River Basin Catchment Summary

Cleddau and Pembrokeshire Coastal Rivers

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

Cleddau and Pembrokeshire Coastal Rivers (see Figure 1 below) consists of 72 wastewater catchments with a total population of 167995. There is a total sewer length of 910km, where 564km is associated to the foul system, 29km is associated to the surface water system and 393km is associated to the combined system. There are 72 Wastewater Treatment Works (WwTW), 219 Sewerage Pumping Stations (SPSs), and 196 Combined Storm Overflows (CSOs) across this river basin catchment level.

The catchment covers the most south-westerly point of Wales stretching from Newport in the north to Pembroke in the Tenby in the South and we estimate it has a population equivalent of approximately 132,986.
The most significant river in Cleddau and Pembrokeshire Coastal Rivers is the River Cleddau which drains north to south discharging to the estuary at Milford Haven. There are some smaller lengths of main river draining local catchments, the more significant of which is the River Nevern draining to Newport on the north coast of the catchment. The largest urban areas within the catchment area are Milford Haven, Pembroke Dock, Haverford West, Fishguard, Newport and St Davids. The area is characterised by seasonal tourist visitors.

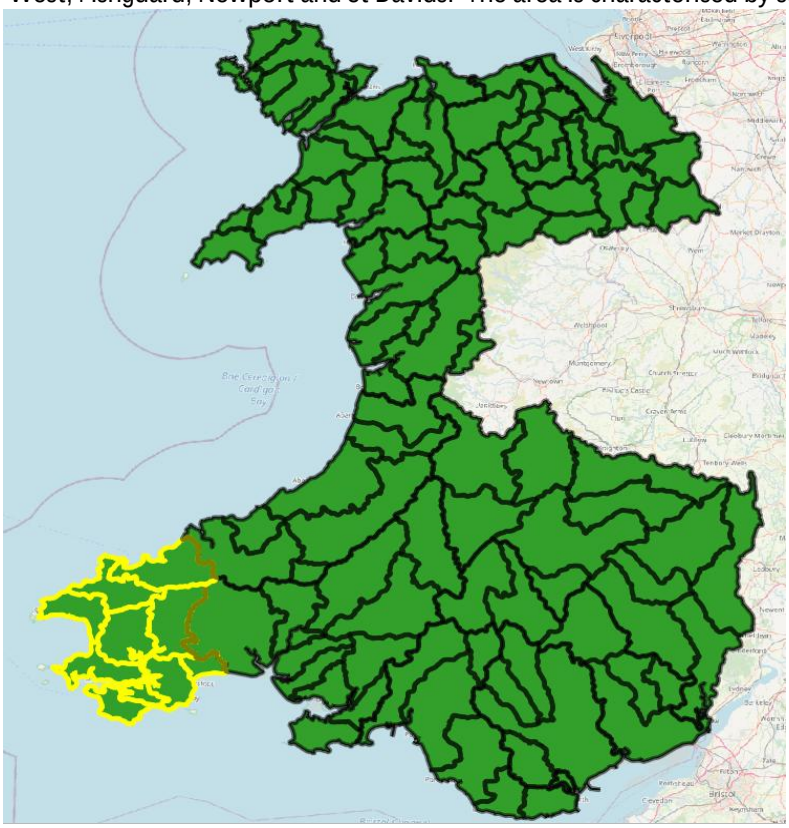


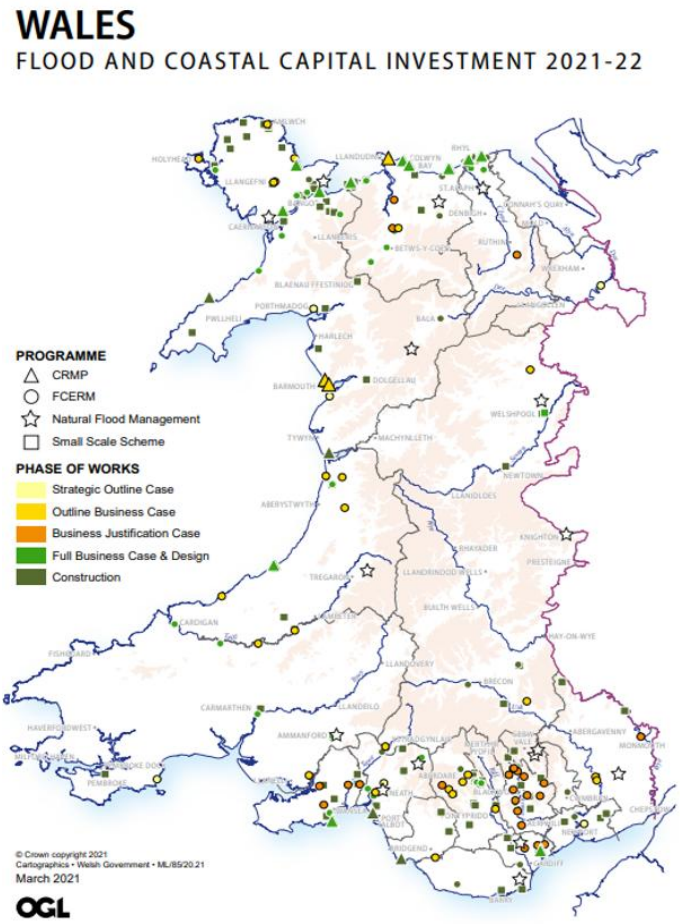
Figure 1 - River basin location detailing the associated tactial planning catchments

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	The catchment is covered by the Mid Wales Area Statement which can be viewed at https://naturalresources.wales/about-us/area-statements/south-west-wales-area-statement/introduction-to-south-west-area-statement/?lang=en	Natural Resources Wales Environment Agency Local partnerships
Flood Risk Management Plans (FRMP)	The Cleddau and Pembrokeshire Coastal Rivers Flood Risk Management Plan is located on the NRW webpage https://cdn.cyfoethnaturiol.cymru/media/675146/final_frmp_-western-wales_pk26b82.pdf?mode=pad&rnd=131466534560000000 The DWMP catchment mirrors the FRMP catchment. The report highlights the coastal flooding caused by a combination of high tides and strong winds in 2014 which particularly impacted properties. The FRMP highlights Haverford West as one of the highest risk communities in Pembrokeshire, affected by both tidal flooding and fluvial flooding.	Welsh Government Water companies Coastal Groups (local authority led) Natural Resources Wales Environment Agency Lead local flood authorities
Shoreline Management Plans (SMP)	Cleddau and Pembrokeshire Coastal Rivers is covered by 2 SMPs, the SMP 21 St Ann's Head to Great Ormes Head (West of Wales) and SMP20 - Lavernock Point to St Ann's Head.	Coastal Groups (local authority led) County councils Lead local flood authorities
River Basin Management Plan (RBMP)	River Basin Management Plans (RBMP) set out how a combination of organisations and parties work together and set out to improve the catchments water quality and environment. The RBMPs can be found here: https://www.gov.uk/government/collections/river-basin-management-plans-2015 https://cdn.cyfoethnaturiol.cymru/media/679390/2016-updated-pembrokeshire_catchment_summary_nrw.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 are strategically outlined FCERM schemes planned in the region from 2021 to 2022. This is illustrated 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 incorportated 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)	Within this cycle other stakeholder groups have not yet been engaged.	



Data is available from: https://gov.

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 how further surface water connected to the sewer network might increase the amount and rate at which rainfall drains into our sewers.

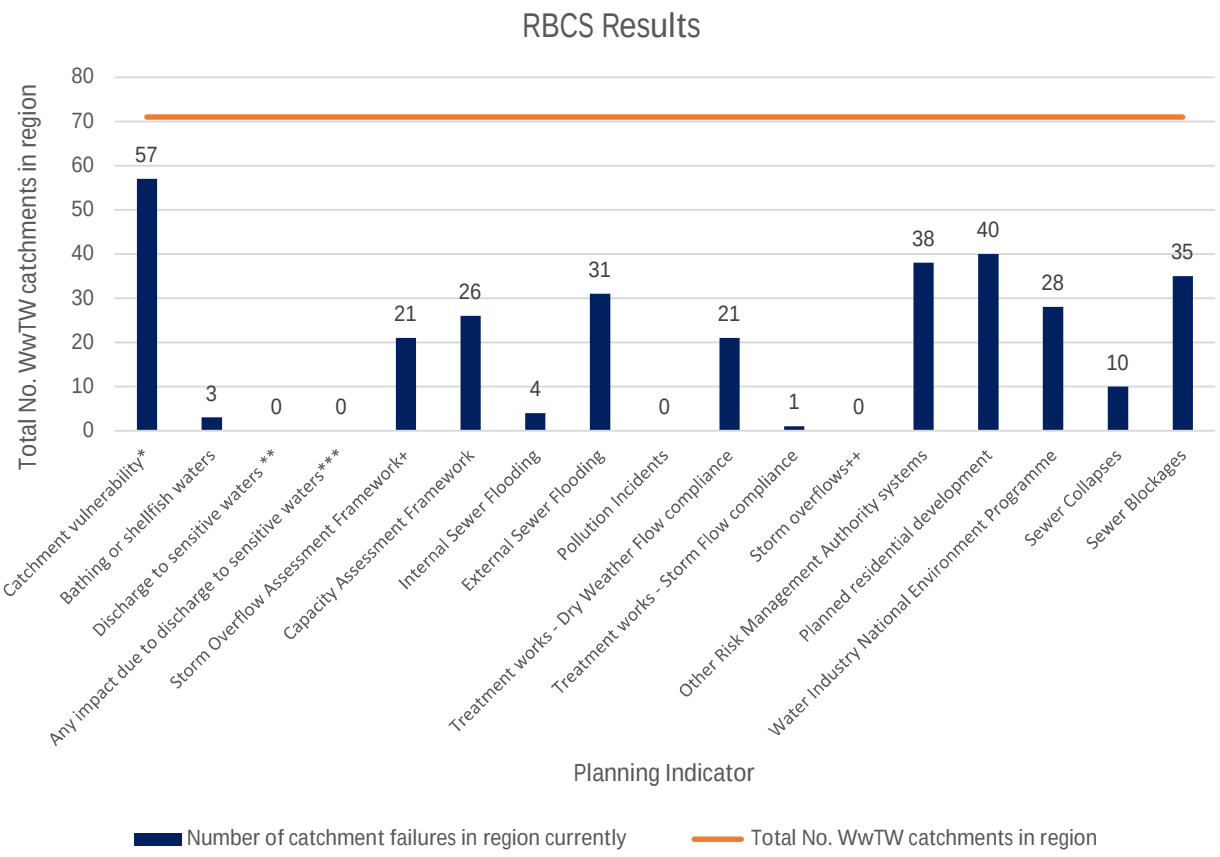
Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

The population in the Cleddau and Pembrokeshire Coastal Rivers region is set to decrease to 134000 by 2050, a change of -20% based on our future projections. However there are major developments in localised areas that will contribute to future pressures on the network, including two developments in Haverford West with 512 units and 459 units.
Climate change is predicted to increase the intensity of storms by around 15% 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 Cleddau and Pembrokeshire Coastal Rivers catchment the biggest concerns indicated by the RBCS are catchment vulnerability and storm flow compliance at Wastewater Treatment works.



* To sewer flooding due to extreme wet weather events.
**Sensitive waters are considered as Bathing Water and Shellfish Water.
** 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.

