

River Basin Catchment Summary



Dee

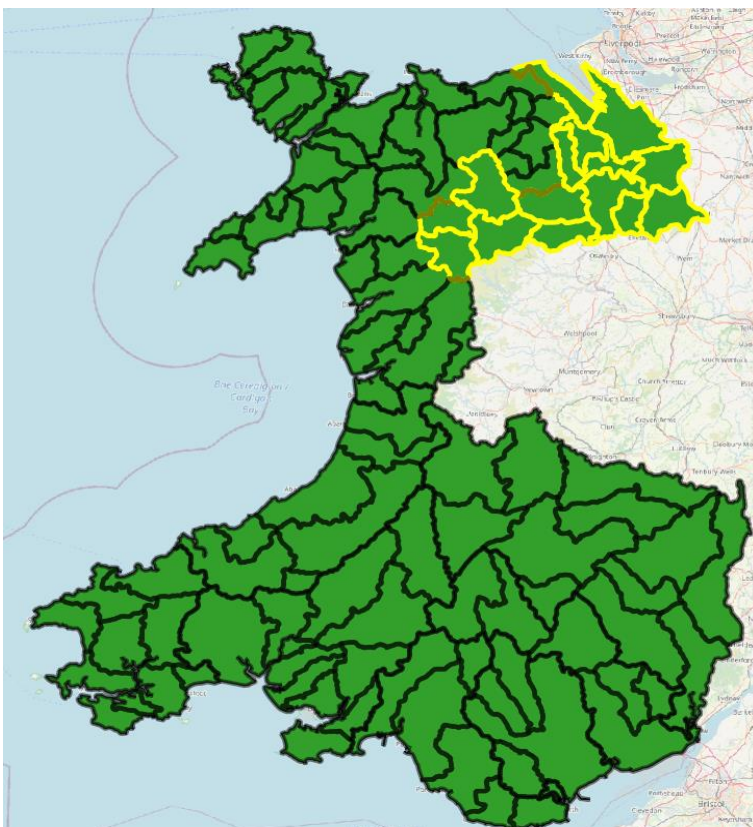
1.0 Introduction

This Drainage and Wastewater Management Plan (DWMP) sets out how Dŵr Cymru Welsh Water (DCWW) will manage and improve its assets to maintain a resilient and robust wastewater drainage system. The plan aims to manage flooding and pollution from our wastewater assets in the future, for our customers and our environment.

1.1 Catchment Information

Dee (see Figure 1 below) consists of 112 wastewater catchments with a total population of 538752. There is a total sewer length of 3340km, where 1233km is associated to the foul system, 771km is associated to the surface water system and 1301km is associated to the combined system. There are 112 Wastewater Treatment Works (WwTW), 537 Sewerage Pumping Stations (SPSs), and 358 Combined Storm Overflows (CSOs) across this river basin catchment level.

The main river in the Dee catchment is the River Dee, which stretches from the Snowdonia National Park to the Dee Estuary. The River Dee flows through the counties of Gwynedd, Conwy, Denbighshire, Wrexham, Flintshire and Cheshire.



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Figure 1 - River basin location detailing the associated tactical planning catchments

2.0 Stakeholder Engagement

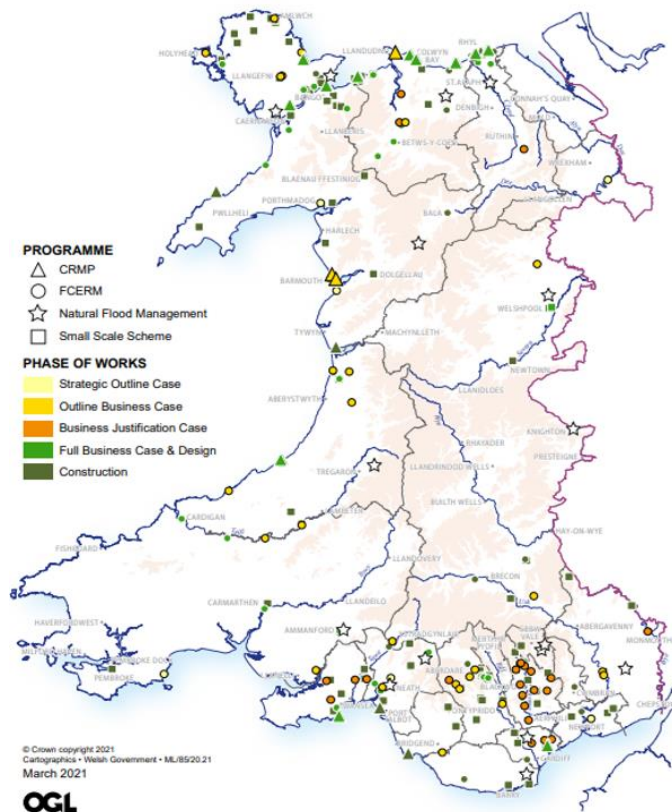
The DWMP aims to enable DCWW to work collaboratively with stakeholders, regulators and local authorities to tackle current and future challenges. DCWW has identified stakeholder objectives that align with the aims of the DWMP and goals of other management plans. Table 1 details the main opportunities we have identified but this is not intended to be exhaustive. Note that these stakeholders have their own planning processes and plans which do not necessarily align with those of DCWW.

Table 1 - Stakeholder opportunity partnerships

Plans	Stakeholder Engagement	Responsible Bodies/Primary Stakeholder
Local Management Plans	Natural Resources Wales (NRW) Dee Management Catchment Strategy: (https://naturalresources.wales/media/3225/dee-management-catchment.pdf)	Natural Resources Wales Environment Agency Local partnerships
Flood Risk Management Plans (FRMP)	The Dee Flood Risk Management Plan is located online at https://cdn.cyfoethnaturiol.cymru/media/685901/lit-10199_dee_frmf.pdf?mode=pad&rnd=131751684520000000 . The report highlights risk of flooding from the Dee, which particularly impacts urban areas such as Wrexham, Mold and Chester. There is also risk of flooding from the sea due to high tides and storm surges which particularly impacts communities along the coast and downstream tributaries.	Welsh Government Water companies Coastal Groups (local authority led) Natural Resources Wales Environment Agency Lead local flood authorities
Shoreline Management Plans (SMP)	The Dee catchment is covered by SMP 22 – The Great Orme. Further information can be found here https://www.mycoastline.org.uk/shoreline-management-plans/	Coastal Groups (local authority led) County councils Lead local flood authorities
River Basin Management Plan (RBMP)	River Basin Management Plans (RBMPs) set out how a combination of organisations and parties work together to improve water quality and environment within a catchment under the Water Framework Directive (WFD). The Dee catchment comes under the Dee RBMP, which can be found here: https://cdn.cyfoethnaturiol.cymru/media/685098/deerbdsummary.pdf	Water companies Coastal Groups (local authority led) Natural Resources Wales Welsh Government Environment Agency Defra
Flood and Coastal Erosion Risk Management Programme (FCERM)	There is opportunity to work with other strategically outlined FCERM schemes planned in the region from 2021 to 2022, as shown in Figure 2.	Coastal Groups (local authority led) Natural Resources Wales Welsh Government Environment Agency Defra
Local Development Plans (LDPs)	The latest local development plans have been incorporated into the plan and future iterations of LDPs will be amended into the DWMP in future cycles.	Local Councils
Other Stakeholders and Non-governmental Organisation (NGOs)	There are a range of other stakeholders of varying interests regarding water in this region including national charities and organisations, as well as local conservation groups for wild swimming and angling (see right).	North Wales Wildlife Trust Welsh Dee Trust River Dee Trust Prince Albert Angling Society

WALES

FLOOD AND COASTAL CAPITAL INVESTMENT 2021-22



Data is available from: <https://gov.wales/flood-and-coastal-erosion-risk-management-programme-2022-2023>

Figure 2 - Flood and Coastal Investment overview

3.0 Risk

We have assessed our likely performance from now to 2050 against the objectives that we set in our most recent business plan. The results of this assessment are presented in the following sections.

To understand future performance, we need to estimate how much population will change by, the degree to which climate change will impact Wales and areas of England that boarder our company, and how further surface water connected to the sewer network might increase the amount and rate at which rainfall drains into our sewers.

Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

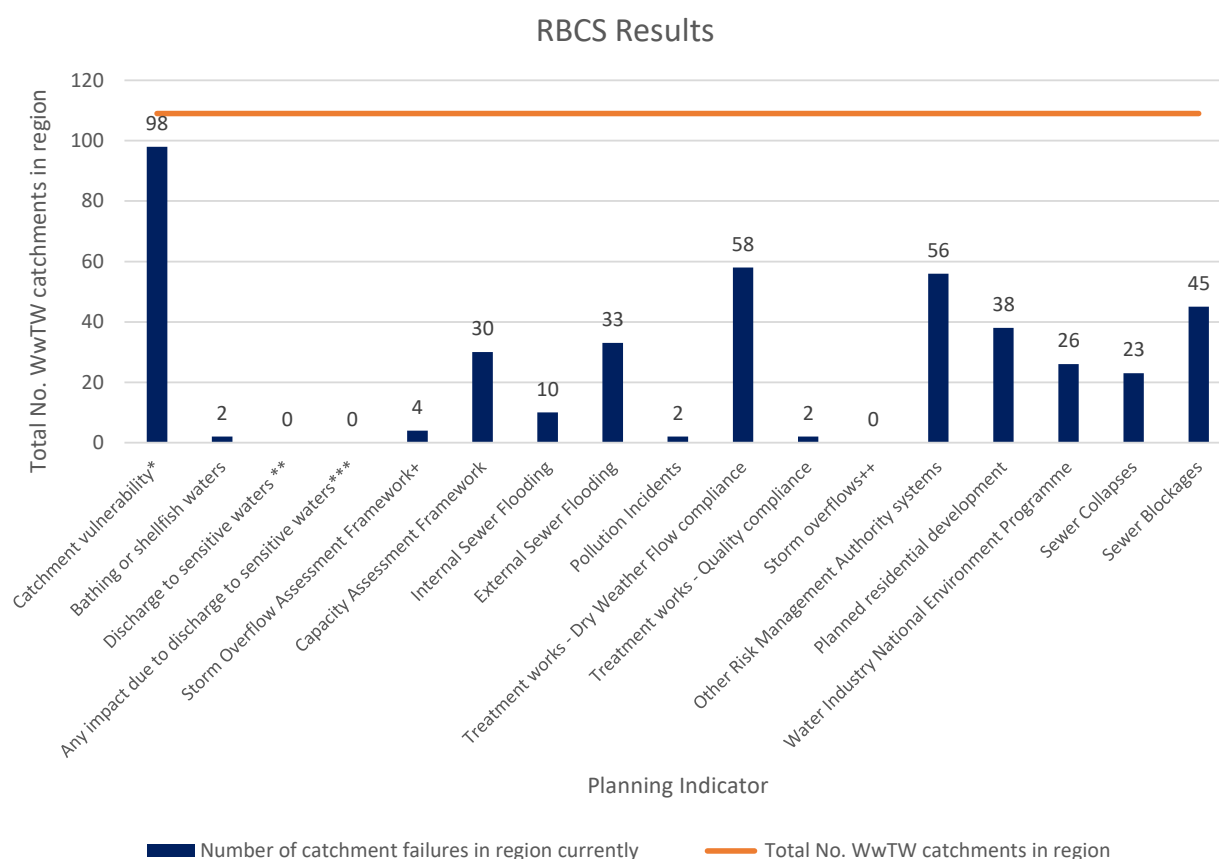
The population in the Dee region is set to decrease to 458700 by 2050, a change of -15% based on our future projections. However there are major developments in localised areas that will contribute to future pressures on the network, including St Martins (near Wrexham) - adjacent to school and Whitchurch - Mount Farm.

Climate change is predicted to increase the intensity of storms by around 35% in this region. In a typical year, winters are likely to be warmer and wetter, and summers generally drier. More intense rainfall will happen more frequently.

3.1 Risk Based Catchment Screening

The Risk Based Catchment Screening (RBCS) is the initial screening process to determine if a more detailed risk assessment is required. The assessment screens catchments against planning indicators which have been stipulated in the national guidance for DWMPs. A catchment will pass through to a more detailed risk assessment if it fails against one or more of these indicators, the results are shown in Figure 3.

For the Dee catchment the biggest concerns indicated by the RBCS are catchment characterisation (based on a vulnerability assessment of flooding due to local characteristics e.g. topography), Wastewater Treatment Works compliance in dry weather and other RMA systems (risk of interaction between other drainage systems).



* To sewer flooding due to extreme wet weather events.

** Categorised as a "planned" scheduled action within the Natural Resources Wales Action Database or considered as "Remedy" on Natural England Designated Sites system.

*** Categorised as a "identified" scheduled action within the Natural Resources Wales Action Database or considered as "Threat" on Natural England Designated Sites system.

+ Frequency investigation triggered.

++Overflow risks not covered by other indicators.

Figure 3 - Risk Based Catchment Screening results

3.2 Baseline Risk And Vulnerability Assessment (BRAVA)

Following on from the RBCS, the Baseline Risk and Vulnerability Assessment (BRAVA) highlights current and future risk. The risk scores are driven by company targets which were set in our last business plan. These targets were subdivided according to population or sewer length, depending on the measure, to derive a target for each river basin catchment.

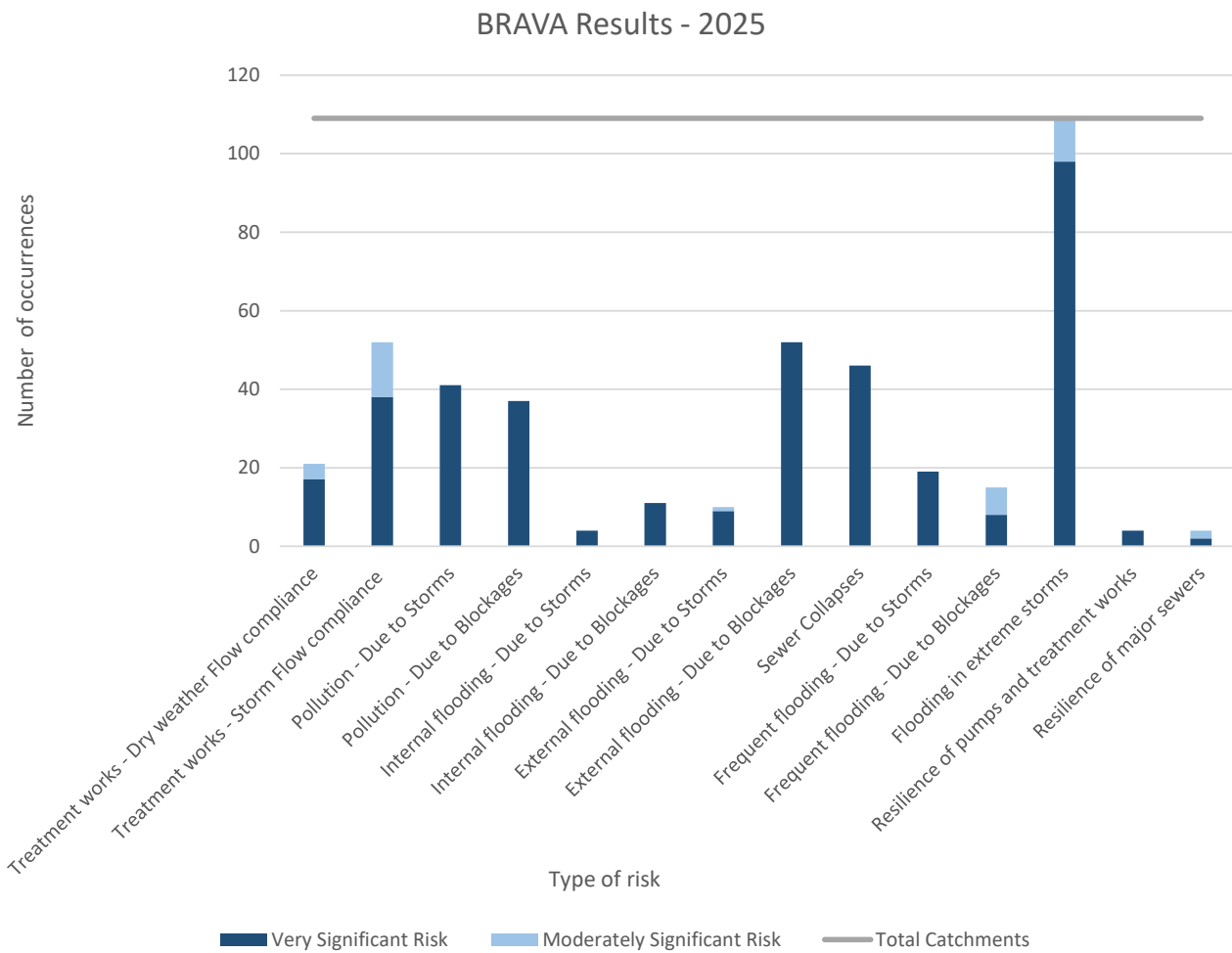


Figure 4 - BRAVA 2025 Summary

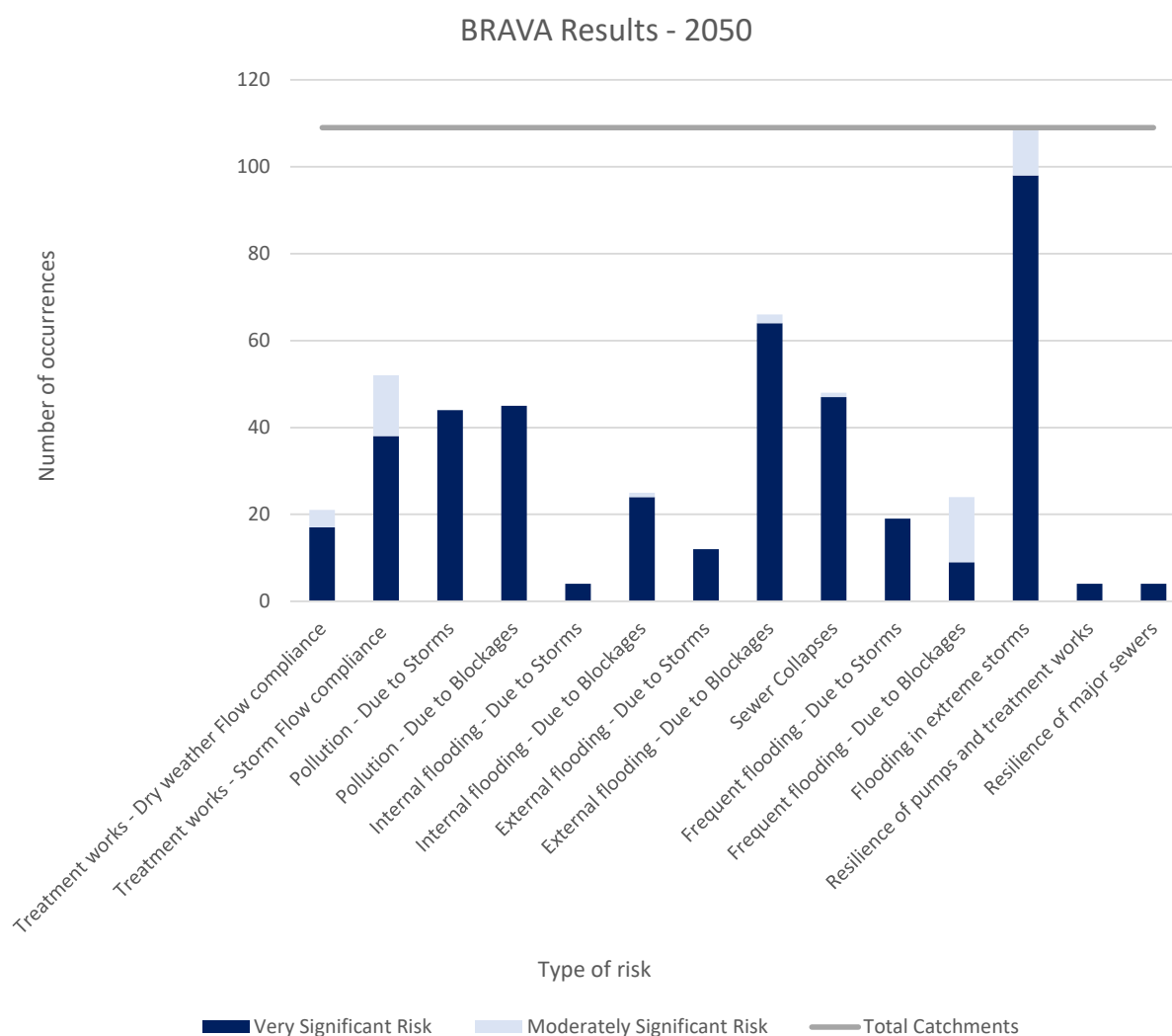


Figure 5 - BRAVA 2050 Summary

In both 2025 and 2050 risk of flooding in an extreme storm is the biggest concern in the Dee catchment, followed by external flooding caused by blockages.

Figures 6 and 7 indicate the current and predicted risk of flooding, pollution, and both flooding and pollution caused by lack of capacity (termed 'hydraulic overload') across our networks. These maps illustrate where the issues occur and can be used to target where we want to work with the community and stakeholders to resolve issues. By working together, we can combine knowledge and resources to deliver the best outcomes for local communities and the environment. We want to include your feedback in our decision-making process.

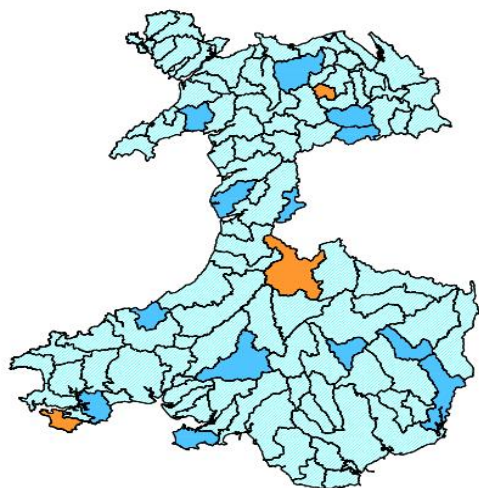
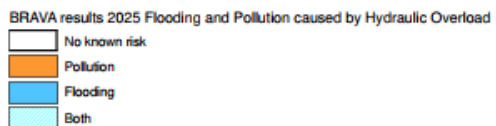


Figure 6 - Associated Strategic Planning Areas priority (2025)

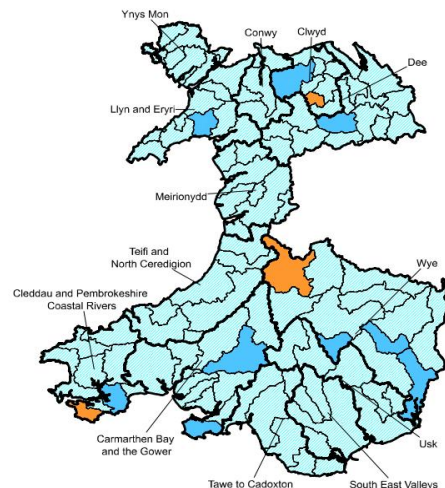
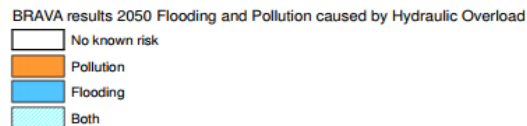


Figure 7 - Associated Strategic Planning Area priority (2050)

4.0 Supply Demand

Supply-demand is an assessment of the capacity of our treatment works. It approximately assesses whether all the treatment works in a region can collectively cope with current and future flows in dry weather. The suitability of the treatment works dry weather consents is tested against forecast future growth and changes in water consumption. This assesses the region's capacity, with no allowance for error, to treat the predicted changes in DWF in the future with no spare treatment works capacity.

Table 2 shows the supply-demand assessment for this region. Where a region may not have adequate capacity, it is flagged dark blue for further investigation. There may be local incapacity issues at individual treatment works within the region.

L2 Area	2025	2030	2035	2040	2045	2050
Dee						

Table 2 - Supply Demand Balance

5.0 Options

Over time the pressures on our sewerage network change due to influences such as catchment growth, creep of rainwater into the network, or influences such as climate change impacting rainfall patterns. To ensure the plan is robust over the 30-year planning horizon we have tested various types of schemes, and combination of schemes, to ensure a robust journey plan is delivered. Figure 8 shows the journey plan scheme types that are most likely to be beneficial in this region across the plan.

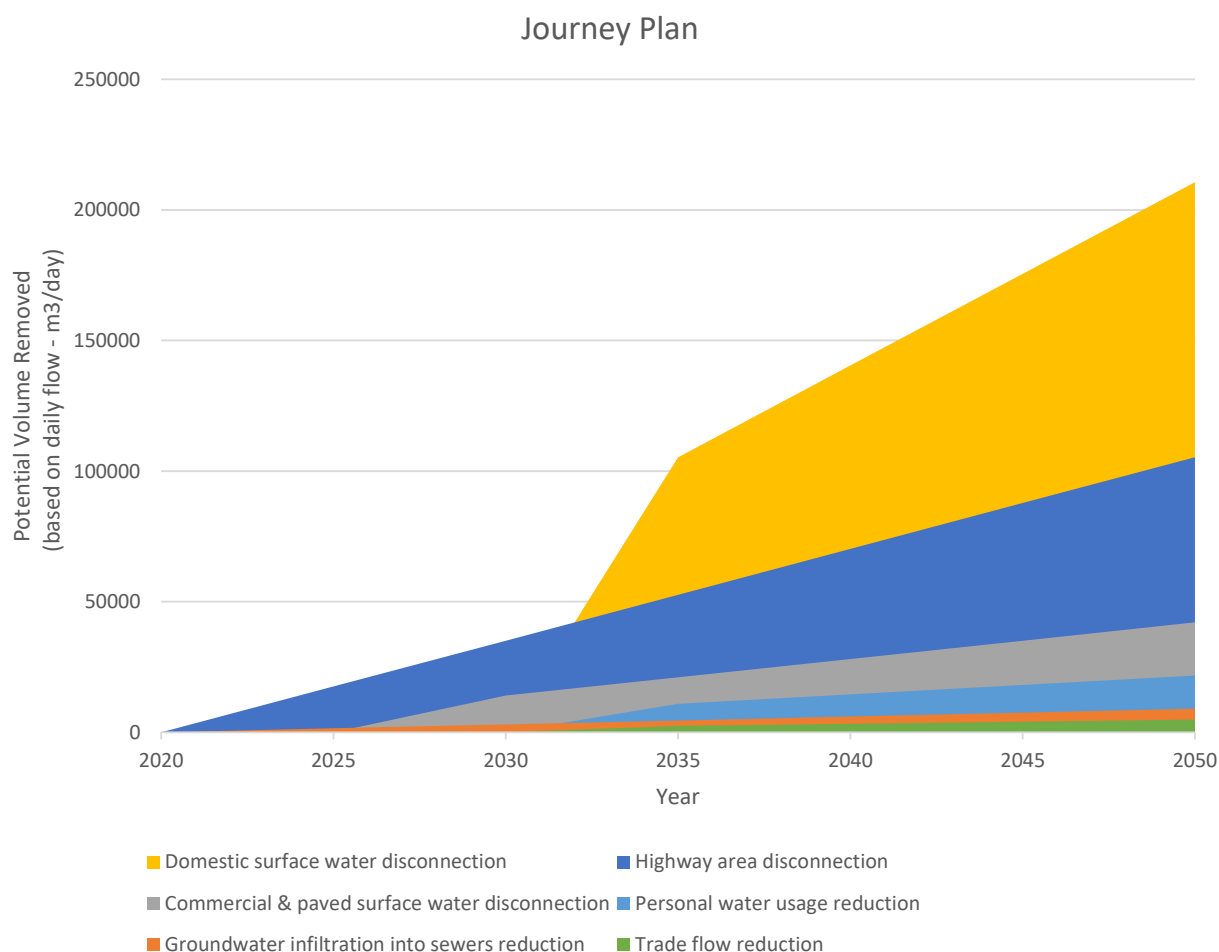


Figure 8 - Journey Plan

We have undertaken analysis to determine the likely costs to mitigate future predicted pollution and flooding. We assess combined sewer overflows based on the number of times they are predicted to spill in a 'typical year'. Table 3 illustrates both the size and cost of potential mitigation measures required to mitigate risk to varying standards. The assessment calculates the impact of rainfall and drainage contribution to the network relative to today's cost.

Mitigating the risk posed by flooding has been assessed in terms of the probability of occurrence, we use the size of a storm event that has the probability of occurring once every 30 years. Table 4 illustrates both the size and cost of potential mitigation measures to mitigate varying flood risk types. These have been assessed against a 'typical year' of rainfall.

The choice of scenarios for storm overflow mitigation in Table 3 is a separate cost and would be required in addition to the choice of scenarios for flooding protection in Table 4. The chosen scenarios for Storm overflows and flooding are to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain Existing Performance*	-	£178,000,000	£263,000,000
40 spills in a Typical Year	£49,000,000	£62,000,000	£66,000,000
20 spills in a Typical Year	£116,000,000	£127,000,000	£149,000,000
10 spills in a Typical Year	£186,000,000	£200,000,000	£223,000,000
0 spills in a Typical Year	£428,000,000	£468,000,000	£558,000,000
Equivalent No. Principality Stadiums Full of Water in 10 spills scenario	0.94	1.14	1.39

* Maintain is a considered scenario where we will continue to maintain the current level of service within the region and improve the network and address known and emerging risk.

Table 3 - Summary of Combined Sewer Overflow Option Investment Strategy Costs

Choice of Scenario	Current Scenario (£)	2050 Scenario (£)	2050 Resilience Scenario (£) 1 in 50 yr. (Storm Dennis)
Internal escapes	£75,000,000	£104,000,000	£96,000,000
External escapes in gardens	£112,000,000	£145,000,000	£141,000,000
Escapes in highways	£288,000,000	£361,000,000	£417,000,000
No future flooding	-	£403,000,000	£136,000,000
Total	£475,000,000	£1,013,000,000	£790,000,000

Table 4 - Summary of Flooding Option Investments Strategy Costs

Tables 3 and 4 are strategic cost indications to illustrate the level of investment needed to provide protection against drainage and network failure, pollution events and flooding, internal and external to properties. The solutions developed highlight the level of investment required to bring our entire network up to the level of protection required to be resilient for future risk and demands. The range of scenarios is to provide a choice for understanding and discussion of future direction.

We are beginning to break down the investment indicated in Table 3 and 4 by creating practical schemes ready for delivery these schemes are designed as 100% traditional, 100% sustainable or green and 100% mixture of the 2. These packages have then been analysed in terms of their long term benefit and environmental and social cost to society and one has been chosen for inclusion as our preferred best value option. The areas where we have started our delivery programme aims to provide protection, to our worst served customers and rivers designated as Special Areas of Conservation (SAC) under the Habitat Directive, as a priority against drainage and network failure which result in pollution events and flooding. The solutions developed highlight the level of investment required to bring our network to the level of protection required to mitigate against these risks.

More detailed information can be seen in the Level 3 reports. For more information on the methodology see the plan main report.

If you want to work with us to develop joint projects to reduce the risk of flooding and protect the environment, please get in touch.

We will continue to work with Welsh Government, Regulators and Local Authorities about the pace, scale and affordability of improvements to be made.

We will be consulting on the preferred approach to planning and once its concluded the next stage is to develop the pipeline of options to meet the pace scale and affordability discussed with Welsh Government and our regulators.

DWMP Tactical Planning Catchment Summary



Aldford Brook

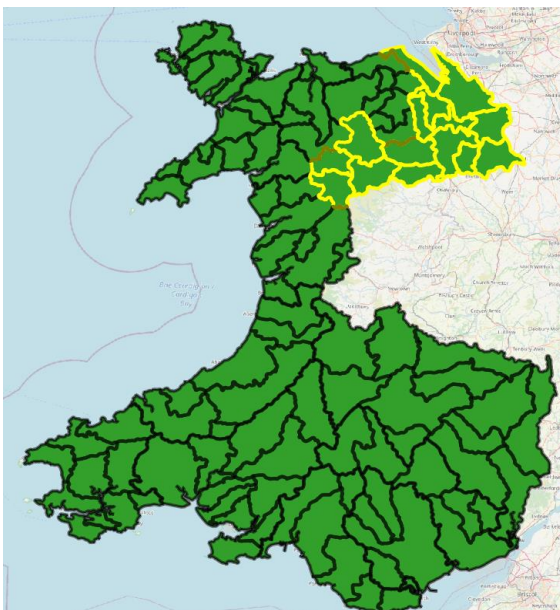
1.0 Introduction

This Drainage and Wastewater Management Plan (DWMP) sets out how Dŵr Cymru Welsh Water (DCWW) will manage and improve its assets to maintain a resilient and robust wastewater drainage system. The plan aims to manage flooding and pollution from our wastewater assets in the future, for our customers and our environment by working collaboratively with stakeholders, regulators and local authorities to provide a complete partnership in tackling current and future problems.

1.1 Catchment Information

The Aldford Brook planning catchment lies within the Dee river basin catchment, (see Figure 1 below), it consists of 16 wastewater catchments (see Figure 2 below). There is a combined population of 8962, this is set to increase to 10583 by 2050, a change of 18%. There is a total sewer length of 67km, with a foul sewer length of 19km, a surface water length of 15km and a combined sewer length of 32km. There are 16 Wastewater Treatment Works (WwTW), 17 Sewerage Pumping Stations (SPSs), and 12 Combined Storm Overflows (CSOs) across this tactical planning unit.

The Aldford Brook catchment stretches either side of the England Wales border. The River Dee runs through the centre of it. Tattenhall and Fardon are the major urban areas.



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Figure 1 - River basin location detailing the associated tactical planning catchments

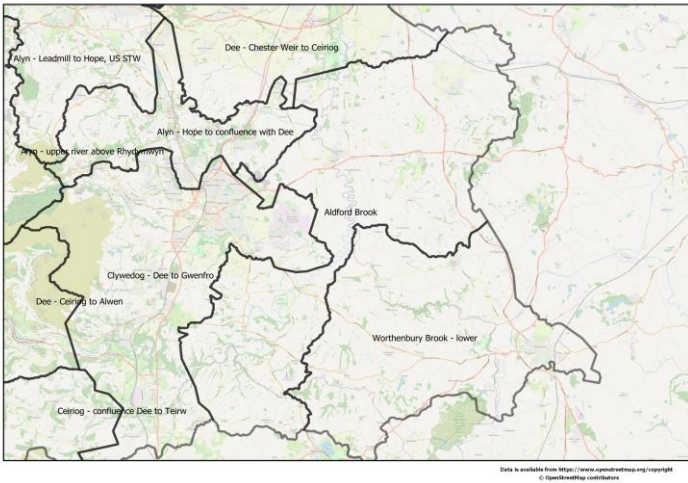


Figure 2- Tactical planning catchments

2.0 Stakeholder Engagement

The DWMP aims to enable DCWW to work collaboratively with stakeholders, regulators and local authorities to tackle current and future challenges. DCWW has identified stakeholder objectives that align with the aims of the DWMP and goals of other management plans. Table 1 details the main opportunities we have identified but this is not intended to be exhaustive. Note that these stakeholders have their own planning processes and plans which do not necessarily align with those of DCWW.

Scheme Information
Stakeholder engagement meetings are scheduled to commence in 2022. These meetings will be held between DCWW and the respective parties, such as NRW, EA, Councils and ENGO's. Further information of the outcome and points of focus towards short and long term strategy planning will be provided in the next cycle of the DWMP assessment.

Table 1 - Current and future investigation schemes

3.0 Risk

We have assessed our likely performance from now to 2050 against the objectives that we set in our most recent business plan. The results of this assessment are presented in the following sections.

To understand future performance, we need to estimate how much population will change by, the degree to which climate change will impact Wales and areas of England that border our company, and how further surface water connected to the sewer network might increase the amount and rate at which rainfall drains into our sewers.

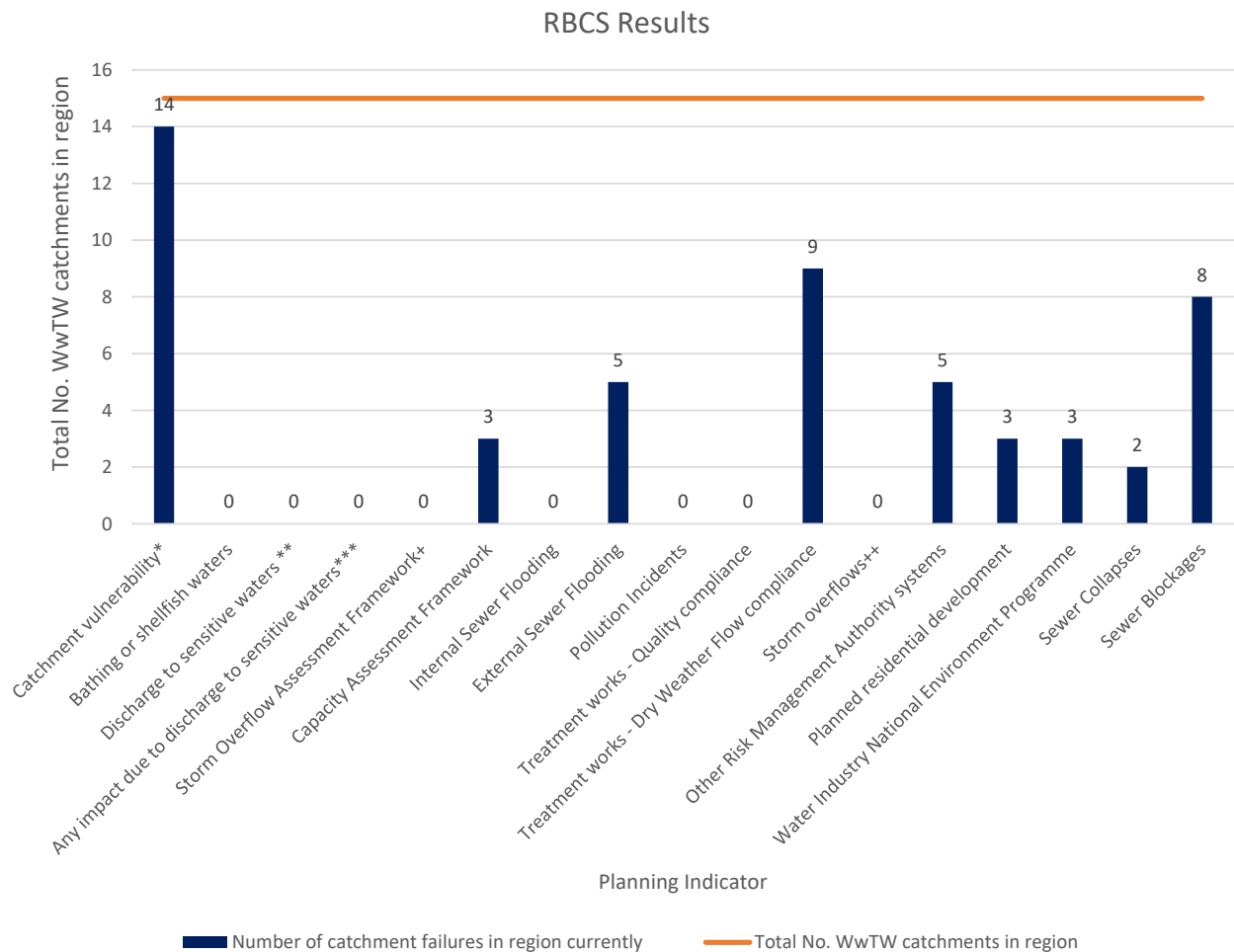
Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

Climate change is predicted to increase the intensity of storms by around 35% in this region. In a typical year, winters are likely to be warmer and wetter, and summers generally drier. More intense rainfall will happen more frequently. The population in the Dee region is set to increase to 10600 by 2050, a change of 18% based on our future projections. However there are major developments in localised areas that will contribute to future pressures on the network, including Dudleston Heath - Ravenscroft Haulage Site.

3.1 Risk Based Catchment Screening

The Risk Based Catchment Screening (RBCS) is the initial screening process to determine if a more detailed risk assessment is required. The assessment screens catchments against planning indicators which have been stipulated in the national guidance for DWMPs. A catchment will pass through to a more detailed risk assessment if it fails against one or more of these indicators, the results are shown in Figure 3.

For the Aldford Brook catchment the biggest concerns indicated by the RBCS are catchment characterisation (based on a vulnerability assessment of flooding due to local characteristics e.g. topography), Wastewater Treatment Works compliance in dry weather and sewer blockages.



*To sewer flooding due to extreme wet weather events.

**Categorised as a "planned" scheduled action within the Natural Resources Wales Action Database or considered as "Remedy" on Natural England Designated Sites system.

***Categorised as a "identified" scheduled action within the Natural Resources Wales Action Database or considered as "Threat" on Natural England Designated Sites system.

+Frequency investigation triggered.

++Overflow risks not covered by other indicators,

Figure 3 - Risk Based Catchment Screening results

3.2 Baseline Risk And Vulnerability Assessment (BRAVA)

Following on from the RBCS, the Baseline Risk and Vulnerability Assessment (BRAVA) highlights current and future risk. The risk scores are driven by company targets which were set in our last business plan. These targets were subdivided according to population or sewer length, depending on the measure, to derive a target for each river basin catchment.

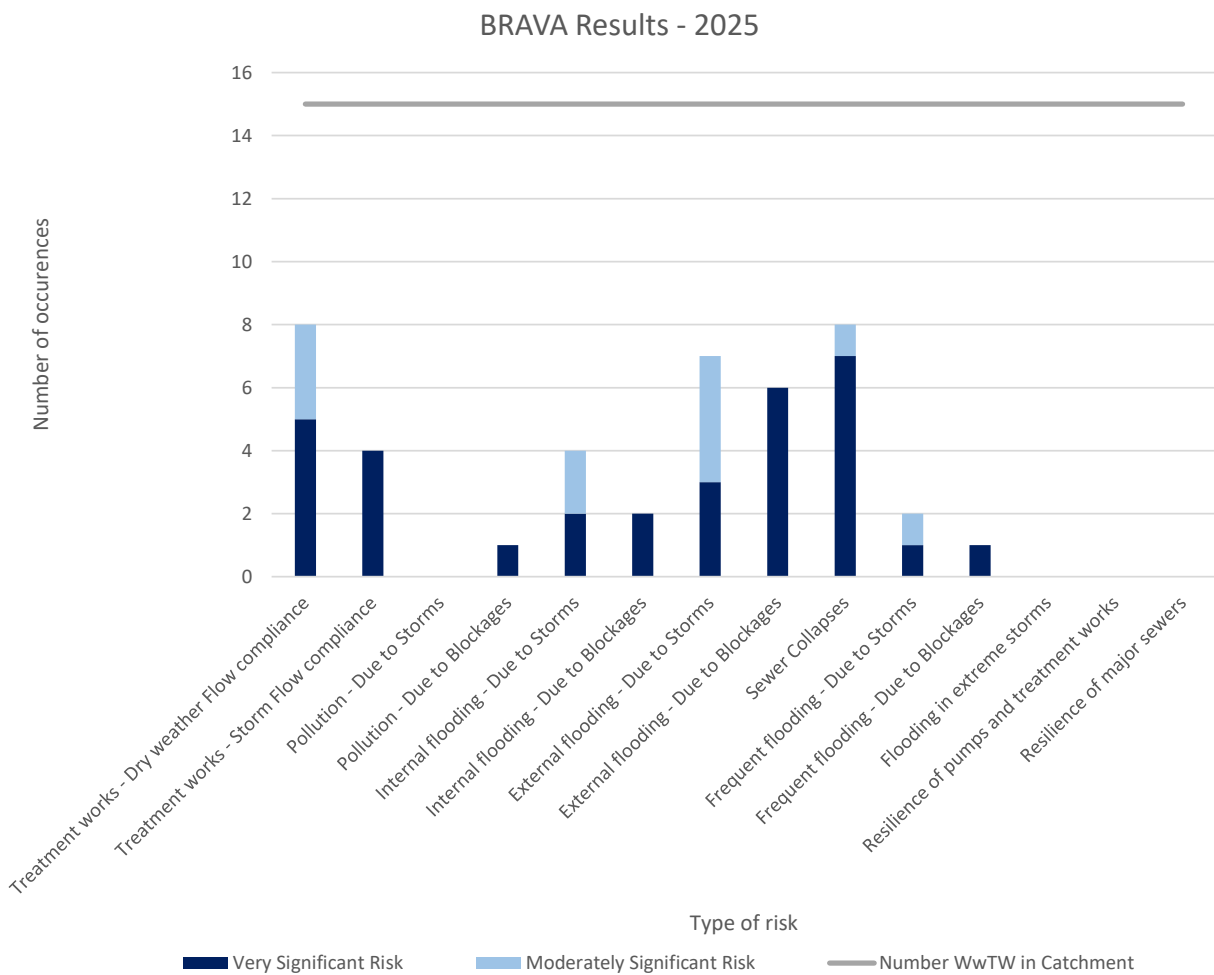


Figure 4 - BRAVA 2025 Summary

In 2025, dry weather compliance at Treatment works and sewer collapses are the biggest concerns in the Aldford Brook catchment.

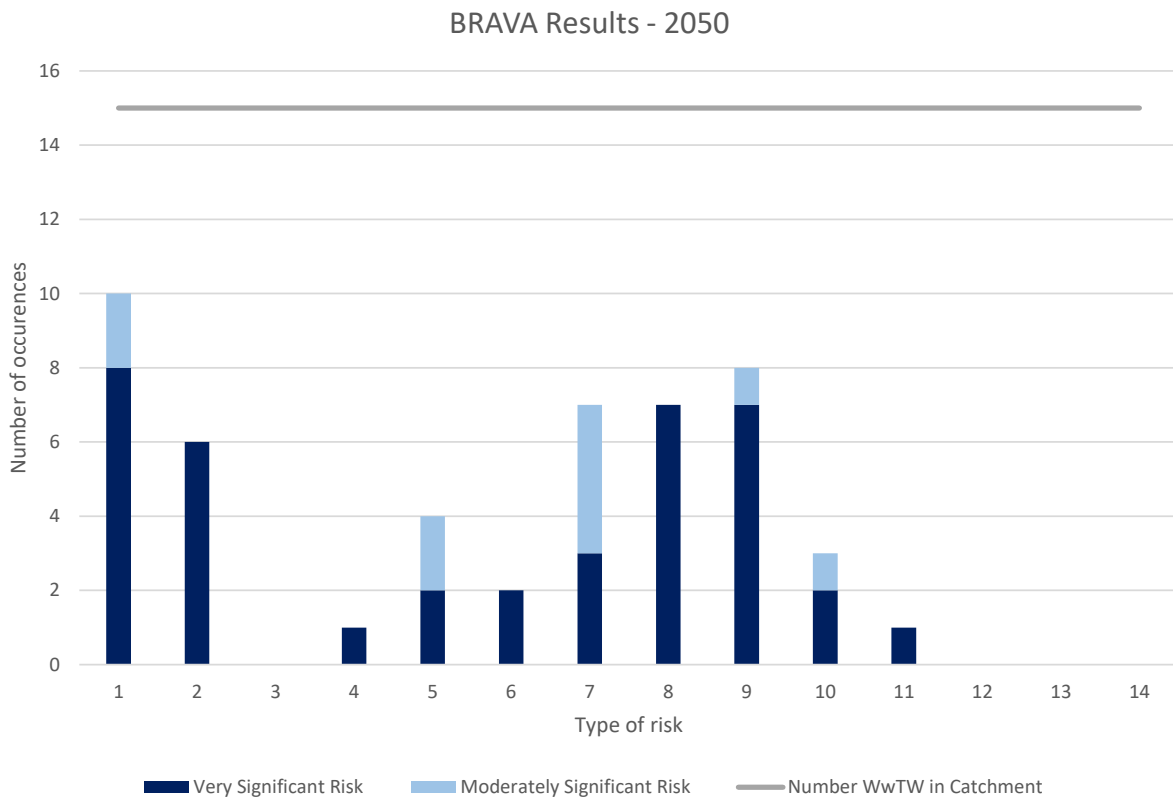


Figure 5 - BRAVA 2050 Summary

In 2050, dry weather compliance at Treatment works and sewer collapses are the biggest concern in the Aldford Brook catchment.

Figures 6 and 7 indicate the current and predicted risk of flooding, pollution, and both flooding and pollution caused by lack of capacity (termed 'hydraulic overload') across our networks. These maps illustrate where the issues occur and can be used to target where we want to work with the community and stakeholders to resolve issues. By working together, we can combine knowledge and resources to deliver the best outcomes for local communities and the environment. We want to include your feedback in our decision-making process.

BRAVA results 2025 Flooding and Pollution caused by Hydraulic Overload

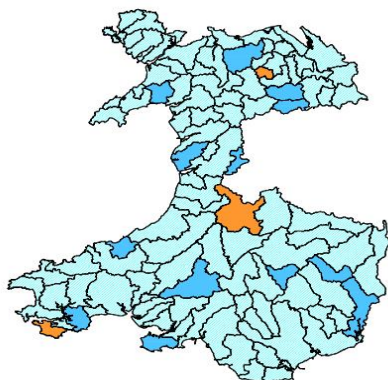
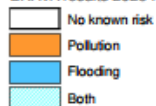


Figure 6 - Associated Strategic Planning Areas priority (2025)

BRAVA results 2050 Flooding and Pollution caused by Hydraulic Overload

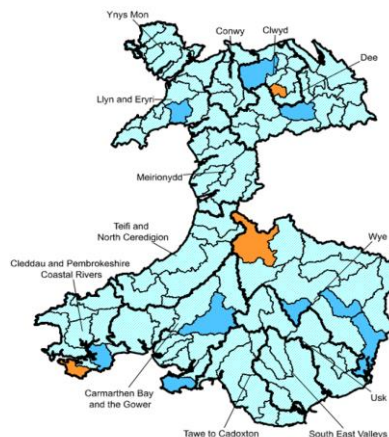
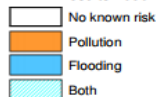


Figure 7 - Associated Strategic Planning Areas

3.3 Water Quality

Water quality is the classification of the quality of watercourses or water bodies in accordance to its physical, biological and chemical properties. Water quality is an important factor of environmental monitoring, ensuring that not only the water body is safe but the surrounding habitat and ecosystem is also.

Water quality status is categorised from 1 to 4, with 4 being the worst case. The priority status is based on the significance towards the risk factors triggering water quality. Aldford Brook has a water quality priority status for 2050 of 2 which indicates targeted investment to mitigate and focus during AMP10.

4.0 Supply Demand

Supply-demand is an assessment of the capacity of our treatment works. It approximately assesses whether all the treatment works in a region can collectively cope with current and future flows in dry and wet weather. There are two parts to the assessment: dry weather flow (DWF) and a wet weather capacity assessment.

For the DWF part of the assessment, the suitability of the dry weather consents is tested against forecast future growth and changes in water consumption. Results for three scenarios are provided: the 0% headroom scenario assesses the region's capability for treating the predicted changes in DWF in the future with no allowance for error, with no spare treatment works capacity. The other scenarios indicate resilience - i.e. could we cope if we had flows 10% or 20% higher than estimated?

The wet weather assessment takes storm consent values where available as an indication of treatment works capacity and estimates the amount of incoming flow the treatment works is able to treat across a year. Again, three scenarios are shown, with differing treatment "targets" - i.e. if we wanted to ensure that 70% of the wet weather flows in a catchment were treated, could the treatment works cope? Changes in rainfall due to climate change and changing dry weather flows within the region mean that the percentage of flow treated across a year can change in the future.

Table 2 shows the supply-demand assessment for this region. Where a region may not have adequate capacity under a given scenario, it is flagged dark blue for further investigation. There may be local incapacity issues at individual works within the region.

L3 Area	Headroom	2025	2030	2035	2040	2045	2050
Aldford Brook	0%						
	10%						
	20%						
	Treatment Target	2025	2030	2035	2040	2045	2050
	70%						
	80%						
	90%						

Table 2 - Supply Demand Balance

5.0 Options

Over time the pressures on our sewerage network change due to influences such as catchment growth, creep of rainwater into the network, or influences such as climate change impacting rainfall patterns. To ensure the plan is robust over the 30-year planning horizon and to account for the uniqueness of each catchment we have tested various types of schemes, and combination of schemes, to ensure a robust 'best value' plan is delivered.

The types of schemes tested are detailed in Table 3 and can be categorised into either improving network resilience to rainfall or improving network headroom in dry weather flow conditions.

Improving Resilience		
10% Reduction in area draining to the combined sewers	Represents removal of runoff from large commercial buildings.	Short term
25% Reduction reduction in area draining to the combined sewers	Represents removal of area runoff from non-residential paved areas where there is only one stakeholder (e.g. Local Authority or Highways Agency).	Medium term
50% Reduction reduction in area draining to the combined sewers	Represents removal of runoff from any connected area including residential properties. There are likely to be multiple stakeholders to engage with.	Long term
Improving Headroom		
Reducing infiltration	Reducing infiltration into sewers by 50%, which could be achieved by relining or replacing the public sewers .	Medium term
Reducing water use	Represents a reduction in water use per person to around 100l per person per day by 2050 by application of water efficiency measures	Medium term
Reducing trade flow	Reduce trade flows by around 25% by application of water efficiency measures.	Long term

Table 3 - Risk mitigation details

We have undertaken an analysis of all our wastewater catchments to determine the benefit in terms of potential volume of water removed from our systems for each scheme type to determine a journey plan, (see Figure 8 below), which provides the direction of the best scheme types to undertake in this catchment for the most benefit against predicted future risk from growth, creep and climate change.

