short residence times. In all aquifer types the range of variation remains relatively high. Given the level of variation observed, direct measurements of groundwater SEC in a catchment should be sought out to build confidence in interpreting catchment-specific data and the role of different hydrological flow paths

At the catchment scale, where significant geochemical differences exist along various hydrological flow paths, SEC measurements can act as a useful screening tool for constraining potential processes. Mapping the results of these measurements across a catchment allows us to examine spatial variations in water quality and attribute responses observed to processes operating within subcatchments. Alternatively, use of automated SEC loggers permits large numbers of measurements to be collected in time at fixed points and thus provide a means of characterising (integrated) temporal variations in water quality (Figure 2).

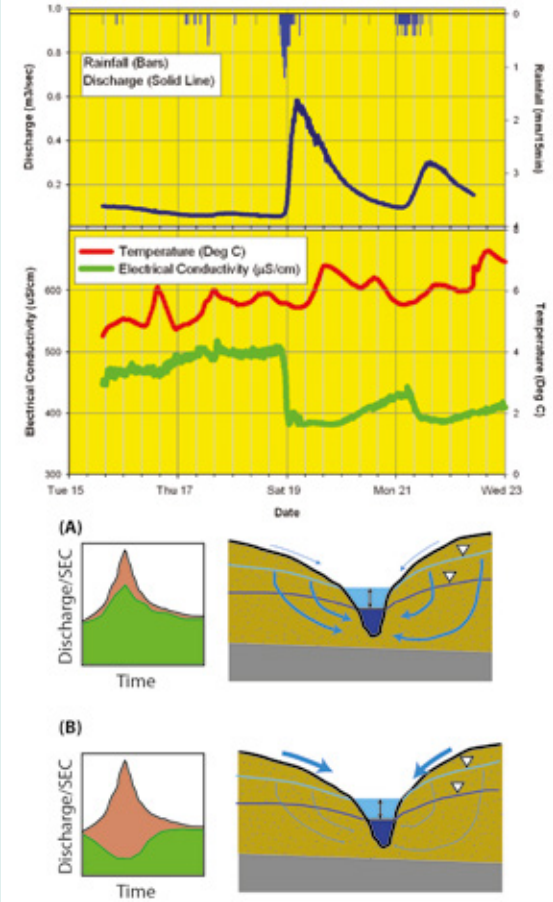


FIGURE 2

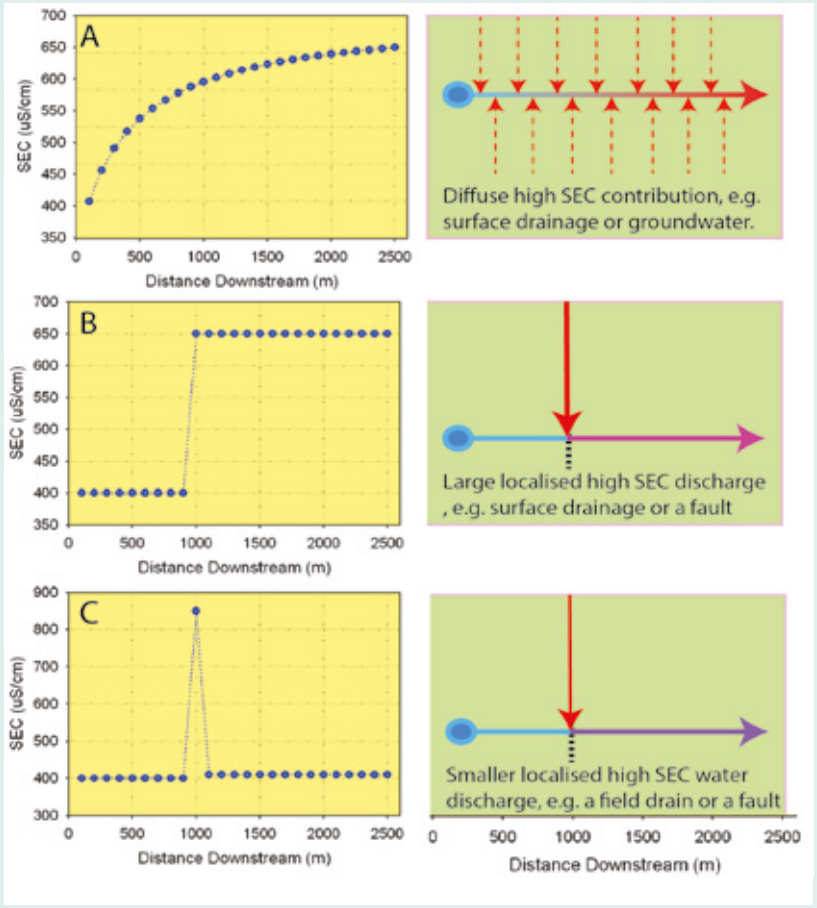


FIGURE 3

Figure 2: (Above) Multiple parameter plot illustrating the change in discharge, water temperature and SEC observed in river water at the outlet of the Glen Burn Test Catchment, Co. Down –February 2011. SEC helps discriminate between possible hydrological pathways. (Below) In Example (A) a rising water table results in increased higher SEC groundwater discharge (in green), while in Example (B) there is a dominance of lower SEC water (in pink) derived from shallower hydrological pathways. This latter case better corresponds to that observed at the Glen Burn (Data: P.Allen,QUB, 2011)

SEC can also prove useful in detecting pollution, particularly where high concentrations of ions are present in source effluent, examples of which include landfill leachate, septic tank effluent and some agricultural wastes. In many cases the conductivities of these liquids prove significantly greater than background levels, thus permitting SEC to be employed as a screening tool for targeting samples for laboratory analyses. At the same time, examining trends in SEC levels along water courses allows us to identify potential sources of surface water pollution and the relative contributions they make to total pollutant load (See Figure 3 and Figure 4).