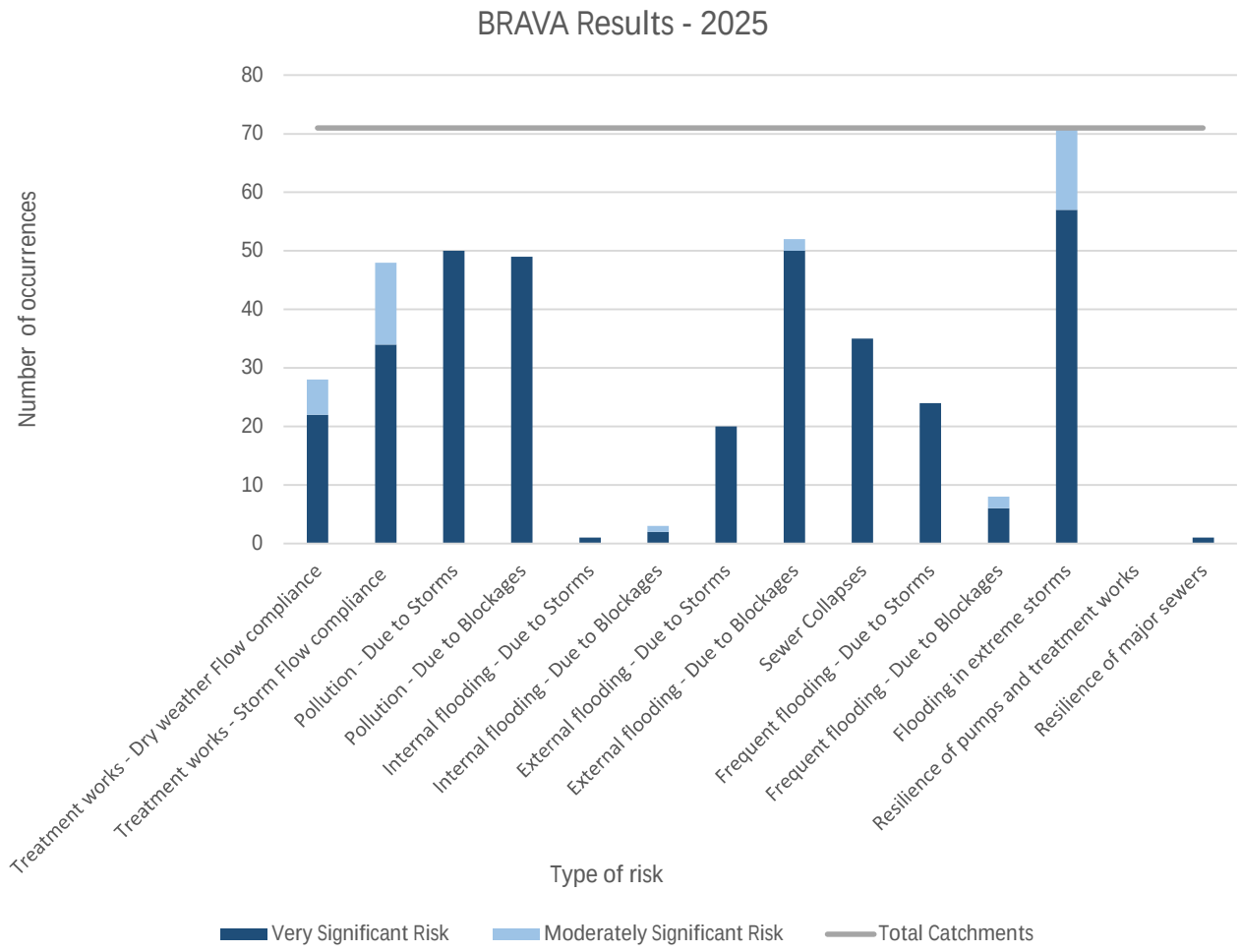


Figure 4 - BRAVA 2025 Summary

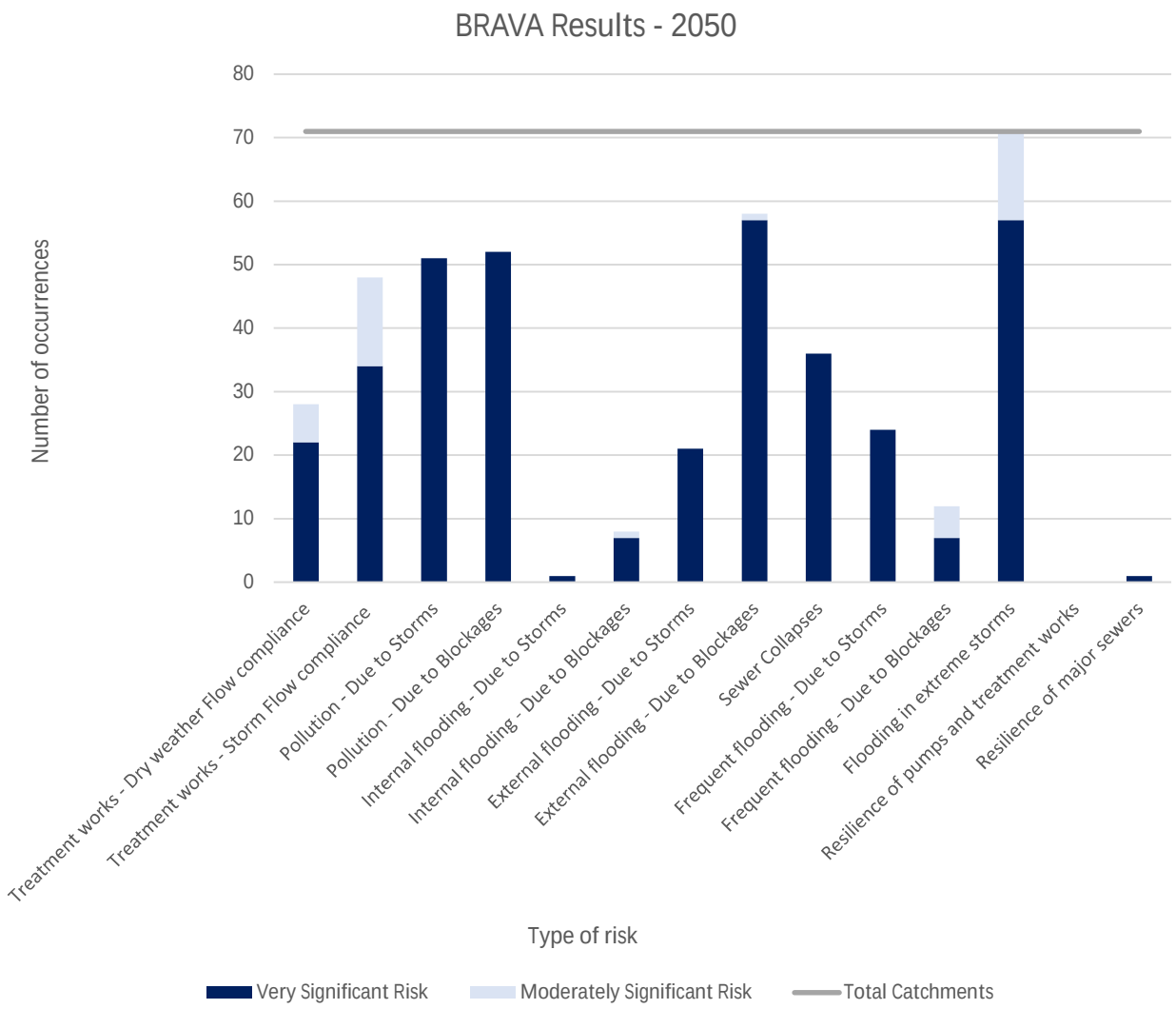


Figure 5 - BRAVA 2050 Summary

BRAVA shows that in both 2025 and 2050 risks due to flooding in extreme events are the biggest concern, and in 2050 there is also an external flooding risk due to blockages in the Cleddau and Pembrokeshire Coastal Rivers.

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.

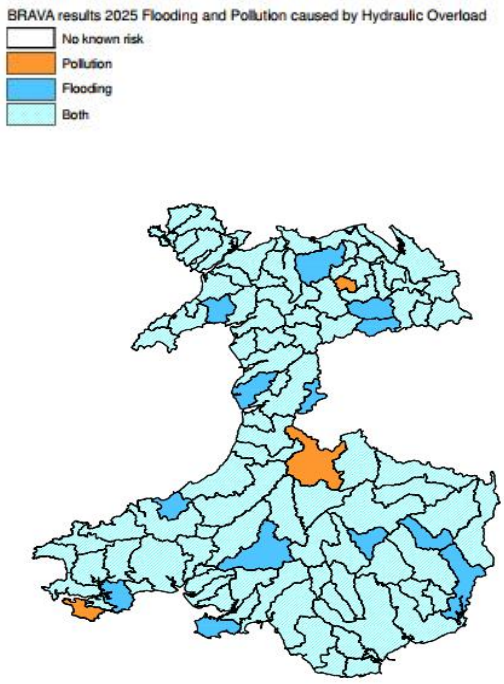


Figure 6 - Associated Strategic Planning Areas priority (2025)

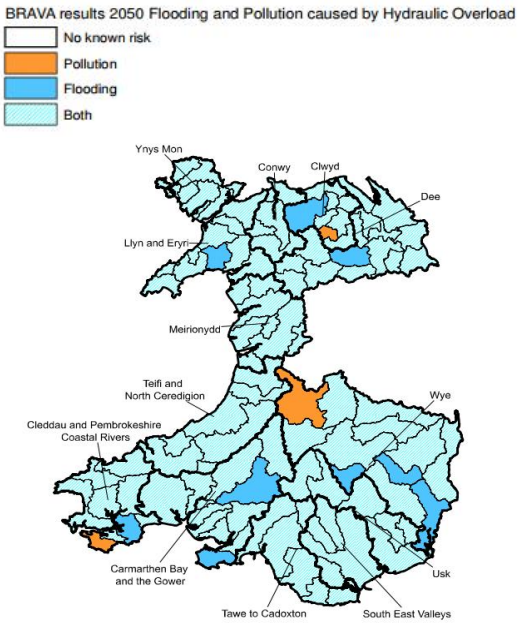


Figure 7 - Associated Strategic Planning Area priority (2050)

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 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
Cleddau and Pembrokeshire Coastal Rivers						

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 ‘best value’ plan is delivered. Figure 8 shows the 'best value' scheme types that are most likely to be beneficial in this region across the plan.

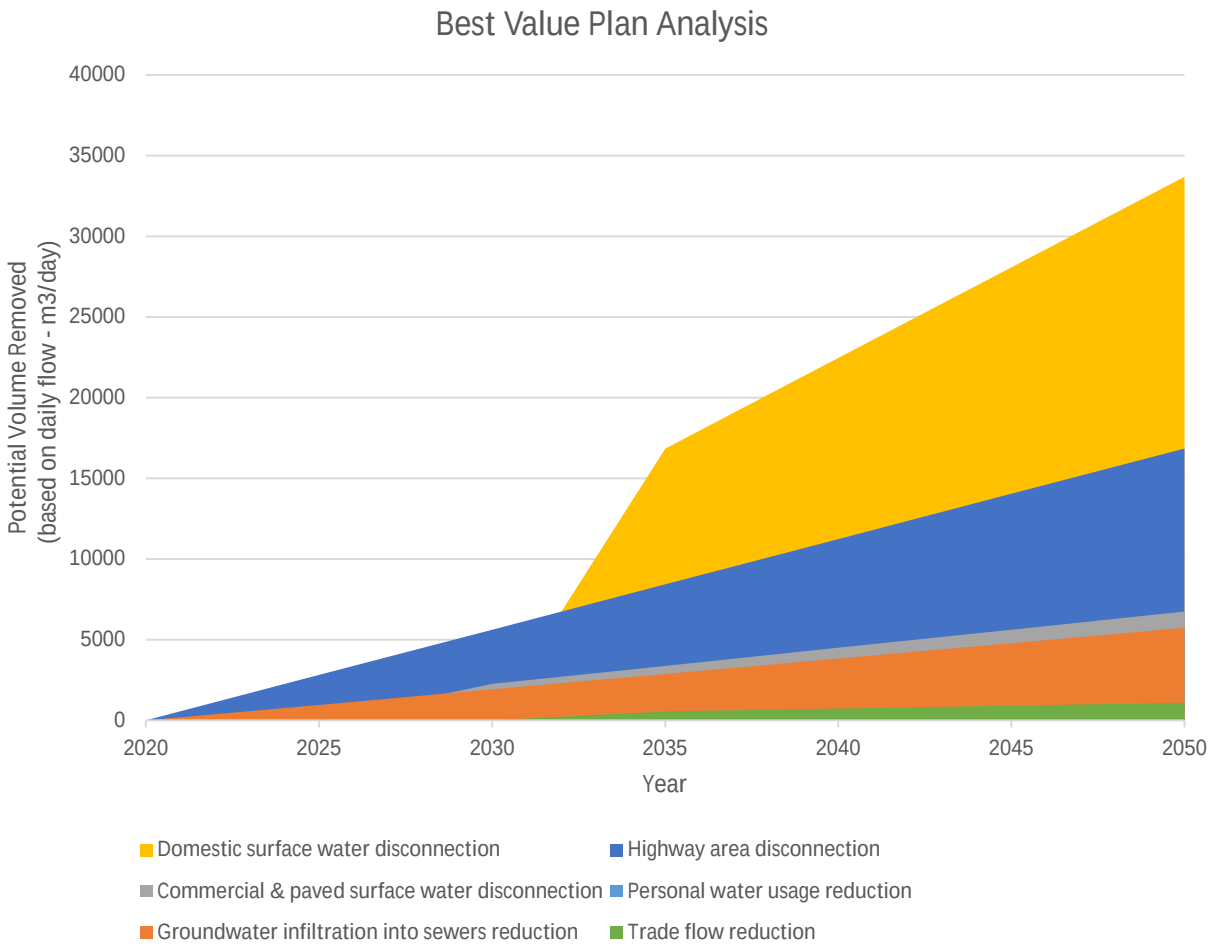


Figure 8 - Best Value Plan Analysis

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 todays 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 probabilty of occuring 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*	-	£200,000,000	£286,700,000
40 spills in a Typical Year	£71,000,000	£70,000,000	£69,000,000
20 spills in a Typical Year	£107,000,000	£108,000,000	£114,000,000
10 spills in a Typical Year	£145,000,000	£148,000,000	£155,000,000
0 spills in a Typical Year	£334,000,000	£348,000,000	£367,000,000
Equivalent No. Principality Stadiums Full of Water in 10 spills scenario	2.80	2.99	3.04

* 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	£19,000,000	£23,000,000	£25,000,000
External escapes in gardens	£15,000,000	£18,000,000	£21,000,000
Escapes in highways	£67,000,000	£81,000,000	£103,000,000
No future flooding	-	£24,000,000	£66,000,000
Total	£101,000,000	£146,000,000	£215,000,000

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 have developed solutions which aim 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

Brandy Brook - headwaters to tidal limit

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 Brandy Brook - headwaters to tidal limit planning catchment lies within the Cleddau and Pembrokeshire Coastal Rivers river basin catchment, (see Figure 1 below), it consists of 5 wastewater catchments (see Figure 2 below). There is a combined population of 6548, this is set to decrease to 4588 by 2050, a change of -30%. There is a total sewer length of 47km, with a foul sewer length of 39km, a surface water length of 0km and a combined sewer length of 7km. There are 5 Wastewater Treatment Works (WwTW), 13 Sewerage Pumping Stations (SPSs), and 9 Combined Storm Overflows (CSOs) across this tactical planning unit.