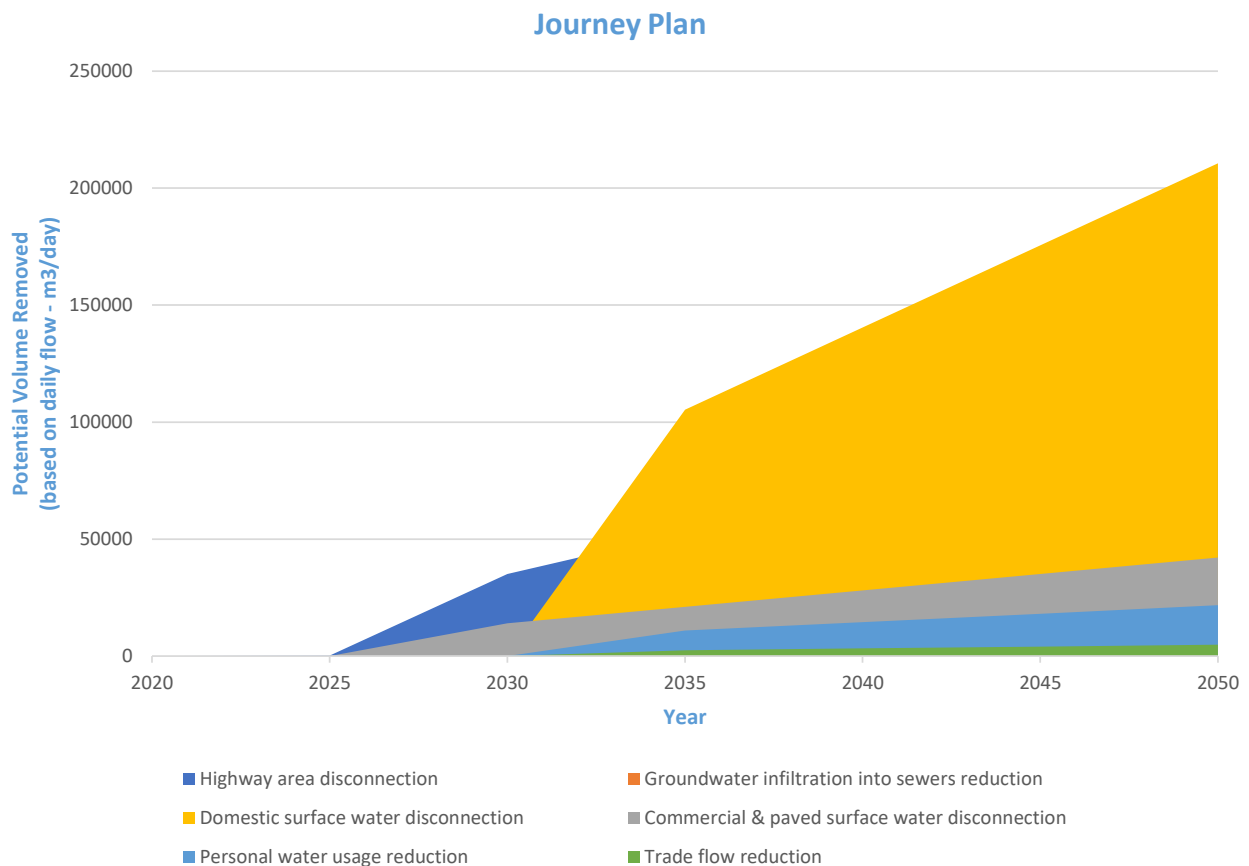


Figure 8 - Journey Plan

Approaches to managing risk

We have undertaken analysis to determine the likely costs to mitigate future predicted pollution and flooding. We assess combined sewer overflows based on the number of times they are predicted to spill in a 'typical year'. Table 4 illustrates the cost of potential measures to mitigate risk to varying standards. The assessment calculates the impact of rainfall and drainage contributions to the network relative to today's costs.

Mitigating the risk posed by flooding has been assessed in terms of probability of occurrence, we use the size of a storm event that has the probability of occurring once every 30 years. Table 5 illustrates the cost of potential mitigation measures to mitigate varying flood risk types.

The choice of scenarios for storm overflow mitigation in Table 4 is a separate cost and would be required in addition to the choice of scenarios for flooding protection in Table 5. The chosen scenarios for Storm overflows and flooding are to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain Existing Performance*	-	£24,000,000.00	£34,000,000.00
40 spills in a Typical Year	£7,000,000.00	£7,000,000.00	£6,000,000.00
20 spills in a Typical Year	£10,000,000.00	£10,000,000.00	£10,000,000.00
10 spills in a Typical Year	£12,000,000.00	£12,000,000.00	£12,000,000.00
0 spills in a Typical Year	£25,000,000.00	£26,000,000.00	£27,000,000.00
Equivalent No. Olympic Swimming Pools in 10 spills scenario	61.00	67.00	73.00

* Maintain is a considered scenario where we will continue to maintain the current level of service within the region and improve the network and address known and emerging risk.

Table 4 - Summary of Combined Sewer Overflow option investments

Choice of Scenario	Current Scenario (£)	2050 Scenario (£)	2050 Resilience Scenario (£) 1 in 50 yr (Storm Dennis)
Internal escapes	£0	£0	£0
External escapes in gardens	£1,000,000	£1,000,000	£1,000,000
Escapes in highways	£5,000,000	£6,000,000	£7,000,000
No future flooding	-	£10,000,000	£21,000,000
Total	£6,000,000.00	£17,000,000	£29,000,000

Table 5 - Summary of Flooding option investments

We have developed solutions which aim to provide protection against drainage and network failure, pollution events and flooding, internal and external to properties. The solutions developed highlight the level of investment required to bring our entire network up to the level of protection required to be resilient for future risk and demands. The range of scenarios is to provide a choice for understanding and discussion of future direction.

We are beginning to break down the investment indicated in Table 4 and 5 by creating practical schemes ready for delivery these schemes are designed as 100% traditional, 100% sustainable or green and 100% mixture of the 2. These packages have then been analysed in terms of their long term benefit and environmental and social cost to society and one has been chosen for inclusion as our preferred best value option. The areas where we have started our delivery programme aims to provide protection, to our worst served customers and rivers designated as Special Areas of Conservation (SAC) under the

For more information on the methodology developed to carry out the assessments see the DWMP plan main report.

If you want to work with us to develop joint projects to reduce the risk of flooding and protect the environment, please get in touch.

We will continue to work with Welsh Government, Regulators and Local Authorities about the pace, scale and affordability of improvements to be made.

We will be consulting on the preferred approach to planning and once its concluded the next stage is to develop the pipeline of options to meet the pace scale and affordability discussed with Welsh Government and our regulators.

Table 6 - Summary of solutions put forward are a first cycle preferred plan before SEA/HRA

L4 Catchments	No. Schemes
FARNDON	0
TATTENHALL	0
CHURTON	0
ALDFORD	0
TILSTON	0
CLUTTON TATTENHALL	0
BARTON CODDINGTON LANE	0
CROWS NEST	0
EASTWICK	0
EDGE (NR TILSTON)	0
PENTRE COED	0
ERBISTOCK (S OF WREXHAM)	0
OVERTON (NR WREXHAM)	0
HOLT STW	0
BANGOR On Dee STW	0
DUDLESTON HEATH	0

DWMP Tactical Planning Catchment Summary



Alwen - Dee to Ceirw

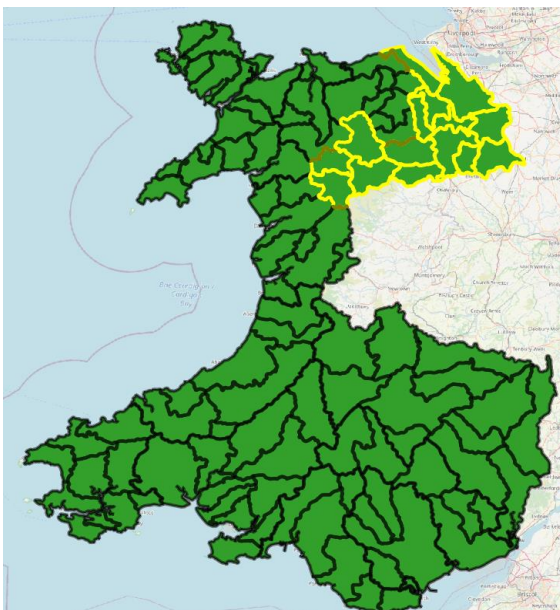
1.0 Introduction

This Drainage and Wastewater Management Plan (DWMP) sets out how Dŵr Cymru Welsh Water (DCWW) will manage and improve its assets to maintain a resilient and robust wastewater drainage system. The plan aims to manage flooding and pollution from our wastewater assets in the future, for our customers and our environment by working collaboratively with stakeholders, regulators and local authorities to provide a complete partnership in tackling current and future problems.

1.1 Catchment Information

The Alwen - Dee to Ceirw planning catchment lies within the Dee river basin catchment, (see Figure 1 below), it consists of 9 wastewater catchments (see Figure 2 below). There is a combined population of 917, this is set to increase to 1234 by 2050, a change of 35%. There is a total sewer length of 7km, with a foul sewer length of 4km, a surface water length of 0km and a combined sewer length of 2km. There are 9 Wastewater Treatment Works (WwTW), 3 Sewerage Pumping Stations (SPSs), and 1 Combined Storm Overflows (CSOs) across this tactical planning unit.

The Alaw catchment is in the centre of North Wales, with Llyn Brenig and Alwen Reservoir in the north. The River Alwen flows down towards Corwen. Cerrigydrudion and Bettws Gwerfil Goch are it's major urban areas.



Data is available from <https://www.openstreetmap.org/copyright> © OpenStreetMap contributors

Figure 1 - River basin location detailing the associated tactical planning catchments

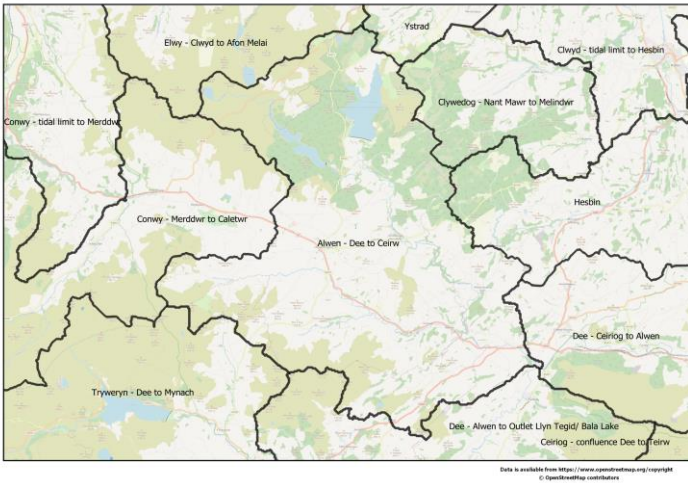


Figure 2- Tactical planning catchments

2.0 Stakeholder Engagement

The DWMP aims to enable DCWW to work collaboratively with stakeholders, regulators and local authorities to tackle current and future challenges. DCWW has identified stakeholder objectives that align with the aims of the DWMP and goals of other management plans. Table 1 details the main opportunities we have identified but this is not intended to be exhaustive. Note that these stakeholders have their own planning processes and plans which do not necessarily align with those of DCWW.

Scheme Information
Stakeholder engagement meetings are scheduled to commence in 2022. These meetings will be held between DCWW and the respective parties, such as NRW, EA, Councils and ENGO's. Further information of the outcome and points of focus towards short and long term strategy planning will be provided in the next cycle of the DWMP assessment.

Table 1 - Current and future investigation schemes

3.0 Risk

We have assessed our likely performance from now to 2050 against the objectives that we set in our most recent business plan. The results of this assessment are presented in the following sections.

To understand future performance, we need to estimate how much population will change by, the degree to which climate change will impact Wales and areas of England that border our company, and how further surface water connected to the sewer network might increase the amount and rate at which rainfall drains into our sewers.

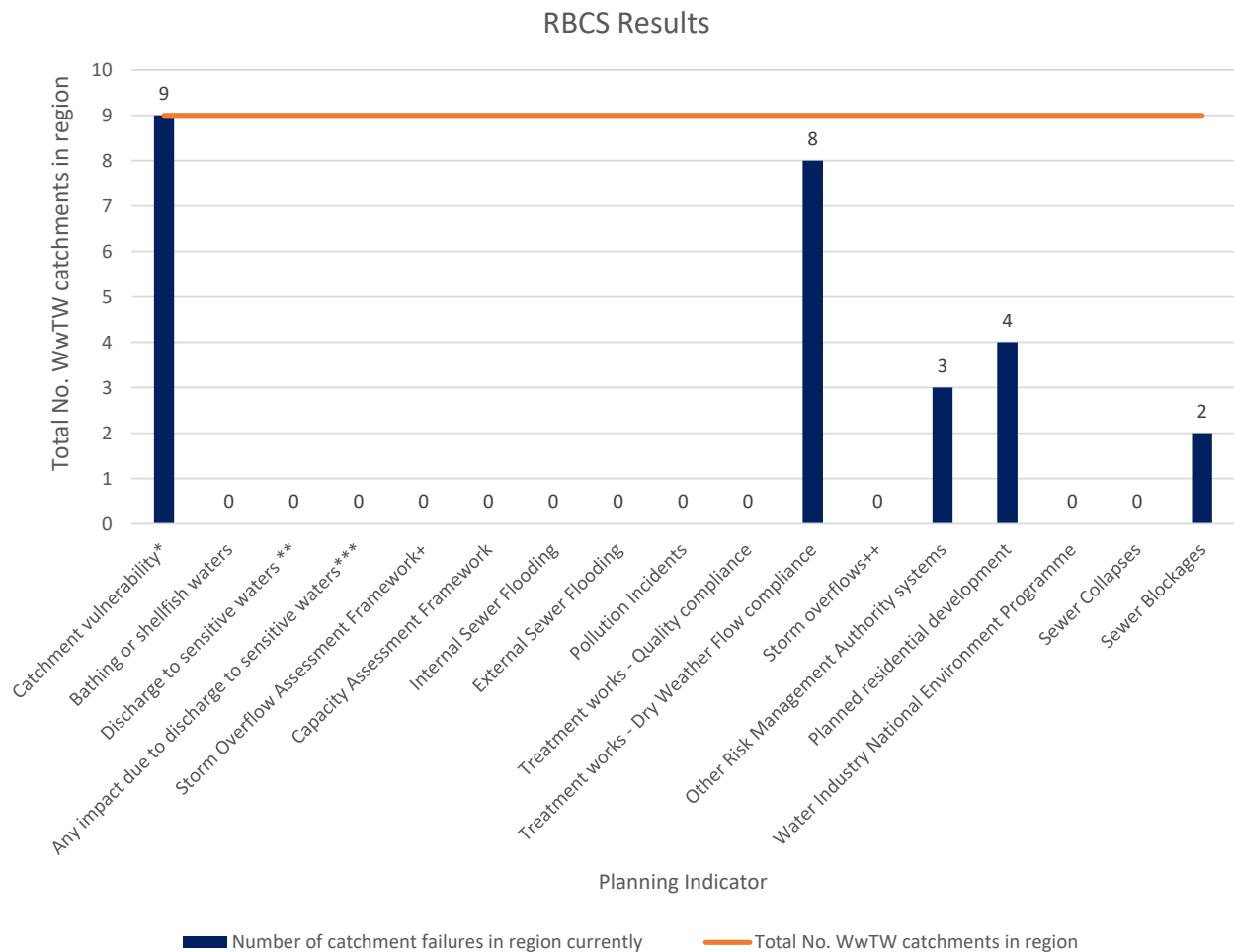
Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

Climate change is predicted to increase the intensity of storms by around 35% in this region. In a typical year, winters are likely to be warmer and wetter, and summers generally drier. More intense rainfall will happen more frequently. The population in the Dee region is set to increase to 1200 by 2050, a change of 35% based on our future projections. However there are major developments in localised areas that will contribute to future pressures on the network, including Cerrigydrudion - land fronting B5105.

3.1 Risk Based Catchment Screening

The Risk Based Catchment Screening (RBCS) is the initial screening process to determine if a more detailed risk assessment is required. The assessment screens catchments against planning indicators which have been stipulated in the national guidance for DWMPs. A catchment will pass through to a more detailed risk assessment if it fails against one or more of these indicators, the results are shown in Figure 3.

For the Alwen - Dee to Ceirw catchment the biggest concerns indicated by the RBCS are catchment characterisation (based on a vulnerability assessment of flooding due to local characteristics e.g. topography), Wastewater Treatment Works compliance in dry weather and planned residential development.



*To sewer flooding due to extreme wet weather events.

**Categorised as a "planned" scheduled action within the Natural Resources Wales Action Database or considered as "Remedy" on Natural England Designated Sites system.

***Categorised as a "identified" scheduled action within the Natural Resources Wales Action Database or considered as "Threat" on Natural England Designated Sites system.

+Frequency investigation triggered.

++Overflow risks not covered by other indicators,

Figure 3 - Risk Based Catchment Screening results

3.2 Baseline Risk And Vulnerability Assessment (BRAVA)

Following on from the RBCS, the Baseline Risk and Vulnerability Assessment (BRAVA) highlights current and future risk. The risk scores are driven by company targets which were set in our last business plan. These targets were subdivided according to population or sewer length, depending on the measure, to derive a target for each river basin catchment.

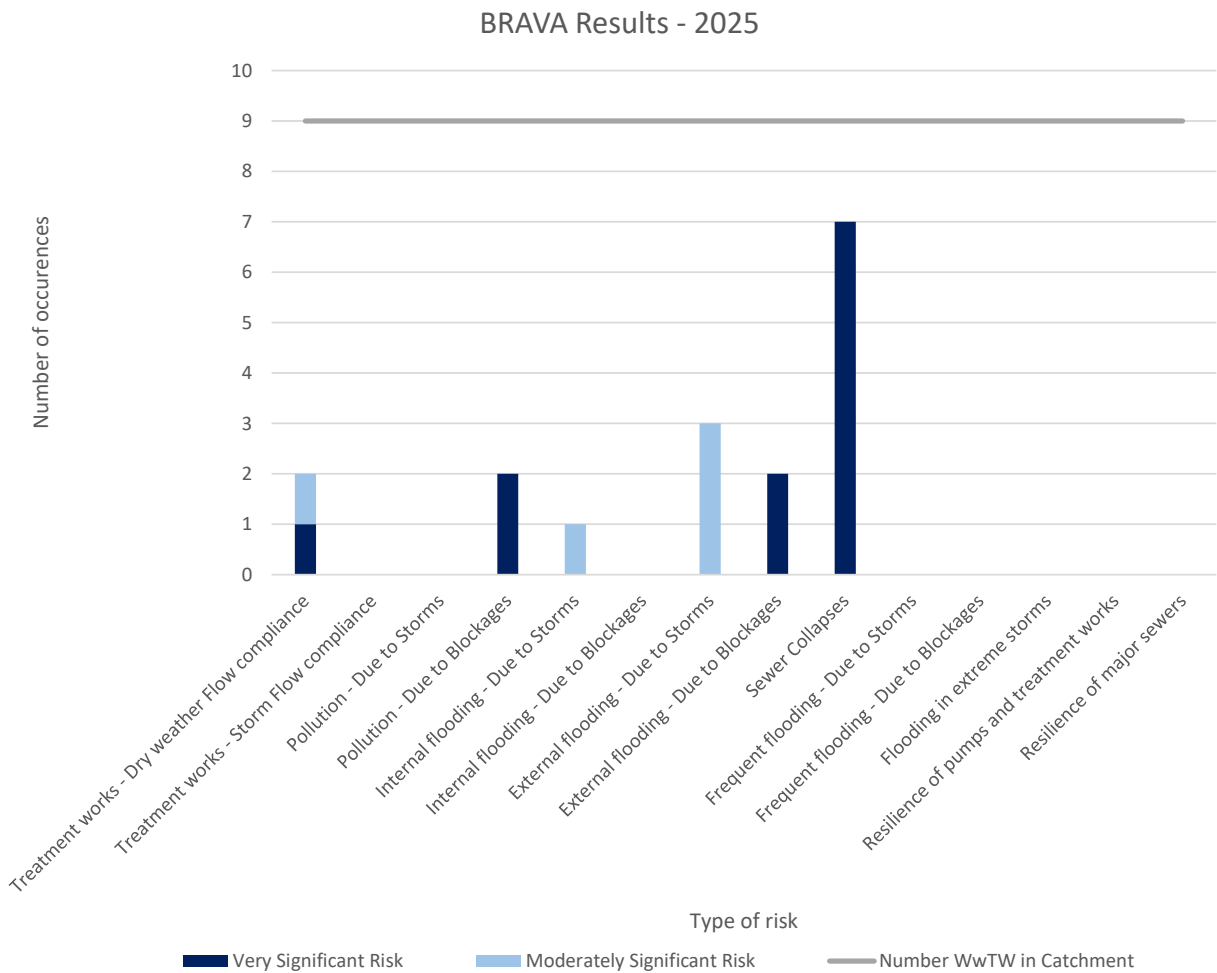


Figure 4 - BRAVA 2025 Summary

In 2025, sewer collapses and external flooding due to storms are the biggest concerns in the Alwen - Dee to Ceirw catchment.

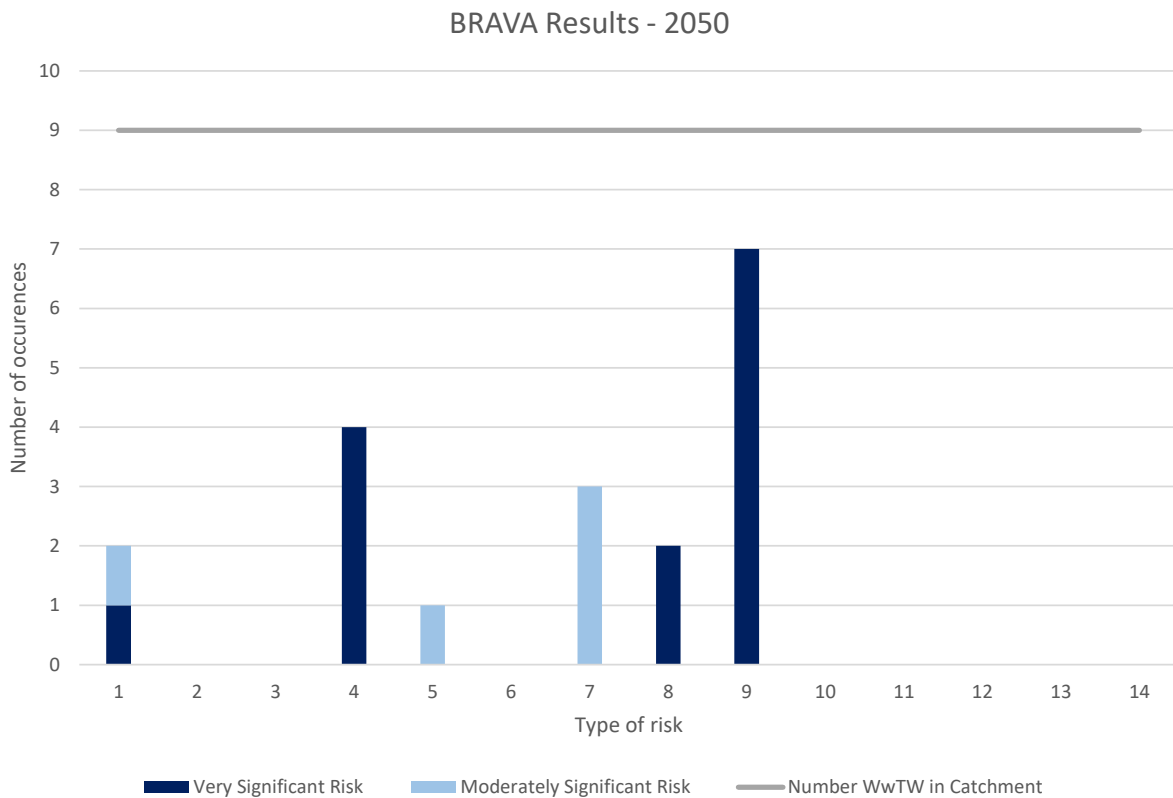


Figure 5 - BRAVA 2050 Summary

In 2050, sewer collapses and pollution due to blockages are the biggest concern in the Alwen - Dee to Ceirw catchment.

Figures 6 and 7 indicate the current and predicted risk of flooding, pollution, and both flooding and pollution caused by lack of capacity (termed 'hydraulic overload') across our networks. These maps illustrate where the issues occur and can be used to target where we want to work with the community and stakeholders to resolve issues. By working together, we can combine knowledge and resources to deliver the best outcomes for local communities and the environment. We want to include your feedback in our decision-making process.

BRAVA results 2025 Flooding and Pollution caused by Hydraulic Overload

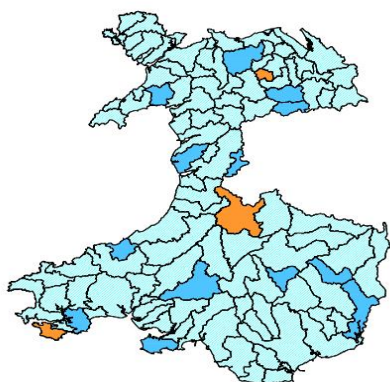
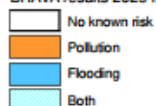


Figure 6 - Associated Strategic Planning Areas priority (2025)

BRAVA results 2050 Flooding and Pollution caused by Hydraulic Overload

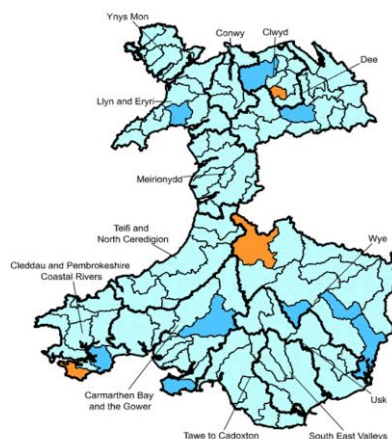
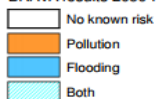


Figure 7 - Associated Strategic Planning Areas

3.3 Water Quality

Water quality is the classification of the quality of watercourses or water bodies in accordance to its physical, biological and chemical properties. Water quality is an important factor of environmental monitoring, ensuring that not only the water body is safe but the surrounding habitat and ecosystem is also.

Water quality status is categorised from 1 to 4, with 4 being the worst case. The priority status is based on the significance towards the risk factors triggering water quality. Alwen - Dee to Ceirw has a water quality priority status for 2050 of 1 which indicates targeted investment to mitigate and focus during AMP11.

4.0 Supply Demand

Supply-demand is an assessment of the capacity of our treatment works. It approximately assesses whether all the treatment works in a region can collectively cope with current and future flows in dry and wet weather. There are two parts to the assessment: dry weather flow (DWF) and a wet weather capacity assessment.

For the DWF part of the assessment, the suitability of the dry weather consents is tested against forecast future growth and changes in water consumption. Results for three scenarios are provided: the 0% headroom scenario assesses the region's capability for treating the predicted changes in DWF in the future with no allowance for error, with no spare treatment works capacity. The other scenarios indicate resilience - i.e. could we cope if we had flows 10% or 20% higher than estimated?

The wet weather assessment takes storm consent values where available as an indication of treatment works capacity and estimates the amount of incoming flow the treatment works is able to treat across a year. Again, three scenarios are shown, with differing treatment "targets" - i.e. if we wanted to ensure that 70% of the wet weather flows in a catchment were treated, could the treatment works cope? Changes in rainfall due to climate change and changing dry weather flows within the region mean that the percentage of flow treated across a year can change in the future.

Table 2 shows the supply-demand assessment for this region. Where a region may not have adequate capacity under a given scenario, it is flagged dark blue for further investigation. There may be local incapacity issues at individual works within the region.

L3 Area	Headroom	2025	2030	2035	2040	2045	2050
Alwen - Dee to Ceirw	0%						
	10%						
	20%						
	Treatment Target	2025	2030	2035	2040	2045	2050
	70%						
	80%						
	90%						

Table 2 - Supply Demand Balance

5.0 Options

Over time the pressures on our sewerage network change due to influences such as catchment growth, creep of rainwater into the network, or influences such as climate change impacting rainfall patterns. To ensure the plan is robust over the 30-year planning horizon and to account for the uniqueness of each catchment we have tested various types of schemes, and combination of schemes, to ensure a robust 'best value' plan is delivered.

The types of schemes tested are detailed in Table 3 and can be categorised into either improving network resilience to rainfall or improving network headroom in dry weather flow conditions.

Improving Resilience		
10% Reduction in area draining to the combined sewers	Represents removal of runoff from large commercial buildings.	Short term
25% Reduction reduction in area draining to the combined sewers	Represents removal of area runoff from non-residential paved areas where there is only one stakeholder (e.g. Local Authority or Highways Agency).	Medium term
50% Reduction reduction in area draining to the combined sewers	Represents removal of runoff from any connected area including residential properties. There are likely to be multiple stakeholders to engage with.	Long term
Improving Headroom		
Reducing infiltration	Reducing infiltration into sewers by 50%, which could be achieved by relining or replacing the public sewers .	Medium term
Reducing water use	Represents a reduction in water use per person to around 100l per person per day by 2050 by application of water efficiency measures	Medium term
Reducing trade flow	Reduce trade flows by around 25% by application of water efficiency measures.	Long term

Table 3 - Risk mitigation details

We have undertaken an analysis of all our wastewater catchments to determine the benefit in terms of potential volume of water removed from our systems for each scheme type to determine a journey plan, (see Figure 8 below), which provides the direction of the best scheme types to undertake in this catchment for the most benefit against predicted future risk from growth, creep and climate change.

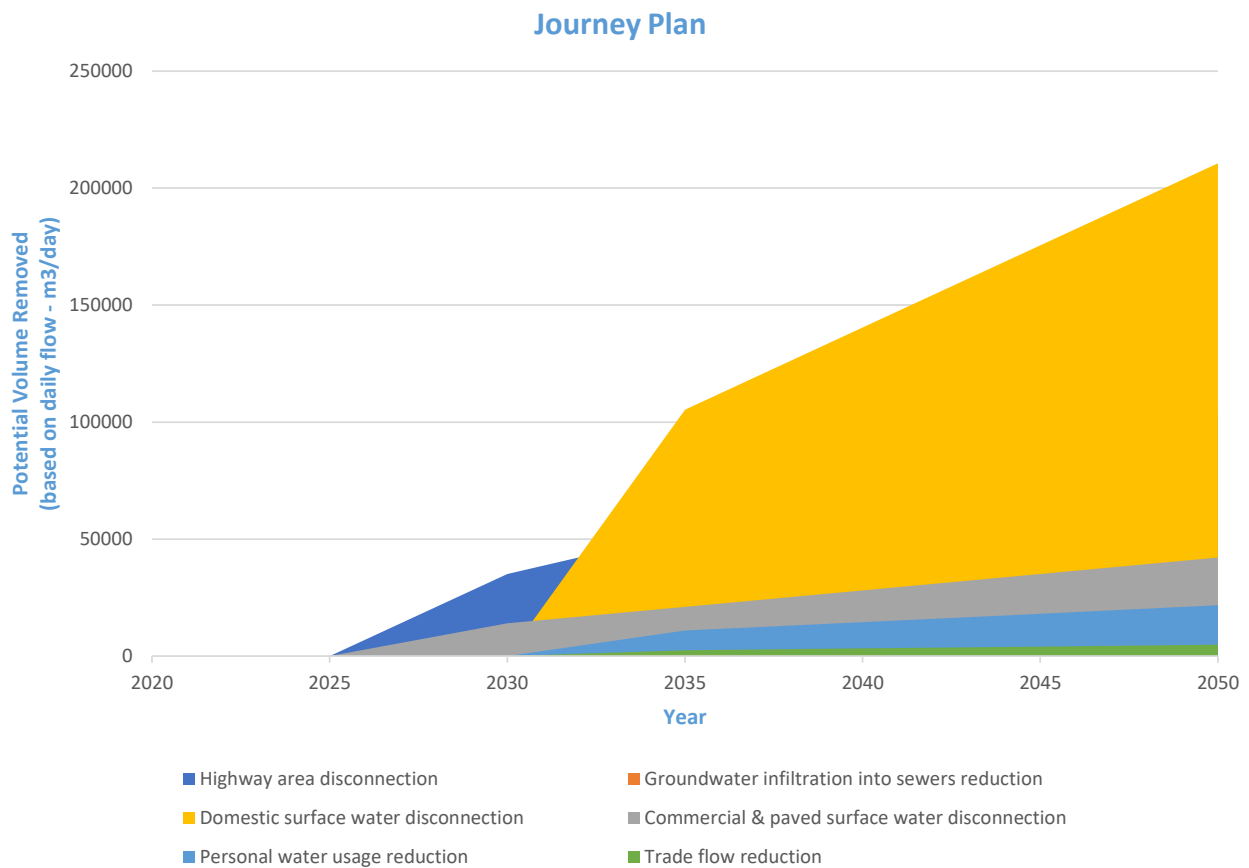


Figure 8 - Journey Plan

Approaches to managing risk

We have undertaken analysis to determine the likely costs to mitigate future predicted pollution and flooding. We assess combined sewer overflows based on the number of times they are predicted to spill in a 'typical year'. Table 4 illustrates the cost of potential measures to mitigate risk to varying standards. The assessment calculates the impact of rainfall and drainage contributions to the network relative to today's costs.

Mitigating the risk posed by flooding has been assessed in terms of probability of occurrence, we use the size of a storm event that has the probability of occurring once every 30 years. Table 5 illustrates the cost of potential mitigation measures to mitigate varying flood risk types.

The choice of scenarios for storm overflow mitigation in Table 4 is a separate cost and would be required in addition to the choice of scenarios for flooding protection in Table 5. The chosen scenarios for Storm overflows and flooding are to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain Existing Performance*	-	£3,000,000.00	£5,000,000.00
40 spills in a Typical Year	£1,000,000.00	£1,000,000.00	£1,000,000.00
20 spills in a Typical Year	£2,000,000.00	£2,000,000.00	£2,000,000.00
10 spills in a Typical Year	£2,000,000.00	£2,000,000.00	£2,000,000.00
0 spills in a Typical Year	£4,000,000.00	£4,000,000.00	£4,000,000.00
Equivalent No. Olympic Swimming Pools in 10 spills scenario	13.00	15.00	16.00

* Maintain is a considered scenario where we will continue to maintain the current level of service within the region and improve the network and address known and emerging risk.

Table 4 - Summary of Combined Sewer Overflow option investments

Choice of Scenario	Current Scenario (£)	2050 Scenario (£)	2050 Resilience Scenario (£) 1 in 50 yr (Storm Dennis)
Internal escapes	£0	£0	£0
External escapes in gardens	£0	£0	£0
Escapes in highways	£1,000,000	£1,000,000	£1,000,000
No future flooding	-	£6,000,000	£15,000,000
Total	£1,000,000.00	£7,000,000	£16,000,000

Table 5 - Summary of Flooding option investments

We have developed solutions which aim to provide protection against drainage and network failure, pollution events and flooding, internal and external to properties. The solutions developed highlight the level of investment required to bring our entire network up to the level of protection required to be resilient for future risk and demands. The range of scenarios is to provide a choice for understanding and discussion of future direction.

We are beginning to break down the investment indicated in Table 4 and 5 by creating practical schemes ready for delivery these schemes are designed as 100% traditional, 100% sustainable or green and 100% mixture of the 2. These packages have then been analysed in terms of their long term benefit and environmental and social cost to society and one has been chosen for inclusion as our preferred best value option. The areas where we have started our delivery programme aims to provide protection, to our worst served customers and rivers designated as Special Areas of Conservation (SAC) under the

For more information on the methodology developed to carry out the assessments see the DWMP plan main report.

If you want to work with us to develop joint projects to reduce the risk of flooding and protect the environment, please get in touch.

We will continue to work with Welsh Government, Regulators and Local Authorities about the pace, scale and affordability of improvements to be made.

We will be consulting on the preferred approach to planning and once its concluded the next stage is to develop the pipeline of options to meet the pace scale and affordability discussed with Welsh Government and our regulators.

Table 6 - Summary of solutions put forward are a first cycle preferred plan before SEA/HRA

L4 Catchments	No. Schemes
GLAN-YR-AFON FOUR CROSSES	0
CERRIGYDRUDION	0
ALWEN	0
Y MAERDY DINMAEL	0
PENTRE-LLYN-CYMMER	0
GLAN-YR-AFON	0
LLANFIHANGEL GLYN MYFYR	0
BETTWS GWERFIL GOCH (SW OF RUTHIN)	0
Cefn Brith STW	0

DWMP Tactical Planning Catchment Summary



Alyn - Hope to confluence with Dee

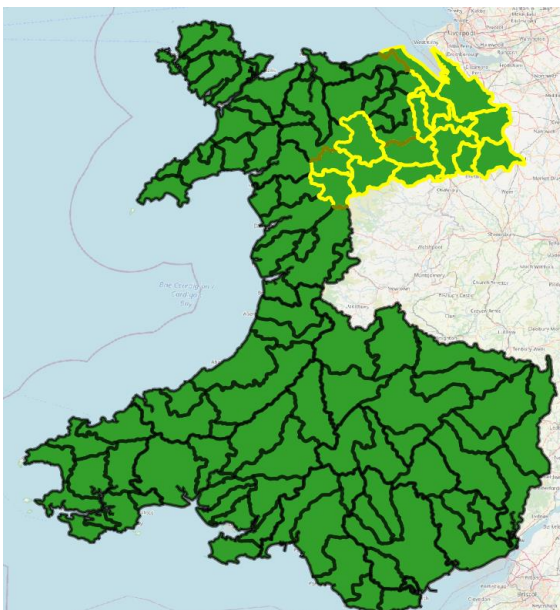
1.0 Introduction

This Drainage and Wastewater Management Plan (DWMP) sets out how Dŵr Cymru Welsh Water (DCWW) will manage and improve its assets to maintain a resilient and robust wastewater drainage system. The plan aims to manage flooding and pollution from our wastewater assets in the future, for our customers and our environment by working collaboratively with stakeholders, regulators and local authorities to provide a complete partnership in tackling current and future problems.

1.1 Catchment Information

The Alyn - Hope to confluence with Dee planning catchment lies within the Dee river basin catchment, (see Figure 1 below), it consists of 7 wastewater catchments (see Figure 2 below). There is a combined population of 34323, this is set to decrease to 30920 by 2050, a change of -10%. There is a total sewer length of 231km, with a foul sewer length of 115km, a surface water length of 34km and a combined sewer length of 80km. There are 7 Wastewater Treatment Works (WwTW), 40 Sewerage Pumping Stations (SPSs), and 16 Combined Storm Overflows (CSOs) across this tactical planning unit.

The Alyn - Hope to confluence with Dee catchment reaches the England Wales border to the North East of Wales. The River Alyn flows down to join the River Dee near Farndon. Hope and Lavister are it's major urban areas.



Data is available from <https://www.openstreetmap.org/copyright> © OpenStreetMap contributors

Figure 1 - River basin location detailing the associated tactical planning catchments

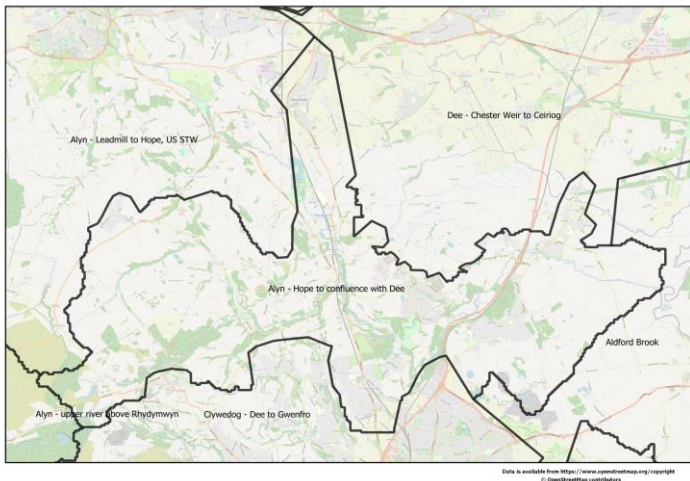


Figure 2- Tactical planning catchments

2.0 Stakeholder Engagement

The DWMP aims to enable DCWW to work collaboratively with stakeholders, regulators and local authorities to tackle current and future challenges. DCWW has identified stakeholder objectives that align with the aims of the DWMP and goals of other management plans. Table 1 details the main opportunities we have identified but this is not intended to be exhaustive. Note that these stakeholders have their own planning processes and plans which do not necessarily align with those of DCWW.

Scheme Information
Stakeholder engagement meetings are scheduled to commence in 2022. These meetings will be held between DCWW and the respective parties, such as NRW, EA, Councils and ENGO's. Further information of the outcome and points of focus towards short and long term strategy planning will be provided in the next cycle of the DWMP assessment.

Table 1 - Current and future investigation schemes

3.0 Risk

We have assessed our likely performance from now to 2050 against the objectives that we set in our most recent business plan. The results of this assessment are presented in the following sections.

To understand future performance, we need to estimate how much population will change by, the degree to which climate change will impact Wales and areas of England that border our company, and how further surface water connected to the sewer network might increase the amount and rate at which rainfall drains into our sewers.

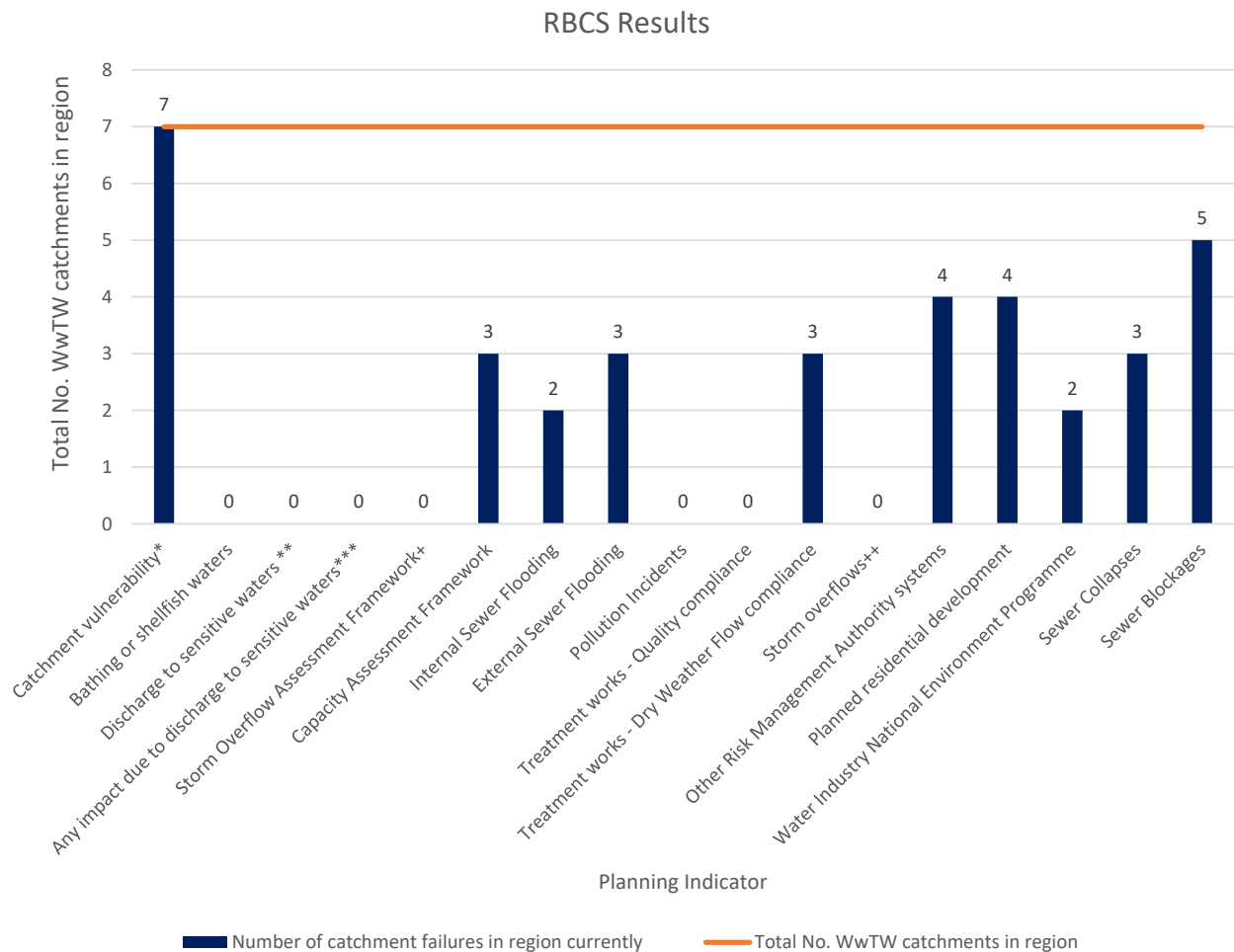
Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

Climate change is predicted to increase the intensity of storms by around 35% in this region. In a typical year, winters are likely to be warmer and wetter, and summers generally drier. More intense rainfall will happen more frequently. The population in the Dee region is set to decrease to 30900 by 2050, a change of -10% based on our future projections. However there are major developments in localised areas that will contribute to future pressures on the network.

3.1 Risk Based Catchment Screening

The Risk Based Catchment Screening (RBCS) is the initial screening process to determine if a more detailed risk assessment is required. The assessment screens catchments against planning indicators which have been stipulated in the national guidance for DWMPs. A catchment will pass through to a more detailed risk assessment if it fails against one or more of these indicators, the results are shown in Figure 3.

For the Alyn - Hope to confluence with Dee catchment the biggest concerns indicated by the RBCS are catchment characterisation (based on a vulnerability assessment of flooding due to local characteristics e.g. topography), sewer blockages, other RMAs and planned residential development.



*To sewer flooding due to extreme wet weather events.

**Categorised as a "planned" scheduled action within the Natural Resources Wales Action Database or considered as "Remedy" on Natural England Designated Sites system.

***Categorised as a "identified" scheduled action within the Natural Resources Wales Action Database or considered as "Threat" on Natural England Designated Sites system.

+Frequency investigation triggered.

++Overflow risks not covered by other indicators,

Figure 3 - Risk Based Catchment Screening results

3.2 Baseline Risk And Vulnerability Assessment (BRAVA)

Following on from the RBCS, the Baseline Risk and Vulnerability Assessment (BRAVA) highlights current and future risk. The risk scores are driven by company targets which were set in our last business plan. These targets were subdivided according to population or sewer length, depending on the measure, to derive a target for each river basin catchment.

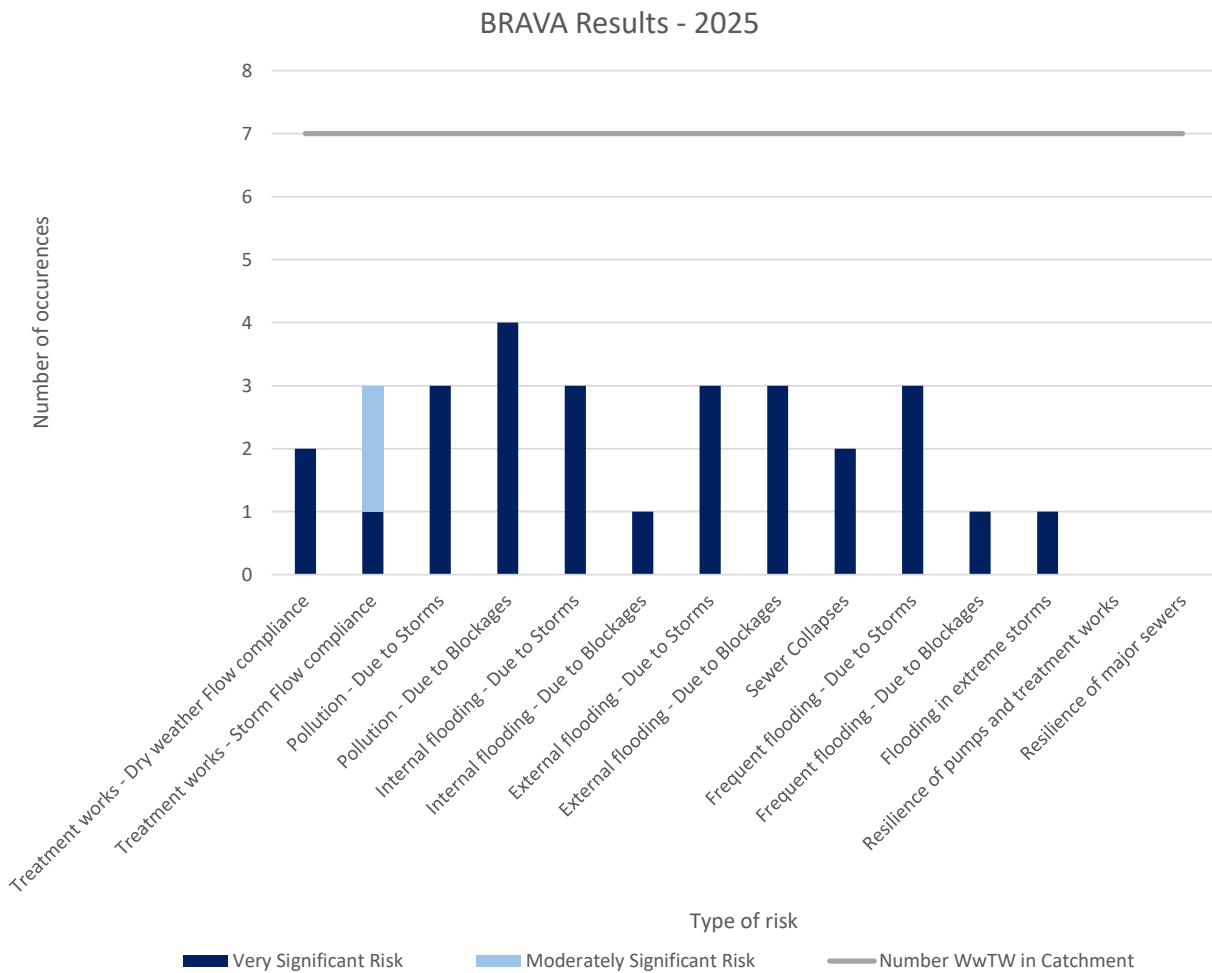


Figure 4 - BRAVA 2025 Summary

In 2025, pollution due to blockages is the biggest concern in the Alyn - Hope to confluence with Dee catchment, followed equally by six other indicators.

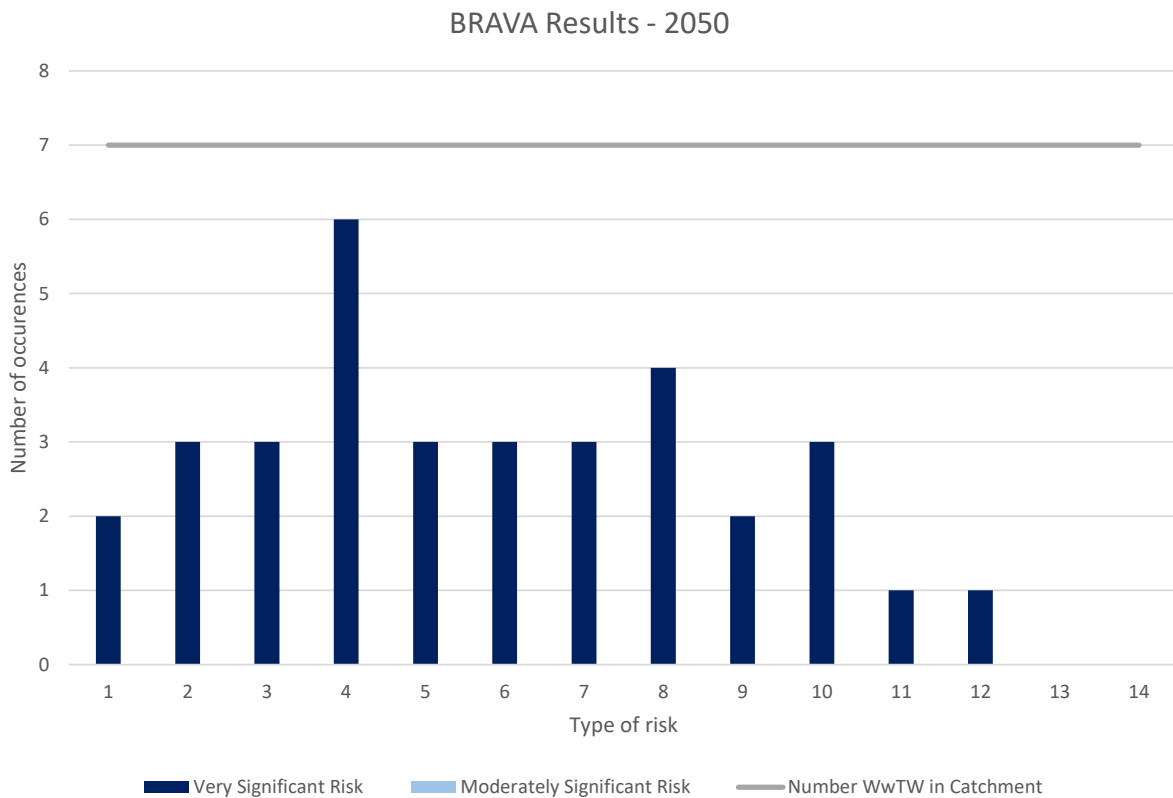


Figure 5 - BRAVA 2050 Summary

In 2050, pollution due to blockages is the biggest concern in the Alyn - Hope to confluence with Dee catchment, followed external flooding due to blockages.

Figures 6 and 7 indicate the current and predicted risk of flooding, pollution, and both flooding and pollution caused by lack of capacity (termed 'hydraulic overload') across our networks. These maps illustrate where the issues occur and can be used to target where we want to work with the community and stakeholders to resolve issues. By working together, we can combine knowledge and resources to deliver the best outcomes for local communities and the environment. We want to include your feedback in our decision-making process.

BRAVA results 2025 Flooding and Pollution caused by Hydraulic Overload

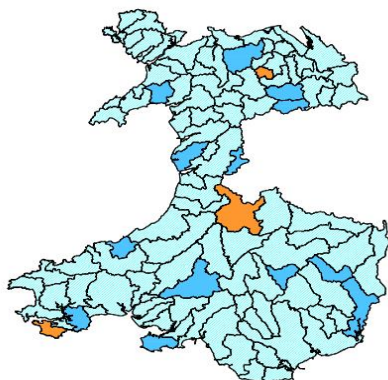
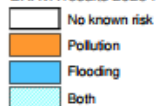


Figure 6 - Associated Strategic Planning Areas priority (2025)

BRAVA results 2050 Flooding and Pollution caused by Hydraulic Overload

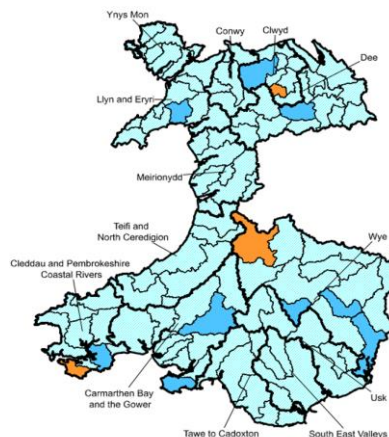
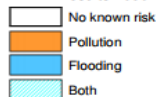


Figure 7 - Associated Strategic Planning Areas

3.3 Water Quality

Water quality is the classification of the quality of watercourses or water bodies in accordance to its physical, biological and chemical properties. Water quality is an important factor of environmental monitoring, ensuring that not only the water body is safe but the surrounding habitat and ecosystem is also.

Water quality status is categorised from 1 to 4, with 4 being the worst case. The priority status is based on the significance towards the risk factors triggering water quality. Alyn - Hope to confluence with Dee has a water quality priority status for 2050 of 1 which indicates targeted investment to mitigate and focus during AMP11.

4.0 Supply Demand

Supply-demand is an assessment of the capacity of our treatment works. It approximately assesses whether all the treatment works in a region can collectively cope with current and future flows in dry and wet weather. There are two parts to the assessment: dry weather flow (DWF) and a wet weather capacity assessment.

For the DWF part of the assessment, the suitability of the dry weather consents is tested against forecast future growth and changes in water consumption. Results for three scenarios are provided: the 0% headroom scenario assesses the region's capability for treating the predicted changes in DWF in the future with no allowance for error, with no spare treatment works capacity. The other scenarios indicate resilience - i.e. could we cope if we had flows 10% or 20% higher than estimated?

The wet weather assessment takes storm consent values where available as an indication of treatment works capacity and estimates the amount of incoming flow the treatment works is able to treat across a year. Again, three scenarios are shown, with differing treatment "targets" - i.e. if we wanted to ensure that 70% of the wet weather flows in a catchment were treated, could the treatment works cope? Changes in rainfall due to climate change and changing dry weather flows within the region mean that the percentage of flow treated across a year can change in the future.