Figure 3: Modelled examples of typical water quality profiles along a river reflecting responses to inputs of elevated SEC water under contrasting physical settings (right).

A. Lower SEC stream (400 mS/cm) receiving sustained inputs of 700mS/cm water (1m3/sec/100m).
B. Input of 700mS/cm water (and doubling of discharge) between 900m and 100mm downstream.
C. Response observed with an equivalent increase in SEC but with a flow increase of 0.1m3/sec over the same interval; the spike in the data (not simulated) reflects incomplete mixing of waters.

While measuring SEC can prove a very valuable investigative tool, it is essential that data be interpreted while considering catchment land use and physical setting. What's more, there can often be considerable temptation to relate SEC to the concentration of specific pollutant concentrations. Although this may be appropriate, one needs to remember that not all ions (even at equivalent concentrations,) will generate the same SEC response. Consequently, SEC should be used, and compared to the results of laboratory based analyses to establish links (if any) with pollutant levels. As a corollary to this point, samples that do not have SECs differing significantly from pristine waters may still be polluted since many pollutants are not ionic and thus do not contribute to measured SEC responses. Furthermore, some pollutants, although ionic, may impact water quality at concentrations below levels that permit them to be confidently measured using field SEC meters. Finally, when interpreting results remember that profiling provides a snapshot of conditions and that water quality varies depending on hydrological processes operating at the time of measurement.

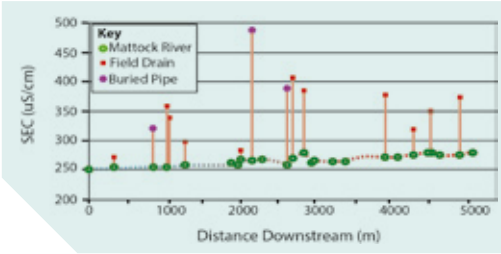


Figure 4: Specific Electrical Conductance profile measured along the course of the Mattock River (Co. Louth/Co. Meath), April 2012. The gradual increase in the SEC of river water reflects minor contributions of elevated SEC water discharging from numerous field drains and buried pipes discharging to the Mattock along its course. (Data P.Rafferty, DkIT)

Despite these limitations, SEC can prove a very useful investigative tool for environmental hydrologists. Maximum benefit can be obtained by combining its use with other routinely measured parameters, including with the results of laboratory water quality analyses, and with physical hydrological data. Moreover, repeated measurements of SEC in the same catchment, particularly during periods of contrasting hydrological conditions, build confidence in interpreting survey results. Although still relatively underutilised in Ireland, continuous monitoring of SEC with discharge during the recently completed EPA-funded Pathways Project demonstrated the value of the parameter for distinguishing between potential hydrological delivery mechanisms. SEC surveying deserves further consideration as an investigative technique in the Environmental Hydrologists tool kit. Experience to date across Ireland suggest that it can act as an useful method in helping identify pollution sources and characterising the pathways by contaminants can reach surface water receptors. This in turn can assist decision makers on taking suitable courses of action to maintain environmental quality.

Raymond Flynn, Queen's University Belfast, and Jenny Deakin, EPA Catchments Unit.

A smart approach to managing open drains protects water quality

Phosphorus is an essential nutrient for crop production, but is easily mobilised to surface waters from heavy soils during rainfall and can negatively impact water-quality.

To maintain Ireland's trend of improving water-quality, solutions that mitigate phosphorus transfers after mobilisation will be needed. These solutions need be economically viable and thus not place undue burden on the area of land required for production. Runoff attenuating features, such as buffer strips, ponds and wetlands, are commonly used to mitigate phosphorus transfers, however their utility is limited by small sizes in larger catchments and so a targeted approach is needed to locate them appropriately.

Phosphorus loss to streams tends to be highest on farms with heavy soils and these farms are likely to have many open drains. Open drains can be considered as networks of linear runoff attenuation features but unlike buffer strips, ponds and wetlands, they do not occur on productive land and occupy larger areas. Small changes to the management of these drains could help farmers achieve production goals without impacting on water-quality.

