

Diffuse Water Pollution in Wales

Issues, solutions and engagement for action.



The purpose of Natural Resources Wales is to ensure that the natural resources of Wales are sustainably maintained, enhanced and used, now and in the future.

Wales faces many challenges - challenges for its people and communities, for its economy and for its environment and wildlife. Securing energy and fuel supply, provision of jobs and income; tackling the threats of climate change and flooding; improving people's health and wellbeing. We believe that by unlocking the potential that lies within Wales' resources, by managing them and using them in a more joined up and integrated way, they can help to meet the challenges we face.

Some of our proposals to meet these challenges are:

- We will work for communities in Wales to make sure people and their homes are protected from environmental incidents like flooding and pollution. We will provide opportunities for people to learn, use and benefit from Wales' natural resources.
- We will work for Wales' economy and enable the sustainable use of natural resources to support jobs & enterprise. We will help businesses and developers to understand and consider environmental impacts when they make important decisions.
- We will work to maintain and improve the quality of the environment for everyone. We will help make the environment and natural resources more resilient to climate change and other pressures.
- We will use our knowledge, and learn from the knowledge of others, to make Natural Resources Wales an efficient, effective and capable organisation for the people and environment of Wales

Published by:

Natural Resources Wales
Tŷ Cambria
29 Newport Road
Cardiff
CF24 0TP

Phone number 0300 065 3000
Email enquiries@naturalresourceswales.gov.uk
Website address www.naturalresourceswales.gov.uk

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Further copies of this report are available from:

Email: enquiries@cyfoethnaturiolcymru.gov.uk
Tel: 0300 065 3000

Foreword

A high quality water environment is essential to support a healthy ecosystem, which in turn provides a number of services for people and species. We are adopting an ecosystem approach to the management of water to complement our role in helping Wales to meet its European environmental obligations.

Under historical assessment requirements, and in comparison to more industrialised areas of the UK, Wales has, on the whole, enjoyed good water quality with dramatic improvements having been made even in those areas with a legacy of heavy industry and intensive mining. With changes in EU legislation and a better understanding of the many factors that need to be considered to better assess the state of our water environment, we face further challenges.

The EU Water Framework Directive (WFD) came into force in 2000, it established new and better ways of protecting and improving rivers, lakes, estuaries, coastal waters and groundwater. It provides the legislative driver for an integrated approach to water management and Natural Resources Wales has a leading role in its implementation across Wales. However, the objectives can only be fully achieved through close, ongoing co-operation between a wide range of both UK and Welsh Government departments, local authorities, business and their representative bodies and many third sector organisations.

WFD River Basin Management Plans for Wales highlight diffuse pollution as a key reason for failure to meet good ecological status in a number of rivers. This problem is not new, and there is already a significant amount of local work being carried out to tackle specific diffuse pollution issues. This document has been produced in order to focus effort in the current round of River Basin Plans and to develop strategic solutions which build upon and complement on-going local delivery of projects. It will also feed into the second cycle of planning for the WFD.

The delivery of Welsh Government's long term outcomes, as stated in their Programme for Government, will be supported through the delivery of actions in this plan including in particular, those relating to: improved environmental quality and resilience; working with communities to understand and address their environmental impact and protection of human health and wellbeing.

Achieving the desired outcomes for Wales' water environment will require strong partnership working, innovative thinking and solutions, and the plan outlines the steps we intend to take to develop these.

Emyr Roberts

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Executive Summary

The natural environment and the ecosystem services it provides is one of Wales' greatest assets, contributing £8.8bn a year to our economy and supporting one in six jobs.

As our control of regulated discharges has become increasingly effective, the significance of other sources of pollution has become more evident. These sources, known as diffuse pollution, typically consist of discharges or contamination that, while relatively minor individually, collectively have a significant impact on water quality. The contamination is frequently associated with rainfall and its chemical and microbial composition can be extremely variable.

There is already a significant amount of local work being carried out to tackle specific diffuse pollution issues. This plan outlines the steps we intend to take to develop strategic solutions which complement local delivery.

Quantifying the extent and impact of 'unseen' diffuse pollutants, and raising awareness among those responsible, is difficult. However, in January 2013 we estimated that at least 35% of Water Framework Directive water-bodies in Wales are failing due to diffuse pollutants.

Building on previous work between Welsh Government and other organisations, we have identified eight areas on which to prioritise effort to tackle diffuse pollution, namely:

- industrial estates,
- small sewage discharges (private),
- drainage misconnections,
- surface water drainage from developed areas,
- livestock management,
- land management,
- storage – slurry, fuel, oils, chemicals,
- mine waters

We will learn from best practice, use alternative rather than additional solutions, and aim to deliver the plan within existing budgets. Where identifiable we will endeavour to apply the polluter pays principle.

Restoring damaged ecosystems is a long-term process and we will need to manage the expectations of those seeking instantaneous improvements. Additionally, where required, changes in business practices and culture, legislation and policy and the commitment of investment, may take time to secure particularly during economically challenging times. To minimise the risk of incurring high costs versus relatively low benefits, intervention on the ground will be undertaken only where there is good evidence of practices causing environmental harm, otherwise we will review and issue best practice guidance for high risk activities.

1. Introduction

The natural environment of Wales is one of our greatest assets contributing £8.8 billion a year to our economy and supporting one-in-six jobs. Ecosystem services underpin this value providing opportunities for businesses to flourish whilst also helping to buffer against the adverse impacts of our activities.

This Strategic Action Plan seeks to implement a range of measures that, through improvements in our management of land and water and associated services, will maintain and increase the value of the Welsh environment. This will help ensure it can positively benefit the economic prosperity and social development of Wales.

The plan will contribute to the delivery of the Wales Environment Strategy. It identifies action to contribute to the Water Framework Directive (WFD) targets, particularly in relation to stopping deterioration in water bodies and achieving “Good Ecological Status” over future WFD planning cycles. Additionally, many of our designated conservation sites will benefit from reduced levels of diffuse pollution, enabling them to either retain, or achieve, favourable condition.

The plan also contributes to Natural Resources Wales’ 2013/14 Business Plan, supports the delivery of our Environmental Quality priorities, and thus aids in achieving some of Welsh Government’s long term outcomes as derived from their Programme for Government (see Appendix B).

As our control of regulated discharges (mainly point sources) has become increasingly effective, the significance of intermittent, multiple source pollutants, has become more evident. These sources, known as diffuse pollution, typically consist of discharges or contamination that, while relatively minor individually, collectively have a significant impact on water quality. The contamination typically comes from unlicensed sources and dispersed land-use activities. It often occurs after rainfall and its chemical and microbial composition can be extremely variable. Sediment is a frequently seen pollutant and along with the usual fine soil particles, often also contain faecal indicator bacteria, metals, nutrients as well as organic material that consumes oxygen from watercourses during the natural degradation process. For details of other common pollutants, see Appendix A (Page 29).

With a statutory monitoring and regulatory function, we take a risk based approach to inspecting adherence to guidelines and rules for activities likely to give rise to diffuse pollution. For example, recognising that some 79% of the land-use in Wales is Agriculture, it is important that compliance with associated regulation such as “cross compliance” is appropriately assessed and enforced.

As well as regulating, we will work with relevant business sectors, or individuals, to resolve problems together. Where problems persist we will, as appropriate, use our formal legal powers to achieve the best environmental outcome for Wales. These powers include the use of civil sanctions, enforcement notices and if necessary the prosecution of polluters. Where necessary we will propose policy changes at a local and government level.

There is already a significant amount of local work being carried out to tackle specific diffuse pollution issues. This Plan will outline the steps we intend to take to develop strategic solutions which build upon and complement the local project delivery and in doing so help co-ordinate activities and contribute to :

- Increasing longevity and accelerated delivery of the outcomes we want.
- Engaging and informing partners (including communities) and implementing catchment based solutions and the ecosystems services approach.
- Increased scale and greater efficiency of the work we deliver.
- Innovative solutions being developed.
- Achieving buy-in from strategic organisations and those who may benefit.
- Tackling more obscure pollution issues not addressed at a local level.