Table 2 shows the supply-demand assessment for this region. Where a region may not have adequate capacity under a given scenario, it is flagged dark blue for further investigation. There may be local incapacity issues at individual works within the region.

L3 Area	Headroom	2025	2030	2035	2040	2045	2050
Alyn - Hope to confluence with Dee	0%						
	10%						
	20%						
	Treatment Target	2025	2030	2035	2040	2045	2050
	70%						
	80%						
	90%						

Table 2 - Supply Demand Balance

5.0 Options

Over time the pressures on our sewerage network change due to influences such as catchment growth, creep of rainwater into the network, or influences such as climate change impacting rainfall patterns. To ensure the plan is robust over the 30-year planning horizon and to account for the uniqueness of each catchment we have tested various types of schemes, and combination of schemes, to ensure a robust 'best value' plan is delivered.

The types of schemes tested are detailed in Table 3 and can be categorised into either improving network resilience to rainfall or improving network headroom in dry weather flow conditions.

Improving Resilience		
10% Reduction in area draining to the combined sewers	Represents removal of runoff from large commercial buildings.	Short term
25% Reduction reduction in area draining to the combined sewers	Represents removal of area runoff from non-residential paved areas where there is only one stakeholder (e.g. Local Authority or Highways Agency).	Medium term
50% Reduction reduction in area draining to the combined sewers	Represents removal of runoff from any connected area including residential properties. There are likely to be multiple stakeholders to engage with.	Long term
Improving Headroom		
Reducing infiltration	Reducing infiltration into sewers by 50%, which could be achieved by relining or replacing the public sewers .	Medium term
Reducing water use	Represents a reduction in water use per person to around 100l per person per day by 2050 by application of water efficiency measures	Medium term
Reducing trade flow	Reduce trade flows by around 25% by application of water efficiency measures.	Long term

Table 3 - Risk mitigation details

We have undertaken an analysis of all our wastewater catchments to determine the benefit in terms of potential volume of water removed from our systems for each scheme type to determine a journey plan, (see Figure 8 below), which provides the direction of the best scheme types to undertake in this catchment for the most benefit against predicted future risk from growth, creep and climate change.

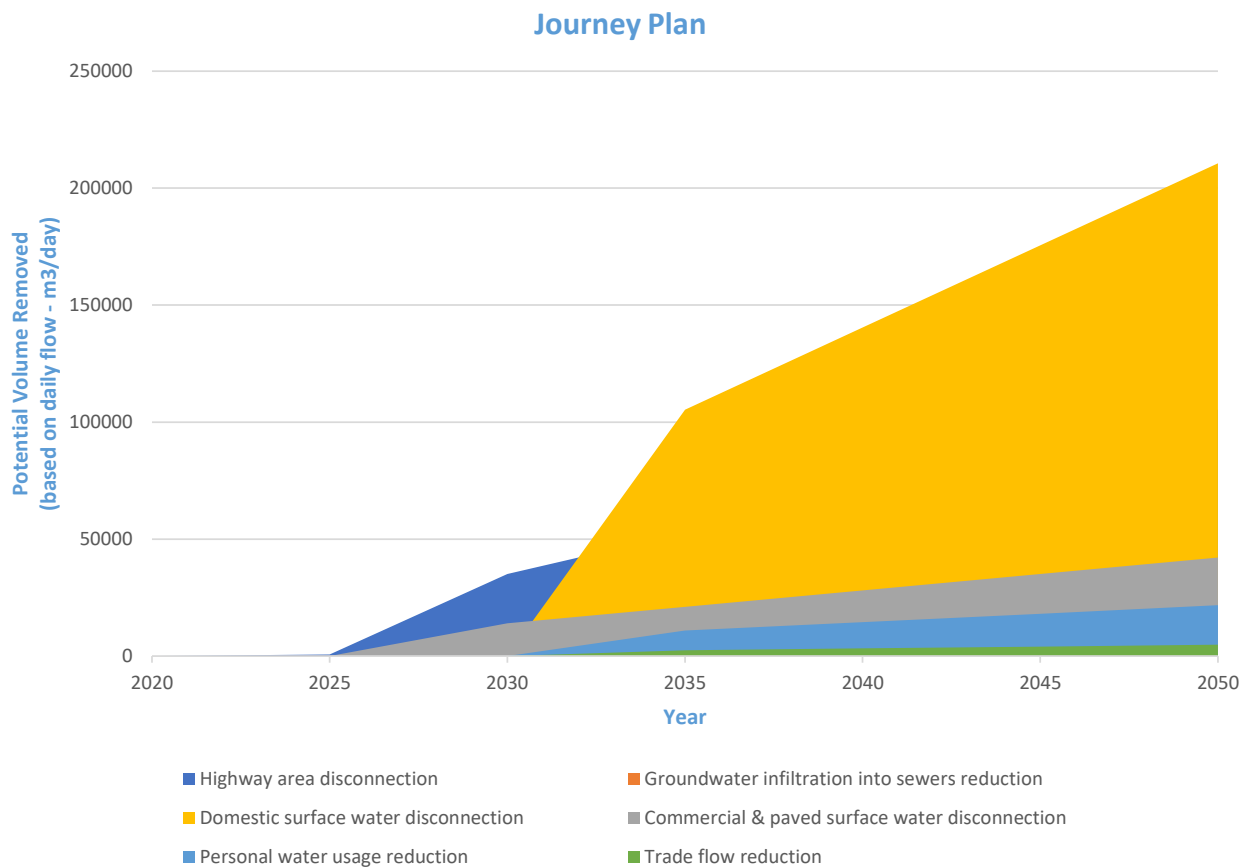


Figure 8 - Journey Plan

Approaches to managing risk

We have undertaken analysis to determine the likely costs to mitigate future predicted pollution and flooding. We assess combined sewer overflows based on the number of times they are predicted to spill in a 'typical year'. Table 4 illustrates the cost of potential measures to mitigate risk to varying standards. The assessment calculates the impact of rainfall and drainage contributions to the network relative to today's costs.

Mitigating the risk posed by flooding has been assessed in terms of probability of occurrence, we use the size of a storm event that has the probability of occurring once every 30 years. Table 5 illustrates the cost of potential mitigation measures to mitigate varying flood risk types.

The choice of scenarios for storm overflow mitigation in Table 4 is a separate cost and would be required in addition to the choice of scenarios for flooding protection in Table 5. The chosen scenarios for Storm overflows and flooding are to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain Existing Performance*	-	£7,000,000.00	£9,000,000.00
40 spills in a Typical Year	£0.00	£0.00	£0.00
20 spills in a Typical Year	£0.00	£1,000,000.00	£4,000,000.00
10 spills in a Typical Year	£7,000,000.00	£8,000,000.00	£8,000,000.00
0 spills in a Typical Year	£21,000,000.00	£25,000,000.00	£26,000,000.00
Equivalent No. Olympic Swimming Pools in 10 spills scenario	5.00	8.00	10.00

* Maintain is a considered scenario where we will continue to maintain the current level of service within the region and improve the network and address known and emerging risk.

Table 4 - Summary of Combined Sewer Overflow option investments

Choice of Scenario	Current Scenario (£)	2050 Scenario (£)	2050 Resilience Scenario (£) 1 in 50 yr (Storm Dennis)
Internal escapes	£8,000,000	£11,000,000	£9,000,000
External escapes in gardens	£3,000,000	£3,000,000	£3,000,000
Escapes in highways	£31,000,000	£37,000,000	£44,000,000
No future flooding	-	£31,000,000	£8,000,000
Total	£42,000,000.00	£82,000,000	£64,000,000

Table 5 - Summary of Flooding option investments

We have developed solutions which aim to provide protection against drainage and network failure, pollution events and flooding, internal and external to properties. The solutions developed highlight the level of investment required to bring our entire network up to the level of protection required to be resilient for future risk and demands. The range of scenarios is to provide a choice for understanding and discussion of future direction.

We are beginning to break down the investment indicated in Table 4 and 5 by creating practical schemes ready for delivery these schemes are designed as 100% traditional, 100% sustainable or green and 100% mixture of the 2. These packages have then been analysed in terms of their long term benefit and environmental and social cost to society and one has been chosen for inclusion as our preferred best value option. The areas where we have started our delivery programme aims to provide protection, to our worst served customers and rivers designated as Special Areas of Conservation (SAC) under the

For more information on the methodology developed to carry out the assessments see the DWMP plan main report.

If you want to work with us to develop joint projects to reduce the risk of flooding and protect the environment, please get in touch.

We will continue to work with Welsh Government, Regulators and Local Authorities about the pace, scale and affordability of improvements to be made.

We will be consulting on the preferred approach to planning and once its concluded the next stage is to develop the pipeline of options to meet the pace scale and affordability discussed with Welsh Government and our regulators.

Table 6 - Summary of solutions put forward are a first cycle preferred plan before SEA/HRA

L4 Catchments	No. Schemes
TREUDDYN LODGE VILLAS	0
LLANFYNYDD (NW OF WREXHAM)	0
TREUDDYN BRIDGE TERRACE	0
TREUDDYN	0
LAVISTER	0
GRESFORD	0
HOPE STW	0

DWMP Tactical Planning Catchment Summary



Alyn - Leadmill to Hope, US STW

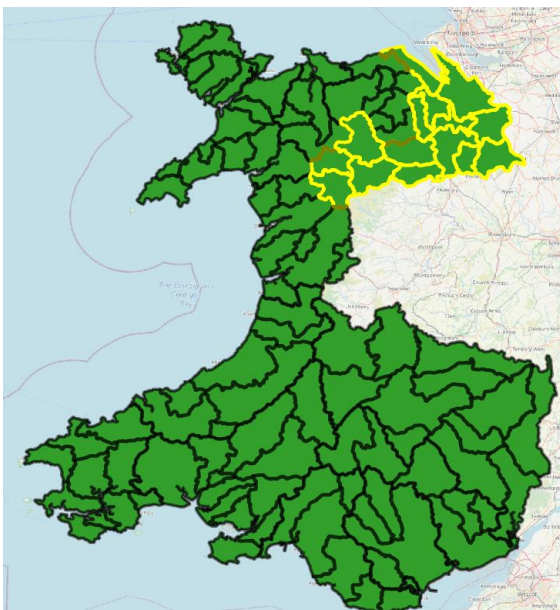
1.0 Introduction

This Drainage and Wastewater Management Plan (DWMP) sets out how Dŵr Cymru Welsh Water (DCWW) will manage and improve its assets to maintain a resilient and robust wastewater drainage system. The plan aims to manage flooding and pollution from our wastewater assets in the future, for our customers and our environment by working collaboratively with stakeholders, regulators and local authorities to provide a complete partnership in tackling current and future problems.

1.1 Catchment Information

The Alyn - Leadmill to Hope, US STW planning catchment lies within the Dee river basin catchment, (see Figure 1 below), it consists of 5 wastewater catchments (see Figure 2 below). There is a combined population of 38658, this is set to decrease to 33235 by 2050, a change of -14%. There is a total sewer length of 259km, with a foul sewer length of 85km, a surface water length of 53km and a combined sewer length of 119km. There are 5 Wastewater Treatment Works (WwTW), 41 Sewerage Pumping Stations (SPSs), and 26 Combined Storm Overflows (CSOs) across this tactical planning unit.

The Alyn - Leadmill to Hope, US STW catchment crosses the Flintshire and Denbighshire counties. The River Alyn flows down towards Hope. Mold and Rhosemor are it's major urban areas.



Data is available from <https://www.openstreetmap.org/copyright> © OpenStreetMap contributors

Figure 1 - River basin location detailing the associated tactical planning catchments

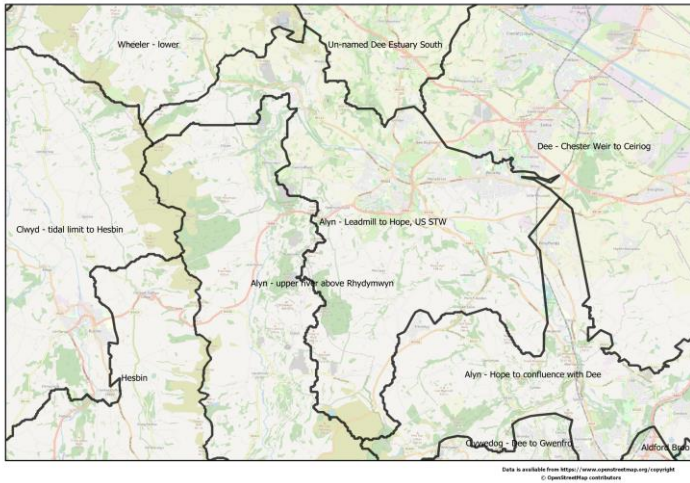


Figure 2- Tactical planning catchments

2.0 Stakeholder Engagement

The DWMP aims to enable DCWW to work collaboratively with stakeholders, regulators and local authorities to tackle current and future challenges. DCWW has identified stakeholder objectives that align with the aims of the DWMP and goals of other management plans. Table 1 details the main opportunities we have identified but this is not intended to be exhaustive. Note that these stakeholders have their own planning processes and plans which do not necessarily align with those of DCWW.

Scheme Information
Stakeholder engagement meetings are scheduled to commence in 2022. These meetings will be held between DCWW and the respective parties, such as NRW, EA, Councils and ENGO's. Further information of the outcome and points of focus towards short and long term strategy planning will be provided in the next cycle of the DWMP assessment.

Table 1 - Current and future investigation schemes

3.0 Risk

We have assessed our likely performance from now to 2050 against the objectives that we set in our most recent business plan. The results of this assessment are presented in the following sections.

To understand future performance, we need to estimate how much population will change by, the degree to which climate change will impact Wales and areas of England that border our company, and how further surface water connected to the sewer network might increase the amount and rate at which rainfall drains into our sewers.

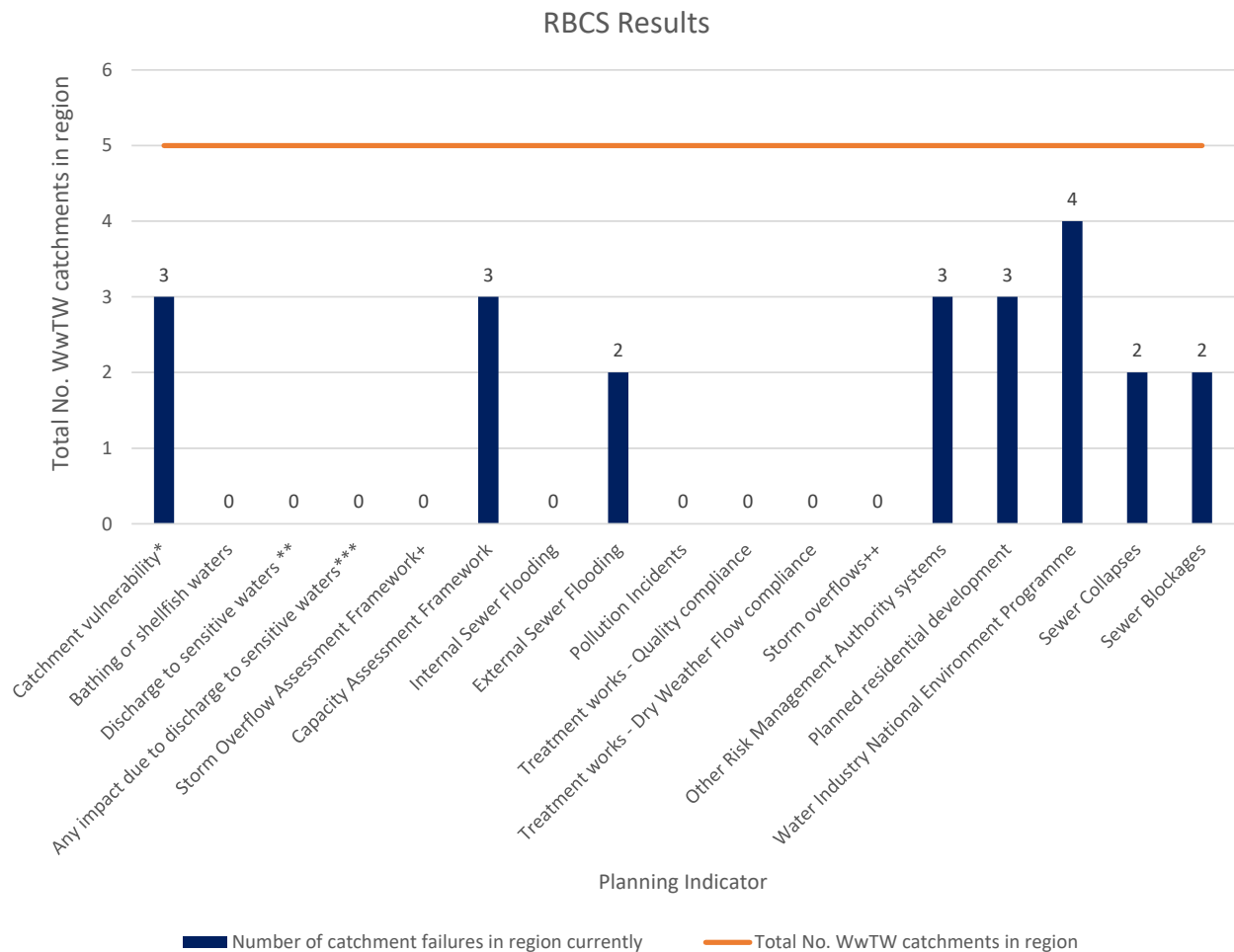
Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

Climate change is predicted to increase the intensity of storms by around 35% in this region. In a typical year, winters are likely to be warmer and wetter, and summers generally drier. More intense rainfall will happen more frequently. The population in the Dee region is set to decrease to 33200 by 2050, a change of -14% based on our future projections. However there are major developments in localised areas that will contribute to future pressures on the network.

3.1 Risk Based Catchment Screening

The Risk Based Catchment Screening (RBCS) is the initial screening process to determine if a more detailed risk assessment is required. The assessment screens catchments against planning indicators which have been stipulated in the national guidance for DWMPs. A catchment will pass through to a more detailed risk assessment if it fails against one or more of these indicators, the results are shown in Figure 3.

For the Alyn - Leadmill to Hope, US STW catchment the biggest concerns indicated by the RBCS are catchment characterisation (based on a vulnerability assessment of flooding due to local characteristics e.g. topography), sewer blockages, other RMAs and planned residential development.



*To sewer flooding due to extreme wet weather events.

**Categorised as a "planned" scheduled action within the Natural Resources Wales Action Database or considered as "Remedy" on Natural England Designated Sites system.

***Categorised as a "identified" scheduled action within the Natural Resources Wales Action Database or considered as "Threat" on Natural England Designated Sites system.

+Frequency investigation triggered.

++Overflow risks not covered by other indicators,

Figure 3 - Risk Based Catchment Screening results

3.2 Baseline Risk And Vulnerability Assessment (BRAVA)

Following on from the RBCS, the Baseline Risk and Vulnerability Assessment (BRAVA) highlights current and future risk. The risk scores are driven by company targets which were set in our last business plan. These targets were subdivided according to population or sewer length, depending on the measure, to derive a target for each river basin catchment.

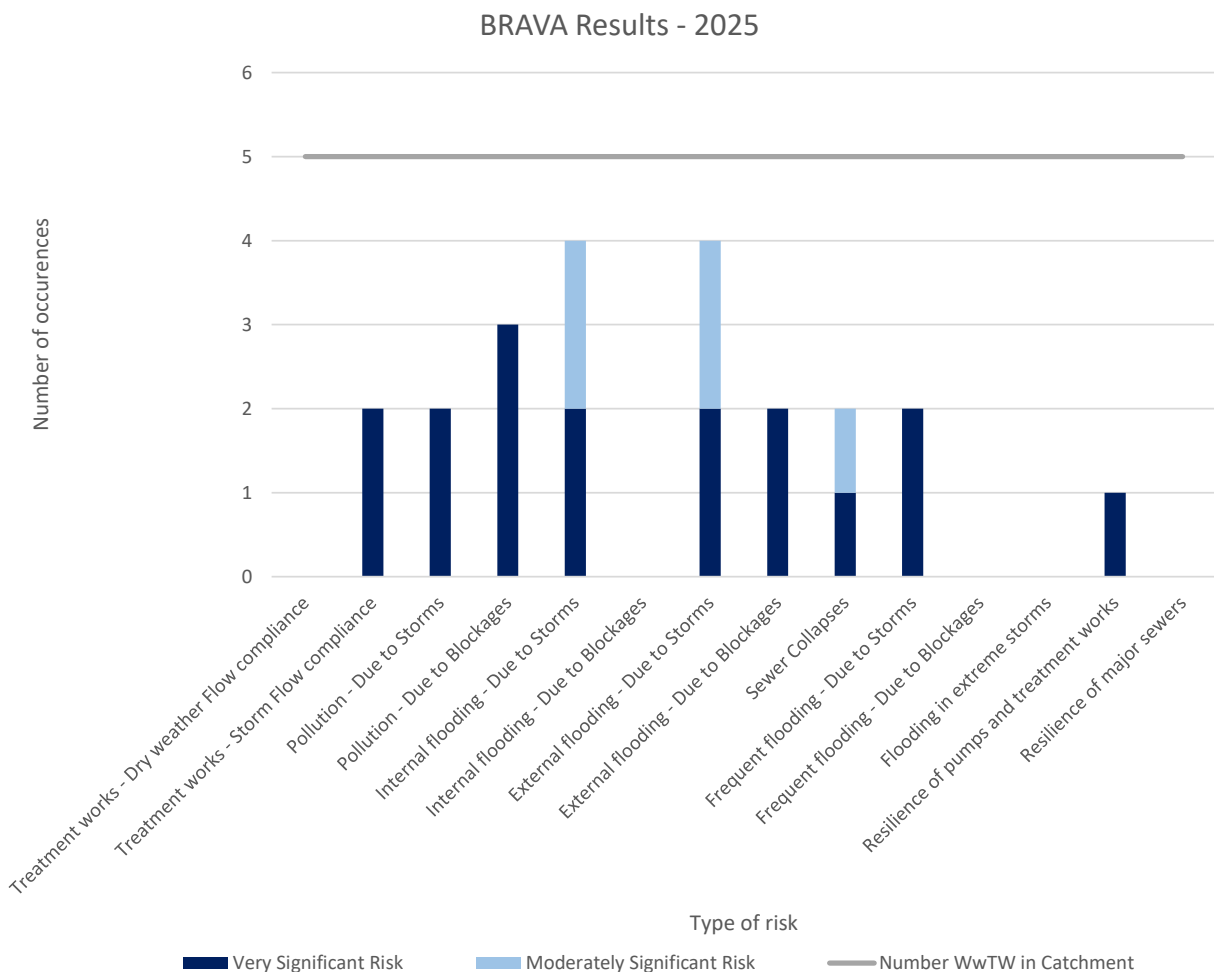


Figure 4 - BRAVA 2025 Summary

In 2025, internal and external flooding due to storms are the biggest concerns in the Alyn - Leadmill to Hope, US STW catchment, followed by pollution due to blockages.

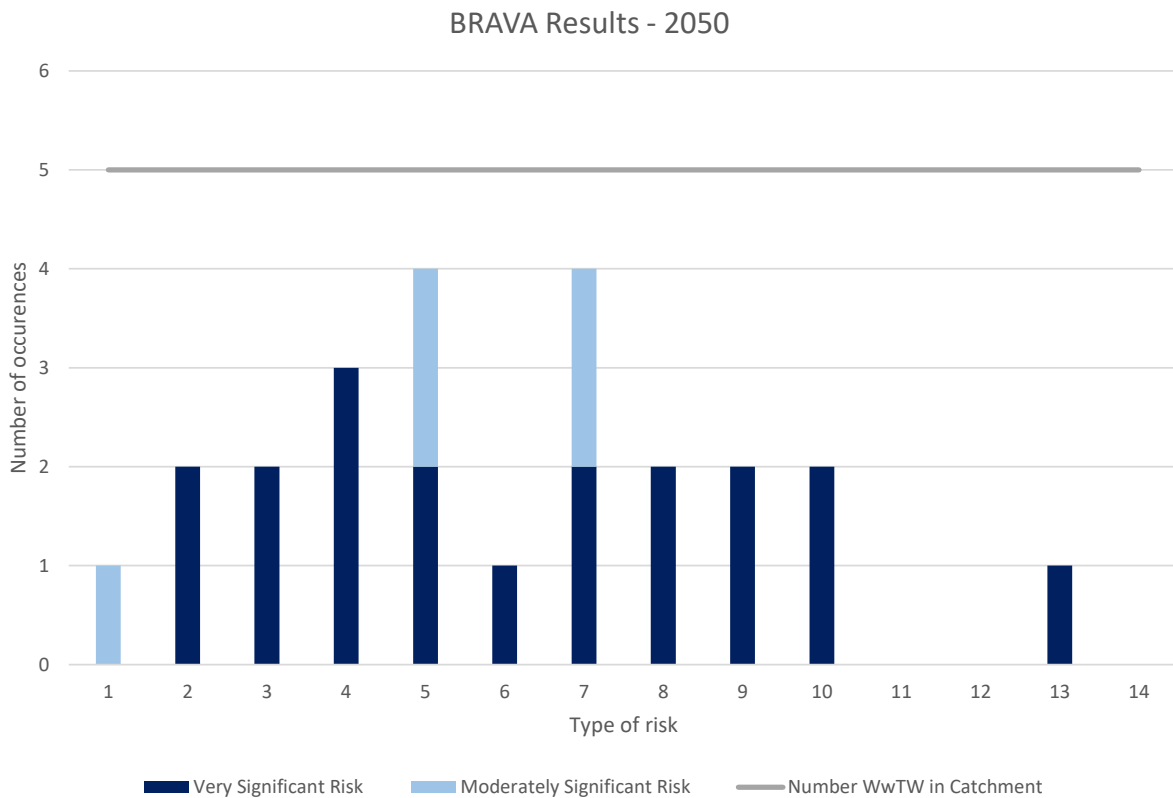


Figure 5 - BRAVA 2050 Summary

In 2050, internal and external flooding due to storms are the biggest concerns in the Alyn - Leadmill to Hope, US STW catchment, followed by pollution due to blockages.

Figures 6 and 7 indicate the current and predicted risk of flooding, pollution, and both flooding and pollution caused by lack of capacity (termed 'hydraulic overload') across our networks. These maps illustrate where the issues occur and can be used to target where we want to work with the community and stakeholders to resolve issues. By working together, we can combine knowledge and resources to deliver the best outcomes for local communities and the environment. We want to include your feedback in our decision-making process.

BRAVA results 2025 Flooding and Pollution caused by Hydraulic Overload

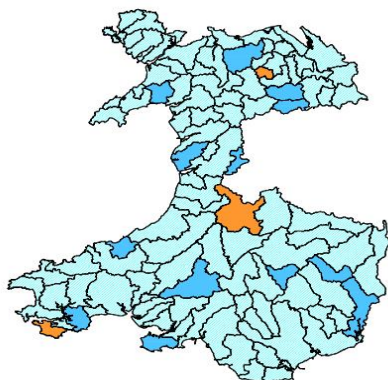
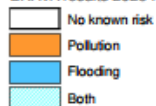


Figure 6 - Associated Strategic Planning Areas priority (2025)

BRAVA results 2050 Flooding and Pollution caused by Hydraulic Overload

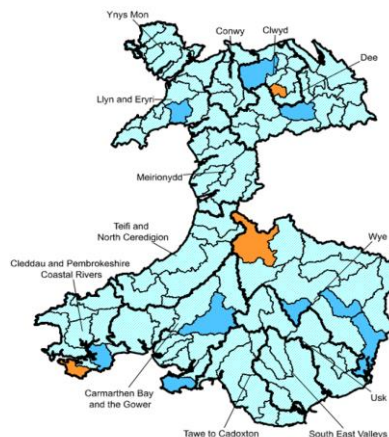
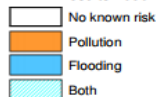


Figure 7 - Associated Strategic Planning Areas

3.3 Water Quality

Water quality is the classification of the quality of watercourses or water bodies in accordance to its physical, biological and chemical properties. Water quality is an important factor of environmental monitoring, ensuring that not only the water body is safe but the surrounding habitat and ecosystem is also.

Water quality status is categorised from 1 to 4, with 4 being the worst case. The priority status is based on the significance towards the risk factors triggering water quality. Alyn - Leadmill to Hope, US STW has a water quality priority status for 2050 of 3 which indicates targeted investment to mitigate and focus during AMP9.

4.0 Supply Demand

Supply-demand is an assessment of the capacity of our treatment works. It approximately assesses whether all the treatment works in a region can collectively cope with current and future flows in dry and wet weather. There are two parts to the assessment: dry weather flow (DWF) and a wet weather capacity assessment.

For the DWF part of the assessment, the suitability of the dry weather consents is tested against forecast future growth and changes in water consumption. Results for three scenarios are provided: the 0% headroom scenario assesses the region's capability for treating the predicted changes in DWF in the future with no allowance for error, with no spare treatment works capacity. The other scenarios indicate resilience - i.e. could we cope if we had flows 10% or 20% higher than estimated?

The wet weather assessment takes storm consent values where available as an indication of treatment works capacity and estimates the amount of incoming flow the treatment works is able to treat across a year. Again, three scenarios are shown, with differing treatment "targets" - i.e. if we wanted to ensure that 70% of the wet weather flows in a catchment were treated, could the treatment works cope? Changes in rainfall due to climate change and changing dry weather flows within the region mean that the percentage of flow treated across a year can change in the future.

Table 2 shows the supply-demand assessment for this region. Where a region may not have adequate capacity under a given scenario, it is flagged dark blue for further investigation. There may be local incapacity issues at individual works within the region.

L3 Area	Headroom	2025	2030	2035	2040	2045	2050
Alyn - Leadmill to Hope, US STW	0%						
	10%						
	20%						
	Treatment Target	2025	2030	2035	2040	2045	2050
	70%						
	80%						
	90%						

Table 2 - Supply Demand Balance

5.0 Options

Over time the pressures on our sewerage network change due to influences such as catchment growth, creep of rainwater into the network, or influences such as climate change impacting rainfall patterns. To ensure the plan is robust over the 30-year planning horizon and to account for the uniqueness of each catchment we have tested various types of schemes, and combination of schemes, to ensure a robust 'best value' plan is delivered.

The types of schemes tested are detailed in Table 3 and can be categorised into either improving network resilience to rainfall or improving network headroom in dry weather flow conditions.

Improving Resilience		
10% Reduction in area draining to the combined sewers	Represents removal of runoff from large commercial buildings.	Short term
25% Reduction reduction in area draining to the combined sewers	Represents removal of area runoff from non-residential paved areas where there is only one stakeholder (e.g. Local Authority or Highways Agency).	Medium term
50% Reduction reduction in area draining to the combined sewers	Represents removal of runoff from any connected area including residential properties. There are likely to be multiple stakeholders to engage with.	Long term
Improving Headroom		
Reducing infiltration	Reducing infiltration into sewers by 50%, which could be achieved by relining or replacing the public sewers .	Medium term
Reducing water use	Represents a reduction in water use per person to around 100l per person per day by 2050 by application of water efficiency measures	Medium term
Reducing trade flow	Reduce trade flows by around 25% by application of water efficiency measures.	Long term

Table 3 - Risk mitigation details

We have undertaken an analysis of all our wastewater catchments to determine the benefit in terms of potential volume of water removed from our systems for each scheme type to determine a journey plan, (see Figure 8 below), which provides the direction of the best scheme types to undertake in this catchment for the most benefit against predicted future risk from growth, creep and climate change.

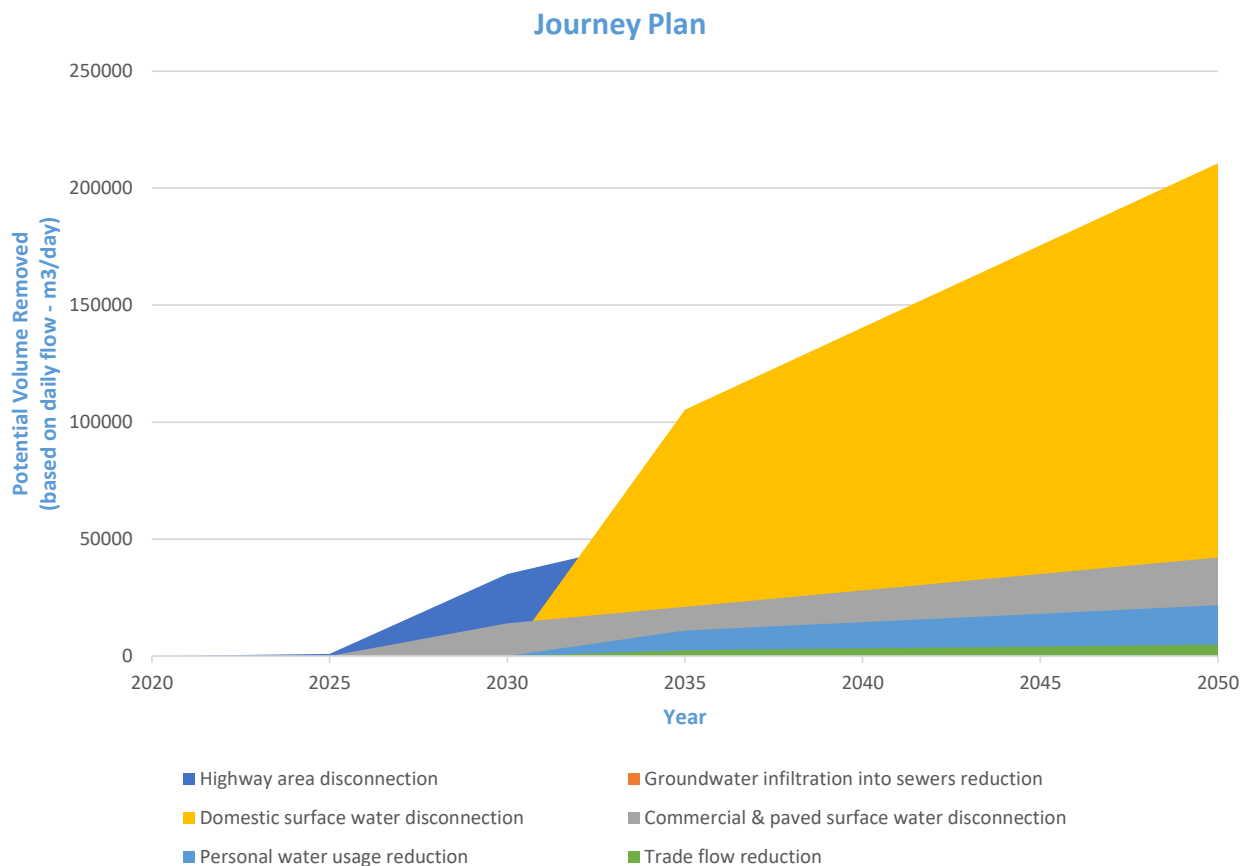


Figure 8 - Journey Plan

Approaches to managing risk

We have undertaken analysis to determine the likely costs to mitigate future predicted pollution and flooding. We assess combined sewer overflows based on the number of times they are predicted to spill in a 'typical year'. Table 4 illustrates the cost of potential measures to mitigate risk to varying standards. The assessment calculates the impact of rainfall and drainage contributions to the network relative to today's costs.

Mitigating the risk posed by flooding has been assessed in terms of probability of occurrence, we use the size of a storm event that has the probability of occurring once every 30 years. Table 5 illustrates the cost of potential mitigation measures to mitigate varying flood risk types.

The choice of scenarios for storm overflow mitigation in Table 4 is a separate cost and would be required in addition to the choice of scenarios for flooding protection in Table 5. The chosen scenarios for Storm overflows and flooding are to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain Existing Performance*	-	£12,000,000.00	£16,000,000.00
40 spills in a Typical Year	£2,000,000.00	£4,000,000.00	£4,000,000.00
20 spills in a Typical Year	£7,000,000.00	£8,000,000.00	£11,000,000.00
10 spills in a Typical Year	£9,000,000.00	£12,000,000.00	£15,000,000.00
0 spills in a Typical Year	£60,000,000.00	£64,000,000.00	£78,000,000.00
Equivalent No. Olympic Swimming Pools in 10 spills scenario	6.00	55.00	66.00

* Maintain is a considered scenario where we will continue to maintain the current level of service within the region and improve the network and address known and emerging risk.

Table 4 - Summary of Combined Sewer Overflow option investments

Choice of Scenario	Current Scenario (£)	2050 Scenario (£)	2050 Resilience Scenario (£) 1 in 50 yr (Storm Dennis)
Internal escapes	£10,000,000	£15,000,000	£10,000,000
External escapes in gardens	£12,000,000	£18,000,000	£21,000,000
Escapes in highways	£20,000,000	£25,000,000	£33,000,000
No future flooding	-	£31,000,000	£2,000,000
Total	£42,000,000.00	£89,000,000	£66,000,000

Table 5 - Summary of Flooding option investments

We have developed solutions which aim to provide protection against drainage and network failure, pollution events and flooding, internal and external to properties. The solutions developed highlight the level of investment required to bring our entire network up to the level of protection required to be resilient for future risk and demands. The range of scenarios is to provide a choice for understanding and discussion of future direction.

We are beginning to break down the investment indicated in Table 4 and 5 by creating practical schemes ready for delivery these schemes are designed as 100% traditional, 100% sustainable or green and 100% mixture of the 2. These packages have then been analysed in terms of their long term benefit and environmental and social cost to society and one has been chosen for inclusion as our preferred best value option. The areas where we have started our delivery programme aims to provide protection, to our worst served customers and rivers designated as Special Areas of Conservation (SAC) under the

For more information on the methodology developed to carry out the assessments see the DWMP plan main report.

If you want to work with us to develop joint projects to reduce the risk of flooding and protect the environment, please get in touch.

We will continue to work with Welsh Government, Regulators and Local Authorities about the pace, scale and affordability of improvements to be made.

We will be consulting on the preferred approach to planning and once its concluded the next stage is to develop the pipeline of options to meet the pace scale and affordability discussed with Welsh Government and our regulators.

Table 6 - Summary of solutions put forward are a first cycle preferred plan before SEA/HRA

L4 Catchments	No. Schemes
RHOESMOR (NR NORTHOP)	0
RHYDYMWYN (NR MOLD) STW	0
GRAIANRHYD	0
BUCKLEY TY GWYN	0
MOLD	0

DWMP Tactical Planning Catchment Summary



Alyn - upper river above Rhydymwyn

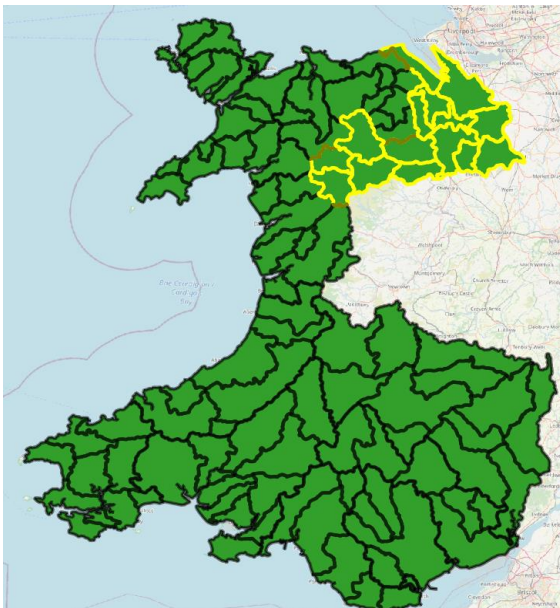
1.0 Introduction

This Drainage and Wastewater Management Plan (DWMP) sets out how Dŵr Cymru Welsh Water (DCWW) will manage and improve its assets to maintain a resilient and robust wastewater drainage system. The plan aims to manage flooding and pollution from our wastewater assets in the future, for our customers and our environment by working collaboratively with stakeholders, regulators and local authorities to provide a complete partnership in tackling current and future problems.

1.1 Catchment Information

The Alyn - upper river above Rhydymwyn planning catchment lies within the Dee river basin catchment, (see Figure 1 below), it consists of 4 wastewater catchments (see Figure 2 below). There is a combined population of 2831, this is set to decrease to 2770 by 2050, a change of -2%. There is a total sewer length of 32km, with a foul sewer length of 20km, a surface water length of 1km and a combined sewer length of 11km. There are 4 Wastewater Treatment Works (WwTW), 5 Sewerage Pumping Stations (SPSSs), and 5 Combined Storm Overflows (CSOs) across this tactical planning unit.

The Alyn - upper river above Rhydymwyn catchment contains the River Alyn that flows down past Pantymwyn. Maes-Y-Groes and Pantymwyn are its major urban areas.



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Figure 1 - River basin location detailing the associated tactical planning catchments

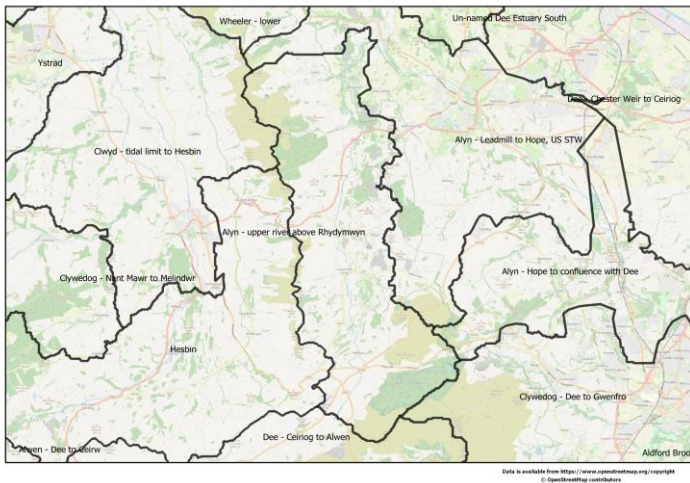


Figure 2- Tactical planning catchments

2.0 Stakeholder Engagement

The DWMP aims to enable DCWW to work collaboratively with stakeholders, regulators and local authorities to tackle current and future challenges. DCWW has identified stakeholder objectives that align with the aims of the DWMP and goals of other management plans. Table 1 details the main opportunities we have identified but this is not intended to be exhaustive. Note that these stakeholders have their own planning processes and plans which do not necessarily align with those of DCWW.

Scheme Information
Stakeholder engagement meetings are scheduled to commence in 2022. These meetings will be held between DCWW and the respective parties, such as NRW, EA, Councils and ENGO's. Further information of the outcome and points of focus towards short and long term strategy planning will be provided in the next cycle of the DWMP assessment.

Table 1 - Current and future investigation schemes

3.0 Risk

We have assessed our likely performance from now to 2050 against the objectives that we set in our most recent business plan. The results of this assessment are presented in the following sections.

To understand future performance, we need to estimate how much population will change by, the degree to which climate change will impact Wales and areas of England that border our company, and how further surface water connected to the sewer network might increase the amount and rate at which rainfall drains into our sewers.

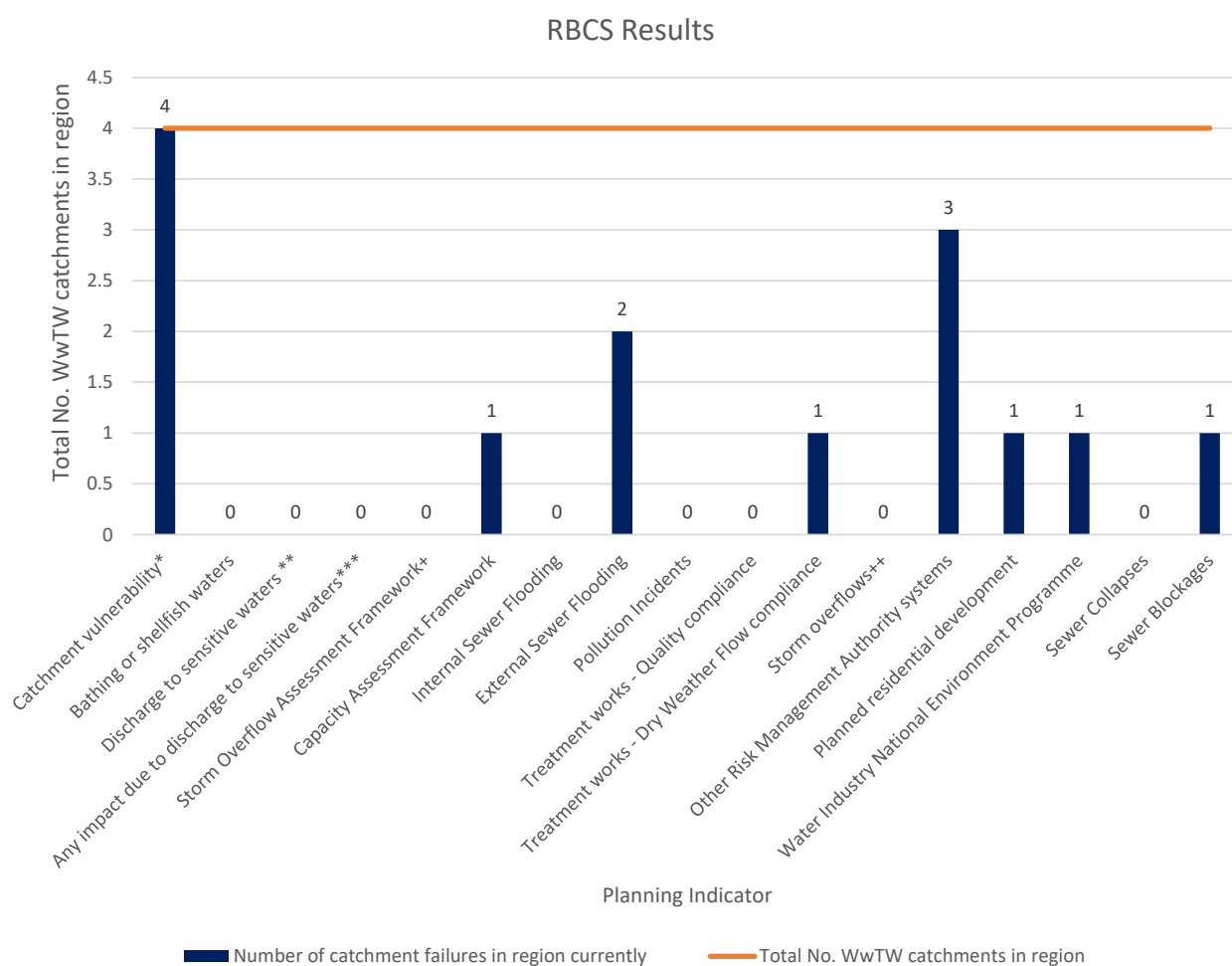
Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

Climate change is predicted to increase the intensity of storms by around 35% in this region. In a typical year, winters are likely to be warmer and wetter, and summers generally drier. More intense rainfall will happen more frequently. The population in the Dee region is set to decrease to 2800 by 2050, a change of -2% based on our future projections. However there are major developments in localised areas that will contribute to future pressures on the network, including two at Llanarmon yn Ial.

3.1 Risk Based Catchment Screening

The Risk Based Catchment Screening (RBCS) is the initial screening process to determine if a more detailed risk assessment is required. The assessment screens catchments against planning indicators which have been stipulated in the national guidance for DWMPs. A catchment will pass through to a more detailed risk assessment if it fails against one or more of these indicators, the results are shown in Figure 3.

For the Alyn - upper river above Rhydymwyn catchment the biggest concerns indicated by the RBCS are catchment characterisation (based on a vulnerability assessment of flooding due to local characteristics e.g. topography), other RMAs and external sewer flooding.



*To sewer flooding due to extreme wet weather events.

**Categorised as a "planned" scheduled action within the Natural Resources Wales Action Database or considered as "Remedy" on Natural England Designated Sites system.

***Categorised as a "identified" scheduled action within the Natural Resources Wales Action Database or considered as "Threat" on Natural England Designated Sites system.

+Frequency investigation triggered.

++Overflow risks not covered by other indicators,

Figure 3 - Risk Based Catchment Screening results

3.2 Baseline Risk And Vulnerability Assessment (BRAVA)

Following on from the RBCS, the Baseline Risk and Vulnerability Assessment (BRAVA) highlights current and future risk. The risk scores are driven by company targets which were set in our last business plan. These targets were subdivided according to population or sewer length, depending on the measure, to derive a target for each river basin catchment.

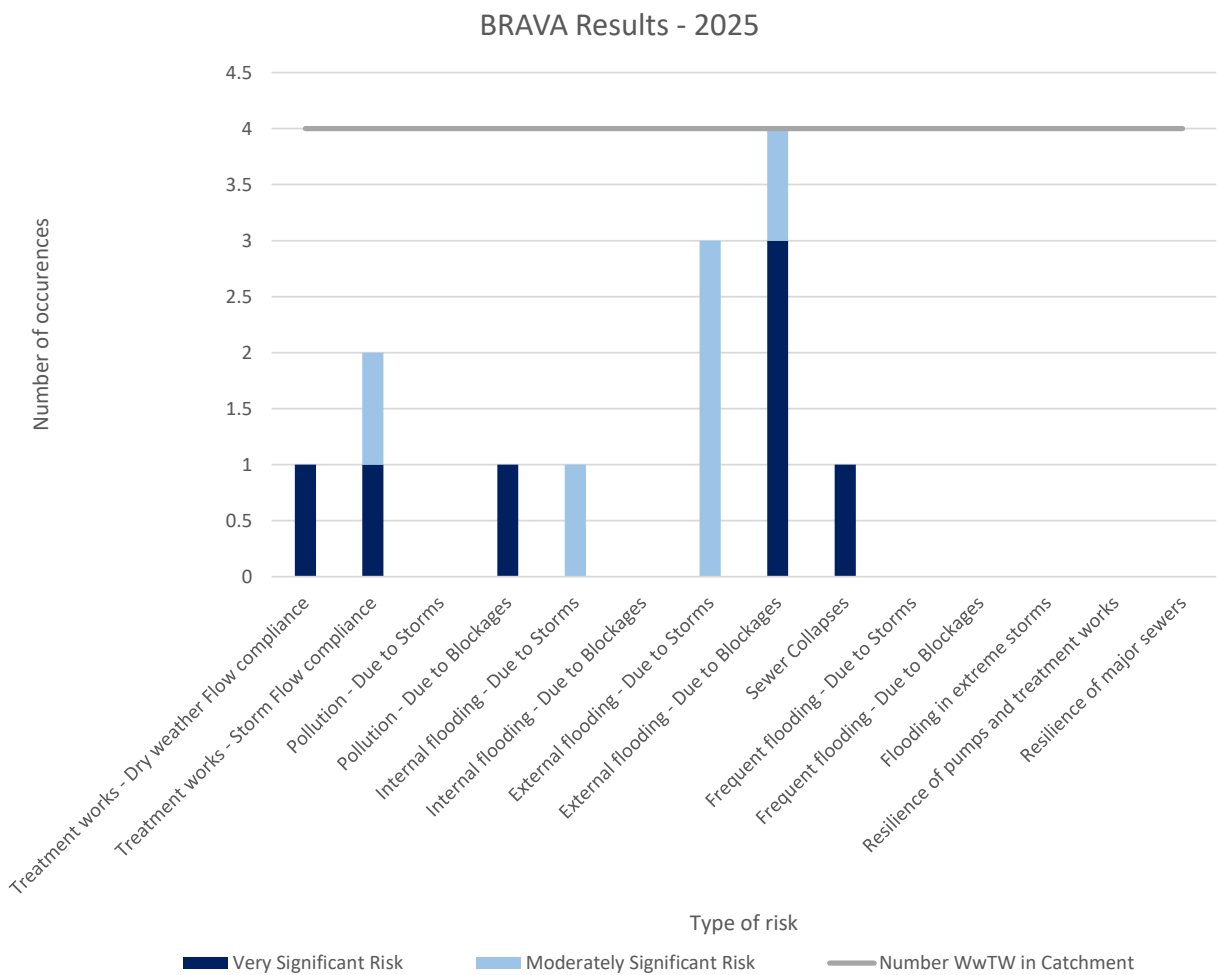


Figure 4 - BRAVA 2025 Summary

In 2025, external flooding due to blockages is the biggest concern in the Alyn - upper river above Rhydymwyn catchment, followed by external flooding due to storms.

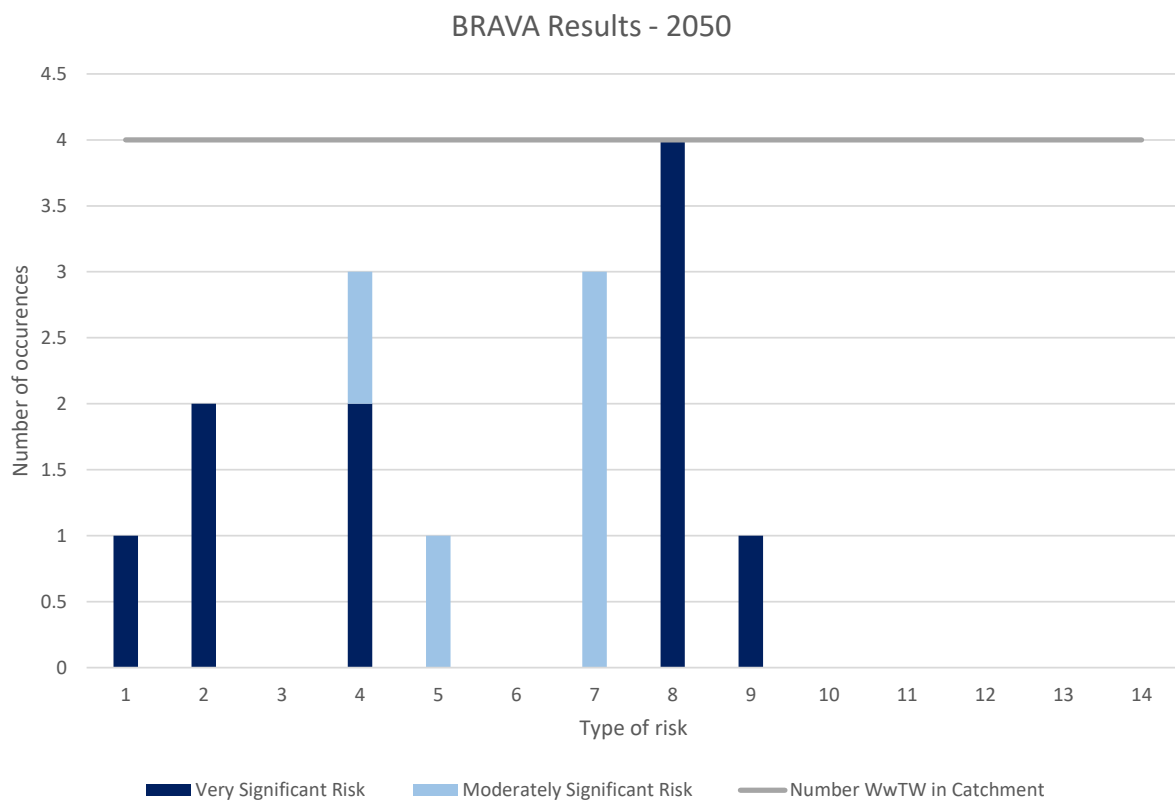


Figure 5 - BRAVA 2050 Summary

In 2050, external flooding due to blockages and storms, and pollution due to blockages are the biggest concern in the Alyn - upper river above Rhydymwyn catchment.