Recently, the Teagasc Agricultural Catchments Programme characterised the open drains and stream channels in two contrasting catchments (both ca. 12km^2) in County Wexford; a well-drained arable catchment and a poorly-drained grassland catchment. The Agricultural Catchments Programme study found that these channels occupied 50,000 m^2 (0.45% of the catchment area) in the arable catchment and 150,000 m^2 (1.25% of the catchment) in the poorly-drained grassland catchment. Laboratory tests showed that the sediments in the open drains had potential to trap phosphorus that had been washed off the land. That is to say the sediments could draw phosphorus out of the overlying water and lock it up. This process reduces the chances of the phosphorus moving into downstream rivers or lakes where it could cause environmental damage. Sediment itself can also directly damage rivers and lakes so any management practices that retain sediments in drain networks and returns it safely to the land would have the dual benefit of reducing both sediment and phosphorus losses downstream. For example, widening the drain would slow down the flow and encourage more sediment and phosphorus retention. This could, therefore, be considered as a management tool in particularly risky areas.

The study found that flat drains (i.e. blue drains in Figure 1) had the greatest potential

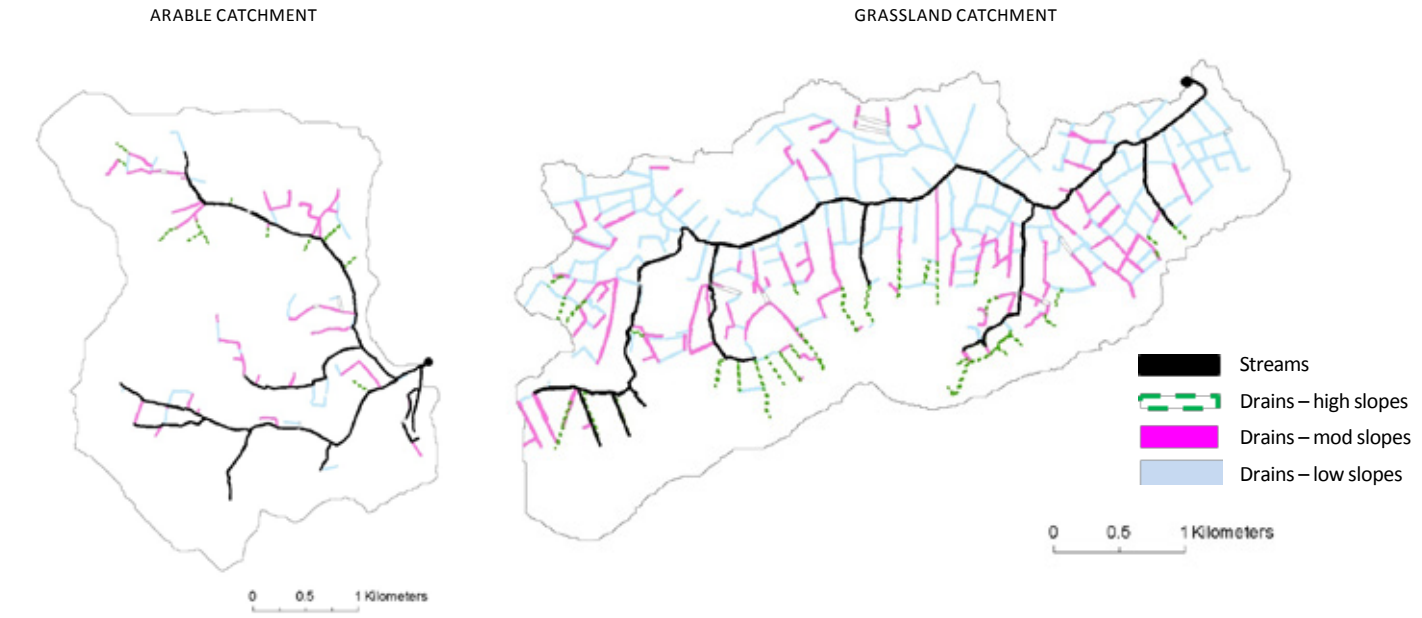


FIGURE 1: DRAINS AND THEIR SLOPES - TEAGASC AGRICULTURAL CATCHMENTS PROGRAMME

to retain sediment and are therefore valuable landscape features. However, over time these flat ditches can get clogged up with sediment and the sediment can become saturated with phosphorus. Once a critical level of phosphorus saturation is reached, the sediment could release the phosphorus back into the drainage water. Regularly cleaning out ditches would ensure that this critical level of saturation is never reached. The sediment that is removed should be kept on the farm where it can be spread on a dry area away from drains to add to soil fertility and prevent it getting back into drains. To protect fish eggs and small salmonids, maintenance of drains likely to contain these species should be carried out between mid-May and mid-September.

Drains with slopes greater than 2% (i.e. pink and green drains in Figure 1) were more vulnerable to sediment and phosphorus being mobilised and washed downstream during rain storms. Encouraging vegetation growth on the drain beds would help to stabilise the sediment and reduce the potential for movement during storms. The ACP has also found that streams (i.e. black channels in Figure 1) don't tend to retain much sediment due to the faster flow of water through them. However, the faster flow rates can erode a lot of the bank sediment, causing water-quality problems downstream. Planting and maintaining hedgerows alongside channels could stabilise these banks and reduce this erosion.

To ensure productivity growth under FoodWise 2025 plans, better use of existing nutrients will be required overall. The smart approach to drain management suggested here will always work best in tandem with good soil nutrient management planning to ensure maximum crop availability and minimum losses in runoff and leaching.