People and organisations already working on various sources of diffuse pollution can refer to this document, particularly its relating future projects, to:

- Learn where other work is likely to complement their localised efforts.
- Identify gaps and synergies and input to the programme so as to address and improve these.

Case Study 1

Delivering social, economic and environmental benefits through partnerships

In the 1990s, compliance with the EC Bathing Water Directive increased in response to sewage treatment improvements by Dŵr Cymru Welsh Water (DCWW) as part of their Asset Management Programme (AMP). However, achievement of more stringent “Guideline” standards was not achieved at all sites, hindering attempts to obtain the prestigious Blue Flag status and potentially impacting on tourism revenue. It was found that the large point source discharges (from treatment works) were masking the effects of diffuse pollution sources and a project was set up to identify and address these.

The diffuse issues, which contributed to the bacterial loading of many bathing beaches included, for example: incorrectly connected foul drainage; badly managed private sewage treatment systems at caravan and camping sites; un-maintained septic tanks serving dwellings and public toilets and poor management of run-off from livestock rearing areas. These issues were addressed with the cooperation of the owners, for example, stock control practices on certain farms were changed, with supplementary feeding systems moved and better control of stock access to watercourses.

In addition to improving local bathing water quality, this project’s work developed a more focussed approach, formed partnerships with other regulators and beach users and shared best practices across the UK.



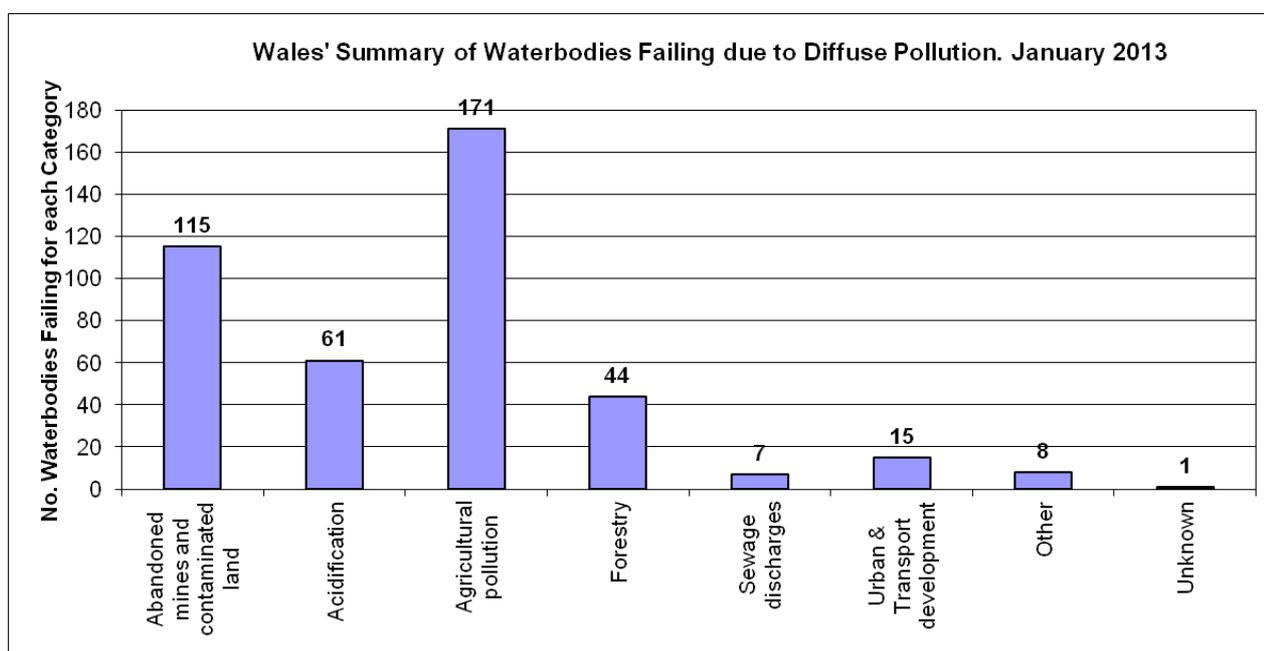
Removing sources of diffuse pollution is vitally important. Keeping livestock out of watercourses can reduce nutrient enrichment and help to protect sites of significant economic importance, such as designated bathing beaches around the Welsh coast.

2. Nature and Scale of the Issue

The first River Basin Management Plans (produced as part of the WFD requirements in 2009) identified a significant number of water bodies in Wales that are failing to achieve the WFD target of 'Good Ecological Status' due to the effects of diffuse pollution.

An assessment of the Reasons for Failure (RFF) of water bodies within WFD indicates that, as at January 2013, a minimum of 35% of failing water bodies are failing due to diffuse pollution issues.

A summary of the sources of diffuse pollution contributing to WFD failures in Wales is shown in the bar chart figure below:



The RFFs illustrated may, in some situations, be solely responsible for water-bodies not achieving Good Ecological Status. However, many water body failures involve a combination of different reasons for failure and hence more than one solution is required to address their impact.

Our Priority Areas

Building on the results of past, Welsh Government consultation we have initially identified eight priority areas for this first action plan (listed in no particular order);

- 1) Industrial estates
- 2) Small sewage discharges (private)
- 3) Drainage misconnections
- 4) Surface water drainage from developed areas
- 5) Livestock management
- 6) Land management
- 7) Storage – slurry, fuel, oils and chemicals
- 8) Mine waters

Our Priority Areas for Action to Tackle Diffuse Water Pollution in Wales

(Central map shows locations of particular concern where diffuse pollution is causing water body failures).

Livestock

The sustainable management of some 8.6 million sheep, 275 and 237 thousand head of dairy and non-dairy cattle respectively, presents a significant challenge.

Poor practices are likely to be contributing to failures at these specific water bodies.

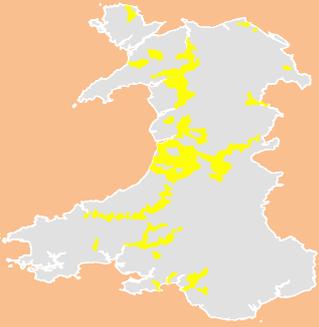


Misconnections

Occurring across Wales pipe work in properties carrying sewage or trade waste is often wrongly connected to surface water drainage systems. Visits to over 1000 properties in Swansea have revealed that over 15% have incorrectly connected pipe-work resulting in untreated discharges to the local environment.

Abandoned Mines

Wales has a history of mining and quarrying for construction material, metals and coal. A large number of these activities have now ceased, however, rainfall, surface and ground water still flows through the abandoned workings, leaching out metals and making many of the discharges acidic. This polluted drainage has severe environmental impacts and likely to affect these specific water-bodies.



Industrial Estates

There are at least 350 industrial estates in Wales. Regularly changing occupancy of multiple units creates a challenge for their effective environmental management.



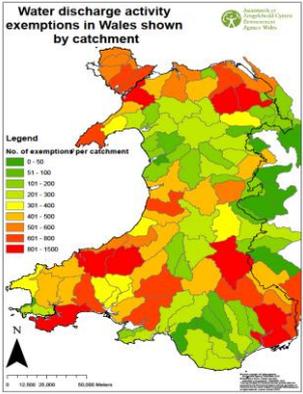
Surface Water Drainage

In many urban areas in Wales our sewer systems are unable to cope with the volume of rainwater that enters them. This causes flooding and sewage discharges. It is estimated that to resolve this problem in Llanelli alone will cost £150m.

Oil Storage

Throughout Wales poorly constructed and/or managed storage of chemicals, fuel and oil are frequent sources of environmental contamination.