The catchment of Brandy Brook - headwaters to tidal limit is situated in the southwest of Wales, with much of the catchment falling within the Pembrokeshire Coast National Park. The catchment stretches from Nolton Haven in the south to Croes-goch in the north, with the city of St Davids situated in the west of the catchment. A number of rivers are present in the catchment including the Solva, the Alun and Brandy Brook.

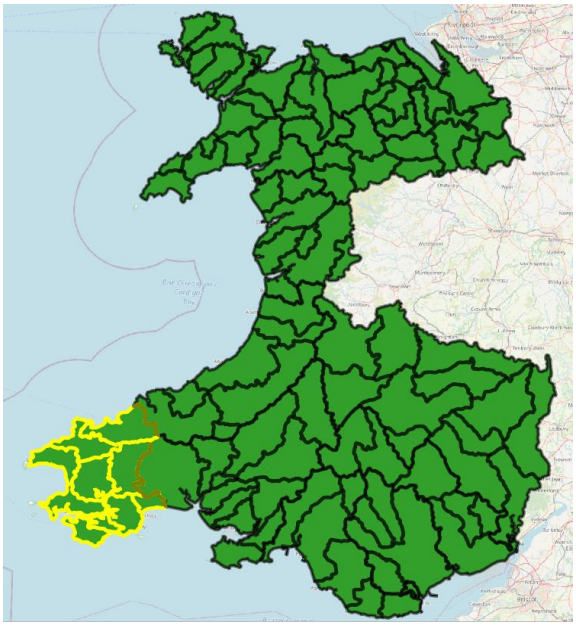


Figure 1 - River basin location detailing the associated tactial planning catchments

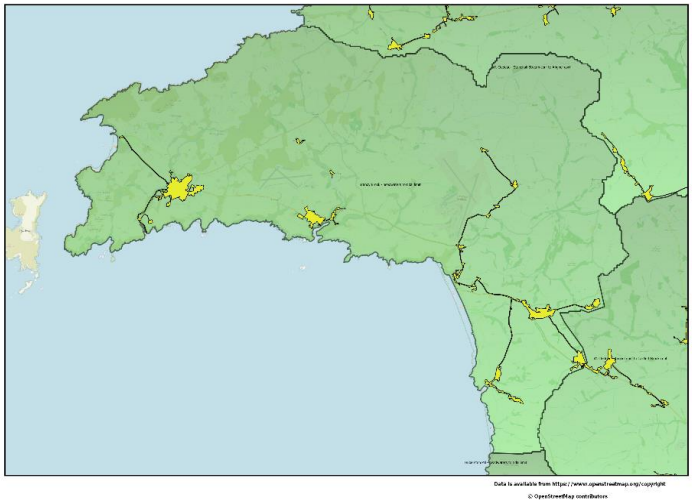


Figure 2- Tactical planning catchment

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 alighn 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.

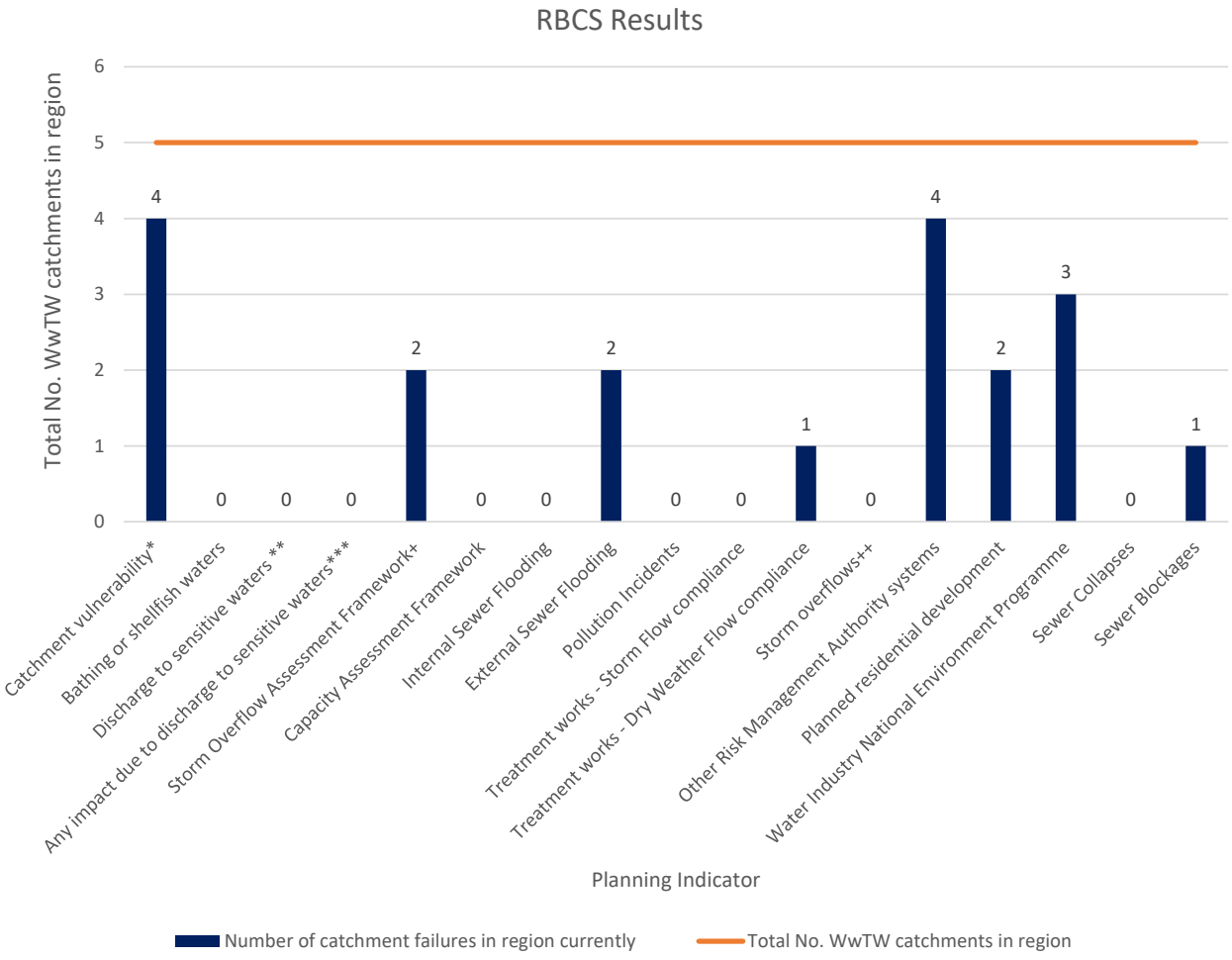
Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

Climate change is predicted to increase the intensity of storms by around 15% 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 Cleddau and Pembrokeshire Coastal Rivers region is set to decrease to 4600 by 2050, a change of -30% based on our future projections. However there are major developments in localised areas that will contribute to future pressures on the network, including West of Glasfyrn Road with 90 units.

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.

The RBCS has highlighted that 4 out of 4 L4 catchments within this L3 are expected to be vulnerable to sewer flooding as a result of extreme storm events. Flooding issues that fall under the scope of other risk management authorities and issues related to the Water Industry National Environment Programme were also flagged as areas of risk that require further investigation.



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**Sensitve waters are considered as Bathing Water and Shellfish Water.
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***Catagorised 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.

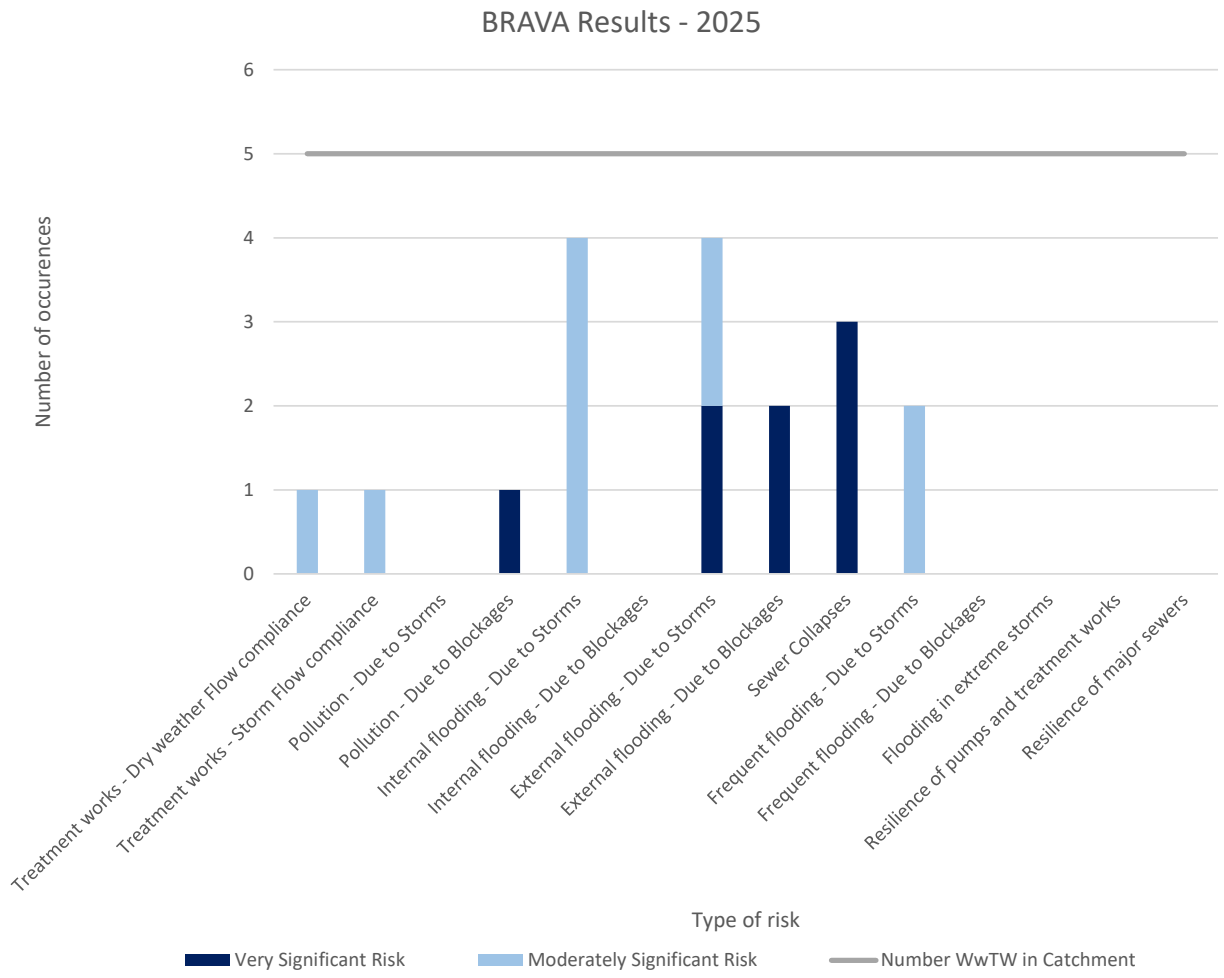


Figure 4 - BRAVA 2025 Summary

In 2025 it is expected that the most significant concerns within the catchment will be external flooding due to both storm events and blockages. 7 different risk types are expected to contribute to the overall risk.

