River Basin Catchment Summary

Llyn and Eryri

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

Llyn and Eryri (see Figure 1 below) consists of 93 wastewater catchments with a total population of 131178. There is a total sewer length of 910km, where 248km is associated to the foul system, 67km is associated to the surface water system and 572km is associated to the combined system. There are 93 Wastewater Treatment Works (WwTW), 190 Sewerage Pumping Stations (SPSs), and 191 Combined Storm Overflows (CSOs) across this river basin catchment level.

The Llyn and Eryri catchment covers part of the county of Gwynedd, including the Llyn Peninsula, Snowdonia and the Glaslyn Estuary. The catchment is covered by a series of rivers, including; the Soch, the Gwyrfai, the Dwyfawr, the Erch, the Glaslyn, the Ogwen and the Caledffrwd.

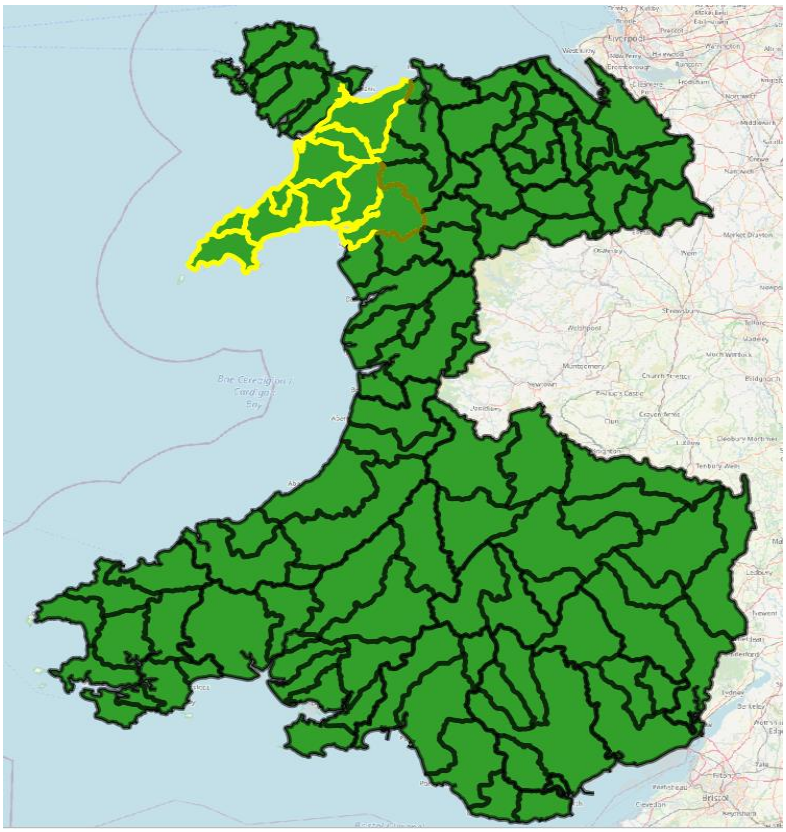


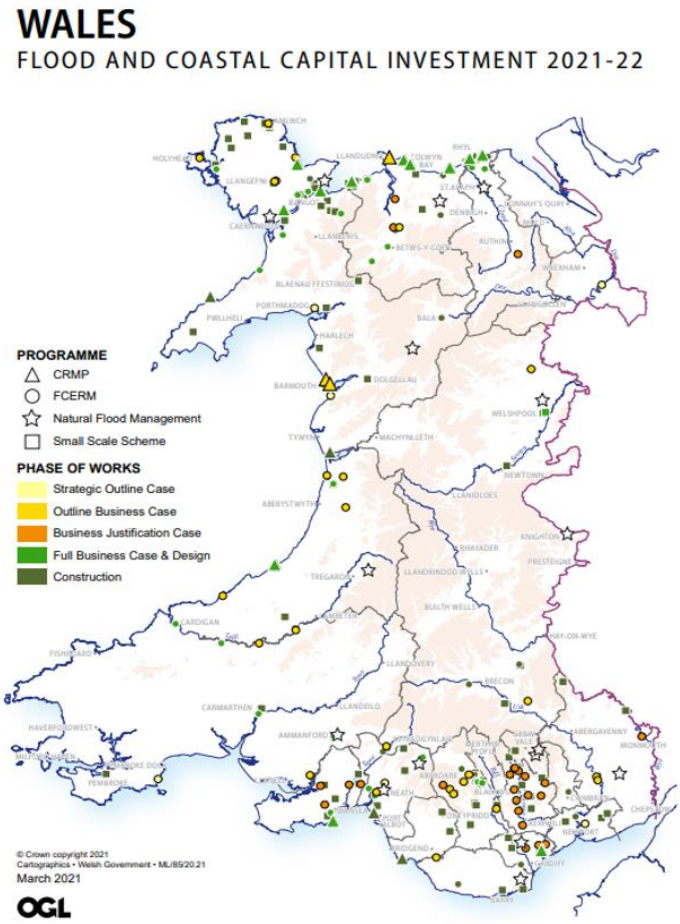
Figure 1 - River basin location detailing the associated tactial planning catchments

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) Llyn and Eryri Management Catchment Strategy: (https://cdn.cyfoethnaturiol.cymru/media/679376/lleyn-and-eryri-catchment-summary-nrw-updated-2016.pdf)	Natural Resources Wales Environment Agency Local partnerships
Flood Risk Management Plans (FRMP)	The Llyn and Eryri Flood Risk Management Plan is located online at https://cdn.cyfoethnaturiol.cymru/media/675146/final_frmp_-western-wales_pk26b82.pdf?mode=pad&rnd=131466534560000000. The report highlights the coastal flooding caused by a combination of high tides and strong winds in 2014 which particularly impacted Porthcawl and Swansea Bay but no properties were officially reported as flooded.	Welsh Government Water companies Coastal Groups (local authority led) Natural Resources Wales Environment Agency Lead local flood authorities
Shoreline Management Plans (SMP)	The Llyn and Eryri catchment is covered by SMP 21 – St Anne's Head to the Great Orme. Further information can be found here https://www.grwparfordirolgorllewincymru.cymru/page/home-page	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 Llyn and Eryri catchment comes under the Western Wales RBMP, which can be found here: https://naturalresources.wales/media/676165/wwrbdsummary.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 North Wales Rivers Trust Snowdonia Society Bangor University



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.

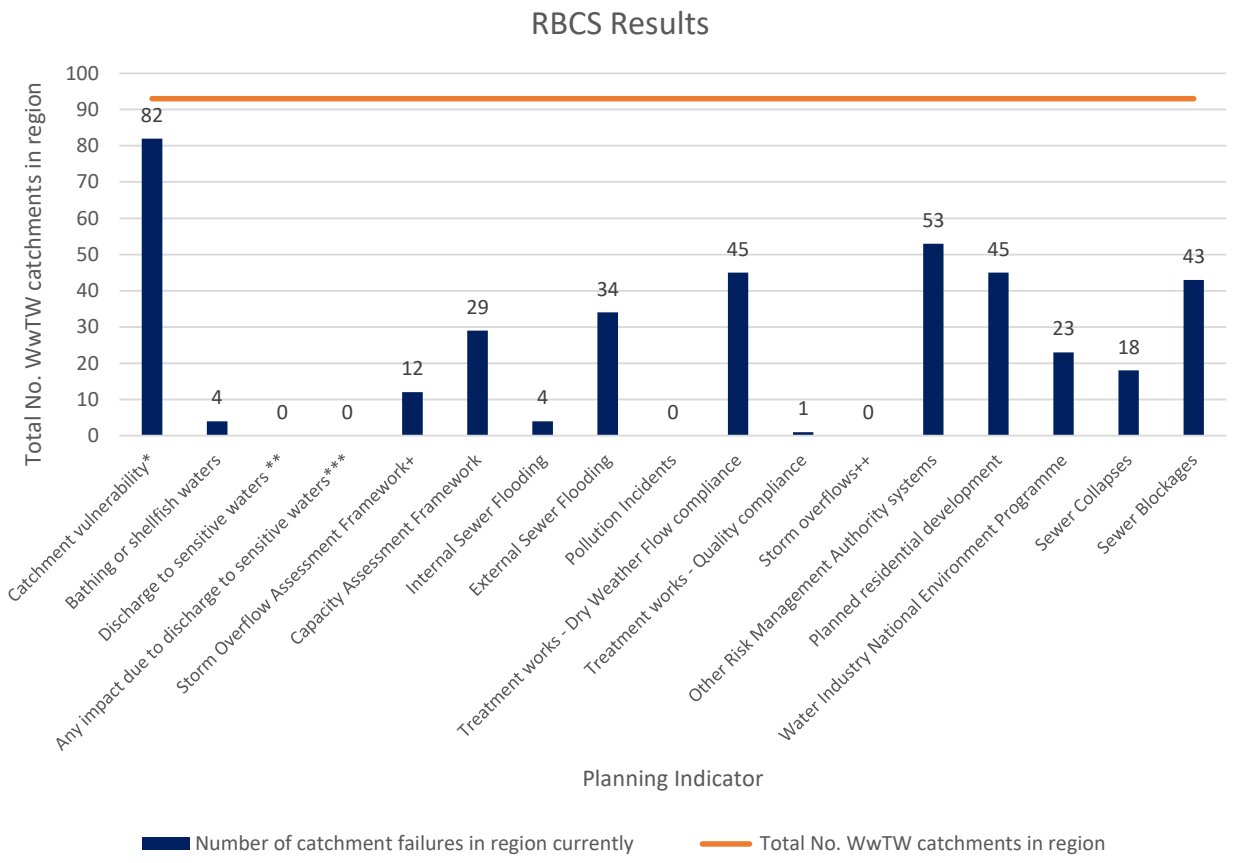
The population in the Llyn and Eryri region is set to decrease to 108100 by 2050, a change of -18% based on our future projections. However there are major developments in localised areas that will contribute to future pressures on the network, including Caernarfon - Stad ddiwydiannol Cibyn and Bangor - Bryn Cegin.

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 Llyn and Eryri 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 RMA systems (risk of interaction between other drainage systems), 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.

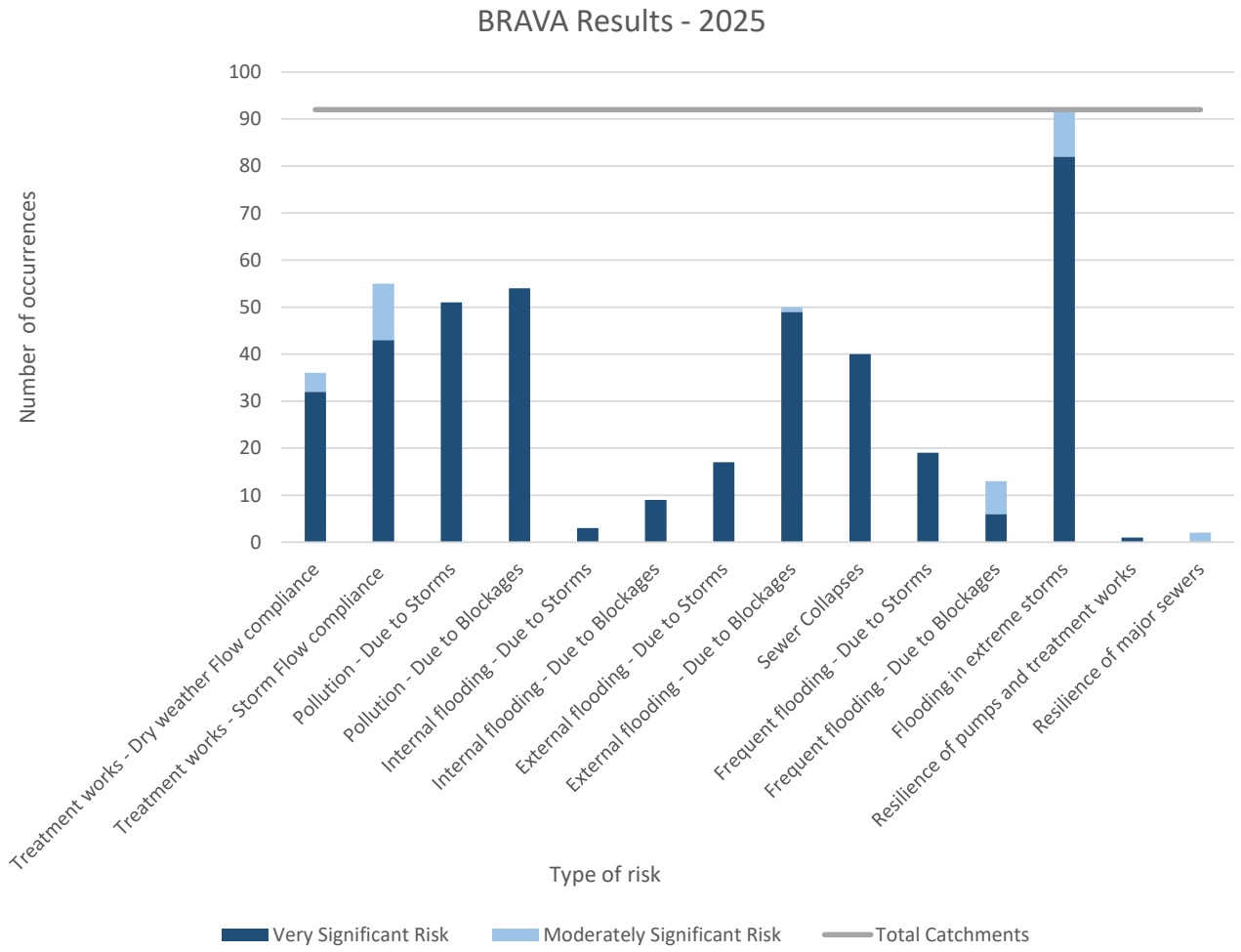


Figure 4 - BRAVA 2025 Summary

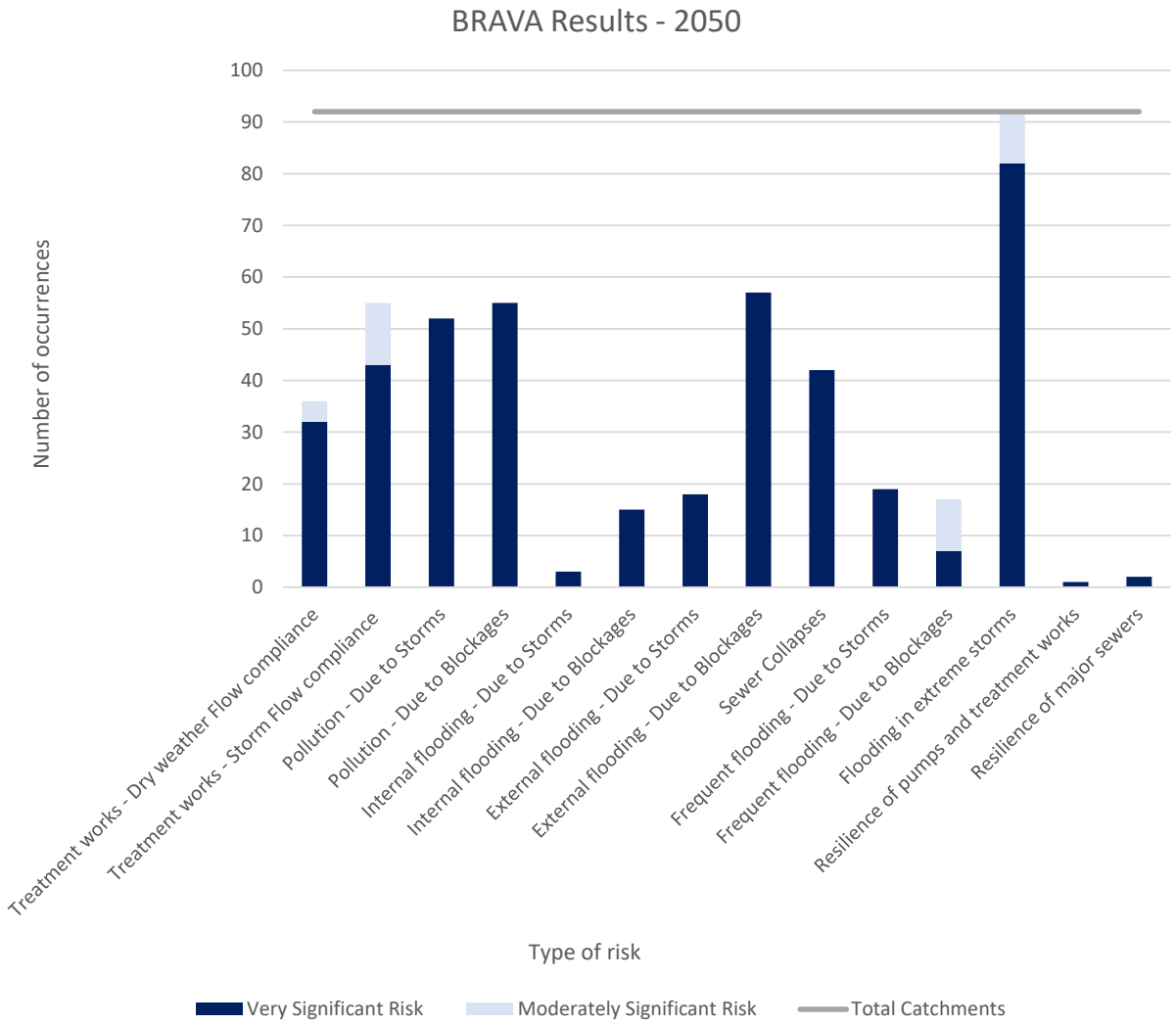


Figure 5 - BRAVA 2050 Summary

In 2025 risk of flooding in an extreme storm is the biggest concern in the Llyn and Eryri catchment, followed by Wastewater Treatment Works compliance in storm events. For 2050 the biggest concern is risk of flooding in an extreme storm, 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.

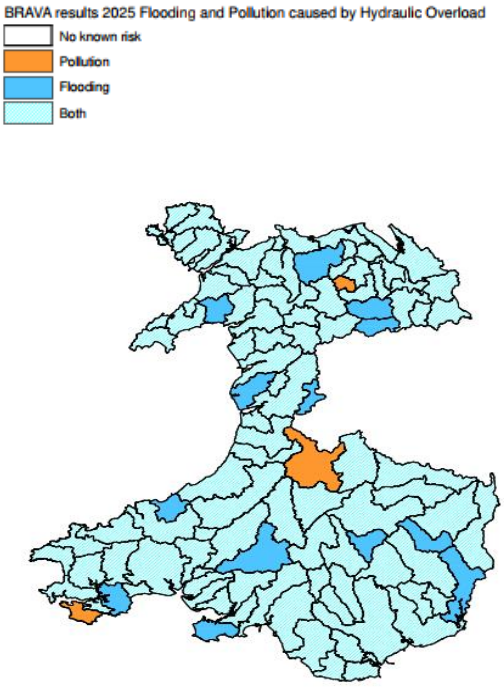


Figure 6 - Associated Strategic Planning Areas priority (2025)

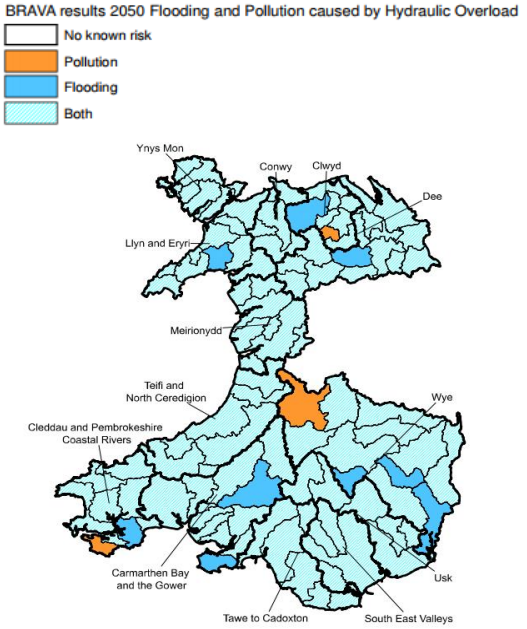


Figure 7 - Associated Strategic Planning Area priority (2050)

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
Llyn and Eryri						

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.

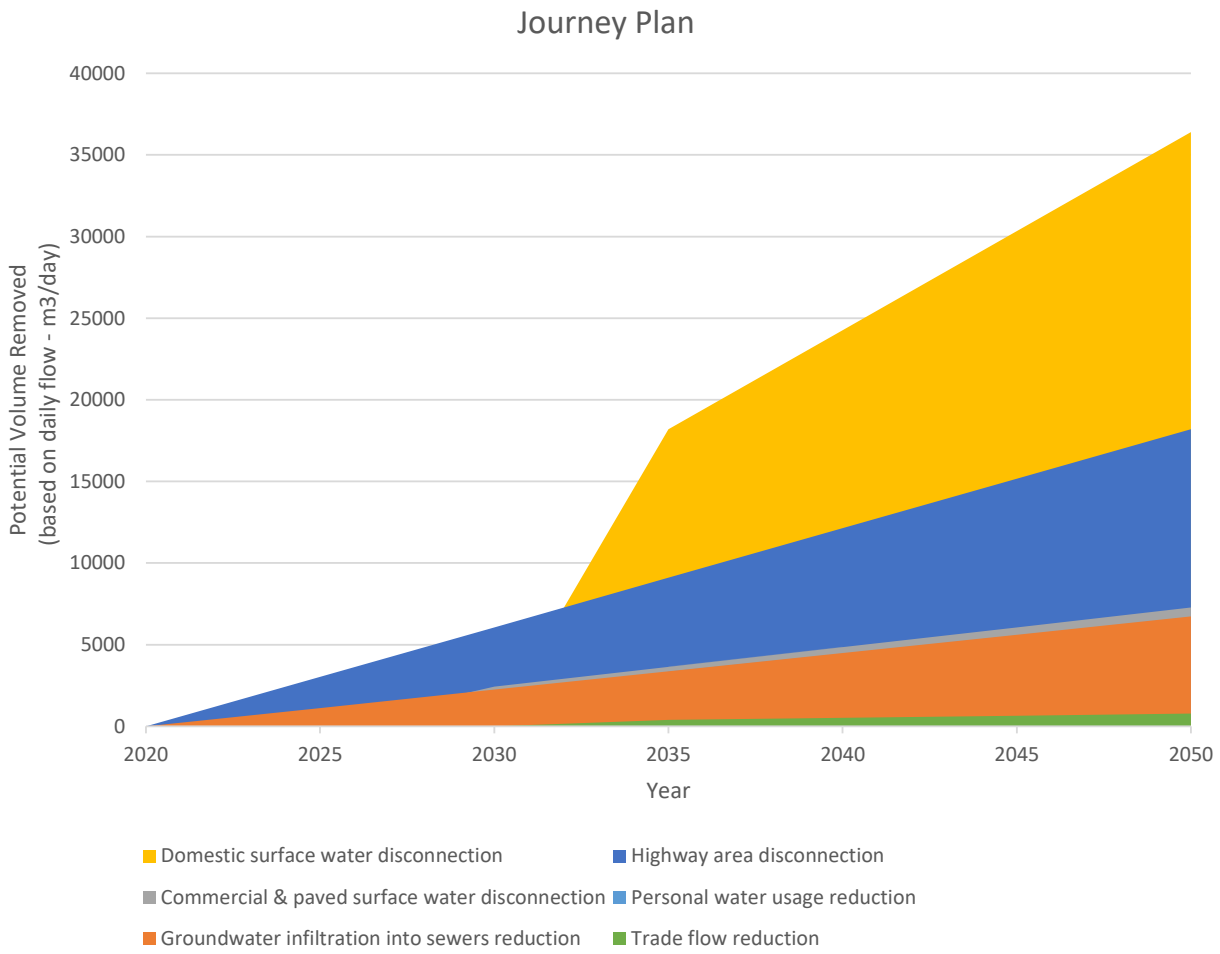


Figure 8 - Journey Plan

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*	-	£174,000,000	£268,400,000
40 spills in a Typical Year	£81,000,000	£86,000,000	£90,000,000
20 spills in a Typical Year	£134,000,000	£140,000,000	£159,000,000
10 spills in a Typical Year	£203,000,000	£211,000,000	£237,000,000
0 spills in a Typical Year	£476,000,000	£515,000,000	£566,000,000
Equivalent No. Principality Stadiums Full of Water in 10 spills scenario	0.93	1.69	1.75

* 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	£18,000,000	£23,000,000	£26,000,000
External escapes in gardens	£9,000,000	£13,000,000	£13,000,000
Escapes in highways	£202,000,000	£224,000,000	£251,000,000
No future flooding	-	£139,000,000	£104,000,000
Total	£229,000,000	£399,000,000	£394,000,000

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 Tactial Planning Catchment Summary

Dwyfawr - 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 Dwyfawr - lower planning catchment lies within the Llyn and Eryri river basin catchment, (see Figure 1 below), it consists of 7 wastewater catchments (see Figure 2 below). There is a combined population of 3758, this is set to decrease to 3543 by 2050, a change of -6%. There is a total sewer length of 31km, with a foul sewer length of 11km, a surface water length of 2km and a combined sewer length of 17km. There are 7 Wastewater Treatment Works (WwTW), 4 Sewerage Pumping Stations (SPSs), and 7 Combined Storm Overflows (CSOs) across this tactical planning unit.

The Dwyfawr - lower catchment reaches the sea at Cardigan Bay. The river Dwyfor flows down into the sea near Criccieth. Criccieth and Garndolbenmaen are the largest urban areas.

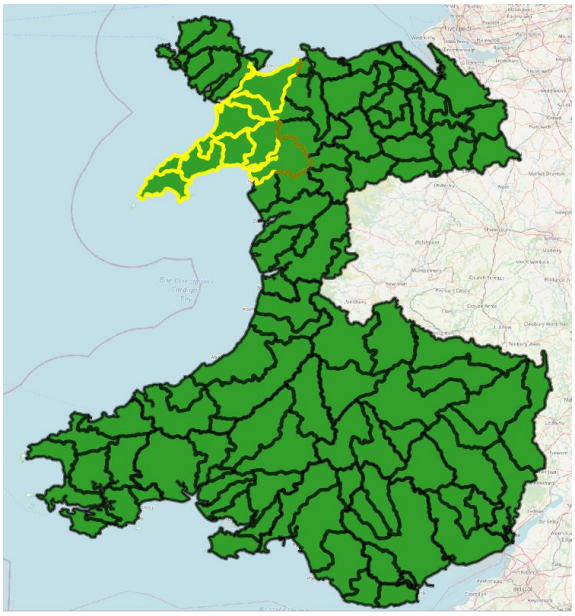


Figure 1 - River basin location detailing the associated tactial planning catchments

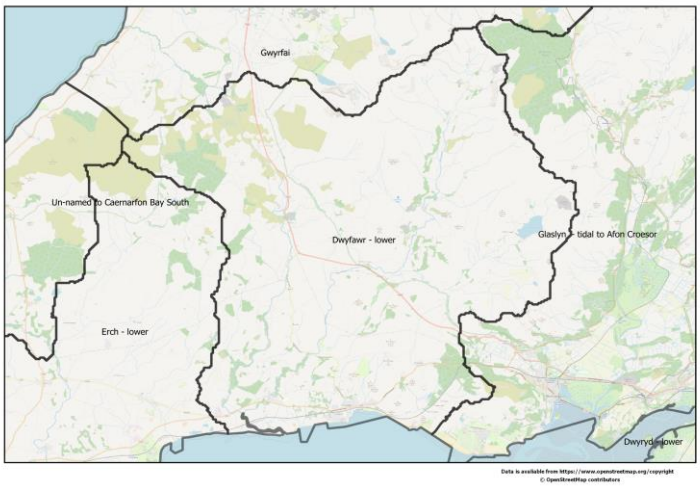


Figure 2- Tactical planning catchments

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 enagement meetings area 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.