Water discharge activity exemptions in Wales shown by catchment



Private Sewage Discharges

There are over 50,000 known septic tanks in Wales discharging partially treated waste into the ground. Recent work indicates that the highest number of such systems are located at the red areas here:

Land Management

At~79% of the land-use in Wales, agriculture dominates the landscape. It is not the only cause of water pollution, e.g. at ~14% of the land-use in Wales, a legacy of issues caused by the historic drive to quickly increase the provision of timber in the UK makes forestry a contributory factor to failures at these specific water-bodies:



3. Aims of Action Plan

In delivering this Action Plan we will:

- Address the causes, and tackle the sources of, diffuse pollution, demonstrating our commitment to, and achievement of, Good Ecological Status - a key aim of the Water Framework Directive (WFD), and the protection of ecosystem services in Wales.
- Improve the understanding of diffuse water pollution, and seek shared ownership of the solutions and the support of lead partners for delivery of actions.
- Promote catchment solutions which will maximise the environmental, economic and social benefits of the work and enhance and protect the wider ecosystem services.
- Use advice, incentives, regulation and enforcement to encourage the sectors causing pollution to meet their responsibilities.
- Carryout awareness raising and local community initiatives to promote best practice and encourage understanding.
- Communicate the proposed actions with both the delivery partners and the businesses affected to share successes and enable us to critically review whether we are taking action in the most cost effective way.
- Seek opportunities to reduce the costs of investigations and implement new approaches through working with and learning from others.
- Take a proportionate, risk based approach to the protection of Wales' precious aquatic environment and the ecosystem services it provides to us.
- Undertake an appraisal of the full range of interventions, and have a catchment-wide understanding of the functioning of ecosystem services so that if we intervene in one part, we know what will happen elsewhere.
- Review the results of new initiatives and application of counter measures on a pilot scale where appropriate before applying widely across Wales.
- Use better informed material which will encourage long-term, positive changes in behaviour and subsequently increased environmental protection.



Discharges, such as those from abandoned mine sites, can cause significant ecological damage. They can also cause harm to economically and socially valuable recreational opportunities such as angling. This occurred in the River Neath (left) when mine water was flushed from abandoned workings.

4. The Challenges

4.1 Provision of Evidence to Support Action

We recognise the need to underpin future actions with supportive evidence, in particular;

- Where problems are identified the initial onus will be on understanding the nature of the problem and then work with partners to deliver sustainable solutions.
- Evidence gathering can be a slow process. However, we will act upon it as soon as possible although in some cases; adoption of the proven measures may need to be delivered in future cycles of the WFD.
- A need for monitoring programmes to collect data to demonstrate whether or not the desired changes have been achieved.
- In recognising that the delivery of long-term monitoring programmes is expensive we will seek to use innovative technology, limit extra monitoring to targeted pilot study areas, and then look to extrapolate or model the data for use elsewhere, particularly in relation to informing the wider delivery of ecosystem services.

4.2 Resources

We will deliver much of this Plan within existing budgets recognising that the work will involve sharing resources, learning from the experiences of others and implementing alternative rather than additional solutions. We will be mindful of noting synergistic benefits across other existing and developing strategies, in particular, close liaison with those working on the Welsh Rural Development Plan and the environment payment scheme, Glastir. In addition, we will learn from best practice developed elsewhere and utilise to deliver single solutions to achieve multiple outcomes

Where significant levels of additional resource are required to resolve particular issues we will explore options for external support. This would include the application of the polluter pays principle, ensuring that those causing damage contribute towards the solutions.

We are mindful of potentially imposing additional financial burdens on businesses and organisations during challenging economic times. Where appropriate, economic appraisal and cost benefit ratio work will be included in the Define the problem and Design a solution phases of proposed actions.

4.3 Timescales

Whilst we will deliver some quick-wins, restoring damaged ecosystems is a long-term process and we will need to manage the expectations of those seeking instantaneous improvements and provide compelling evidence of impacts in order to change people's attitudes and behaviours.

Further research into appropriate techniques to tackle pollution (eg. from metal mines) is needed to assess technical feasibility and proportionate costs, before investment is made.

Where required, changes in business practices and culture, legislation and policy and the commitment of investment, may take time to secure particularly during economically challenging times. The best solution may not always be the one implemented quickest.

5. Action Plan Delivery

We have a good understanding of most causes of diffuse pollution and a significant amount of work has been targeted at producing guidance to minimise its impacts. In order to progress further we need to:

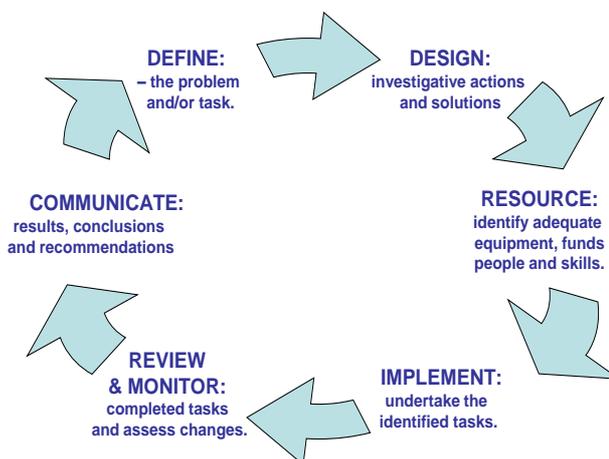
- Improve and sustain the uptake of good practice, ensuring that we endeavour to predict future alterations to operations that may be caused by climate or business changes, e.g. the potential of an increase in the number of farms growing maize and the elevated risk of soil erosion that may bring.
- Work with others, in particular, the local and agricultural communities (see Case study 2 below), and share our commitment to protecting and improving the quality of our natural waters.
- Explore and develop catchment solutions and ecosystem services, ensuring integration with water company plans and agricultural interests.
- Enhance our enforcement and regulatory powers introducing new regulations where required.
- Motivate business to include pollution prevention practices in their day to day operations.
- Provide new codes of practice for priority Sectors.
- To minimise the risk of incurring high costs versus relatively low benefits, intervention on the ground will be undertaken only where there is good evidence of practices causing environmental harm, otherwise we will review and issue best practice guidance for high risk activities.

Priority will be given to WFD Protected Areas such as bathing waters, drinking water protected areas, fisheries, shellfish beds and water dependent Natura 2000 sites (Special Area of Conservation and Special Protected Areas).

Description of strategic actions, and staged approach to tackling diffuse pollution.(see also worked example in Appendix

Many sources of diffuse pollution already have existing work. This strategic action plan aims to identify complementary actions or gaps in effort using the system summarised in the diagram (right).

Working with relevant partners, the process will be applied in varying degrees to any significant activity or persistent problem under each of the priority headings.



Case study 2

Staged Approach to Delivery:

Cain Valley Catchment initiative, 2007 to 2010

The Afon Cain, a tributary of the upper River Severn drains 78 square kilometres. The dominant land-use is agriculture (beef and sheep), with small areas of commercial and privately owned forestry. Monitoring evidence suggested that the Cain valley water-bodies would not achieve WFD Good Ecological Status due to organic and nutrient pollution, primarily sourced from agriculture (**Define**).

Our Catchment Co-ordinator worked to engage and build trust with the community and local businesses (**Design**), give guidance on good environmental management and the economic and social benefits this can deliver. To promote the benefits of nutrient management planning on farms, we provided free soil sampling and analysis, allowing farmers to make more economical use of their farm manure and be less dependent on inorganic fertiliser (**Resource**). The initiative was supported by forest managers who ensured that watercourses were protected from the effects of harvesting activities. Local flooding and contaminated surface water issues were tackled via rural and urban sustainable drainage systems (**Implement**).

A unique way of engaging with the local community was achieved through the local schools who were helped to raise Atlantic Salmon from the egg stage through to their release into the local rivers as salmon fry. In 2010, all water bodies forming the Cain Valley were assessed as Good status under the Water Framework Directive (**Review and Monitor**). This work has now been extended into the neighbouring Tanat Valley (**Communicate**).



A community wetland constructed in the Afon Cain catchment which captures run-off from a car park serving the village of Llanfyllin.