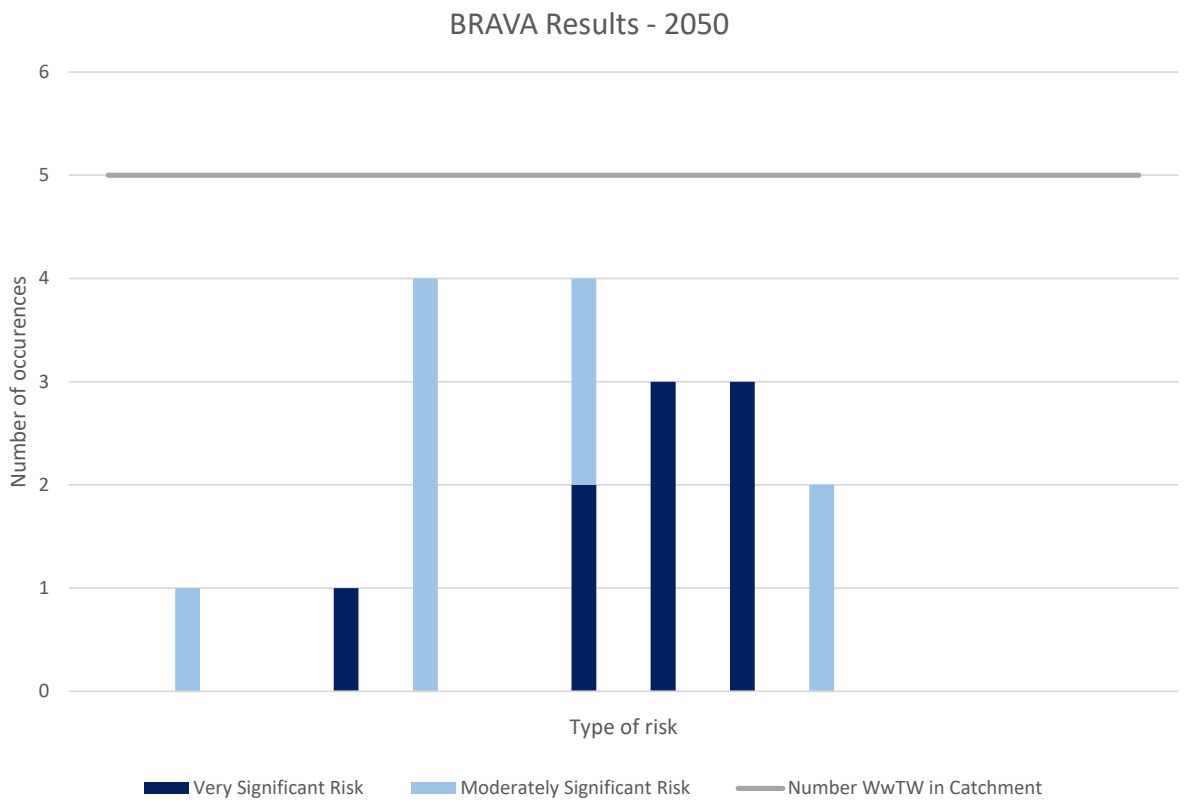


Figure 5 - BRAVA 2050 Summary

In 2050 it is expected that sewer collapse will be the most significant risk within the catchment followed by treatment work compliance and external flooding, both due to storms.

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.

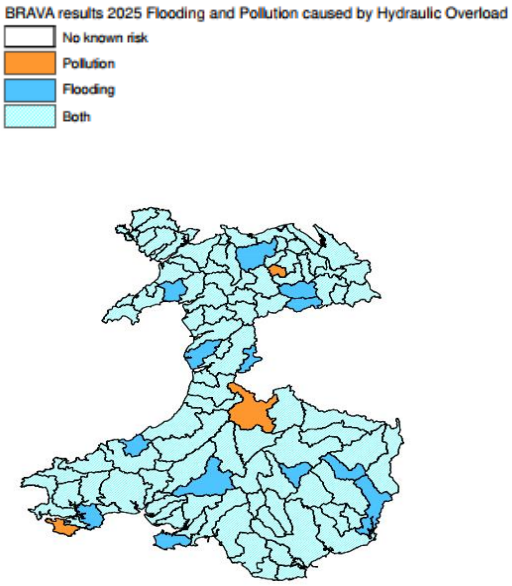


Figure 6 - Associated Strategic Planning Areas priority (2025)

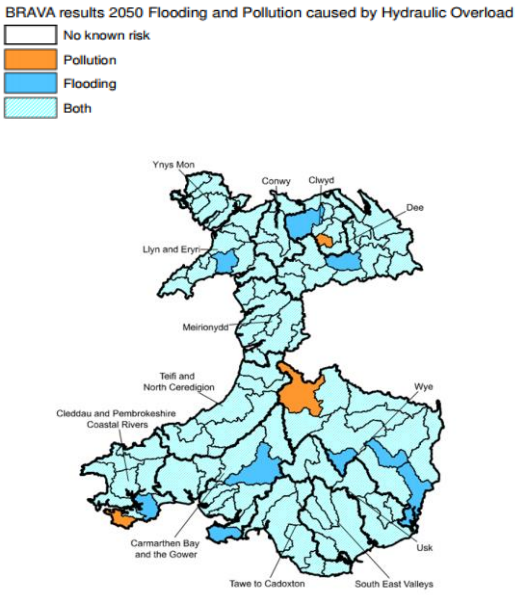


Figure 7 - Associated Strategic Planning Areas

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. Brandy Brook - headwaters to tidal limit 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 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
Brandy Brook - headwaters to tidal limit	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.

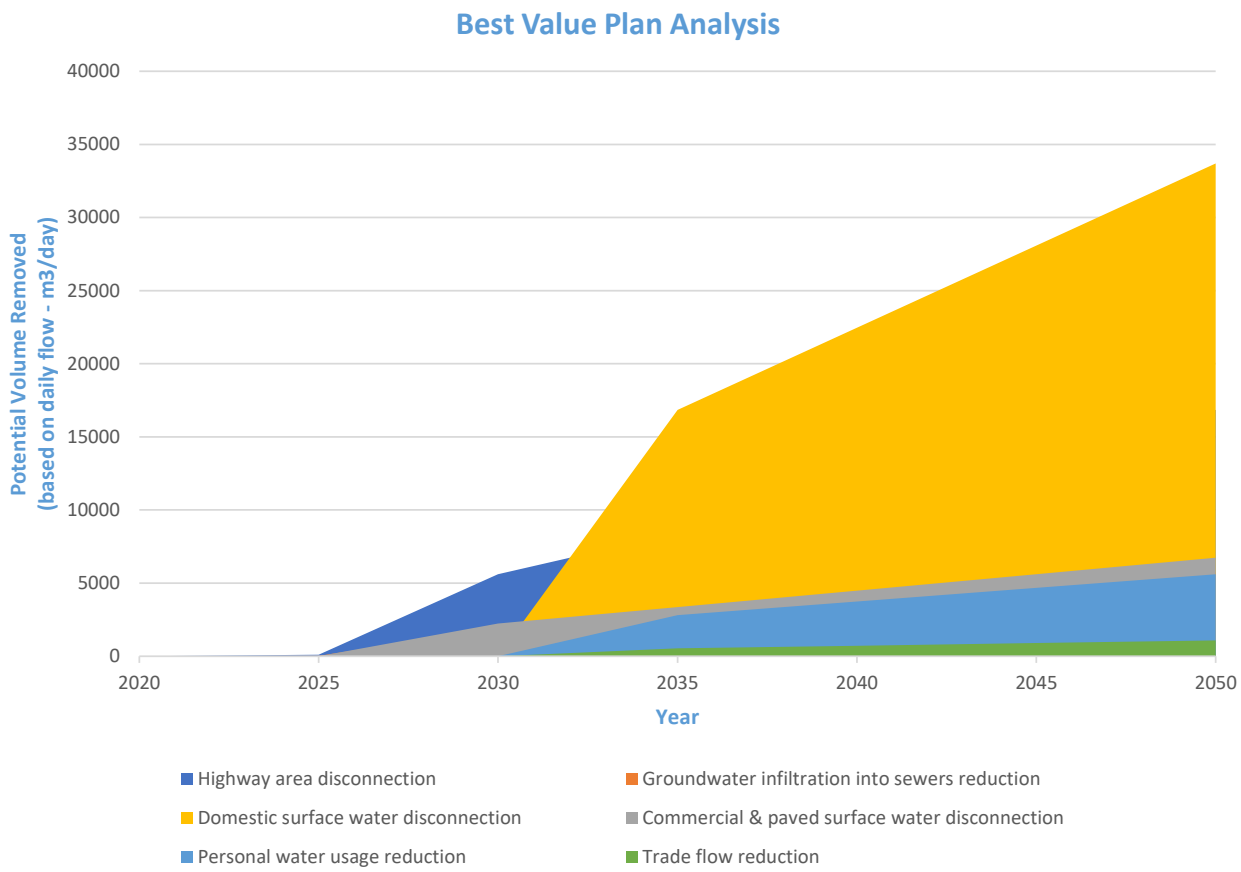


Figure 8 - Best Value Plan Analysis

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 probability of occurring once every 30 years. Table 5 illustrates the cost of potential mitigation measures to mitigate varying flood risk types.

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

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain Existing Performance*	-	£12,000,000.00	£17,000,000.00
40 spills in a Typical Year	£3,000,000.00	£4,000,000.00	£3,000,000.00
20 spills in a Typical Year	£7,000,000.00	£10,000,000.00	£10,000,000.00
10 spills in a Typical Year	£11,000,000.00	£11,000,000.00	£11,000,000.00
0 spills in a Typical Year	£16,000,000.00	£16,000,000.00	£17,000,000.00
Equivalent No. Olympic Swimming Pools in 10 spills scenario	60.00	73.00	74.00

* 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	£5,000,000	£6,000,000	£8,000,000
No flooding	-	£1,000,000	£2,000,000
Total	£5,000,000.00	£7,000,000	£10,000,000

Table 5 - Summary of Flooding option investments

Table 4 and 5 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 two. 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

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

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

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

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

Table 6 - Summary of schemes per WwTW within the Tactical Planning catchment first cycle prior to HRA/ SEA

L4 Catchments	No. Schemes
MIDDLE MILL	0
CAERFACHELL	0
ST DAVIDS	0
NEWGALE STW	0
SOLVA STW	0

DWMP Tactial Planning Catchment Summary

Castlemartin Corse - headwaters to tidal limit

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 Castlemartin Corse - headwaters to tidal limit planning catchment lies within the Cleddau and Pembrokeshire Coastal Rivers river basin catchment, (see Figure 1 below), it consists of 6 wastewater catchments (see Figure 2 below). There is a combined population of 37223, this is set to decrease to 28443 by 2050, a change of -24%. There is a total sewer length of 273km, with a foul sewer length of 79km, a surface water length of 13km and a combined sewer length of 173km. There are 6 Wastewater Treatment Works (WwTW), 20 Sewerage Pumping Stations (SPSs), and 50 Combined Storm Overflows (CSOs) across this tactical planning unit.

Castlemartin Corse - headwaters to tidal limit is situated in the southwest of Wales within Pembrokeshire. It stretches from Angle in the west to Freshwater East in the east. The catchment is relatively flat and coastal, with several towns throughout such as Castlemartin and Warren. Castlemartin Corse is the only main river within the catchment.

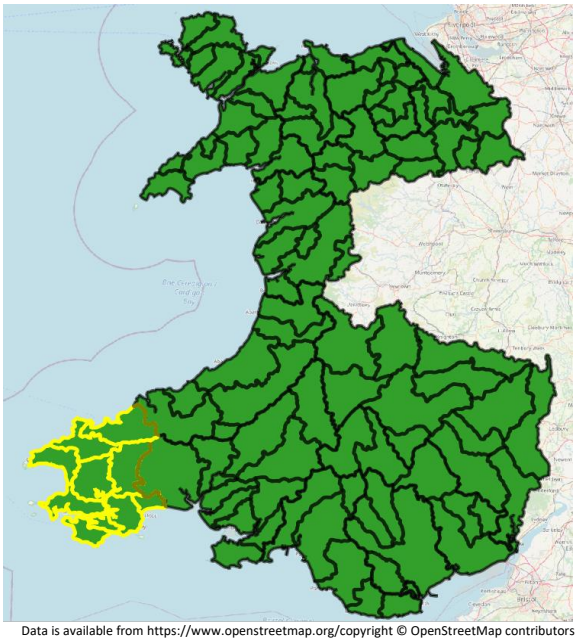


Figure 1 - River basin location detailing the associated tactial planning catchments

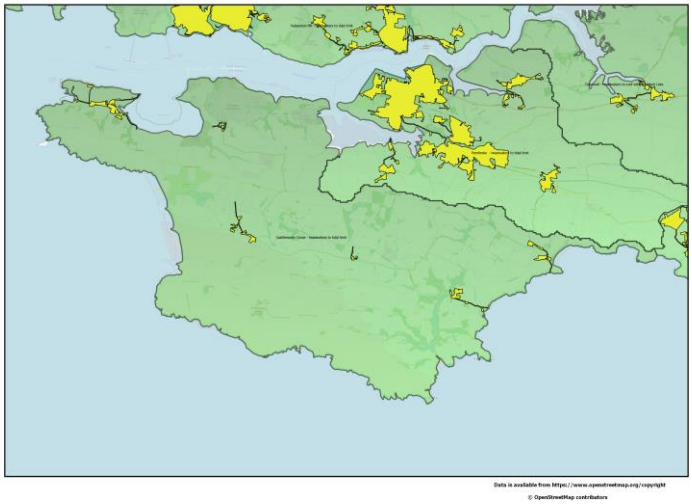


Figure 2- Tactical planning catchment

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 alighn 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.