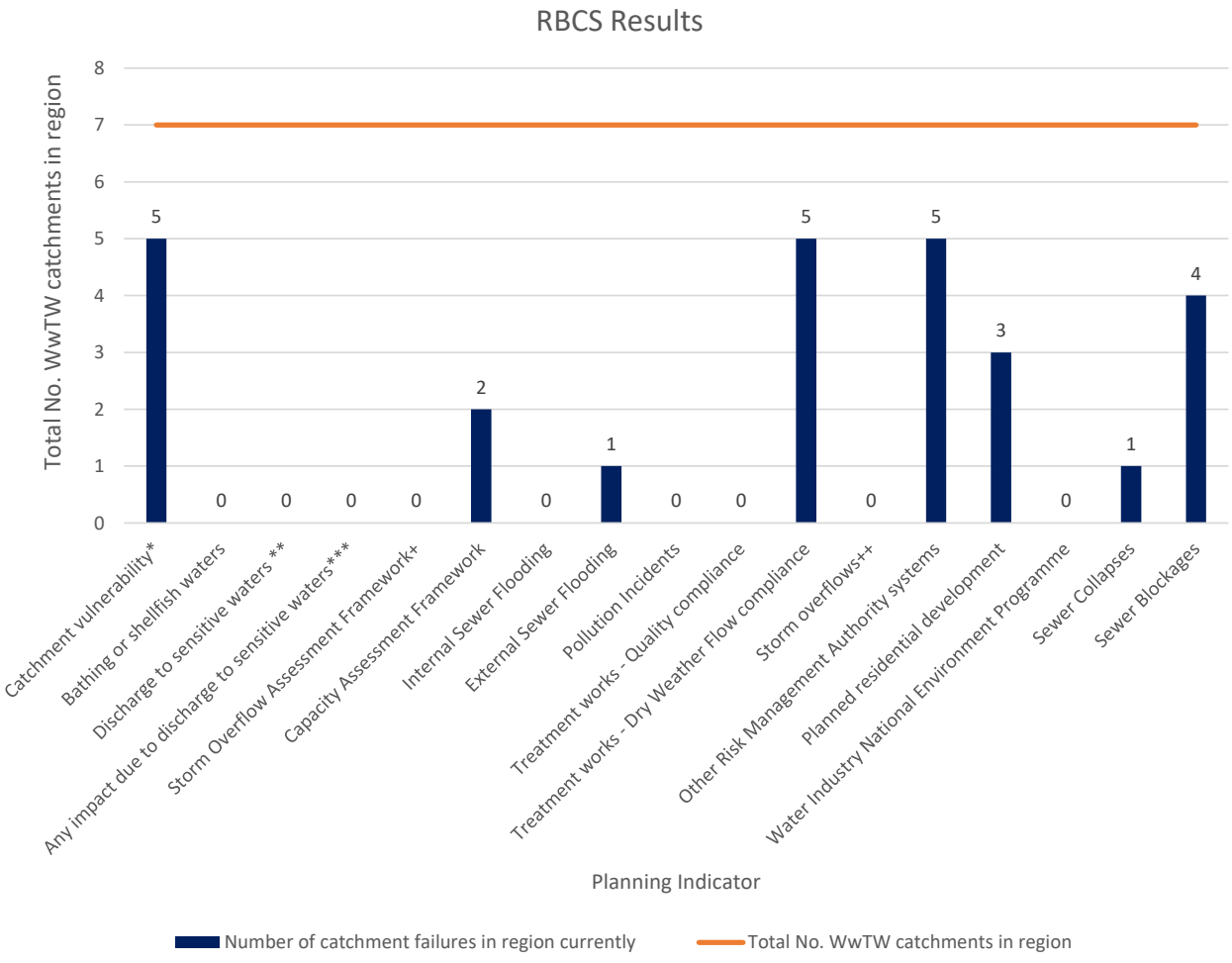
Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

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 Llyn and Eryri region is set to decrease to 3500 by 2050, a change of -6% based on our future projections. However there are major developments in localised areas that will contribute to future pressures on the network, including Llanystrumdwy - Park Amaeth and Criccieth - land near North Terrace.

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 Dwyfawr - 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), treatment works dry weather flow compliance 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.

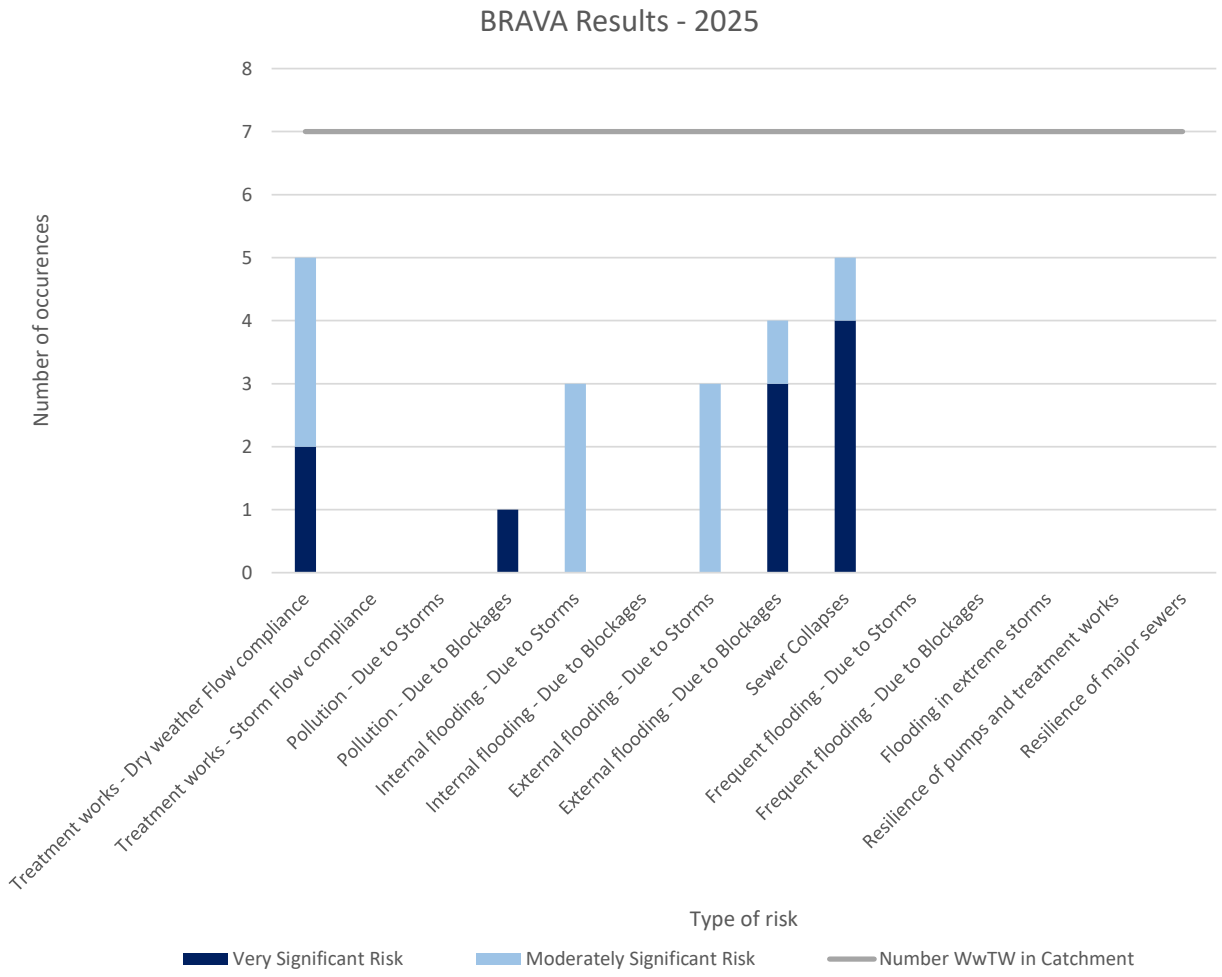


Figure 4 - BRAVA 2025 Summary

In 2025, sewer collapses and treatment works - DWF compliance are the biggest concern in the Dwyfawr - lower catchment.

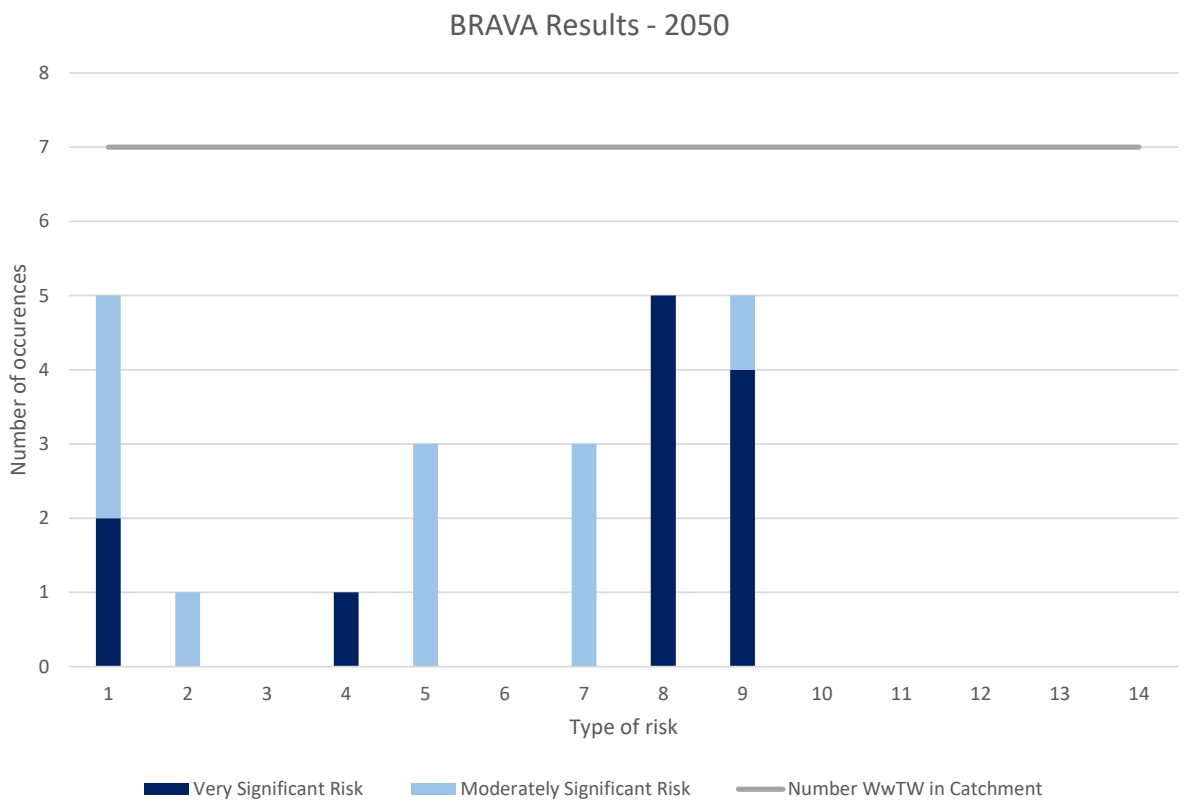


Figure 5 - BRAVA 2050 Summary

In 2050, sewer collapses and treatment works - DWF compliance are the biggest concern in the Dwyfawr - lower 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.

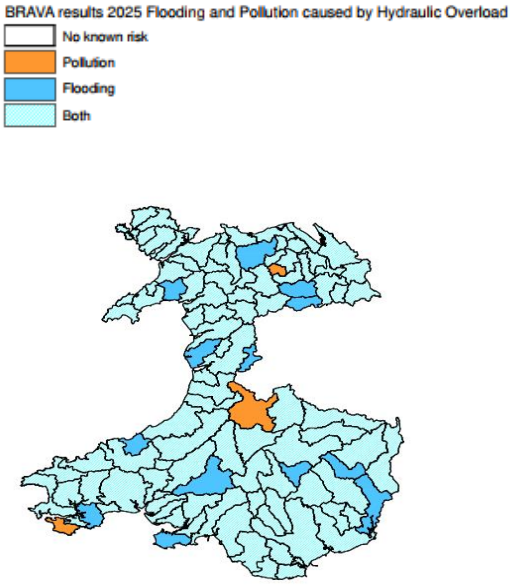


Figure 6 - Associated Strategic Planning Areas priority (2025)

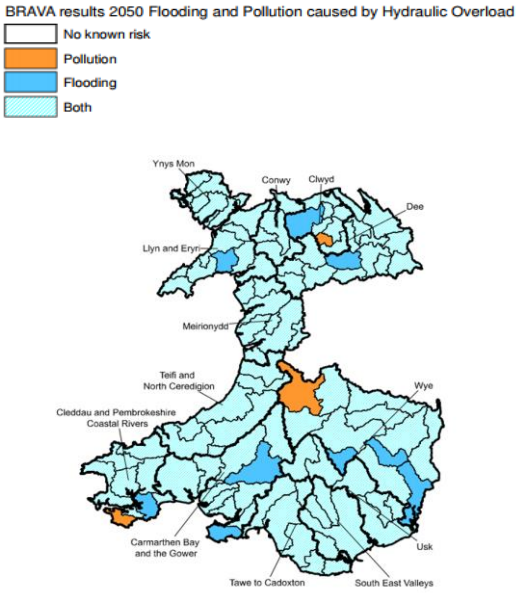


Figure 7 - Associated Strategic Planning Areas

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. Dwyfawr - lower 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
Dwyfawr - 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.

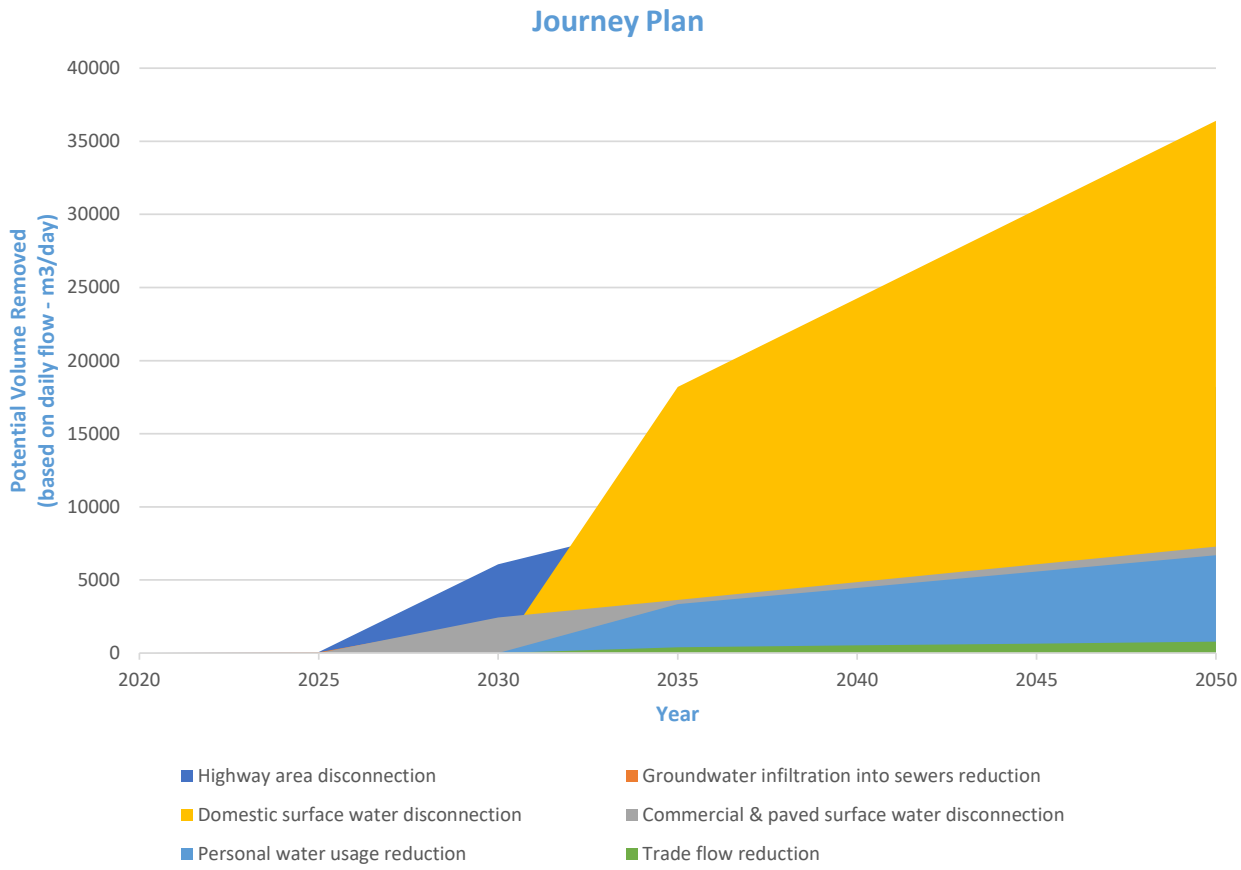


Figure 8 - Journey Plan

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 todays 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 probabilty of occuring 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 seperate cost and would be required in addition to the choice of scenarios for flooding protection in Table 5. The chosen scenarios for Storm overflows nd flooding are to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain Existing Performance*	-	£28,000,000.00	£44,000,000.00
40 spills in a Typical Year	£6,000,000.00	£5,000,000.00	£5,000,000.00
20 spills in a Typical Year	£10,000,000.00	£10,000,000.00	£12,000,000.00
10 spills in a Typical Year	£14,000,000.00	£14,000,000.00	£17,000,000.00
0 spills in a Typical Year	£28,000,000.00	£30,000,000.00	£34,000,000.00
Equivalent No. Olympic Swimming Pools in 10 spills scenario	55.00	61.00	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	£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	-	£3,000,000	£9,000,000
Total	£1,000,000.00	£5,000,000	£11,000,000

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 asessments 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
RHOSLAN	0
PANT GLAS	0
BRYNCIR	0
GARNDOLBENMAEN	0
LLANYSTUMDWY (W PORTHMADOG) A	0
PENTREFELIN DWYFOR	0
CRICCIETH	0

DWMP Tactial Planning Catchment Summary

Dwyryd - 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 Dwyryd - lower planning catchment lies within the Llyn and Eryri river basin catchment, (see Figure 1 below), it consists of 12 wastewater catchments (see Figure 2 below). There is a combined population of 6759, this is set to decrease to 5943 by 2050, a change of -12%. There is a total sewer length of 56km, with a foul sewer length of 3km, a surface water length of 2km and a combined sewer length of 51km. There are 12 Wastewater Treatment Works (WwTW), 11 Sewerage Pumping Stations (SPSs), and 15 Combined Storm Overflows (CSOs) across this tactical planning unit.

The Dwyryd - lower catchment reaches the sea at Cardigan Bay. The River Dwyryd flows down into the sea near Harlech. Blaenau Ffestiniog and Llan Ffestiniog are the largest urban areas.

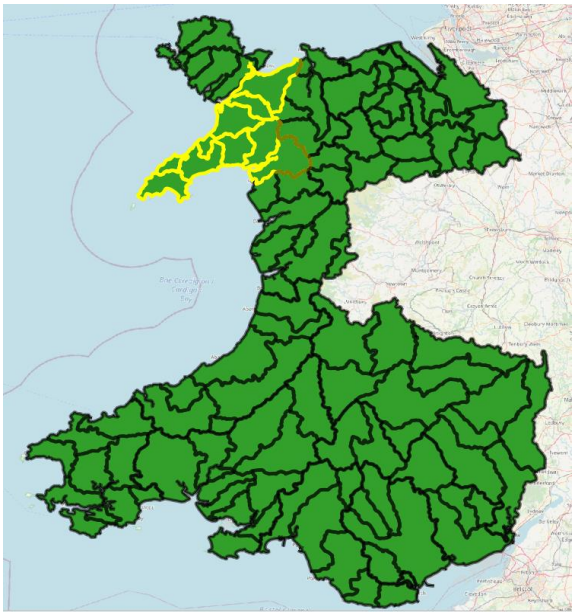


Figure 1 - River basin location detailing the associated tactial planning catchments

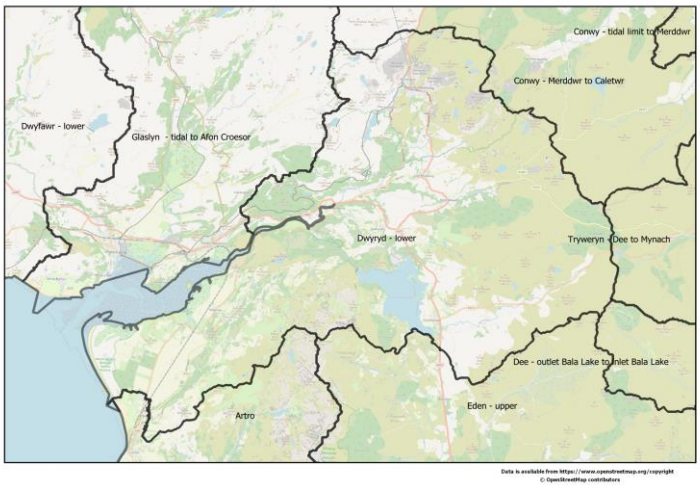


Figure 2- Tactical planning catchments

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 enagement meetings area 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.

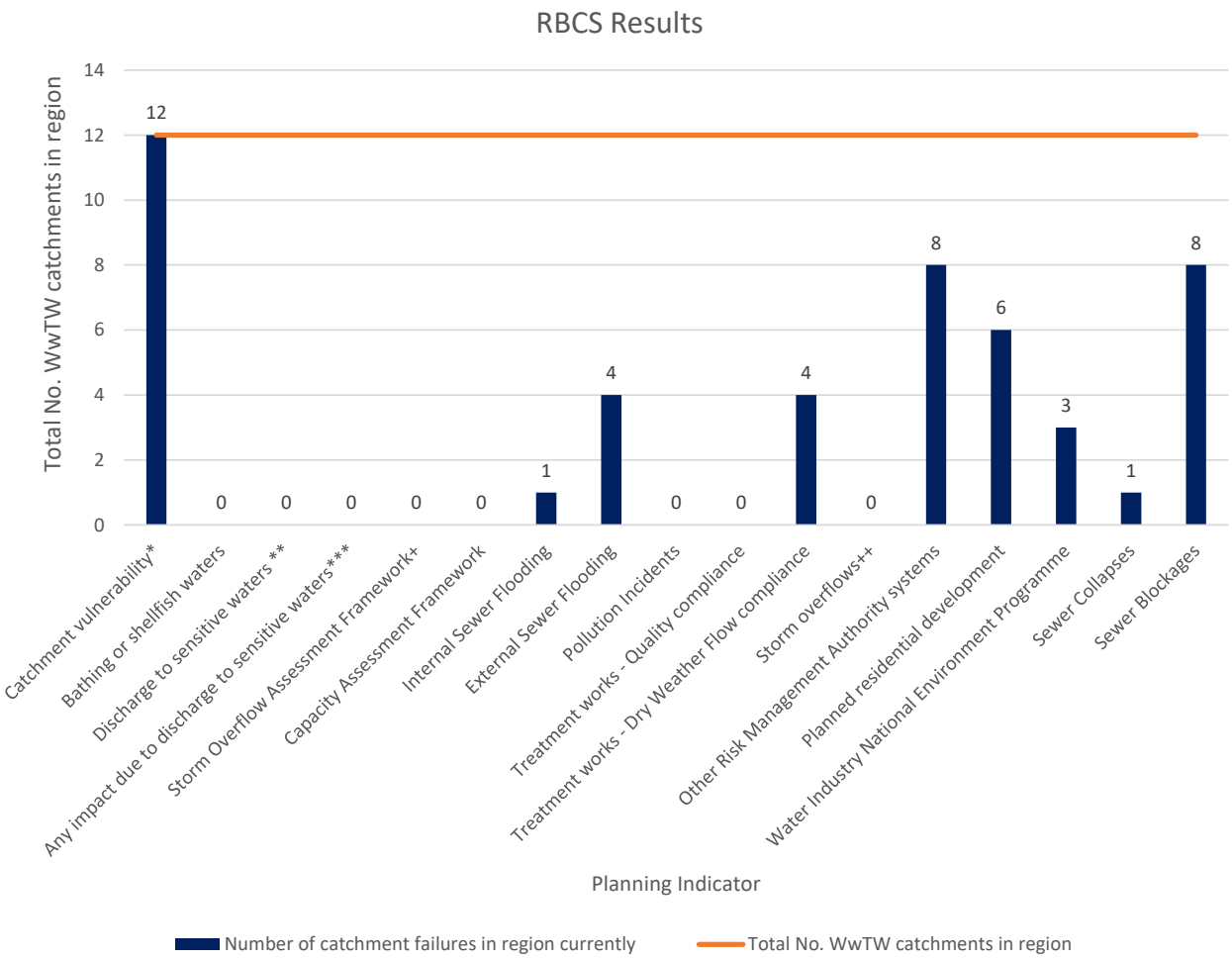
Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

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 Llyn and Eryri region is set to decrease to 5900 by 2050, a change of -12% based on our future projections. However there are major developments in localised areas that will contribute to future pressures on the network, including two in Blaenau Ffestiniog - Cae Rygbi and former playning fields.

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 Dwyryd - 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).



*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.

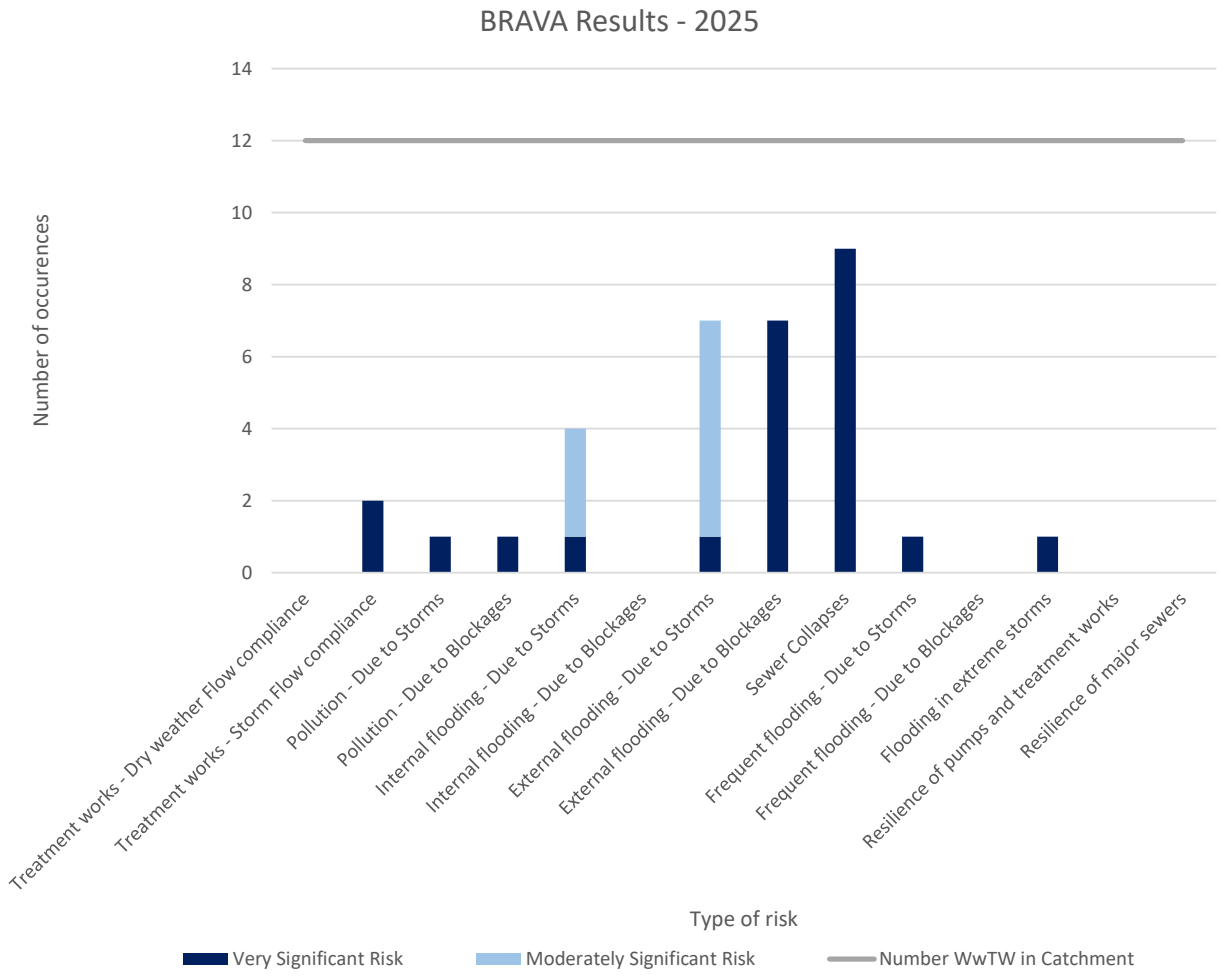


Figure 4 - BRAVA 2025 Summary

In 2025, sewer collapses are the biggest concern in the Dwyryd - lower catchment.