Mairead Shore, Hydrochemist, Teagasc Agricultural Catchments Programme

The Local Authority Waters and Communities Office

Waters & communities
Healthy Waters supporting Vibrant Communities

In Ireland, we are never far from at least one of our natural waters, be they our rivers, lakes, transitional, coastal and groundwaters. The quality of these waters and the wildlife habitats they sustain play an important part in many aspects of our lives.

Much of our recreation time is spent on or around water, whether it's fishing, boating or simply walking along a beach or a river bank. We use water on a daily basis in our homes and our hotels, on our farms and in our factories, in our cities and our towns. Our very existence depends on the availability of water. As such, we all have a vested interest in the management of our waters and areas around them, which are referred to as catchments.

A water catchment is simply defined as an area of land contributing to a river, lake or other water body, such as groundwater. These areas are not defined by the administrative boundaries we normally associate with our counties and therefore ownership and responsibility for the management of these waters must lie with their local communities.

The national Local Authority Waters and Communities Office has been established to deliver two key objectives:

(i) to coordinate the activities of all 31 local authorities in areas relevant to the Water Framework Directive and

(ii) to carry out public consultation and engagement with communities and stakeholders, as required by the Directive.

The office is operated by Kilkenny and Tipperary County Councils on a local authority shared services basis, and is headed up by Matt Shortt, Director of Services, Tipperary County Council and assisted by Carol McCarthy, A/Senior Engineer, Environment Section, Kilkenny County Council.

A staff compliment has now been appointed which includes:

- Bernie O'Flaherty, Regional Coordinator, Border Region and links with Northern Ireland. Based in Carrick-on-Shannon.
- Ray Spain, Regional Coordinator, Mid Region (East-West). Based in Tullamore.
- Dr Fran Igoe, Regional Coordinator, Southern Region. Based in Clonmel.

The three specialist support officers, based in the Clonmel office are:

- Sheevaun Thompson, Funding Lead;
- Alan Walsh, Communications and Marketing Lead and
- Michael Pollard, Technology and Research Lead.

In addition, there will be a network of twelve Community Water Officers located in centres throughout the Republic of Ireland and a recruitment process for these is currently underway.

So far the Local Authority Waters and Communities Office has set about meeting with local authorities through various fora

such as Strategic Policy Committee meetings, Management Team Meetings and Regional Information Sessions. Initial public engagement has taken place through the Public Participation Networks, Local Community Development Committees, LEADER Groups, Partnerships, sectoral interest groups, Rural Development companies and the Irish Local Development Network. From August 2016 onwards our Community Water Officers will actively engage with the public on areas connected with water management both locally and in the wider catchments.

The success of community led projects such as those run by IRD Duhallow LIFE are good examples of a bottom up approach to local governance. By looking at the experiences of the Rivers Trusts across Ireland and the UK, and also Rural Development Companies, we can see the benefits of community stewardship in relation to water management. For this catchment based approach to be successful it will require all stakeholders including Local Authorities, Public Authorities, Non-Government Organisations and Communities to cooperate and work together for common goals.

Funding will be critical if communities are to be mobilised and empowered to take on a greater role in the management of their local water environment. To this end, our office will offer technical advice and assistance to local authorities, community and voluntary groups on local, regional, national and EU funding streams with a connection to water management.

INTRODUCING THE STAFF OF THE WATERS AND COMMUNITIES OFFICE, L TO R: ALAN WALSH, BERNIE O'FLAHERTY, FRAN IGOE, CAROL MCCARTHY, RAY SPAIN (STANDING), SHEEVAUN THOMPSON, MICHAEL POLLARD.

Community engagement will require education and awareness campaigns to deliver the right message to the right groups in the right way. Results and lessons learnt from projects and initiatives with a connection to water can be shared widely on social media platforms, thereby facilitating knowledge and information transfer between communities.

This innovative approach to integrated catchment management has never been attempted on this scale anywhere in Europe. For this to work we must see all our influences on our natural waters as part of a bigger picture in the wider catchment sense and work together to manage them. This should result in improved water quality and the associated benefits that go with it.

Finally, a quote from the Water Framework Directive 'water is not a commercial product like any other but rather, a heritage which must be protected, defended and treated as such'.

For further information about the Local Authority Waters and Communities Office phone 0761 065 262 or email info@lawco.ie . You can also visit our website at www.lawco.ie , like us on Facebook. com/watersandcommunities and follow us on Twitter - @lawco7

Alan Walsh, Local Authority Waters and Communities Office.

Making the most of our waters - the LEADER approach and future funding opportunities

A workshop by the Local Authority Waters and Communities Office, WaterLIFE & IRD Duhallow was held on Monday 16th and Tuesday 17th May 2016 at IRD Duhallow, James O'Keefe Institute, Newmarket, Co. Cork.