Figures 6 and 7 indicate the current and predicted risk of flooding, pollution, and both flooding and pollution caused by lack of capacity (termed 'hydraulic overload') across our networks. These maps illustrate where the issues occur and can be used to target where we want to work with the community and stakeholders to resolve issues. By working together, we can combine knowledge and resources to deliver the best outcomes for local communities and the environment. We want to include your feedback in our decision-making process.

BRAVA results 2025 Flooding and Pollution caused by Hydraulic Overload

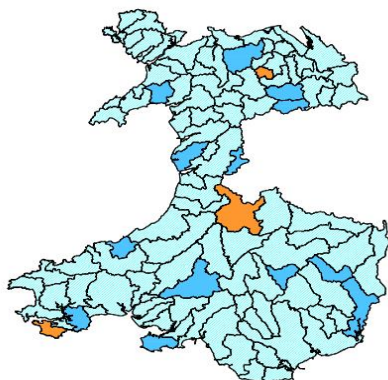
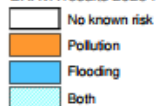


Figure 6 - Associated Strategic Planning Areas priority (2025)

BRAVA results 2050 Flooding and Pollution caused by Hydraulic Overload

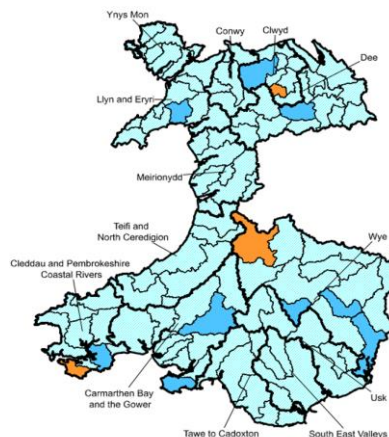
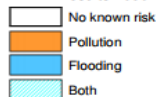


Figure 7 - Associated Strategic Planning Areas

3.3 Water Quality

Water quality is the classification of the quality of watercourses or water bodies in accordance to its physical, biological and chemical properties. Water quality is an important factor of environmental monitoring, ensuring that not only the water body is safe but the surrounding habitat and ecosystem is also.

Water quality status is categorised from 1 to 4, with 4 being the worst case. The priority status is based on the significance towards the risk factors triggering water quality. Alyn - upper river above Rhydymwyn has a water quality priority status for 2050 of 3 which indicates targeted investment to mitigate and focus during AMP9.

4.0 Supply Demand

Supply-demand is an assessment of the capacity of our treatment works. It approximately assesses whether all the treatment works in a region can collectively cope with current and future flows in dry and wet weather. There are two parts to the assessment: dry weather flow (DWF) and a wet weather capacity assessment.

For the DWF part of the assessment, the suitability of the dry weather consents is tested against forecast future growth and changes in water consumption. Results for three scenarios are provided: the 0% headroom scenario assesses the region's capability for treating the predicted changes in DWF in the future with no allowance for error, with no spare treatment works capacity. The other scenarios indicate resilience - i.e. could we cope if we had flows 10% or 20% higher than estimated?

The wet weather assessment takes storm consent values where available as an indication of treatment works capacity and estimates the amount of incoming flow the treatment works is able to treat across a year. Again, three scenarios are shown, with differing treatment "targets" - i.e. if we wanted to ensure that 70% of the wet weather flows in a catchment were treated, could the treatment works cope? Changes in rainfall due to climate change and changing dry weather flows within the region mean that the percentage of flow treated across a year can change in the future.

Table 2 shows the supply-demand assessment for this region. Where a region may not have adequate capacity under a given scenario, it is flagged dark blue for further investigation. There may be local incapacity issues at individual works within the region.

L3 Area	Headroom	2025	2030	2035	2040	2045	2050
Alyn - upper river above Rhydymwyn	0%						
	10%						
	20%						
	Treatment Target	2025	2030	2035	2040	2045	2050
	70%						
	80%						
	90%						

Table 2 - Supply Demand Balance

5.0 Options

Over time the pressures on our sewerage network change due to influences such as catchment growth, creep of rainwater into the network, or influences such as climate change impacting rainfall patterns. To ensure the plan is robust over the 30-year planning horizon and to account for the uniqueness of each catchment we have tested various types of schemes, and combination of schemes, to ensure a robust 'best value' plan is delivered.

The types of schemes tested are detailed in Table 3 and can be categorised into either improving network resilience to rainfall or improving network headroom in dry weather flow conditions.

Improving Resilience		
10% Reduction in area draining to the combined sewers	Represents removal of runoff from large commercial buildings.	Short term
25% Reduction reduction in area draining to the combined sewers	Represents removal of area runoff from non-residential paved areas where there is only one stakeholder (e.g. Local Authority or Highways Agency).	Medium term
50% Reduction reduction in area draining to the combined sewers	Represents removal of runoff from any connected area including residential properties. There are likely to be multiple stakeholders to engage with.	Long term
Improving Headroom		
Reducing infiltration	Reducing infiltration into sewers by 50%, which could be achieved by relining or replacing the public sewers .	Medium term
Reducing water use	Represents a reduction in water use per person to around 100l per person per day by 2050 by application of water efficiency measures	Medium term
Reducing trade flow	Reduce trade flows by around 25% by application of water efficiency measures.	Long term

Table 3 - Risk mitigation details

We have undertaken an analysis of all our wastewater catchments to determine the benefit in terms of potential volume of water removed from our systems for each scheme type to determine a journey plan, (see Figure 8 below), which provides the direction of the best scheme types to undertake in this catchment for the most benefit against predicted future risk from growth, creep and climate change.

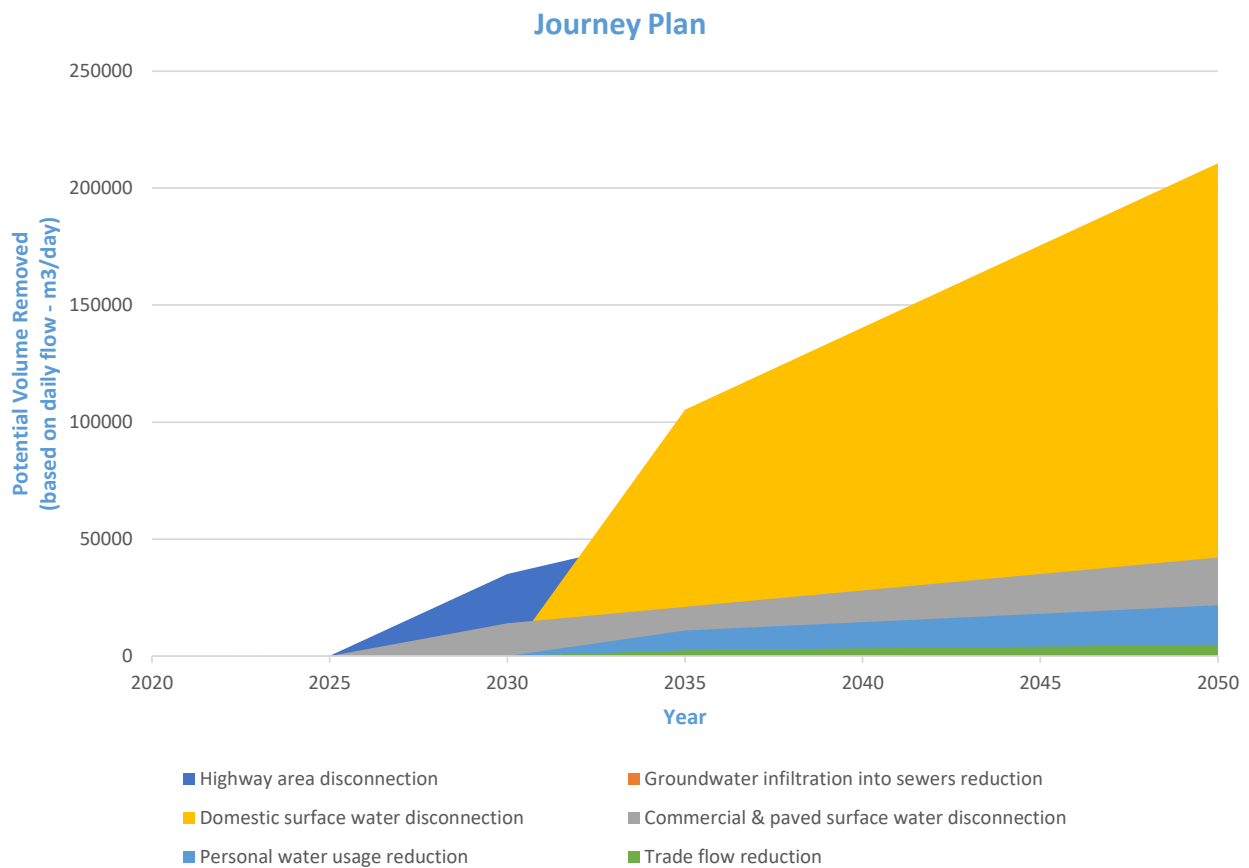


Figure 8 - Journey Plan

Approaches to managing risk

We have undertaken analysis to determine the likely costs to mitigate future predicted pollution and flooding. We assess combined sewer overflows based on the number of times they are predicted to spill in a 'typical year'. Table 4 illustrates the cost of potential measures to mitigate risk to varying standards. The assessment calculates the impact of rainfall and drainage contributions to the network relative to today's costs.

Mitigating the risk posed by flooding has been assessed in terms of probability of occurrence, we use the size of a storm event that has the probability of occurring once every 30 years. Table 5 illustrates the cost of potential mitigation measures to mitigate varying flood risk types.

The choice of scenarios for storm overflow mitigation in Table 4 is a separate cost and would be required in addition to the choice of scenarios for flooding protection in Table 5. The chosen scenarios for Storm overflows and flooding are to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain Existing Performance*	-	£7,000,000.00	£10,000,000.00
40 spills in a Typical Year	£1,000,000.00	£1,000,000.00	£1,000,000.00
20 spills in a Typical Year	£3,000,000.00	£3,000,000.00	£3,000,000.00
10 spills in a Typical Year	£4,000,000.00	£4,000,000.00	£4,000,000.00
0 spills in a Typical Year	£7,000,000.00	£7,000,000.00	£8,000,000.00
Equivalent No. Olympic Swimming Pools in 10 spills scenario	16.00	18.00	19.00

* Maintain is a considered scenario where we will continue to maintain the current level of service within the region and improve the network and address known and emerging risk.

Table 4 - Summary of Combined Sewer Overflow option investments

Choice of Scenario	Current Scenario (£)	2050 Scenario (£)	2050 Resilience Scenario (£) 1 in 50 yr (Storm Dennis)
Internal escapes	£0	£0	£0
External escapes in gardens	£0	£0	£0
Escapes in highways	£1,000,000	£2,000,000	£2,000,000
No future flooding	-	£1,000,000	£4,000,000
Total	£1,000,000.00	£3,000,000	£6,000,000

Table 5 - Summary of Flooding option investments

We have developed solutions which aim to provide protection against drainage and network failure, pollution events and flooding, internal and external to properties. The solutions developed highlight the level of investment required to bring our entire network up to the level of protection required to be resilient for future risk and demands. The range of scenarios is to provide a choice for understanding and discussion of future direction.

We are beginning to break down the investment indicated in Table 4 and 5 by creating practical schemes ready for delivery these schemes are designed as 100% traditional, 100% sustainable or green and 100% mixture of the 2. These packages have then been analysed in terms of their long term benefit and environmental and social cost to society and one has been chosen for inclusion as our preferred best value option. The areas where we have started our delivery programme aims to provide protection, to our worst served customers and rivers designated as Special Areas of Conservation (SAC) under the

For more information on the methodology developed to carry out the assessments see the DWMP plan main report.

If you want to work with us to develop joint projects to reduce the risk of flooding and protect the environment, please get in touch.

We will continue to work with Welsh Government, Regulators and Local Authorities about the pace, scale and affordability of improvements to be made.

We will be consulting on the preferred approach to planning and once its concluded the next stage is to develop the pipeline of options to meet the pace scale and affordability discussed with Welsh Government and our regulators.

Table 6 - Summary of solutions put forward are a first cycle preferred plan before SEA/HRA

L4 Catchments	No. Schemes
PEN-Y-STRYT	0
LLANARMON-YN-IAL	0
CILCAIN MAES-Y-GROES	0
PANTYMWYN (NR CILCAIN) STW	0

DWMP Tactical Planning Catchment Summary



Ceiriog - confluence Dee to Teirw

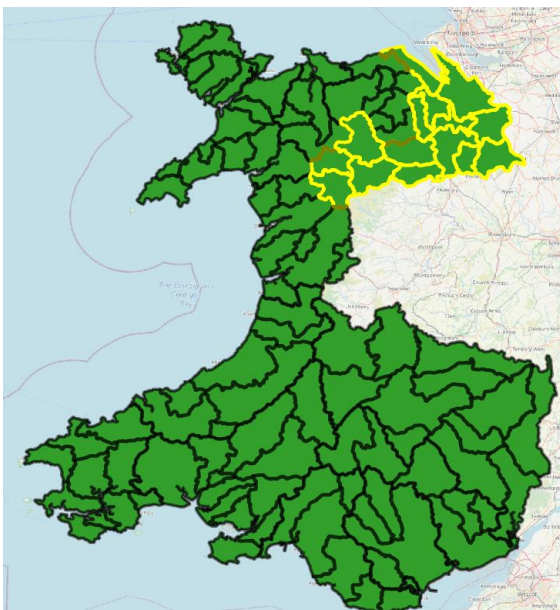
1.0 Introduction

This Drainage and Wastewater Management Plan (DWMP) sets out how Dŵr Cymru Welsh Water (DCWW) will manage and improve its assets to maintain a resilient and robust wastewater drainage system. The plan aims to manage flooding and pollution from our wastewater assets in the future, for our customers and our environment by working collaboratively with stakeholders, regulators and local authorities to provide a complete partnership in tackling current and future problems.

1.1 Catchment Information

The Ceiriog - confluence Dee to Teirw planning catchment lies within the Dee river basin catchment, (see Figure 1 below), it consists of 6 wastewater catchments (see Figure 2 below). There is a combined population of 775, this is set to increase to 1286 by 2050, a change of 66%. There is a total sewer length of 10km, with a foul sewer length of 10km, a surface water length of 0km and a combined sewer length of 0km. There are 6 Wastewater Treatment Works (WwTW), 1 Sewerage Pumping Stations (SPSs), and 5 Combined Storm Overflows (CSOs) across this tactical planning unit.

The Ceiriog - confluence Dee to Teirw catchment reaches the England Wales border just north of the centre of Wales. The river Ceiriog flows down into the River Dee east of Chrik. Glyn Ceiriog and Pontfadog are its major urban areas.



Data is available from <https://www.openstreetmap.org/copyright> © OpenStreetMap contributors

Figure 1 - River basin location detailing the associated tactical planning catchments

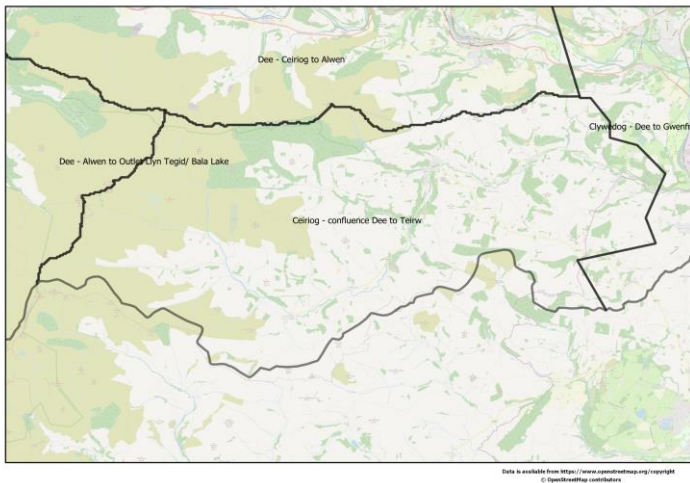


Figure 2- Tactical planning catchments

2.0 Stakeholder Engagement

The DWMP aims to enable DCWW to work collaboratively with stakeholders, regulators and local authorities to tackle current and future challenges. DCWW has identified stakeholder objectives that align with the aims of the DWMP and goals of other management plans. Table 1 details the main opportunities we have identified but this is not intended to be exhaustive. Note that these stakeholders have their own planning processes and plans which do not necessarily align with those of DCWW.

Scheme Information
Stakeholder engagement meetings are scheduled to commence in 2022. These meetings will be held between DCWW and the respective parties, such as NRW, EA, Councils and ENGO's. Further information of the outcome and points of focus towards short and long term strategy planning will be provided in the next cycle of the DWMP assessment.

Table 1 - Current and future investigation schemes

3.0 Risk

We have assessed our likely performance from now to 2050 against the objectives that we set in our most recent business plan. The results of this assessment are presented in the following sections.

To understand future performance, we need to estimate how much population will change by, the degree to which climate change will impact Wales and areas of England that border our company, and how further surface water connected to the sewer network might increase the amount and rate at which rainfall drains into our sewers.

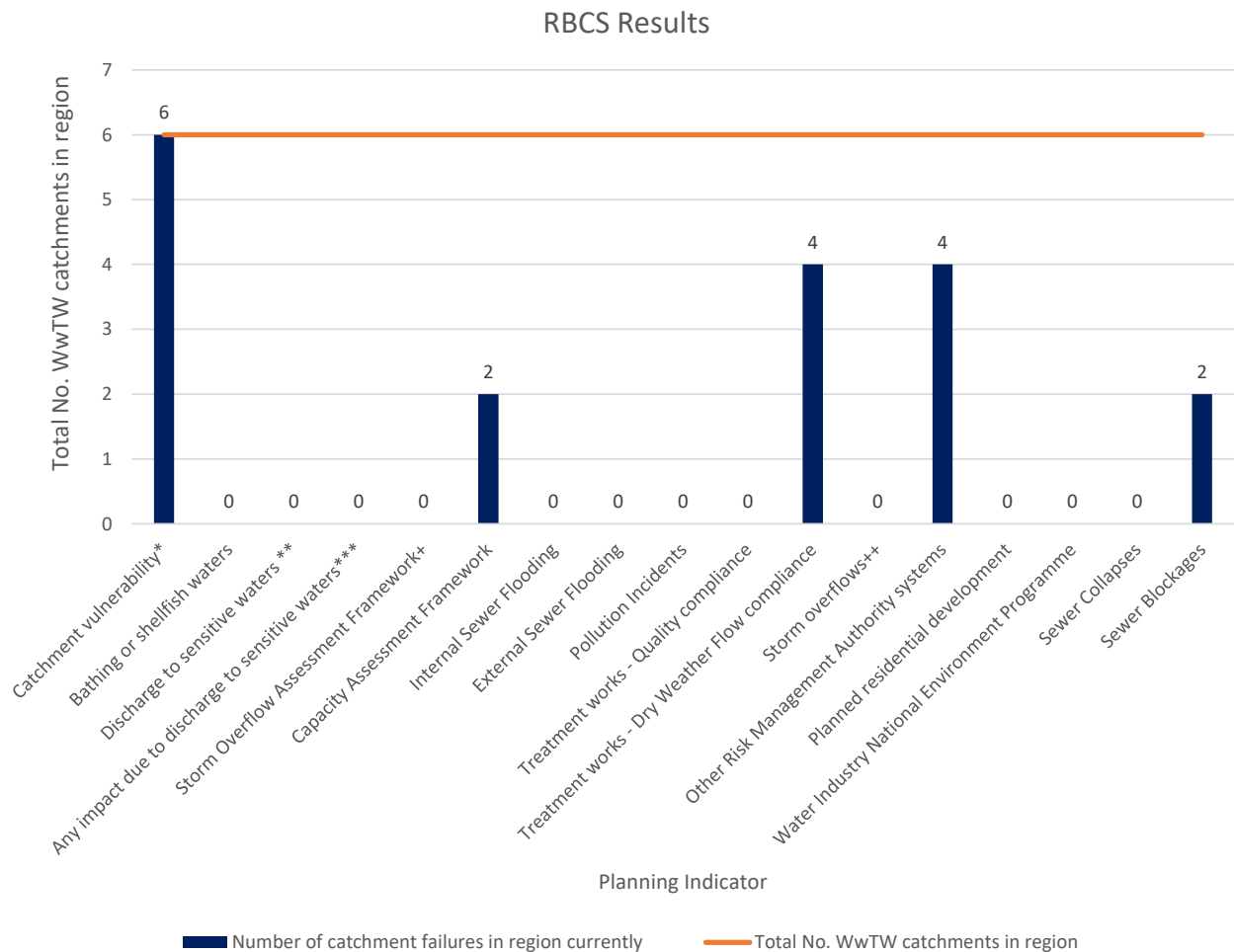
Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

Climate change is predicted to increase the intensity of storms by around 35% in this region. In a typical year, winters are likely to be warmer and wetter, and summers generally drier. More intense rainfall will happen more frequently. The population in the Dee region is set to increase to 1300 by 2050, a change of 66% based on our future projections. However there are major developments in localised areas that will contribute to future pressures on the network.

3.1 Risk Based Catchment Screening

The Risk Based Catchment Screening (RBCS) is the initial screening process to determine if a more detailed risk assessment is required. The assessment screens catchments against planning indicators which have been stipulated in the national guidance for DWMPs. A catchment will pass through to a more detailed risk assessment if it fails against one or more of these indicators, the results are shown in Figure 3.

For the Ceiriog - confluence Dee to Teirw catchment the biggest concerns indicated by the RBCS are catchment characterisation (based on a vulnerability assessment of flooding due to local characteristics e.g. topography), dry weather flow compliance at treatment works and other RMAs.



*To sewer flooding due to extreme wet weather events.

**Categorised as a "planned" scheduled action within the Natural Resources Wales Action Database or considered as "Remedy" on Natural England Designated Sites system.

***Categorised as a "identified" scheduled action within the Natural Resources Wales Action Database or considered as "Threat" on Natural England Designated Sites system.

+Frequency investigation triggered.

++Overflow risks not covered by other indicators,

Figure 3 - Risk Based Catchment Screening results

3.2 Baseline Risk And Vulnerability Assessment (BRAVA)

Following on from the RBCS, the Baseline Risk and Vulnerability Assessment (BRAVA) highlights current and future risk. The risk scores are driven by company targets which were set in our last business plan. These targets were subdivided according to population or sewer length, depending on the measure, to derive a target for each river basin catchment.

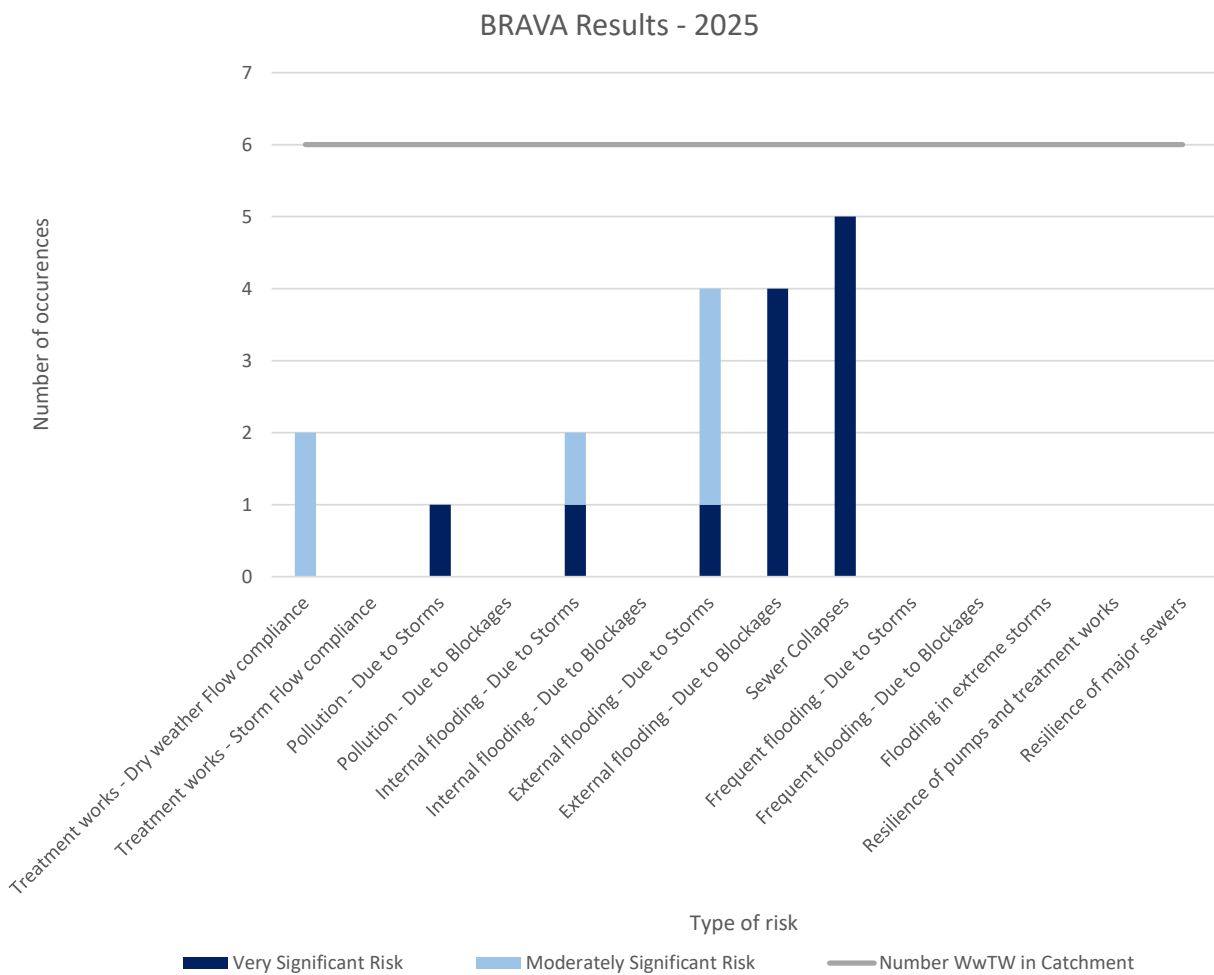


Figure 4 - BRAVA 2025 Summary

In 2025, sewer collapse, followed by external flooding due to storms and blockages are the biggest concerns in the Ceiriog - confluence Dee to Teirw catchment.

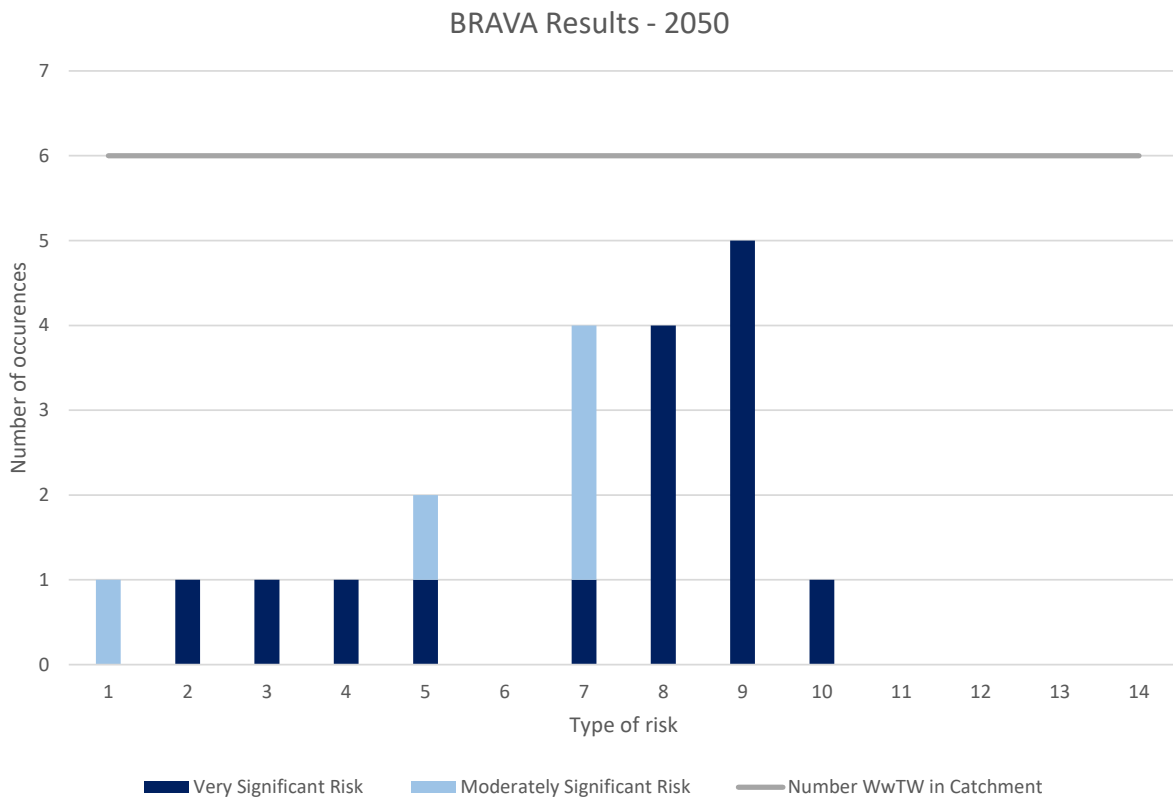


Figure 5 - BRAVA 2050 Summary

In 2050, sewer collapse followed by external flooding due to storms and blockages are the biggest concerns in the Ceiriog - confluence Dee to Teirw catchment.

Figures 6 and 7 indicate the current and predicted risk of flooding, pollution, and both flooding and pollution caused by lack of capacity (termed 'hydraulic overload') across our networks. These maps illustrate where the issues occur and can be used to target where we want to work with the community and stakeholders to resolve issues. By working together, we can combine knowledge and resources to deliver the best outcomes for local communities and the environment. We want to include your feedback in our decision-making process.

BRAVA results 2025 Flooding and Pollution caused by Hydraulic Overload

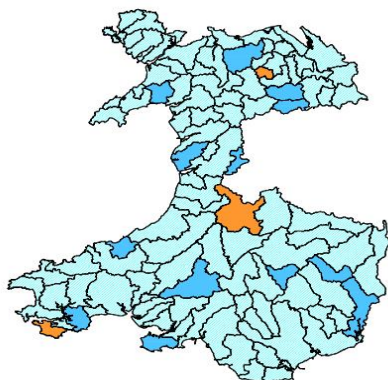
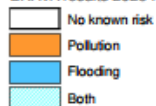


Figure 6 - Associated Strategic Planning Areas priority (2025)

BRAVA results 2050 Flooding and Pollution caused by Hydraulic Overload

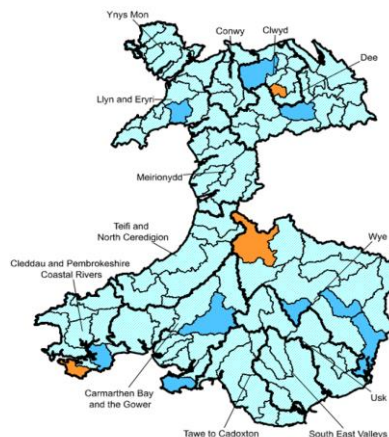
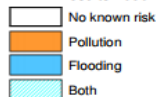


Figure 7 - Associated Strategic Planning Areas

3.3 Water Quality

Water quality is the classification of the quality of watercourses or water bodies in accordance to its physical, biological and chemical properties. Water quality is an important factor of environmental monitoring, ensuring that not only the water body is safe but the surrounding habitat and ecosystem is also.

Water quality status is categorised from 1 to 4, with 4 being the worst case. The priority status is based on the significance towards the risk factors triggering water quality. Ceiriog - confluence Dee to Teirw has a water quality priority status for 2050 of 3 which indicates targeted investment to mitigate and focus during AMP9.

4.0 Supply Demand

Supply-demand is an assessment of the capacity of our treatment works. It approximately assesses whether all the treatment works in a region can collectively cope with current and future flows in dry and wet weather. There are two parts to the assessment: dry weather flow (DWF) and a wet weather capacity assessment.

For the DWF part of the assessment, the suitability of the dry weather consents is tested against forecast future growth and changes in water consumption. Results for three scenarios are provided: the 0% headroom scenario assesses the region's capability for treating the predicted changes in DWF in the future with no allowance for error, with no spare treatment works capacity. The other scenarios indicate resilience - i.e. could we cope if we had flows 10% or 20% higher than estimated?

The wet weather assessment takes storm consent values where available as an indication of treatment works capacity and estimates the amount of incoming flow the treatment works is able to treat across a year. Again, three scenarios are shown, with differing treatment "targets" - i.e. if we wanted to ensure that 70% of the wet weather flows in a catchment were treated, could the treatment works cope? Changes in rainfall due to climate change and changing dry weather flows within the region mean that the percentage of flow treated across a year can change in the future.

Table 2 shows the supply-demand assessment for this region. Where a region may not have adequate capacity under a given scenario, it is flagged dark blue for further investigation. There may be local incapacity issues at individual works within the region.

L3 Area	Headroom	2025	2030	2035	2040	2045	2050
Ceiriog - confluence Dee to Teirw	0%						
	10%						
	20%						
	Treatment Target	2025	2030	2035	2040	2045	2050
	70%						
	80%						
	90%						

Table 2 - Supply Demand Balance

5.0 Options

Over time the pressures on our sewerage network change due to influences such as catchment growth, creep of rainwater into the network, or influences such as climate change impacting rainfall patterns. To ensure the plan is robust over the 30-year planning horizon and to account for the uniqueness of each catchment we have tested various types of schemes, and combination of schemes, to ensure a robust 'best value' plan is delivered.

The types of schemes tested are detailed in Table 3 and can be categorised into either improving network resilience to rainfall or improving network headroom in dry weather flow conditions.

Improving Resilience		
10% Reduction in area draining to the combined sewers	Represents removal of runoff from large commercial buildings.	Short term
25% Reduction reduction in area draining to the combined sewers	Represents removal of area runoff from non-residential paved areas where there is only one stakeholder (e.g. Local Authority or Highways Agency).	Medium term
50% Reduction reduction in area draining to the combined sewers	Represents removal of runoff from any connected area including residential properties. There are likely to be multiple stakeholders to engage with.	Long term
Improving Headroom		
Reducing infiltration	Reducing infiltration into sewers by 50%, which could be achieved by relining or replacing the public sewers .	Medium term
Reducing water use	Represents a reduction in water use per person to around 100l per person per day by 2050 by application of water efficiency measures	Medium term
Reducing trade flow	Reduce trade flows by around 25% by application of water efficiency measures.	Long term

Table 3 - Risk mitigation details

We have undertaken an analysis of all our wastewater catchments to determine the benefit in terms of potential volume of water removed from our systems for each scheme type to determine a journey plan, (see Figure 8 below), which provides the direction of the best scheme types to undertake in this catchment for the most benefit against predicted future risk from growth, creep and climate change.

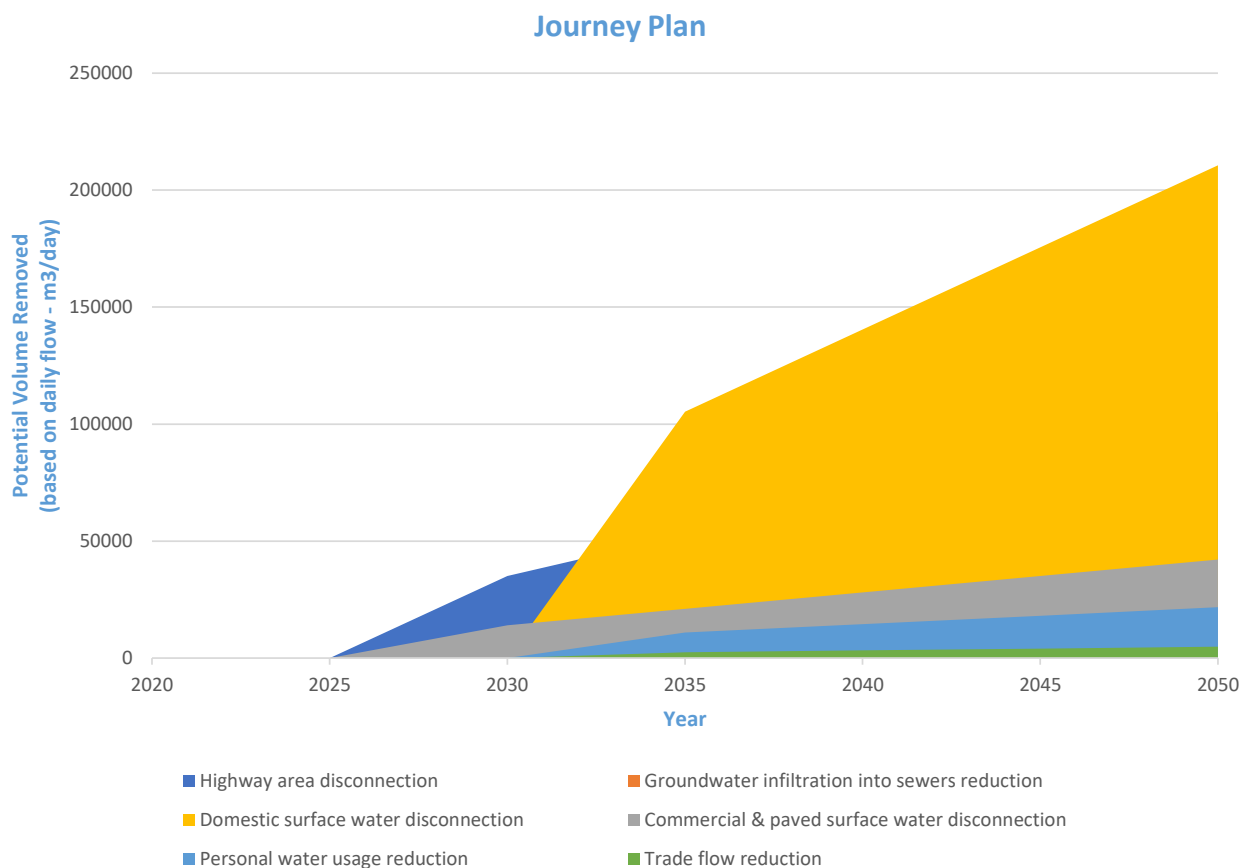


Figure 8 - Journey Plan

Approaches to managing risk

We have undertaken analysis to determine the likely costs to mitigate future predicted pollution and flooding. We assess combined sewer overflows based on the number of times they are predicted to spill in a 'typical year'. Table 4 illustrates the cost of potential measures to mitigate risk to varying standards. The assessment calculates the impact of rainfall and drainage contributions to the network relative to today's costs.

Mitigating the risk posed by flooding has been assessed in terms of probability of occurrence, we use the size of a storm event that has the probability of occurring once every 30 years. Table 5 illustrates the cost of potential mitigation measures to mitigate varying flood risk types.

The choice of scenarios for storm overflow mitigation in Table 4 is a separate cost and would be required in addition to the choice of scenarios for flooding protection in Table 5. The chosen scenarios for Storm overflows and flooding are to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain Existing Performance*	-	£14,000,000.00	£20,000,000.00
40 spills in a Typical Year	£3,000,000.00	£3,000,000.00	£3,000,000.00
20 spills in a Typical Year	£3,000,000.00	£3,000,000.00	£3,000,000.00
10 spills in a Typical Year	£6,000,000.00	£6,000,000.00	£6,000,000.00
0 spills in a Typical Year	£14,000,000.00	£15,000,000.00	£15,000,000.00
Equivalent No. Olympic Swimming Pools in 10 spills scenario	14.00	16.00	17.00

* Maintain is a considered scenario where we will continue to maintain the current level of service within the region and improve the network and address known and emerging risk.

Table 4 - Summary of Combined Sewer Overflow option investments

Choice of Scenario	Current Scenario (£)	2050 Scenario (£)	2050 Resilience Scenario (£) 1 in 50 yr (Storm Dennis)
Internal escapes	£0	£0	£0
External escapes in gardens	£1,000,000	£1,000,000	£1,000,000
Escapes in highways	£1,000,000	£1,000,000	£1,000,000
No future flooding	-	£3,000,000	£8,000,000
Total	£2,000,000.00	£5,000,000	£10,000,000

Table 5 - Summary of Flooding option investments

We have developed solutions which aim to provide protection against drainage and network failure, pollution events and flooding, internal and external to properties. The solutions developed highlight the level of investment required to bring our entire network up to the level of protection required to be resilient for future risk and demands. The range of scenarios is to provide a choice for understanding and discussion of future direction.

We are beginning to break down the investment indicated in Table 4 and 5 by creating practical schemes ready for delivery these schemes are designed as 100% traditional, 100% sustainable or green and 100% mixture of the 2. These packages have then been analysed in terms of their long term benefit and environmental and social cost to society and one has been chosen for inclusion as our preferred best value option. The areas where we have started our delivery programme aims to provide protection, to our worst served customers and rivers designated as Special Areas of Conservation (SAC) under the

For more information on the methodology developed to carry out the assessments see the DWMP plan main report.

If you want to work with us to develop joint projects to reduce the risk of flooding and protect the environment, please get in touch.

We will continue to work with Welsh Government, Regulators and Local Authorities about the pace, scale and affordability of improvements to be made.

We will be consulting on the preferred approach to planning and once its concluded the next stage is to develop the pipeline of options to meet the pace scale and affordability discussed with Welsh Government and our regulators.

Table 6 - Summary of solutions put forward are a first cycle preferred plan before SEA/HRA

L4 Catchments	No. Schemes
TREGEIRIOG	0
PANDY (S OF LLANGOLLEN)	0
LLANARMON DYFFRYN CEIRIOG	0
PONTFADOG	0
DOLYWERN (NR CHIRK)	0
GLYN CEIRIOG	0

DWMP Tactical Planning Catchment Summary



Clywedog - Dee to Gwenfro

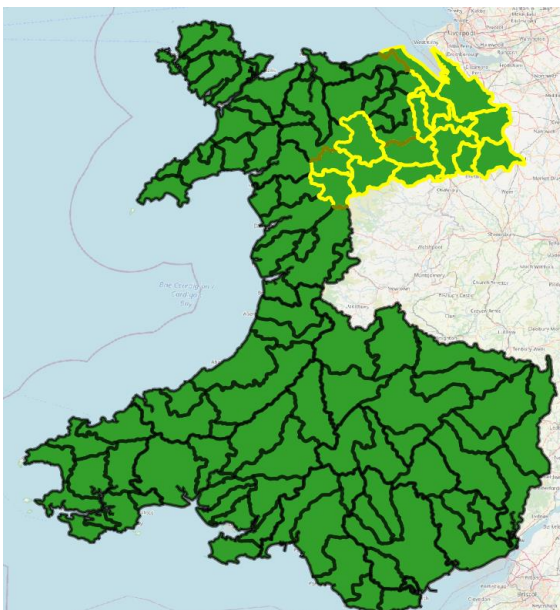
1.0 Introduction

This Drainage and Wastewater Management Plan (DWMP) sets out how Dŵr Cymru Welsh Water (DCWW) will manage and improve its assets to maintain a resilient and robust wastewater drainage system. The plan aims to manage flooding and pollution from our wastewater assets in the future, for our customers and our environment by working collaboratively with stakeholders, regulators and local authorities to provide a complete partnership in tackling current and future problems.

1.1 Catchment Information

The Clywedog - Dee to Gwenfro planning catchment lies within the Dee river basin catchment, (see Figure 1 below), it consists of 10 wastewater catchments (see Figure 2 below). There is a combined population of 122267, this is set to decrease to 102828 by 2050, a change of -16%. There is a total sewer length of 725km, with a foul sewer length of 256km, a surface water length of 103km and a combined sewer length of 354km. There are 10 Wastewater Treatment Works (WwTW), 93 Sewerage Pumping Stations (SPSs), and 67 Combined Storm Overflows (CSOs) across this tactical planning unit.

The Clywedog - Dee to Gwenfro catchment sits on the England Wales border, crossing the border in the south and stretching to Wrexham in the north. The River Clywedog flows down into the River Dee, which flows back through the south of the catchment. Wrexham and Rhosllanerchrugog are its major urban areas.



Data is available from <https://www.openstreetmap.org/copyright> © OpenStreetMap contributors

Figure 1 - River basin location detailing the associated tactical planning catchments

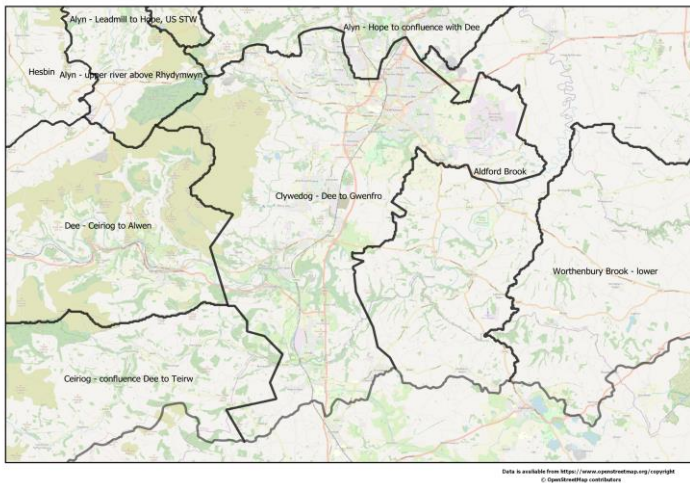


Figure 2- Tactical planning catchments

2.0 Stakeholder Engagement

The DWMP aims to enable DCWW to work collaboratively with stakeholders, regulators and local authorities to tackle current and future challenges. DCWW has identified stakeholder objectives that align with the aims of the DWMP and goals of other management plans. Table 1 details the main opportunities we have identified but this is not intended to be exhaustive. Note that these stakeholders have their own planning processes and plans which do not necessarily align with those of DCWW.

Scheme Information
Stakeholder engagement meetings are scheduled to commence in 2022. These meetings will be held between DCWW and the respective parties, such as NRW, EA, Councils and ENGO's. Further information of the outcome and points of focus towards short and long term strategy planning will be provided in the next cycle of the DWMP assessment.

Table 1 - Current and future investigation schemes

3.0 Risk

We have assessed our likely performance from now to 2050 against the objectives that we set in our most recent business plan. The results of this assessment are presented in the following sections.

To understand future performance, we need to estimate how much population will change by, the degree to which climate change will impact Wales and areas of England that border our company, and how further surface water connected to the sewer network might increase the amount and rate at which rainfall drains into our sewers.

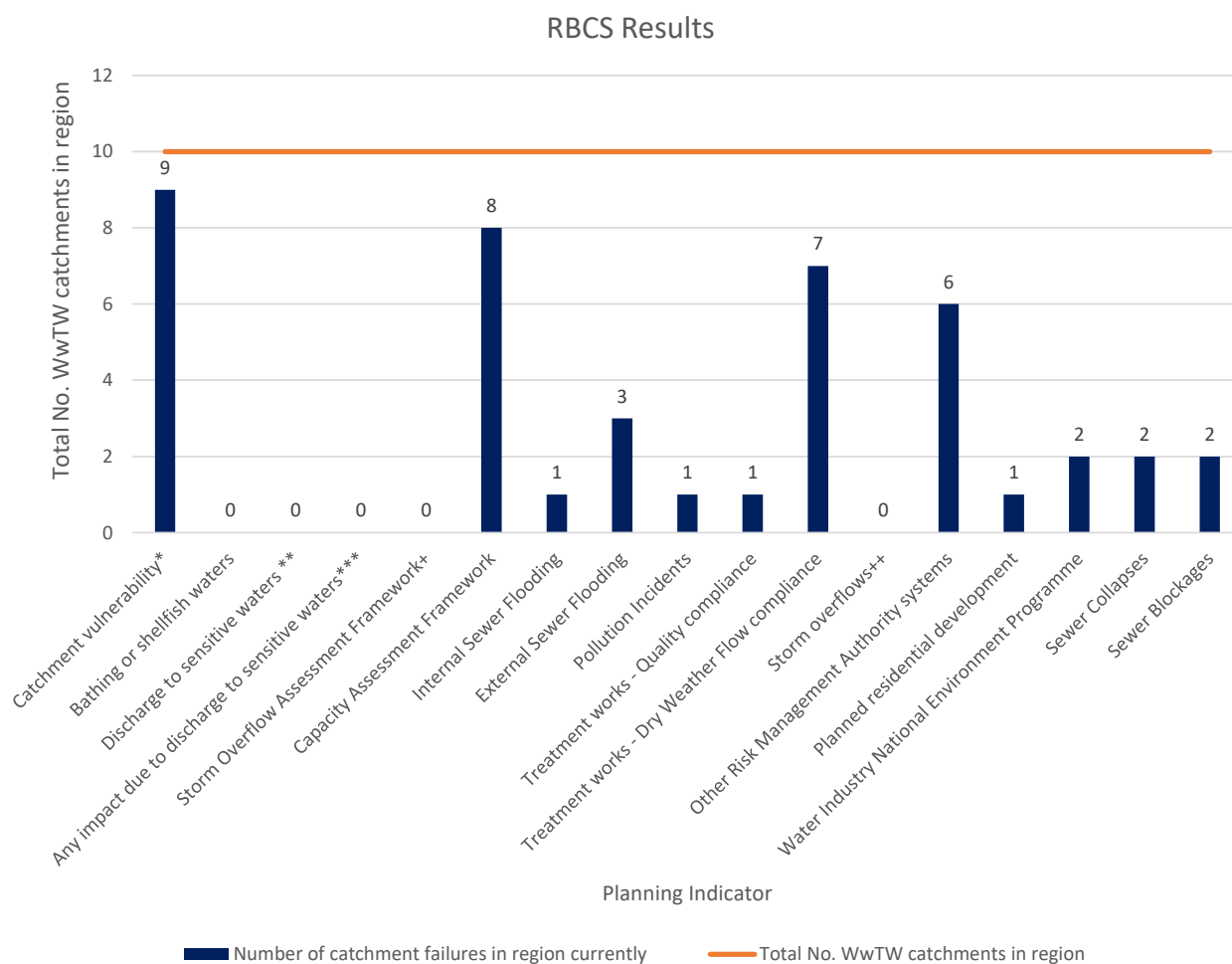
Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

Climate change is predicted to increase the intensity of storms by around 35% in this region. In a typical year, winters are likely to be warmer and wetter, and summers generally drier. More intense rainfall will happen more frequently. The population in the Dee region is set to decrease to 102800 by 2050, a change of -16% based on our future projections. However there are major developments in localised areas that will contribute to future pressures on the network, including St Martins - land adjacent to school and Rhosweil - south of Station Road.

3.1 Risk Based Catchment Screening

The Risk Based Catchment Screening (RBCS) is the initial screening process to determine if a more detailed risk assessment is required. The assessment screens catchments against planning indicators which have been stipulated in the national guidance for DWMPs. A catchment will pass through to a more detailed risk assessment if it fails against one or more of these indicators, the results are shown in Figure 3.

For the Clywedog - Dee to Gwenfro catchment the biggest concerns indicated by the RBCS are catchment characterisation (based on a vulnerability assessment of flooding due to local characteristics e.g. topography) and Capacity Assessment Framework.



*To sewer flooding due to extreme wet weather events.

**Categorised as a "planned" scheduled action within the Natural Resources Wales Action Database or considered as "Remedy" on Natural England Designated Sites system.

***Categorised as a "identified" scheduled action within the Natural Resources Wales Action Database or considered as "Threat" on Natural England Designated Sites system.

+Frequency investigation triggered.

++Overflow risks not covered by other indicators,

Figure 3 - Risk Based Catchment Screening results

3.2 Baseline Risk And Vulnerability Assessment (BRAVA)

Following on from the RBCS, the Baseline Risk and Vulnerability Assessment (BRAVA) highlights current and future risk. The risk scores are driven by company targets which were set in our last business plan. These targets were subdivided according to population or sewer length, depending on the measure, to derive a target for each river basin catchment.

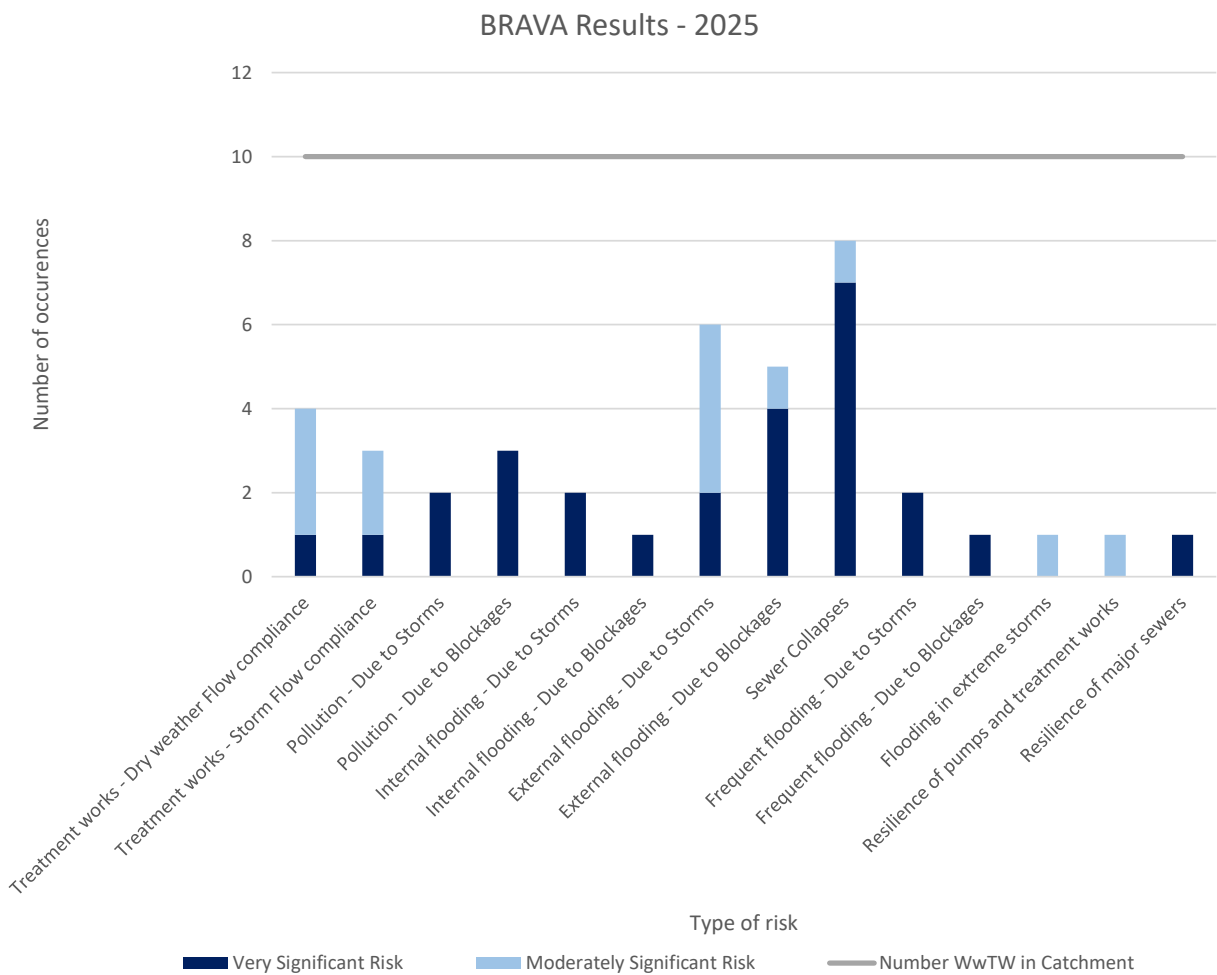


Figure 4 - BRAVA 2025 Summary

In 2025, sewer collapses, followed by external flooding due to storms are the biggest concerns in the Clywedog - Dee to Gwenfro catchment.