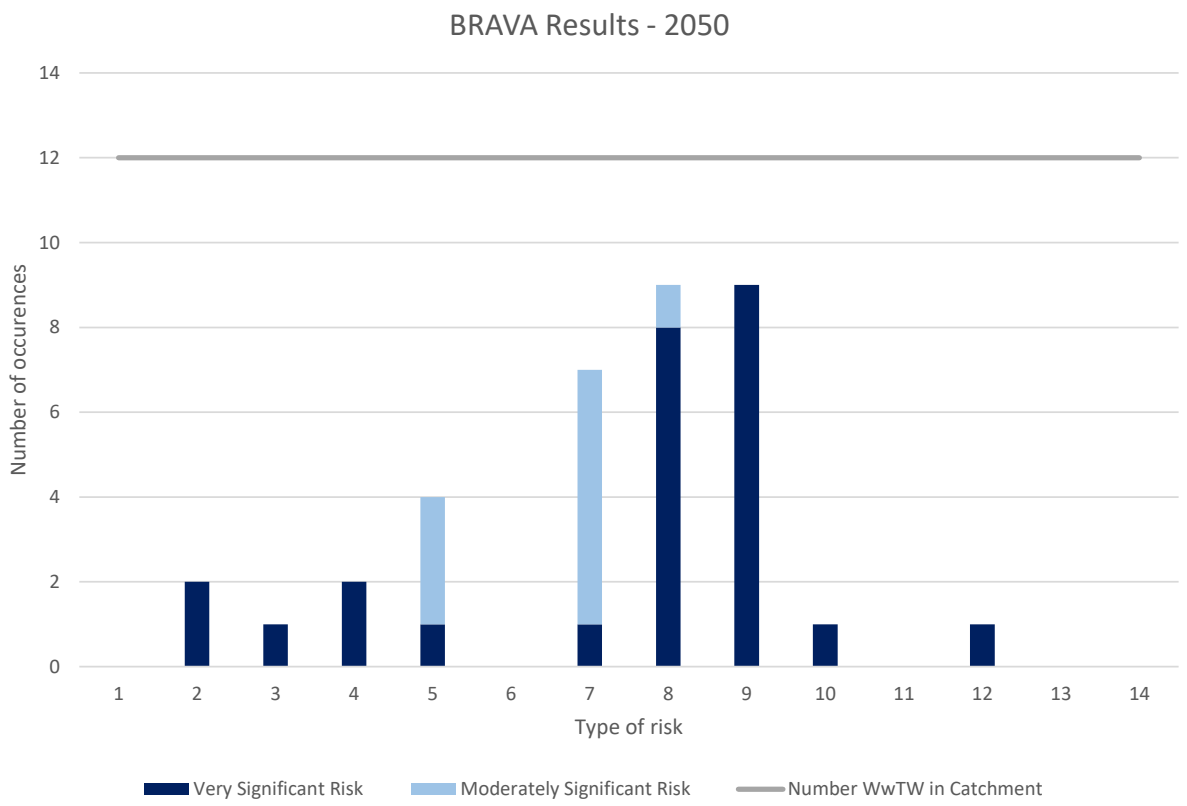


Figure 5 - BRAVA 2050 Summary

In 2050, sewer collapses are the biggest concern in the Dwyryd - lower 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.

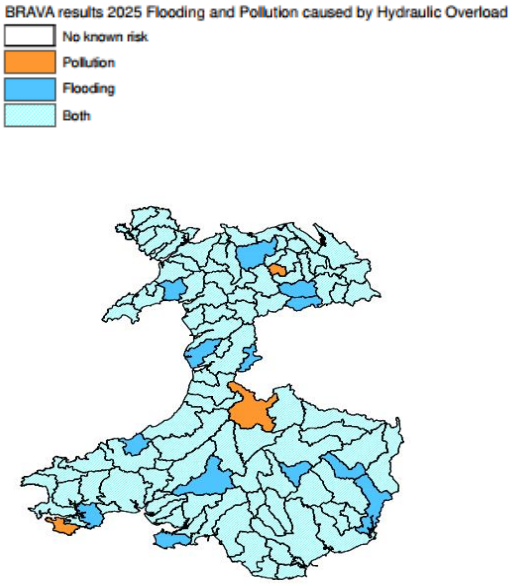


Figure 6 - Associated Strategic Planning Areas priority (2025)

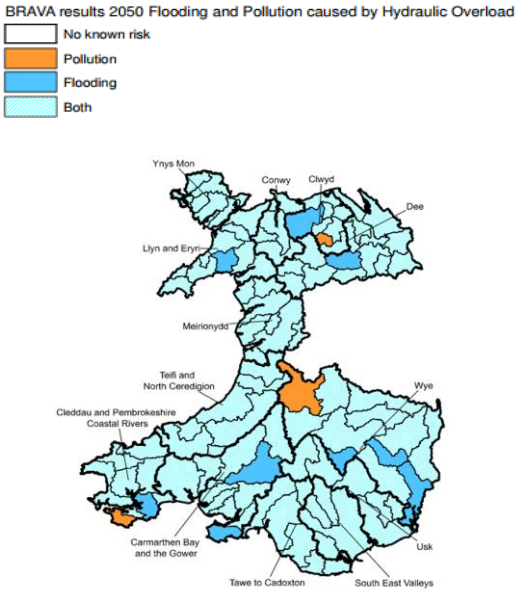


Figure 7 - Associated Strategic Planning Areas

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. Dwyryd - 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
Dwyryd - 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.

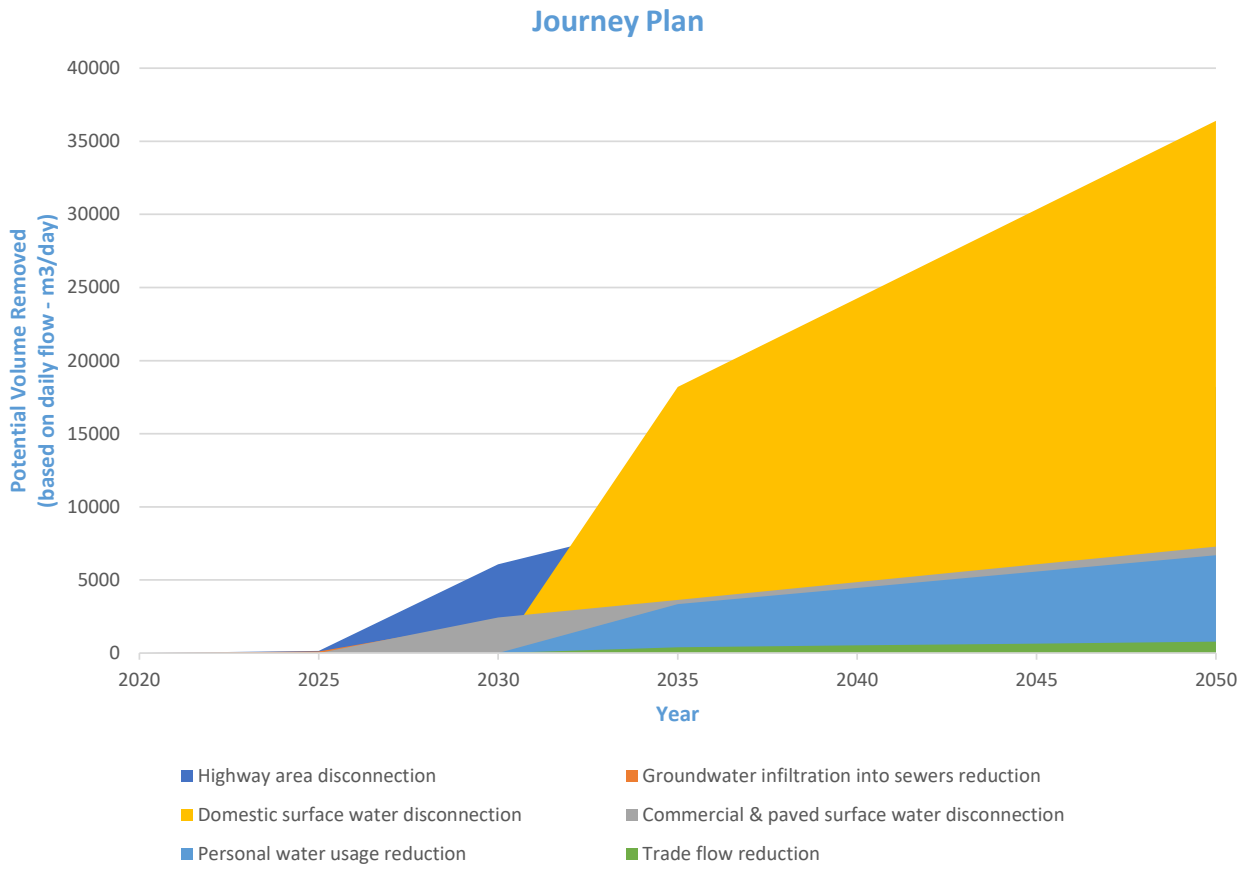


Figure 8 - Journey Plan

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 todays 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 probabilty of occuring 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 seperate cost and would be required in addition to the choice of scenarios for flooding protection in Table 5. The chosen scenarios for Storm overflows nd flooding are to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain Existing Performance*	-	£35,000,000.00	£54,000,000.00
40 spills in a Typical Year	£17,000,000.00	£19,000,000.00	£19,000,000.00
20 spills in a Typical Year	£27,000,000.00	£29,000,000.00	£32,000,000.00
10 spills in a Typical Year	£34,000,000.00	£36,000,000.00	£39,000,000.00
0 spills in a Typical Year	£63,000,000.00	£67,000,000.00	£77,000,000.00
Equivalent No. Olympic Swimming Pools in 10 spills scenario	-47.00	240.00	245.00

* 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	£1,000,000	£1,000,000	£1,000,000
External escapes in gardens	£0	£0	£0
Escapes in highways	£2,000,000	£3,000,000	£4,000,000
No future flooding	-	£9,000,000	£15,000,000
Total	£3,000,000.00	£13,000,000	£20,000,000

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 asessments 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
LLAN FFESTINIOG	0
TAN Y GRISIAU (CROMLECH)	0
Rhyd-y-sarn, Gwynedd Septic Tank	0
RHYD	0
TALWAENYDD SEPTIC TANK	0
YNYS	0
LLANDECWYN (E OF PORTHMADOG) CILFOR	0
MAENTWROG STW	0
TALSARNAU	0
GELLILYDAN	0
TRAWSFYNYDD (FRONGALED)	0
BLAENAU FFESTINIOG	0

DWMP Tactial Planning Catchment Summary

Erch - 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 Erch - lower planning catchment lies within the Llyn and Eryri river basin catchment, (see Figure 1 below), it consists of 19 wastewater catchments (see Figure 2 below). There is a combined population of 10764, this is set to decrease to 9352 by 2050, a change of -13%. There is a total sewer length of 72km, with a foul sewer length of 19km, a surface water length of 2km and a combined sewer length of 48km. There are 19 Wastewater Treatment Works (WwTW), 23 Sewerage Pumping Stations (SPSs), and 18 Combined Storm Overflows (CSOs) across this tactical planning unit.

The Erch - lower catchment stretches across the Llyn peninsula, bordering the Irish sea in the North and South. The River Erch flows down into the sea near Pwllheli. Pwllheli and Lithfaen are the largest urban areas.

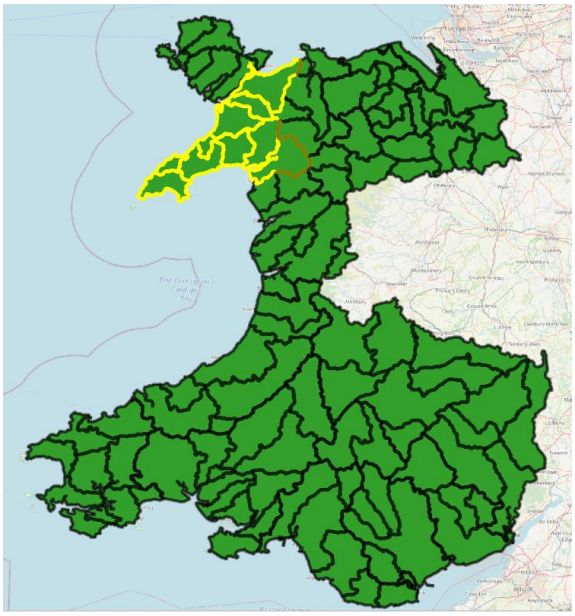


Figure 1 - River basin location detailing the associated tactial planning catchments

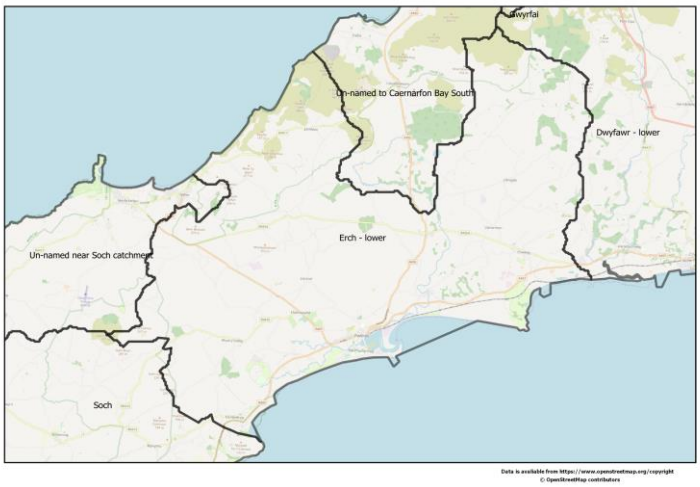


Figure 2- Tactical planning catchments

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 enagement meetings area 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.

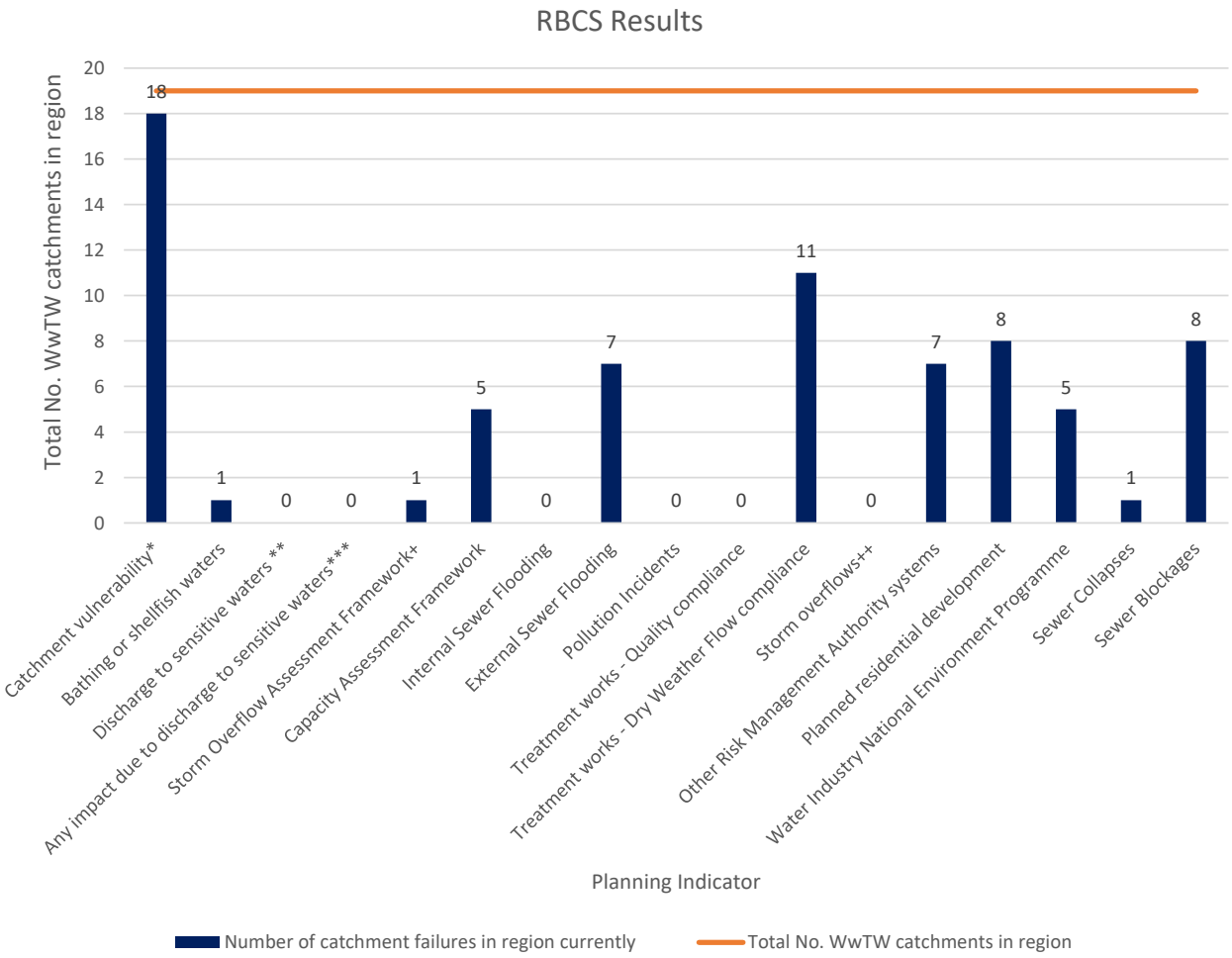
Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

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 Llyn and Eryri region is set to decrease to 9400 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, including Pwllheli - Adwy'r Hafan & Stad Glanydon and Rhosfawr - Safle Wynstay Farmers.

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 Erch - 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).



*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.

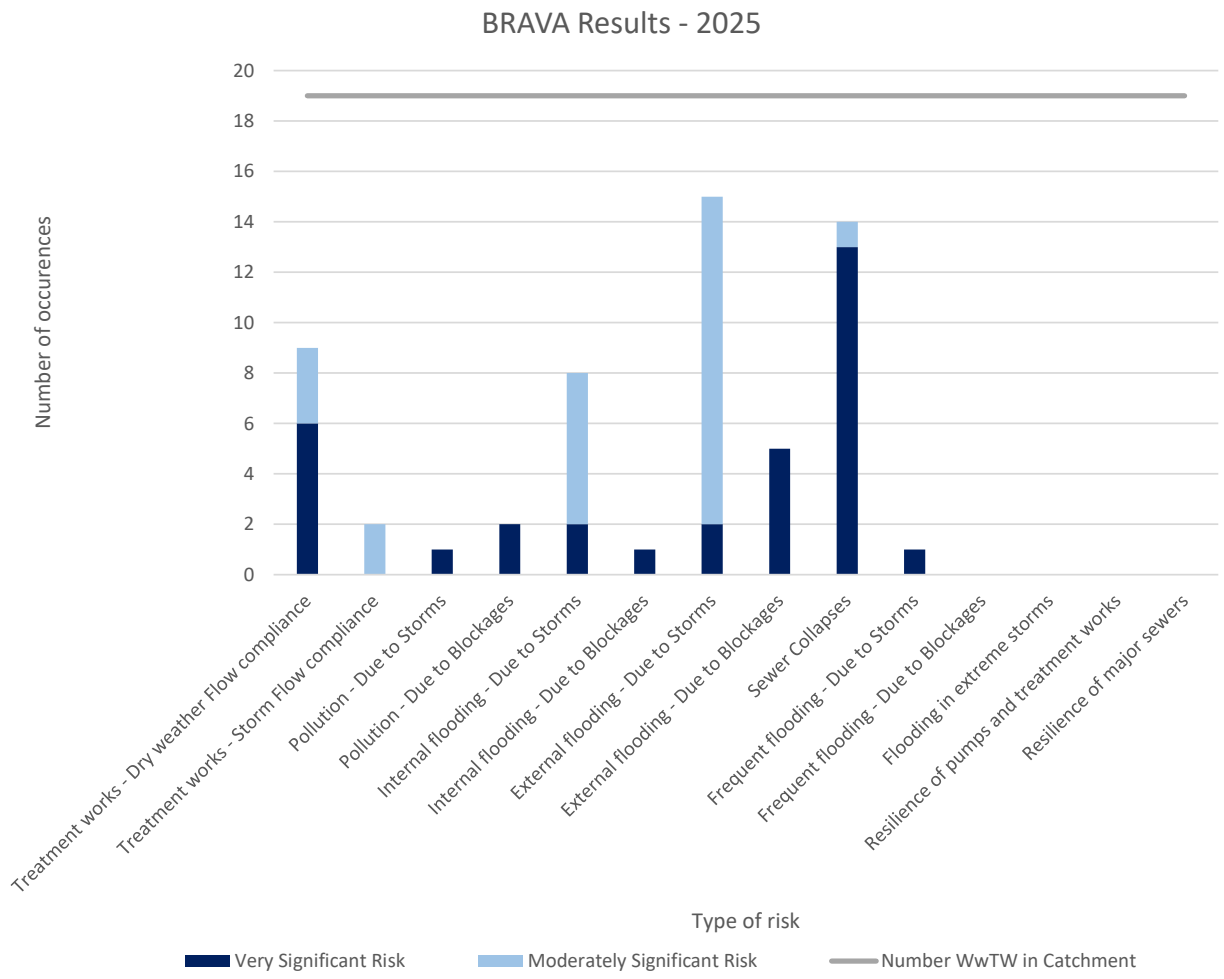


Figure 4 - BRAVA 2025 Summary

In 2025, external flooding due to storms and sewer collapses are the biggest concern in the Erch - lower catchment.

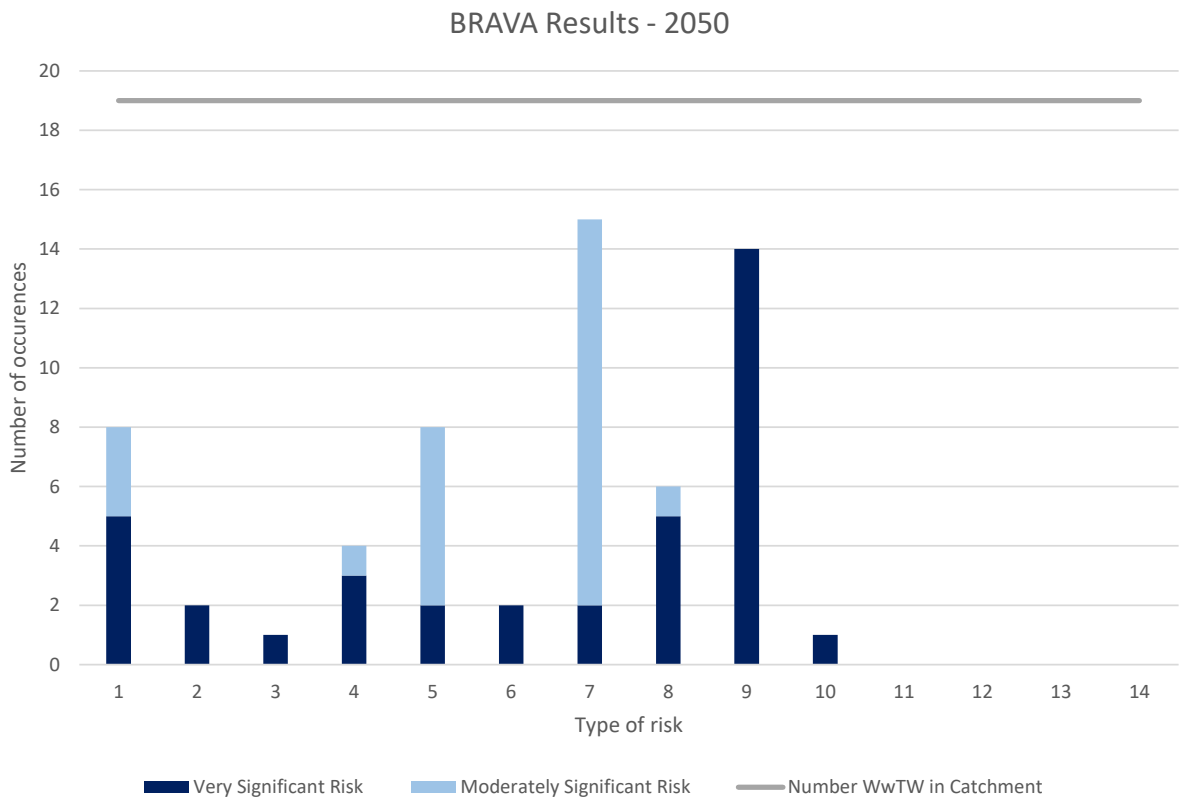


Figure 5 - BRAVA 2050 Summary

In 2050, external flooding due to storms and sewer collapses are the biggest concern in the Erch - lower 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.

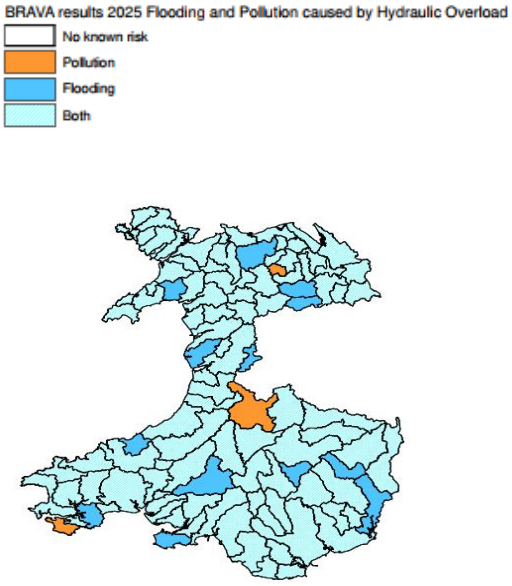


Figure 6 - Associated Strategic Planning Areas priority (2025)

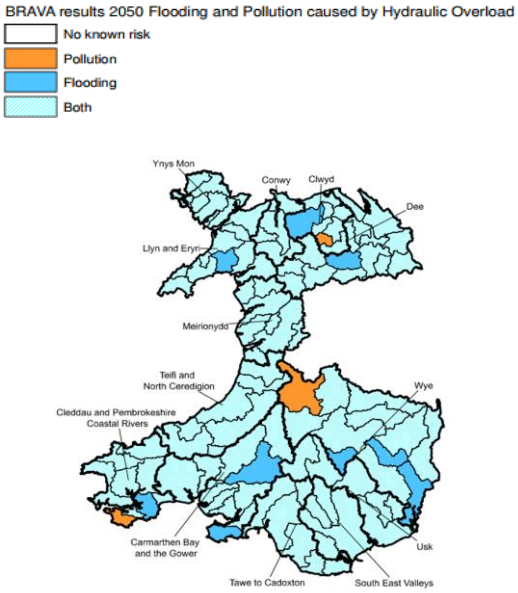


Figure 7 - Associated Strategic Planning Areas

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. Erch - lower 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
Erch - 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.

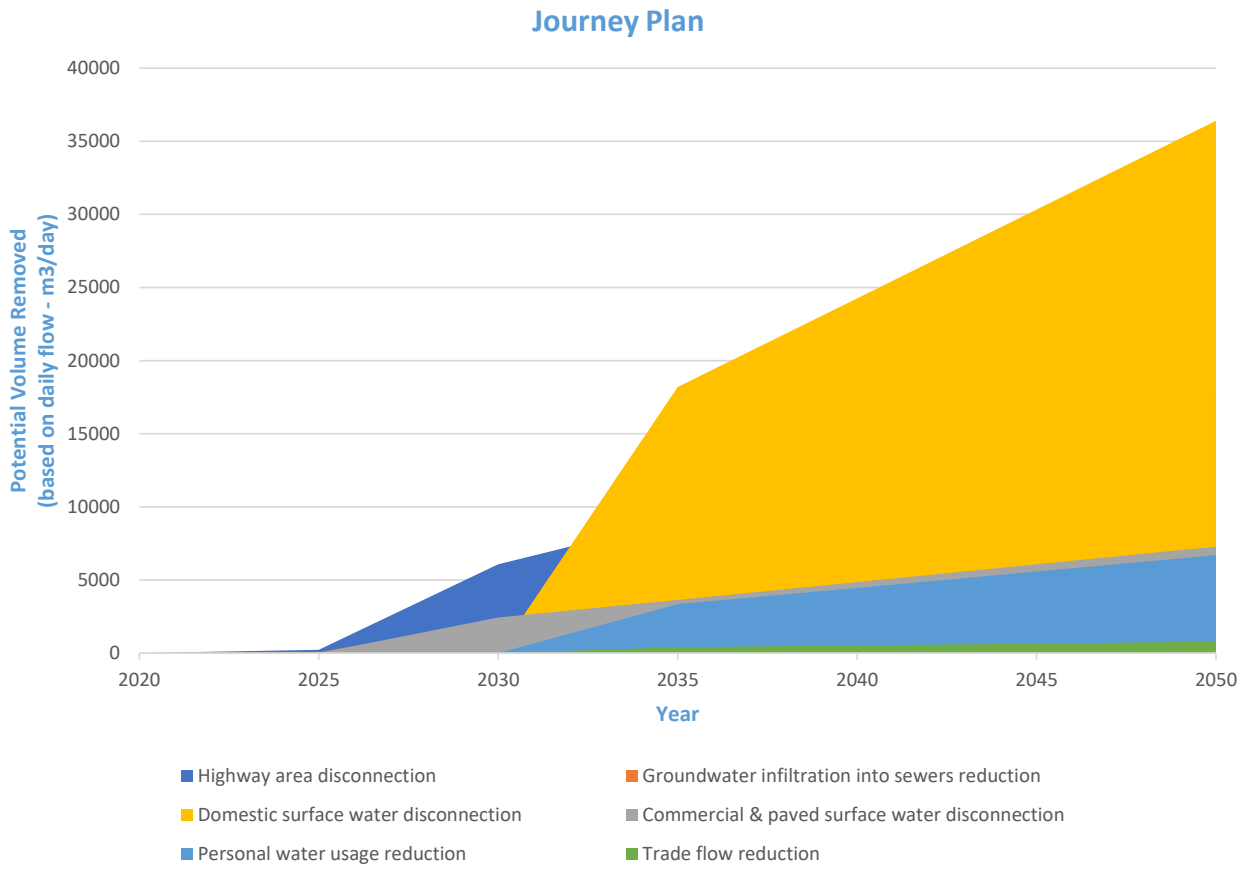


Figure 8 - Journey Plan

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 todays 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 probabilty of occuring 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 seperate cost and would be required in addition to the choice of scenarios for flooding protection in Table 5. The chosen scenarios for Storm overflows nd flooding are to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain Existing Performance*	-	£28,000,000.00	£38,000,000.00
40 spills in a Typical Year	£8,000,000.00	£8,000,000.00	£8,000,000.00
20 spills in a Typical Year	£10,000,000.00	£10,000,000.00	£12,000,000.00
10 spills in a Typical Year	£21,000,000.00	£21,000,000.00	£22,000,000.00
0 spills in a Typical Year	£54,000,000.00	£59,000,000.00	£64,000,000.00
Equivalent No. Olympic Swimming Pools in 10 spills scenario	131.00	147.00	163.00

* 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	£4,000,000	£5,000,000	£5,000,000
External escapes in gardens	£0	£0	£0
Escapes in highways	£6,000,000	£7,000,000	£9,000,000
No future flooding	-	£16,000,000	£26,000,000
Total	£10,000,000.00	£28,000,000	£40,000,000

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 asessments 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
RHYD-Y-CLAFDY (NR PWLLHELI) STW	0
PENPRYS	0
PWLLHELI RIVERSIDE	0
BODUAN	0
PENTREUCHAF	0
RHOS-FAWR	0
PENRHOS (W OF PWLLHELI)	0
AFONWEN	0
LLANGYBI (W OF PORTHMADOG)	0
PENCAENEWYDD	0
PISTYLL	0
LLANNOR	0
LLITHFAEN	0
EFAILNEWYDD	0
ABERERCH STW	0
PWLLHELI	0
Y FFOR STW	0
CHWILOG	0

DWMP Tactial Planning Catchment Summary

Glaslyn - tidal to Afon Croesor

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 Glaslyn - tidal to Afon Croesor planning catchment lies within the Llyn and Eryri river basin catchment, (see Figure 1 below), it consists of 10 wastewater catchments (see Figure 2 below). There is a combined population of 12122, this is set to decrease to 9333 by 2050, a change of -23%. There is a total sewer length of 71km, with a foul sewer length of 18km, a surface water length of 8km and a combined sewer length of 41km. There are 10 Wastewater Treatment Works (WwTW), 27 Sewerage Pumping Stations (SPSs), and 16 Combined Storm Overflows (CSOs) across this tactical planning unit.