6. Sectoral Plans

6.1 Industrial Estates

Issue

There are over 350 industrial estates across Wales. Much of the SME sector operates on them and over the years the infrastructure and services of many of these estates has deteriorated. Regularly changing occupancy and small workforces creates a challenge for their effective environmental management. Diffuse water pollution from industrial estates arises from a wide range of activities and variety of pollutants including;

- Unloading, storage and handling of raw materials and products.
- Cleaning, maintenance, and the use of herbicides.
- Sewage and trade effluent discharges from wrongly connected drainage systems.
- Construction work.

Impact

The impact of these activities is exacerbated by the presence of large impermeable paved areas which can often drain directly to our rivers and streams, poor knowledge of the drainage and where it runs, and the drainage frequently being contaminated with pollutants.

Given that many industrial estates are located close to residential sites the presence of pollutants can detract from the aesthetic, recreational and ecological value of local watercourses.

Solutions

Our current management approach is through voluntary action, based on good practice guidance (Business Link Wales & Environment Agency), combined with regulatory action when pollution occurs. Generally, the approach has been piecemeal, targeting local issues on a reactive basis. We need to aim for a more pro-active and strategic approach to prevent pollution in the first place.

To strengthen the existing approach, we propose to undertake best practice projects at one or more industrial estates to identify how best to deliver long lasting pollution prevention advice covering the range of sources of pollution, along with improved enforcement. The projects would evaluate the impact of this package of measures on water quality and would enable us to develop an understanding of the effectiveness of different types of measures. Work to date has highlighted problems with on-site drainage systems caused by a lack of knowledge of which drains served foul or surface water.

Our Top Three Actions.

- 1) Identify the locations and ownership of industrial estates in Wales and their coincidence with failing water bodies.
- 2) Review and develop best practice guidance (Codes of Practice) for industrial site managers/owners. Disseminate and promote adoption of new guidance and promote.
- 3) Ensure that publicly owned sites are exemplars of best practice.

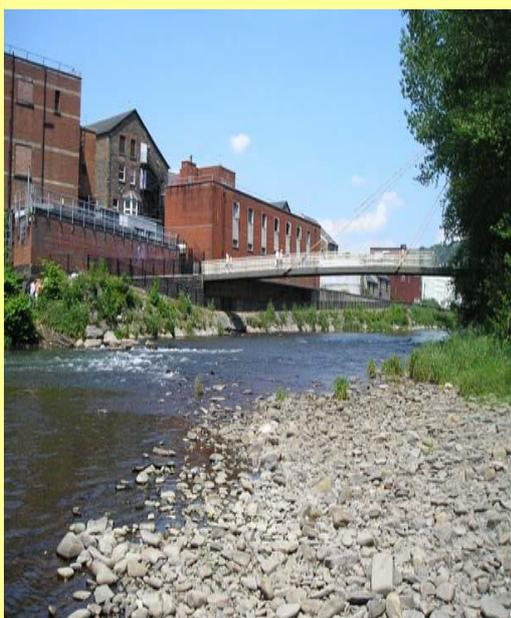
Measuring Progress

We will know that we have progressed in tackling this issue when industrial estates are shown to have no impact on water quality in their surrounding environment and :

- 1) The number of breaches of regulations and pollution incidents at the higher risk Industrial Estates are significantly reduced.
- 2) Site audits indicate that businesses are implementing pollution prevention measures.
- 3) The majority of business-unit leases contain pollution prevention conditions.
- 4) Publicly owned sites are seen as exemplars of best practice.

Case Study 3:

Drainage investigations at Treforest Industrial Estate, Pontypridd



In 2010, a pollution prevention campaign was carried out at Treforest industrial estate where a surface water outfall, serving the site, was discharging pollutants into the River Taff.

Initial investigations didn't reveal an obvious cause. EAW set up a partnership group to include DCWW, the site managers, and the owners of the site. Dye-tracing of the foul drains from the units revealed a number of misconnections to the surface water system as well as a damaged sewer that was contaminating nearby surface water.

Following sewer repairs, DCWW completed a CCTV survey of site drainage and confirmed they were operating effectively.

6.2 Private Small Sewage Discharges (SSD)

Issue

There could be as many as 100,000 properties in Wales not connected to the public foul sewerage system. In most cases, these properties will rely on a septic tank, a cess pit (a sealed tank) or a package sewage treatment plant for their sewage treatment.

Impact

All such systems run the risk of polluting their local environment and pose a risk to health if they are not properly installed and maintained. Studies from Lough Leane in Ireland show that 85% of tanks had not been serviced and were full of sludge. UK studies found that septic tanks contributed up to 76% of the phosphates in a catchment. In some locations there may be so many systems that even well maintained systems will collectively overload the capacity of the local environment to effectively absorb the discharges.

Solutions

Through the Environmental Permitting Regulations 2010 all discharges from septic tank and small sewage treatment plants in Wales are being registered. This will allow the risk these systems pose to be estimated. We can then investigate the cumulative impact on the water environment and identify if further steps, such as the construction of new public sewers or better maintenance of existing septic tanks, is appropriate where the environment is currently at risk.

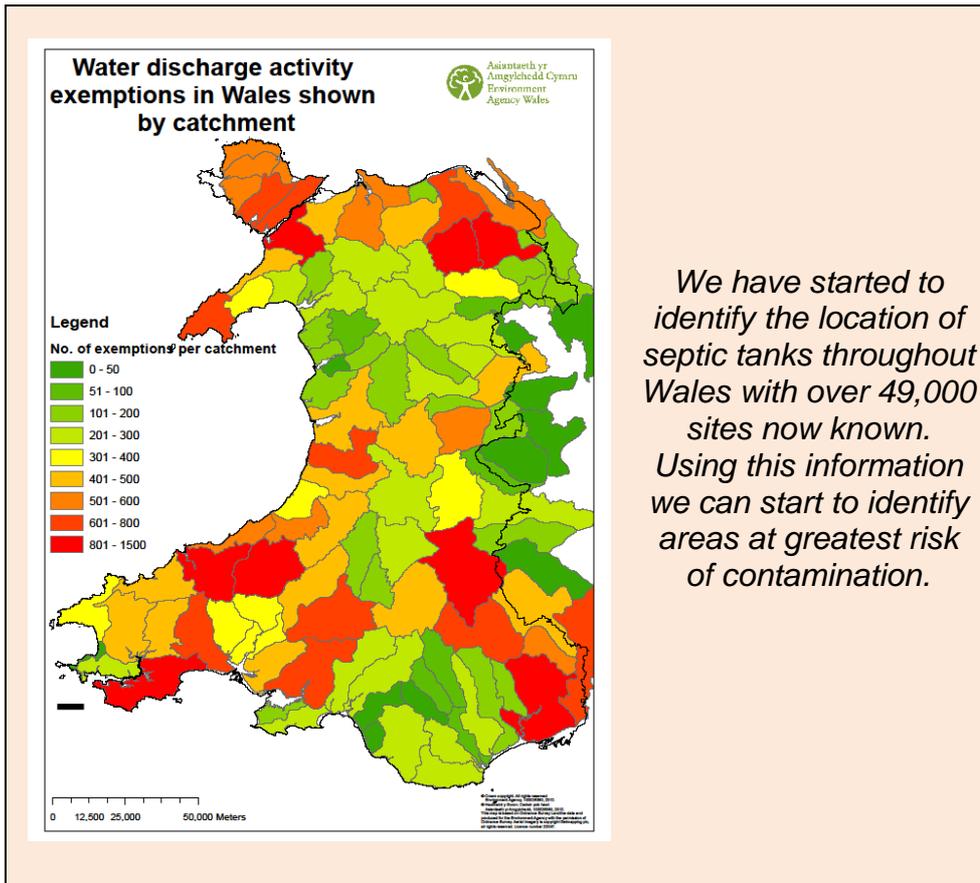
Our Top Three Actions.

- 1) Using data gathered from the registration process in 2011/12, identify gaps and permit the majority of private SSDs in Wales as completely as possible.
- 2) Identify areas where SSDs are having an adverse environmental impact.
- 3) Develop best practice guidance and deliver programmes to address local impacts and to improve the management of SSDs.