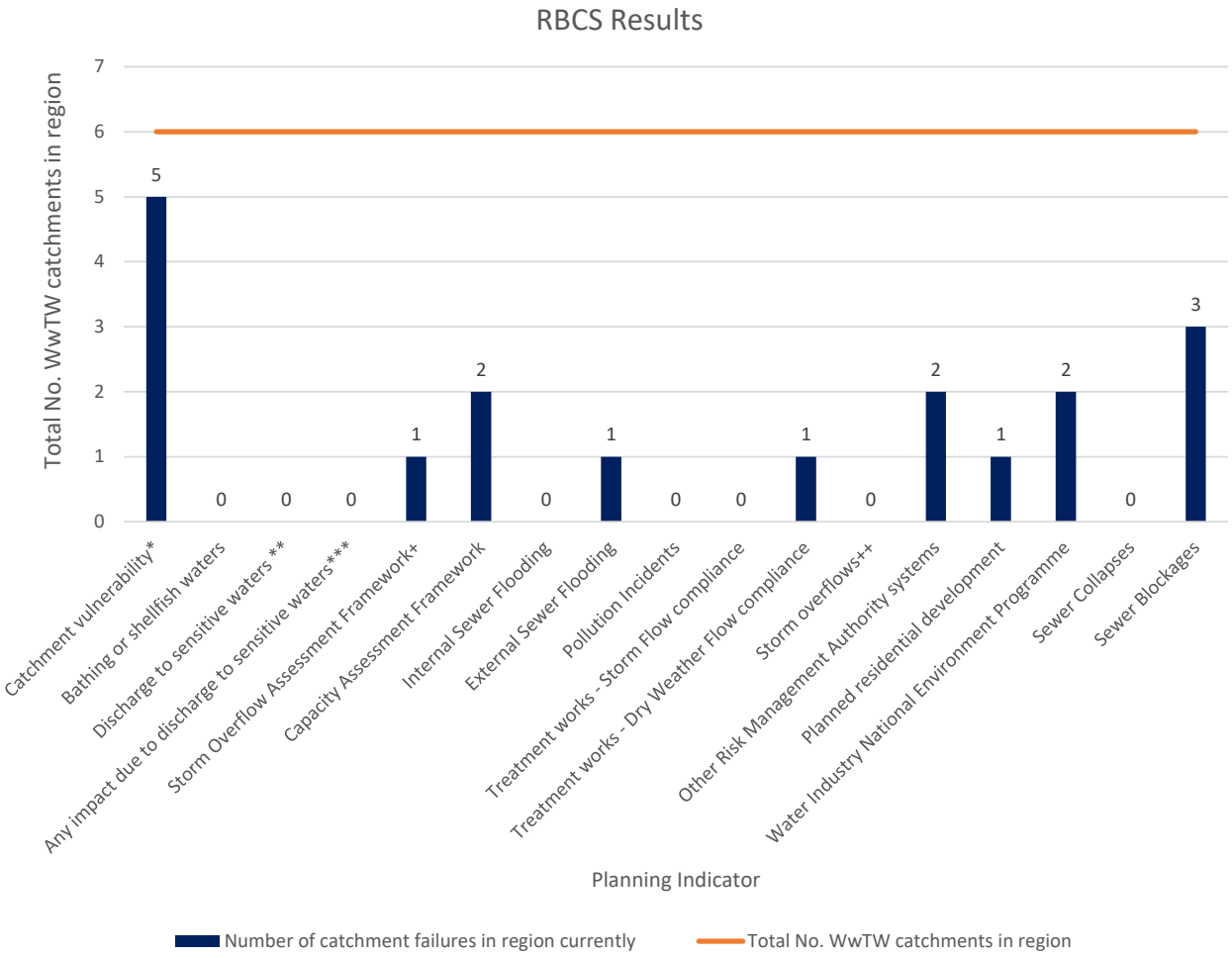
Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

Climate change is predicted to increase the intensity of storms by around 15% 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 Cleddau and Pembrokeshire Coastal Rivers region is set to decrease to 28400 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.

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.

The RBCS has highlighted that 5 out of the 6 L4 catchments within this L3 are likely to be vulnerable to sewer flooding due to an extreme storm event. Sewer blockages was also flagged as a risk within this catchment.



*To sewer flooding due to extreme wet weather events.
**Sensitve waters are considered as Bathing Water and Shellfish Water.
**Catagorised as a "planned" scheduled action within the Natural Resources Wales Action Database or considered as "Remedy" on Natural England Designated Sites system.
***Catagorised 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.

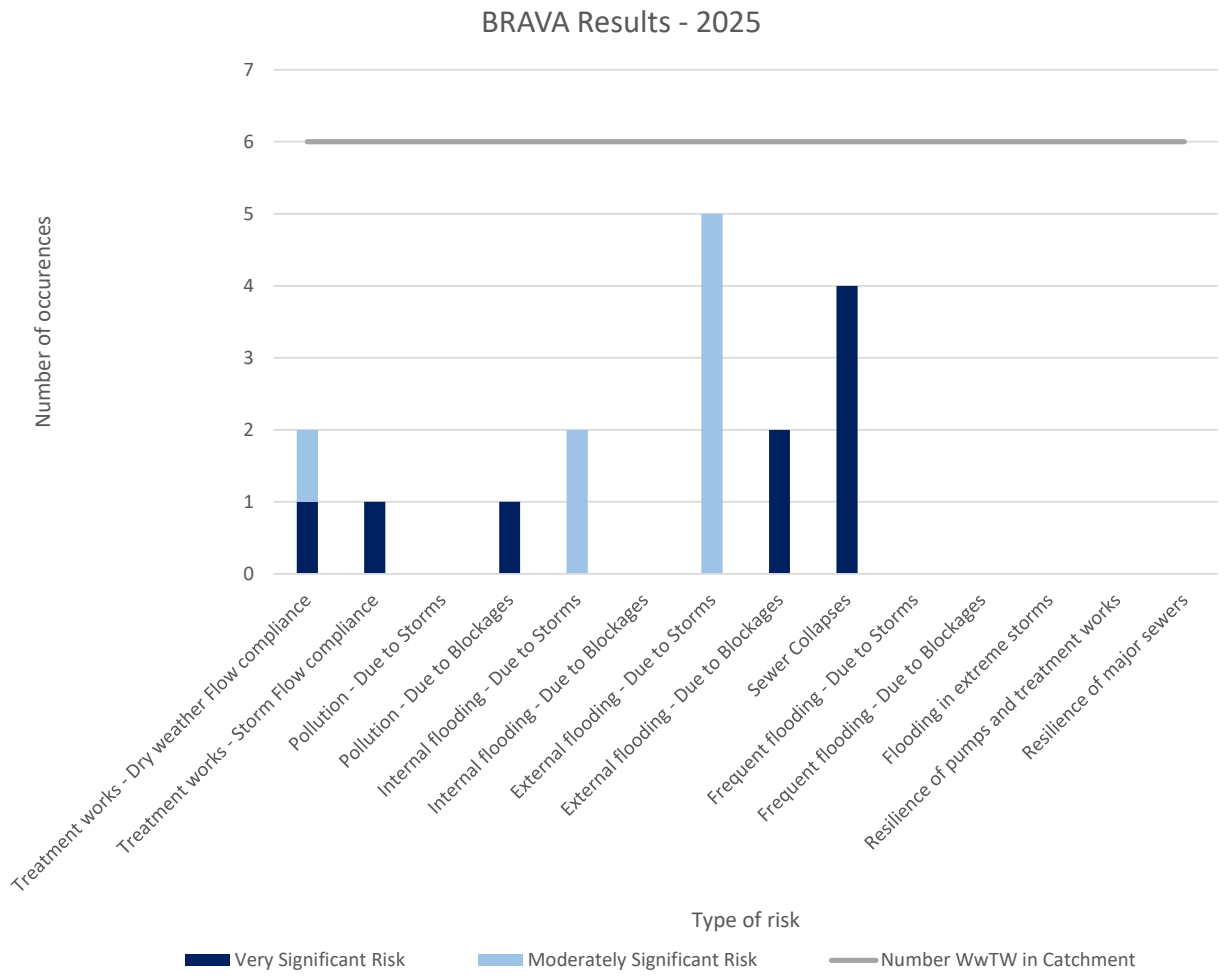


Figure 4 - BRAVA 2025 Summary

In 2025, the assessment did not highlight any areas of risk for the catchment.

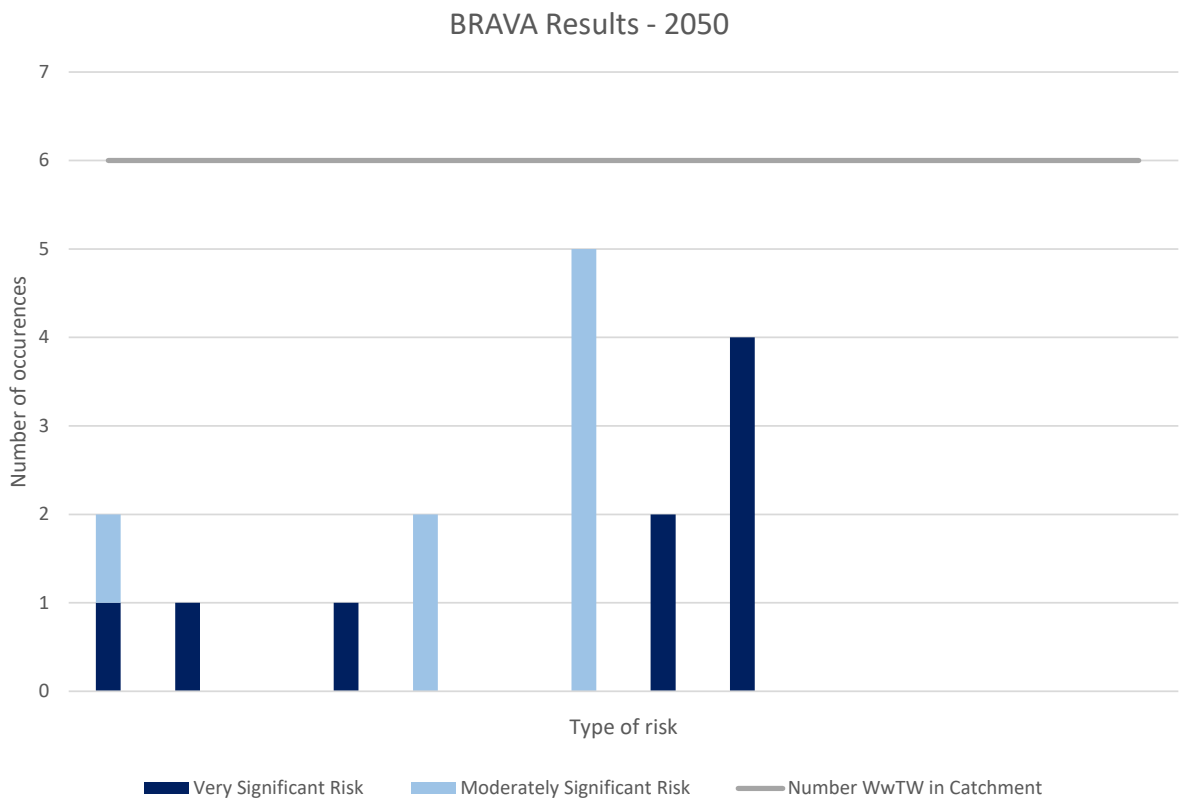


Figure 5 - BRAVA 2050 Summary

In 2050, it is expected that the overall risk will remain relatively low. However treatment work compliance during dry weather flows and storm events, poluution from storm events and internal flooding due to blockages were now highlighted as areas of risk.