The Glaslyn - tidal to Afon Croesor catchment falls at the inland end of the Llyn Peninsula, bordering the Irish sea to the South. The River Glaslyn flows down into the sea near Porthmadog. Porthmadog and Penrhyndeudraeth are its major urban areas.

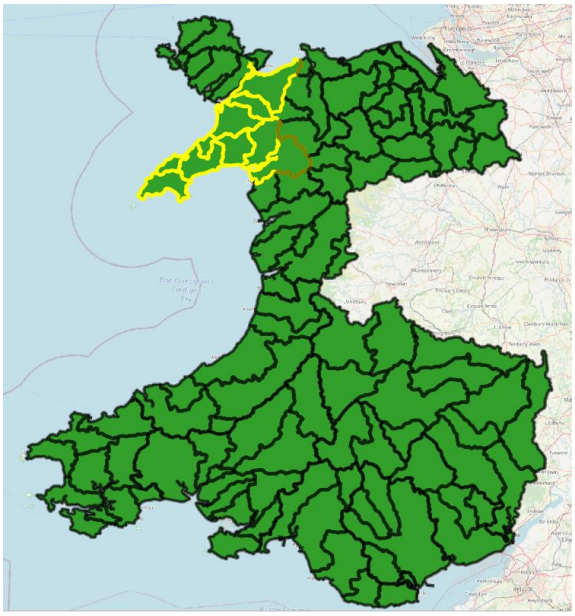


Figure 1 - River basin location detailing the associated tactial planning catchments

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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 enagement meetings area 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.

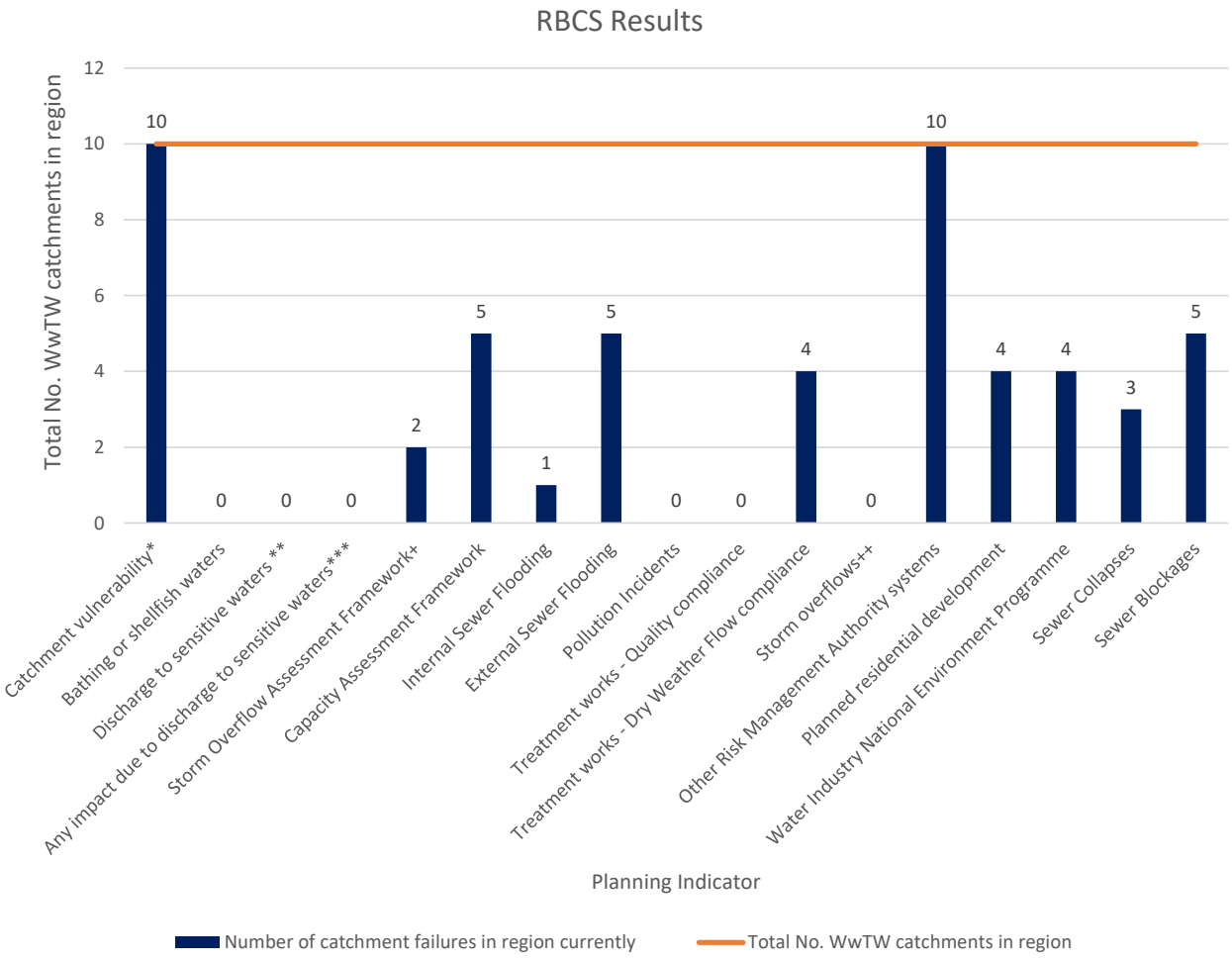
Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

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 Llyn and Eryri region is set to decrease to 9300 by 2050, a change of -23% based on our future projections. However there are major developments in localised areas that will contribute to future pressures on the network, including Porthmadog - Stad Penamser and Penrhyndeudraeth - Park Eryri.

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 Glaslyn - tidal to Afon Croesor 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 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.

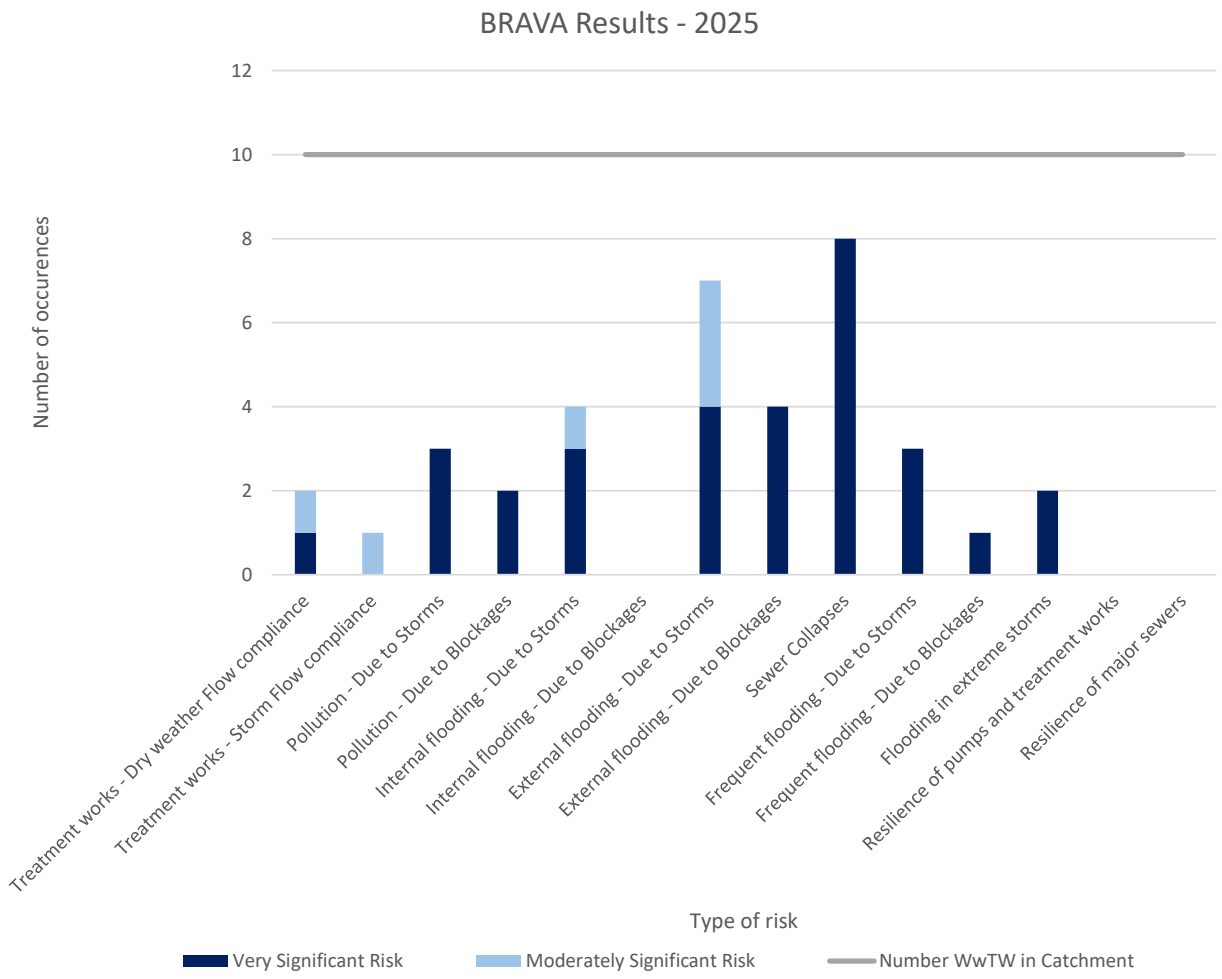


Figure 4 - BRAVA 2025 Summary

In 2025, external flooding due to storms and sewer collapses are the biggest concern in the Glaslyn - tidal to Afon Croesor catchment.

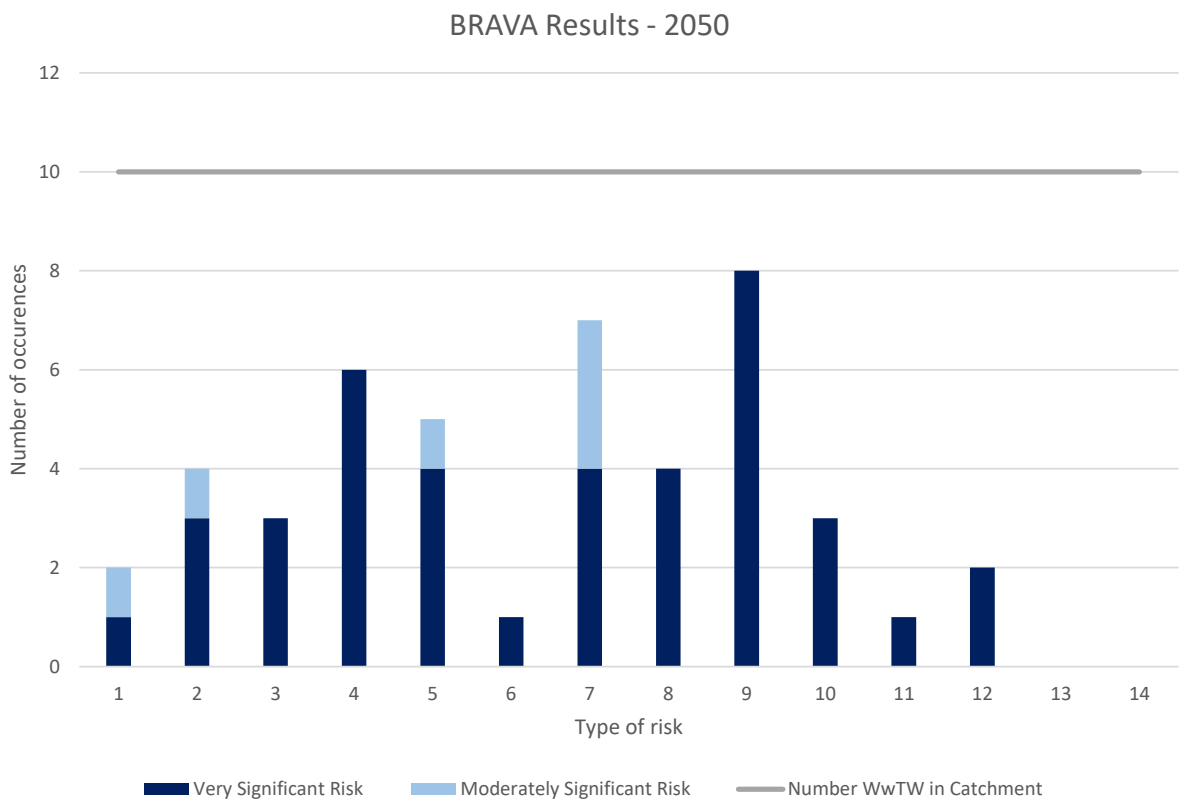


Figure 5 - BRAVA 2050 Summary

In 2050, external flooding due to storms and sewer collapses are the biggest concern in the Glaslyn - tidal to Afon Croesor 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.

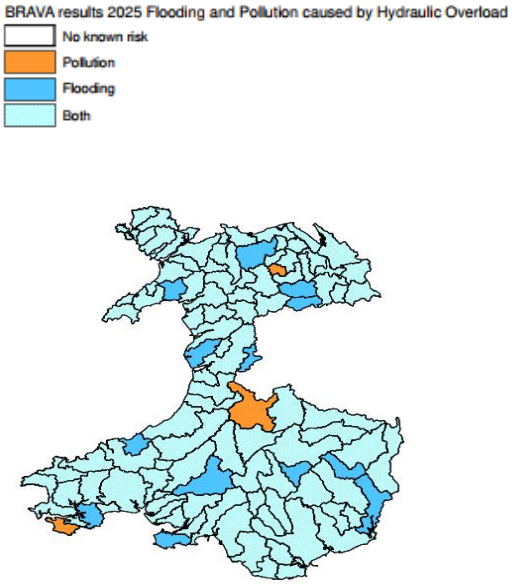


Figure 6 - Associated Strategic Planning Areas priority (2025)

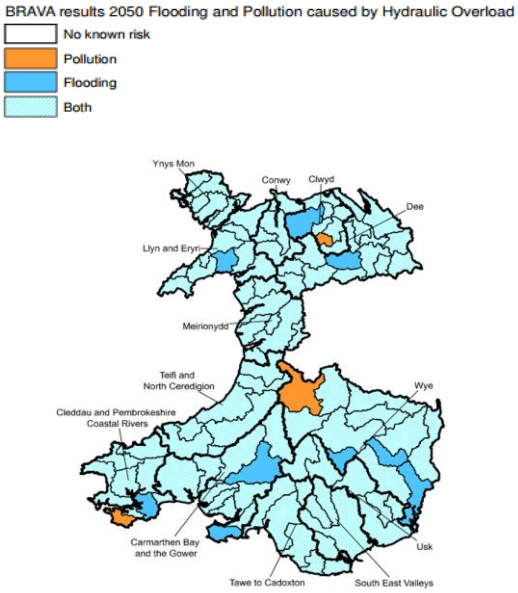


Figure 7 - Associated Strategic Planning Areas

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. Glaslyn - tidal to Afon Croesor 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
Glaslyn - tidal to Afon Croesor	0%	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	10%	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	20%	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	Treatment Target	2025	2030	2035	2040	2045	2050
	70%	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	80%	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	90%	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

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.

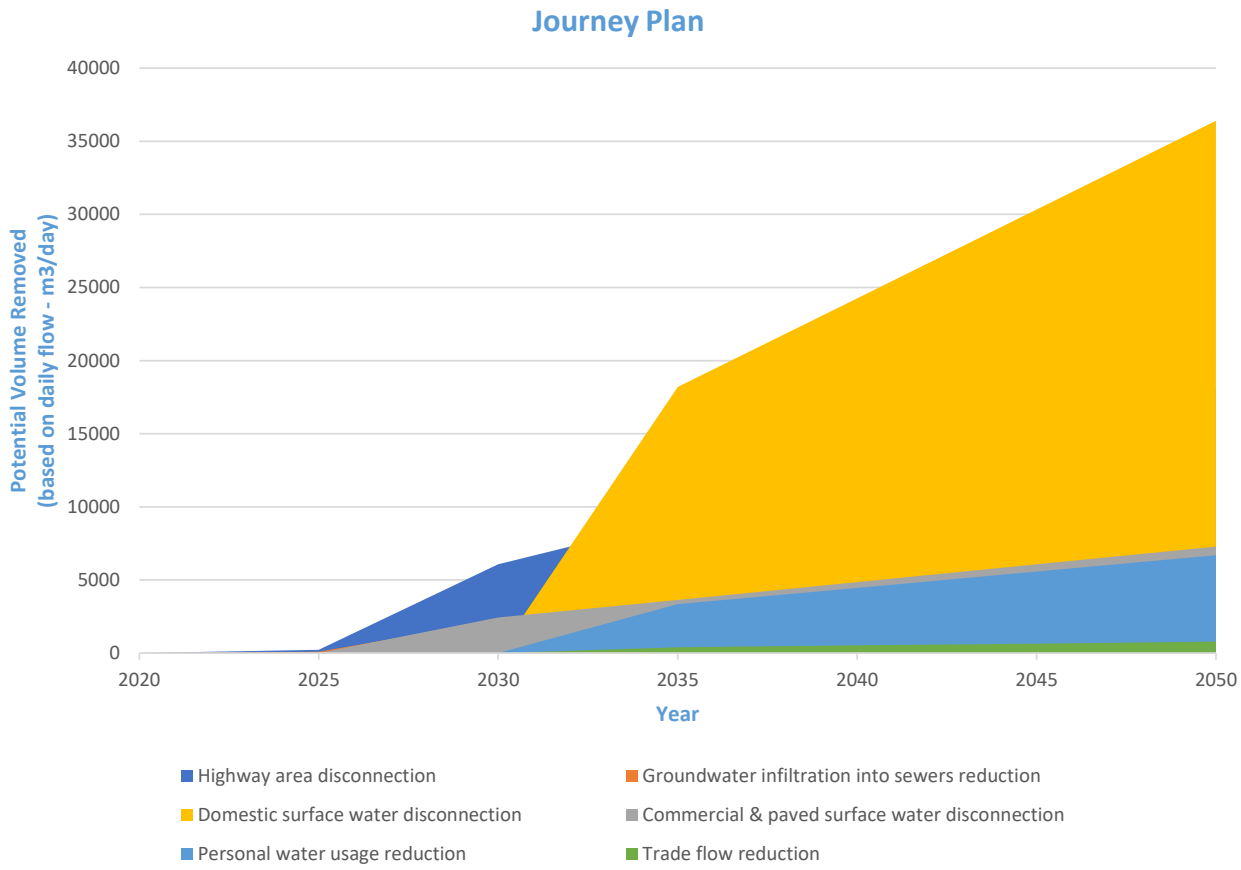


Figure 8 - Journey Plan

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 todays 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 probabilty of occuring 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 seperate cost and would be required in addition to the choice of scenarios for flooding protection in Table 5. The chosen scenarios for Storm overflows nd flooding are to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain Existing Performance*	-	£0.00	£0.00
40 spills in a Typical Year	£0.00	£0.00	£0.00
20 spills in a Typical Year	£0.00	£0.00	£0.00
10 spills in a Typical Year	£0.00	£0.00	£0.00
0 spills in a Typical Year	£0.00	£0.00	£0.00
Equivalent No. Olympic Swimming Pools in 10 spills scenario	0.00	0.00	0.00

* 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	£1,000,000	£2,000,000	£1,000,000
External escapes in gardens	£0	£1,000,000	£0
Escapes in highways	£11,000,000	£13,000,000	£16,000,000
No future flooding	-	£11,000,000	£8,000,000
Total	£12,000,000.00	£27,000,000	£25,000,000

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 asessments 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
PENRHYNDEUDRAETH	0
LLANFROTHEN GARREG	0
NANT GWYNANT	0
CROESOR 3	0
NANTMOR	0
NANT GWYNANT BETHANIA	0
BEDDGELERT STW	0
PRENTEG	0
PORTHMADOG	4
Morfa Bychan WwTW	0

DWMP Tactial Planning Catchment Summary

Gwyrfai

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 Gwyrfai planning catchment lies within the Llyn and Eryri river basin catchment, (see Figure 1 below), it consists of 7 wastewater catchments (see Figure 2 below). There is a combined population of 10908, this is set to decrease to 9916 by 2050, a change of -9%. There is a total sewer length of 120km, with a foul sewer length of 31km, a surface water length of 7km and a combined sewer length of 79km. There are 7 Wastewater Treatment Works (WwTW), 17 Sewerage Pumping Stations (SPSs), and 30 Combined Storm Overflows (CSOs) across this tactical planning unit.

The Gwyrfai catchment is just South of Anglesey, bordering the Irish sea to the West. The River Gwyrfai flows down into the sea near Caernarfon Airport. Y Bontnewydd and Groeslon are its major urban areas.

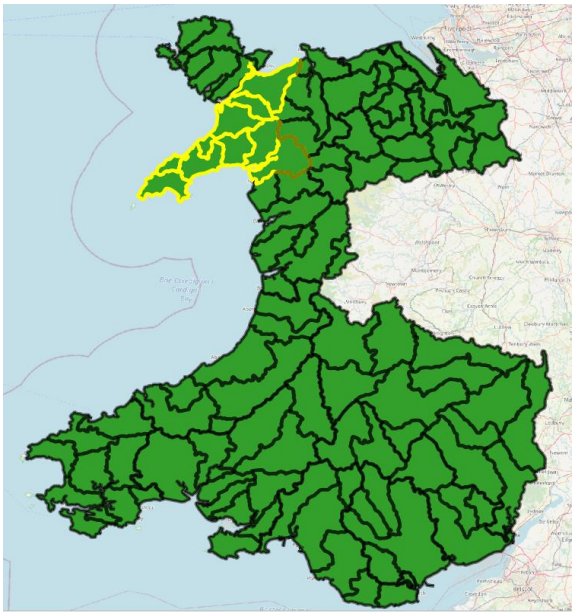


Figure 1 - River basin location detailing the associated tactial planning catchments

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 enagement meetings area 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.

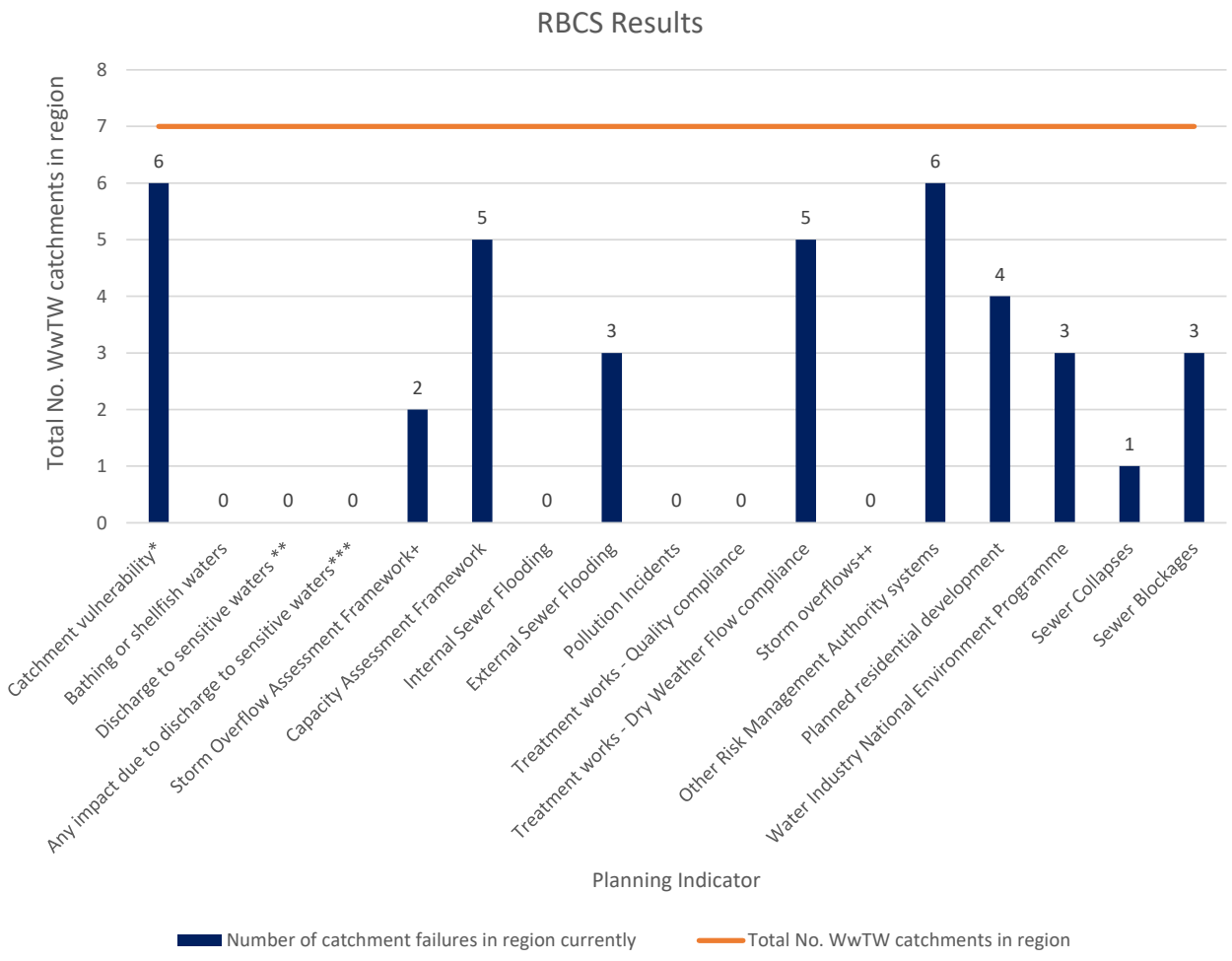
Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

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 Llyn and Eryri region is set to decrease to 9900 by 2050, a change of -9% based on our future projections. However there are major developments in localised areas that will contribute to future pressures on the network, including Penygroes - Stad ddiwydianol Penygores and Land adjacent to Maes Dylun.

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 Gwyrfai 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 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.