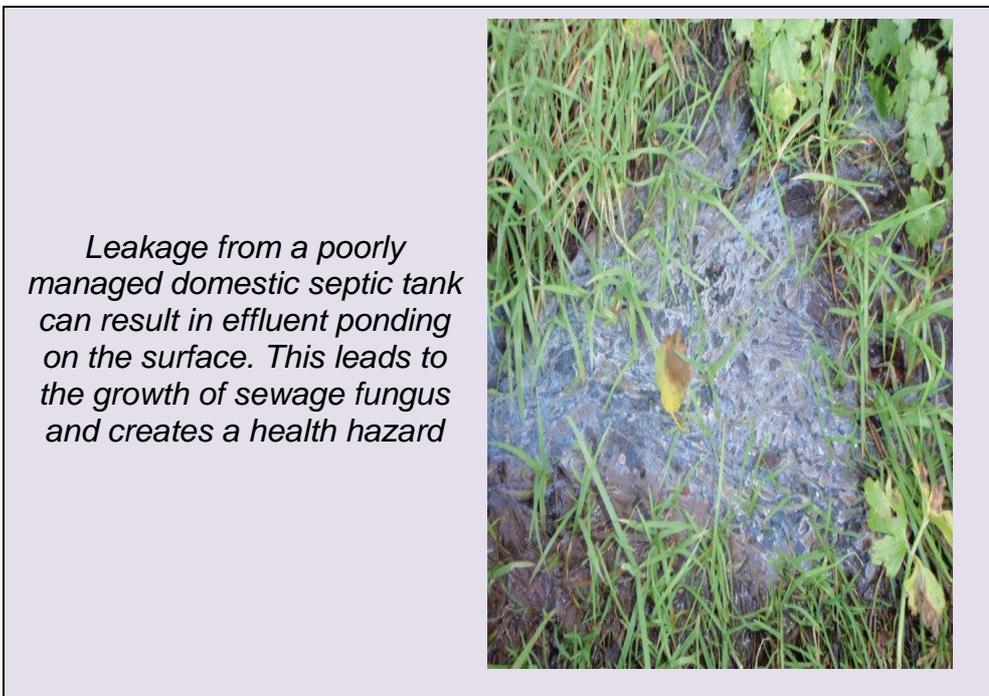
Measuring Progress

We will know that we have progressed in tackling this issue when:

- 1) Our records indicate that the number of pollution incidents & failing water bodies caused by small sewage discharges are significantly reduced.
- 2) In areas with high concentrations of small sewage systems, faecal bacteria failures are significantly reduced at nearby bathing waters and shellfish beds.
- 3) Natural Resources Wales has confidence that all small private discharges are appropriately registered, their locations are mapped and they are operating properly.



We have started to identify the location of septic tanks throughout Wales with over 49,000 sites now known. Using this information we can start to identify areas at greatest risk of contamination.



6.3 Drainage Misconnections

Issue

Sewage and trade effluent are normally collected in foul sewers for treatment at a sewage treatment works. However, often as a result of error, or negligence, some foul discharges are connected to surface water drainage systems which drain into nearby rivers and streams.

Mainly originating from sanitary appliances, washing machines and trade effluents the sewage contains high levels of organic material and pathogenic bacteria, as well as a wide range of nutrients, detergents, fats and oils, sanitary items and traces of metals and organic chemicals.

Impact

This results in contaminated water flowing untreated to watercourses or groundwater. Where detailed studies have been undertaken across Wales, and specifically at Caswell near Swansea, one in ten of the properties tested had misconnections.

Solutions

Water companies, which treat the foul waste, do not have the power to correct a misconnection and recharge the responsible person. This power currently mainly rests with the local authority, although the Environment Agency could also take action. Extending this power to sewerage undertakers, in order to simplify the process and reduce administrative costs could have significant benefits. We propose to work with sewerage undertakers and local authorities to raise awareness of drainage misconnections throughout Wales.

Our Top Three Actions.

- 1) Raise awareness of the issue amongst planners, property owners, building developers and trade operators (plumbers etc) and seek to reduce incidents via more frequent and stringent inspections during construction.
- 2) Target sites with known water quality problems to address specific issues.
- 3) Review the powers of local authorities and water companies to enable them to undertake faster corrective actions, and to simplify responsibility for urban drainage.

Measuring Success

We will know that we have progressed in tackling this issue when:

- 1) Our records indicate that the number of pollution incidents, caused by wrongly connected drainage systems, is significantly reduced.
- 2) The Water Company and Local Authorities' investigations of surface water culverts contaminated with sewage reveal that significantly less are due to wrongly connected drains, i.e. less than the 2011/12 average of 10% of tested properties.
- 3) Surveys indicate that provision of guidance by white goods manufacturers on correct connection to sewer has increased.



Awareness of the need to dispose of waste water via the correct drainage systems has been highlighted through demonstration schemes where dye is used to show the link between site drains (left) and the local watercourse (below).



6.4 Surface Water Drainage

Issue

Rainfall drainage systems for our urban areas have historically been designed to protect property from flooding. The past approach has been to collect rainwater and direct it into underground pipes removing the water from the site as rapidly as possible. These systems are usually designed to accommodate a rainfall event that will occur once in 30 years.

Impact

This approach has a number of adverse impacts on the water environment:

- Accumulated pollutants are washed into the drainage system, damaging downstream water quality and ecology.
- Water is prevented from soaking into the ground naturally affecting soil moisture and groundwater levels.
- Changes to the pattern of flows in receiving streams, with higher peak flows which can damage stream ecology and increase flood risk downstream.
- Rainwater drainage is often discharged into our sewers, which although designed to spill untreated dilute sewage into our rivers and streams, will do so more frequently.

Solutions

Sustainable Drainage Schemes (SuDS) use a range of techniques to mimic the natural drainage, attempting to keep rain where it falls through infiltration or storage. Systems frequently incorporate flow buffering and filters that remove sediments and provide natural treatment of pollutants. A further step is to use Water Sensitive Urban Design to maximise the benefit from the water before dispersal.

Whilst SuDS are well understood and encouraged by both planning guidance and building regulations, there has been limited uptake on new and existing developments. This is often because of difficulties faced obtaining agreement with the local authority or the sewerage undertaker on long term ownership and maintenance. In order to improve the uptake of the SuDS approach, the Flood and Water Management Act, 2010, introduced a requirement for the approval and adoption of SuDS serving new developments. This makes the right of connection of surface water drainage to the public sewerage system conditional.

In order to tackle diffuse water pollution from existing areas, retrofitting of SuDS is required. This involves implementing SuDS solutions where improvements to local drainage are proposed and usually, in conjunction with other projects such as town centre refurbishments, improvements to green space or road improvements.

Our Top Three Actions.

- 1) Identify priority sites that are both within failing WFD water-bodies and are of high risk of flooding, and assess feasibility of retrospectively fitting sustainable drainage systems.

- 2) Improve the availability and accuracy of maps for foul and surface water drainage systems in urban areas so that our knowledge of our drainage systems is enhanced.
- 3) In areas where there are a high proportion of combined foul and surface water drainage, seek community buy-in to create new permeable areas to receive the surface water and also enhance the visual appeal of the local environment.

Measuring Success

We will know that we have progressed in tackling this issue when:

- 1) Water Sensitive Urban Design is evident in all new developments.
- 2) Where the Water Company, Local Authorities and Natural Resources Wales identify areas for sewer flooding, river and surface water quality problems, there is an increase in the number of remedial schemes that successfully promote local surface water infiltration and storage as opposed to increasing the foul sewer capacity.
- 3) The water company, DCWW, and the Local Authorities have accurate maps for the extent of combined foul and surface drainage systems in urban areas.

Case Study 4: Impact of Impermeable Developments (diagrams by D. Bayliss)



A suburb of Cardiff in 1984 is shown on the left. The grey areas are impermeable surfaces and the drainage of the site is designed to accommodate run-off from a 1 in 30 year return period storm. On the right is the same suburb in 2009. It shows, in red, the 20% increase in impermeable area, through home extensions, conservatories and paving of gardens. Despite this increase, the drains remain unchanged. Due to these changes, and the increasing rainfall predicted from our changing climate, sewer flows in Wales are projected to increase by over 1% a year. Applying SuDs techniques to new developments will not address flooding on existing sites. To do this, SuDS techniques need to be implemented on existing sites or the risk of surface water and sewer flooding will inevitably rise.