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.

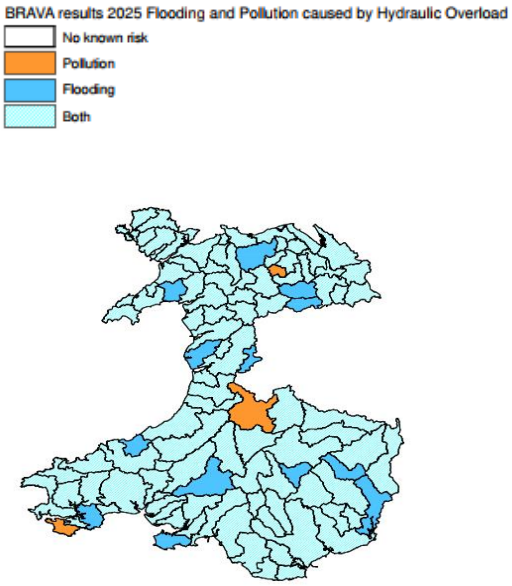


Figure 6 - Associated Strategic Planning Areas priority (2025)

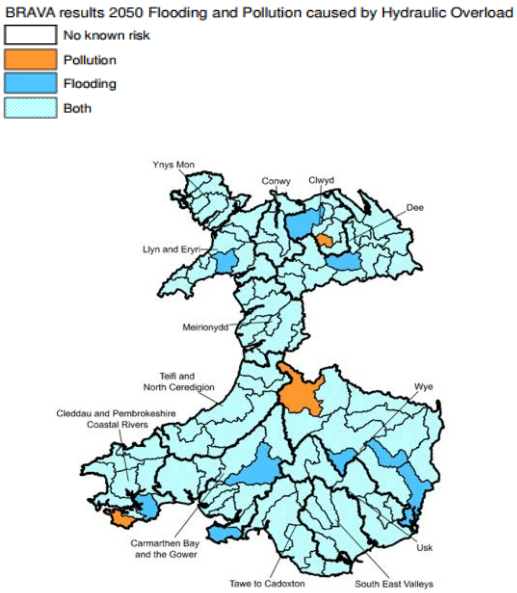


Figure 7 - Associated Strategic Planning Areas

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. Castlemartin Corse - headwaters to tidal limit has a water quality priority status for 2050 of 2 which indicates targeted investment to mitigate and focus during AMP10.

4.0 Supply Demand

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

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

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

Table 2 shows the supply-demand assessment for this region. Where a region may not have adequate capacity under a given scenario, it is flagged 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
Castlemartin Corse - headwaters to tidal limit	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.

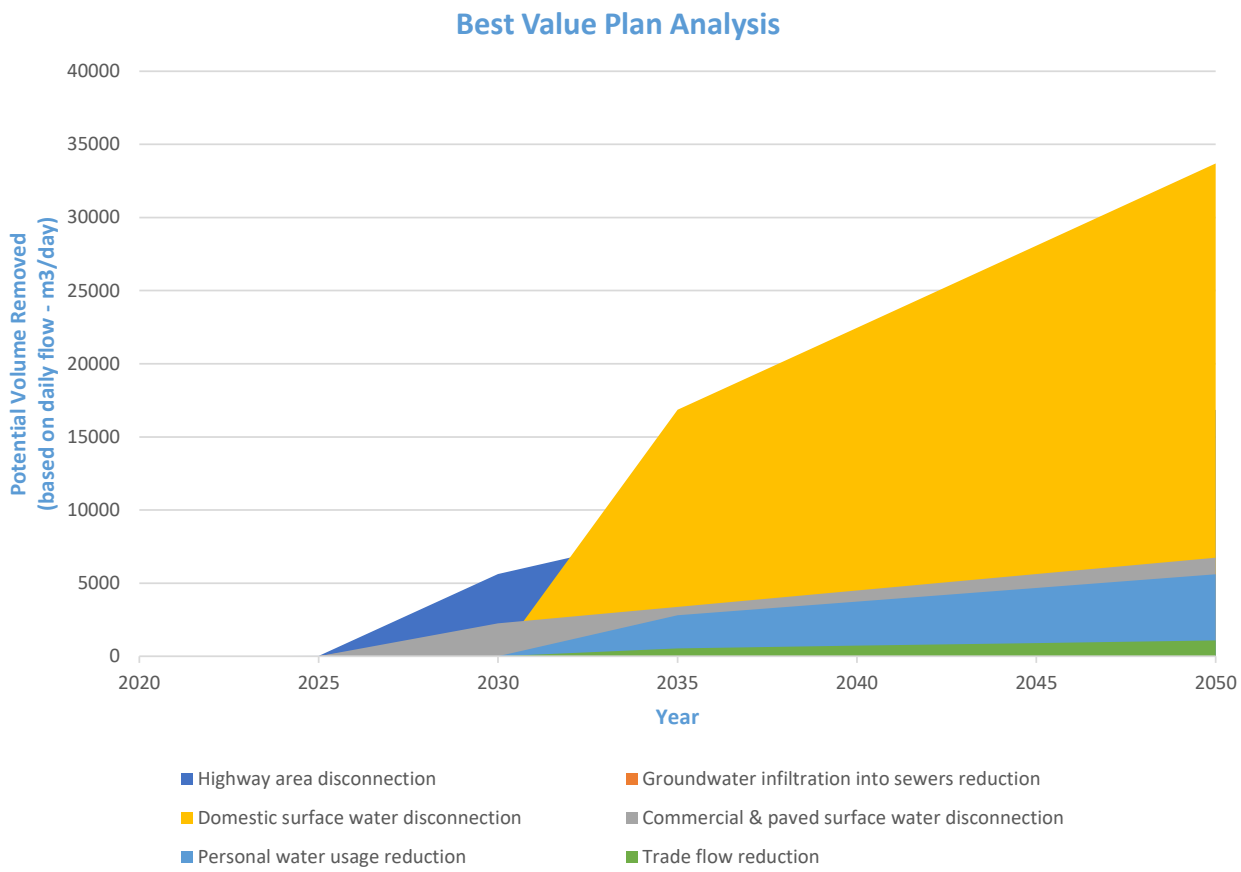


Figure 8 - Best Value Plan Analysis

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 probability of occurring once every 30 years. Table 5 illustrates the cost of potential mitigation measures to mitigate varying flood risk types.

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

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain Existing Performance*	-	£4,000,000.00	£5,000,000.00
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	£2,000,000.00	£2,000,000.00	£2,000,000.00
0 spills in a Typical Year	£5,000,000.00	£6,000,000.00	£6,000,000.00
Equivalent No. Olympic Swimming Pools in 10 spills scenario	3.00	3.00	3.00

* 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	£1,000,000
No flooding	-	£3,000,000	£9,000,000
Total	£1,000,000.00	£5,000,000	£10,000,000

Table 5 - Summary of Flooding option investments

Table 4 and 5 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 two. 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

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

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

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

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

Table 6 - Summary of schemes per WwTW within the Tactical Planning catchment first cycle prior to HRA/ SEA

L4 Catchments	No. Schemes
RHOSCROWTHER	0
ANGLE	0
ST TWYNNELLS (PEMBROKE)	0
STACKPOLE	0
CASTLEMARTIN STW	0
FRESHWATER EAST (SE OF PEMBROKE)	0

DWMP Tactial Planning Catchment Summary

Cresswell - headwaters to conf with Waddock Lake

1.0 Introduction

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

1.1 Catchment Information

The Cresswell - headwaters to conf with Waddock Lake planning catchment lies within the Cleddau and Pembrokeshire Coastal Rivers river basin catchment, (see Figure 1 below), it consists of 5 wastewater catchments (see Figure 2 below). There is a combined population of 26191, this is set to decrease to 20312 by 2050, a change of -22%. There is a total sewer length of 133km, with a foul sewer length of 111km, a surface water length of 2km and a combined sewer length of 14km. There are 5 Wastewater Treatment Works (WwTW), 52 Sewerage Pumping Stations (SPSs), and 24 Combined Storm Overflows (CSOs) across this tactical planning unit.

The catchment of Cresswell - headwaters to conf with Waddock Lake is situated in southwest Wales, stretching from Penally in the south to near Templeton in the north. Much of the catchment is coastal and rural, falling within the Pembrokeshire Coast National Park. The largest settlement in the catchment is Saundersfoot, in the east of the catchment. Within the catchment are the rivers Ritec and Cresswell.

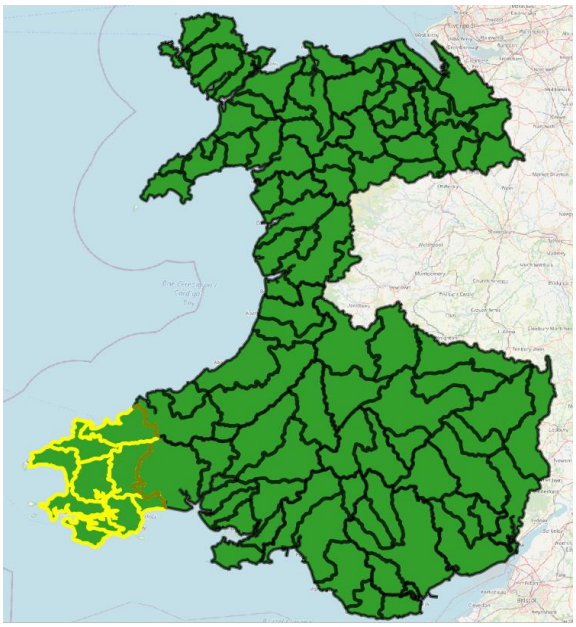


Figure 1 - River basin location detailing the associated tactial planning catchments

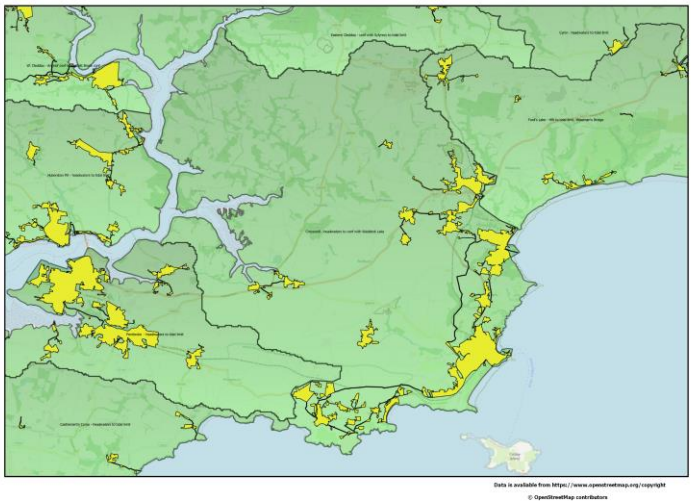


Figure 2- Tactical planning catchment

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 alighn 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.