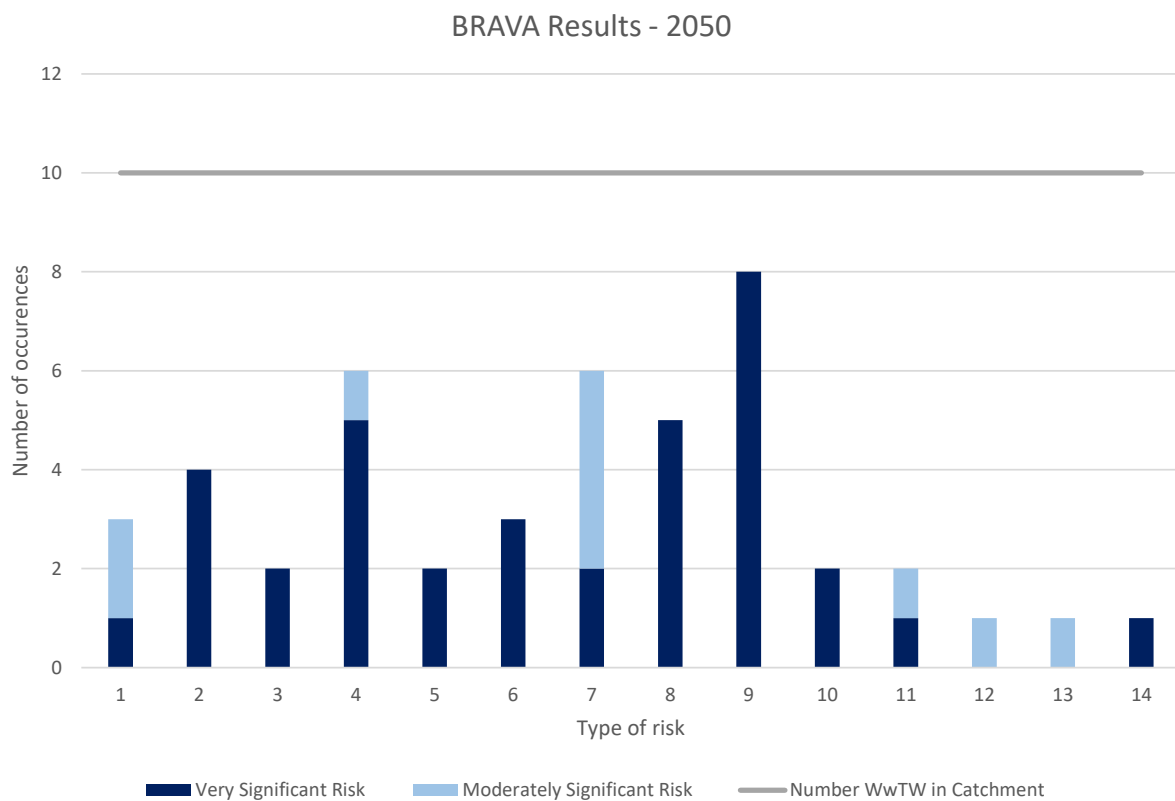


Figure 5 - BRAVA 2050 Summary

In 2050, sewer collapses followed by external flooding due to storms and pollution due to blockages are the biggest concerns in the Clywedog - Dee to Gwenfro catchment.

Figures 6 and 7 indicate the current and predicted risk of flooding, pollution, and both flooding and pollution caused by lack of capacity (termed 'hydraulic overload') across our networks. These maps illustrate where the issues occur and can be used to target where we want to work with the community and stakeholders to resolve issues. By working together, we can combine knowledge and resources to deliver the best outcomes for local communities and the environment. We want to include your feedback in our decision-making process.

BRAVA results 2025 Flooding and Pollution caused by Hydraulic Overload

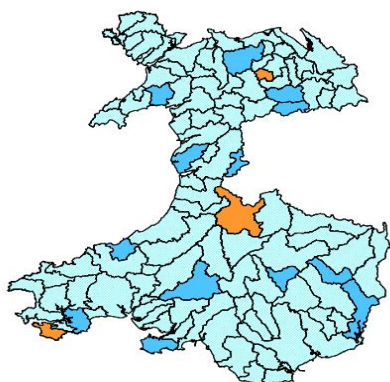
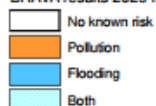


Figure 6 - Associated Strategic Planning Areas priority (2025)

BRAVA results 2050 Flooding and Pollution caused by Hydraulic Overload

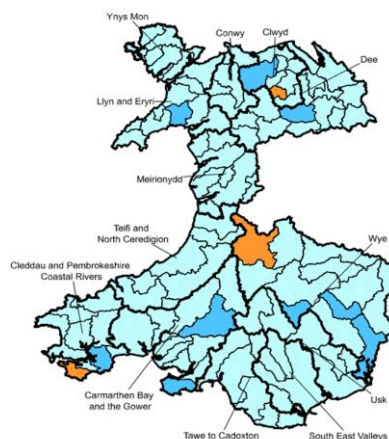
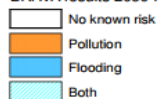


Figure 7 - Associated Strategic Planning Areas

3.3 Water Quality

Water quality is the classification of the quality of watercourses or water bodies in accordance to its physical, biological and chemical properties. Water quality is an important factor of environmental monitoring, ensuring that not only the water body is safe but the surrounding habitat and ecosystem is also.

Water quality status is categorised from 1 to 4, with 4 being the worst case. The priority status is based on the significance towards the risk factors triggering water quality. Clywedog - Dee to Gwenfro has a water quality priority status for 2050 of 3 which indicates targeted investment to mitigate and focus during AMP9.

4.0 Supply Demand

Supply-demand is an assessment of the capacity of our treatment works. It approximately assesses whether all the treatment works in a region can collectively cope with current and future flows in dry and wet weather. There are two parts to the assessment: dry weather flow (DWF) and a wet weather capacity assessment.

For the DWF part of the assessment, the suitability of the dry weather consents is tested against forecast future growth and changes in water consumption. Results for three scenarios are provided: the 0% headroom scenario assesses the region's capability for treating the predicted changes in DWF in the future with no allowance for error, with no spare treatment works capacity. The other scenarios indicate resilience - i.e. could we cope if we had flows 10% or 20% higher than estimated?

The wet weather assessment takes storm consent values where available as an indication of treatment works capacity and estimates the amount of incoming flow the treatment works is able to treat across a year. Again, three scenarios are shown, with differing treatment "targets" - i.e. if we wanted to ensure that 70% of the wet weather flows in a catchment were treated, could the treatment works cope? Changes in rainfall due to climate change and changing dry weather flows within the region mean that the percentage of flow treated across a year can change in the future.

Table 2 shows the supply-demand assessment for this region. Where a region may not have adequate capacity under a given scenario, it is flagged dark blue for further investigation. There may be local incapacity issues at individual works within the region.

L3 Area	Headroom	2025	2030	2035	2040	2045	2050
Clywedog - Dee to Gwenvro	0%						
	10%						
	20%						
	Treatment Target	2025	2030	2035	2040	2045	2050
	70%						
	80%						
	90%						

Table 2 - Supply Demand Balance

5.0 Options

Over time the pressures on our sewerage network change due to influences such as catchment growth, creep of rainwater into the network, or influences such as climate change impacting rainfall patterns. To ensure the plan is robust over the 30-year planning horizon and to account for the uniqueness of each catchment we have tested various types of schemes, and combination of schemes, to ensure a robust 'best value' plan is delivered.

The types of schemes tested are detailed in Table 3 and can be categorised into either improving network resilience to rainfall or improving network headroom in dry weather flow conditions.

Improving Resilience		
10% Reduction in area draining to the combined sewers	Represents removal of runoff from large commercial buildings.	Short term
25% Reduction reduction in area draining to the combined sewers	Represents removal of area runoff from non-residential paved areas where there is only one stakeholder (e.g. Local Authority or Highways Agency).	Medium term
50% Reduction reduction in area draining to the combined sewers	Represents removal of runoff from any connected area including residential properties. There are likely to be multiple stakeholders to engage with.	Long term
Improving Headroom		
Reducing infiltration	Reducing infiltration into sewers by 50%, which could be achieved by relining or replacing the public sewers .	Medium term
Reducing water use	Represents a reduction in water use per person to around 100l per person per day by 2050 by application of water efficiency measures	Medium term
Reducing trade flow	Reduce trade flows by around 25% by application of water efficiency measures.	Long term

Table 3 - Risk mitigation details

We have undertaken an analysis of all our wastewater catchments to determine the benefit in terms of potential volume of water removed from our systems for each scheme type to determine a journey plan, (see Figure 8 below), which provides the direction of the best scheme types to undertake in this catchment for the most benefit against predicted future risk from growth, creep and climate change.

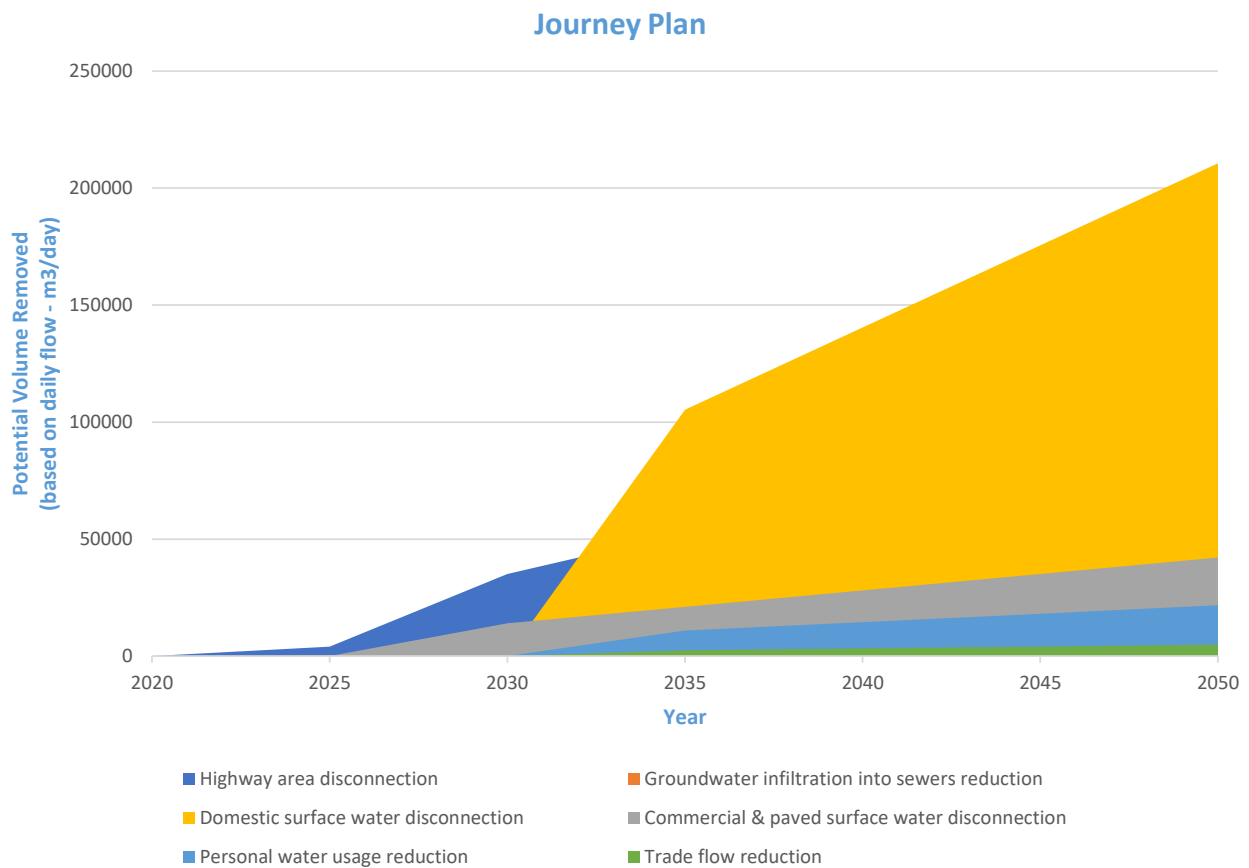


Figure 8 - Journey Plan

Approaches to managing risk

We have undertaken analysis to determine the likely costs to mitigate future predicted pollution and flooding. We assess combined sewer overflows based on the number of times they are predicted to spill in a 'typical year'. Table 4 illustrates the cost of potential measures to mitigate risk to varying standards. The assessment calculates the impact of rainfall and drainage contributions to the network relative to today's costs.

Mitigating the risk posed by flooding has been assessed in terms of probability of occurrence, we use the size of a storm event that has the probability of occurring once every 30 years. Table 5 illustrates the cost of potential mitigation measures to mitigate varying flood risk types.

The choice of scenarios for storm overflow mitigation in Table 4 is a separate cost and would be required in addition to the choice of scenarios for flooding protection in Table 5. The chosen scenarios for Storm overflows and flooding are to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain Existing Performance*	-	£13,000,000.00	£20,000,000.00
40 spills in a Typical Year	£7,000,000.00	£10,000,000.00	£11,000,000.00
20 spills in a Typical Year	£13,000,000.00	£15,000,000.00	£16,000,000.00
10 spills in a Typical Year	£16,000,000.00	£19,000,000.00	£20,000,000.00
0 spills in a Typical Year	£53,000,000.00	£58,000,000.00	£69,000,000.00
Equivalent No. Olympic Swimming Pools in 10 spills scenario	51.00	61.00	72.00

* Maintain is a considered scenario where we will continue to maintain the current level of service within the region and improve the network and address known and emerging risk.

Table 4 - Summary of Combined Sewer Overflow option investments

Choice of Scenario	Current Scenario (£)	2050 Scenario (£)	2050 Resilience Scenario (£) 1 in 50 yr (Storm Dennis)
Internal escapes	£16,000,000	£22,000,000	£18,000,000
External escapes in gardens	£23,000,000	£28,000,000	£26,000,000
Escapes in highways	£57,000,000	£69,000,000	£73,000,000
No future flooding	-	£50,000,000	£15,000,000
Total	£96,000,000.00	£169,000,000	£132,000,000

Table 5 - Summary of Flooding option investments

We have developed solutions which aim to provide protection against drainage and network failure, pollution events and flooding, internal and external to properties. The solutions developed highlight the level of investment required to bring our entire network up to the level of protection required to be resilient for future risk and demands. The range of scenarios is to provide a choice for understanding and discussion of future direction.

We are beginning to break down the investment indicated in Table 4 and 5 by creating practical schemes ready for delivery these schemes are designed as 100% traditional, 100% sustainable or green and 100% mixture of the 2. These packages have then been analysed in terms of their long term benefit and environmental and social cost to society and one has been chosen for inclusion as our preferred best value option. The areas where we have started our delivery programme aims to provide protection, to our worst served customers and rivers designated as Special Areas of Conservation (SAC) under the

For more information on the methodology developed to carry out the assessments see the DWMP plan main report.

If you want to work with us to develop joint projects to reduce the risk of flooding and protect the environment, please get in touch.

We will continue to work with Welsh Government, Regulators and Local Authorities about the pace, scale and affordability of improvements to be made.

We will be consulting on the preferred approach to planning and once its concluded the next stage is to develop the pipeline of options to meet the pace scale and affordability discussed with Welsh Government and our regulators.

Table 6 - Summary of solutions put forward are a first cycle preferred plan before SEA/HRA

L4 Catchments	No. Schemes
WHITEHURST HALT	0
ABENBURY	0
MARSHLEA	0
WHITEHURST	0
BOWLING BANK	0
PONTFAEN	0
HALTON (NR CHIRK)	0
FRONCYSYLLTE	0
CEFN-MAWR	0
FIVE FORDS (WREXHAM)	15

DWMP Tactical Planning Catchment Summary



Dee - Alwen to Outlet Llyn Tegid Bala Lake

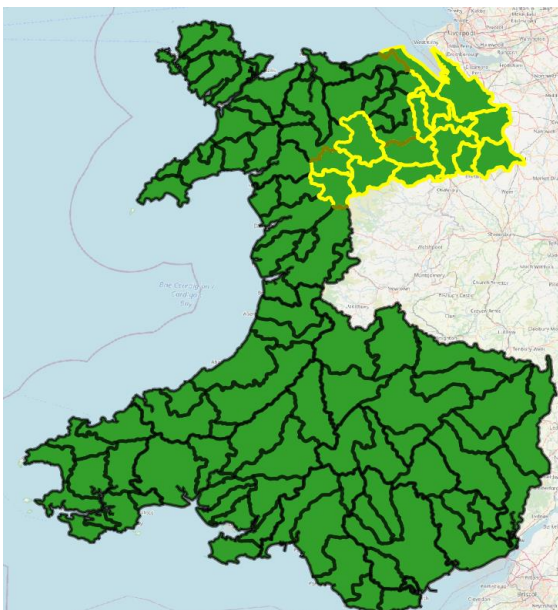
1.0 Introduction

This Drainage and Wastewater Management Plan (DWMP) sets out how Dŵr Cymru Welsh Water (DCWW) will manage and improve its assets to maintain a resilient and robust wastewater drainage system. The plan aims to manage flooding and pollution from our wastewater assets in the future, for our customers and our environment by working collaboratively with stakeholders, regulators and local authorities to provide a complete partnership in tackling current and future problems.

1.1 Catchment Information

The Dee - Alwen to Outlet Llyn Tegid Bala Lake planning catchment lies within the Dee river basin catchment, (see Figure 1 below), it consists of 6 wastewater catchments (see Figure 2 below). There is a combined population of 1377, this is set to decrease to 1317 by 2050, a change of -4%. There is a total sewer length of 8km, with a foul sewer length of 5km, a surface water length of 1km and a combined sewer length of 2km. There are 6 Wastewater Treatment Works (WwTW), 2 Sewerage Pumping Stations (SPSs), and 16 Combined Storm Overflows (CSOs) across this tactical planning unit.

The Dee - Alwen to Outlet Llyn Tegid Bala Lake catchment is North of central Wales, east of Bala Lake. The Dee flows down into the sea near Chester. Cynwyd and Llandrillo are the largest urban areas.



Data is available from <https://www.openstreetmap.org/copyright> © OpenStreetMap contributors

Figure 1 - River basin location detailing the associated tactical planning catchments

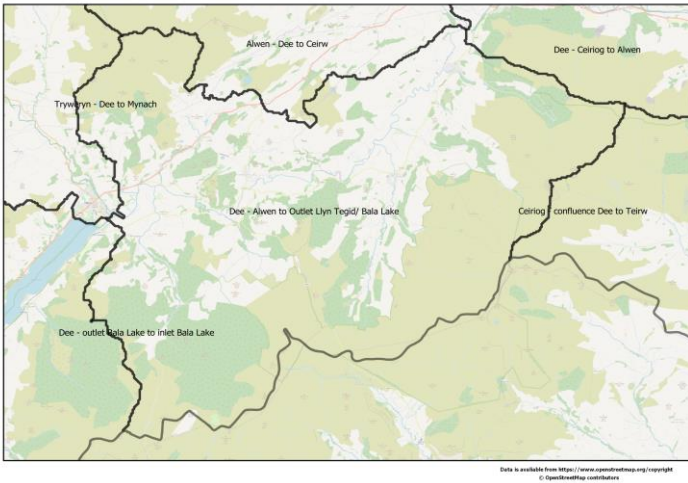


Figure 2- Tactical planning catchments

2.0 Stakeholder Engagement

The DWMP aims to enable DCWW to work collaboratively with stakeholders, regulators and local authorities to tackle current and future challenges. DCWW has identified stakeholder objectives that align with the aims of the DWMP and goals of other management plans. Table 1 details the main opportunities we have identified but this is not intended to be exhaustive. Note that these stakeholders have their own planning processes and plans which do not necessarily align with those of DCWW.

Scheme Information
Stakeholder engagement meetings are scheduled to commence in 2022. These meetings will be held between DCWW and the respective parties, such as NRW, EA, Councils and ENGO's. Further information of the outcome and points of focus towards short and long term strategy planning will be provided in the next cycle of the DWMP assessment.

Table 1 - Current and future investigation schemes

3.0 Risk

We have assessed our likely performance from now to 2050 against the objectives that we set in our most recent business plan. The results of this assessment are presented in the following sections.

To understand future performance, we need to estimate how much population will change by, the degree to which climate change will impact Wales and areas of England that border our company, and how further surface water connected to the sewer network might increase the amount and rate at which rainfall drains into our sewers.

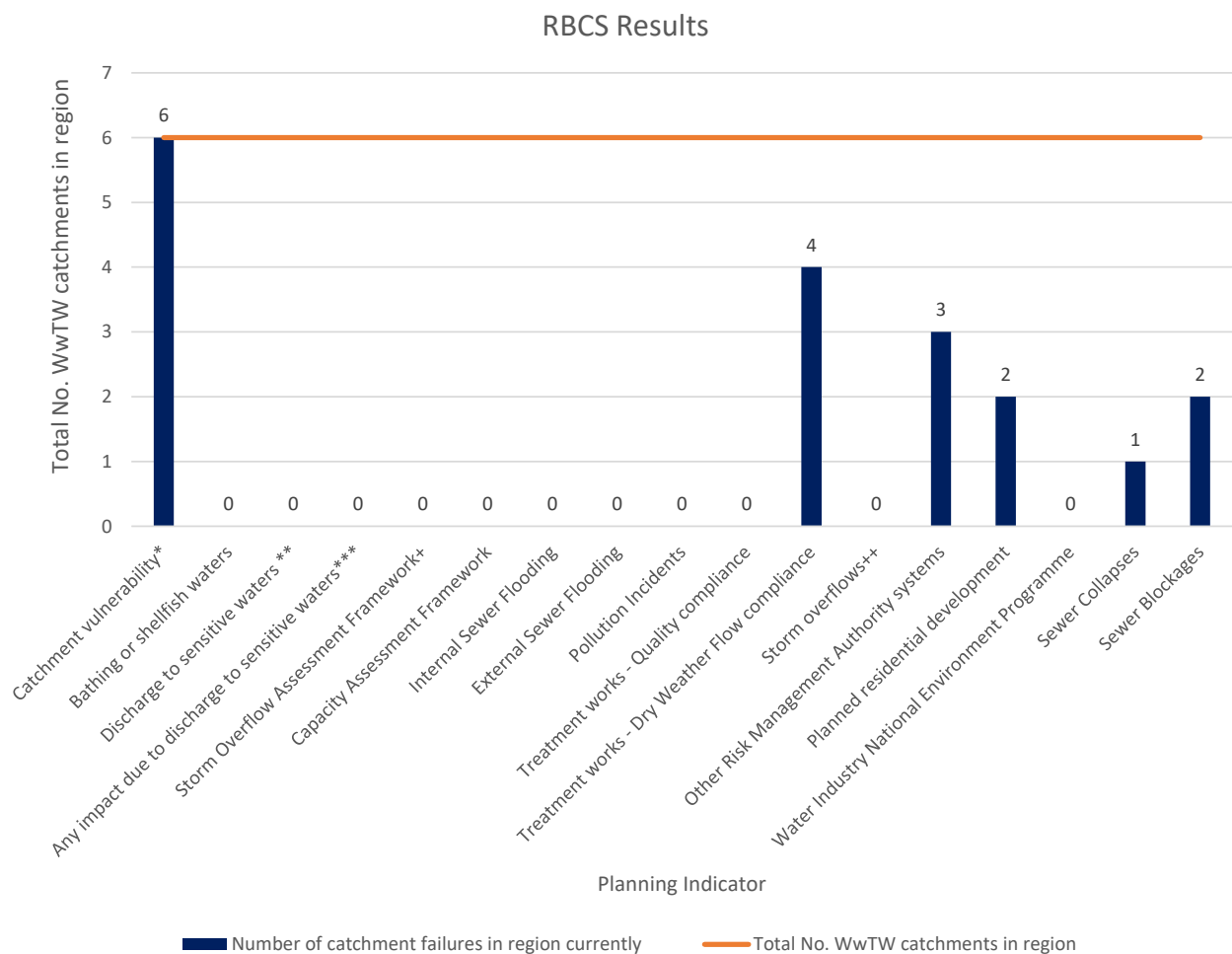
Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

Climate change is predicted to increase the intensity of storms by around 35% in this region. In a typical year, winters are likely to be warmer and wetter, and summers generally drier. More intense rainfall will happen more frequently. The population in the Dee region is set to decrease to 1300 by 2050, a change of -4% based on our future projections. However there are major developments in localised areas that will contribute to future pressures on the network, including Cynwyd - land adjacent to Llandrillo Road and Llandrillo - land behind Capel Hermon.

3.1 Risk Based Catchment Screening

The Risk Based Catchment Screening (RBCS) is the initial screening process to determine if a more detailed risk assessment is required. The assessment screens catchments against planning indicators which have been stipulated in the national guidance for DWMPs. A catchment will pass through to a more detailed risk assessment if it fails against one or more of these indicators, the results are shown in Figure 3.

For the Dee - Alwen to Outlet Llyn Tegid Bala Lake catchment the biggest concerns indicated by the RBCS are - catchment characterisation (based on a vulnerability assessment of flooding due to local characteristics e.g. topography).



*To sewer flooding due to extreme wet weather events.

**Categorised as a "planned" scheduled action within the Natural Resources Wales Action Database or considered as "Remedy" on Natural England Designated Sites system.

***Categorised as a "identified" scheduled action within the Natural Resources Wales Action Database or considered as "Threat" on Natural England Designated Sites system.

+Frequency investigation triggered.

++Overflow risks not covered by other indicators,

Figure 3 - Risk Based Catchment Screening results

3.2 Baseline Risk And Vulnerability Assessment (BRAVA)

Following on from the RBCS, the Baseline Risk and Vulnerability Assessment (BRAVA) highlights current and future risk. The risk scores are driven by company targets which were set in our last business plan. These targets were subdivided according to population or sewer length, depending on the measure, to derive a target for each river basin catchment.

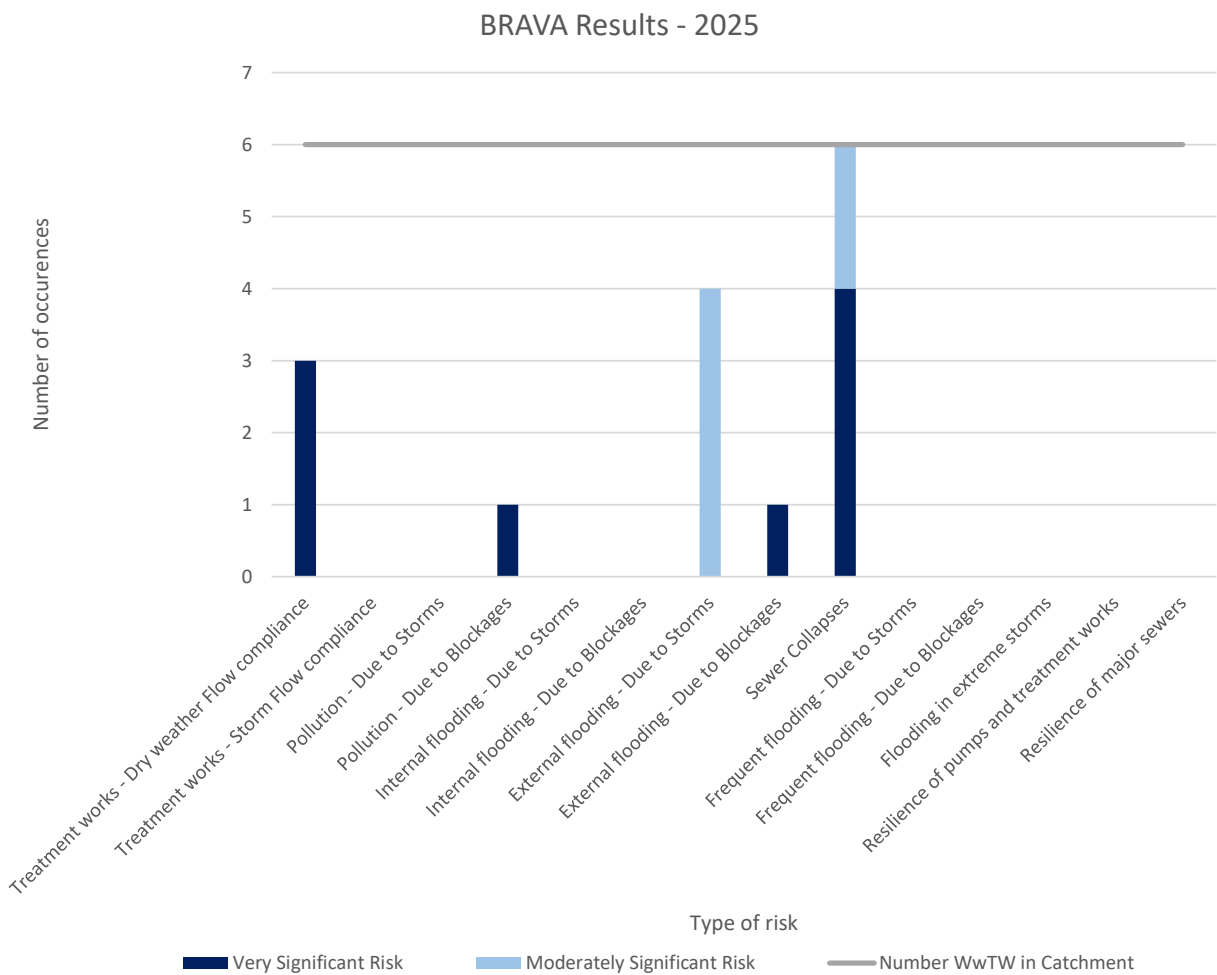


Figure 4 - BRAVA 2025 Summary

In 2025, sewer collapses and external flooding due to storms are the biggest concerns in the Dee - Alwen to Outlet Llyn Tegid Bala Lake catchment.

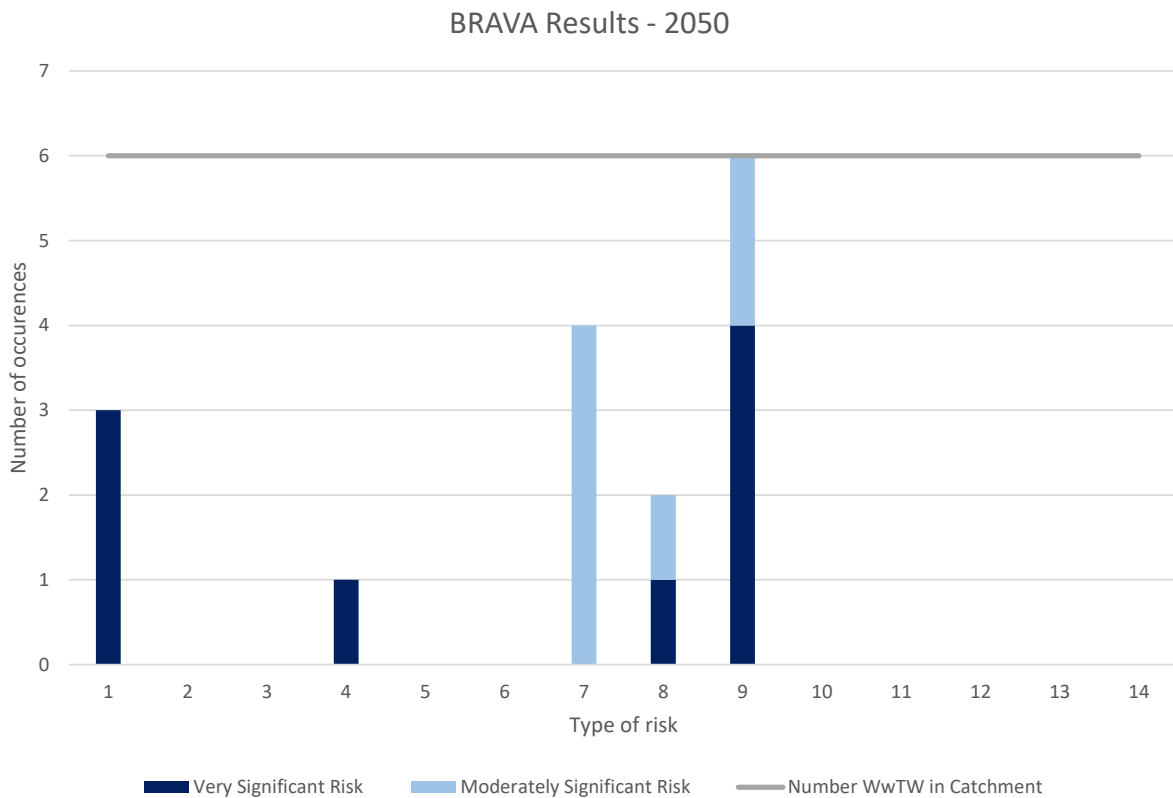


Figure 5 - BRAVA 2050 Summary

In 2050, sewer collapses and external flooding due to storms are the biggest concerns in the Dee - Alwen to Outlet Llyn Tegid Bala Lake catchment.

Figures 6 and 7 indicate the current and predicted risk of flooding, pollution, and both flooding and pollution caused by lack of capacity (termed 'hydraulic overload') across our networks. These maps illustrate where the issues occur and can be used to target where we want to work with the community and stakeholders to resolve issues. By working together, we can combine knowledge and resources to deliver the best outcomes for local communities and the environment. We want to include your feedback in our decision-making process.

BRAVA results 2025 Flooding and Pollution caused by Hydraulic Overload

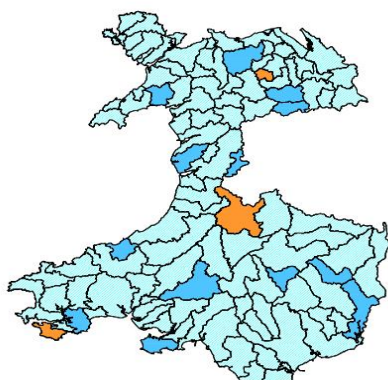
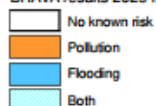


Figure 6 - Associated Strategic Planning Areas priority (2025)

BRAVA results 2050 Flooding and Pollution caused by Hydraulic Overload

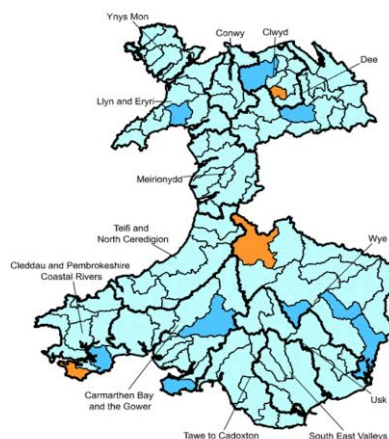
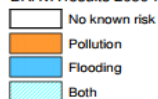


Figure 7 - Associated Strategic Planning Areas

3.3 Water Quality

Water quality is the classification of the quality of watercourses or water bodies in accordance to its physical, biological and chemical properties. Water quality is an important factor of environmental monitoring, ensuring that not only the water body is safe but the surrounding habitat and ecosystem is also.

Water quality status is categorised from 1 to 4, with 4 being the worst case. The priority status is based on the significance towards the risk factors triggering water quality. Dee - Alwen to Outlet Llyn Tegid Bala Lake has a water quality priority status for 2050 of 1 which indicates targeted investment to mitigate and focus during AMP11.

4.0 Supply Demand

Supply-demand is an assessment of the capacity of our treatment works. It approximately assesses whether all the treatment works in a region can collectively cope with current and future flows in dry and wet weather. There are two parts to the assessment: dry weather flow (DWF) and a wet weather capacity assessment.

For the DWF part of the assessment, the suitability of the dry weather consents is tested against forecast future growth and changes in water consumption. Results for three scenarios are provided: the 0% headroom scenario assesses the region's capability for treating the predicted changes in DWF in the future with no allowance for error, with no spare treatment works capacity. The other scenarios indicate resilience - i.e. could we cope if we had flows 10% or 20% higher than estimated?

The wet weather assessment takes storm consent values where available as an indication of treatment works capacity and estimates the amount of incoming flow the treatment works is able to treat across a year. Again, three scenarios are shown, with differing treatment "targets" - i.e. if we wanted to ensure that 70% of the wet weather flows in a catchment were treated, could the treatment works cope? Changes in rainfall due to climate change and changing dry weather flows within the region mean that the percentage of flow treated across a year can change in the future.

Table 2 shows the supply-demand assessment for this region. Where a region may not have adequate capacity under a given scenario, it is flagged dark blue for further investigation. There may be local incapacity issues at individual works within the region.

L3 Area	Headroom	2025	2030	2035	2040	2045	2050
Dee - Alwen to Outlet Llyn Tegid Bala Lake	0%						
	10%						
	20%						
	Treatment Target	2025	2030	2035	2040	2045	2050
	70%						
	80%						
	90%						

Table 2 - Supply Demand Balance

5.0 Options

Over time the pressures on our sewerage network change due to influences such as catchment growth, creep of rainwater into the network, or influences such as climate change impacting rainfall patterns. To ensure the plan is robust over the 30-year planning horizon and to account for the uniqueness of each catchment we have tested various types of schemes, and combination of schemes, to ensure a robust 'best value' plan is delivered.

The types of schemes tested are detailed in Table 3 and can be categorised into either improving network resilience to rainfall or improving network headroom in dry weather flow conditions.

Improving Resilience		
10% Reduction in area draining to the combined sewers	Represents removal of runoff from large commercial buildings.	Short term
25% Reduction reduction in area draining to the combined sewers	Represents removal of area runoff from non-residential paved areas where there is only one stakeholder (e.g. Local Authority or Highways Agency).	Medium term
50% Reduction reduction in area draining to the combined sewers	Represents removal of runoff from any connected area including residential properties. There are likely to be multiple stakeholders to engage with.	Long term
Improving Headroom		
Reducing infiltration	Reducing infiltration into sewers by 50%, which could be achieved by relining or replacing the public sewers .	Medium term
Reducing water use	Represents a reduction in water use per person to around 100l per person per day by 2050 by application of water efficiency measures	Medium term
Reducing trade flow	Reduce trade flows by around 25% by application of water efficiency measures.	Long term

Table 3 - Risk mitigation details

We have undertaken an analysis of all our wastewater catchments to determine the benefit in terms of potential volume of water removed from our systems for each scheme type to determine a journey plan, (see Figure 8 below), which provides the direction of the best scheme types to undertake in this catchment for the most benefit against predicted future risk from growth, creep and climate change.

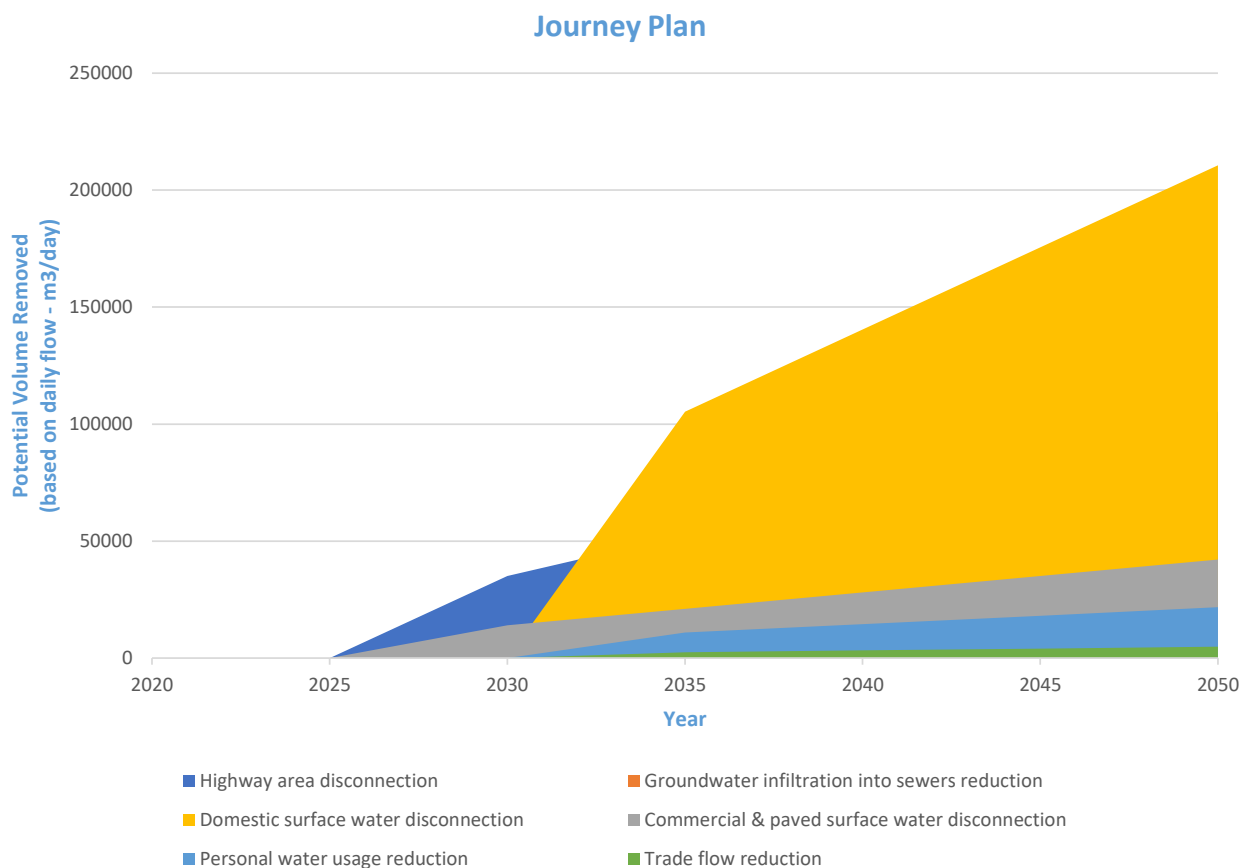


Figure 8 - Journey Plan

Approaches to managing risk

We have undertaken analysis to determine the likely costs to mitigate future predicted pollution and flooding. We assess combined sewer overflows based on the number of times they are predicted to spill in a 'typical year'. Table 4 illustrates the cost of potential measures to mitigate risk to varying standards. The assessment calculates the impact of rainfall and drainage contributions to the network relative to today's costs.

Mitigating the risk posed by flooding has been assessed in terms of probability of occurrence, we use the size of a storm event that has the probability of occurring once every 30 years. Table 5 illustrates the cost of potential mitigation measures to mitigate varying flood risk types.

The choice of scenarios for storm overflow mitigation in Table 4 is a separate cost and would be required in addition to the choice of scenarios for flooding protection in Table 5. The chosen scenarios for Storm overflows and flooding are to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain Existing Performance*	-	£7,000,000.00	£10,000,000.00
40 spills in a Typical Year	£1,000,000.00	£1,000,000.00	£1,000,000.00
20 spills in a Typical Year	£3,000,000.00	£3,000,000.00	£3,000,000.00
10 spills in a Typical Year	£4,000,000.00	£4,000,000.00	£4,000,000.00
0 spills in a Typical Year	£7,000,000.00	£7,000,000.00	£8,000,000.00
Equivalent No. Olympic Swimming Pools in 10 spills scenario	19.00	21.00	23.00

* Maintain is a considered scenario where we will continue to maintain the current level of service within the region and improve the network and address known and emerging risk.

Table 4 - Summary of Combined Sewer Overflow option investments

Choice of Scenario	Current Scenario (£)	2050 Scenario (£)	2050 Resilience Scenario (£) 1 in 50 yr (Storm Dennis)
Internal escapes	£0	£0	£0
External escapes in gardens	£0	£0	£0
Escapes in highways	£1,000,000	£1,000,000	£1,000,000
No future flooding	-	£3,000,000	£9,000,000
Total	£1,000,000.00	£4,000,000	£10,000,000

Table 5 - Summary of Flooding option investments

We have developed solutions which aim to provide protection against drainage and network failure, pollution events and flooding, internal and external to properties. The solutions developed highlight the level of investment required to bring our entire network up to the level of protection required to be resilient for future risk and demands. The range of scenarios is to provide a choice for understanding and discussion of future direction.

We are beginning to break down the investment indicated in Table 4 and 5 by creating practical schemes ready for delivery these schemes are designed as 100% traditional, 100% sustainable or green and 100% mixture of the 2. These packages have then been analysed in terms of their long term benefit and environmental and social cost to society and one has been chosen for inclusion as our preferred best value option. The areas where we have started our delivery programme aims to provide protection, to our worst served customers and rivers designated as Special Areas of Conservation (SAC) under the

For more information on the methodology developed to carry out the assessments see the DWMP plan main report.

If you want to work with us to develop joint projects to reduce the risk of flooding and protect the environment, please get in touch.

We will continue to work with Welsh Government, Regulators and Local Authorities about the pace, scale and affordability of improvements to be made.

We will be consulting on the preferred approach to planning and once its concluded the next stage is to develop the pipeline of options to meet the pace scale and affordability discussed with Welsh Government and our regulators.

Table 6 - Summary of solutions put forward are a first cycle preferred plan before SEA/HRA

L4 Catchments	No. Schemes
LLANFOR	0
CYNWYD	0
GWALIA COTTAGES (NR CORWEN)	0
LLANDRILLO (SW OF LLANGOLLEN)	0
SARNAU	0
LLANDDERFEL STW	0

DWMP Tactical Planning Catchment Summary



Dee - Ceiriog to Alwen

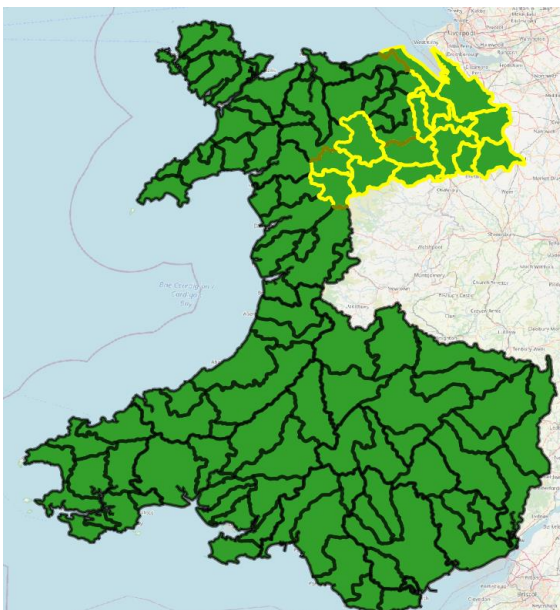
1.0 Introduction

This Drainage and Wastewater Management Plan (DWMP) sets out how Dŵr Cymru Welsh Water (DCWW) will manage and improve its assets to maintain a resilient and robust wastewater drainage system. The plan aims to manage flooding and pollution from our wastewater assets in the future, for our customers and our environment by working collaboratively with stakeholders, regulators and local authorities to provide a complete partnership in tackling current and future problems.

1.1 Catchment Information

The Dee - Ceiriog to Alwen planning catchment lies within the Dee river basin catchment, (see Figure 1 below), it consists of 10 wastewater catchments (see Figure 2 below). There is a combined population of 6684, this is set to increase to 6822 by 2050, a change of 2%. There is a total sewer length of 50km, with a foul sewer length of 26km, a surface water length of 6km and a combined sewer length of 18km. There are 10 Wastewater Treatment Works (WwTW), 14 Sewerage Pumping Stations (SPSs), and 17 Combined Storm Overflows (CSOs) across this tactical planning unit.

The Dee - Ceiriog to Alwen catchment lies in central North Wales. The Dee flows down into the sea near Chester. Corwen and Llangollen are the largest urban areas.



Data is available from <https://www.openstreetmap.org/copyright> © OpenStreetMap contributors

Figure 1 - River basin location detailing the associated tactical planning catchments

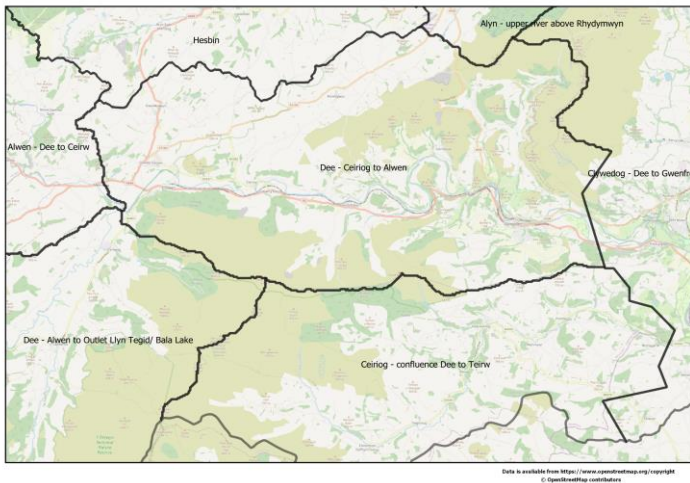


Figure 2- Tactical planning catchments

2.0 Stakeholder Engagement

The DWMP aims to enable DCWW to work collaboratively with stakeholders, regulators and local authorities to tackle current and future challenges. DCWW has identified stakeholder objectives that align with the aims of the DWMP and goals of other management plans. Table 1 details the main opportunities we have identified but this is not intended to be exhaustive. Note that these stakeholders have their own planning processes and plans which do not necessarily align with those of DCWW.

Scheme Information
Stakeholder engagement meetings are scheduled to commence in 2022. These meetings will be held between DCWW and the respective parties, such as NRW, EA, Councils and ENGO's. Further information of the outcome and points of focus towards short and long term strategy planning will be provided in the next cycle of the DWMP assessment.

Table 1 - Current and future investigation schemes

3.0 Risk

We have assessed our likely performance from now to 2050 against the objectives that we set in our most recent business plan. The results of this assessment are presented in the following sections.

To understand future performance, we need to estimate how much population will change by, the degree to which climate change will impact Wales and areas of England that border our company, and how further surface water connected to the sewer network might increase the amount and rate at which rainfall drains into our sewers.

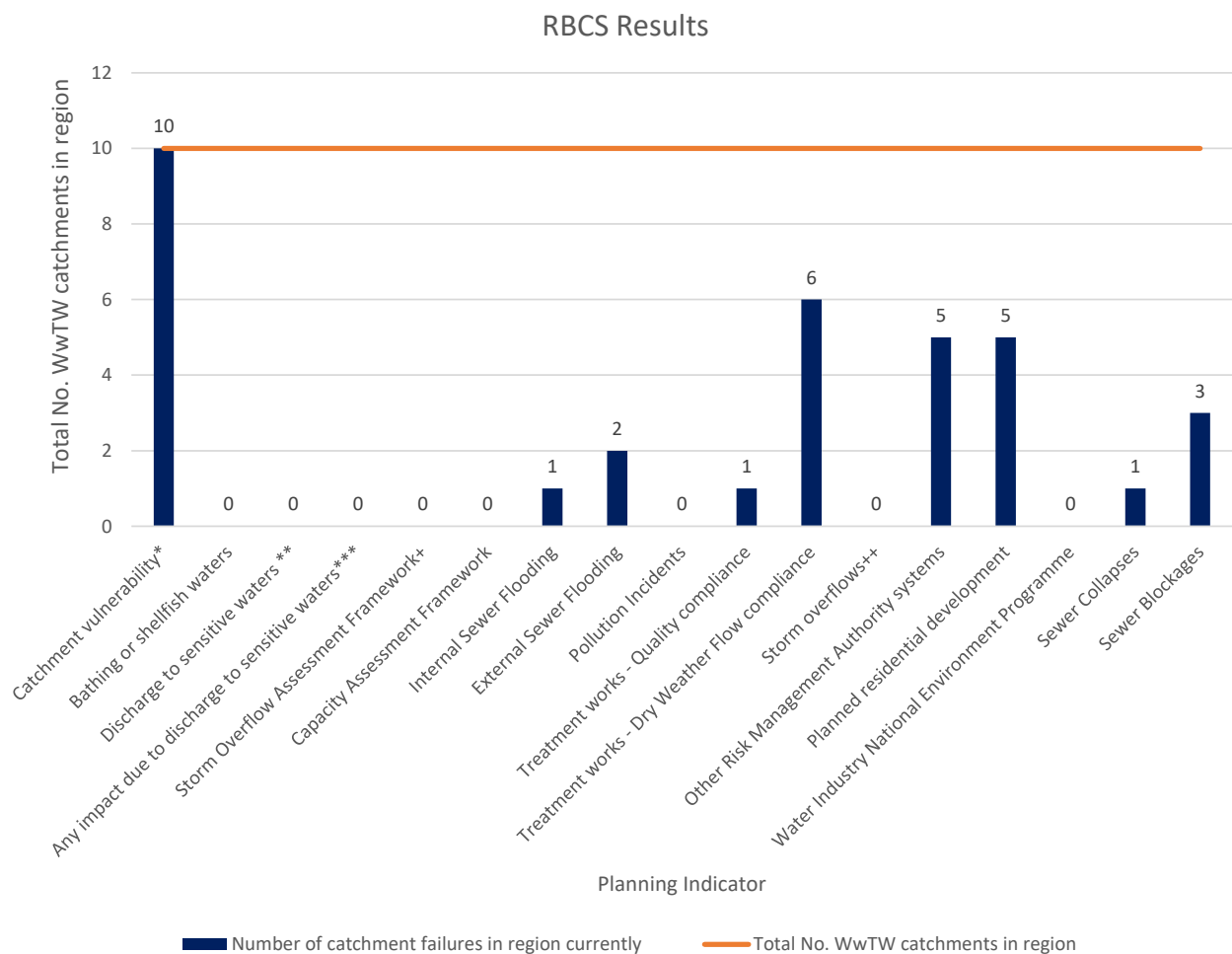
Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

Climate change is predicted to increase the intensity of storms by around 35% in this region. In a typical year, winters are likely to be warmer and wetter, and summers generally drier. More intense rainfall will happen more frequently. The population in the Dee region is set to increase to 6800 by 2050, a change of 2% based on our future projections. However there are major developments in localised areas that will contribute to future pressures on the network, including two at Clawdd Poncen - both on land adjacent to B6437.

3.1 Risk Based Catchment Screening

The Risk Based Catchment Screening (RBCS) is the initial screening process to determine if a more detailed risk assessment is required. The assessment screens catchments against planning indicators which have been stipulated in the national guidance for DWMPs. A catchment will pass through to a more detailed risk assessment if it fails against one or more of these indicators, the results are shown in Figure 3.

For the Dee - Ceiriog to Alwen catchment the biggest concerns indicated by the RBCS are - catchment characterisation (based on a vulnerability assessment of flooding due to local characteristics e.g. topography).



*To sewer flooding due to extreme wet weather events.

**Categorised as a "planned" scheduled action within the Natural Resources Wales Action Database or considered as "Remedy" on Natural England Designated Sites system.

***Categorised as a "identified" scheduled action within the Natural Resources Wales Action Database or considered as "Threat" on Natural England Designated Sites system.

+Frequency investigation triggered.

++Overflow risks not covered by other indicators,

Figure 3 - Risk Based Catchment Screening results

3.2 Baseline Risk And Vulnerability Assessment (BRAVA)

Following on from the RBCS, the Baseline Risk and Vulnerability Assessment (BRAVA) highlights current and future risk. The risk scores are driven by company targets which were set in our last business plan. These targets were subdivided according to population or sewer length, depending on the measure, to derive a target for each river basin catchment.