6.5 Livestock Management

Issue

There are over 8 million sheep and 0.5 million cattle in Wales. They produce significant amounts of waste that, through their grazing habits and soil compaction, can directly impact upon the environment. Despite past support from Government and the farming sector for the provision of guidance for farmers, the uptake of this advice has been variable. As a result livestock management has been identified as a major reason for Water Framework Directive failures.

Impact

This has a number of impacts on the environment:

- Surface water run-off from fields and yards containing animal waste, nutrients and sediment pollutes watercourses.
- High stock numbers, particularly on fields with poor soil structure, can lead to surface compaction of the soil (field poaching). This reduces the capacity for rain to infiltrate into the soil, resulting in a greater volume of run-off and increased flood risk and transportation of materials from fields.
- Stock rearing in upland areas can cause erosion of peat, leading to the discolouration of water used for public supply, significantly adding to the cost of its treatment.
- Management of stock welfare where application of veterinary medical products, e.g. sheep dip, are inappropriately used or disposed of.
- Animal gut bacteria such as coliforms can affect bathing water areas and shellfish beds, potentially impacting on recreational activities as well as the incomes of people reliant on tourism or fishing.

Solutions

The majority of the measures to counter problems from stock rearing are well established and are largely summarised in the Environment Agency guidance “Best farming practices: what’s in it for you”, for example:

- For improved pasture areas, better manage the frequency of stock movement, and/or numbers of animals, according to soil type and vegetation cover available.
- Where gradient and soil type make areas prone to erosion, deny access to stock for selected areas to grow a dense cover to act as buffer strips.
- Locate feeder units only on well drained soils and move frequently to minimise compaction and build up of wastes.
- Use temporary fencing to deny access to natural drainage channels or ditches in improved pasture areas.

We need to examine the current uptake of such guidelines and work with the farming sector to improve it. In addition, under the rural development Plan, NRW and WG are examining the introduction of additional farm payments specifically aimed at addressing problems of dealing with the adequate storage of slurry and waste water storage arising at the farmstead, particularly that from stock over wintered there.

Our Top Three Actions.

- 1) Expand the “Rivers Walks” programme within failing WFD water bodies to build up a comprehensive evidence base of the risks posed to watercourses from livestock management.
- 2) Review lessons learned from work elsewhere in the UK on assessing the effectiveness of established measures to counter diffuse pollution from agriculture. Use the evidence to inform thinking on how to incentivise their take up by Welsh farmers.
- 3) Work with farming unions and third sector organisations to create showcase farms where the construction and maintenance of counter measures could be viewed by visiting farmers, e.g. effective and simple methods to buffer contaminated flows using blind ditches and constructed wetlands.

Measures of Success

We will know that we have progressed in tackling this issue when:

- 1) Surveys indicate that a greater number of farmers are incorporating methods to exclude stock from watercourses as part of their stock management.
- 2) There is a reduction in the number of WFD water-bodies failing due to phosphate sourced from agricultural run-off.
- 3) River walk assessments find greater lengths of river corridors are healthy and not impacted by stock rearing.
- 4) The majority of farm visits glean information about the farm’s environmental performance.



Where livestock enters watercourses (left) bankside vegetation is poached, destabilising the bed and banks of rivers and streams, leading to loss of ecological value and increased soil loss through erosion. One solution is to introduce livestock bridges to control access and prevent entry to the watercourse (right).

6.6 Land Management

Issue

Agriculture and commercial forestry are our dominant land-uses covering 79% and 14% respectively of the area of Wales.

Impact

Inappropriate or outdated practices associated with agriculture and forestry can result in increased levels of sediment, acidity, metals, nutrients, herbicides and pesticides entering ground and surface water. These pollutants harm in-stream insects, fish and plants and can also affect the treatment costs of drinking water.

Solution

We need to improve and sustain the uptake of good practice guidelines and ensure a greater appreciation of the eco-system services provided by a more diverse and natural environment.

We will assess ways to improve the adoption of best practices, this with partners such as DCWW, farming unions, farmers and forestry contractors. We will use WFD classification data and associated Reasons for Failure assessments, to target pilot studies on the water-bodies worst affected by these activities. These studies will identify how best to deliver pollution prevention advice and improved enforcement. The pilot studies would also evaluate the impact and effectiveness of the measures on water quality. Catchment initiative work across six sites in Wales has already incorporated a community and partnership based approach to minimising impacts from various local land management impacts.

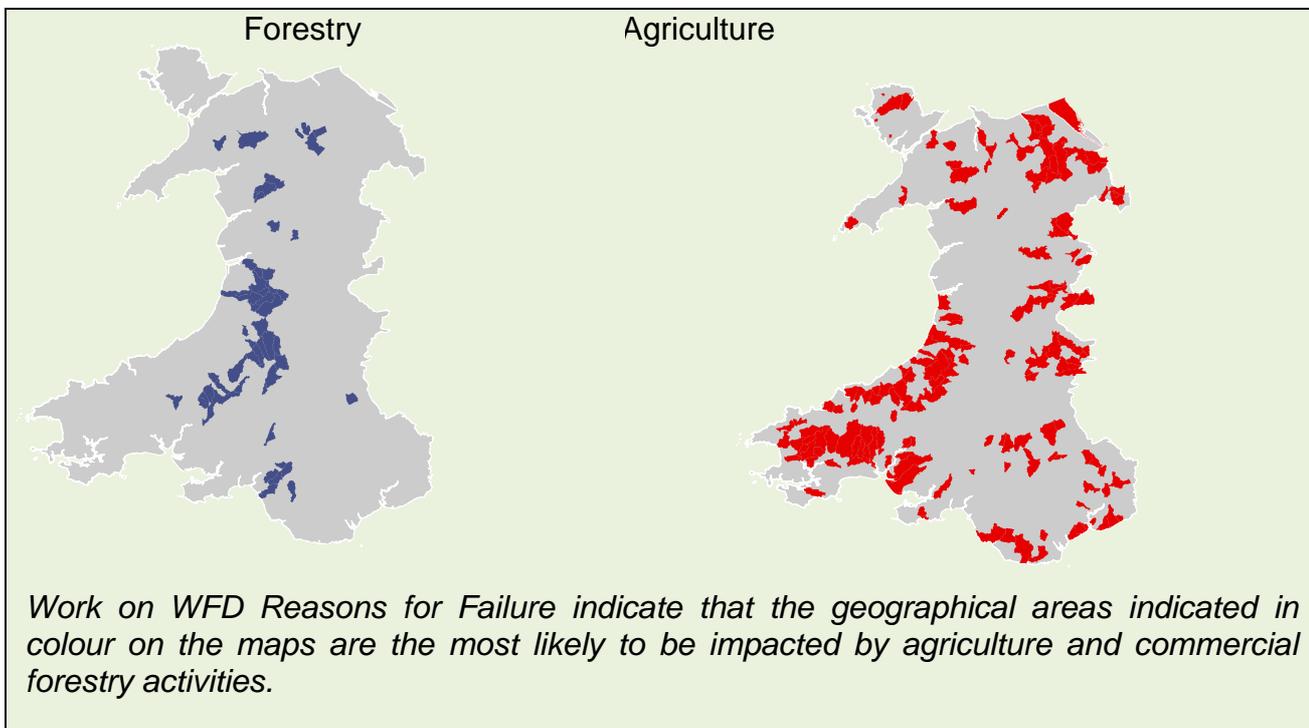
Our Top Three Actions.