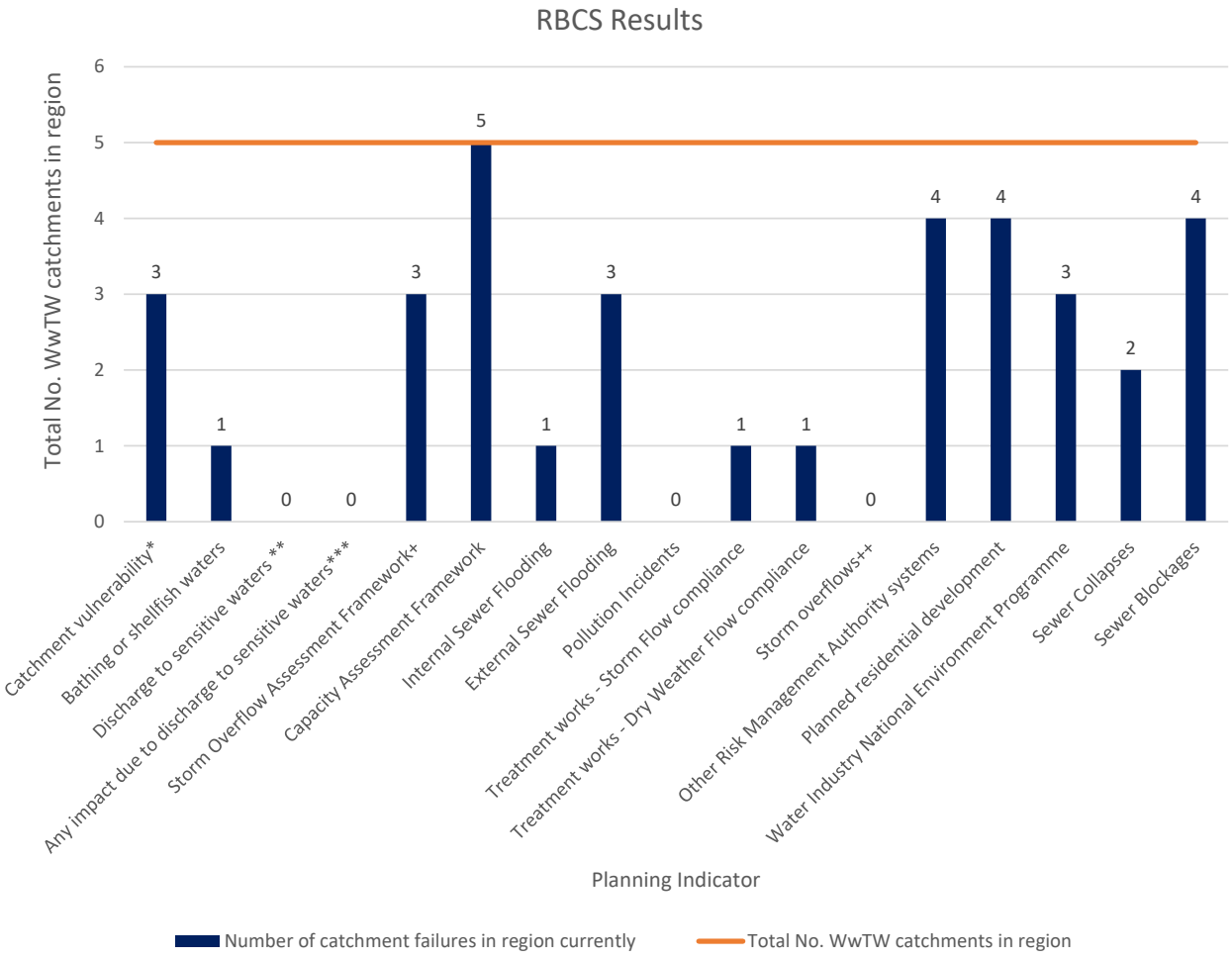
Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

Climate change is predicted to increase the intensity of storms by around 15% 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 Cleddau and Pembrokeshire Coastal Rivers region is set to decrease to 20300 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 Brynhir with 168 units and Butts Field Car Park, Tenby with 80 units.

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.

According to the RBCS 3 out of 5 L4 catchments within this L3 are expected to be vulnerable to sewer flooding as a result of extreme storm events. The RBCS has highlighted that Capacity Assessment Framework is an area of significant risk.



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

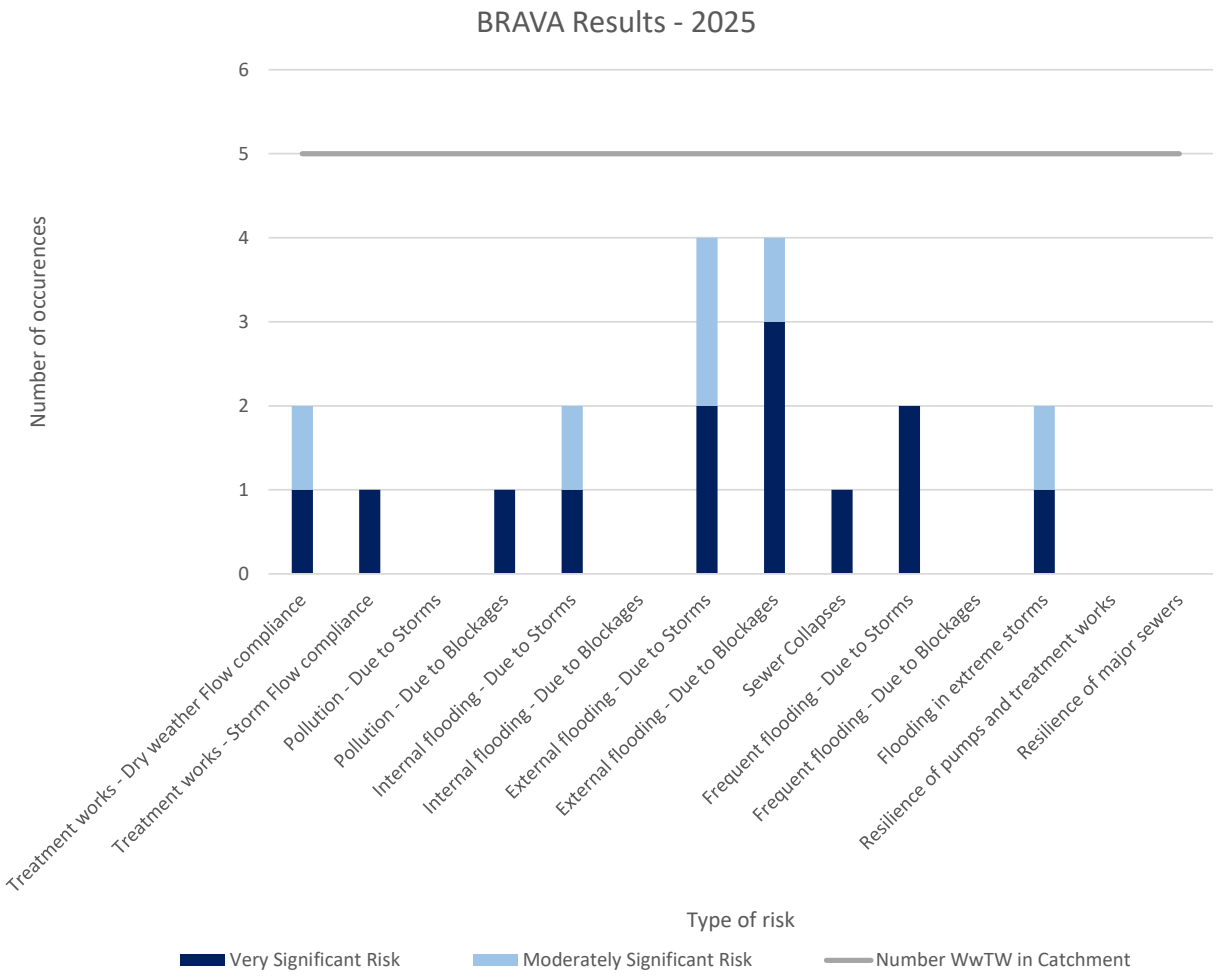


Figure 4 - BRAVA 2025 Summary

In 2025 it is expected that the risks within the catchment will be treatment work compliance during dry weather flow, pollution due to blockages and external flooding due to storm events.

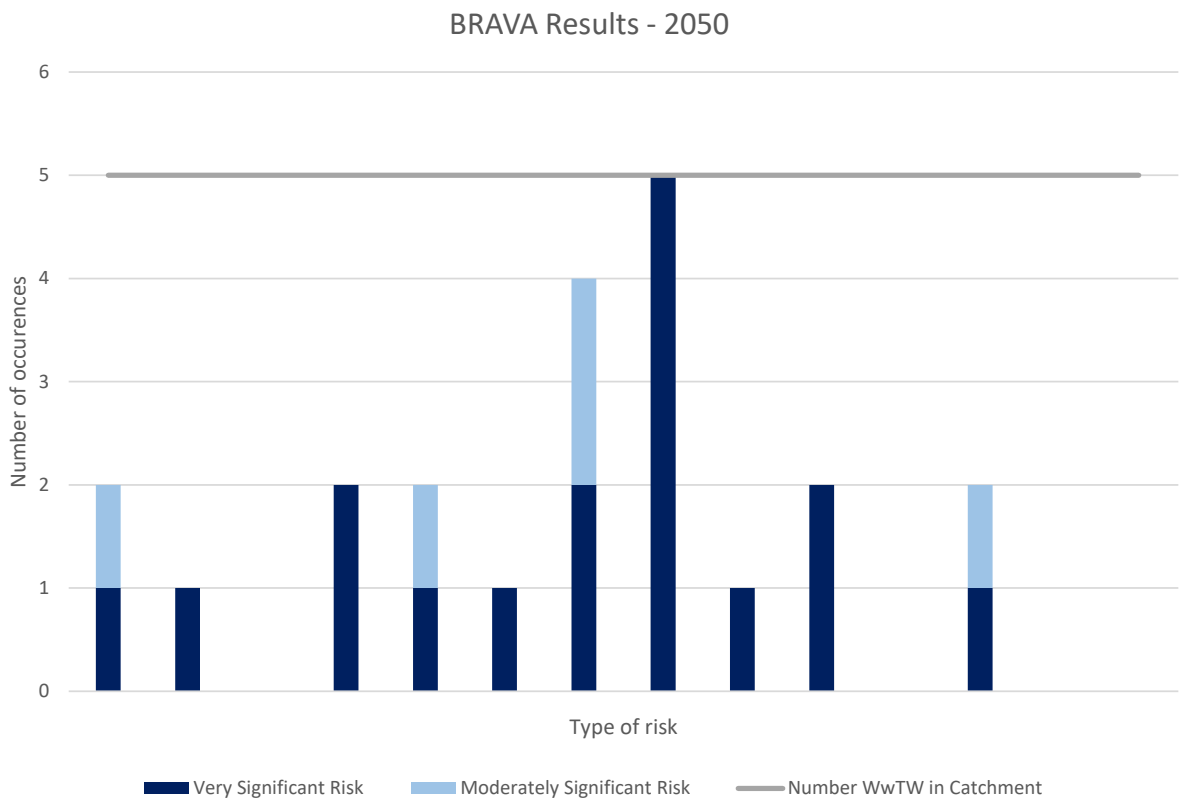


Figure 5 - BRAVA 2050 Summary

In 2050 it is expected that the most significant risk within the catchment will be sewer collapse, followed by pollution due to storm events. In total it is expected that 6 types of risk will contribute to the overall risk.

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.

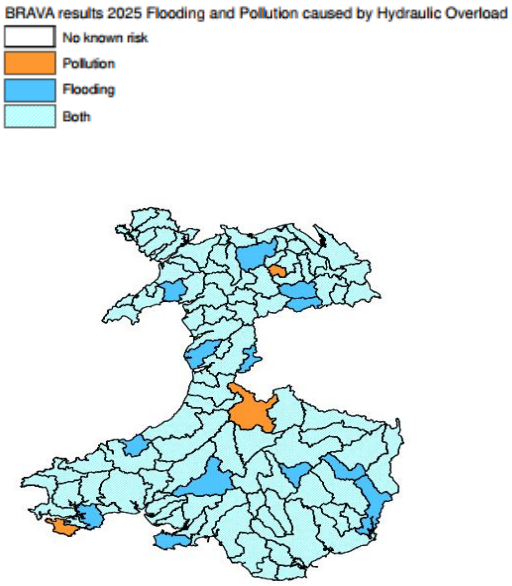


Figure 6 - Associated Strategic Planning Areas priority (2025)

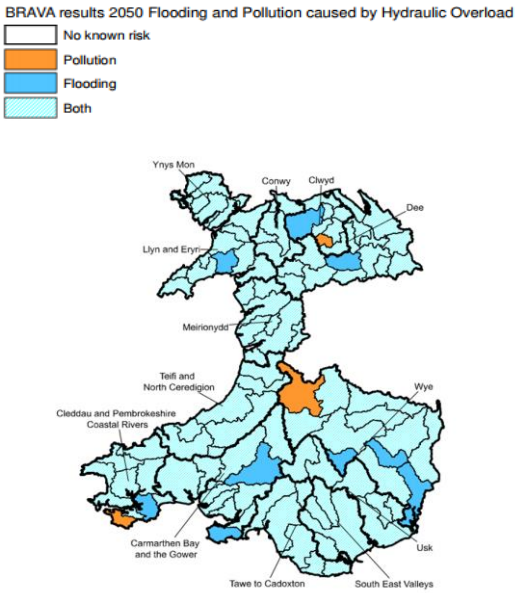


Figure 7 - Associated Strategic Planning Areas

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. Cresswell - headwaters to conf with Waddock Lake has a water quality priority status for 2050 of 1 which indicates targeted investment to mitigate and focus during AMP11.