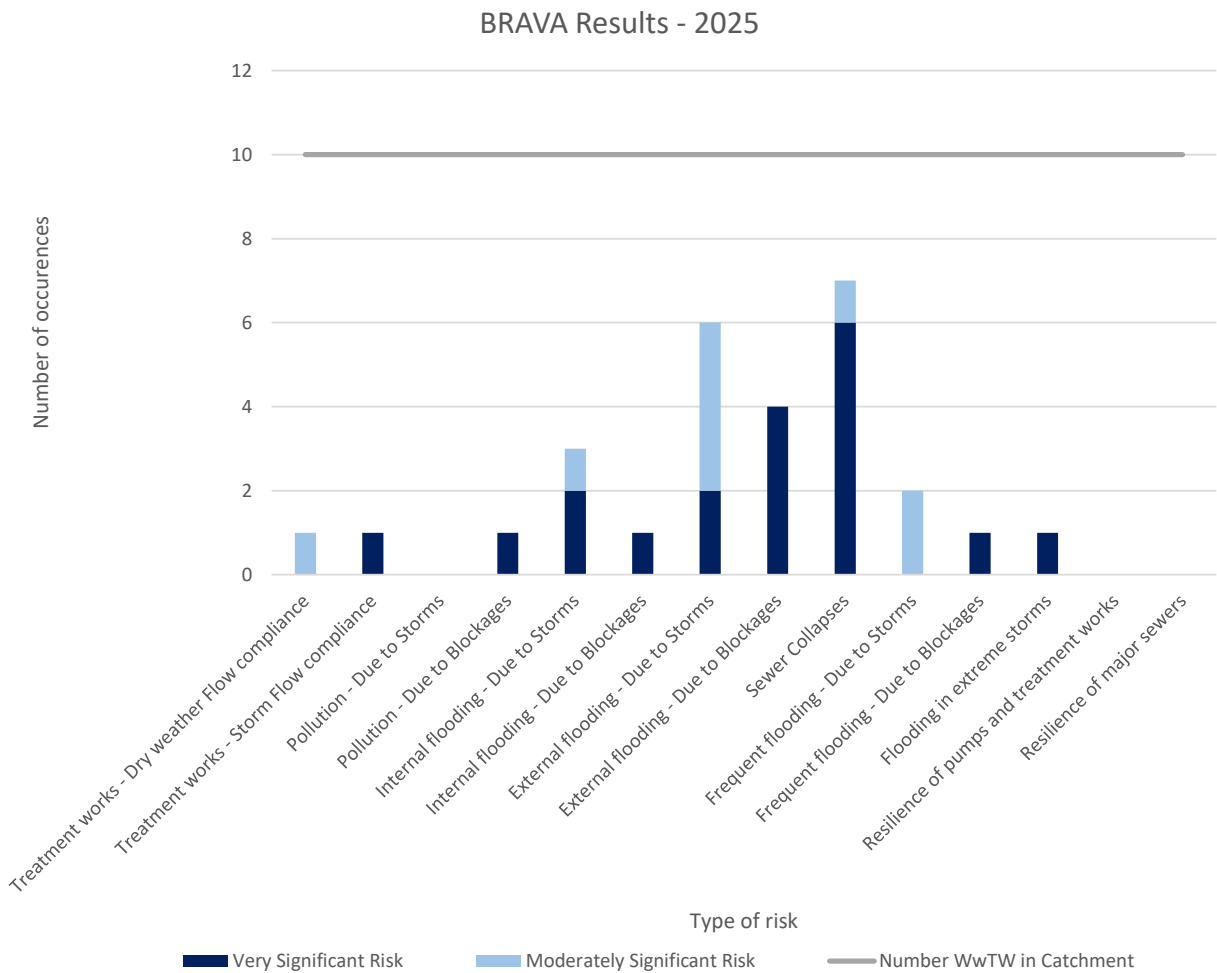


Figure 4 - BRAVA 2025 Summary

In 2025, sewer collapses and external flooding due to storms are the biggest concerns in the Dee - Ceiriog to Alwen catchment.

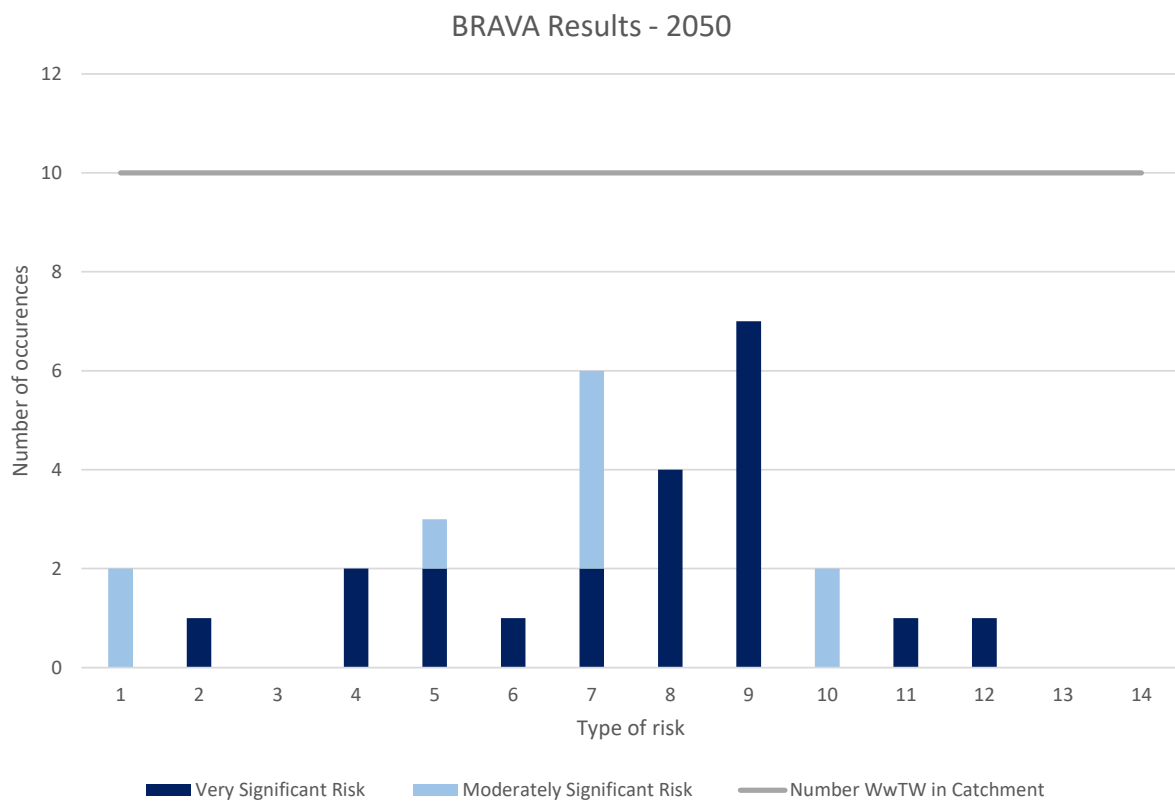


Figure 5 - BRAVA 2050 Summary

In 2050, sewer collapses and external flooding due to storms are the biggest concerns in the Dee - Ceiriog to Alwen catchment.

Figures 6 and 7 indicate the current and predicted risk of flooding, pollution, and both flooding and pollution caused by lack of capacity (termed 'hydraulic overload') across our networks. These maps illustrate where the issues occur and can be used to target where we want to work with the community and stakeholders to resolve issues. By working together, we can combine knowledge and resources to deliver the best outcomes for local communities and the environment. We want to include your feedback in our decision-making process.

BRAVA results 2025 Flooding and Pollution caused by Hydraulic Overload

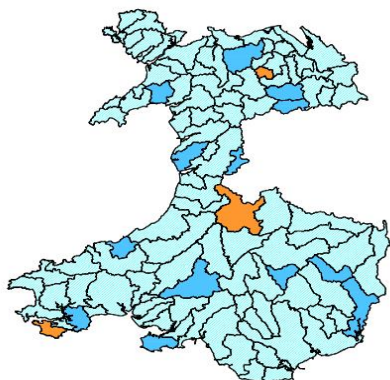
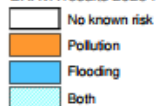


Figure 6 - Associated Strategic Planning Areas priority (2025)

BRAVA results 2050 Flooding and Pollution caused by Hydraulic Overload

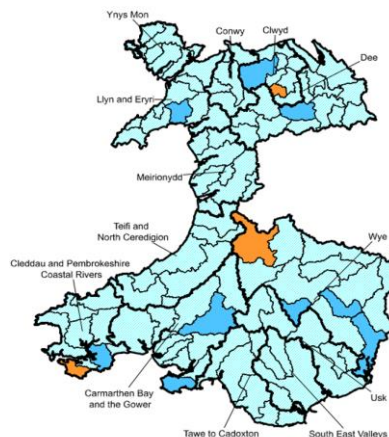
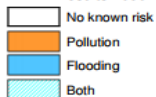


Figure 7 - Associated Strategic Planning Areas

3.3 Water Quality

Water quality is the classification of the quality of watercourses or water bodies in accordance to its physical, biological and chemical properties. Water quality is an important factor of environmental monitoring, ensuring that not only the water body is safe but the surrounding habitat and ecosystem is also.

Water quality status is categorised from 1 to 4, with 4 being the worst case. The priority status is based on the significance towards the risk factors triggering water quality. Dee - Ceiriog to Alwen has a water quality priority status for 2050 of 1 which indicates targeted investment to mitigate and focus during AMP11.

4.0 Supply Demand

Supply-demand is an assessment of the capacity of our treatment works. It approximately assesses whether all the treatment works in a region can collectively cope with current and future flows in dry and wet weather. There are two parts to the assessment: dry weather flow (DWF) and a wet weather capacity assessment.

For the DWF part of the assessment, the suitability of the dry weather consents is tested against forecast future growth and changes in water consumption. Results for three scenarios are provided: the 0% headroom scenario assesses the region's capability for treating the predicted changes in DWF in the future with no allowance for error, with no spare treatment works capacity. The other scenarios indicate resilience - i.e. could we cope if we had flows 10% or 20% higher than estimated?

The wet weather assessment takes storm consent values where available as an indication of treatment works capacity and estimates the amount of incoming flow the treatment works is able to treat across a year. Again, three scenarios are shown, with differing treatment "targets" - i.e. if we wanted to ensure that 70% of the wet weather flows in a catchment were treated, could the treatment works cope? Changes in rainfall due to climate change and changing dry weather flows within the region mean that the percentage of flow treated across a year can change in the future.

Table 2 shows the supply-demand assessment for this region. Where a region may not have adequate capacity under a given scenario, it is flagged dark blue for further investigation. There may be local incapacity issues at individual works within the region.

L3 Area	Headroom	2025	2030	2035	2040	2045	2050
Dee - Ceiriog to Alwen	0%						
	10%						
	20%						
	Treatment Target	2025	2030	2035	2040	2045	2050
	70%						
	80%						
	90%						

Table 2 - Supply Demand Balance

5.0 Options

Over time the pressures on our sewerage network change due to influences such as catchment growth, creep of rainwater into the network, or influences such as climate change impacting rainfall patterns. To ensure the plan is robust over the 30-year planning horizon and to account for the uniqueness of each catchment we have tested various types of schemes, and combination of schemes, to ensure a robust 'best value' plan is delivered.

The types of schemes tested are detailed in Table 3 and can be categorised into either improving network resilience to rainfall or improving network headroom in dry weather flow conditions.

Improving Resilience		
10% Reduction in area draining to the combined sewers	Represents removal of runoff from large commercial buildings.	Short term
25% Reduction reduction in area draining to the combined sewers	Represents removal of area runoff from non-residential paved areas where there is only one stakeholder (e.g. Local Authority or Highways Agency).	Medium term
50% Reduction reduction in area draining to the combined sewers	Represents removal of runoff from any connected area including residential properties. There are likely to be multiple stakeholders to engage with.	Long term
Improving Headroom		
Reducing infiltration	Reducing infiltration into sewers by 50%, which could be achieved by relining or replacing the public sewers .	Medium term
Reducing water use	Represents a reduction in water use per person to around 100l per person per day by 2050 by application of water efficiency measures	Medium term
Reducing trade flow	Reduce trade flows by around 25% by application of water efficiency measures.	Long term

Table 3 - Risk mitigation details

We have undertaken an analysis of all our wastewater catchments to determine the benefit in terms of potential volume of water removed from our systems for each scheme type to determine a journey plan, (see Figure 8 below), which provides the direction of the best scheme types to undertake in this catchment for the most benefit against predicted future risk from growth, creep and climate change.

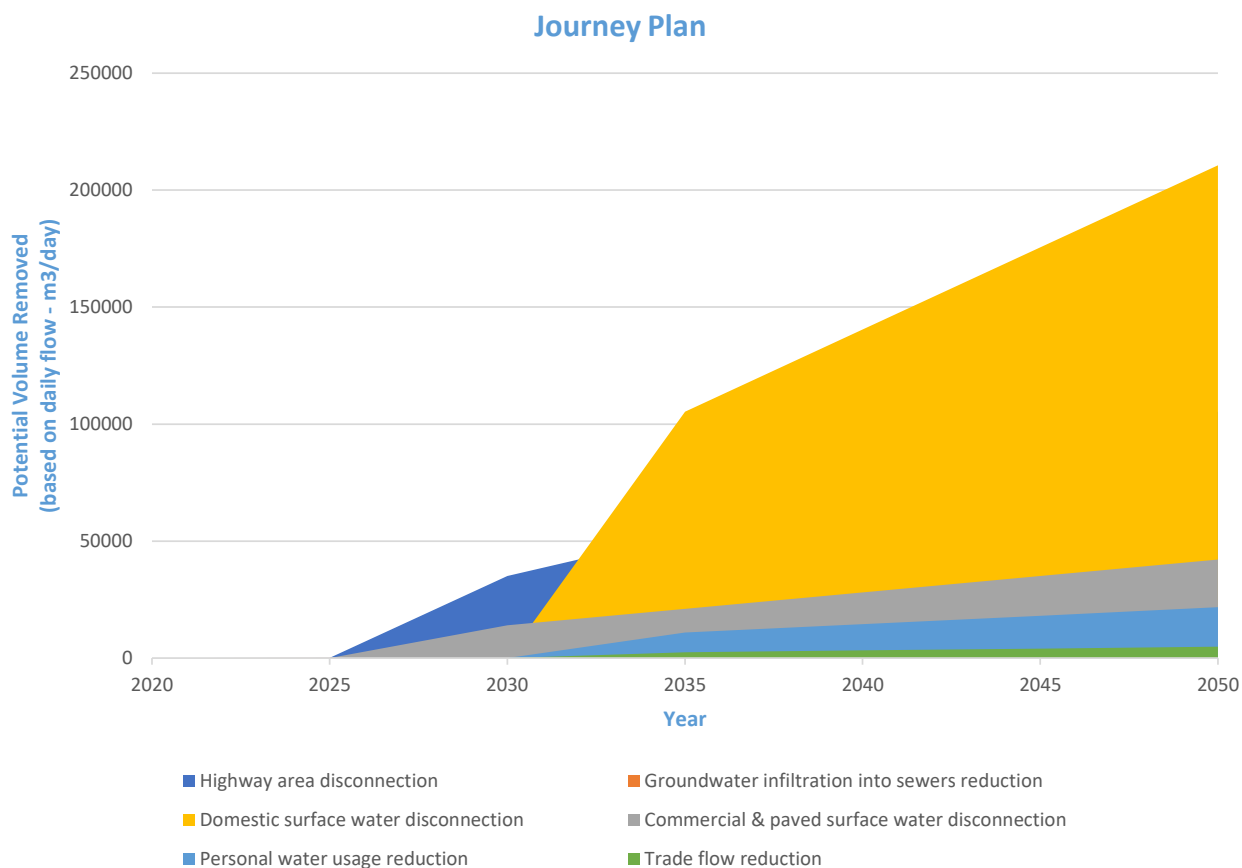


Figure 8 - Journey Plan

Approaches to managing risk

We have undertaken analysis to determine the likely costs to mitigate future predicted pollution and flooding. We assess combined sewer overflows based on the number of times they are predicted to spill in a 'typical year'. Table 4 illustrates the cost of potential measures to mitigate risk to varying standards. The assessment calculates the impact of rainfall and drainage contributions to the network relative to today's costs.

Mitigating the risk posed by flooding has been assessed in terms of probability of occurrence, we use the size of a storm event that has the probability of occurring once every 30 years. Table 5 illustrates the cost of potential mitigation measures to mitigate varying flood risk types.

The choice of scenarios for storm overflow mitigation in Table 4 is a separate cost and would be required in addition to the choice of scenarios for flooding protection in Table 5. The chosen scenarios for Storm overflows and flooding are to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain Existing Performance*	-	£14,000,000.00	£24,000,000.00
40 spills in a Typical Year	£3,000,000.00	£3,000,000.00	£3,000,000.00
20 spills in a Typical Year	£3,000,000.00	£3,000,000.00	£3,000,000.00
10 spills in a Typical Year	£4,000,000.00	£4,000,000.00	£4,000,000.00
0 spills in a Typical Year	£14,000,000.00	£15,000,000.00	£19,000,000.00
Equivalent No. Olympic Swimming Pools in 10 spills scenario	22.00	25.00	27.00

* Maintain is a considered scenario where we will continue to maintain the current level of service within the region and improve the network and address known and emerging risk.

Table 4 - Summary of Combined Sewer Overflow option investments

Choice of Scenario	Current Scenario (£)	2050 Scenario (£)	2050 Resilience Scenario (£) 1 in 50 yr (Storm Dennis)
Internal escapes	£0	£0	£0
External escapes in gardens	£0	£0	£0
Escapes in highways	£8,000,000	£10,000,000	£14,000,000
No future flooding	-	£5,000,000	£13,000,000
Total	£8,000,000.00	£15,000,000	£27,000,000

Table 5 - Summary of Flooding option investments

We have developed solutions which aim to provide protection against drainage and network failure, pollution events and flooding, internal and external to properties. The solutions developed highlight the level of investment required to bring our entire network up to the level of protection required to be resilient for future risk and demands. The range of scenarios is to provide a choice for understanding and discussion of future direction.

We are beginning to break down the investment indicated in Table 4 and 5 by creating practical schemes ready for delivery these schemes are designed as 100% traditional, 100% sustainable or green and 100% mixture of the 2. These packages have then been analysed in terms of their long term benefit and environmental and social cost to society and one has been chosen for inclusion as our preferred best value option. The areas where we have started our delivery programme aims to provide protection, to our worst served customers and rivers designated as Special Areas of Conservation (SAC) under the

For more information on the methodology developed to carry out the assessments see the DWMP plan main report.

If you want to work with us to develop joint projects to reduce the risk of flooding and protect the environment, please get in touch.

We will continue to work with Welsh Government, Regulators and Local Authorities about the pace, scale and affordability of improvements to be made.

We will be consulting on the preferred approach to planning and once its concluded the next stage is to develop the pipeline of options to meet the pace scale and affordability discussed with Welsh Government and our regulators.

Table 6 - Summary of solutions put forward are a first cycle preferred plan before SEA/HRA

L4 Catchments	No. Schemes
CORWEN	0
LLANGOLLEN STW	0
GLYNDYFRDWY (NR LLANGOLLEN)	0
BRYNEGLWYS	0
CARROG	0
LLIDIART Y PARC (W OF LLANGOLLEN)	0
EIRIANALLT COTTAGES (NR LLANGOLLEN)	0
PEN-YR-ALLT	0
MIN-Y-RHOS	0
LLIDIART ANNIE (W OF LLANGOLLEN)	0

DWMP Tactical Planning Catchment Summary



Dee - Chester Weir to Ceiriog

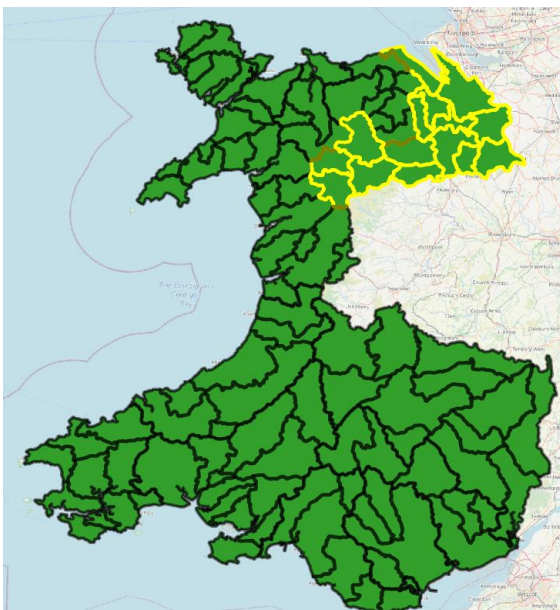
1.0 Introduction

This Drainage and Wastewater Management Plan (DWMP) sets out how Dŵr Cymru Welsh Water (DCWW) will manage and improve its assets to maintain a resilient and robust wastewater drainage system. The plan aims to manage flooding and pollution from our wastewater assets in the future, for our customers and our environment by working collaboratively with stakeholders, regulators and local authorities to provide a complete partnership in tackling current and future problems.

1.1 Catchment Information

The Dee - Chester Weir to Ceiriog planning catchment lies within the Dee river basin catchment, (see Figure 1 below), it consists of 9 wastewater catchments (see Figure 2 below). There is a combined population of 223976, this is set to decrease to 184976 by 2050, a change of -17%. There is a total sewer length of 1327km, with a foul sewer length of 373km, a surface water length of 398km and a combined sewer length of 545km. There are 9 Wastewater Treatment Works (WwTW), 187 Sewerage Pumping Stations (SPSs), and 110 Combined Storm Overflows (CSOs) across this tactical planning unit.

The Dee - Chester Weir to Ceiriog catchment straddles the North end of the England Wales border. The Dee flows down into the sea near Deeside industrial estate. Chester and Shotton are its major urban areas.



Data is available from <https://www.openstreetmap.org/copyright> © OpenStreetMap contributors

Figure 1 - River basin location detailing the associated tactical planning catchments

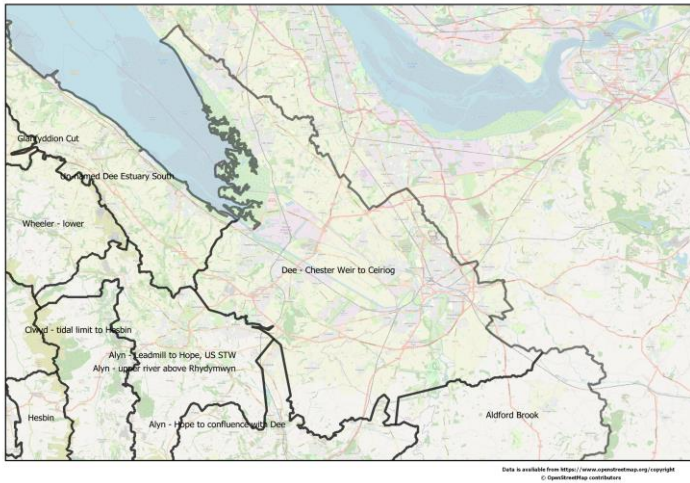


Figure 2- Tactical planning catchments

2.0 Stakeholder Engagement

The DWMP aims to enable DCWW to work collaboratively with stakeholders, regulators and local authorities to tackle current and future challenges. DCWW has identified stakeholder objectives that align with the aims of the DWMP and goals of other management plans. Table 1 details the main opportunities we have identified but this is not intended to be exhaustive. Note that these stakeholders have their own planning processes and plans which do not necessarily align with those of DCWW.

Scheme Information
Stakeholder engagement meetings are scheduled to commence in 2022. These meetings will be held between DCWW and the respective parties, such as NRW, EA, Councils and ENGO's. Further information of the outcome and points of focus towards short and long term strategy planning will be provided in the next cycle of the DWMP assessment.

Table 1 - Current and future investigation schemes

3.0 Risk

We have assessed our likely performance from now to 2050 against the objectives that we set in our most recent business plan. The results of this assessment are presented in the following sections.

To understand future performance, we need to estimate how much population will change by, the degree to which climate change will impact Wales and areas of England that border our company, and how further surface water connected to the sewer network might increase the amount and rate at which rainfall drains into our sewers.

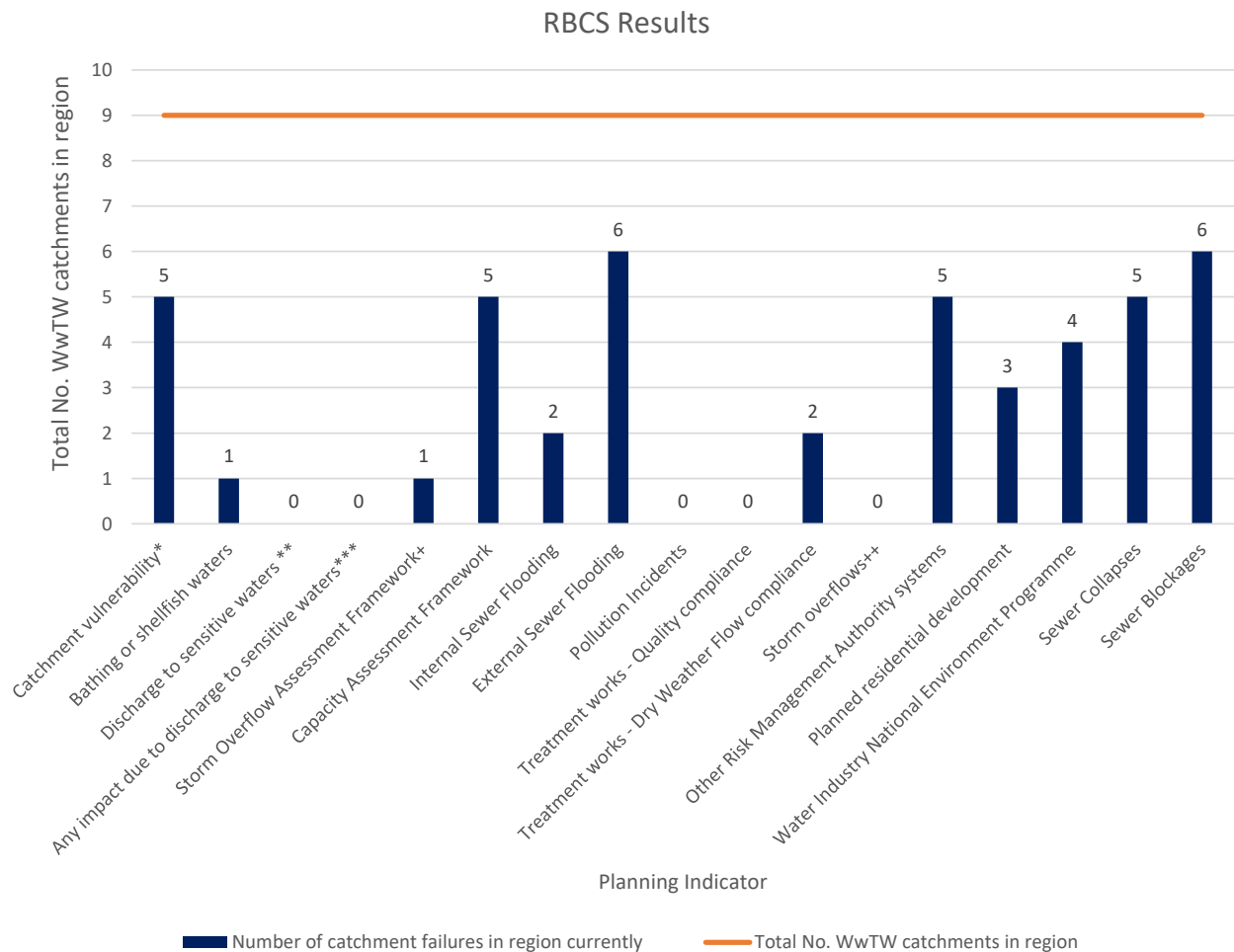
Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

Climate change is predicted to increase the intensity of storms by around 35% in this region. In a typical year, winters are likely to be warmer and wetter, and summers generally drier. More intense rainfall will happen more frequently. The population in the Dee region is set to decrease to 185000 by 2050, a change of -17% based on our future projections. However there are major developments in localised areas that will contribute to future pressures on the network.

3.1 Risk Based Catchment Screening

The Risk Based Catchment Screening (RBCS) is the initial screening process to determine if a more detailed risk assessment is required. The assessment screens catchments against planning indicators which have been stipulated in the national guidance for DWMPs. A catchment will pass through to a more detailed risk assessment if it fails against one or more of these indicators, the results are shown in Figure 3.

For the Dee - Chester Weir to Ceiriog catchment the biggest concerns indicated by the RBCS are sewer blockages and external sewer flooding.



*To sewer flooding due to extreme wet weather events.

**Categorised as a "planned" scheduled action within the Natural Resources Wales Action Database or considered as "Remedy" on Natural England Designated Sites system.

***Categorised as a "identified" scheduled action within the Natural Resources Wales Action Database or considered as "Threat" on Natural England Designated Sites system.

+Frequency investigation triggered.

++Overflow risks not covered by other indicators,

Figure 3 - Risk Based Catchment Screening results

3.2 Baseline Risk And Vulnerability Assessment (BRAVA)

Following on from the RBCS, the Baseline Risk and Vulnerability Assessment (BRAVA) highlights current and future risk. The risk scores are driven by company targets which were set in our last business plan. These targets were subdivided according to population or sewer length, depending on the measure, to derive a target for each river basin catchment.

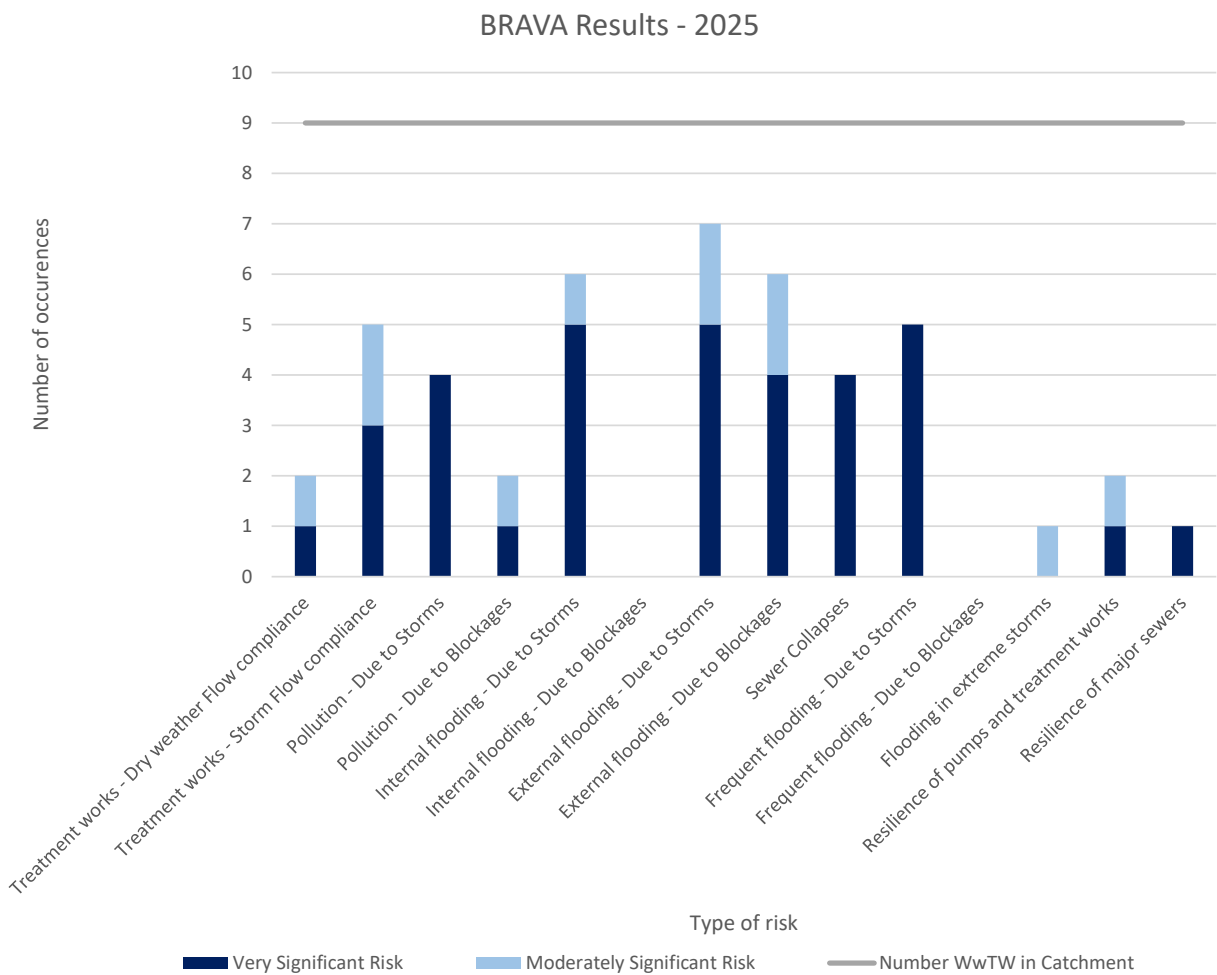


Figure 4 - BRAVA 2025 Summary

In 2025, external flooding due to storms and blockages, and internal flooding due to storms are the biggest concerns in the Dee - Chester Weir to Ceiriog catchment.

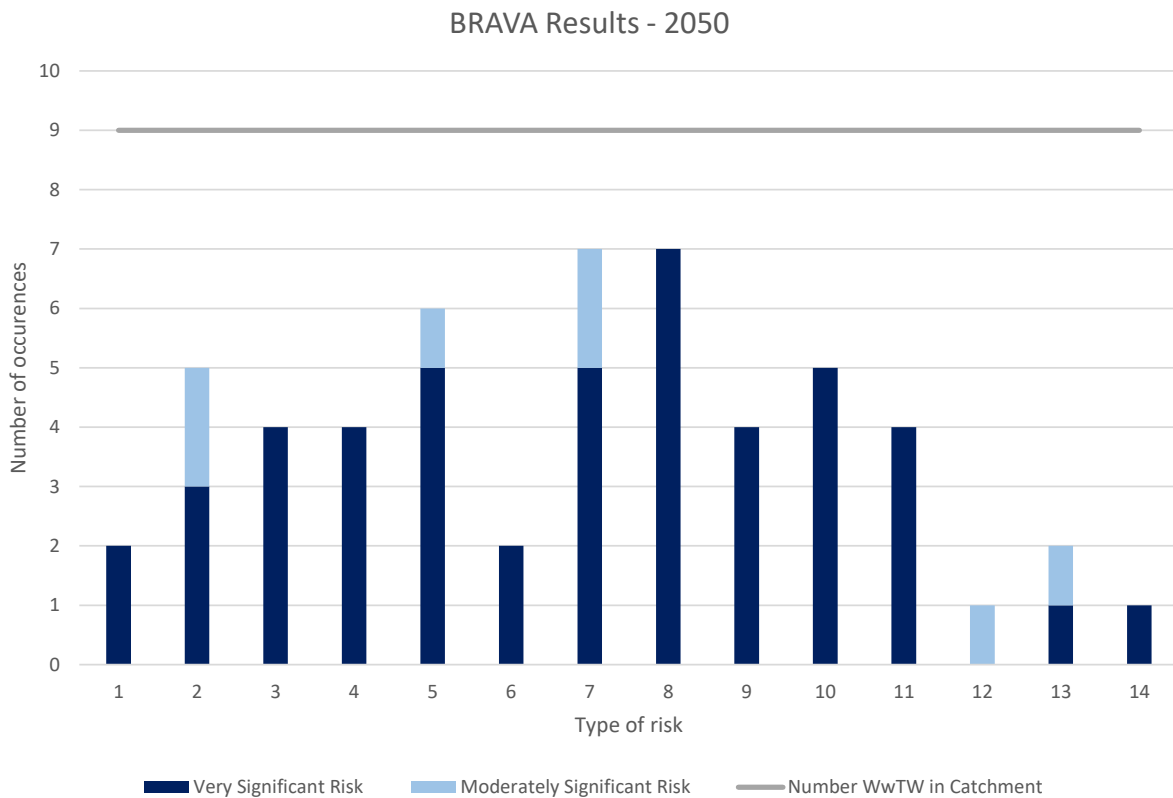


Figure 5 - BRAVA 2050 Summary

In 2050, external flooding due to storms and blockages, and internal flooding due to storms are the biggest concerns in the Dee - Chester Weir to Ceiriog catchment.

Figures 6 and 7 indicate the current and predicted risk of flooding, pollution, and both flooding and pollution caused by lack of capacity (termed 'hydraulic overload') across our networks. These maps illustrate where the issues occur and can be used to target where we want to work with the community and stakeholders to resolve issues. By working together, we can combine knowledge and resources to deliver the best outcomes for local communities and the environment. We want to include your feedback in our decision-making process.

BRAVA results 2025 Flooding and Pollution caused by Hydraulic Overload

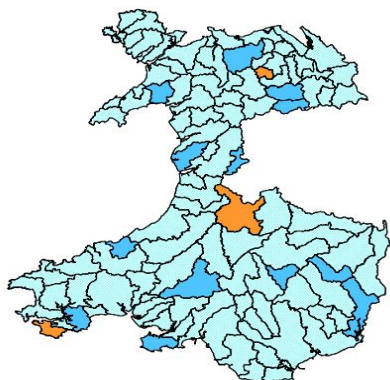
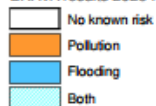


Figure 6 - Associated Strategic Planning Areas priority (2025)

BRAVA results 2050 Flooding and Pollution caused by Hydraulic Overload

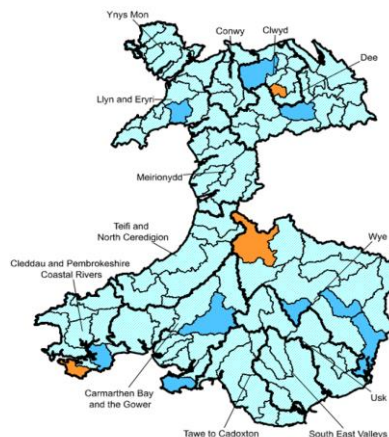
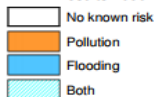


Figure 7 - Associated Strategic Planning Areas

3.3 Water Quality

Water quality is the classification of the quality of watercourses or water bodies in accordance to its physical, biological and chemical properties. Water quality is an important factor of environmental monitoring, ensuring that not only the water body is safe but the surrounding habitat and ecosystem is also.

Water quality status is categorised from 1 to 4, with 4 being the worst case. The priority status is based on the significance towards the risk factors triggering water quality. Dee - Chester Weir to Ceiriog has a water quality priority status for 2050 of 3 which indicates targeted investment to mitigate and focus during AMP9.

4.0 Supply Demand

Supply-demand is an assessment of the capacity of our treatment works. It approximately assesses whether all the treatment works in a region can collectively cope with current and future flows in dry and wet weather. There are two parts to the assessment: dry weather flow (DWF) and a wet weather capacity assessment.

For the DWF part of the assessment, the suitability of the dry weather consents is tested against forecast future growth and changes in water consumption. Results for three scenarios are provided: the 0% headroom scenario assesses the region's capability for treating the predicted changes in DWF in the future with no allowance for error, with no spare treatment works capacity. The other scenarios indicate resilience - i.e. could we cope if we had flows 10% or 20% higher than estimated?

The wet weather assessment takes storm consent values where available as an indication of treatment works capacity and estimates the amount of incoming flow the treatment works is able to treat across a year. Again, three scenarios are shown, with differing treatment "targets" - i.e. if we wanted to ensure that 70% of the wet weather flows in a catchment were treated, could the treatment works cope? Changes in rainfall due to climate change and changing dry weather flows within the region mean that the percentage of flow treated across a year can change in the future.

Table 2 shows the supply-demand assessment for this region. Where a region may not have adequate capacity under a given scenario, it is flagged dark blue for further investigation. There may be local incapacity issues at individual works within the region.

L3 Area	Headroom	2025	2030	2035	2040	2045	2050
Dee - Chester Weir to Ceiriog	0%						
	10%						
	20%						
	Treatment Target	2025	2030	2035	2040	2045	2050
	70%						
	80%						
	90%						

Table 2 - Supply Demand Balance

5.0 Options

Over time the pressures on our sewerage network change due to influences such as catchment growth, creep of rainwater into the network, or influences such as climate change impacting rainfall patterns. To ensure the plan is robust over the 30-year planning horizon and to account for the uniqueness of each catchment we have tested various types of schemes, and combination of schemes, to ensure a robust 'best value' plan is delivered.

The types of schemes tested are detailed in Table 3 and can be categorised into either improving network resilience to rainfall or improving network headroom in dry weather flow conditions.

Improving Resilience		
10% Reduction in area draining to the combined sewers	Represents removal of runoff from large commercial buildings.	Short term
25% Reduction reduction in area draining to the combined sewers	Represents removal of area runoff from non-residential paved areas where there is only one stakeholder (e.g. Local Authority or Highways Agency).	Medium term
50% Reduction reduction in area draining to the combined sewers	Represents removal of runoff from any connected area including residential properties. There are likely to be multiple stakeholders to engage with.	Long term
Improving Headroom		
Reducing infiltration	Reducing infiltration into sewers by 50%, which could be achieved by relining or replacing the public sewers .	Medium term
Reducing water use	Represents a reduction in water use per person to around 100l per person per day by 2050 by application of water efficiency measures	Medium term
Reducing trade flow	Reduce trade flows by around 25% by application of water efficiency measures.	Long term

Table 3 - Risk mitigation details

We have undertaken an analysis of all our wastewater catchments to determine the benefit in terms of potential volume of water removed from our systems for each scheme type to determine a journey plan, (see Figure 8 below), which provides the direction of the best scheme types to undertake in this catchment for the most benefit against predicted future risk from growth, creep and climate change.

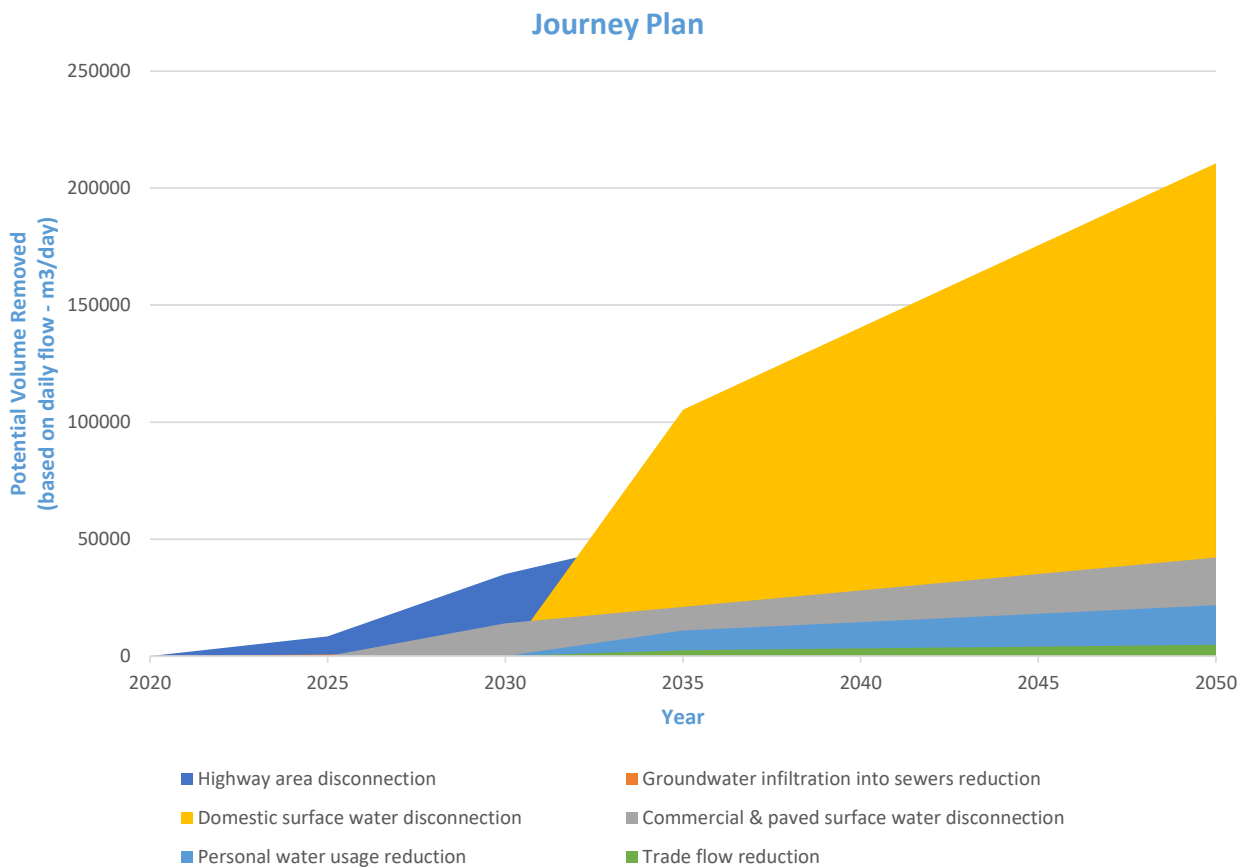


Figure 8 - Journey Plan

Approaches to managing risk

We have undertaken analysis to determine the likely costs to mitigate future predicted pollution and flooding. We assess combined sewer overflows based on the number of times they are predicted to spill in a 'typical year'. Table 4 illustrates the cost of potential measures to mitigate risk to varying standards. The assessment calculates the impact of rainfall and drainage contributions to the network relative to today's costs.

Mitigating the risk posed by flooding has been assessed in terms of probability of occurrence, we use the size of a storm event that has the probability of occurring once every 30 years. Table 5 illustrates the cost of potential mitigation measures to mitigate varying flood risk types.

The choice of scenarios for storm overflow mitigation in Table 4 is a separate cost and would be required in addition to the choice of scenarios for flooding protection in Table 5. The chosen scenarios for Storm overflows and flooding are to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain Existing Performance*	-	£20,000,000.00	£30,000,000.00
40 spills in a Typical Year	£17,000,000.00	£26,000,000.00	£31,000,000.00
20 spills in a Typical Year	£54,000,000.00	£64,000,000.00	£77,000,000.00
10 spills in a Typical Year	£90,000,000.00	£98,000,000.00	£113,000,000.00
0 spills in a Typical Year	£146,000,000.00	£165,000,000.00	£214,000,000.00
Equivalent No. Olympic Swimming Pools in 10 spills scenario	277.00	309.00	417.00

* Maintain is a considered scenario where we will continue to maintain the current level of service within the region and improve the network and address known and emerging risk.

Table 4 - Summary of Combined Sewer Overflow option investments

Choice of Scenario	Current Scenario (£)	2050 Scenario (£)	2050 Resilience Scenario (£) 1 in 50 yr (Storm Dennis)
Internal escapes	£28,000,000	£39,000,000	£41,000,000
External escapes in gardens	£48,000,000	£63,000,000	£57,000,000
Escapes in highways	£106,000,000	£138,000,000	£147,000,000
No future flooding	-	£200,000,000	£6,000,000
Total	£182,000,000.00	£440,000,000	£251,000,000

Table 5 - Summary of Flooding option investments

We have developed solutions which aim to provide protection against drainage and network failure, pollution events and flooding, internal and external to properties. The solutions developed highlight the level of investment required to bring our entire network up to the level of protection required to be resilient for future risk and demands. The range of scenarios is to provide a choice for understanding and discussion of future direction.

We are beginning to break down the investment indicated in Table 4 and 5 by creating practical schemes ready for delivery these schemes are designed as 100% traditional, 100% sustainable or green and 100% mixture of the 2. These packages have then been analysed in terms of their long term benefit and environmental and social cost to society and one has been chosen for inclusion as our preferred best value option. The areas where we have started our delivery programme aims to provide protection, to our worst served customers and rivers designated as Special Areas of Conservation (SAC) under the

For more information on the methodology developed to carry out the assessments see the DWMP plan main report.

If you want to work with us to develop joint projects to reduce the risk of flooding and protect the environment, please get in touch.

We will continue to work with Welsh Government, Regulators and Local Authorities about the pace, scale and affordability of improvements to be made.

We will be consulting on the preferred approach to planning and once its concluded the next stage is to develop the pipeline of options to meet the pace scale and affordability discussed with Welsh Government and our regulators.

Table 6 - Summary of solutions put forward are a first cycle preferred plan before SEA/HRA

L4 Catchments	No. Schemes
CHESTER	0
BURTON (N OF QUEENSFERRY)	0
SAIGHTON	0
BACKFORD	0
BUCKLEY ALLTAMI ROAD	0
HESWALL WWTW	0
NESTON	0
QUEENSFERRY STW	0
CONNAHS QUAY	0

DWMP Tactical Planning Catchment Summary



Dee - outlet Bala Lake to inlet Bala Lake

1.0 Introduction

This Drainage and Wastewater Management Plan (DWMP) sets out how Dŵr Cymru Welsh Water (DCWW) will manage and improve its assets to maintain a resilient and robust wastewater drainage system. The plan aims to manage flooding and pollution from our wastewater assets in the future, for our customers and our environment by working collaboratively with stakeholders, regulators and local authorities to provide a complete partnership in tackling current and future problems.

1.1 Catchment Information

The Dee - outlet Bala Lake to inlet Bala Lake planning catchment lies within the Dee river basin catchment, (see Figure 1 below), it consists of 3 wastewater catchments (see Figure 2 below). There is a combined population of 453, this is set to decrease to 392 by 2050, a change of -13%. There is a total sewer length of 4km, with a foul sewer length of 1km, a surface water length of 0km and a combined sewer length of 3km. There are 3 Wastewater Treatment Works (WwTW), 3 Sewerage Pumping Stations (SPSSs), and 2 Combined Storm Overflows (CSOs) across this tactical planning unit.

The Dee - outlet Bala Lake to inlet Bala Lake catchment is in West Wales, East of Snowdonia National Park. The Dee flows down into the sea near Chester. Llanuwchllyn is the largest urban area.

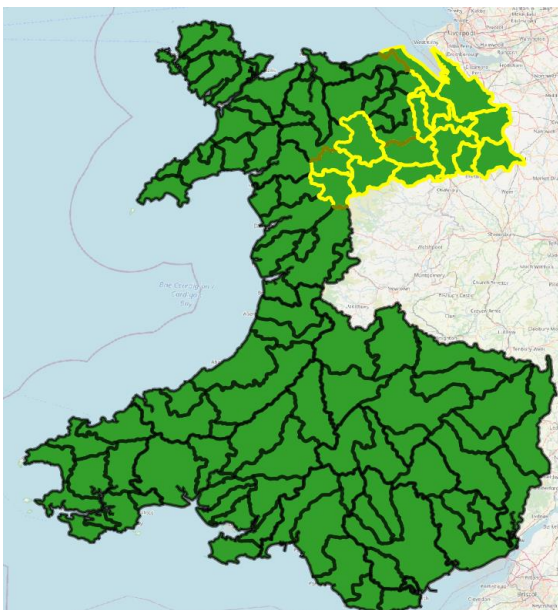


Figure 1 - River basin location detailing the associated tactical planning catchments

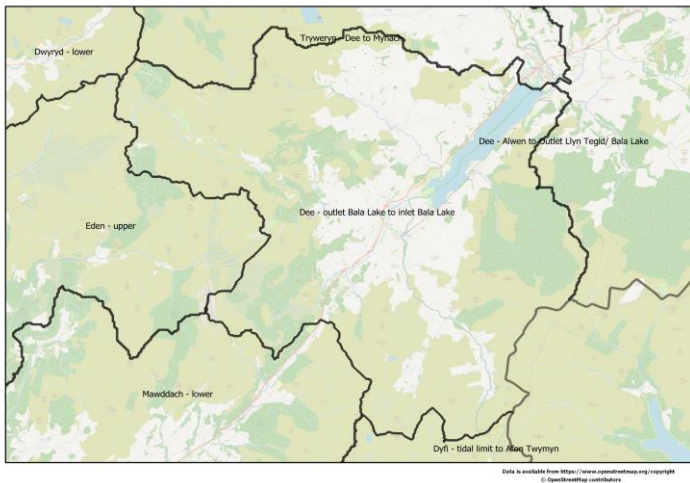


Figure 2- Tactical planning catchments

2.0 Stakeholder Engagement

The DWMP aims to enable DCWW to work collaboratively with stakeholders, regulators and local authorities to tackle current and future challenges. DCWW has identified stakeholder objectives that align with the aims of the DWMP and goals of other management plans. Table 1 details the main opportunities we have identified but this is not intended to be exhaustive. Note that these stakeholders have their own planning processes and plans which do not necessarily align with those of DCWW.

Scheme Information
Stakeholder engagement meetings are scheduled to commence in 2022. These meetings will be held between DCWW and the respective parties, such as NRW, EA, Councils and ENGO's. Further information of the outcome and points of focus towards short and long term strategy planning will be provided in the next cycle of the DWMP assessment.

Table 1 - Current and future investigation schemes

3.0 Risk

We have assessed our likely performance from now to 2050 against the objectives that we set in our most recent business plan. The results of this assessment are presented in the following sections.

To understand future performance, we need to estimate how much population will change by, the degree to which climate change will impact Wales and areas of England that border our company, and how further surface water connected to the sewer network might increase the amount and rate at which rainfall drains into our sewers.