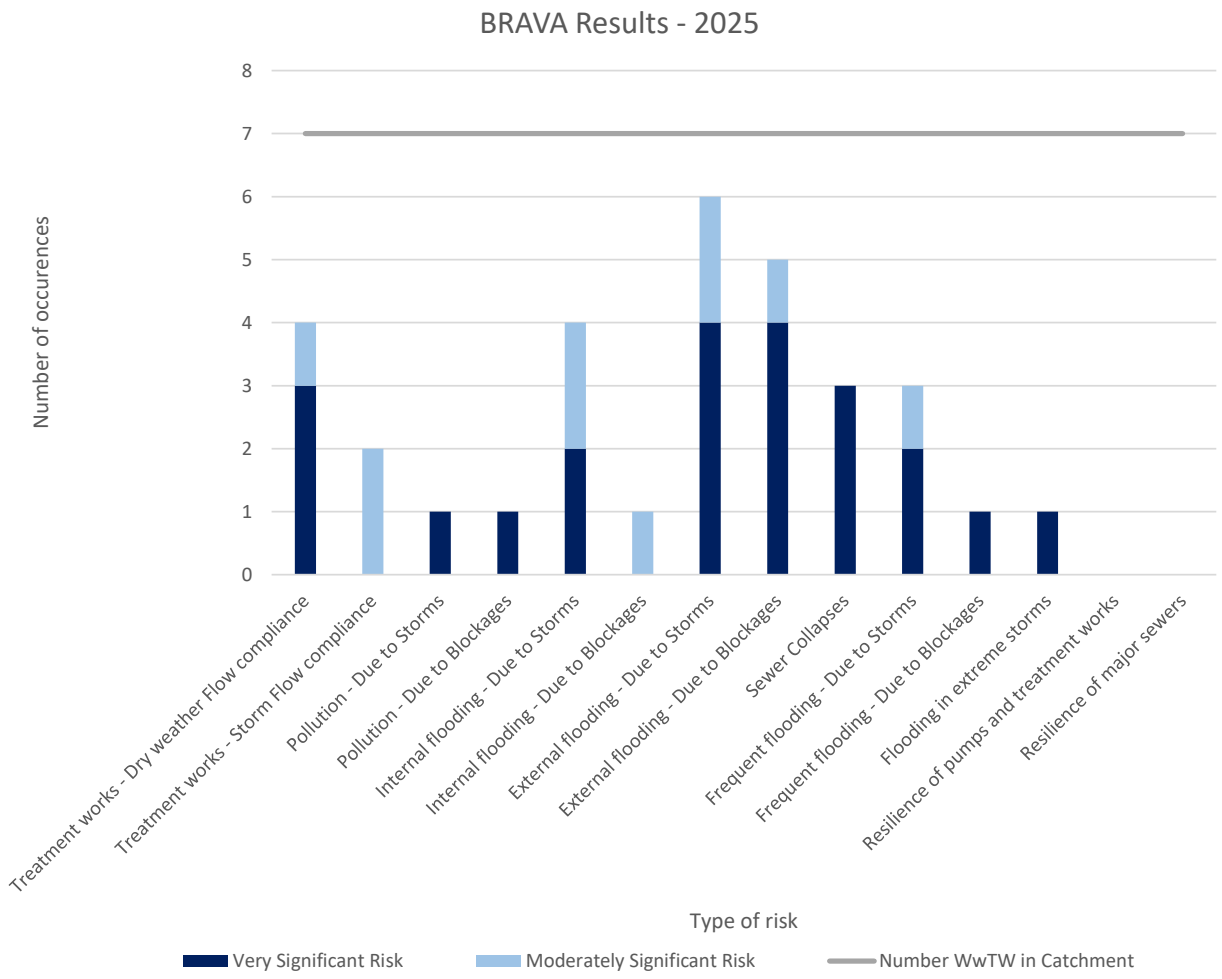


Figure 4 - BRAVA 2025 Summary

In 2025, external flooding due to storms and blockages are the biggest concern in the Gwyrfai catchment.

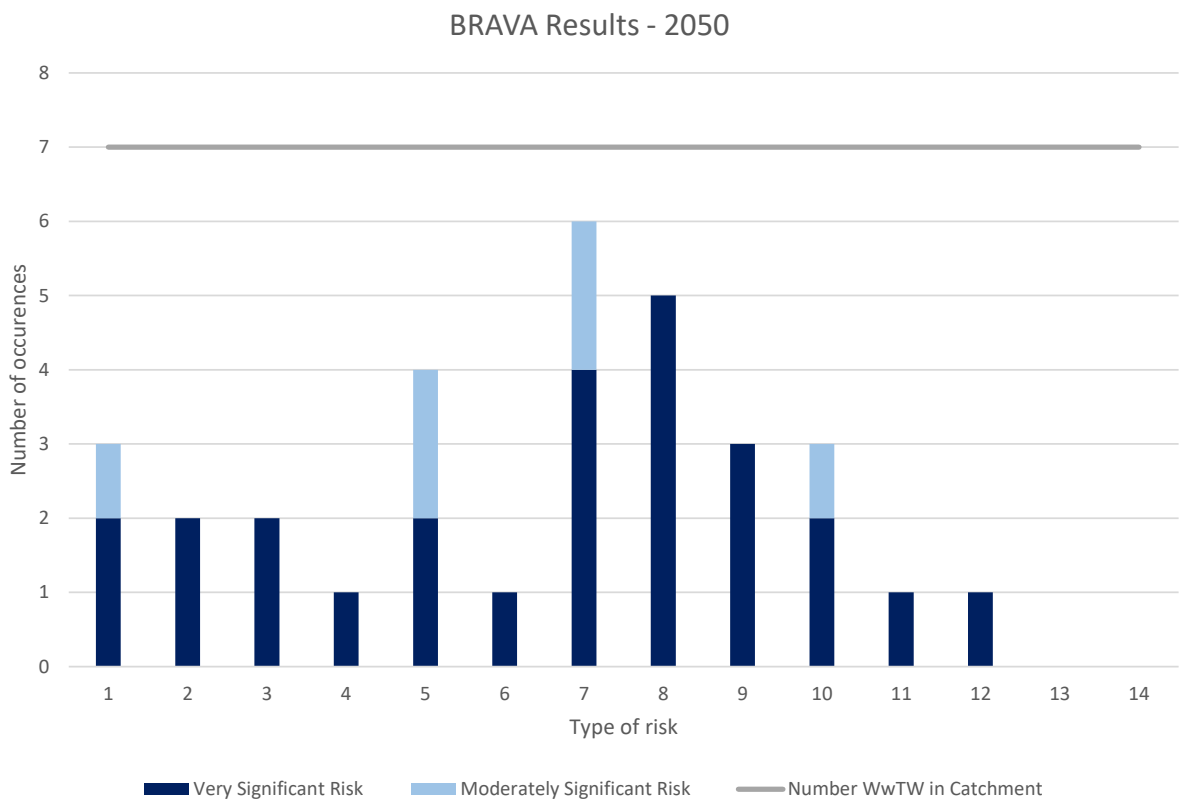


Figure 5 - BRAVA 2050 Summary

In 2050, external flooding due to storms and blockages are the biggest concern in the Gwyrfai 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.

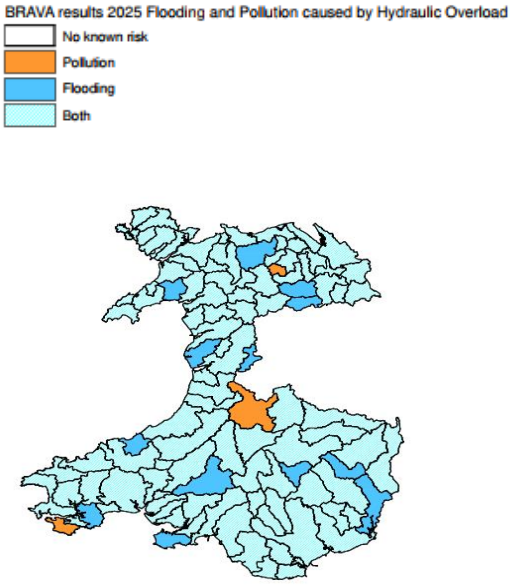


Figure 6 - Associated Strategic Planning Areas priority (2025)

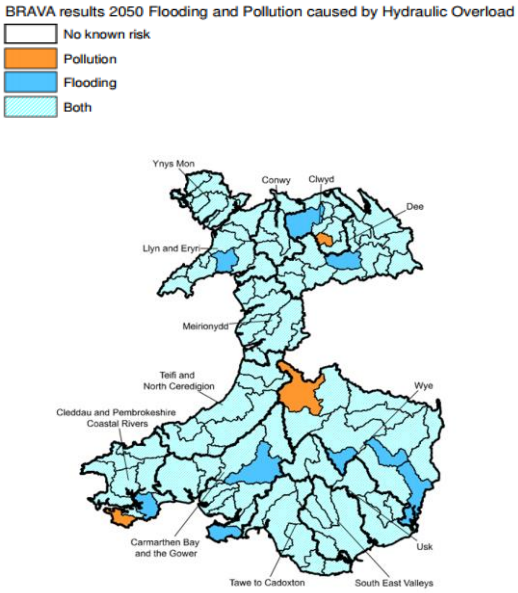


Figure 7 - Associated Strategic Planning Areas

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. Gwyrfai 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
Gwyrfai	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.

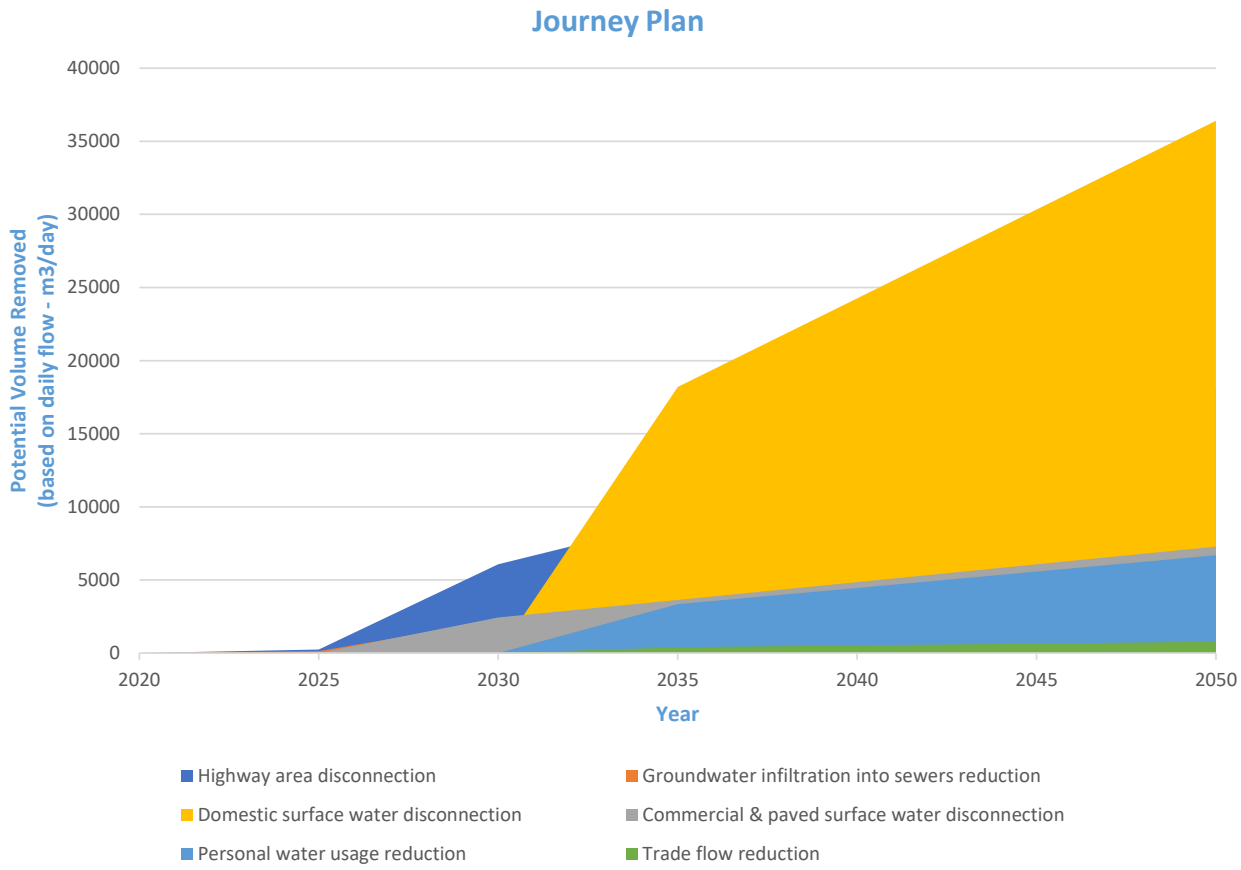


Figure 8 - Journey Plan

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 todays 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 probabilty of occuring 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 seperate cost and would be required in addition to the choice of scenarios for flooding protection in Table 5. The chosen scenarios for Storm overflows nd flooding are to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain Existing Performance*	-	£8,000,000.00	£14,000,000.00
40 spills in a Typical Year	£5,000,000.00	£5,000,000.00	£6,000,000.00
20 spills in a Typical Year	£7,000,000.00	£7,000,000.00	£8,000,000.00
10 spills in a Typical Year	£13,000,000.00	£15,000,000.00	£15,000,000.00
0 spills in a Typical Year	£31,000,000.00	£32,000,000.00	£35,000,000.00
Equivalent No. Olympic Swimming Pools in 10 spills scenario	39.00	44.00	49.00

* 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	£3,000,000	£4,000,000	£4,000,000
External escapes in gardens	£1,000,000	£1,000,000	£2,000,000
Escapes in highways	£11,000,000	£14,000,000	£19,000,000
No future flooding	-	£7,000,000	£6,000,000
Total	£15,000,000.00	£26,000,000	£31,000,000

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 asessments 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
TAI'N LON	0
BETWS GARMON (SE OF CAERNARFON) STW	0
RHYD-DDU	0
PONTLLYFNI STW	0
WAUNFAWR STW	0
LLANFAGLAN	3
LLANLLYFNI	0

DWMP Tactial Planning Catchment Summary

Ogwen - 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 Ogwen - lower planning catchment lies within the Llyn and Eryri river basin catchment, (see Figure 1 below), it consists of 9 wastewater catchments (see Figure 2 below). There is a combined population of 51988, this is set to decrease to 42546 by 2050, a change of -18%. There is a total sewer length of 331km, with a foul sewer length of 94km, a surface water length of 28km and a combined sewer length of 200km. There are 9 Wastewater Treatment Works (WwTW), 59 Sewerage Pumping Stations (SPSs), and 53 Combined Storm Overflows (CSOs) across this tactical planning unit.

The Ogwen - lower catchment sits at the northern end of the Menai Straits, opposite Anglesey. The River Ogwen flows down to join the sea near Bangor. Banger and Bethesda are its major urban areas.

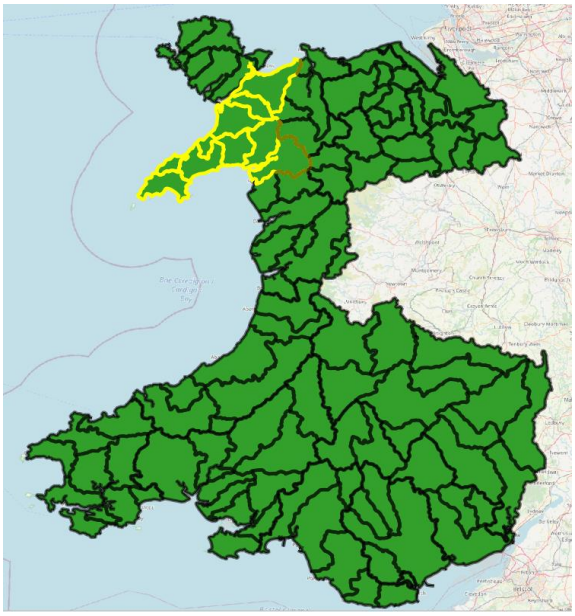


Figure 1 - River basin location detailing the associated tactial planning catchments

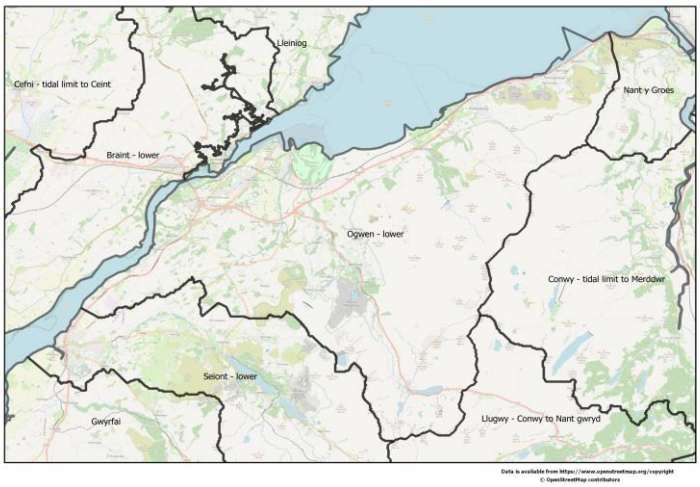


Figure 2- Tactical planning catchments

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 enagement meetings area 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.

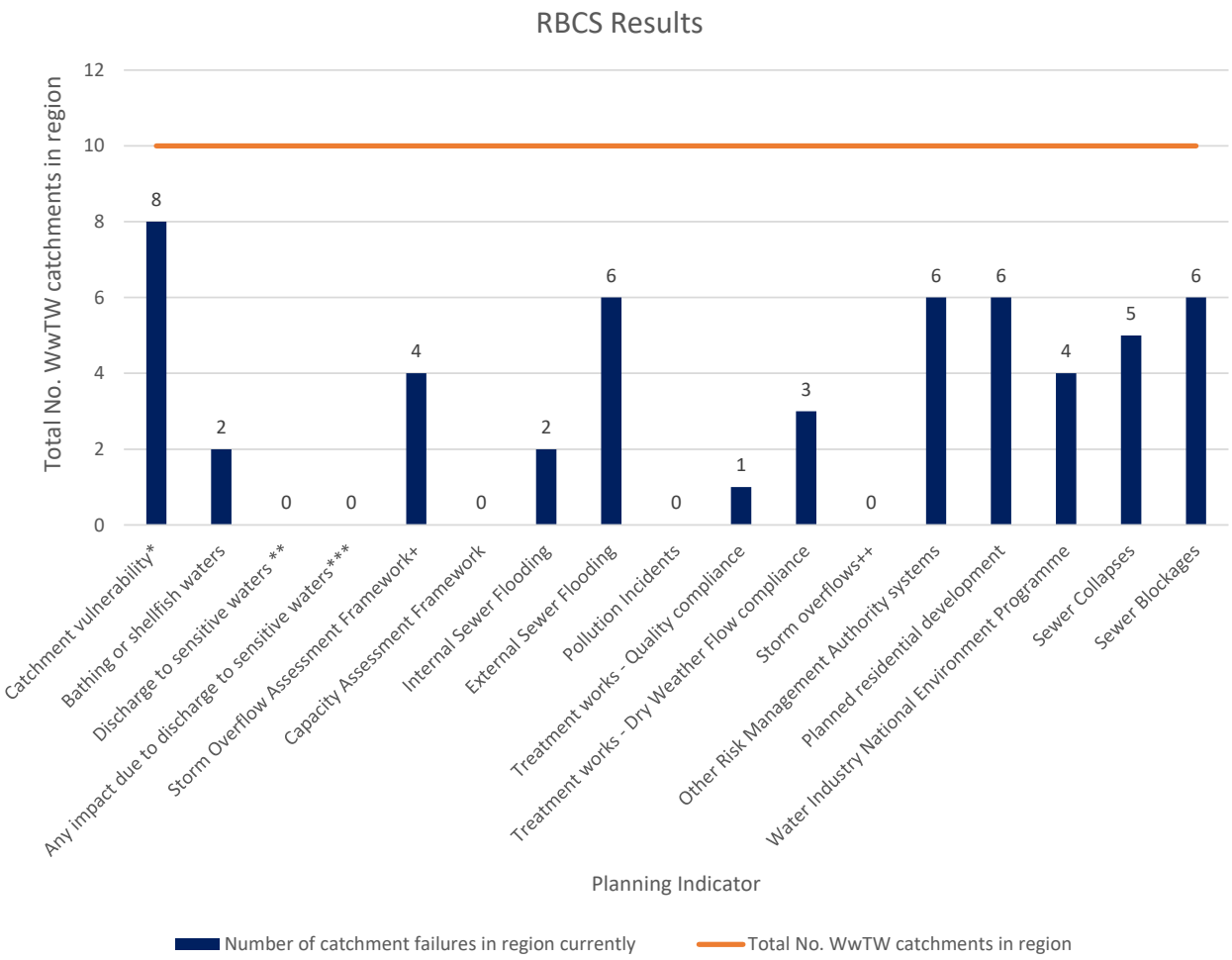
Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

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 Llyn and Eryri region is set to decrease to 42500 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 Bangor - Bryn Cegin and Park Menai.

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 Ogwen - lower catchment the biggest concern indicated by the RBCS is 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.

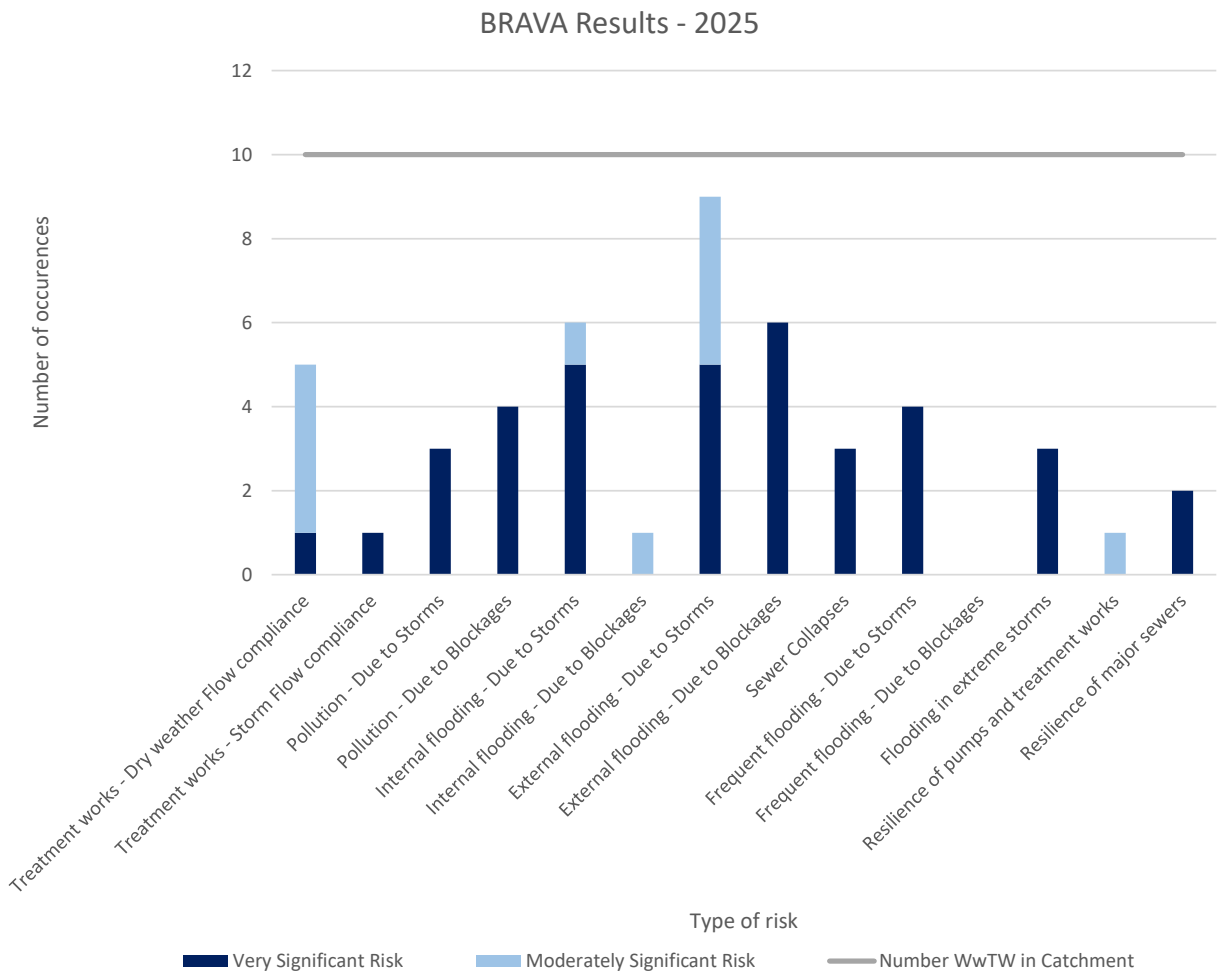


Figure 4 - BRAVA 2025 Summary

In 2025, external flooding due to blockages and storm, and internal flooding due to storms are the biggest concern in the Ogwen - lower catchment.

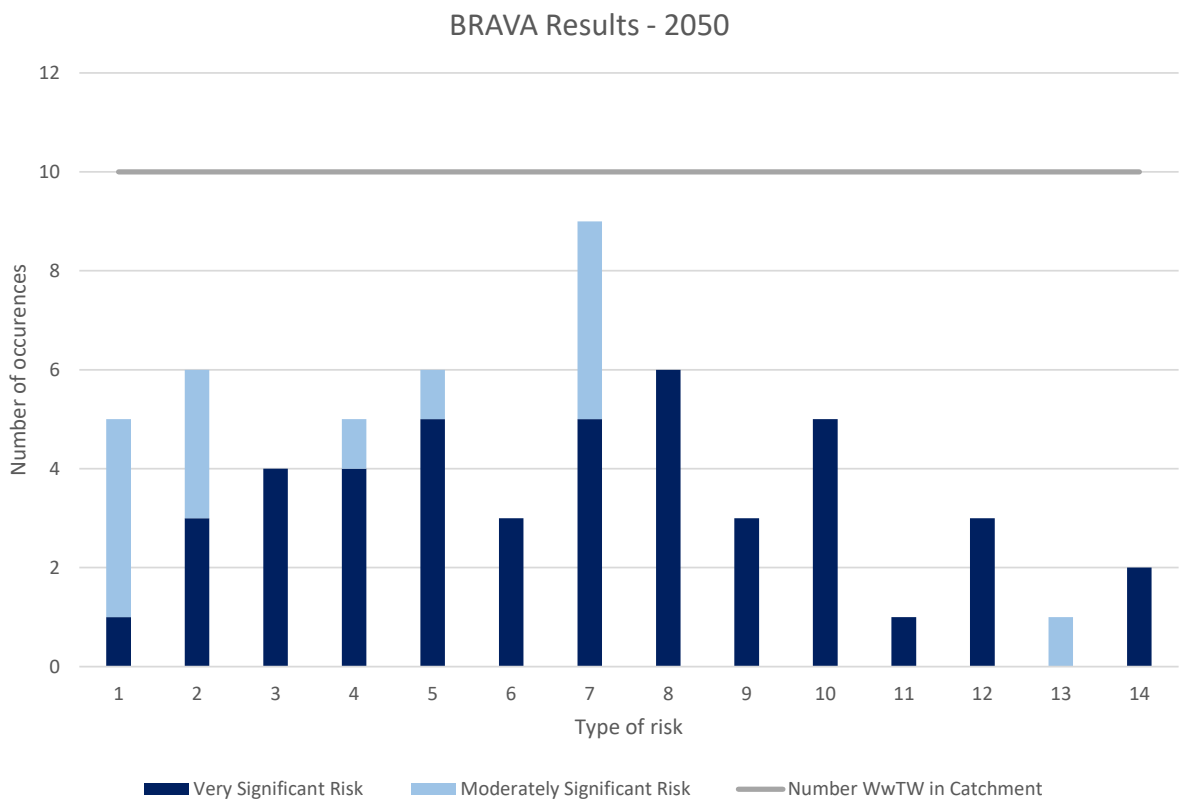


Figure 5 - BRAVA 2050 Summary

In 2050, external flooding due to storms are the biggest concern in the Ogwen - lower 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.

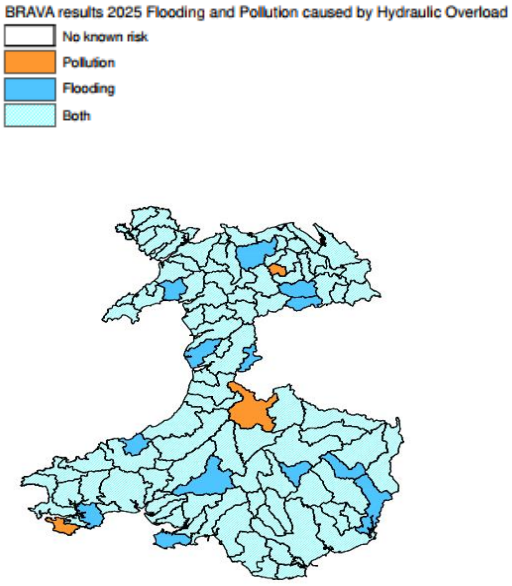


Figure 6 - Associated Strategic Planning Areas priority (2025)

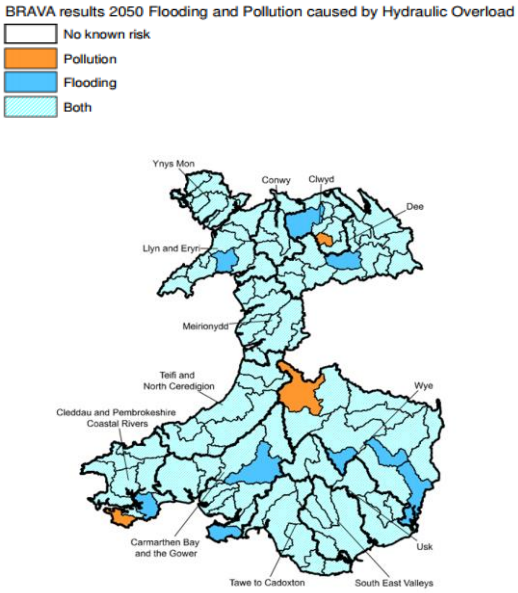


Figure 7 - Associated Strategic Planning Areas

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. Ogwen - lower 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
Ogwen - 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.