This workshop explored the potential role of Rural Development Companies and Urban Partnerships in water management, and how we can work together to manage our community water resources into the future. The new LEADER programme offers exciting opportunities for the development of local economies in both the rural and urban environments, underpinned by good management of water and its related biodiversity. How to do this in an effective manner is a challenge for each community group as this is an evolving area which

HANNAH BLACKBURN PRESENTING ON THE WATERLIFE EXPERIENCE IN THE UK

requires specialist expertise. The workshop included knowledge exchange via the LIFE+ WaterLIFE project (waterlife.org.uk) and the Catchment Based Approach (www.catchmentbasedapproach.org) two closely aligned initiatives to drive collaborative water management in the UK. By looking at the UK and Irish experience in community based water management, the workshop took a practical look at how to develop water based projects, considering the issues to watch out for and how community groups can maximize the water potential of their local areas.

Improved water quality and habitats underpin water based ecotourism and communities also depend on these for a good quality of life. The workshop contained a mixture of practical examples and highlighted potential roadblocks to good projects, ideas for project development were illustrated and how these fit into the bigger of picture of better water management.

The overall objective was to explore and demonstrate ways in which Rural Development Companies can become more that just funders by taking proactive roles in strategic planning, animation of and coordinators of stakeholders with an interest in sustainable water management in Ireland. In addition Rural Development Companies and Partnerships are well positioned to leverage other schemes (Rural Social Scheme/ Tús) to carry out large scale programmes such as invasive species control. This two day event showcased how this can be done based on proven and practical approaches from both Ireland and the United Kingdom.

Article courtesy of the Local Authority Waters and Communities Office and IRD Duhallow.

WORKSHOP PROGRAMME

DAY 1: Monday 16th May 2016

10. 00	Registration, tea, coffee and scones.
	What is it all about? Chairperson Michael Twohig Kanturk Trout Anglers and member of Blackwater River Trust.
10.30 - 11.00	Introduction and relevance of meeting for Rural Development Companies (Maura Walsh, CEO IRD Duhallow).
11.00 - 11.30	Presentation from DECLG and LAWCO on Water Framework Directive (Cían O'Lionan, Department of Environment, Community and Local Government) and (Matt Short, LAWCO).
11.30 - 11.45	The value of water - economy, recreation and health (Ray Spain, LAWCO).
11.45 - 12.30	WaterLIFE and the Catchment Based Approach: Overview of the UK approach experience: (Hannah Blackburn, WWF-UK and Rob Collins, The Rivers Trust).
12.30 - 13.30	Irish examples of LEADER funded projects followed by discussion.
13.30 - 14.30	Lunch.
14.30 - 14.50	Inland Fisheries Ireland funding - past projects and future potential for angling clubs and LEADER Companies. (Suzanne Campion, Inland Fisheries Ireland).
14.50 - 15.10	Invasive species control - harnessing the RSS and Tús potential (Eileen Linehan, IRD Duhallow).
15.10 - 15.40	The process of a large scale river restoration project funded through LEADER (Fran Igoe, LAWCO).
15.40 - 16.00	Discussion and questions from the floor.
16.00 - 17.00	Local Fieldtrip visit (5 mins walk from meeting location): Don't forget to bring suitable walking shoes and rain gear for the outdoors.

DAY 2: Tuesday 17th May 2016 *Preparing for LEADER and other funding opportunities*

09.30	Registration, tea, coffee and scones.
	Where to from here? Chairperson Michael Doyle - Chair of IRD Duhallow Environment Group and Environment representative on Cork North LCDC.
10.00 - 10.45	WaterLIFE and the Catchment Based Approach – Collaborative Delivery Examples. (Hannah Blackburn, WWF-UK and Rob Collins, The Rivers Trust).
10.45 - 11.10	Community engagement in cross border projects (Bernie O'Flaherty, LAWCO).
11.10 - 11.35	The development and work of Rivers Trusts in Ireland (Mark Horton Rivers Trust).
11.35 - 11.50	Coffee.
11.50 - 12.10	Formation of River Allow catchment management group (Bryan Riney, Cork Co. Council/ Catherine Dalton, Mary Immaculate College, University of Limerick).
12.10 - 12.30	Bottom up approach to Water Management – lessons to date from EPA Research project (John Ballanger, IRD Duhallow).
12.30 - 12.45	Other potential funding streams (Sheevaun Thompson - LAWCO).
12.45 - 13.15	Designing a successful LIFE project and the pitfalls (Fran Igoe, LAWCO).
13.15 - 13.45	"LEADER project presentations pointing to the way forward - working together for the future" with panel discussion (Eileen Linehan, Assistant Manager IRD Duhallow, Doirín Graham, CEO Clare LEADER, Isabel Cambie, CEO South Tipperary LEADER, Michael Murray, CEO North Tipperary LEADER).
13.45 - 14.45	Lunch.

Workshop conclusion (delegates are welcome to linger and view other environment and social enterprise projects).

THE EMPOWERMENT OF OUR COMMUNITIES FOR THE IMPROVEMENT OF OUR WATER QUALITY AND QUANTITY, UNLOCKING ECONOMIC AND RECREATIONAL POTENTIAL.