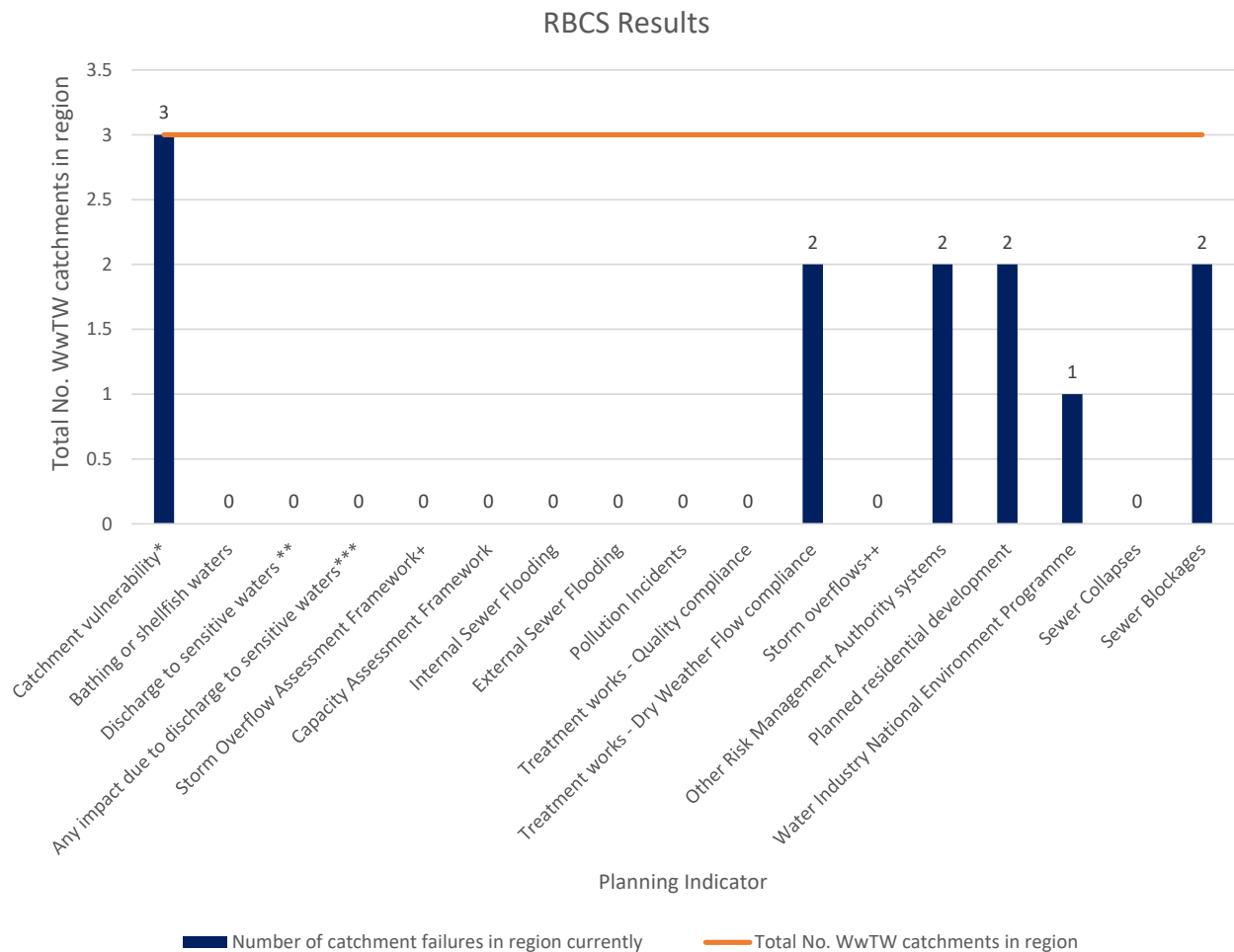
Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

Climate change is predicted to increase the intensity of storms by around 35% in this region. In a typical year, winters are likely to be warmer and wetter, and summers generally drier. More intense rainfall will happen more frequently. The population in the Dee region is set to decrease to 400 by 2050, a change of -13% based on our future projections. However there are major developments in localised areas that will contribute to future pressures on the network.

3.1 Risk Based Catchment Screening

The Risk Based Catchment Screening (RBCS) is the initial screening process to determine if a more detailed risk assessment is required. The assessment screens catchments against planning indicators which have been stipulated in the national guidance for DWMPs. A catchment will pass through to a more detailed risk assessment if it fails against one or more of these indicators, the results are shown in Figure 3.

For the Dee - outlet Bala Lake to inlet Bala Lake catchment the biggest concerns indicated by the RBCS are - catchment characterisation (based on a vulnerability assessment of flooding due to local characteristics e.g. topography).



*To sewer flooding due to extreme wet weather events.

**Categorised as a "planned" scheduled action within the Natural Resources Wales Action Database or considered as "Remedy" on Natural England Designated Sites system.

***Categorised as a "identified" scheduled action within the Natural Resources Wales Action Database or considered as "Threat" on Natural England Designated Sites system.

+Frequency investigation triggered.

++Overflow risks not covered by other indicators,

Figure 3 - Risk Based Catchment Screening results

3.2 Baseline Risk And Vulnerability Assessment (BRAVA)

Following on from the RBCS, the Baseline Risk and Vulnerability Assessment (BRAVA) highlights current and future risk. The risk scores are driven by company targets which were set in our last business plan. These targets were subdivided according to population or sewer length, depending on the measure, to derive a target for each river basin catchment.

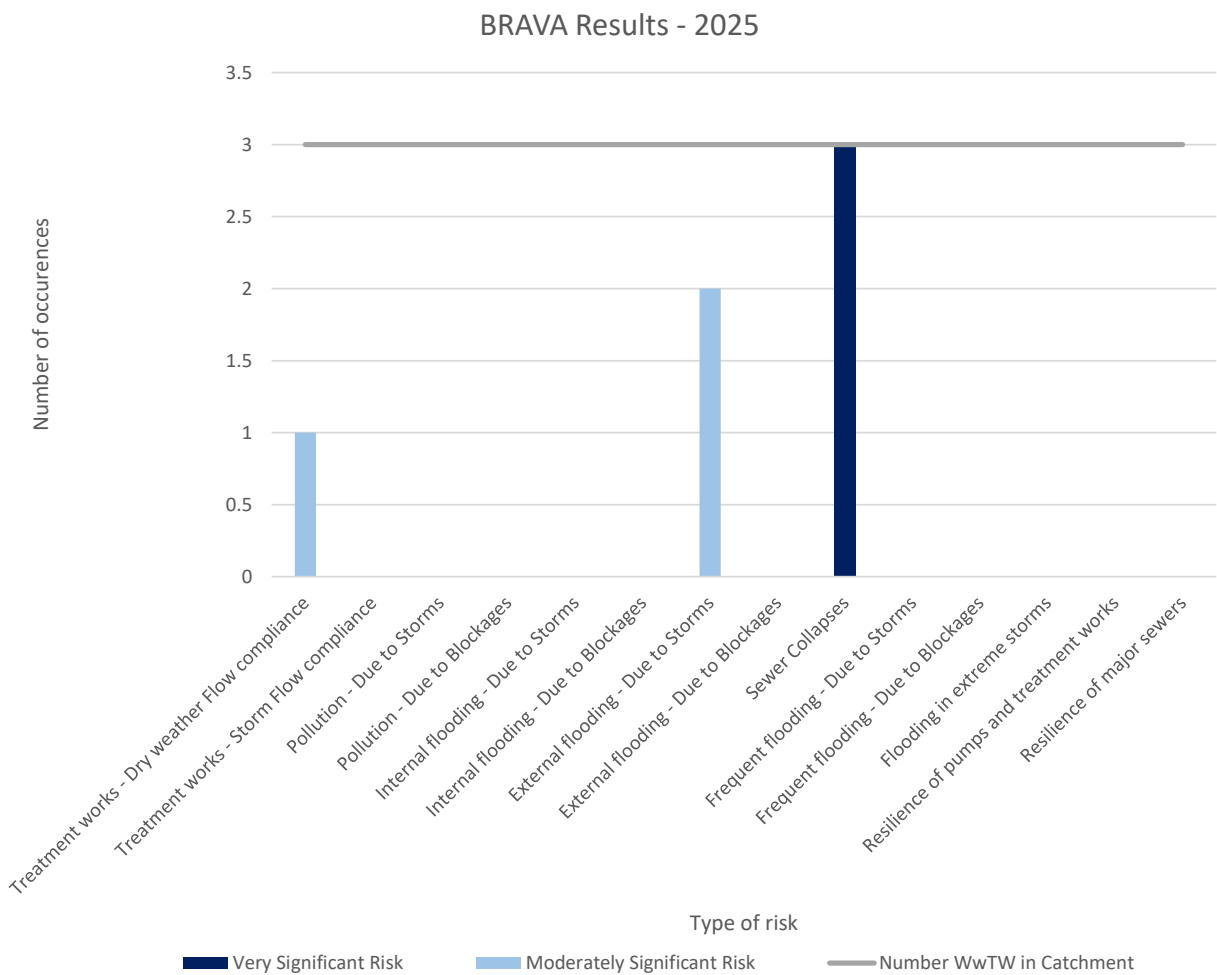


Figure 4 - BRAVA 2025 Summary

In 2025, sewer collapses and external flooding due to storms are the biggest concerns in the Dee - outlet Bala Lake to inlet Bala Lake catchment.

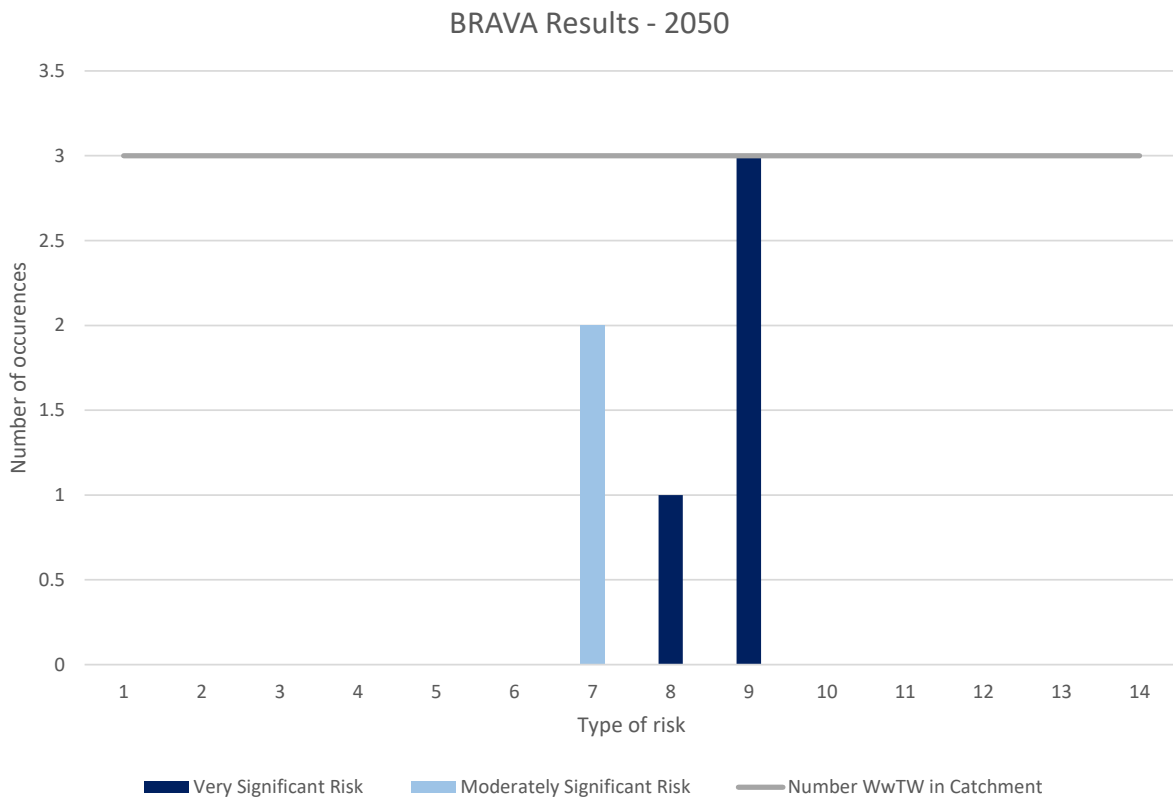


Figure 5 - BRAVA 2050 Summary

In 2050, sewer collapses and external flooding due to storms are the biggest concerns in the Dee - outlet Bala Lake to inlet Bala Lake catchment.

Figures 6 and 7 indicate the current and predicted risk of flooding, pollution, and both flooding and pollution caused by lack of capacity (termed 'hydraulic overload') across our networks. These maps illustrate where the issues occur and can be used to target where we want to work with the community and stakeholders to resolve issues. By working together, we can combine knowledge and resources to deliver the best outcomes for local communities and the environment. We want to include your feedback in our decision-making process.

BRAVA results 2025 Flooding and Pollution caused by Hydraulic Overload

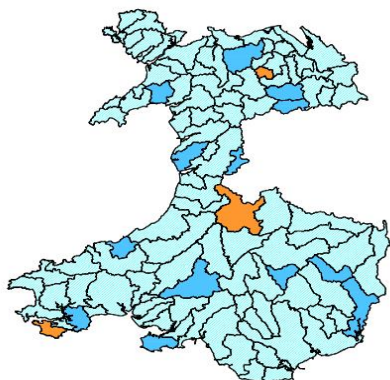
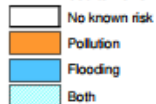


Figure 6 - Associated Strategic Planning Areas priority (2025)

BRAVA results 2050 Flooding and Pollution caused by Hydraulic Overload

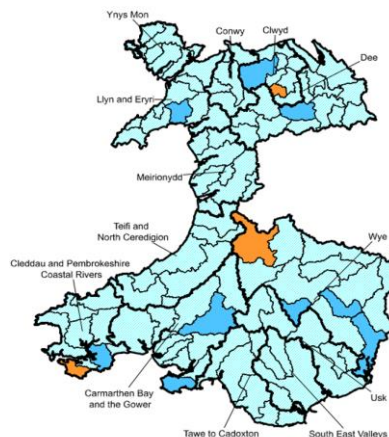
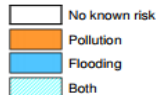


Figure 7 - Associated Strategic Planning Areas

3.3 Water Quality

Water quality is the classification of the quality of watercourses or water bodies in accordance to its physical, biological and chemical properties. Water quality is an important factor of environmental monitoring, ensuring that not only the water body is safe but the surrounding habitat and ecosystem is also.

Water quality status is categorised from 1 to 4, with 4 being the worst case. The priority status is based on the significance towards the risk factors triggering water quality. Dee - outlet Bala Lake to inlet Bala Lake has a water quality priority status for 2050 of 1 which indicates targeted investment to mitigate and focus during AMP11.

4.0 Supply Demand

Supply-demand is an assessment of the capacity of our treatment works. It approximately assesses whether all the treatment works in a region can collectively cope with current and future flows in dry and wet weather. There are two parts to the assessment: dry weather flow (DWF) and a wet weather capacity assessment.

For the DWF part of the assessment, the suitability of the dry weather consents is tested against forecast future growth and changes in water consumption. Results for three scenarios are provided: the 0% headroom scenario assesses the region's capability for treating the predicted changes in DWF in the future with no allowance for error, with no spare treatment works capacity. The other scenarios indicate resilience - i.e. could we cope if we had flows 10% or 20% higher than estimated?

The wet weather assessment takes storm consent values where available as an indication of treatment works capacity and estimates the amount of incoming flow the treatment works is able to treat across a year. Again, three scenarios are shown, with differing treatment "targets" - i.e. if we wanted to ensure that 70% of the wet weather flows in a catchment were treated, could the treatment works cope? Changes in rainfall due to climate change and changing dry weather flows within the region mean that the percentage of flow treated across a year can change in the future.

Table 2 shows the supply-demand assessment for this region. Where a region may not have adequate capacity under a given scenario, it is flagged dark blue for further investigation. There may be local incapacity issues at individual works within the region.

L3 Area	Headroom	2025	2030	2035	2040	2045	2050
Dee - outlet Bala Lake to inlet Bala Lake	0%						
	10%						
	20%						
	Treatment Target	2025	2030	2035	2040	2045	2050
	70%						
	80%						
	90%						

Table 2 - Supply Demand Balance

5.0 Options

Over time the pressures on our sewerage network change due to influences such as catchment growth, creep of rainwater into the network, or influences such as climate change impacting rainfall patterns. To ensure the plan is robust over the 30-year planning horizon and to account for the uniqueness of each catchment we have tested various types of schemes, and combination of schemes, to ensure a robust 'best value' plan is delivered.

The types of schemes tested are detailed in Table 3 and can be categorised into either improving network resilience to rainfall or improving network headroom in dry weather flow conditions.

Improving Resilience		
10% Reduction in area draining to the combined sewers	Represents removal of runoff from large commercial buildings.	Short term
25% Reduction reduction in area draining to the combined sewers	Represents removal of area runoff from non-residential paved areas where there is only one stakeholder (e.g. Local Authority or Highways Agency).	Medium term
50% Reduction reduction in area draining to the combined sewers	Represents removal of runoff from any connected area including residential properties. There are likely to be multiple stakeholders to engage with.	Long term
Improving Headroom		
Reducing infiltration	Reducing infiltration into sewers by 50%, which could be achieved by relining or replacing the public sewers .	Medium term
Reducing water use	Represents a reduction in water use per person to around 100l per person per day by 2050 by application of water efficiency measures	Medium term
Reducing trade flow	Reduce trade flows by around 25% by application of water efficiency measures.	Long term

Table 3 - Risk mitigation details

We have undertaken an analysis of all our wastewater catchments to determine the benefit in terms of potential volume of water removed from our systems for each scheme type to determine a journey plan, (see Figure 8 below), which provides the direction of the best scheme types to undertake in this catchment for the most benefit against predicted future risk from growth, creep and climate change.

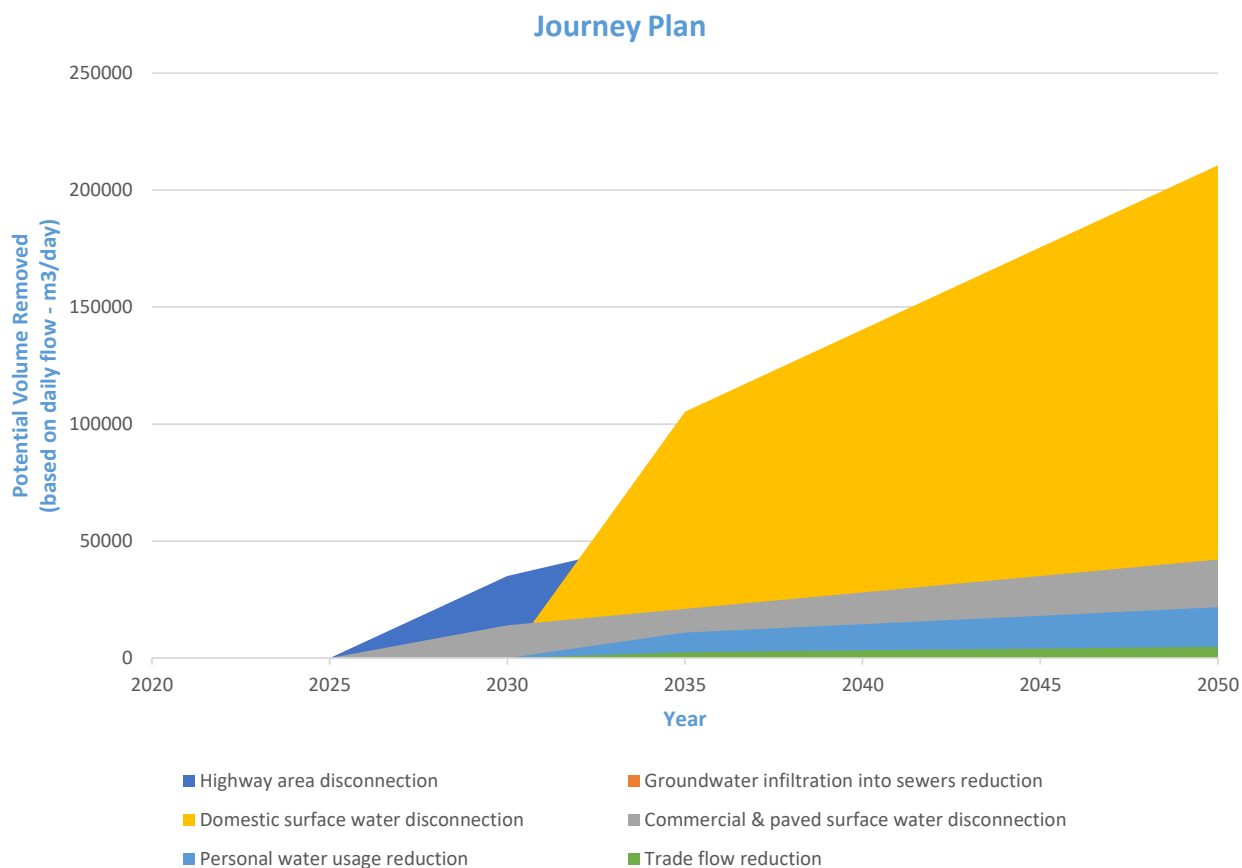


Figure 8 - Journey Plan

Approaches to managing risk

We have undertaken analysis to determine the likely costs to mitigate future predicted pollution and flooding. We assess combined sewer overflows based on the number of times they are predicted to spill in a 'typical year'. Table 4 illustrates the cost of potential measures to mitigate risk to varying standards. The assessment calculates the impact of rainfall and drainage contributions to the network relative to today's costs.

Mitigating the risk posed by flooding has been assessed in terms of probability of occurrence, we use the size of a storm event that has the probability of occurring once every 30 years. Table 5 illustrates the cost of potential mitigation measures to mitigate varying flood risk types.

The choice of scenarios for storm overflow mitigation in Table 4 is a separate cost and would be required in addition to the choice of scenarios for flooding protection in Table 5. The chosen scenarios for Storm overflows and flooding are to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain Existing Performance*	-	£3,000,000.00	£5,000,000.00
40 spills in a Typical Year	£1,000,000.00	£1,000,000.00	£1,000,000.00
20 spills in a Typical Year	£2,000,000.00	£2,000,000.00	£2,000,000.00
10 spills in a Typical Year	£2,000,000.00	£2,000,000.00	£2,000,000.00
0 spills in a Typical Year	£4,000,000.00	£4,000,000.00	£4,000,000.00
Equivalent No. Olympic Swimming Pools in 10 spills scenario	11.00	12.00	13.00

* Maintain is a considered scenario where we will continue to maintain the current level of service within the region and improve the network and address known and emerging risk.

Table 4 - Summary of Combined Sewer Overflow option investments

Choice of Scenario	Current Scenario (£)	2050 Scenario (£)	2050 Resilience Scenario (£) 1 in 50 yr (Storm Dennis)
Internal escapes	£0	£0	£0
External escapes in gardens	£0	£0	£0
Escapes in highways	£0	£0	£0
No future flooding	-	£2,000,000	£6,000,000
Total	£0.00	£2,000,000	£6,000,000

Table 5 - Summary of Flooding option investments

We have developed solutions which aim to provide protection against drainage and network failure, pollution events and flooding, internal and external to properties. The solutions developed highlight the level of investment required to bring our entire network up to the level of protection required to be resilient for future risk and demands. The range of scenarios is to provide a choice for understanding and discussion of future direction.

We are beginning to break down the investment indicated in Table 4 and 5 by creating practical schemes ready for delivery these schemes are designed as 100% traditional, 100% sustainable or green and 100% mixture of the 2. These packages have then been analysed in terms of their long term benefit and environmental and social cost to society and one has been chosen for inclusion as our preferred best value option. The areas where we have started our delivery programme aims to provide protection, to our worst served customers and rivers designated as Special Areas of Conservation (SAC) under the

For more information on the methodology developed to carry out the assessments see the DWMP plan main report.

If you want to work with us to develop joint projects to reduce the risk of flooding and protect the environment, please get in touch.

We will continue to work with Welsh Government, Regulators and Local Authorities about the pace, scale and affordability of improvements to be made.

We will be consulting on the preferred approach to planning and once its concluded the next stage is to develop the pipeline of options to meet the pace scale and affordability discussed with Welsh Government and our regulators.

Table 6 - Summary of solutions put forward are a first cycle preferred plan before SEA/HRA

L4 Catchments	No. Schemes
LLANGOWER	0
PARC (SW OF BALA)	0
LLANUWCHLLYN STW	0

DWMP Tactical Planning Catchment Summary



Tryweryn - Dee to Mynach

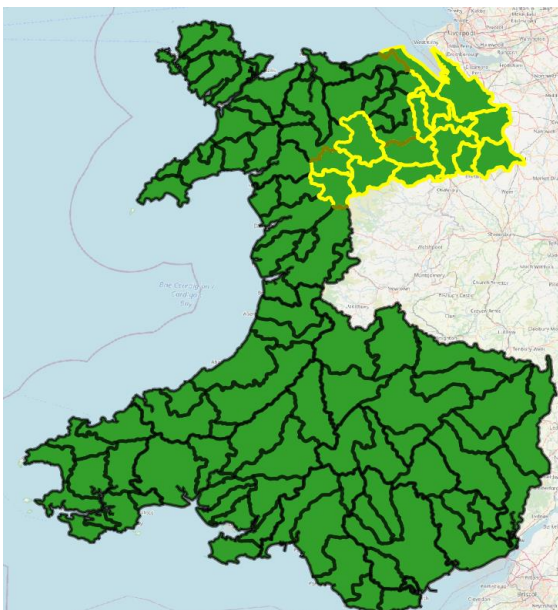
1.0 Introduction

This Drainage and Wastewater Management Plan (DWMP) sets out how Dŵr Cymru Welsh Water (DCWW) will manage and improve its assets to maintain a resilient and robust wastewater drainage system. The plan aims to manage flooding and pollution from our wastewater assets in the future, for our customers and our environment by working collaboratively with stakeholders, regulators and local authorities to provide a complete partnership in tackling current and future problems.

1.1 Catchment Information

The Tryweryn - Dee to Mynach planning catchment lies within the Dee river basin catchment, (see Figure 1 below), it consists of 4 wastewater catchments (see Figure 2 below). There is a combined population of 3027, this is set to decrease to 2140 by 2050, a change of -29%. There is a total sewer length of 23km, with a foul sewer length of 2km, a surface water length of 6km and a combined sewer length of 14km. There are 4 Wastewater Treatment Works (WwTW), 9 Sewerage Pumping Stations (SPSs), and 1 Combined Storm Overflows (CSOs) across this tactical planning unit.

The Tryweryn - Dee to Mynach catchment Lies east of Snowdonia National Park, in line with the Llyn Peninsula. The River Tryweryn flows down to join the River Dee near Y Bala. Y Bala and Y Frongoch are its largest urban areas.



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Figure 1 - River basin location detailing the associated tactical planning catchments

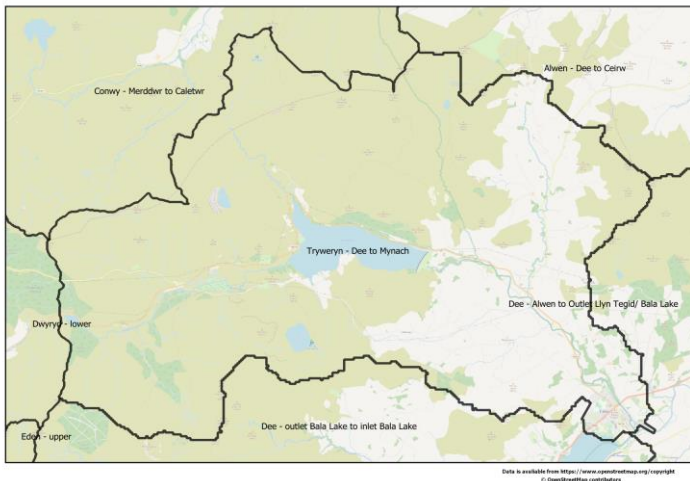


Figure 2- Tactical planning catchments

2.0 Stakeholder Engagement

The DWMP aims to enable DCWW to work collaboratively with stakeholders, regulators and local authorities to tackle current and future challenges. DCWW has identified stakeholder objectives that align with the aims of the DWMP and goals of other management plans. Table 1 details the main opportunities we have identified but this is not intended to be exhaustive. Note that these stakeholders have their own planning processes and plans which do not necessarily align with those of DCWW.

Scheme Information
Stakeholder engagement meetings are scheduled to commence in 2022. These meetings will be held between DCWW and the respective parties, such as NRW, EA, Councils and ENGO's. Further information of the outcome and points of focus towards short and long term strategy planning will be provided in the next cycle of the DWMP assessment.

Table 1 - Current and future investigation schemes

3.0 Risk

We have assessed our likely performance from now to 2050 against the objectives that we set in our most recent business plan. The results of this assessment are presented in the following sections.

To understand future performance, we need to estimate how much population will change by, the degree to which climate change will impact Wales and areas of England that border our company, and how further surface water connected to the sewer network might increase the amount and rate at which rainfall drains into our sewers.

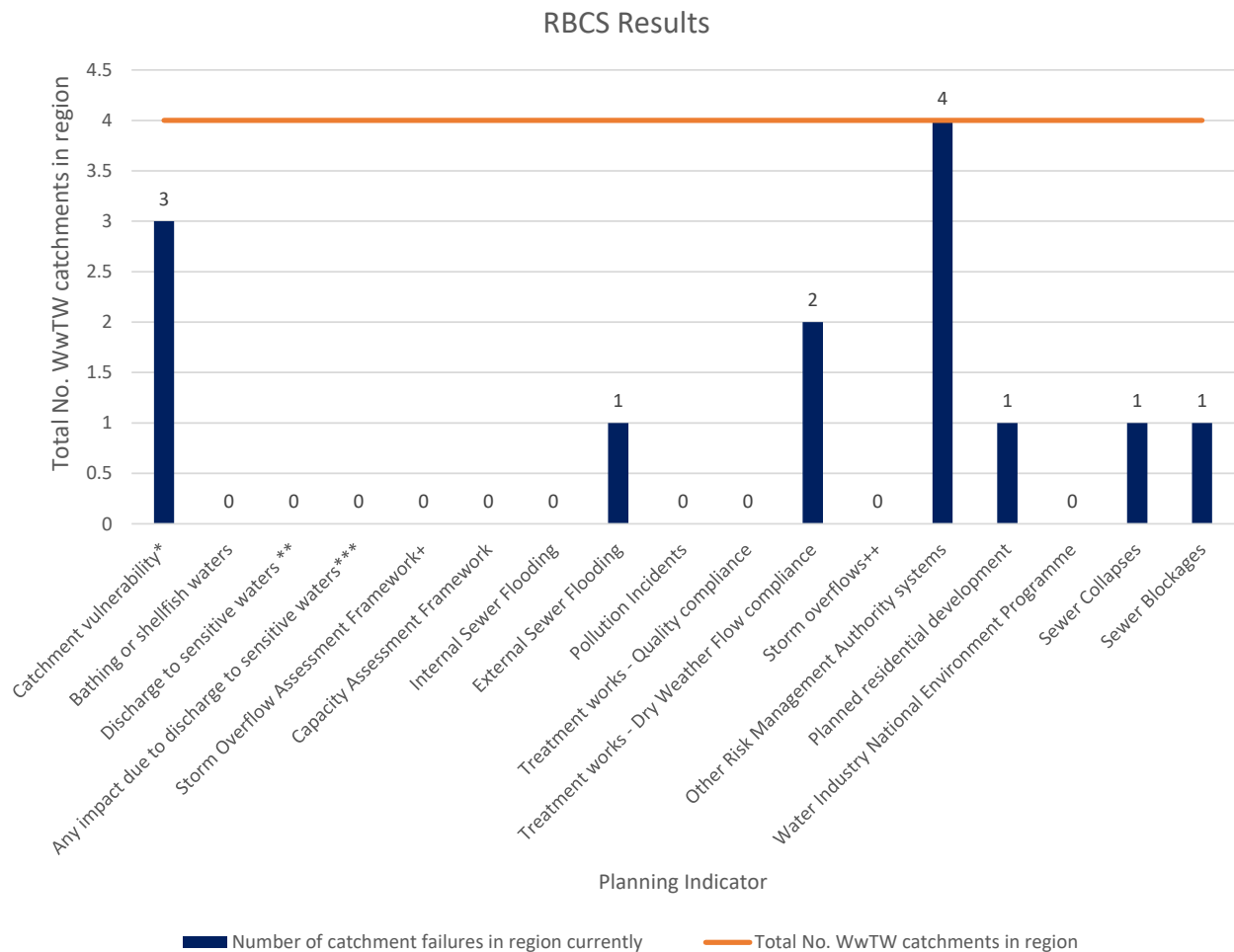
Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

Climate change is predicted to increase the intensity of storms by around 35% in this region. In a typical year, winters are likely to be warmer and wetter, and summers generally drier. More intense rainfall will happen more frequently. The population in the Dee region is set to decrease to 2100 by 2050, a change of -29% based on our future projections. However there are major developments in localised areas that will contribute to future pressures on the network, including Bala - sites adjacent to Cae Gadlas and Cysgod y Coleg.

3.1 Risk Based Catchment Screening

The Risk Based Catchment Screening (RBCS) is the initial screening process to determine if a more detailed risk assessment is required. The assessment screens catchments against planning indicators which have been stipulated in the national guidance for DWMPs. A catchment will pass through to a more detailed risk assessment if it fails against one or more of these indicators, the results are shown in Figure 3.

For the Tryweryn - Dee to Mynach catchment the biggest concern indicated by the RBCS is other RMAs.



*To sewer flooding due to extreme wet weather events.

**Categorised as a "planned" scheduled action within the Natural Resources Wales Action Database or considered as "Remedy" on Natural England Designated Sites system.

***Categorised as a "identified" scheduled action within the Natural Resources Wales Action Database or considered as "Threat" on Natural England Designated Sites system.

+Frequency investigation triggered.

++Overflow risks not covered by other indicators,

Figure 3 - Risk Based Catchment Screening results

3.2 Baseline Risk And Vulnerability Assessment (BRAVA)

Following on from the RBCS, the Baseline Risk and Vulnerability Assessment (BRAVA) highlights current and future risk. The risk scores are driven by company targets which were set in our last business plan. These targets were subdivided according to population or sewer length, depending on the measure, to derive a target for each river basin catchment.

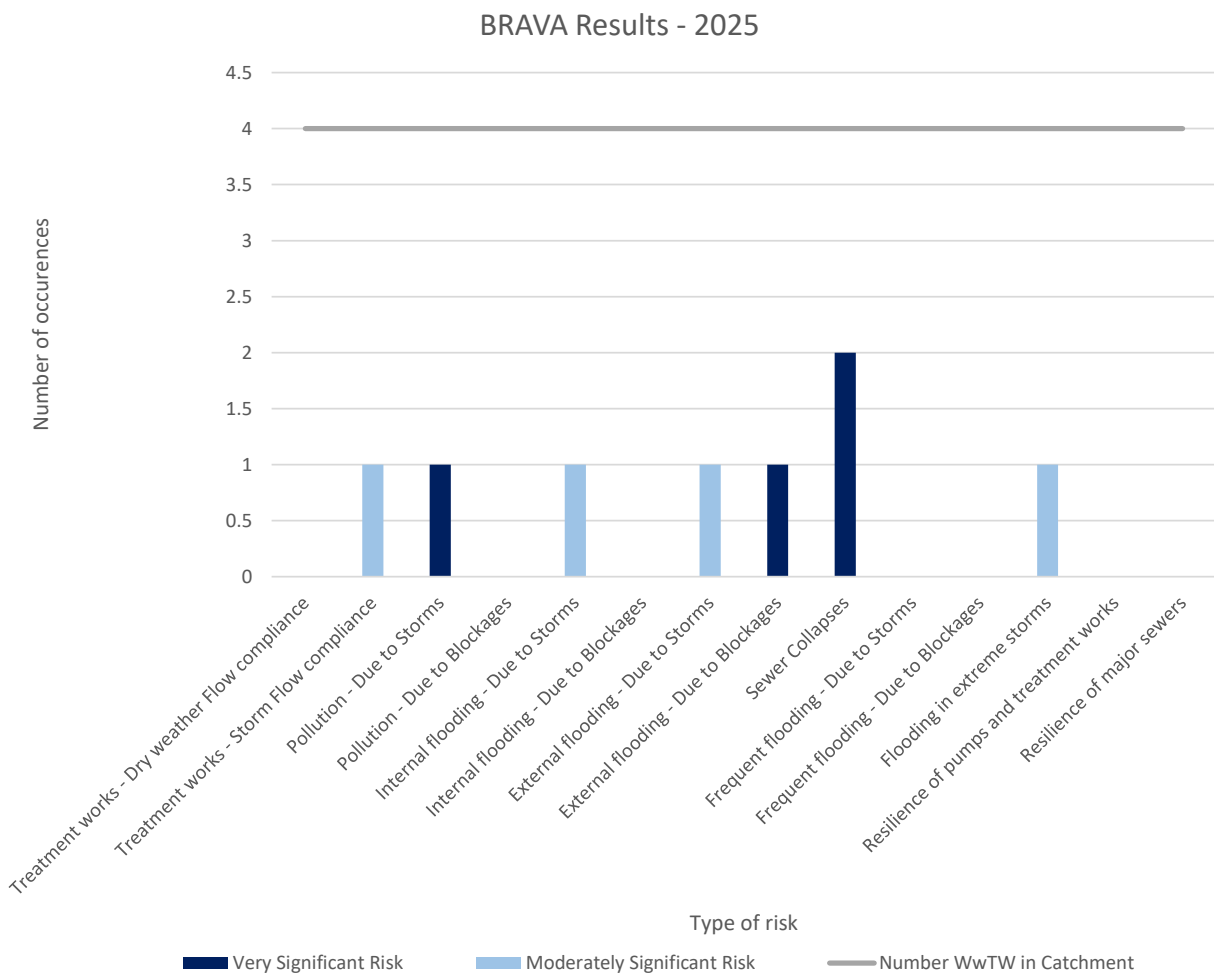


Figure 4 - BRAVA 2025 Summary

In 2025, sewer collapses are the biggest concern in the Tryweryn - Dee to Mynach catchment.

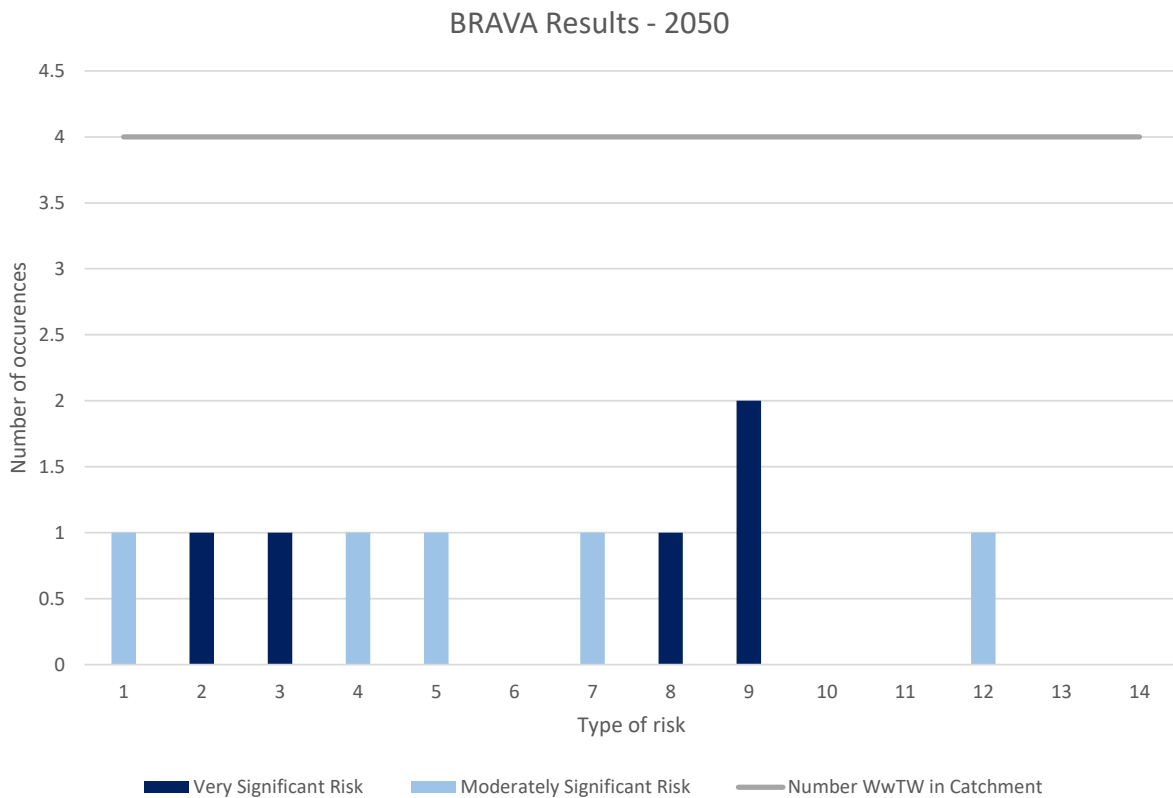


Figure 5 - BRAVA 2050 Summary

In 2050, sewer collapses are the biggest concern in the Tryweryn - Dee to Mynach catchment.

Figures 6 and 7 indicate the current and predicted risk of flooding, pollution, and both flooding and pollution caused by lack of capacity (termed 'hydraulic overload') across our networks. These maps illustrate where the issues occur and can be used to target where we want to work with the community and stakeholders to resolve issues. By working together, we can combine knowledge and resources to deliver the best outcomes for local communities and the environment. We want to include your feedback in our decision-making process.

BRAVA results 2025 Flooding and Pollution caused by Hydraulic Overload

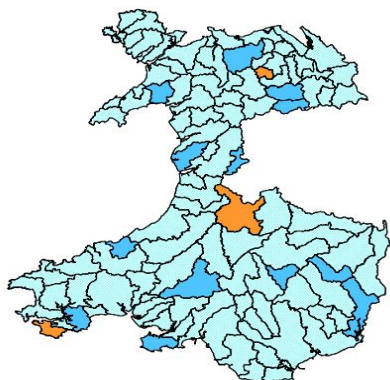
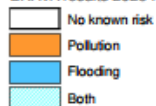


Figure 6 - Associated Strategic Planning Areas priority (2025)

BRAVA results 2050 Flooding and Pollution caused by Hydraulic Overload

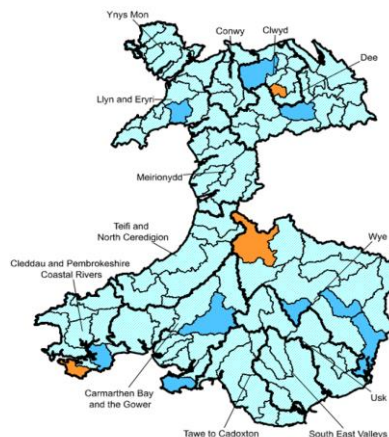
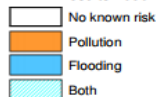


Figure 7 - Associated Strategic Planning Areas

3.3 Water Quality

Water quality is the classification of the quality of watercourses or water bodies in accordance to its physical, biological and chemical properties. Water quality is an important factor of environmental monitoring, ensuring that not only the water body is safe but the surrounding habitat and ecosystem is also.

Water quality status is categorised from 1 to 4, with 4 being the worst case. The priority status is based on the significance towards the risk factors triggering water quality. Tryweryn - Dee to Mynach has a water quality priority status for 2050 of 1 which indicates targeted investment to mitigate and focus during AMP11.

4.0 Supply Demand

Supply-demand is an assessment of the capacity of our treatment works. It approximately assesses whether all the treatment works in a region can collectively cope with current and future flows in dry and wet weather. There are two parts to the assessment: dry weather flow (DWF) and a wet weather capacity assessment.

For the DWF part of the assessment, the suitability of the dry weather consents is tested against forecast future growth and changes in water consumption. Results for three scenarios are provided: the 0% headroom scenario assesses the region's capability for treating the predicted changes in DWF in the future with no allowance for error, with no spare treatment works capacity. The other scenarios indicate resilience - i.e. could we cope if we had flows 10% or 20% higher than estimated?

The wet weather assessment takes storm consent values where available as an indication of treatment works capacity and estimates the amount of incoming flow the treatment works is able to treat across a year. Again, three scenarios are shown, with differing treatment "targets" - i.e. if we wanted to ensure that 70% of the wet weather flows in a catchment were treated, could the treatment works cope? Changes in rainfall due to climate change and changing dry weather flows within the region mean that the percentage of flow treated across a year can change in the future.

Table 2 shows the supply-demand assessment for this region. Where a region may not have adequate capacity under a given scenario, it is flagged dark blue for further investigation. There may be local incapacity issues at individual works within the region.

L3 Area	Headroom	2025	2030	2035	2040	2045	2050
Tryweryn - Dee to Mynach	0%						
	10%						
	20%						
	Treatment Target	2025	2030	2035	2040	2045	2050
	70%						
	80%						
	90%						

Table 2 - Supply Demand Balance

5.0 Options

Over time the pressures on our sewerage network change due to influences such as catchment growth, creep of rainwater into the network, or influences such as climate change impacting rainfall patterns. To ensure the plan is robust over the 30-year planning horizon and to account for the uniqueness of each catchment we have tested various types of schemes, and combination of schemes, to ensure a robust 'best value' plan is delivered.

The types of schemes tested are detailed in Table 3 and can be categorised into either improving network resilience to rainfall or improving network headroom in dry weather flow conditions.

Improving Resilience		
10% Reduction in area draining to the combined sewers	Represents removal of runoff from large commercial buildings.	Short term
25% Reduction reduction in area draining to the combined sewers	Represents removal of area runoff from non-residential paved areas where there is only one stakeholder (e.g. Local Authority or Highways Agency).	Medium term
50% Reduction reduction in area draining to the combined sewers	Represents removal of runoff from any connected area including residential properties. There are likely to be multiple stakeholders to engage with.	Long term
Improving Headroom		
Reducing infiltration	Reducing infiltration into sewers by 50%, which could be achieved by relining or replacing the public sewers .	Medium term
Reducing water use	Represents a reduction in water use per person to around 100l per person per day by 2050 by application of water efficiency measures	Medium term
Reducing trade flow	Reduce trade flows by around 25% by application of water efficiency measures.	Long term

Table 3 - Risk mitigation details

We have undertaken an analysis of all our wastewater catchments to determine the benefit in terms of potential volume of water removed from our systems for each scheme type to determine a journey plan, (see Figure 8 below), which provides the direction of the best scheme types to undertake in this catchment for the most benefit against predicted future risk from growth, creep and climate change.

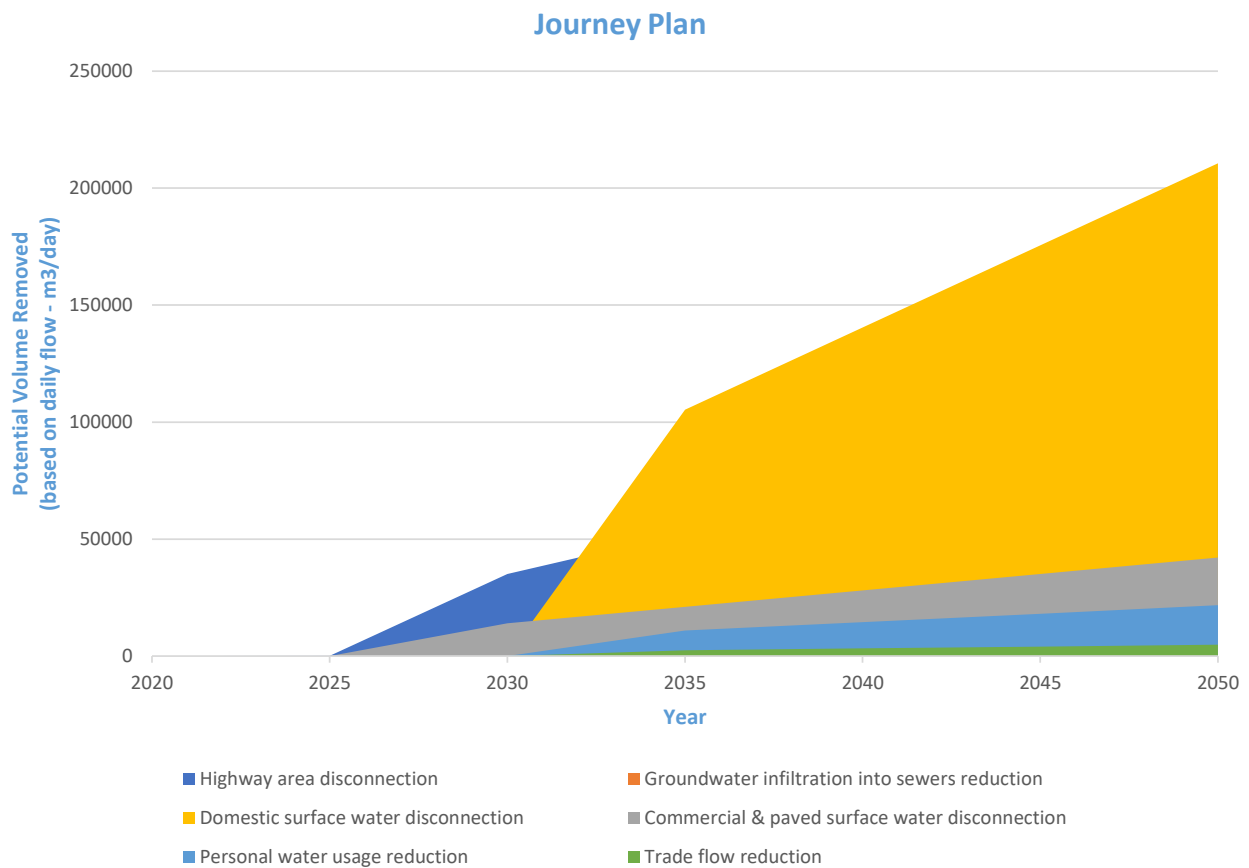


Figure 8 - Journey Plan

Approaches to managing risk

We have undertaken analysis to determine the likely costs to mitigate future predicted pollution and flooding. We assess combined sewer overflows based on the number of times they are predicted to spill in a 'typical year'. Table 4 illustrates the cost of potential measures to mitigate risk to varying standards. The assessment calculates the impact of rainfall and drainage contributions to the network relative to today's costs.

Mitigating the risk posed by flooding has been assessed in terms of probability of occurrence, we use the size of a storm event that has the probability of occurring once every 30 years. Table 5 illustrates the cost of potential mitigation measures to mitigate varying flood risk types.

The choice of scenarios for storm overflow mitigation in Table 4 is a separate cost and would be required in addition to the choice of scenarios for flooding protection in Table 5. The chosen scenarios for Storm overflows and flooding are to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain Existing Performance*	-	£3,000,000.00	£5,000,000.00
40 spills in a Typical Year	£1,000,000.00	£1,000,000.00	£1,000,000.00
20 spills in a Typical Year	£2,000,000.00	£2,000,000.00	£2,000,000.00
10 spills in a Typical Year	£2,000,000.00	£2,000,000.00	£2,000,000.00
0 spills in a Typical Year	£4,000,000.00	£4,000,000.00	£4,000,000.00
Equivalent No. Olympic Swimming Pools in 10 spills scenario	19.00	21.00	23.00

* Maintain is a considered scenario where we will continue to maintain the current level of service within the region and improve the network and address known and emerging risk.

Table 4 - Summary of Combined Sewer Overflow option investments

Choice of Scenario	Current Scenario (£)	2050 Scenario (£)	2050 Resilience Scenario (£) 1 in 50 yr (Storm Dennis)
Internal escapes	£0	£0	£0
External escapes in gardens	£0	£0	£0
Escapes in highways	£8,000,000	£10,000,000	£15,000,000
No future flooding	-	£2,000,000	£6,000,000
Total	£8,000,000.00	£12,000,000	£21,000,000

Table 5 - Summary of Flooding option investments

We have developed solutions which aim to provide protection against drainage and network failure, pollution events and flooding, internal and external to properties. The solutions developed highlight the level of investment required to bring our entire network up to the level of protection required to be resilient for future risk and demands. The range of scenarios is to provide a choice for understanding and discussion of future direction.

We are beginning to break down the investment indicated in Table 4 and 5 by creating practical schemes ready for delivery these schemes are designed as 100% traditional, 100% sustainable or green and 100% mixture of the 2. These packages have then been analysed in terms of their long term benefit and environmental and social cost to society and one has been chosen for inclusion as our preferred best value option. The areas where we have started our delivery programme aims to provide protection, to our worst served customers and rivers designated as Special Areas of Conservation (SAC) under the

For more information on the methodology developed to carry out the assessments see the DWMP plan main report.

If you want to work with us to develop joint projects to reduce the risk of flooding and protect the environment, please get in touch.

We will continue to work with Welsh Government, Regulators and Local Authorities about the pace, scale and affordability of improvements to be made.

We will be consulting on the preferred approach to planning and once its concluded the next stage is to develop the pipeline of options to meet the pace scale and affordability discussed with Welsh Government and our regulators.

Table 6 - Summary of solutions put forward are a first cycle preferred plan before SEA/HRA

L4 Catchments	No. Schemes
BALA RHYD-UCHAF	0
LLYN CELYN DAM	0
FRONGOCH	0
BALA	0

DWMP Tactical Planning Catchment Summary



Un-named Dee Estuary South

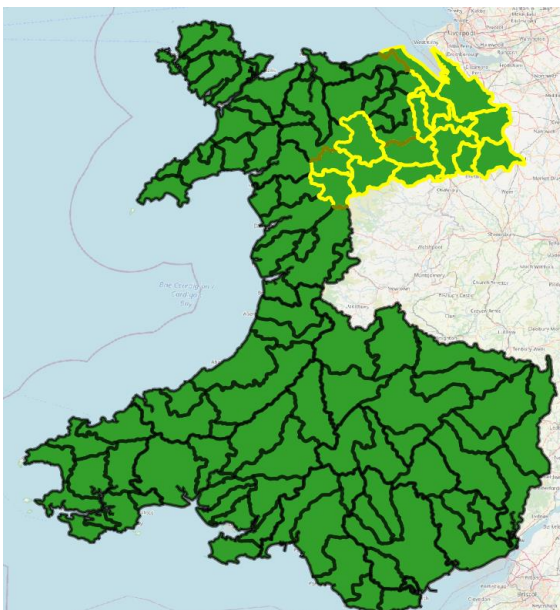
1.0 Introduction

This Drainage and Wastewater Management Plan (DWMP) sets out how Dŵr Cymru Welsh Water (DCWW) will manage and improve its assets to maintain a resilient and robust wastewater drainage system. The plan aims to manage flooding and pollution from our wastewater assets in the future, for our customers and our environment by working collaboratively with stakeholders, regulators and local authorities to provide a complete partnership in tackling current and future problems.

1.1 Catchment Information

The Un-named Dee Estuary South planning catchment lies within the Dee river basin catchment, (see Figure 1 below), it consists of 6 wastewater catchments (see Figure 2 below). There is a combined population of 78539, this is set to decrease to 63106 by 2050, a change of -20%. There is a total sewer length of 493km, with a foul sewer length of 267km, a surface water length of 134km and a combined sewer length of 89km. There are 6 Wastewater Treatment Works (WwTW), 98 Sewerage Pumping Stations (SPSs), and 65 Combined Storm Overflows (CSOs) across this tactical planning unit.

The Un-named Dee Estuary South catchment lies along the West side of the River Dee Estuary, North East Wales. Holywell and Prestatyn are its major urban areas.



Data is available from <https://www.openstreetmap.org/copyright> © OpenStreetMap contributors

Figure 1 - River basin location detailing the associated tactical planning catchments

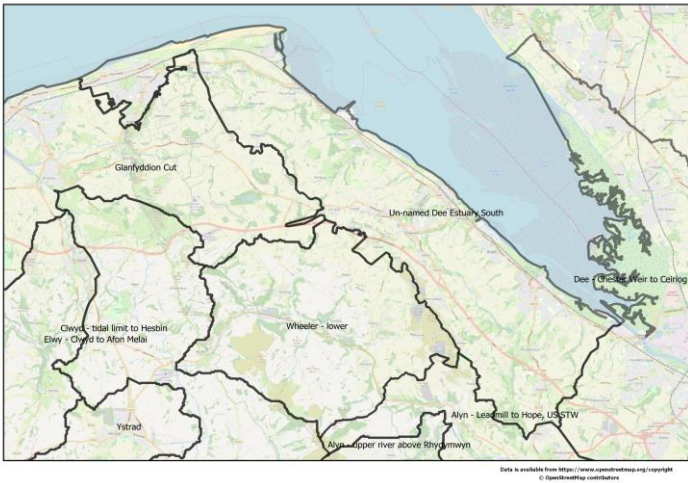


Figure 2- Tactical planning catchments

2.0 Stakeholder Engagement

The DWMP aims to enable DCWW to work collaboratively with stakeholders, regulators and local authorities to tackle current and future challenges. DCWW has identified stakeholder objectives that align with the aims of the DWMP and goals of other management plans. Table 1 details the main opportunities we have identified but this is not intended to be exhaustive. Note that these stakeholders have their own planning processes and plans which do not necessarily align with those of DCWW.