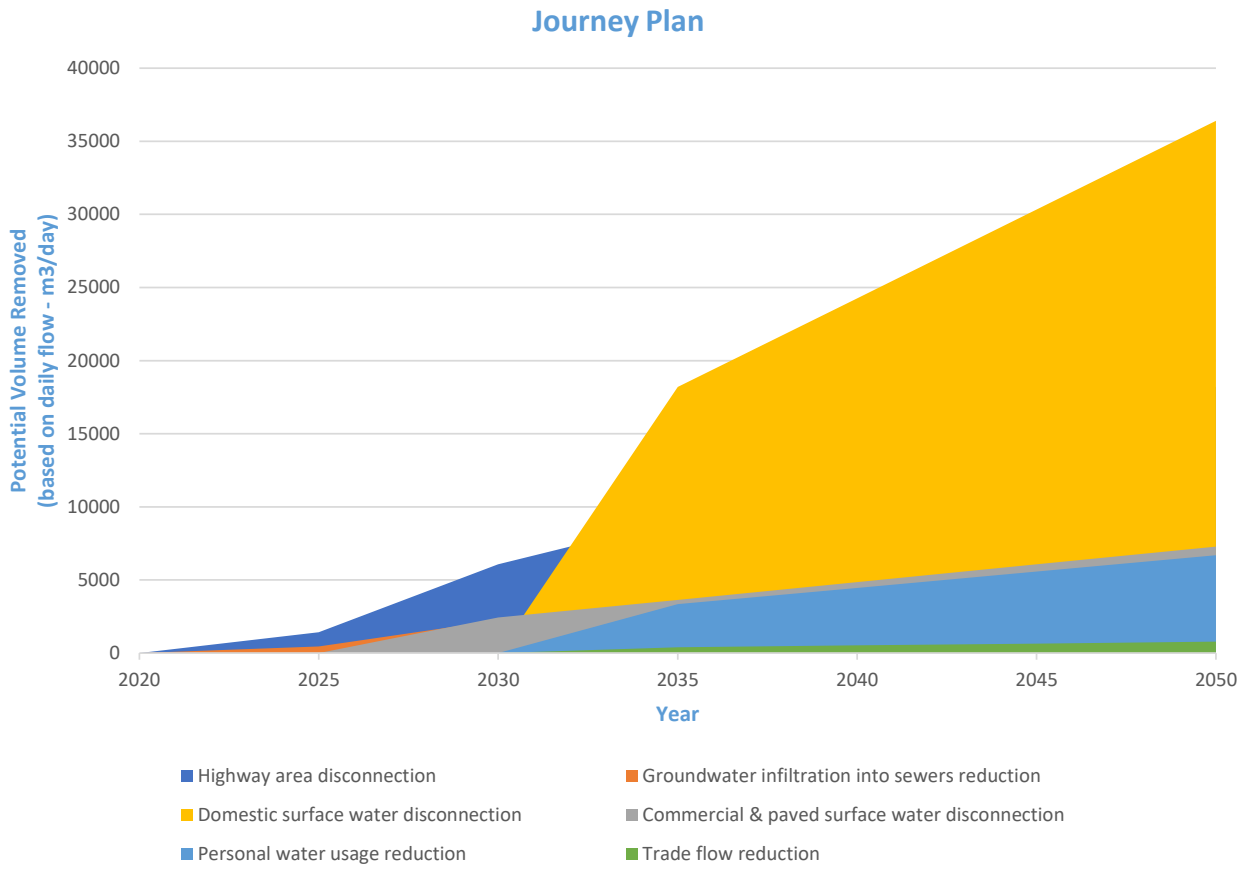


Figure 8 - Journey Plan

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 todays 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 probabilty of occuring 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 seperate cost and would be required in addition to the choice of scenarios for flooding protection in Table 5. The chosen scenarios for Storm overflows nd flooding are to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain Existing Performance*	-	£16,000,000.00	£30,000,000.00
40 spills in a Typical Year	£30,000,000.00	£32,000,000.00	£33,000,000.00
20 spills in a Typical Year	£45,000,000.00	£49,000,000.00	£55,000,000.00
10 spills in a Typical Year	£69,000,000.00	£74,000,000.00	£86,000,000.00
0 spills in a Typical Year	£183,000,000.00	£194,000,000.00	£208,000,000.00
Equivalent No. Olympic Swimming Pools in 10 spills scenario	194.00	203.00	193.00

* 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	£5,000,000	£6,000,000	£8,000,000
External escapes in gardens	£6,000,000	£9,000,000	£7,000,000
Escapes in highways	£147,000,000	£155,000,000	£162,000,000
No future flooding	-	£58,000,000	£8,000,000
Total	£158,000,000.00	£228,000,000	£185,000,000

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 asessments 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
SEION 1	0
SEION 2	0
LLANDEGAI	0
TAL-Y-BONT (SE OF BANGOR)	0
RHIWLAS	0
PENMAENMAWR	0
LLANFAIRFECHAN	0
TREGARTH	0
BANGOR TREBORTH	9
BETHESDA	0

DWMP Tactial Planning Catchment Summary

Seiont - 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 Seiont - lower planning catchment lies within the Llyn and Eryri river basin catchment, (see Figure 1 below), it consists of 9 wastewater catchments (see Figure 2 below). There is a combined population of 22283, this is set to decrease to 17415 by 2050, a change of -22%. There is a total sewer length of 126km, with a foul sewer length of 28km, a surface water length of 17km and a combined sewer length of 80km. There are 9 Wastewater Treatment Works (WwTW), 26 Sewerage Pumping Stations (SPSs), and 26 Combined Storm Overflows (CSOs) across this tactical planning unit.

The Seiont - lower catchment sits adjacent to the Menai Straits, opposite Anglesey. The River Seiont flows down to join the Sea near Caernarfon. Caernarfon and Llanrug are its major urban areas.

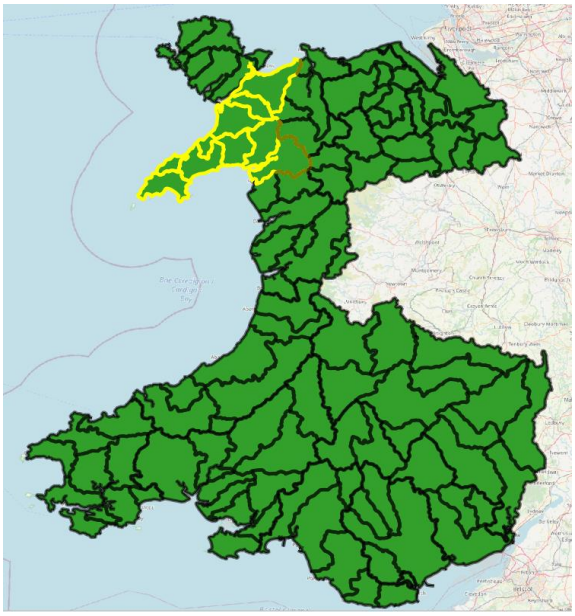


Figure 1 - River basin location detailing the associated tactial planning catchments

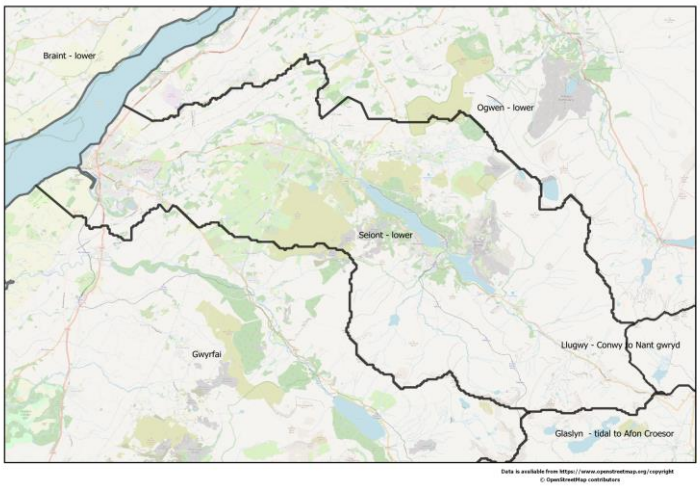


Figure 2- Tactical planning catchments

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 enagement meetings area 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.

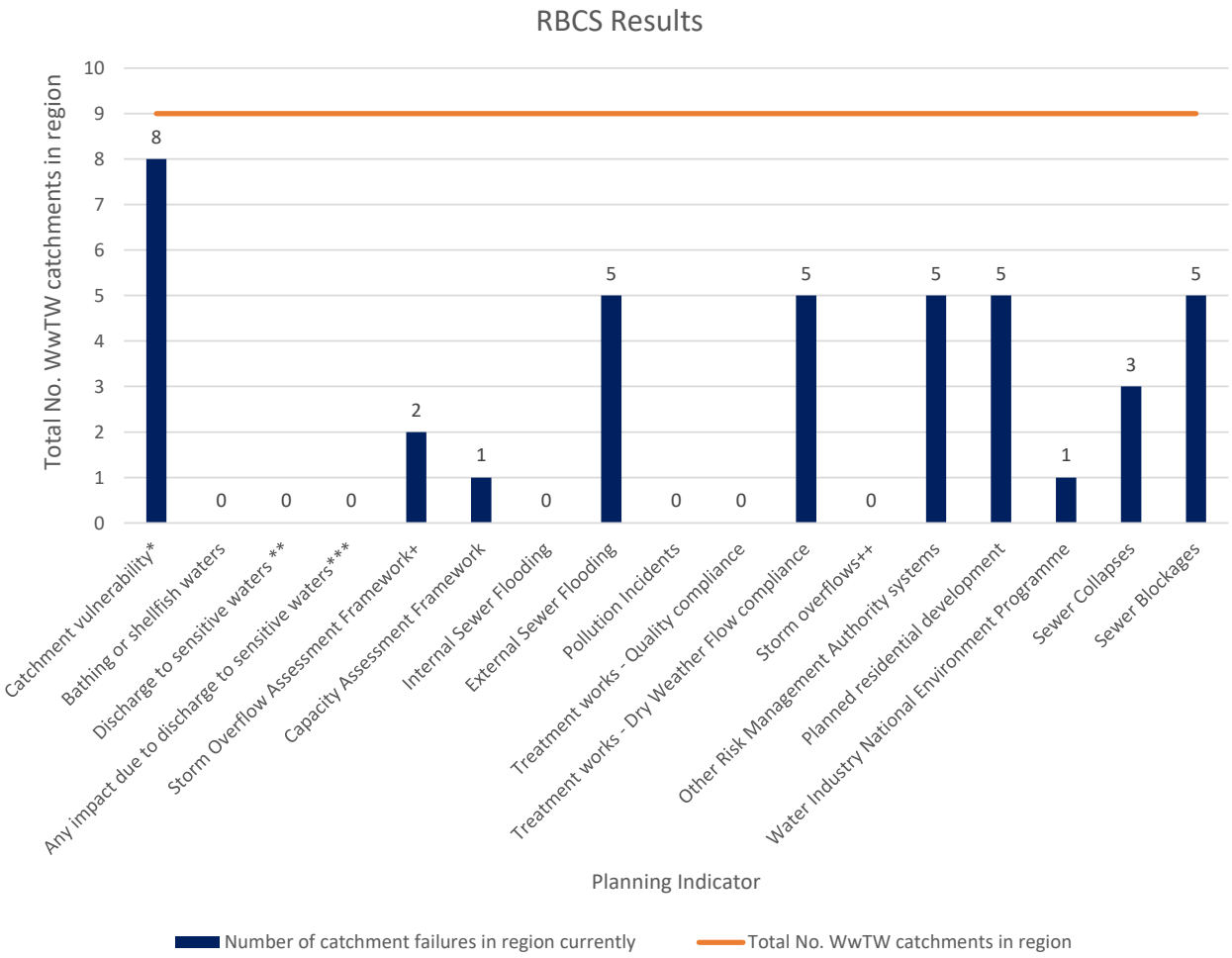
Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

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 Llyn and Eryri region is set to decrease to 17400 by 2050, a change of -22% based on our future projections. However there are major developments in localised areas that will contribute to future pressures on the network, including Caernarfon - Stad ddiwydiannol Cibyn and Llanberis - Glyn Rhonwy.

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 Seiont - lower catchment the biggest concern indicated by the RBCS is 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.

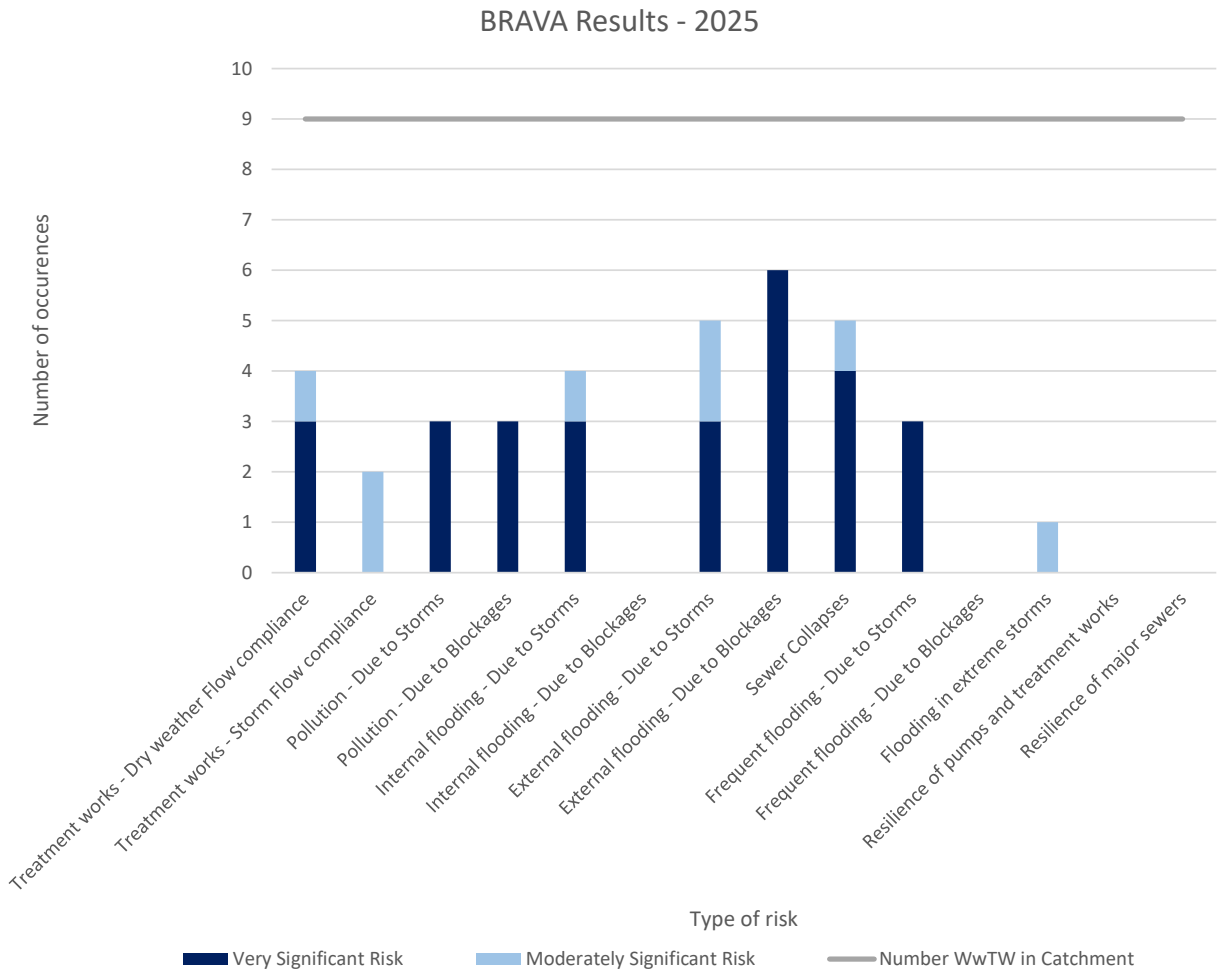


Figure 4 - BRAVA 2025 Summary

In 2025, external flooding due to blockages and storms, and sewer collapses are the biggest concern in the Seiont - lower catchment.

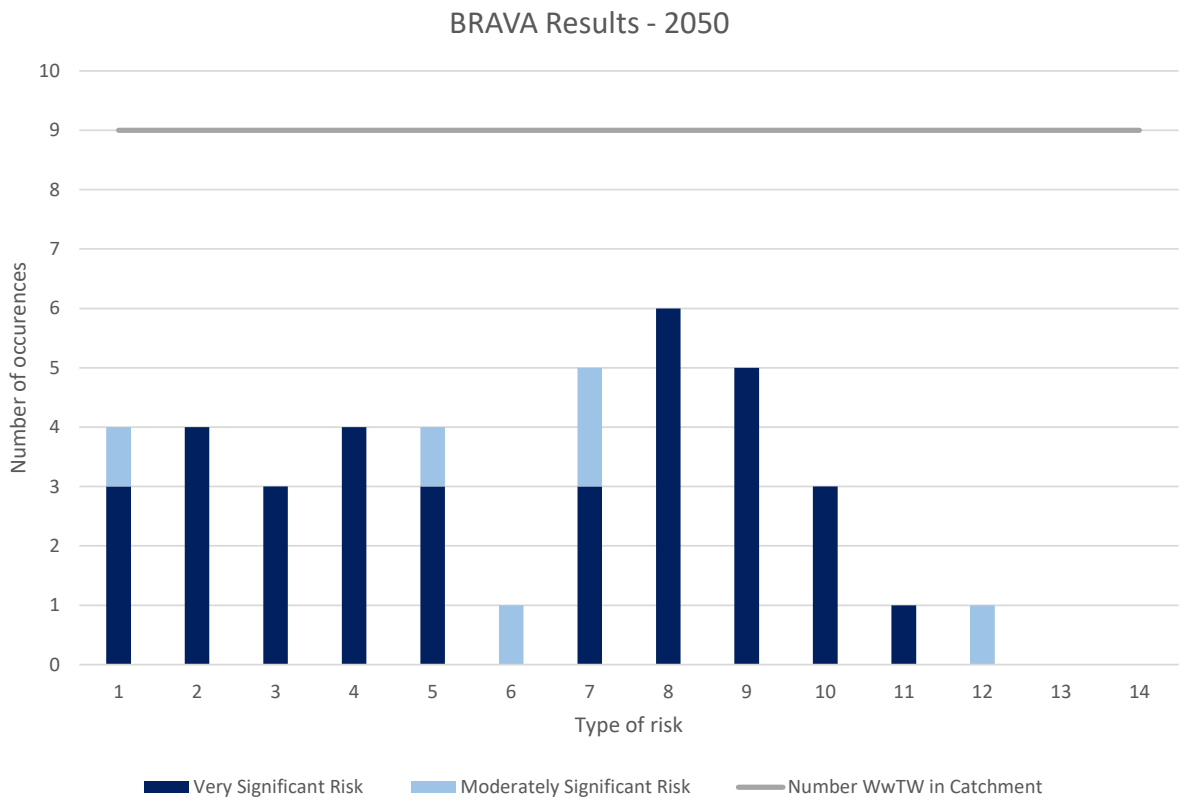


Figure 5 - BRAVA 2050 Summary

In 2050, external flooding due to blockages and storms, and sewer collapses are the biggest concern in the Seiont - lower 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.

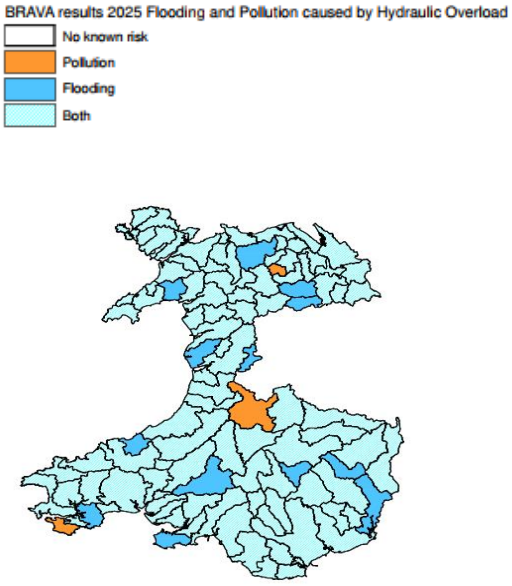


Figure 6 - Associated Strategic Planning Areas priority (2025)

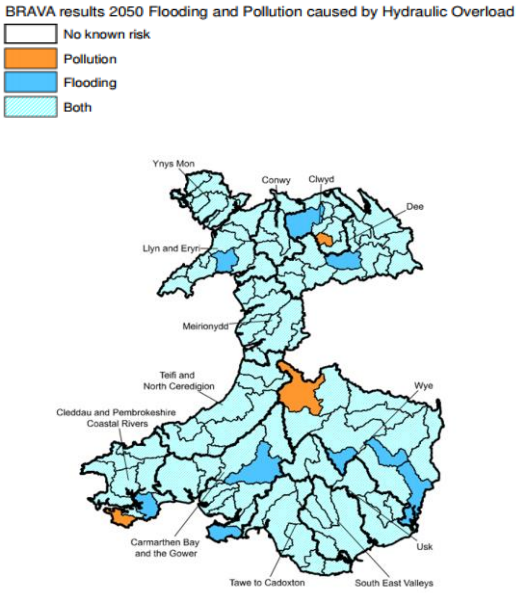


Figure 7 - Associated Strategic Planning Areas

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. Seiont - lower 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
Seiont - 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.

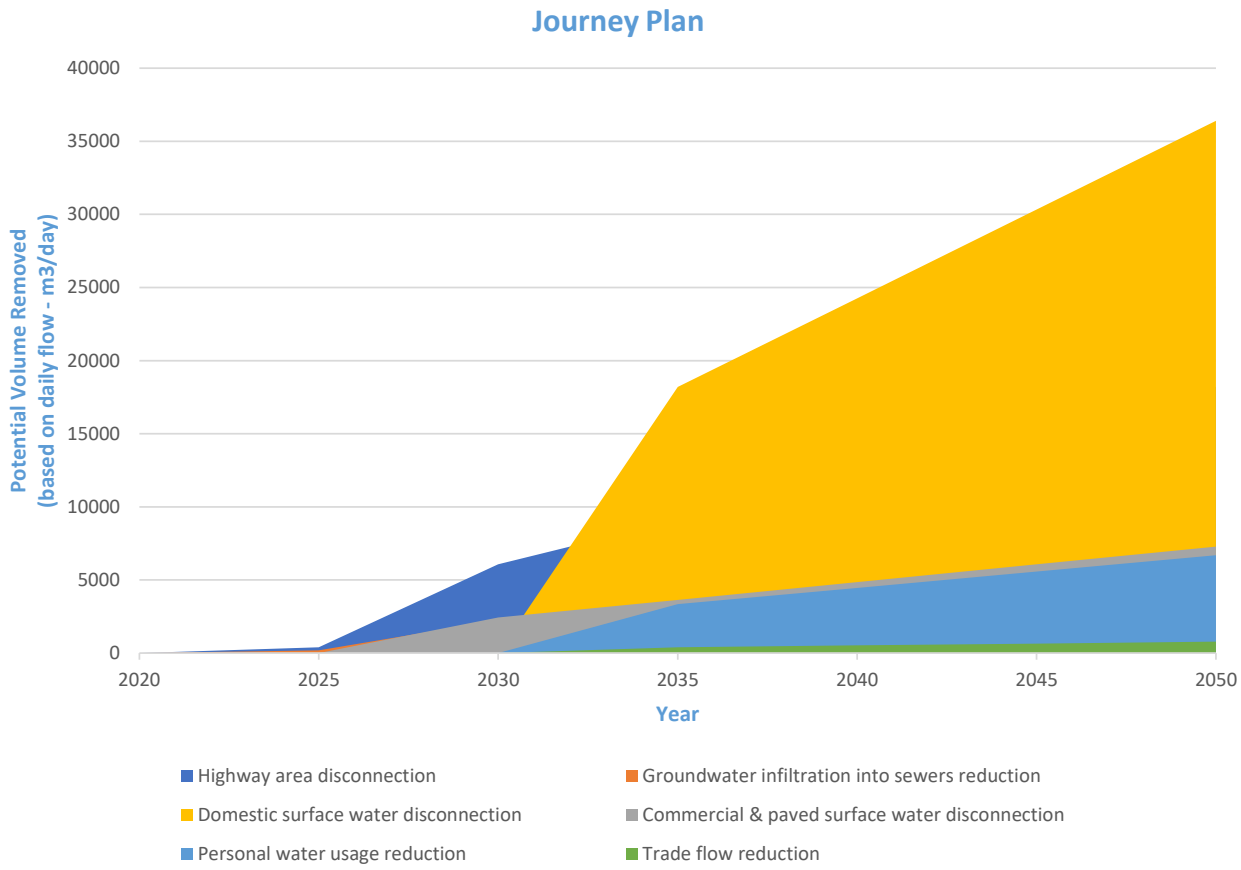


Figure 8 - Journey Plan

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 todays 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 probabilty of occuring 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 seperate cost and would be required in addition to the choice of scenarios for flooding protection in Table 5. The chosen scenarios for Storm overflows nd flooding are to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain Existing Performance*	-	£16,000,000.00	£22,000,000.00
40 spills in a Typical Year	£4,000,000.00	£4,000,000.00	£6,000,000.00
20 spills in a Typical Year	£7,000,000.00	£9,000,000.00	£9,000,000.00
10 spills in a Typical Year	£12,000,000.00	£14,000,000.00	£18,000,000.00
0 spills in a Typical Year	£26,000,000.00	£37,000,000.00	£43,000,000.00
Equivalent No. Olympic Swimming Pools in 10 spills scenario	36.00	68.00	76.00

* 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	£1,000,000	£2,000,000	£1,000,000
External escapes in gardens	£0	£0	£0
Escapes in highways	£16,000,000	£21,000,000	£25,000,000
No future flooding	-	£20,000,000	£6,000,000
Total	£17,000,000.00	£43,000,000	£32,000,000

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 asessments 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
DINORWIC 3 MINFFORDD	0
DINORWIC 4 CHAPEL	0
GALLT-Y-FOEL (DEINIOLEN)	0
NANT PERIS	0
PENISA'R WAUN WwTW	0
DEINIOLEN BRYNREFAIL	0
LLANBERIS	0
LLANRUG	0
CAERNARFON	0

DWMP Tactial Planning Catchment Summary

Soch

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 Soch planning catchment lies within the Llyn and Eryri river basin catchment, (see Figure 1 below), it consists of 10 wastewater catchments (see Figure 2 below). There is a combined population of 8027, this is set to decrease to 6066 by 2050, a change of -24%. There is a total sewer length of 62km, with a foul sewer length of 34km, a surface water length of 0km and a combined sewer length of 26km. There are 10 Wastewater Treatment Works (WwTW), 15 Sewerage Pumping Stations (SPSs), and 9 Combined Storm Overflows (CSOs) across this tactical planning unit.

The Soch catchment sits at the end of the Llyn Peninsula. The River Soch flows down to join the sea at Abersoch. Abersoch and Mynytho are its largest urban areas.

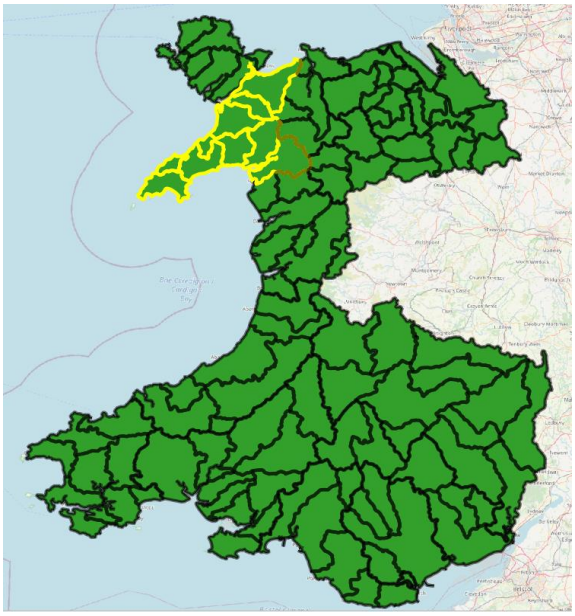


Figure 1 - River basin location detailing the associated tactial planning catchments

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 enagement meetings area 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.