TO BOOK YOUR PLACE: t: 029 60633 e: duhallow@irdduhallow.com w: www.lawco.ie

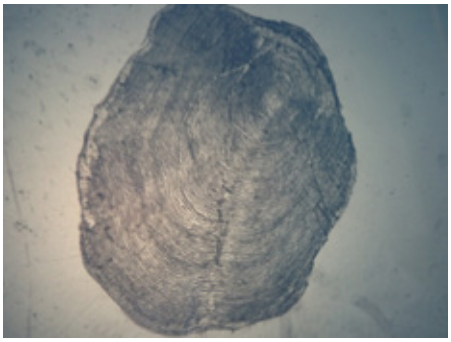
THE AGENDA FOR THE EVENT

LOCAL FIELD TRIP TO LOOK AT THE RESULTS OF THE LIFE PROJECT AND IMPROVED ECOSYSTEM AT IRD DUHALLOW.

MOREFISH - research on improving freshwater aquaculture production management, resource efficiency and sustainability

Aquaculture is one of the fastest growing food sectors in Europe. Ireland is the seventh largest producer of aquaculture in terms of volume of high value fish species and exports of Irish aquaculture products support approximately 2,000 direct jobs in rural communities.

It is envisaged that Ireland's aquaculture production will be increased under Food Harvest 2020. With an expected increase in production, it is imperative that the environmental impacts on water quality be minimised and the overall performance of the current systems be evaluated. The majority of



A BROWN TROUT SCALE UNDERGOING AGE ANALYSIS TO ESTABLISH GROWTH RATES THROUGH BACK CALCULATING LENGTH FOR THE YEARS OF THE FISHES LIFE

Ireland's freshwater aquaculture occurs in rural communities where they provide a source of local employment, however, these activities face pressure from water quality issues and increasing regulatory control.

The MOREFISH project is a joint multidisciplinary aquaculture project between NUI Galway (NUIG) and Athlone Institute of Technology (AIT) that will significantly improve production management, resource efficiencies and sustainability at freshwater aquaculture sites.

MOREFISH, which is funded by the Department of Agriculture, Food and the Marine, aims to develop and test new innovative technologies and processes for use in freshwater aquaculture. The project, led by Dr Eoghan Clifford from the College of Engineering and Informatics at NUIG and Professor Neil Rowan from AIT's Bioscience Research Institute addresses critically important needs identified by the industry and various stakeholders, including, the potential use and benefits of improved technologies, such as, advanced aeration technologies, deployment of next-generation disinfection technologies; all of which contribute to waste minimisation and more efficient production management.

This multidisciplinary research project will position Ireland as a leading innovator for established and emerging problem solving for freshwater fish production. The overall aims are to enhance production efficiency and sustainability in Irish freshwater aquaculture, leading to increased competitiveness for the sector and reduced impact on the environment.

The industry has actively supported the project by providing full access to a number of sites around the country which allow for a comprehensive study of these Irish freshwater aquaculture systems. These farms utilise a diverse range of rearing environments from recirculating systems, to partially recirculating and flow through systems, which abstract water from lentic and lotic sources. Within these systems different farm layouts can be observed such as: pond, tanks and raceway systems.

As part of the work programme, the historical biological imprint of each site will be evaluated and then undergo an intensive sampling campaign to assess the performance of the farm in terms of production and waste management. From this sampling, real time solutions can be given that will improve efficiency and help improve the environmental performance of the farms sampled.

This project brings together a critical mass of engineering and scientific expertise from industry stakeholders and policy-makers, commercial operators and international experts who can respond directly to pressing issues identified through industry scoping.

The NUI Galway team of (Dr Richard Walsh, Mr Alan Kennedy, Mr Ronan Cooney) and the Athlone Institute of Technology team of (Dr Alexandre Tahar, Dr Andy Fogarty, Ms Sarah Naughton and Dr Siobhan Kavanagh), envisage that MOREFISH will provide real time impact for pressing challenges facing fish farmers that will ultimately help increase fish biomass yields, improve stock health and welfare, and reduce production costs and wastes.

For more information please visit the MOREFISH website www.MOREFISH.ie or follow us on Twitter @MOREFISHproject

Ronan Cooney, College of Engineering and Informatics, National University of Ireland Galway

A TYPICAL FLOW THROUGH EARTHEN POND SYSTEM

Groundwater Newsletter - Geological Survey of Ireland

The GSI Groundwater Newsletter deals with issues concerning groundwater protection and management in Ireland. Among items discussed across issues are: exploration, management, pollution, development, quality and reviews.

bit.ly/gsigwnews

Rural Water News - National Federation of Group Water Schemes

Rural Water News is the magazine of The National Federation of Group Water Schemes (NFGWS), which is the representative and negotiating organisation for community-owned rural water services in Ireland. From the outset, the objective of the NFGWS has been to secure equality of treatment, ensuring that those it represents receive their full entitlement with regard to the financial supports already conceded to their fellow citizens in urban areas. The primary external role of the National Federation of Group Water Schemes (NFGWS) is to assist schemes in meeting the challenges of water quality legislation

bit.ly/ruralwaternews

Waterways Ireland Holiday Guides

If you are considering holidaying in and around Ireland's waterways this year, did you know that you can order Waterways Ireland guide to What's on in 2016, Voyages and Visits, and A Taste of the Waterways free from their shop online?

http://bit.ly/whatsonwaterways

bit.ly/waterwaysvoyagesvisits

bit.ly/tasteofwaterways2016

Anglers look after white-tailed Eagle chicks

Anglers who were keeping an eye on some eagles in Lough Lein, one of the Killarney Lakes, were covered for their good work in The Irish Times.