- 1) Work with the farming unions and third sector organisations to review and promote greater awareness and adoption of the Welsh Code of Good Agricultural Practice.
- 2) Work to ensure that the Glastir Payment system delivers for the environment, in particular, monitor the Glastir Advanced part of the scheme by routinely noting related work during farm visits.
- 3) We will implement an action plan to adopt best practices, as detailed in the 5th edition of the “Forest and Water Guidelines (2011)” and the recent (2013) “Managing Forests in Acid Sensitive Catchments – an implementation guide for Wales”, this across the Welsh Government Woodlands Estate. We will look to increase the adoption of best practice across the forestry sector as a whole by engaging with forest owners, managers and contractors, developing training and through conditions in Glastir woodland management grants.

Measuring Success

We will know that we have progressed in tackling this issue when:

- 1) Surveys indicate that a greater number of farmers are incorporating soil nutrient content assessment as part of their land management.
- 2) There is a reduction in the number of WFD water-bodies failing due to phosphate sourced from agricultural run-off.
- 3) Forestry contractors routinely produce site specific pollution prevention plans for their operations.
- 4) River walk assessments find greater lengths of river corridors are healthy and not impacted by agricultural land and/or forestry management.



6.7 Storage of Fuel, Oil and Chemicals

Issue

Oil and fuel pollution continues to be one of the most common and serious causes of water pollution in Wales. Regulations setting minimum standards for storage were introduced in England in 2001, where there has been a significant reduction in the number of such incidents. We want to explore the introduction of similar regulations for Wales.

Whilst there are far fewer sites where chemicals are stored, and proportionately fewer pollution incidents reported, we propose to seek improved uptake of existing pollution prevention guidance to reduce the risk of pollution.

Impact

Oil is a highly visible pollutant that affects the water environment in a number of ways. It can reduce levels of dissolved oxygen and taint drinking water supplies from both surface and groundwater even at very low concentrations, making them unsuitable for use.

Fuel and oil can harm wildlife with wildfowl being particularly vulnerable, both through damage to the waterproofing of their plumage and through ingestion of oil during preening. Mammals such as water voles may also be affected. The flesh of fish exposed to oil can become tainted.

The impact of leaking chemicals can be similar to that of oil. However, in many cases the chemicals are not noticeable without detailed chemical analysis of samples and consequently their presence is difficult to confirm. As well as contaminating drinking water, chemicals can have direct toxic impacts on plants and animals and can be bio-accumulated in the food chain.

Solutions

Ensuring improved management of storage facilities is critical to reducing the number of spills and leaks that occur. This will be done through education and awareness raising so that improvements are made on a voluntary basis. Where such measures do not prove to be effective then firmer legal action remains an option.

Our Top Three Actions.

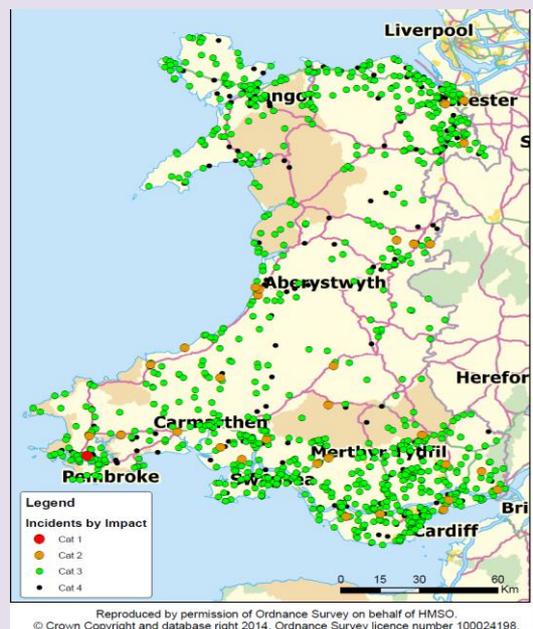
- 1) Raise awareness on the methods of site protection and reducing the impact of spills. Look to introduce initiatives that increase the uptake of guidance and reduce the number of incidents.
- 2) Review the current evidence to help promote the introduction of Fuel and Oil Storage Regulations in Wales.
- 3) Where we identify persistent bad practices and non-adherence to guidance, undertake proactive enforcement against those contravening legislation.

Measuring Success

We will know that we have progressed in tackling this issue when:

- 1) Natural Resources Wales incident records indicate a significant reduction in those caused by the storage of chemicals, fuel and oils.
- 2) Site inspections record a higher use of appropriate storage systems.
- 3) Random surveys indicate that the majority of storage site operators are both aware of and are employing appropriate storage systems.

There are numerous reports each year of pollution incidents involving oil and fuel. The map shows the reported incidents in Wales since 2009 in each incident category, with Cat 1 being the most serious and Cat 4 the least.



Poor fuel storage practices such as un-banded oil cans can lead to leakage and subsequent reports of pollution.

6.8 Mine and Quarry Waters

Issue

Wales has a very long history of mining and quarrying for construction material, metals and coal. A large number of these activities have now ceased, however, rainfall, surface and ground water still flows through the abandoned workings.

Areas notably affected by metal mines in Wales are Cwm Rheidol and Cwm Ystwyth in mid West Wales, the Parys (copper) Mountain on Anglesey and the river Twymyn, tributary of the Dyfi, in mid Wales. Traditional salmon and sea trout fishing rivers such as the Mawddach, Glaslyn and Conwy also have significant stretches affected by elevated metal concentrations. Blaenau Ffestiniog, Bethesda and Llanberis have large areas of both active and closed slate quarrying. Extensive coal mining areas exist across South Wales from Pembrokeshire to Monmouthshire and in North East Wales.

Impact

Drainage of these workings can leach out metals and minerals making many of the discharges acidic. This polluted drainage can have severe environmental impacts. Perhaps the most striking is the orange staining of watercourses caused by oxidised iron. In contrast, some mine and quarry discharges and downstream water courses can be crystal clear. This is where the toxicity of the mixture of metals present is such that there is no visible in-stream life and no algae or plankton in the water column to impair visibility.

Solutions

Mine water remediation can involve treatment of point-source discharges or interventions to separate clean surface water from contaminated mine waste or underground workings. Treatment can be achieved using active or passive technology, but the latter is likely to be cheaper and more sustainable in the long term. Soluble metals such as zinc and cadmium are, however, relatively difficult to remove in such systems; therefore large scale systems with long residence times may be required to achieve adequate treatment.

Our Top Three Actions.

- 1) Seek additional resources to deliver remediation at priority sites.
- 2) Continue to identify best practice and develop innovative solutions.
- 3) Monitor recovery of sites and promote results.

Measuring Success

We will know that we have progressed in tackling this issue when:

- 1) Monitoring indicates that the numbers of WFD failures attributed to metal contamination are decreasing.
- 2) Maintenance of essential mine water treatment systems are on a sustained footing.
- 3) Researchers successfully implement sustainable low energy (passive) solutions for mine water treatment.

Case Study:

Metal Mines Project in Wales

This project produced a list of the top 50 mines in Wales. With partners, such as the Welsh Government, local authorities and landowners, work has been targeted at remediating three of the most polluting mining areas. This involves diverting surface water away from the mines, capping associated waste tips and, where feasible, installing treatment systems to reduce the metal content and acidity of the main discharges.

Recent successes include the installation of pilot-scale mine-water treatment systems at Cwm Rheidol and Parys Mountain. The former site uses a unique combination of manure and cockle shells to aid in the precipitation and removal of the metals from the mine water. To date, this passive treatment system has successfully removed up to 99% of the zinc, lead and cadmium in the Cwm Rheidol mine water, however, this system would need to be built on a much larger scale to deliver significant benefits to the ecology of the Afon Rheidol downstream and increased compliance with WFD.



7. Appendices

APPENDIX A : Plan development , current work, proposed tasks to take it forward, and reporting.

Background:

From the initial assessments of compliance with the EU Water Framework Directive (WFD) in 2006/7, it was clear that the picture in Wales would look different (not as good) to that indicated by the legacy directives and the previously used UK General Quality Assessment methods. Related discussions with Welsh Government (WG) highlighted that a variety of causes and sources of diffuse water pollution was likely to be a significant obstacle to achieving and sustaining WFD Good Ecological Status (GES) for water-bodies.