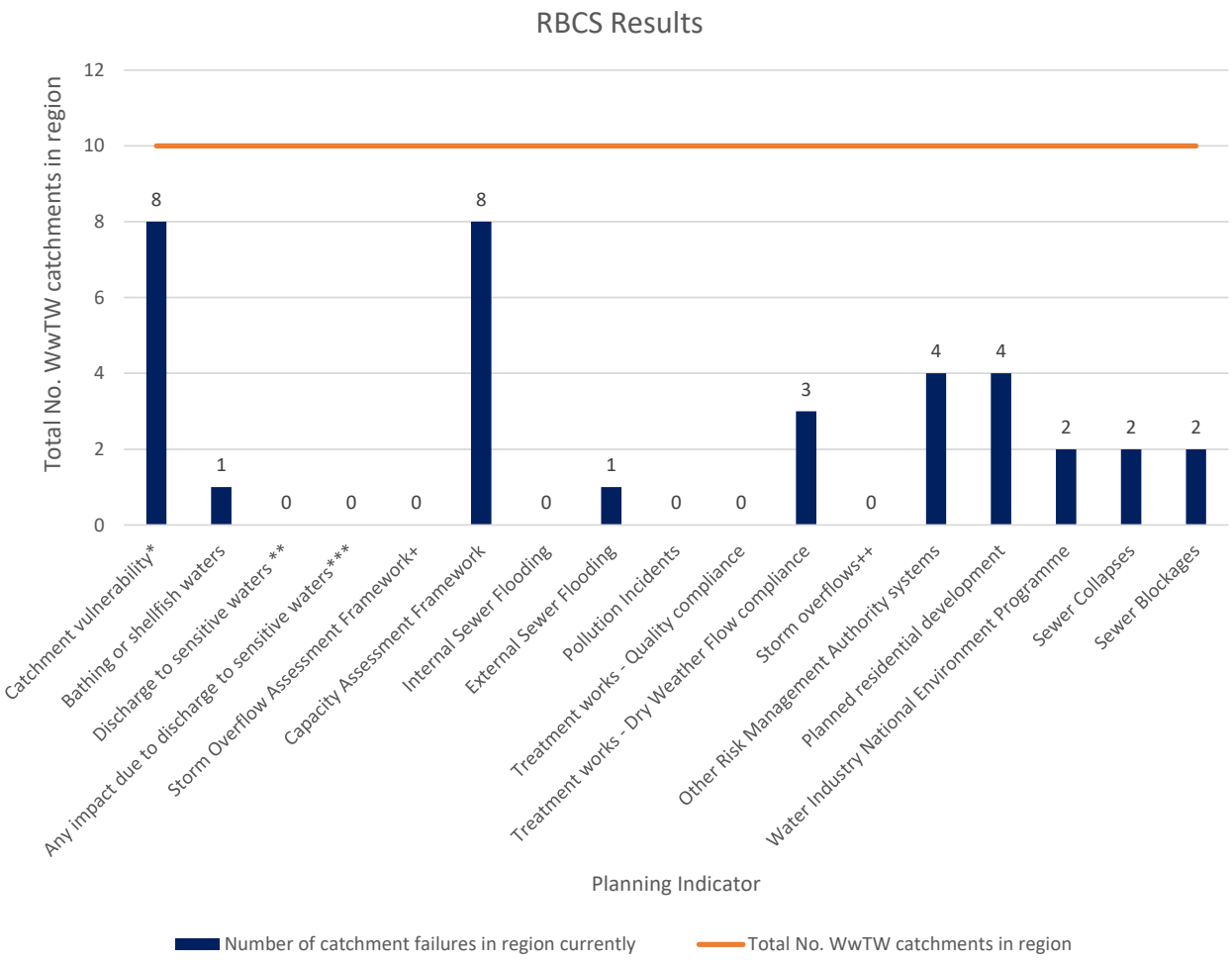
Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

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 Llyn and Eryri region is set to decrease to 6100 by 2050, a change of -24% based on our future projections. However there are major developments in localised areas that will contribute to future pressures on the network, including Botwnnog - Cae Cefn Capel and land adjacent to Pentre.

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 Soch catchment the biggest concerns indicated by the RBCS is 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.

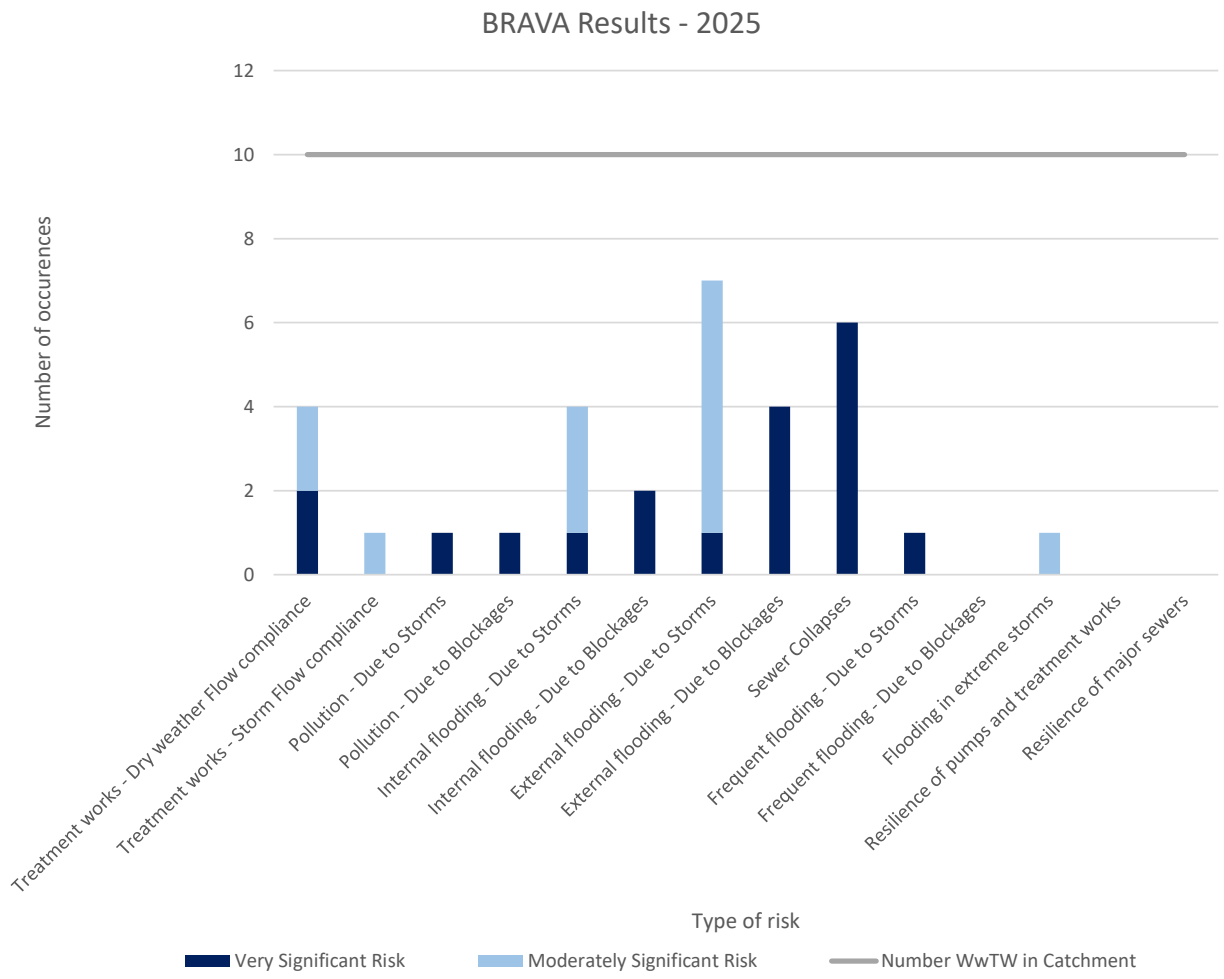


Figure 4 - BRAVA 2025 Summary

In 2025, external flooding due to storms and sewer collapses are the biggest concern in the Soch catchment.

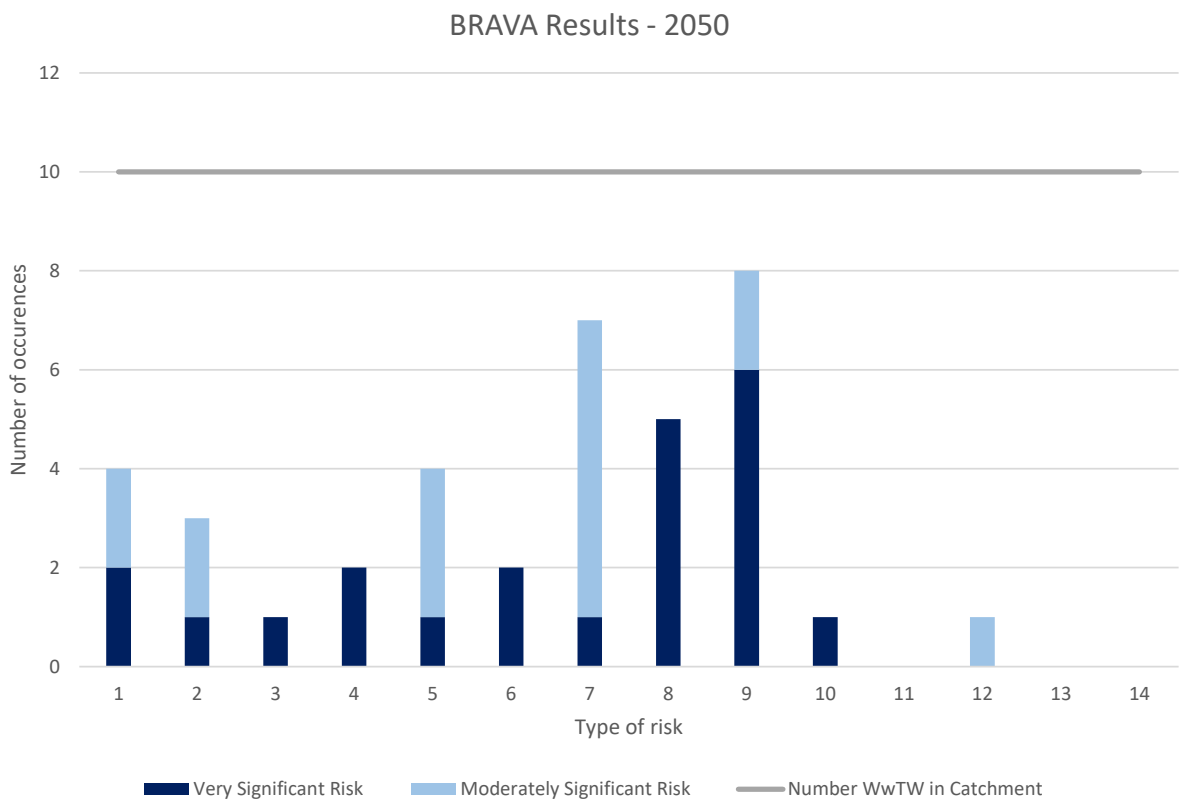


Figure 5 - BRAVA 2050 Summary

In 2050, external flooding due to storms and sewer collapses are the biggest concern in the Soch 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.

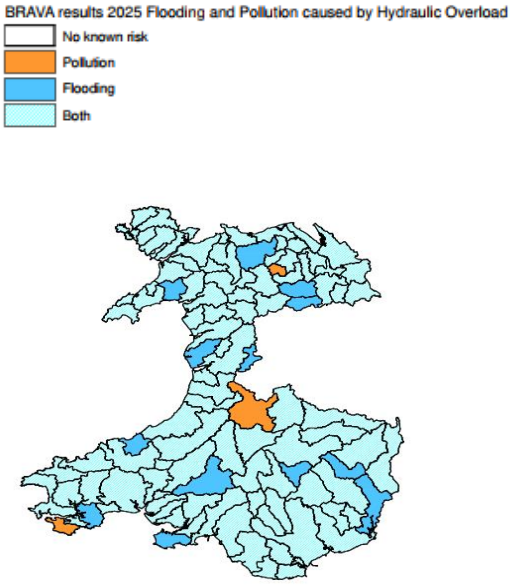


Figure 6 - Associated Strategic Planning Areas priority (2025)

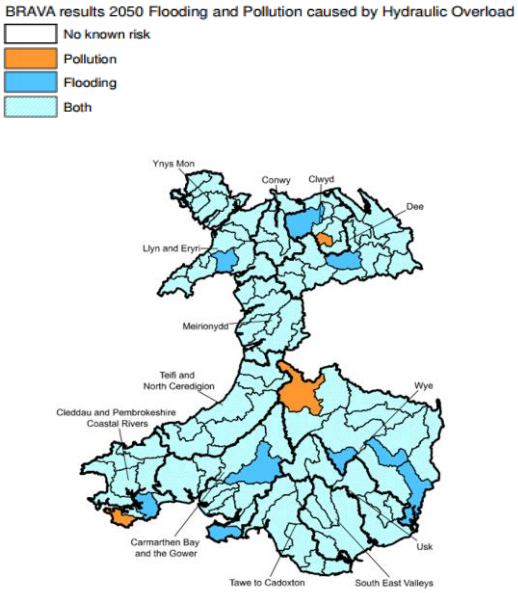


Figure 7 - Associated Strategic Planning Areas

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. Soch 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
Soch	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.

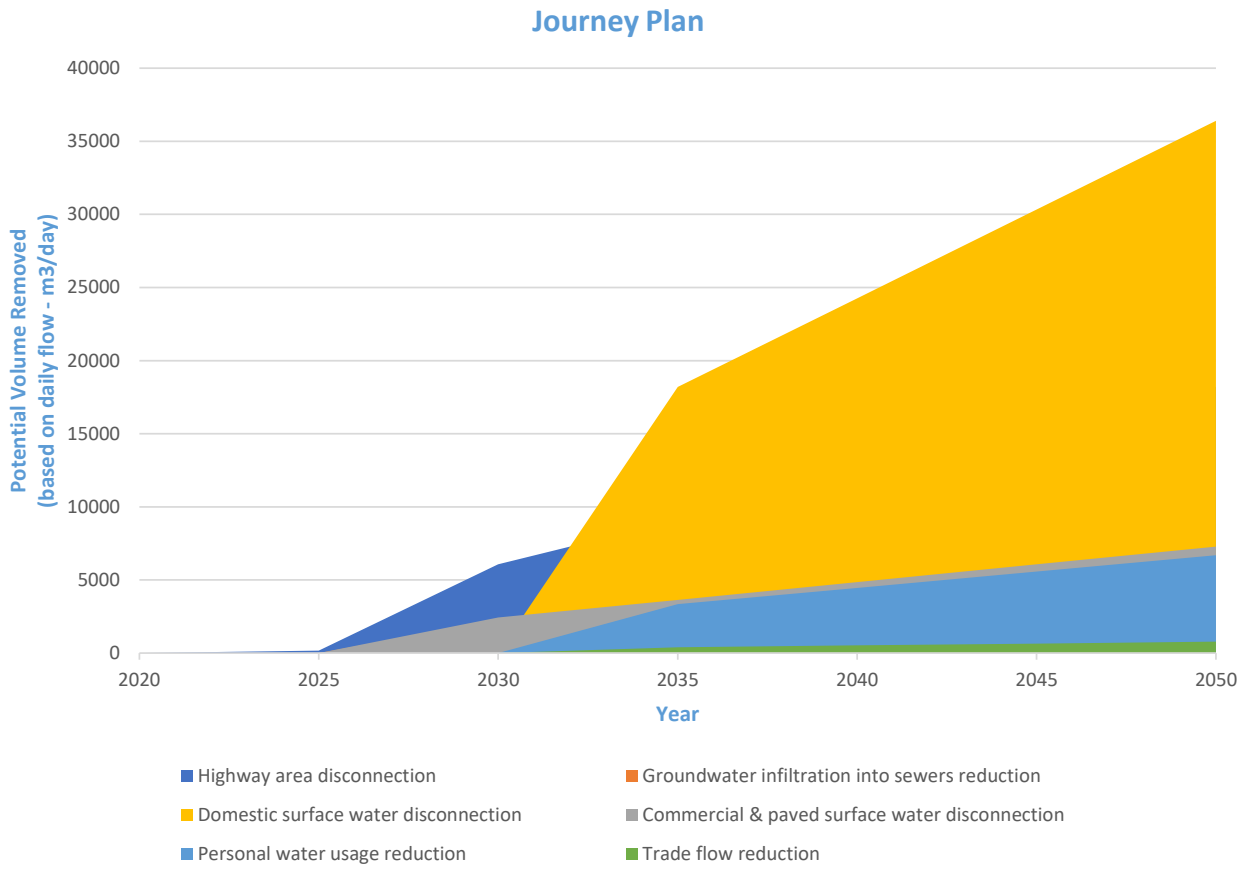


Figure 8 - Journey Plan

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 todays 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 probabilty of occuring 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 seperate cost and would be required in addition to the choice of scenarios for flooding protection in Table 5. The chosen scenarios for Storm overflows nd 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	£0.00	£0.00	£0.00
20 spills in a Typical Year	£4,000,000.00	£3,000,000.00	£4,000,000.00
10 spills in a Typical Year	£6,000,000.00	£6,000,000.00	£6,000,000.00
0 spills in a Typical Year	£9,000,000.00	£9,000,000.00	£10,000,000.00
Equivalent No. Olympic Swimming Pools in 10 spills scenario	7.00	8.00	8.00

* 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	£3,000,000	£3,000,000	£4,000,000
External escapes in gardens	£0	£0	£0
Escapes in highways	£5,000,000	£6,000,000	£8,000,000
No future flooding	-	£9,000,000	£13,000,000
Total	£8,000,000.00	£18,000,000	£25,000,000

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 asessments 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
BOTWNNOG	0
COED Y FRON	0
SARN	0
BRYNCROES	0
LLANIESTYN	0
Y RHIW STW	0
MYNYTHO	0
SARN MEYLLTEYRN	0
ABERDARON STW	0
ABERSOCH	0

DWMP Tactial Planning Catchment Summary

Un-named near Soch catchment

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 near Soch catchment planning catchment lies within the Llyn and Eryri river basin catchment, (see Figure 1 below), it consists of 3 wastewater catchments (see Figure 2 below). There is a combined population of 3462, this is set to decrease to 2879 by 2050, a change of -17%. There is a total sewer length of 37km, with a foul sewer length of 7km, a surface water length of 2km and a combined sewer length of 25km. There are 3 Wastewater Treatment Works (WwTW), 8 Sewerage Pumping Stations (SPSs), and 15 Combined Storm Overflows (CSOs) across this tactical planning unit.

The Un-named near Soch catchment catchment sits on the northern end of the Llyn Peninsula. Nefyn and Morfa Nefyn are its largest urban areas.

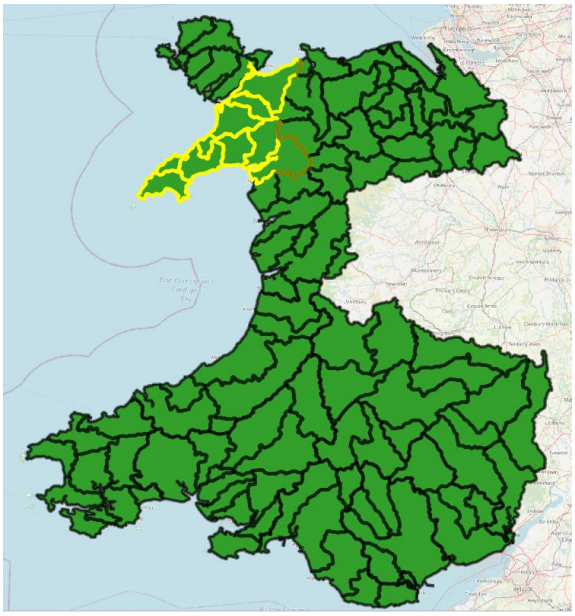


Figure 1 - River basin location detailing the associated tactial planning catchments

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 enagement meetings area 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.

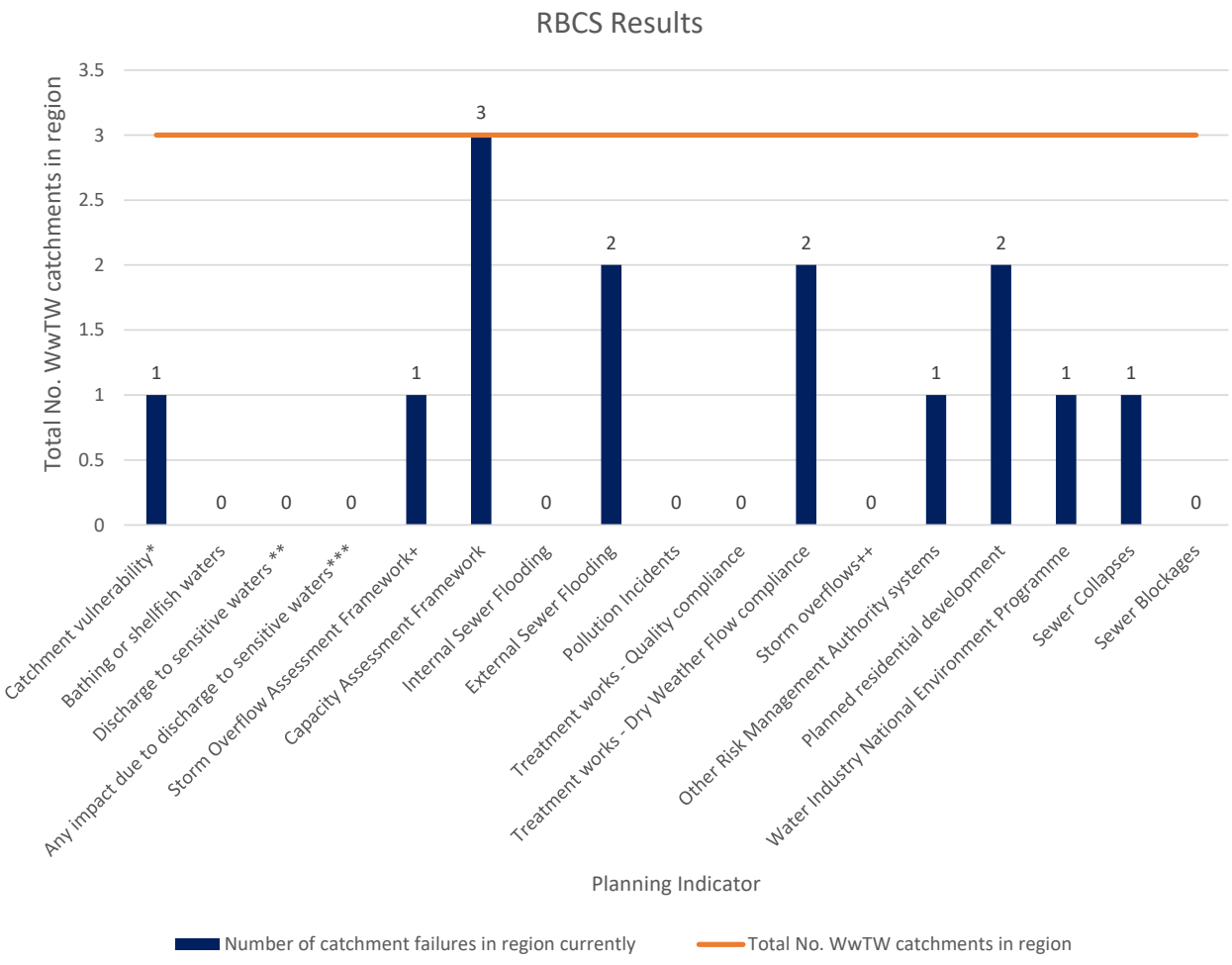
Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

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 Llyn and Eryri region is set to decrease to 2900 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, including Nefyn - Stad Ddiwydiannol Nefyn and land adjacent to Helyg.

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 near Soch catchment the biggest concern indicated by the RBCS is 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.

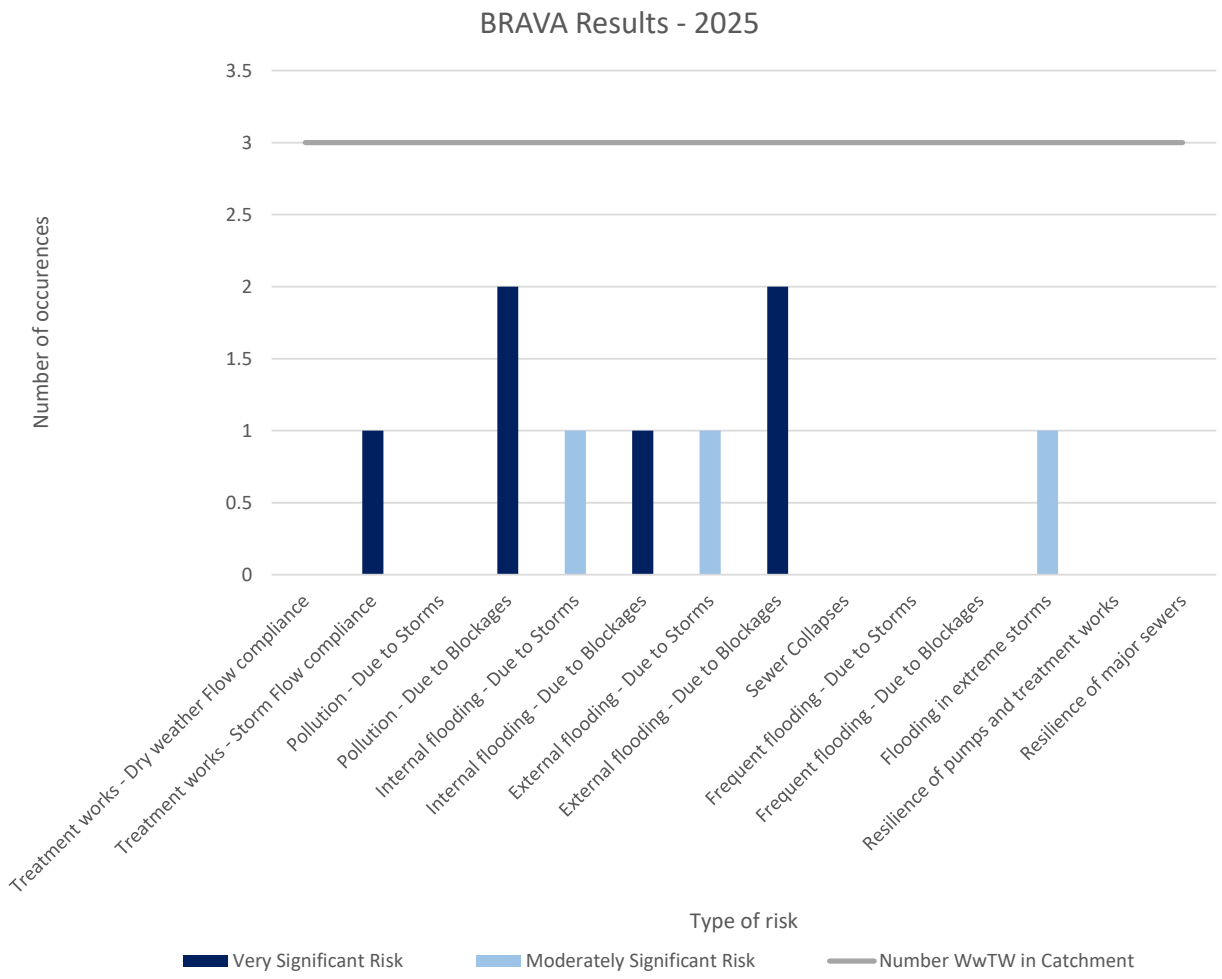


Figure 4 - BRAVA 2025 Summary

In 2025, external flooding and pollution due to blockages are the biggest concerns in the Un-named near Soch catchment catchment.