bit.ly/eagleanglers

Discover things to do on the water

For a comprehensive list of water events and activities both inland and on the coast, the Discover Ireland website has a great list of things to do all around Ireland

bit.ly/discoveronthewater

HAB Bulletin: status of harmful and/or toxic Algae – Marine Institute

The weekly HAB Bulletin from the Marine Institute provides information on the potential development of toxic and/or harmful phytoplankton.

bit.ly/marinehab

RESOURCES

National Economic and Social Council publishes research paper on Burren Life

The Burren is a unique area in North Clare, known for its abundant biodiversity and rich heritage. It provides the context for a fascinating account of the Burren Life Programme, with this overview by Dr Brendan Dunford, its programme manager and a key player in its development. It provides the history and development of an approach to agricultural management which protects and enhances natural habitats and biodiversity.

bit.ly/nescburrenlife

European Forum on Nature Conservation and Pastoralism on CAP and permanent pastures

The EFNCP has published new reports looking at the application of CAP to permanent pasture in 6 EU member states, highlighting some of the differences in implementation and identifying negative policy drivers.

bit.ly/efncpcap

Irish Forum on Natural Capital

The Irish Forum on Natural Capital (IFNC) brings together a diverse range of organisations and individuals from academic, public, private and NGO sectors who are interested in the development and application of the natural capital agenda in Ireland. Their vision is for an Ireland in which natural capital and ecosystem goods and services are valued, protected and restored.

http://www.naturalcapitalireland.com/

ChangeX.org – social innovation for the environment

Are you passionate about environmental issues like green living, promoting a sustainable lifestyle, fighting climate change or food waste? ChangeX.org highlights proven social innovations that can help you to address these issues in your local community, and provides a platform for connecting with others who may be interested.

http://www.changex.org/social-innovations/environment

Financial Times Podcast – London's River Workers

Millions of people work in London, but very few work on the Thames itself. This 9 minute podcast interviews some of the City's river workers about their day.

bit.ly/ftlrw

Smart Dublin

Smart Dublin is an initiative of the four Dublin Local Authorities to engage with smart technology providers, researchers and citizens to solve city challenges and improve city life. It aims to position Dublin as a world leader in the development of new urban solutions, using open data, and with the city region as a test bed.

http://smartdublin.ie/

How Deep Learning gives us a precise picture of all water on earth

Where exactly is all the water on Earth's surface? Stand-alone satellite images have their limitations, but using artificial intelligence to examine them can now glean precise levels of water around the world and how they are changing week by week.

Palo Alto startup Orbital Insight uses freely available images taken by the U.S. Geological Survey's Landsat 7 and 8 satellites, much like the images you see on Google Maps. The startup feeds the images into a neural network, whic h then learns as it is fed more images, and pinpoints the exact location and area of surface water.

bit.ly/deeplearningwater

How local communities can help pollinators

Most people appreciate the beauty wildflowers bring to our landscape, they want the option to grow their own fruits and vegetables, and they want to buy affordable Irish apples or strawberries in our shops. This can only happen in a landscape that supports pollinators and provides them with nesting areas and a diverse diet from spring to autumn. If we choose to manage our local communities in a highly manicured way, it is at the expense of pollinators who cannot survive there. Local communities can lead the way in driving a better and more sustainable balance and bringing more natural, flower-rich pockets back into our landscape.

These guidelines are aimed at all those groups who are interested in making their local community more pollinator friendly e.g., Tidy Towns, Keep Northern Ireland Beautiful, Entente Florale, Green Communities, youth groups, local wildlife/environmental groups, PURE mile groups, community gardens, historic graveyard groups, college campuses and residents associations.

bit.ly/localcommunitypollinators

Don't mow, let it grow

Great project in Northern Ireland showing how to better manage roadside verges for biodiversity

http://dontmowletitgrow.com/

Tidy Towns Value Water Award

The aim of the Irish Water Value Water Award is to raise awareness of the importance of mindful water consumption in communities and encourage participation of members of the community to reduce consumption per household and per neighbourhood by promoting behaviours that conserve water, e.g. using water butts instead of hosepipes to garden common areas, car washing schemes that use less water.

It will reconnect communities with their water and where it comes from and reward communities by recognising positive impacts of TidyTowns activities on the sustainable supply of water to their community and environment.

bit.ly/tidytownsvaluewater

European Commission refers Germany to the Court of Justice of the EU over water pollution caused by nitrates

The European Commission is referring Germany to the Court of Justice of the EU for failing to take stronger measures to combat water pollution caused by nitrates. Nitrates are essential for plants to grow and they are widely used as fertilisers. However, excess levels cause severe water pollution, with consequences for people's health, the economy and the environment.

bit.ly/nitratesgermanyecj

The White House hosts a Water Summit

In honor of World Water Day on March 22nd, the White House hosted a Water Summit to shine a spotlight on the importance of cross-cutting, creative solutions to solving the water problems of today, as well as to highlight the innovative strategies that will catalyze change in how we use, conserve, protect, and think about water in the years to come.