Associated with this, the Welsh Assembly Government's Environment Strategy for Wales noted the need for diffuse pollution to be better understood and that action is taken to reduce and manage it. In light of this and the concern over the extent of water bodies in Wales affected by diffuse pollution, the Minister's remit letter to the Environment Agency Wales (EAW), 2009/10, included a request to "develop a strategic Water Quality plan to deliver diffuse pollution measures to address key environmental objectives in time for the second cycle (2105-2021) of the river basin management plans".

History:

In 2010, the Environment Agency Wales (EAW) proposed a strategy for tackling diffuse pollution and, following discussion with WG, produced a more specific action based plan to deal with perceived priority causes and sources. A document detailing comprehensive reasons for more than 90 ongoing and proposed actions was considered by lead partners in 2011. Those consulted included; the Fisheries, Environment & Recreation Advisory Committee (FERAC), the Environment Protection Advisory Committee (EPAC), WG's Water Division and all three of Wales' WFD River Basin Panels.

Comments received, and debate on existing and proposed counter measures focused on:

- Continued delivery of actions on the ground was important, however;
- We need to review the effectiveness of both current and past work.
- Develop evidence based best practices.
- Provide evidence of the current harm as well as the benefits of change.
- Use the evidence to persuade business, organisations and people to behave and operate differently.
- Develop incentives as well as using regulation as appropriate.

Current Work (2013/14):

The consultation has resulted in the production of a plan that concentrates on summarising the problems, including case studies, as well as highlighting eight current

and historic business and land uses causing diffuse pollution. Three high level priority outcomes are suggested for each activity or impact (e.g. historic mining). It is anticipated that debate with various partners to deliver solutions will lead to the generation of a number of specific actions and tasks by applying the cyclical process to Define the issues -> Design solutions -> Resource the work -> Implement actions -> Monitor & Review the completed tasks -> Communicate the results and conclusions . See worked example in Appendix D.

What needs to happen now (2013/14) to take the plan forward.

The plan has identified 8 Priority Areas:

- industrial estates,
- small sewage discharges (private),
- drainage misconnections,
- surface water drainage from developed areas,
- livestock management,
- land management,
- storage – slurry, fuel, oils, chemicals,
- mine waters.

Natural Resources Wales are re-assessing, via discussions with Area teams and using their WFD Area Environment Planning Tool (AEP), what associated work is already underway and any results. From this, NRW will engage likely lead partners in the cyclical process described above to identify additional or complementary actions.

Reporting Arrangements.

The overall driver for the diffuse water pollution effort is the EU Water Framework Directive. NRW will report on WFD compliance (classification of water-bodies) to the EU via DEFRA.

Internally, we regularly monitor progress with Area delivery of WFD Reasons for Failure work as well as the completion and results of associated projects.

As lead partner tasks on diffuse water pollution are progressed, we will note achievement of milestones and progress with intended outcomes and communicate successes more widely, as appropriate.

APPENDIX B: How the plan fits with our 2013/14 Business Plan.

NRW Business Plan Priorities.	Contribution the Diffuse Water Pollution Plan will make.
<p>Environmental Resilience</p> <ul style="list-style-type: none"> • Quality of land and water that we manage or influence. • Strong biodiversity. 	<ul style="list-style-type: none"> • The key outcome of the plan will be the delivery of improved water quality throughout Wales and the benefits that will bring to ecology and to drinking water supplies. • Changes to Land Management practices (e.g. changes to upland grazing and drainage, river corridor buffer zones) will also help counter the impact of climate change on rainfall patterns and strengthen biodiversity.
<p>Environmental Quality</p> <ul style="list-style-type: none"> • People experience high quality environment • Businesses are compliant with regulations. • Land managed to best practice standards 	<ul style="list-style-type: none"> • Tackling sources of diffuse pollution at Industrial Estates and in urban areas generally, will improve peoples' local environment. Encouraging the creation of extra urban green spaces to absorb and filter surface water that would otherwise run to and add to overloading of foul sewers. • Increased awareness for those that are causing problems. Subsequent voluntary action or response to regulation to improve compliance and practices. • Provision of evidence of harm caused by historic practices and updated guidance to improve.
<p>Jobs and Enterprise</p> <ul style="list-style-type: none"> • Provide clear, timely advice to business. • Manage our own and influence the assets of others to benefit tourism. 	<ul style="list-style-type: none"> • Provision of evidence of the financial benefits of changes in practices. Review and draft updated guidance on best practice as appropriate. • We will ensure adoption of best practices for our own activities, particularly, forest management. The plan will pursue better management of drainage and private sewage disposal systems, thus leading to reduced discharges of misconnected or poorly treated waste into recreational areas.

<p>Flood Risk and Incident Management</p> <ul style="list-style-type: none"> • Delivering and developing innovative flood risk management solutions, including improved land-use management and working with communities. 	<ul style="list-style-type: none"> • Many of the land management actions will contribute to the retention of water and reduction of water-course erosion, thus contributing to the protection of properties from flooding. • Tackling causes of Eutrophication that can lead to excessive plant growth which increases flood risk by reducing channel flow and by blocking culverts and screens. • Work to counter problems caused by poorly managed sewer networks that can lead to sewer flooding of highways and properties. • Creation of extra urban green spaces to absorb and filter surface water that would otherwise run to and add to overloading of foul sewers.
<p>Health and Well Being and Community Involvement</p> <ul style="list-style-type: none"> • Encourage community groups and individuals to get involved in helping to manage our natural resources. 	<ul style="list-style-type: none"> • From previous experience that sustained improvements are best attained by involving communities, the plan will pursue this approach in its solution designs.
<p>Understanding our Impact</p> <ul style="list-style-type: none"> • Provide compelling evidence to ensure that we and others make informed decisions to protect the environment. • We work with others to achieve the above. • We make our contribution to delivery of EU objectives. 	<ul style="list-style-type: none"> • Convincing people that their actions are causing an ‘invisible’ pollution risk, with solutions possibly adding to their operating costs, will require unequivocal evidence. Such evidence is not absolute for all the sectors or risks we have identified in the plan and is one of our primary challenges. • Involving business and communities in gathering and interpreting evidence is a crucial stage in gaining buy-in to the problem and the solution. • Due to the impacts of diffuse water pollution, we are currently at risk of failing to meet the requirements of various EU Directives. (e.g. Habitats, Water Framework, Bathing Water, Shellfish Water)

APPENDIX C: What are the key diffuse pollutants in Wales and their impacts?

The following table provides a brief summary of the key types of pollutant in Wales and some of their impacts. This list is not exhaustive.

Pollutant	Example Sources	Environmental Impact
Nitrogen	Fertilisers, Atmospheric deposits	Nutrient enrichment (eutrophication) of water-bodies. Acidification.
Phosphorus	Fertilisers, urban runoff, poorly managed private sewage treatment systems, sewage discharges. Household detergents and washing powders.	Eutrophication of water. Loss of ecological value and amenity use.
Herbicides/Pesticides	Weed and insect control chemicals, sheep dips.	Toxicity to flora and fauna. Contamination of potable water supplies.
Sediment	Run off from arable land. Erosion. Forestry drainage (particularly during clear-felling).	Loss of riverine habitat, sedimentation of spawning areas. Increased costs to abstractors.
Organic wastes	Agricultural wastes (slurry, silage liquor), food production (abattoirs, creameries) and sewage wastes.	Oxygen demand and nutrient enrichment.
Faecal Pathogens	Organic waste applied to farmland, leaking pipes/ misconnected sewage systems.	Health risks. Loss of amenity and economic benefit to areas dependent on water recreation.
Trace Metals	Urban runoff. Industrial and sewage sludge.	Toxicity in both short and long term (bioaccumulation) within the food chain.
Acidifying pollutants	Burning of fossil fuels (eg. Power stations, car emissions).	Reduced pH, acid rain. Loss of ecological value.
Chemicals	Industrial run-off from factory sites. Domestic surface water drainage.	Toxicity. Contamination of potable supplies.