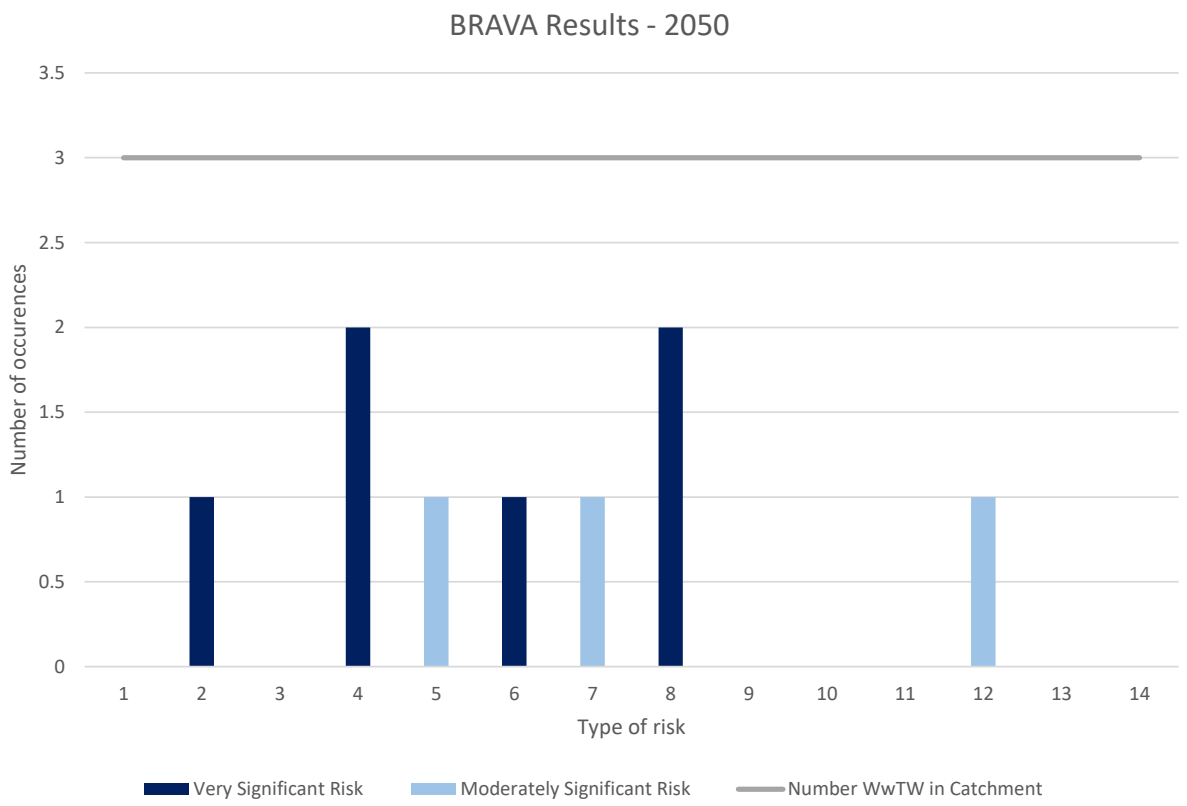


Figure 5 - BRAVA 2050 Summary

In 2050, external flooding and pollution due to blockages are the biggest concerns in the Un-named near Soch catchment 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.

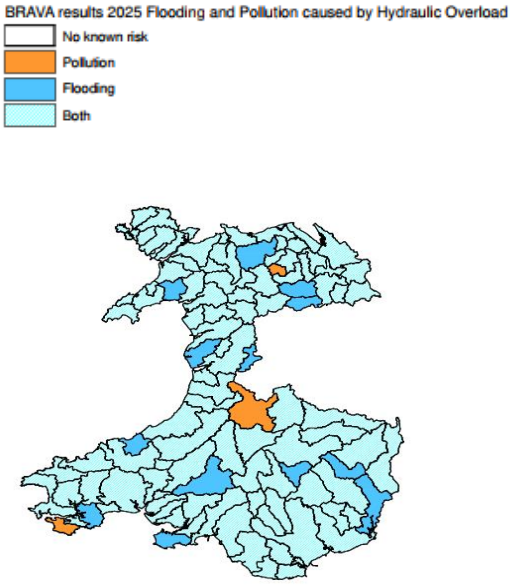


Figure 6 - Associated Strategic Planning Areas priority (2025)

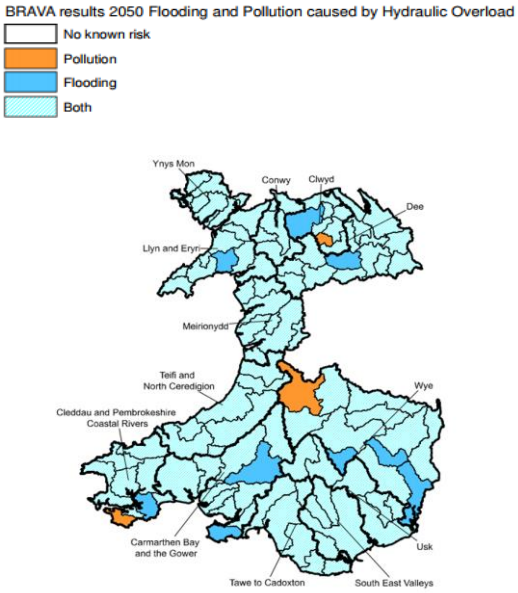


Figure 7 - Associated Strategic Planning Areas

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 near Soch catchment 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 near Soch catchment	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.

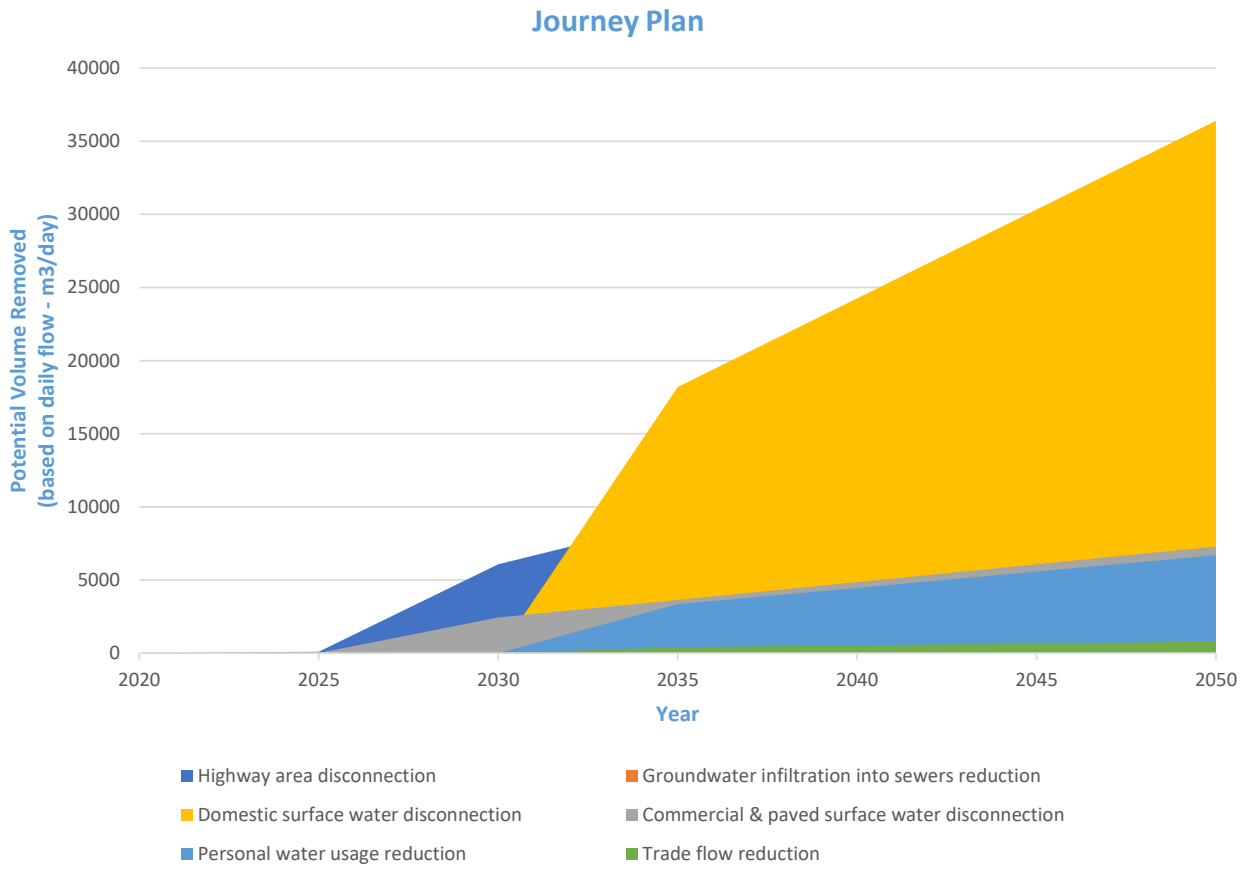


Figure 8 - Journey Plan

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 todays 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 probabilty of occuring 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 seperate cost and would be required in addition to the choice of scenarios for flooding protection in Table 5. The chosen scenarios for Storm overflows nd flooding are to be added together.

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain Existing Performance*	-	£21,000,000.00	£34,000,000.00
40 spills in a Typical Year	£4,000,000.00	£4,000,000.00	£4,000,000.00
20 spills in a Typical Year	£9,000,000.00	£8,000,000.00	£10,000,000.00
10 spills in a Typical Year	£12,000,000.00	£12,000,000.00	£15,000,000.00
0 spills in a Typical Year	£21,000,000.00	£22,000,000.00	£27,000,000.00
Equivalent No. Olympic Swimming Pools in 10 spills scenario	54.00	59.00	64.00

* 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	£1,000,000	£2,000,000	£2,000,000
External escapes in gardens	£2,000,000	£2,000,000	£4,000,000
Escapes in highways	£2,000,000	£2,000,000	£4,000,000
No future flooding	-	£1,000,000	£4,000,000
Total	£5,000,000.00	£7,000,000	£14,000,000

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 asessments 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
DINAS (LLEYN PENINSULA)	0
TUDWEILIOG	0
NEFYN NEW SWK	0

DWMP Tactial Planning Catchment Summary

Un-named to Caernarfon Bay 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 to Caernarfon Bay South planning catchment lies within the Llyn and Eryri river basin catchment, (see Figure 1 below), it consists of 6 wastewater catchments (see Figure 2 below). There is a combined population of 1106, this is set to increase to 1135 by 2050, a change of 3%. There is a total sewer length of 8km, with a foul sewer length of 4km, a surface water length of 0km and a combined sewer length of 4km. There are 6 Wastewater Treatment Works (WwTW), 0 Sewerage Pumping Stations (SPSs), and 2 Combined Storm Overflows (CSOs) across this tactical planning unit.

The Un-named to Caernarfon Bay South catchment sits on the northern edge of the Llyn Peninsula. Trefor and Llanaelhaearn are its largest urban areas.

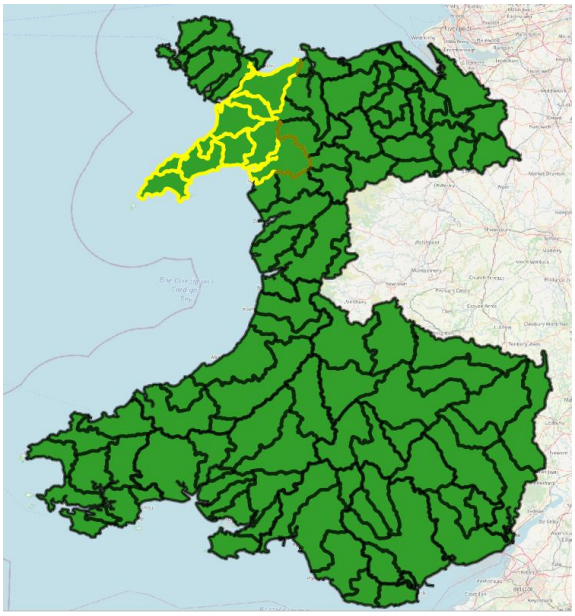


Figure 1 - River basin location detailing the associated tactial planning catchments

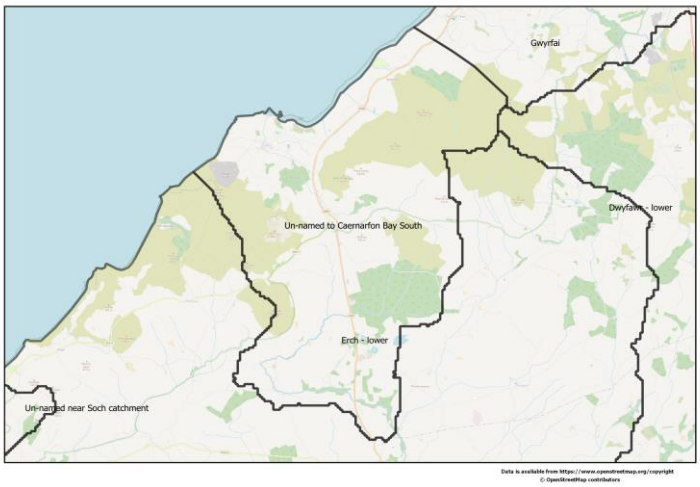


Figure 2- Tactical planning catchments

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 enagement meetings area 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.

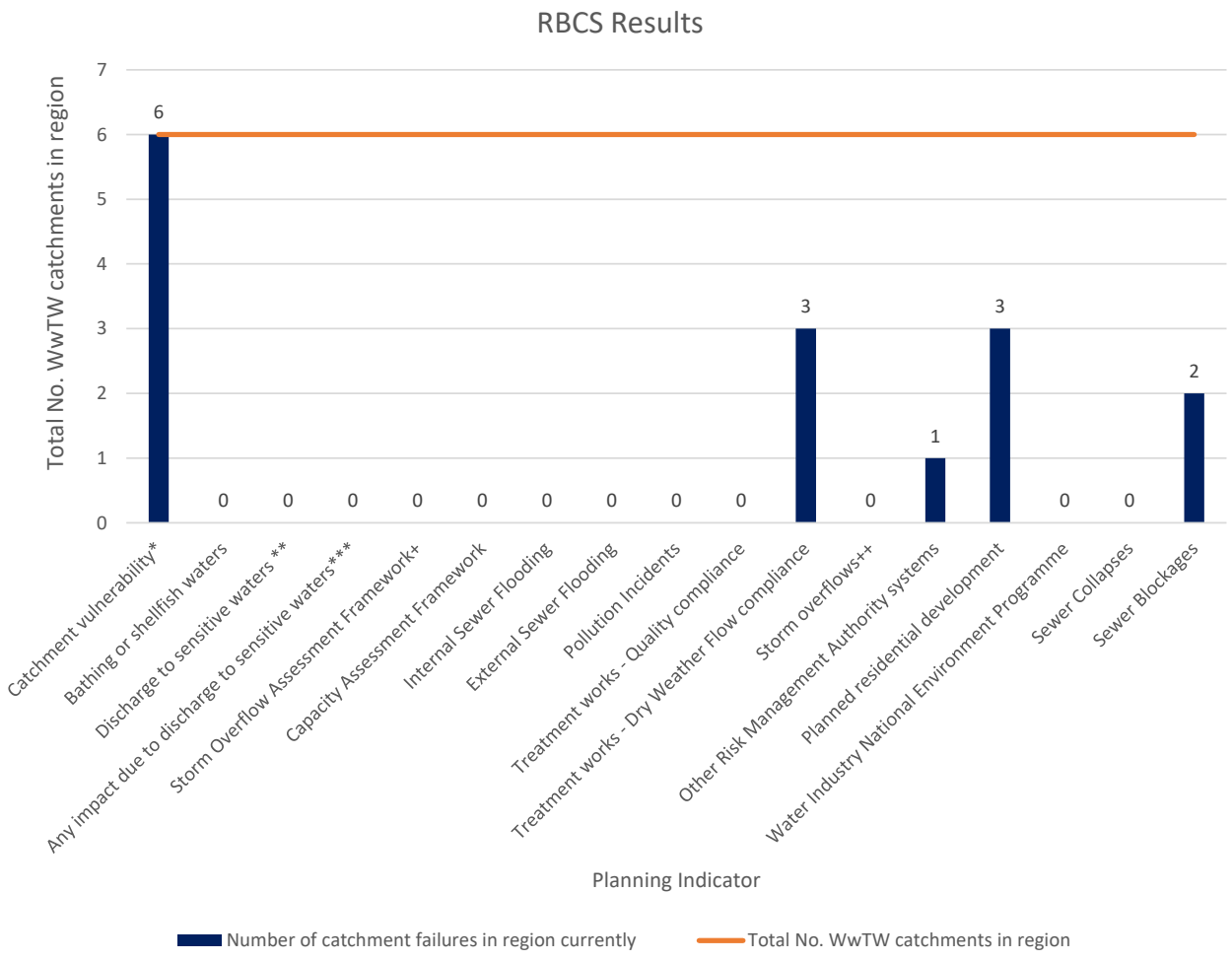
Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

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 Meirionnydd region is set to decrease to 7000 by 2050, a change of -45% 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 to Caernarfon Bay South catchment the biggest concern indicated by the RBCS is - 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.

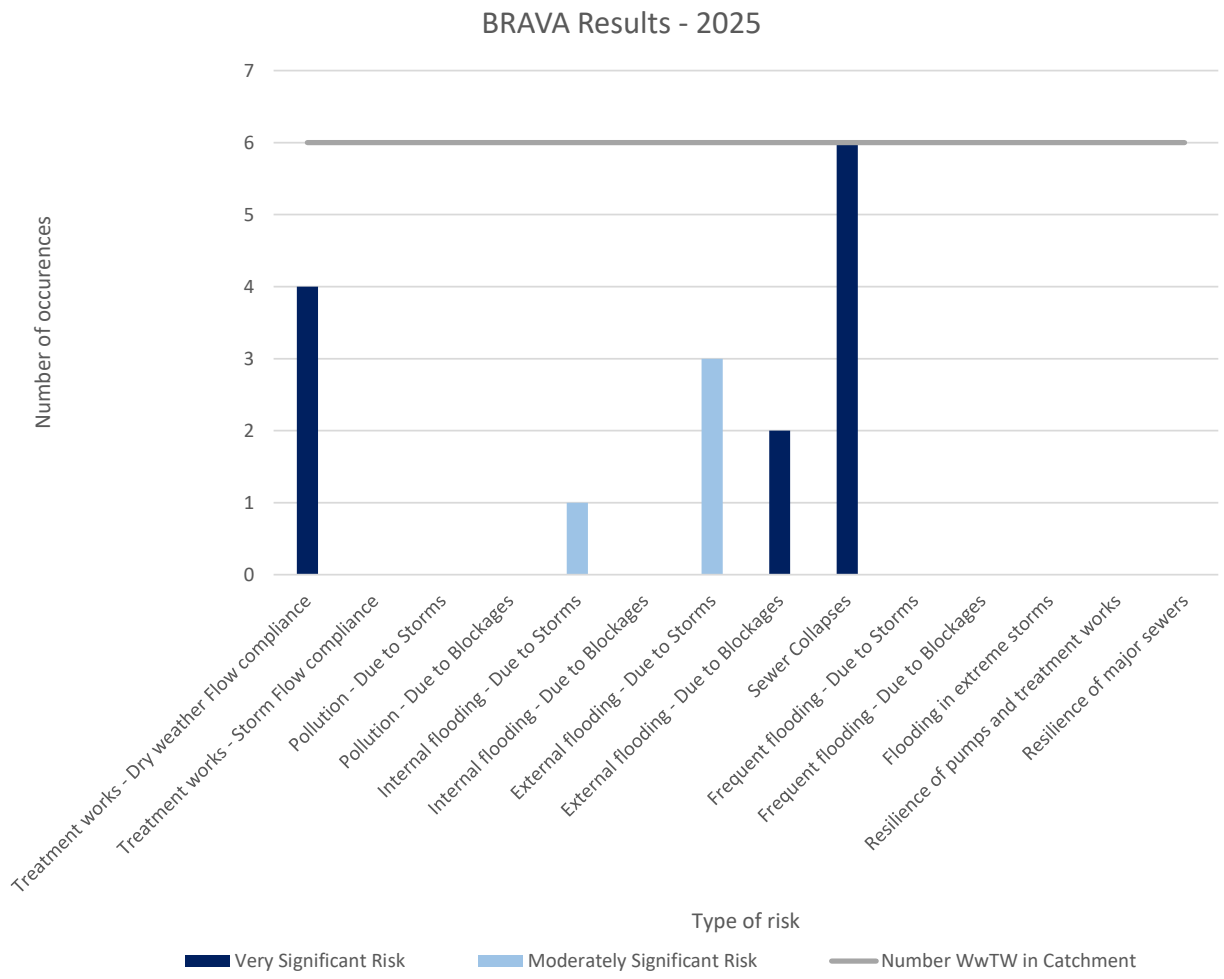


Figure 4 - BRAVA 2025 Summary

In 2025, sewer collapses and treatment works - dry weather flow compliance are the biggest concerns in the Un-named to Caernarfon Bay South catchment.

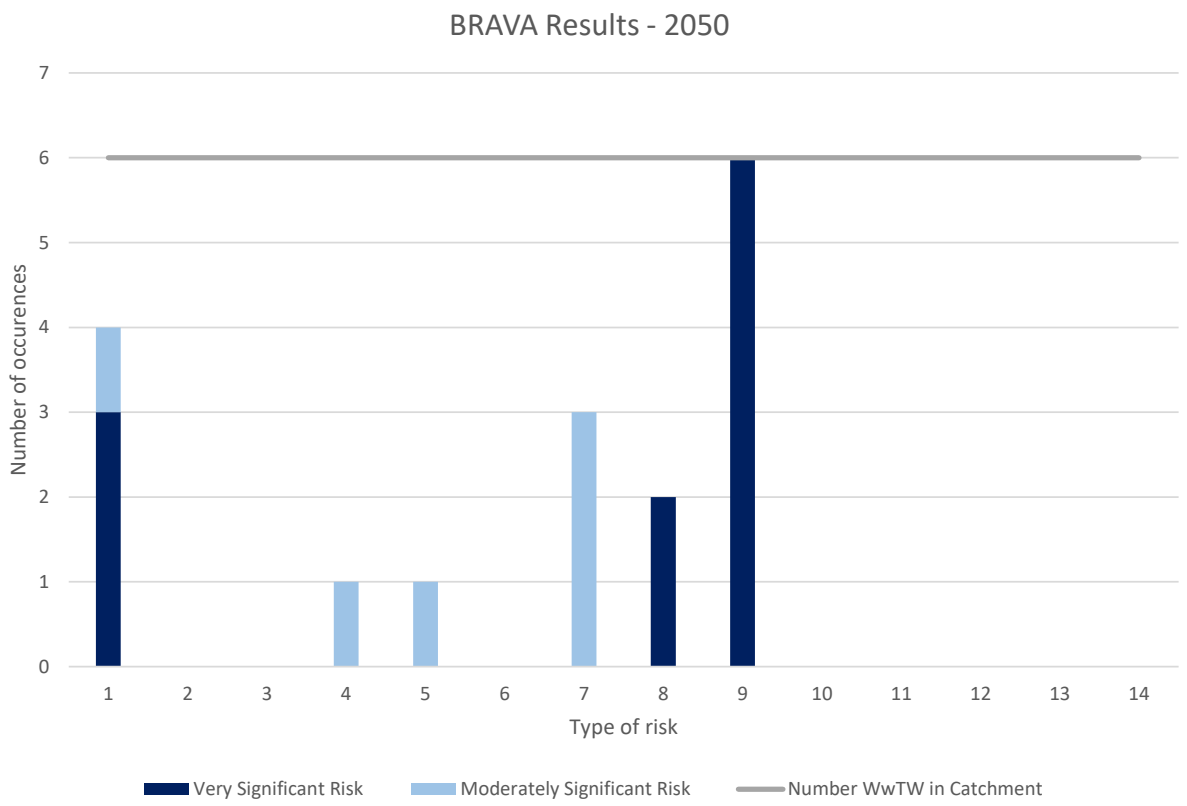


Figure 5 - BRAVA 2050 Summary

In 2050, sewer collapses and treatment works - dry weather flow compliance are the biggest concerns in the Un-named to Caernarfon Bay 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.

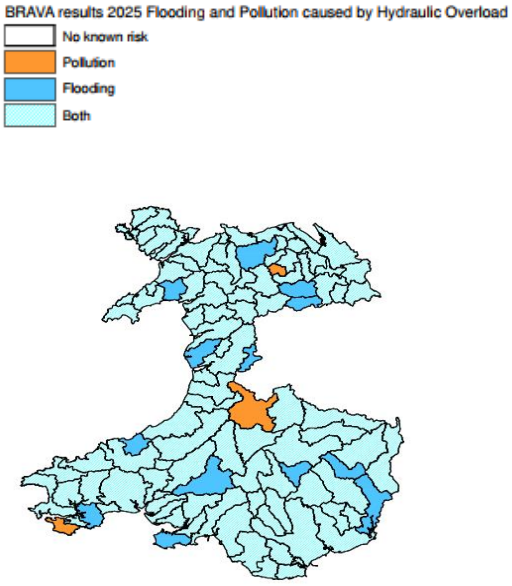


Figure 6 - Associated Strategic Planning Areas priority (2025)

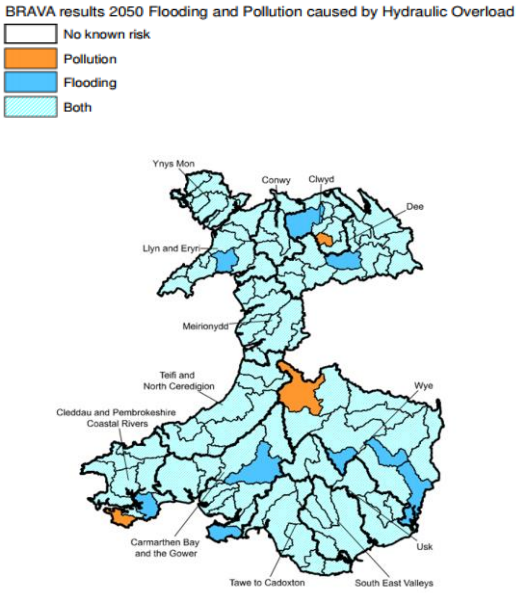


Figure 7 - Associated Strategic Planning Areas

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 to Caernarfon Bay 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 to Caernarfon Bay 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.

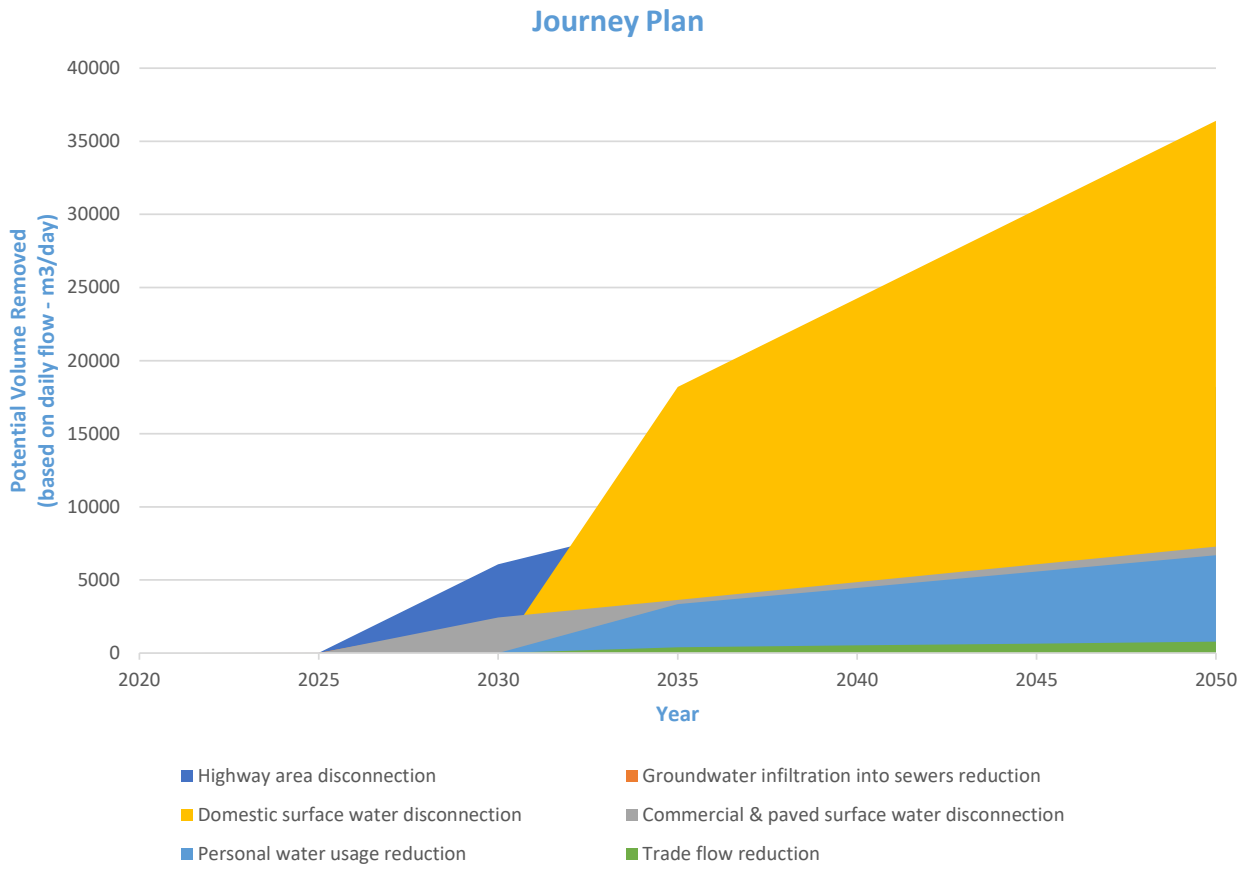


Figure 8 - Journey Plan

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 todays 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 probabilty of occuring 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 seperate cost and would be required in addition to the choice of scenarios for flooding protection in Table 5. The chosen scenarios for Storm overflows nd 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	£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	£7,000,000.00	£7,000,000.00	£8,000,000.00
Equivalent No. Olympic Swimming Pools in 10 spills scenario	29.00	33.00	35.00

* 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 asessments 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
TREFOR (GWYDIR MAWR)	0
TREFOR NORTH-WEST	0
SEA VIEW COTTAGES	0
TYDDYN HYWEL	0
GYRN GOCH	0
LLANAELHAEARN	0