bit.ly/whitehousewatersummit

EPA launch updated Hydronet portal

The EPA is launching an updated HydroNet web portal providing access to river flow, river level and groundwater data. The upgraded website will contain data from all currently active and all historic EPA/Local Authority hydrometric stations and will contain station details and data links for hydrometric stations operated by other organisations such as the OPW. HydroNet can be accessed at

http://www.epa.ie/hydronet

EPA Research 165: Contaminant Movement and Attenuation along Pathways from the Land Surface to Aquatic Receptors: the PATHWAYS Project

In order for Ireland to meet its obligations under the Water Framework Directive we need to understand how diffuse nutrients reach water bodies and impact on Irish aquatic ecosystems. By combining information on hydrological and hydrogeological pathways with land use pressures, a conceptual understanding was developed in the Irish context which provides a basis for assessing the impacts of land use on water quality. This knowledge provides a foundation for identifying the areas in Irish catchments that contribute the greatest proportion of nutrients to water bodies (receptors). These areas are referred to as critical source areas.

Findings from the PATHWAYS Project have informed the Environmental Protection Agency's Water Framework Directive characterisation approach, with both surface and subsurface pathways considered in the risk assessment process. The findings have also permitted the development of a suite of catchment management support tools to assist environmental/water resources/catchment managers in defining critical source areas for diffuse contaminants and assessing appropriate measures for protection and/or improvement of water quality. Outputs from the catchment management support tool include a national suite of pollution impact potential (PIP) maps that delineate critical source areas for nutrients (Phosphate and Nitrogen) and these maps have been refined since the completion of the Pathways Project for use by the EPA Catchments Unit and local authorities in catchment management.

bit.ly/eparesearch165

EPA Research 167: Relay Risk: Examining the Communication of Environmental Risk through a Case Study of Domestic Wastewater Treatment Systems in the Republic of Ireland

There are approximately 500,000 septic tanks in operation in Ireland. Septic tanks not operated and maintained adequately can pose economic, environmental and social risks. The fundamental objective of this project was to explore and identify how to effectively communicate environmental risk, by focusing on the case study of domestic waste water treatment systems (DWWTS) in the Republic of Ireland. Risk communication aims to address the divergence in how risk is perceived between expert and lay positions, and when carried out effectively, it empowers individuals to recognise and manage risk. By identifying what influences householder behaviour regarding their DWWTS, it is possible to formulate a communication approach that aims to improve compliance with environmental regulation, thus protecting human health and the environment.

bit.ly/eparesearch167

EPA Research 167: Guidelines for effective Risk Communication

These guidelines examine the elements required for the preparation, implementation and monitoring of engagement strategy.

bit.ly/eparesearch167guidelines

EPA Research 168: Increasing Resource Efficiency in Wastewater Treatment Plants

This research adopted a multi-pronged approach to audit and benchmark the resource efficiency of Irish waste water treatment plants, including the use of life-cycle analysis and exergy analysis. Ten representative plants were audited in detail. The plants varied in scale, with regard to their design capacities, from a plant designed to manage waste water from 600 people to one designed for 186,000 people. Simultaneous energy and resource consumption and water quality audits were undertaken, resulting in the development of benchmarking tools and auditing methodologies, and the detailed performance evaluation of the plants to support better resource management and to provide baseline data with regard to the holistic performance of the WWTPs.

The results of this research should be of interest to Irish Water and other water utilities, the EPA, WWTP managers, researchers, and policymakers, amongst others.

bit.ly/eparesearch168

EPA Research 172: Combining earth observation and geochemical tracing techniques for groundwater detection and evaluation in Ireland

Research completed as part of the CONNECT project endeavoured to address knowledge gaps in field-based scientific information on the interaction between groundwater, lakes and coastal areas. GIS, remote sensing and geochemical tracing tools were developed and combined to detect and evaluate groundwater-surface water interactions. The outputs presented in this report can be used potentially to inform and guide any future studies seeking to localise and quantify groundwater discharge and associated nutrient loading to surface-water features.

bit.ly/eparesearch172

www.LiveGreen.ie

Keen to live green and looking for advice about the small lifestyle changes you can make?

Livegreen.ie is a new online resource for householders and families. It provides trusted and reliable advice and guidance on a range of environmental and health matters. Living green means making small changes at home or in our communities. In turn, living green can make a big difference to our wellbeing – and your pocket - helping you to live a more sustainable lifestyle.

Livegreen.ie provides practical information across the following household themes:

- Water Conservation
- Waste Prevention
- Energy Efficiency
- Health & Community projects

Livegreen.ie, developed by the Environmental Protection Agency with expert knowledge and advice from Healthy Ireland, Irish Water and the Sustainable Energy Authority of Ireland, supports the public in accessing reliable environmental information.

livegreen

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IRELAND'S ENVIRONMENT

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CAN YOU CONTRIBUTE TO THE NEXT ISSUE?

Do you have a story you would like to tell, or a resource you would like to share?

The Catchments Newsletter is issued quarterly at the start of March, June, September and December. If you would like to submit an article, please email catchments@epa.ie and let us know. The deadline is one month in advance of publication. The only rule is you need to avoid acronyms, if at all possible.

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For further information

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