Scheme Information
Stakeholder engagement meetings are scheduled to commence in 2022. These meetings will be held between DCWW and the respective parties, such as NRW, EA, Councils and ENGO's. Further information of the outcome and points of focus towards short and long term strategy planning will be provided in the next cycle of the DWMP assessment.

Table 1 - Current and future investigation schemes

3.0 Risk

We have assessed our likely performance from now to 2050 against the objectives that we set in our most recent business plan. The results of this assessment are presented in the following sections.

To understand future performance, we need to estimate how much population will change by, the degree to which climate change will impact Wales and areas of England that border our company, and how further surface water connected to the sewer network might increase the amount and rate at which rainfall drains into our sewers.

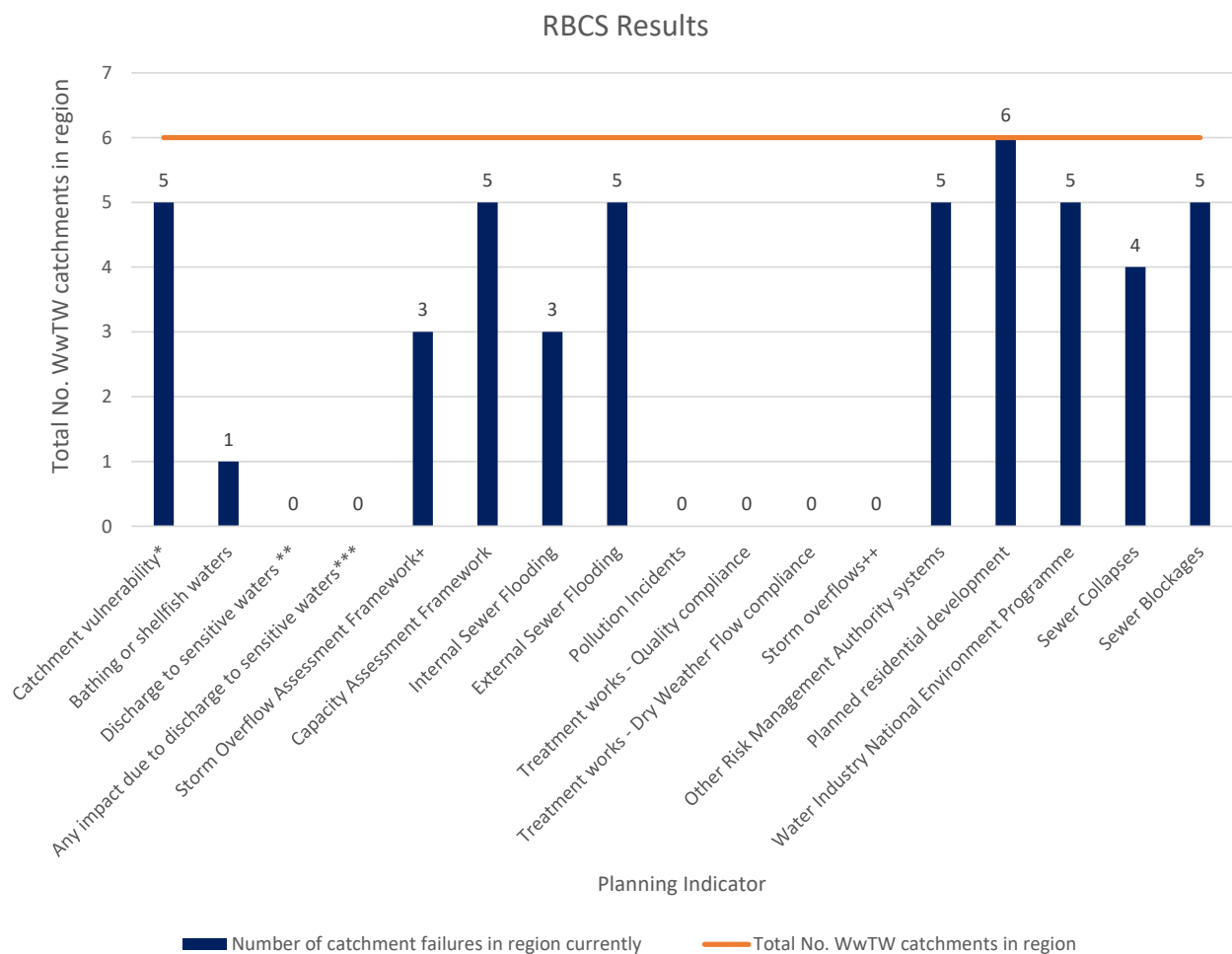
Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

Climate change is predicted to increase the intensity of storms by around 35% in this region. In a typical year, winters are likely to be warmer and wetter, and summers generally drier. More intense rainfall will happen more frequently. The population in the Conwy region is set to decrease to 400 by 2050, a change of -3% based on our future projections. However there are major developments in localised areas that will contribute to future pressures on the network.

3.1 Risk Based Catchment Screening

The Risk Based Catchment Screening (RBCS) is the initial screening process to determine if a more detailed risk assessment is required. The assessment screens catchments against planning indicators which have been stipulated in the national guidance for DWMPs. A catchment will pass through to a more detailed risk assessment if it fails against one or more of these indicators, the results are shown in Figure 3.

For the Un-named Dee Estuary South catchment the biggest concern indicated by the RBCS is planned residential development.



*To sewer flooding due to extreme wet weather events.

**Categorised as a "planned" scheduled action within the Natural Resources Wales Action Database or considered as "Remedy" on Natural England Designated Sites system.

***Categorised as a "identified" scheduled action within the Natural Resources Wales Action Database or considered as "Threat" on Natural England Designated Sites system.

+Frequency investigation triggered.

++Overflow risks not covered by other indicators,

Figure 3 - Risk Based Catchment Screening results

3.2 Baseline Risk And Vulnerability Assessment (BRAVA)

Following on from the RBCS, the Baseline Risk and Vulnerability Assessment (BRAVA) highlights current and future risk. The risk scores are driven by company targets which were set in our last business plan. These targets were subdivided according to population or sewer length, depending on the measure, to derive a target for each river basin catchment.

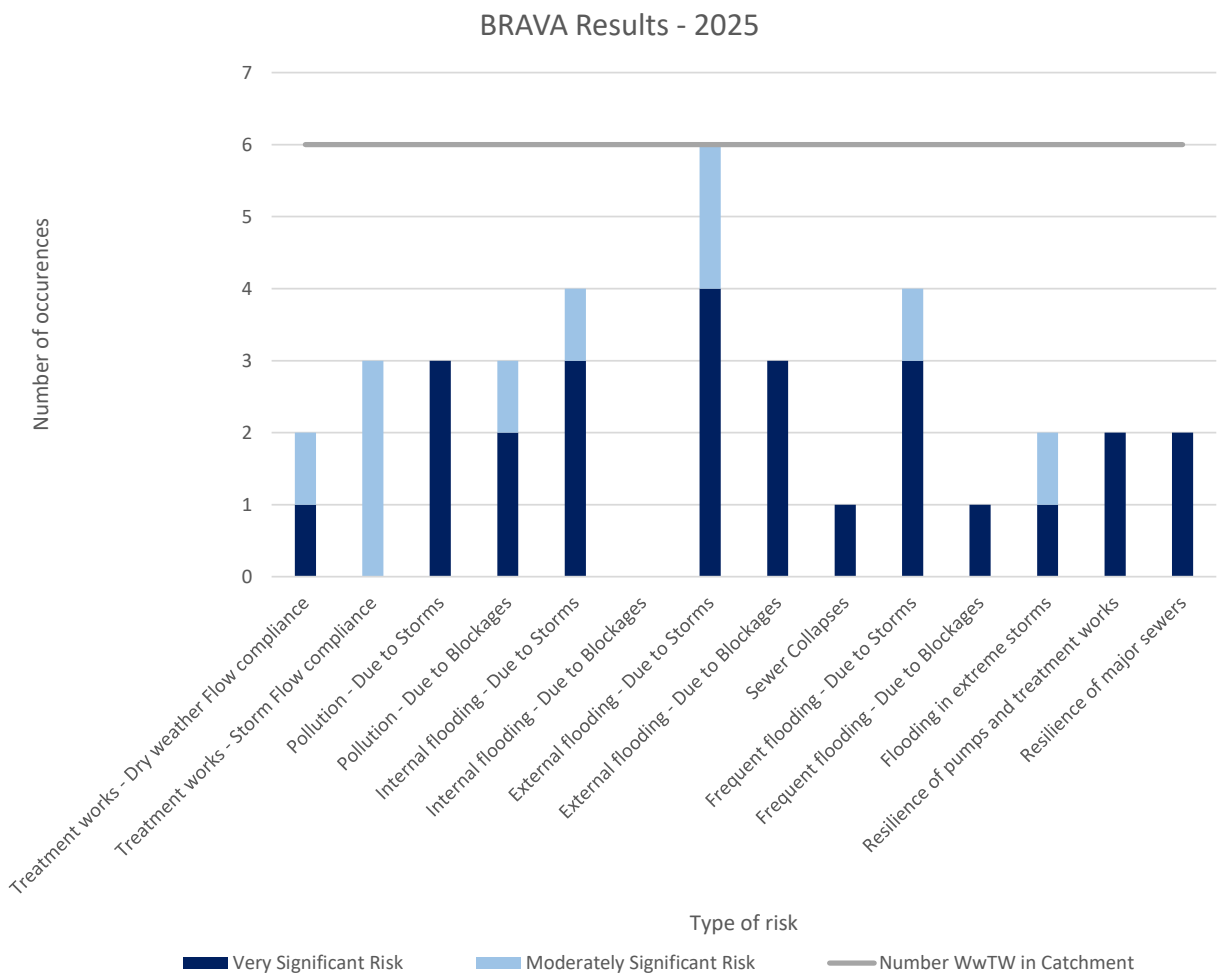


Figure 4 - BRAVA 2025 Summary

In 2025, external flooding due to storms is the biggest concern in the Un-named Dee Estuary South catchment.

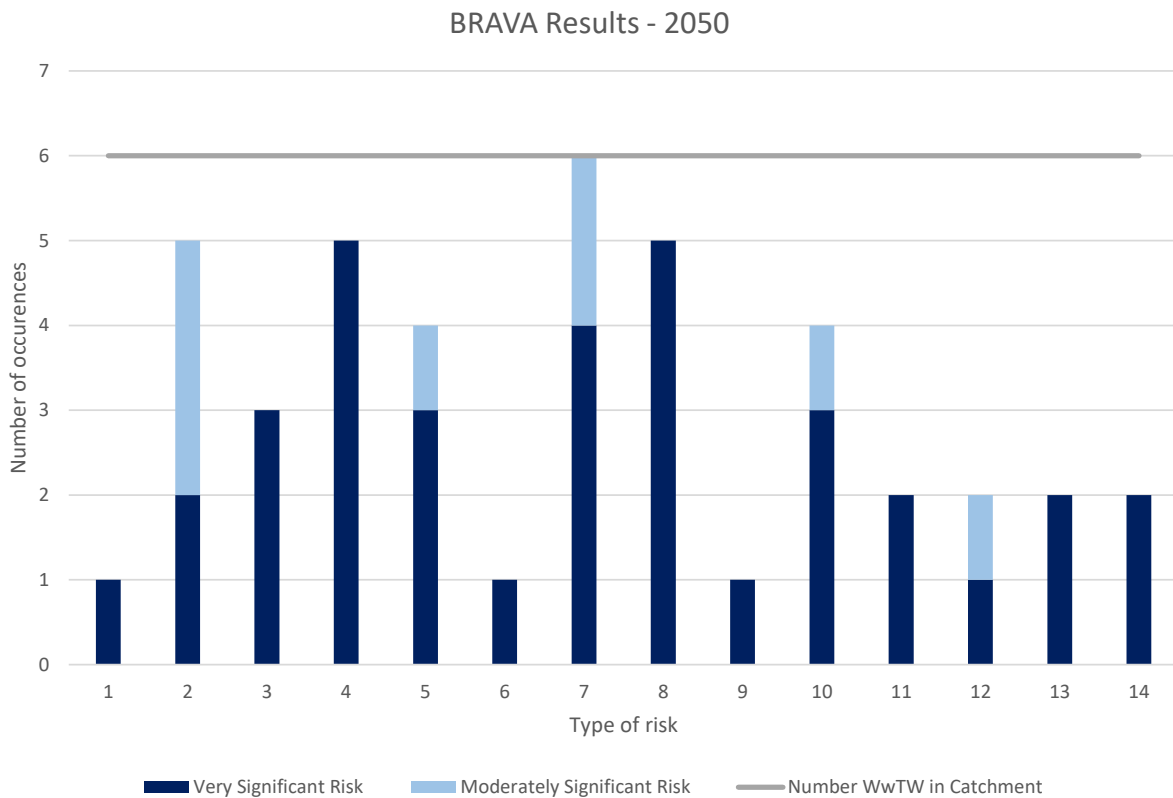


Figure 5 - BRAVA 2050 Summary

In 2050, external flooding due to storms is the biggest concern in the Un-named Dee Estuary South catchment.

Figures 6 and 7 indicate the current and predicted risk of flooding, pollution, and both flooding and pollution caused by lack of capacity (termed 'hydraulic overload') across our networks. These maps illustrate where the issues occur and can be used to target where we want to work with the community and stakeholders to resolve issues. By working together, we can combine knowledge and resources to deliver the best outcomes for local communities and the environment. We want to include your feedback in our decision-making process.

BRAVA results 2025 Flooding and Pollution caused by Hydraulic Overload

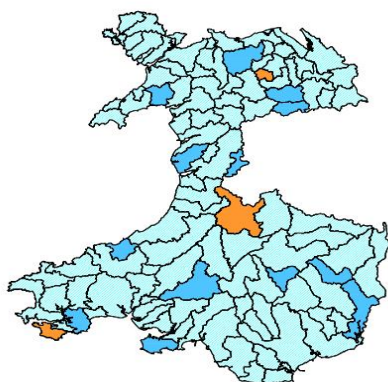
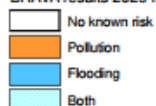


Figure 6 - Associated Strategic Planning Areas priority (2025)

BRAVA results 2050 Flooding and Pollution caused by Hydraulic Overload

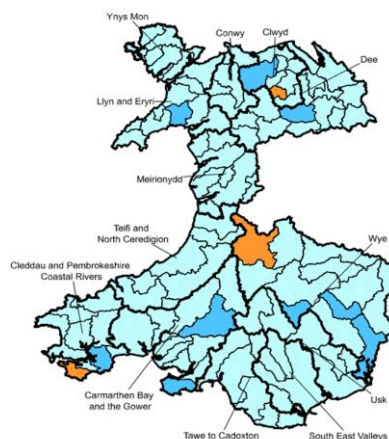
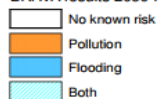


Figure 7 - Associated Strategic Planning Areas

3.3 Water Quality

Water quality is the classification of the quality of watercourses or water bodies in accordance to its physical, biological and chemical properties. Water quality is an important factor of environmental monitoring, ensuring that not only the water body is safe but the surrounding habitat and ecosystem is also.

Water quality status is categorised from 1 to 4, with 4 being the worst case. The priority status is based on the significance towards the risk factors triggering water quality. Un-named Dee Estuary South has a water quality priority status for 2050 of 1.

4.0 Supply Demand

Supply-demand is an assessment of the capacity of our treatment works. It approximately assesses whether all the treatment works in a region can collectively cope with current and future flows in dry and wet weather. There are two parts to the assessment: dry weather flow (DWF) and a wet weather capacity assessment.

For the DWF part of the assessment, the suitability of the dry weather consents is tested against forecast future growth and changes in water consumption. Results for three scenarios are provided: the 0% headroom scenario assesses the region's capability for treating the predicted changes in DWF in the future with no allowance for error, with no spare treatment works capacity. The other scenarios indicate resilience - i.e. could we cope if we had flows 10% or 20% higher than estimated?

The wet weather assessment takes storm consent values where available as an indication of treatment works capacity and estimates the amount of incoming flow the treatment works is able to treat across a year. Again, three scenarios are shown, with differing treatment "targets" - i.e. if we wanted to ensure that 70% of the wet weather flows in a catchment were treated, could the treatment works cope? Changes in rainfall due to climate change and changing dry weather flows within the region mean that the percentage of flow treated across a year can change in the future.

Table 2 shows the supply-demand assessment for this region. Where a region may not have adequate capacity under a given scenario, it is flagged dark blue for further investigation. There may be local incapacity issues at individual works within the region.

L3 Area	Headroom	2025	2030	2035	2040	2045	2050
Un-named Dee Estuary South	0%						
	10%						
	20%						
	Treatment Target	2025	2030	2035	2040	2045	2050
	70%						
	80%						
	90%						

Table 2 - Supply Demand Balance

5.0 Options

Over time the pressures on our sewerage network change due to influences such as catchment growth, creep of rainwater into the network, or influences such as climate change impacting rainfall patterns. To ensure the plan is robust over the 30-year planning horizon and to account for the uniqueness of each catchment we have tested various types of schemes, and combination of schemes, to ensure a robust 'best value' plan is delivered.

The types of schemes tested are detailed in Table 3 and can be categorised into either improving network resilience to rainfall or improving network headroom in dry weather flow conditions.

Improving Resilience		
10% Reduction in area draining to the combined sewers	Represents removal of runoff from large commercial buildings.	Short term
25% Reduction reduction in area draining to the combined sewers	Represents removal of area runoff from non-residential paved areas where there is only one stakeholder (e.g. Local Authority or Highways Agency).	Medium term
50% Reduction reduction in area draining to the combined sewers	Represents removal of runoff from any connected area including residential properties. There are likely to be multiple stakeholders to engage with.	Long term
Improving Headroom		
Reducing infiltration	Reducing infiltration into sewers by 50%, which could be achieved by relining or replacing the public sewers .	Medium term
Reducing water use	Represents a reduction in water use per person to around 100l per person per day by 2050 by application of water efficiency measures	Medium term
Reducing trade flow	Reduce trade flows by around 25% by application of water efficiency measures.	Long term

Table 3 - Risk mitigation details

We have undertaken an analysis of all our wastewater catchments to determine the benefit in terms of potential volume of water removed from our systems for each scheme type to determine a journey plan, (see Figure 8 below), which provides the direction of the best scheme types to undertake in this catchment for the most benefit against predicted future risk from growth, creep and climate change.

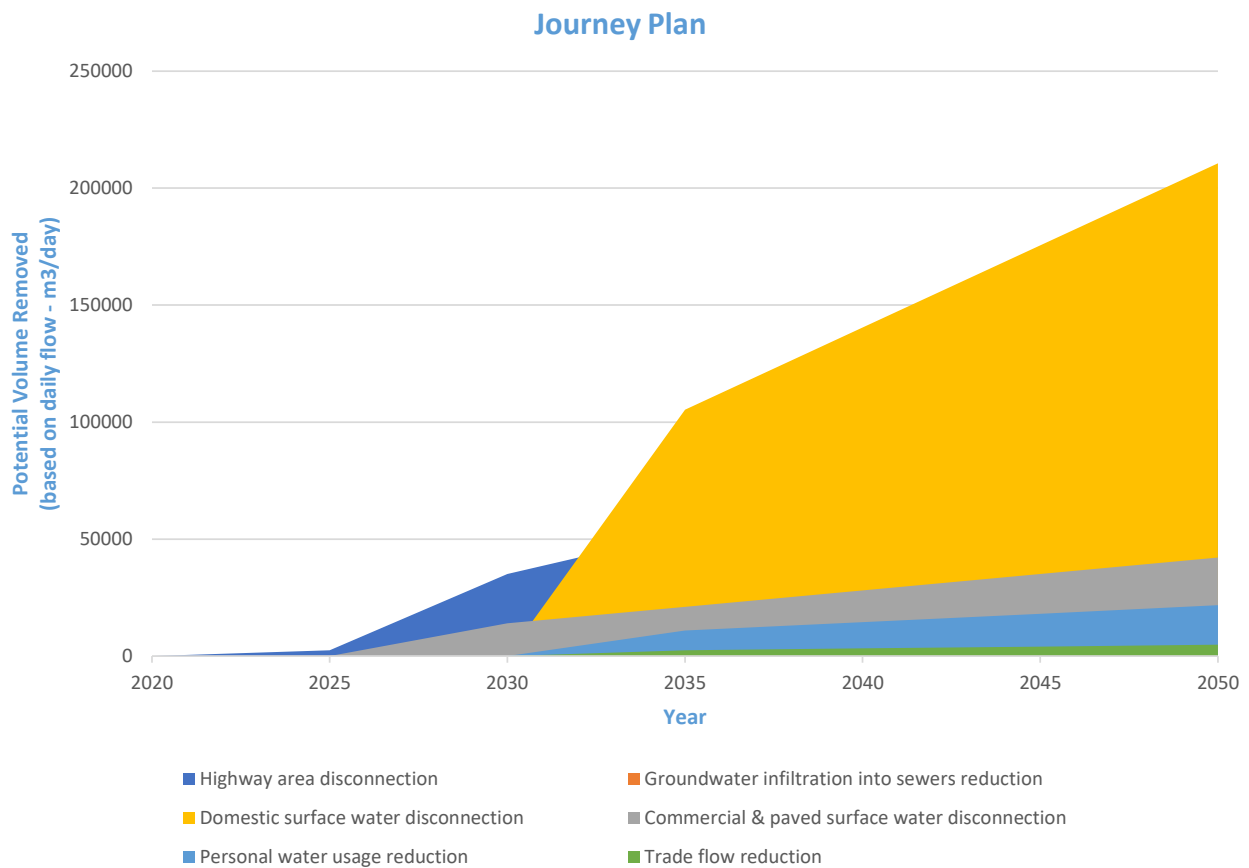


Figure 8 - Journey Plan

Approaches to managing risk

We have undertaken analysis to determine the likely costs to mitigate future predicted pollution and flooding. We assess combined sewer overflows based on the number of times they are predicted to spill in a 'typical year'. Table 4 illustrates the cost of potential measures to mitigate risk to varying standards. The assessment calculates the impact of rainfall and drainage contributions to the network relative to today's costs.

Mitigating the risk posed by flooding has been assessed in terms of probability of occurrence, we use the size of a storm event that has the probability of occurring once every 30 years. Table 5 illustrates the cost of potential mitigation measures to mitigate varying flood risk types.

The choice of scenarios for storm overflow mitigation in Table 4 is a separate cost and would be required in addition to the choice of scenarios for flooding protection in Table 5. The chosen scenarios for Storm overflows and flooding are to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain Existing Performance*	-	£29,000,000.00	£46,000,000.00
40 spills in a Typical Year	£3,000,000.00	£3,000,000.00	£3,000,000.00
20 spills in a Typical Year	£7,000,000.00	£7,000,000.00	£7,000,000.00
10 spills in a Typical Year	£15,000,000.00	£16,000,000.00	£18,000,000.00
0 spills in a Typical Year	£49,000,000.00	£53,000,000.00	£61,000,000.00
Equivalent No. Olympic Swimming Pools in 10 spills scenario	31.00	36.00	39.00

* Maintain is a considered scenario where we will continue to maintain the current level of service within the region and improve the network and address known and emerging risk.

Table 4 - Summary of Combined Sewer Overflow option investments

Choice of Scenario	Current Scenario (£)	2050 Scenario (£)	2050 Resilience Scenario (£) 1 in 50 yr (Storm Dennis)
Internal escapes	£13,000,000	£17,000,000	£17,000,000
External escapes in gardens	£22,000,000	£28,000,000	£28,000,000
Escapes in highways	£40,000,000	£49,000,000	£59,000,000
No future flooding	-	£51,000,000	£2,000,000
Total	£75,000,000.00	£145,000,000	£106,000,000

Table 5 - Summary of Flooding option investments

We have developed solutions which aim to provide protection against drainage and network failure, pollution events and flooding, internal and external to properties. The solutions developed highlight the level of investment required to bring our entire network up to the level of protection required to be resilient for future risk and demands. The range of scenarios is to provide a choice for understanding and discussion of future direction.

We are beginning to break down the investment indicated in Table 4 and 5 by creating practical schemes ready for delivery these schemes are designed as 100% traditional, 100% sustainable or green and 100% mixture of the 2. These packages have then been analysed in terms of their long term benefit and environmental and social cost to society and one has been chosen for inclusion as our preferred best value option. The areas where we have started our delivery programme aims to provide protection, to our worst served customers and rivers designated as Special Areas of Conservation (SAC) under the

For more information on the methodology developed to carry out the assessments see the DWMP plan main report.

If you want to work with us to develop joint projects to reduce the risk of flooding and protect the environment, please get in touch.

We will continue to work with Welsh Government, Regulators and Local Authorities about the pace, scale and affordability of improvements to be made.

We will be consulting on the preferred approach to planning and once its concluded the next stage is to develop the pipeline of options to meet the pace scale and affordability discussed with Welsh Government and our regulators.

Table 6 - Summary of solutions put forward are a first cycle preferred plan before SEA/HRA

L4 Catchments	No. Schemes
WHITFORD	0
NORTHOP	0
MOSTYN	0
LLANASA (NR PRESTATYN)	11
GREENFIELD	0
FLINT	0

DWMP Tactical Planning Catchment Summary



Worthenbury Brook - lower

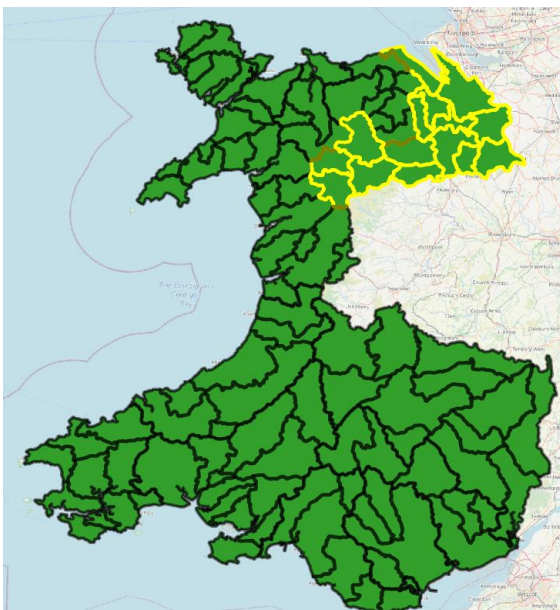
1.0 Introduction

This Drainage and Wastewater Management Plan (DWMP) sets out how Dŵr Cymru Welsh Water (DCWW) will manage and improve its assets to maintain a resilient and robust wastewater drainage system. The plan aims to manage flooding and pollution from our wastewater assets in the future, for our customers and our environment by working collaboratively with stakeholders, regulators and local authorities to provide a complete partnership in tackling current and future problems.

1.1 Catchment Information

The Worthenbury Brook - lower planning catchment lies within the Dee river basin catchment, (see Figure 1 below), it consists of 16 wastewater catchments (see Figure 2 below). There is a combined population of 15962, this is set to increase to 17065 by 2050, a change of 7%. There is a total sewer length of 102km, with a foul sewer length of 49km, a surface water length of 21km and a combined sewer length of 31km. There are 16 Wastewater Treatment Works (WwTW), 24 Sewerage Pumping Stations (SPSs), and 15 Combined Storm Overflows (CSOs) across this tactical planning unit.

The Worthenbury Brook - lower catchment stretches across the England Wales border to the North East of Wales. The Worthenbury Brook flows down to join the River Dee. Whitchurch and Malpas are its largest urban areas.



Data is available from <https://www.openstreetmap.org/copyright> © OpenStreetMap contributors

Figure 1 - River basin location detailing the associated tactical planning catchments

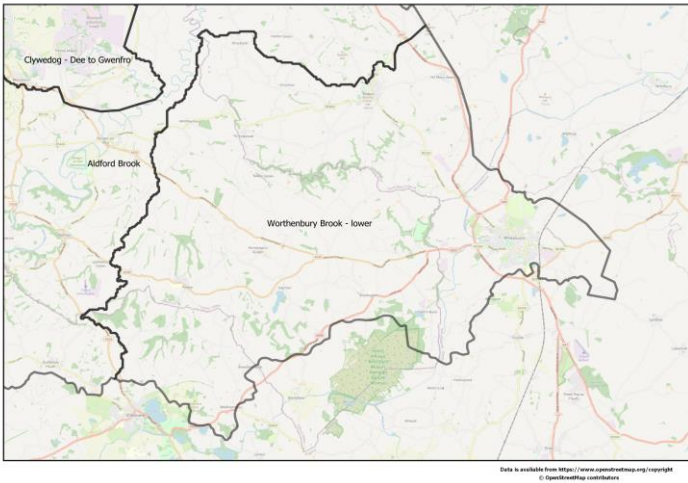


Figure 2- Tactical planning catchments

2.0 Stakeholder Engagement

The DWMP aims to enable DCWW to work collaboratively with stakeholders, regulators and local authorities to tackle current and future challenges. DCWW has identified stakeholder objectives that align with the aims of the DWMP and goals of other management plans. Table 1 details the main opportunities we have identified but this is not intended to be exhaustive. Note that these stakeholders have their own planning processes and plans which do not necessarily align with those of DCWW.

Scheme Information
Stakeholder engagement meetings are scheduled to commence in 2022. These meetings will be held between DCWW and the respective parties, such as NRW, EA, Councils and ENGO's. Further information of the outcome and points of focus towards short and long term strategy planning will be provided in the next cycle of the DWMP assessment.

Table 1 - Current and future investigation schemes

3.0 Risk

We have assessed our likely performance from now to 2050 against the objectives that we set in our most recent business plan. The results of this assessment are presented in the following sections.

To understand future performance, we need to estimate how much population will change by, the degree to which climate change will impact Wales and areas of England that border our company, and how further surface water connected to the sewer network might increase the amount and rate at which rainfall drains into our sewers.

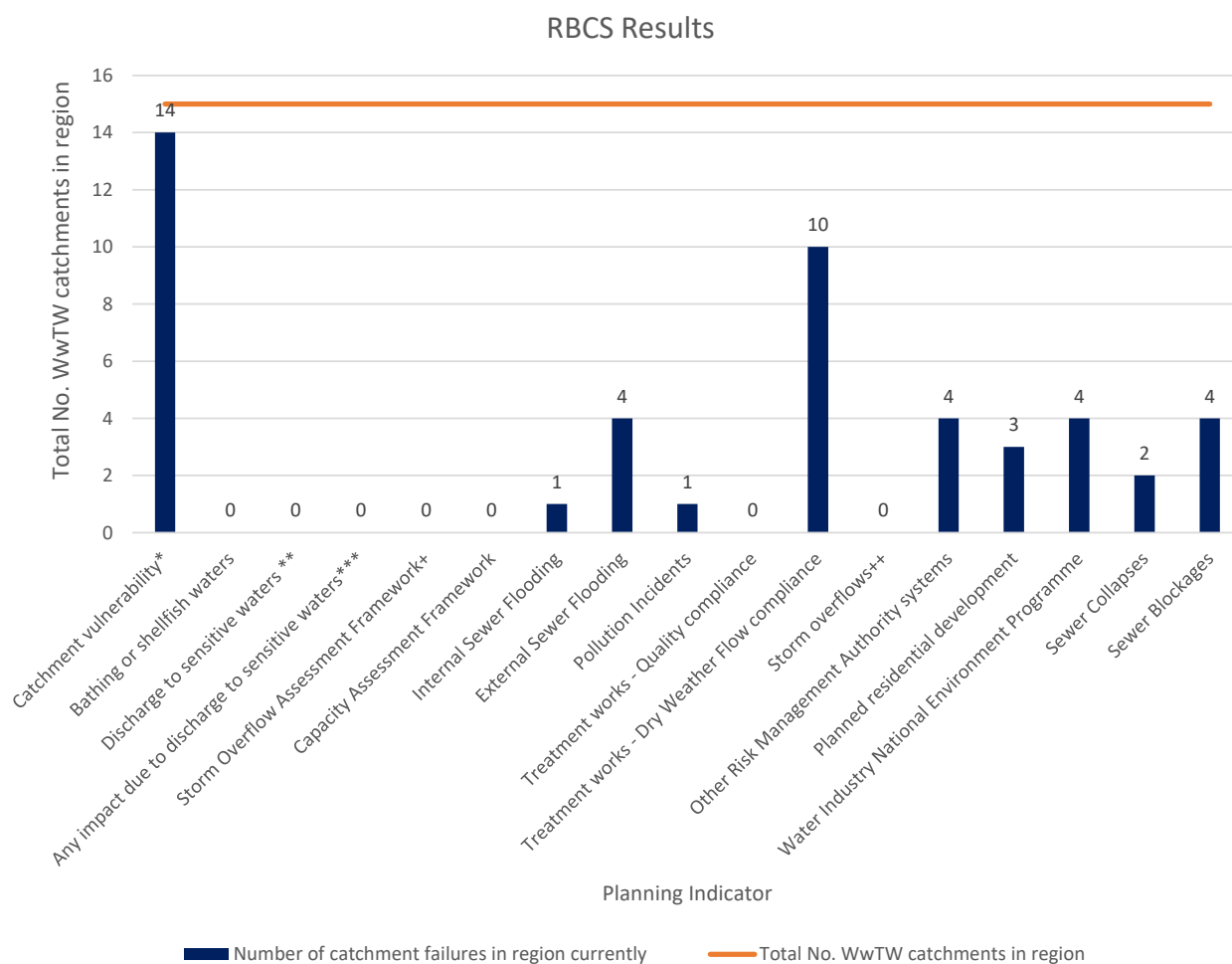
Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

Climate change is predicted to increase the intensity of storms by around 35% in this region. In a typical year, winters are likely to be warmer and wetter, and summers generally drier. More intense rainfall will happen more frequently. The population in the Dee region is set to increase to 17100 by 2050, a change of 7% based on our future projections. However there are major developments in localised areas that will contribute to future pressures on the network, including Whitchurch - land at Mount Farm and land North of Waymills.

3.1 Risk Based Catchment Screening

The Risk Based Catchment Screening (RBCS) is the initial screening process to determine if a more detailed risk assessment is required. The assessment screens catchments against planning indicators which have been stipulated in the national guidance for DWMPs. A catchment will pass through to a more detailed risk assessment if it fails against one or more of these indicators, the results are shown in Figure 3.

For the Worthenbury Brook - lower catchment the biggest concerns indicated by the RBCS are catchment characterisation (based on a vulnerability assessment of flooding due to local characteristics e.g. topography) and treatment works dry weather flow compliance.



*To sewer flooding due to extreme wet weather events.

**Categorised as a "planned" scheduled action within the Natural Resources Wales Action Database or considered as "Remedy" on Natural England Designated Sites system.

***Categorised as a "identified" scheduled action within the Natural Resources Wales Action Database or considered as "Threat" on Natural England Designated Sites system.

+Frequency investigation triggered.

++Overflow risks not covered by other indicators,

Figure 3 - Risk Based Catchment Screening results

3.2 Baseline Risk And Vulnerability Assessment (BRAVA)

Following on from the RBCS, the Baseline Risk and Vulnerability Assessment (BRAVA) highlights current and future risk. The risk scores are driven by company targets which were set in our last business plan. These targets were subdivided according to population or sewer length, depending on the measure, to derive a target for each river basin catchment.

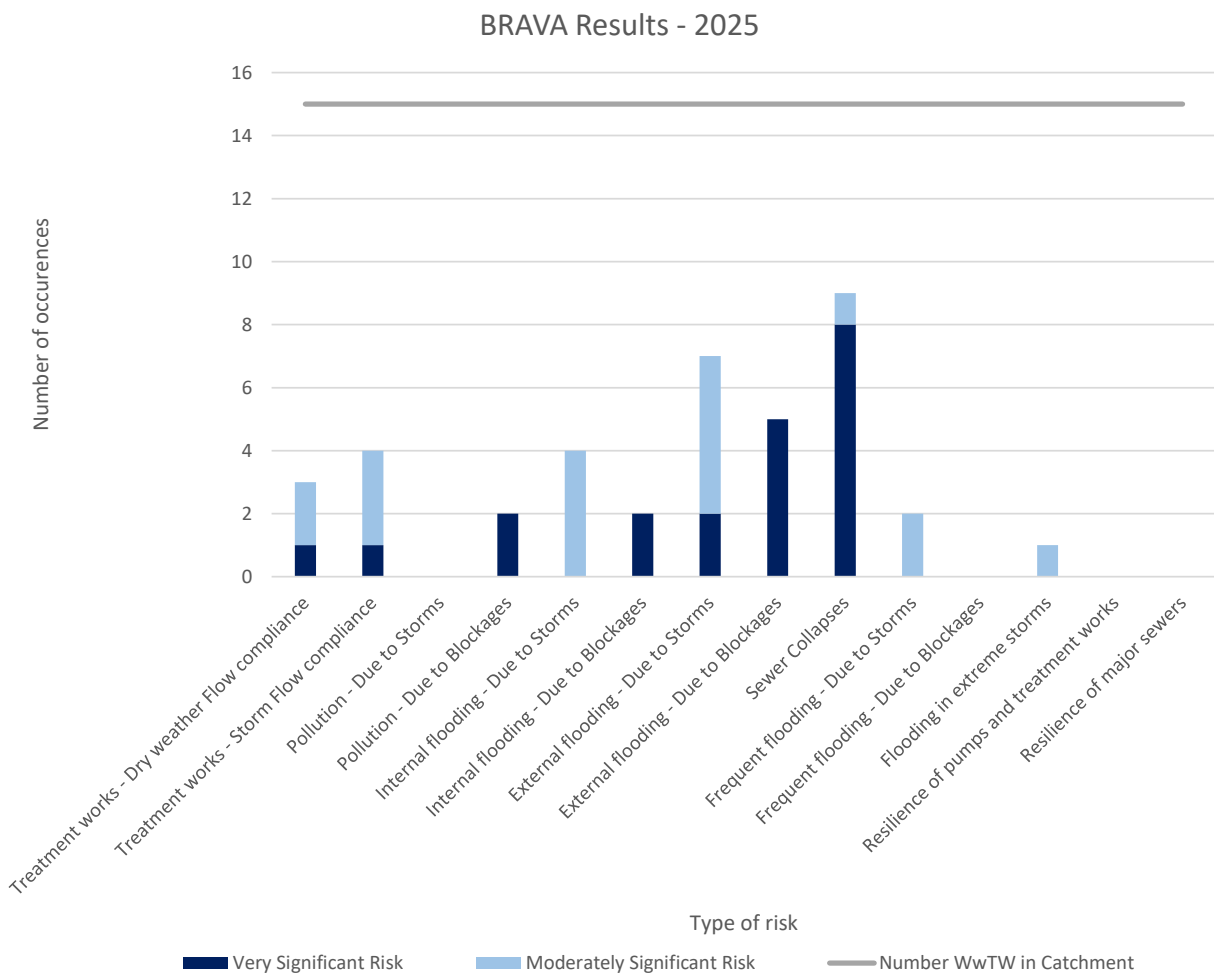


Figure 4 - BRAVA 2025 Summary

In 2025, sewer collapses and external flooding due to storms are the biggest concerns in the Worthenbury Brook - lower catchment.

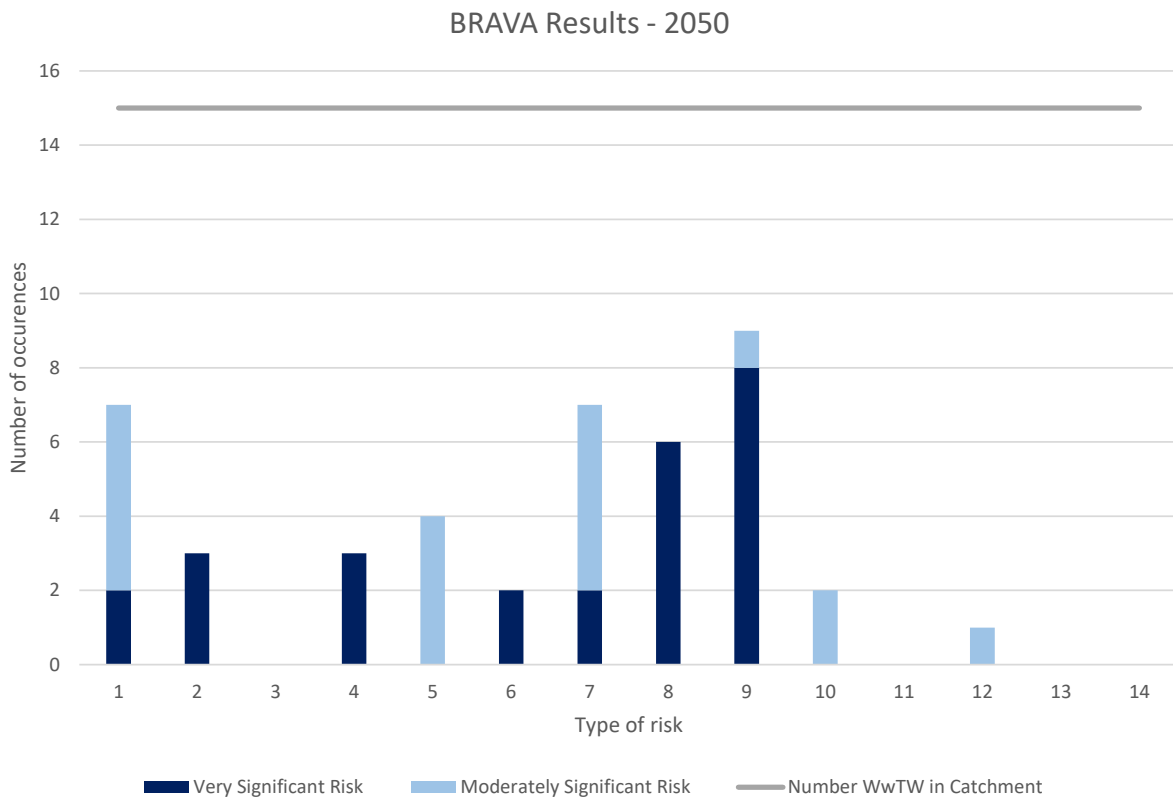


Figure 5 - BRAVA 2050 Summary

In 2025, sewer collapses and external flooding due to storms are the biggest concerns in the This Drainage and Wastewater Management Plan (DWMP) sets out how Dŵr Cymru Welsh Water (DCWW) will manage and improve its assets to maintain a resilient and robust wastewater drainage system. The plan aims to manage flooding and pollution from our wastewater assets in the future, for our customers and our environment by working collaboratively with stakeholders, regulators and local authorities to provide a complete partnership in tackling current and future problems. Figures 6 and 7 indicate the current and predicted risk of flooding, pollution, and both flooding and pollution caused by lack of capacity (termed 'hydraulic overload') across our networks. These maps illustrate where the issues occur and can be used to target where we want to work with the community and stakeholders to resolve issues. By working together, we can combine knowledge and resources to deliver the best outcomes for local communities and the environment. We want to include your feedback in our decision-making process.

BRAVA results 2025 Flooding and Pollution caused by Hydraulic Overload

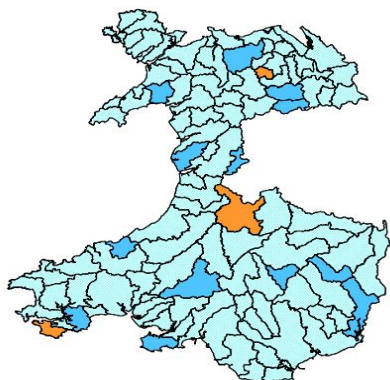
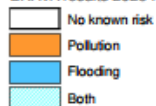


Figure 6 - Associated Strategic Planning Areas priority (2025)

BRAVA results 2050 Flooding and Pollution caused by Hydraulic Overload

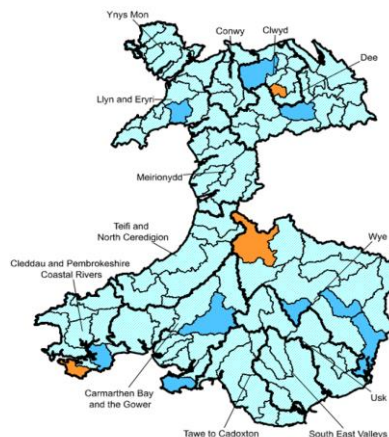
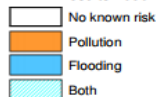


Figure 7 - Associated Strategic Planning Areas

3.3 Water Quality

Water quality is the classification of the quality of watercourses or water bodies in accordance to its physical, biological and chemical properties. Water quality is an important factor of environmental monitoring, ensuring that not only the water body is safe but the surrounding habitat and ecosystem is also.

Water quality status is categorised from 1 to 4, with 4 being the worst case. The priority status is based on the significance towards the risk factors triggering water quality. Worthenbury Brook - lower has a water quality priority status for 2050 of 3 which indicates targeted investment to mitigate and focus during AMP9.

4.0 Supply Demand

Supply-demand is an assessment of the capacity of our treatment works. It approximately assesses whether all the treatment works in a region can collectively cope with current and future flows in dry and wet weather. There are two parts to the assessment: dry weather flow (DWF) and a wet weather capacity assessment.

For the DWF part of the assessment, the suitability of the dry weather consents is tested against forecast future growth and changes in water consumption. Results for three scenarios are provided: the 0% headroom scenario assesses the region's capability for treating the predicted changes in DWF in the future with no allowance for error, with no spare treatment works capacity. The other scenarios indicate resilience - i.e. could we cope if we had flows 10% or 20% higher than estimated?

The wet weather assessment takes storm consent values where available as an indication of treatment works capacity and estimates the amount of incoming flow the treatment works is able to treat across a year. Again, three scenarios are shown, with differing treatment "targets" - i.e. if we wanted to ensure that 70% of the wet weather flows in a catchment were treated, could the treatment works cope? Changes in rainfall due to climate change and changing dry weather flows within the region mean that the percentage of flow treated across a year can change in the future.

Table 2 shows the supply-demand assessment for this region. Where a region may not have adequate capacity under a given scenario, it is flagged dark blue for further investigation. There may be local incapacity issues at individual works within the region.

L3 Area	Headroom	2025	2030	2035	2040	2045	2050
Worthenbury Brook - lower	0%						
	10%						
	20%						
	Treatment Target	2025	2030	2035	2040	2045	2050
	70%						
	80%						
	90%						

Table 2 - Supply Demand Balance

5.0 Options

Over time the pressures on our sewerage network change due to influences such as catchment growth, creep of rainwater into the network, or influences such as climate change impacting rainfall patterns. To ensure the plan is robust over the 30-year planning horizon and to account for the uniqueness of each catchment we have tested various types of schemes, and combination of schemes, to ensure a robust 'best value' plan is delivered.

The types of schemes tested are detailed in Table 3 and can be categorised into either improving network resilience to rainfall or improving network headroom in dry weather flow conditions.

Improving Resilience		
10% Reduction in area draining to the combined sewers	Represents removal of runoff from large commercial buildings.	Short term
25% Reduction reduction in area draining to the combined sewers	Represents removal of area runoff from non-residential paved areas where there is only one stakeholder (e.g. Local Authority or Highways Agency).	Medium term
50% Reduction reduction in area draining to the combined sewers	Represents removal of runoff from any connected area including residential properties. There are likely to be multiple stakeholders to engage with.	Long term
Improving Headroom		
Reducing infiltration	Reducing infiltration into sewers by 50%, which could be achieved by relining or replacing the public sewers .	Medium term
Reducing water use	Represents a reduction in water use per person to around 100l per person per day by 2050 by application of water efficiency measures	Medium term
Reducing trade flow	Reduce trade flows by around 25% by application of water efficiency measures.	Long term

Table 3 - Risk mitigation details

We have undertaken an analysis of all our wastewater catchments to determine the benefit in terms of potential volume of water removed from our systems for each scheme type to determine a journey plan, (see Figure 8 below), which provides the direction of the best scheme types to undertake in this catchment for the most benefit against predicted future risk from growth, creep and climate change.

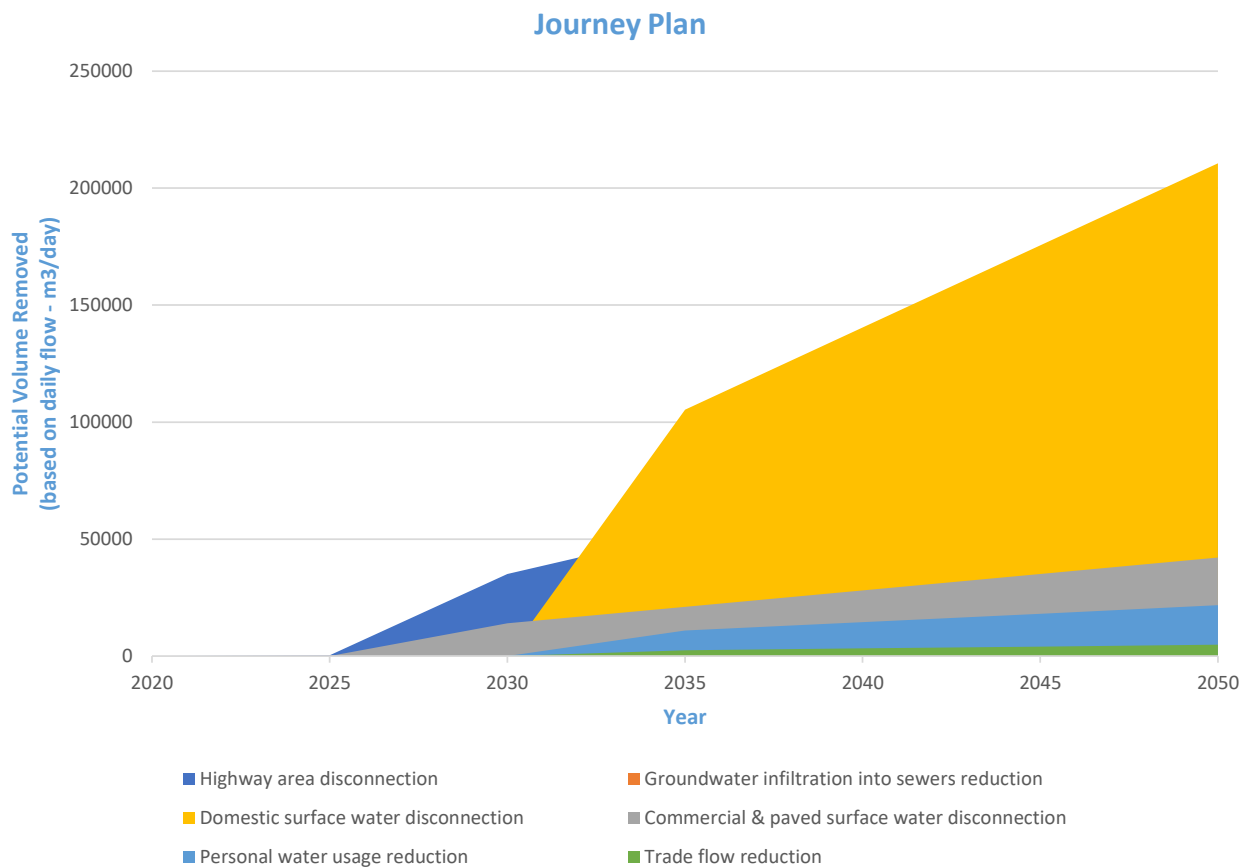


Figure 8 - Journey Plan

Approaches to managing risk

We have undertaken analysis to determine the likely costs to mitigate future predicted pollution and flooding. We assess combined sewer overflows based on the number of times they are predicted to spill in a 'typical year'. Table 4 illustrates the cost of potential measures to mitigate risk to varying standards. The assessment calculates the impact of rainfall and drainage contributions to the network relative to today's costs.

Mitigating the risk posed by flooding has been assessed in terms of probability of occurrence, we use the size of a storm event that has the probability of occurring once every 30 years. Table 5 illustrates the cost of potential mitigation measures to mitigate varying flood risk types.

The choice of scenarios for storm overflow mitigation in Table 4 is a separate cost and would be required in addition to the choice of scenarios for flooding protection in Table 5. The chosen scenarios for Storm overflows and flooding are to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain Existing Performance*	-	£21,000,000.00	£29,000,000.00
40 spills in a Typical Year	£0.00	£0.00	£0.00
20 spills in a Typical Year	£5,000,000.00	£5,000,000.00	£5,000,000.00
10 spills in a Typical Year	£12,000,000.00	£12,000,000.00	£12,000,000.00
0 spills in a Typical Year	£21,000,000.00	£22,000,000.00	£23,000,000.00
Equivalent No. Olympic Swimming Pools in 10 spills scenario	17.00	19.00	20.00

* Maintain is a considered scenario where we will continue to maintain the current level of service within the region and improve the network and address known and emerging risk.

Table 4 - Summary of Combined Sewer Overflow option investments

Choice of Scenario	Current Scenario (£)	2050 Scenario (£)	2050 Resilience Scenario (£) 1 in 50 yr (Storm Dennis)
Internal escapes	£0	£0	£0
External escapes in gardens	£3,000,000	£3,000,000	£5,000,000
Escapes in highways	£10,000,000	£12,000,000	£19,000,000
No future flooding	-	£8,000,000	£23,000,000
Total	£13,000,000.00	£23,000,000	£47,000,000

Table 5 - Summary of Flooding option investments

We have developed solutions which aim to provide protection against drainage and network failure, pollution events and flooding, internal and external to properties. The solutions developed highlight the level of investment required to bring our entire network up to the level of protection required to be resilient for future risk and demands. The range of scenarios is to provide a choice for understanding and discussion of future direction.

We are beginning to break down the investment indicated in Table 4 and 5 by creating practical schemes ready for delivery these schemes are designed as 100% traditional, 100% sustainable or green and 100% mixture of the 2. These packages have then been analysed in terms of their long term benefit and environmental and social cost to society and one has been chosen for inclusion as our preferred best value option. The areas where we have started our delivery programme aims to provide protection, to our worst served customers and rivers designated as Special Areas of Conservation (SAC) under the

For more information on the methodology developed to carry out the assessments see the DWMP plan main report.

If you want to work with us to develop joint projects to reduce the risk of flooding and protect the environment, please get in touch.

We will continue to work with Welsh Government, Regulators and Local Authorities about the pace, scale and affordability of improvements to be made.

We will be consulting on the preferred approach to planning and once its concluded the next stage is to develop the pipeline of options to meet the pace scale and affordability discussed with Welsh Government and our regulators.

Table 6 - Summary of solutions put forward are a first cycle preferred plan before SEA/HRA

L4 Catchments	No. Schemes
WHITCHURCH (SHROPSHIRE) RISING SUN	0
MALPAS WHITCHURCH ROAD	0
NO MANS HEATH	0
WELSHAMPTON	0
ALKINGTON	0
FENNS BANK	0
ALKINGTON SPRINGHILL COTTAGES	0
BROUGHALL	0
BROWN MOSS	0
WORTHENBURY	0
HORSEMANS GREEN (E OF LLANGOLLEN)	0
HIGHER LANES (NR WHITCHURCH)	0
HANMER AROWRY	0
BRONINGTON	0
PENLEY (E OF CHIRK)	0
ASH MAGNA	0