4.0 Supply Demand

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

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

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

Table 2 shows the supply-demand assessment for this region. Where a region may not have adequate capacity under a given scenario, it is flagged 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
Cresswell - headwaters to conf with Waddock Lake	0%						
	10%						
	20%						
	Treatment Target	2025	2030	2035	2040	2045	2050
	70%						
	80%						
	90%						

Table 2 - Supply Demand Balance

5.0 Options

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

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

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

Table 3 - Risk mitigation details

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

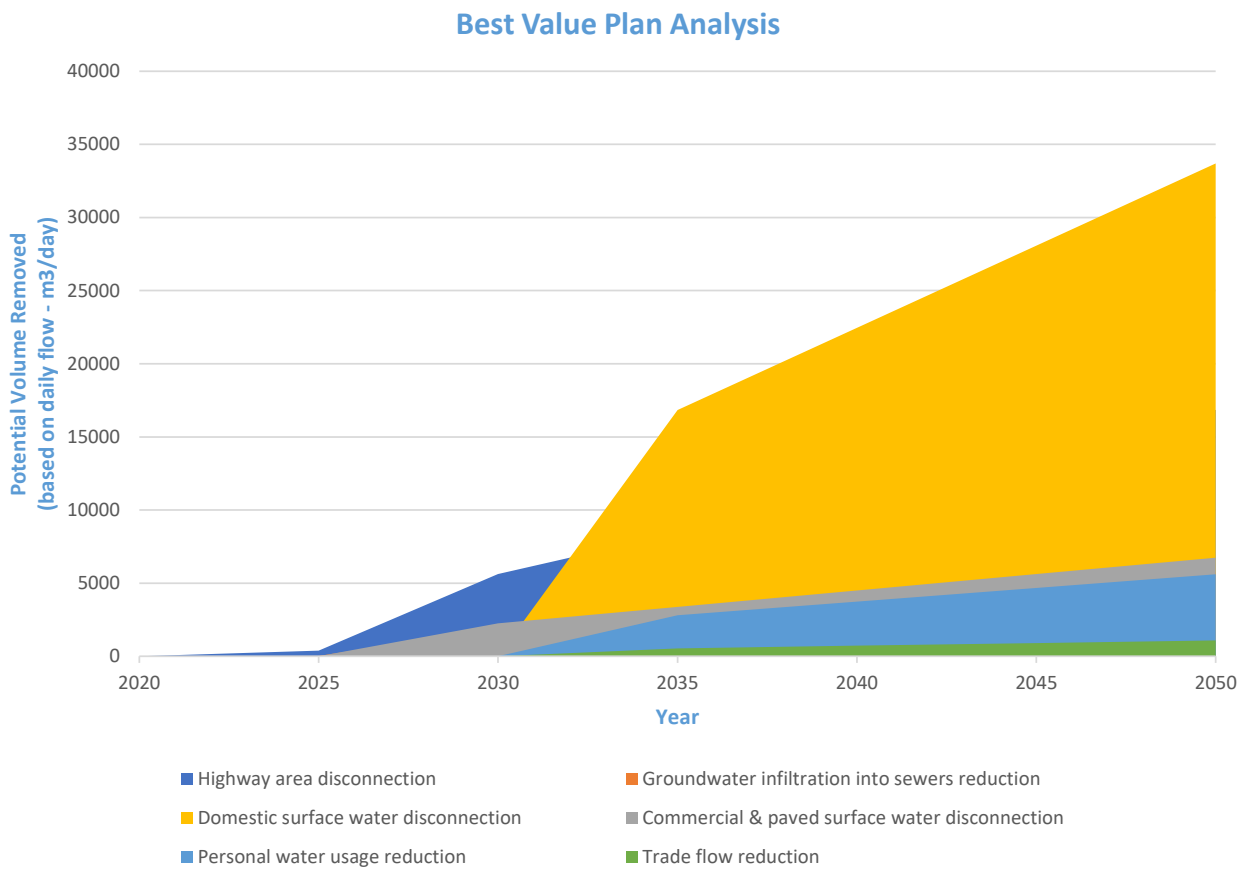


Figure 8 - Best Value Plan Analysis

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 probability of occurring once every 30 years. Table 5 illustrates the cost of potential mitigation measures to mitigate varying flood risk types.

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

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain Existing Performance*	-	£59,000,000.00	£88,000,000.00
40 spills in a Typical Year	£8,000,000.00	£8,000,000.00	£9,000,000.00
20 spills in a Typical Year	£15,000,000.00	£15,000,000.00	£17,000,000.00
10 spills in a Typical Year	£24,000,000.00	£26,000,000.00	£27,000,000.00
0 spills in a Typical Year	£63,000,000.00	£70,000,000.00	£75,000,000.00
Equivalent No. Olympic Swimming Pools in 10 spills scenario	123.00	136.00	147.00

* 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	£2,000,000	£3,000,000	£4,000,000
Escapes in highways	£10,000,000	£12,000,000	£14,000,000
No flooding	-	£1,000,000	£2,000,000
Total	£13,000,000.00	£17,000,000	£21,000,000

Table 5 - Summary of Flooding option investments

Table 4 and 5 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 two. 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

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

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

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

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

Table 6 - Summary of schemes per WwTW within the Tactical Planning catchment first cycle prior to HRA/ SEA

L4 Catchments	No. Schemes
ST FLORENCE STW	0
REYNALTON	0
LANGDON	0
CAREW	0
TENBY	0

DWMP Tactial Planning Catchment Summary

Eastern Cleddau - conf with Syfynwy to tidal limit

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 Eastern Cleddau - conf with Syfynwy to tidal limit planning catchment lies within the Cleddau and Pembrokeshire Coastal Rivers river basin catchment, (see Figure 1 below), it consists of 5 wastewater catchments (see Figure 2 below). There is a combined population of 4721, this is set to decrease to 4543 by 2050, a change of -4%. There is a total sewer length of 29km, with a foul sewer length of 22km, a surface water length of 1km and a combined sewer length of 5km. There are 5 Wastewater Treatment Works (WwTW), 5 Sewerage Pumping Stations (SPSs), and 7 Combined Storm Overflows (CSOs) across this tactical planning unit.

The Eastern Cleddau catchment is located in central Pembrokeshire. The Pembrokehsire Coastal National Park is present in both the north and south of the catchment. Much of the catchment is steep and rural, with a number of villages spread across the catchment. The East Cleddau River is the main watercourse, running from the catchments north to south. In the catchments south east the East and West Cleddau Rivers meet.

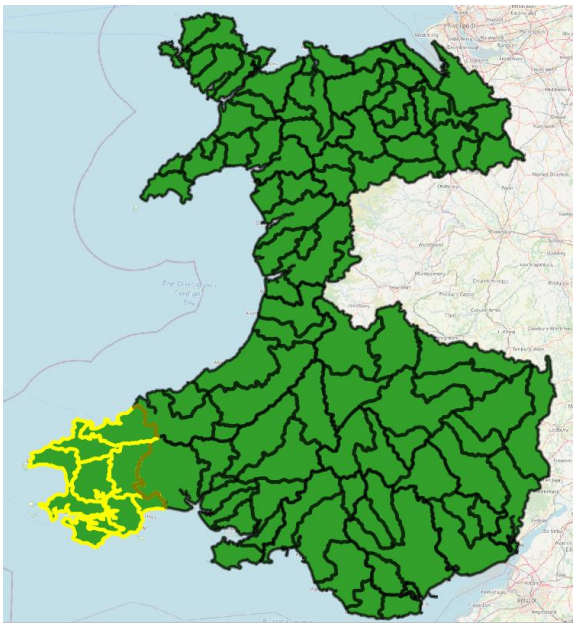


Figure 1 - River basin location detailing the associated tactial planning catchments

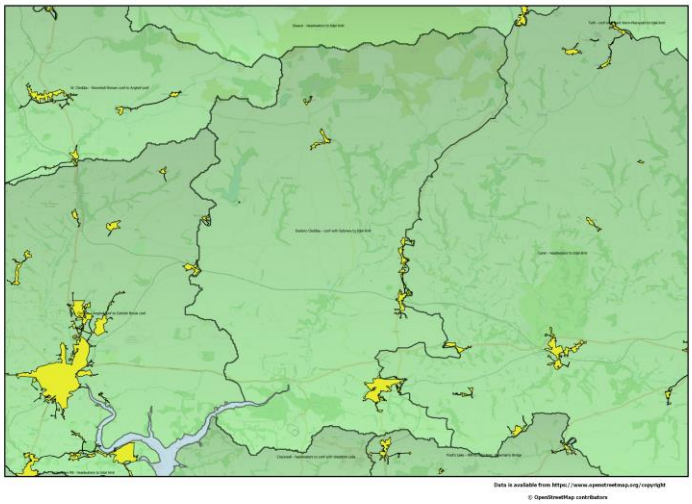


Figure 2- Tactical planning catchment

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 alighn 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.

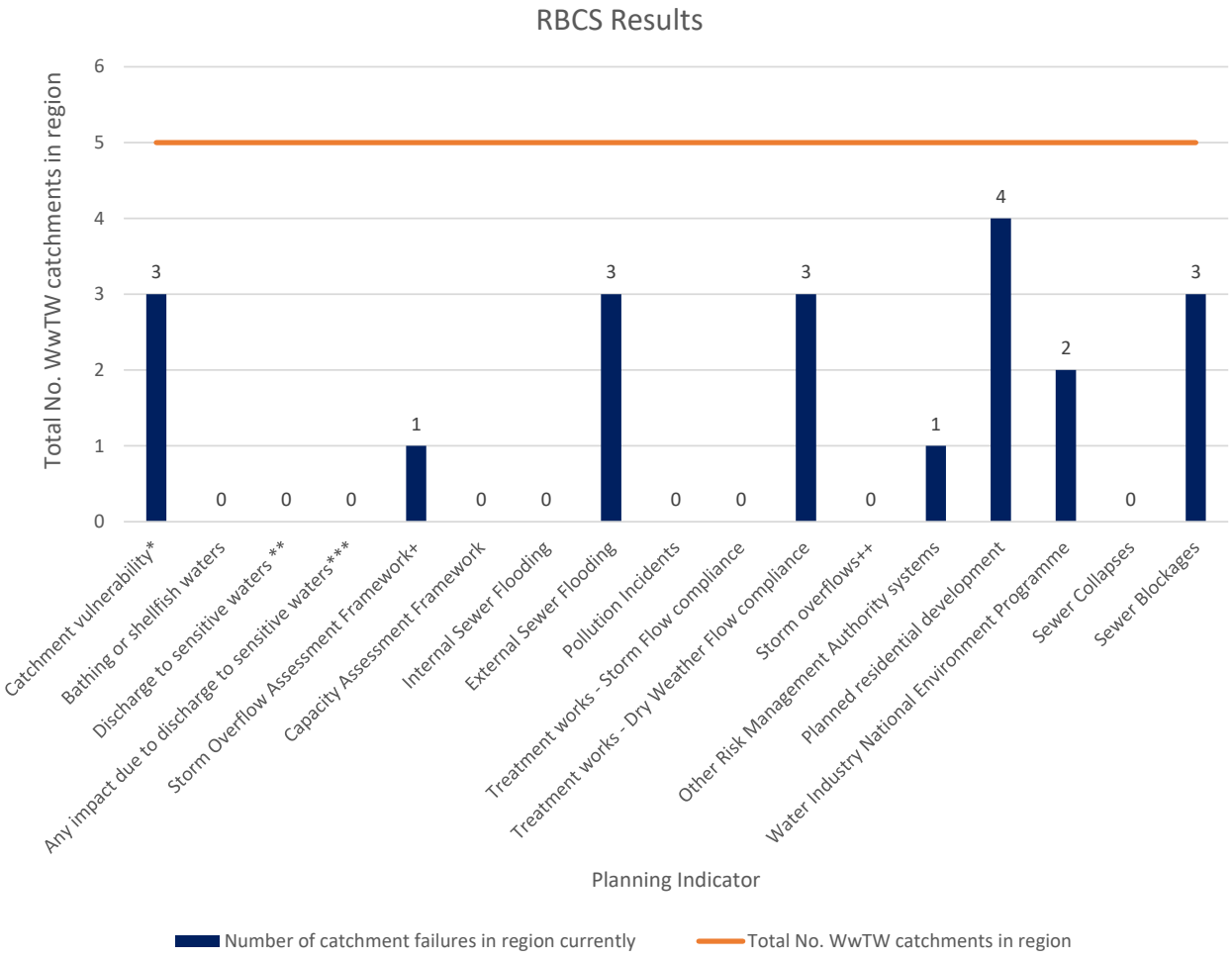
Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

Climate change is predicted to increase the intensity of storms by around 15% 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 Cleddau and Pembrokeshire Coastal Rivers region is set to decrease to 4500 by 2050, a change of -4% based on our future projections. However there are major developments in localised areas that will contribute to future pressures on the network, including west of Bloomfield Gardens, Narberth with 89 units and West of Rushacre, Narberth with 58 units.

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.

In the event of an extreme storm 3 out of 4 catchments in Eastern Cleddau are predicted to flood. It is reported that there will be planned developments in these catchments and a high predicted growth rate. Leading to compliance issues at the WwTW in dry conditions in the majority of these catchments



*To sewer flooding due to extreme wet weather events.
**Sensitve waters are considered as Bathing Water and Shellfish Water.
**Catagorised as a "planned" scheduled action within the Natural Resources Wales Action Database or considered as "Remedy" on Natural England Designated Sites system.
***Catagorised 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.

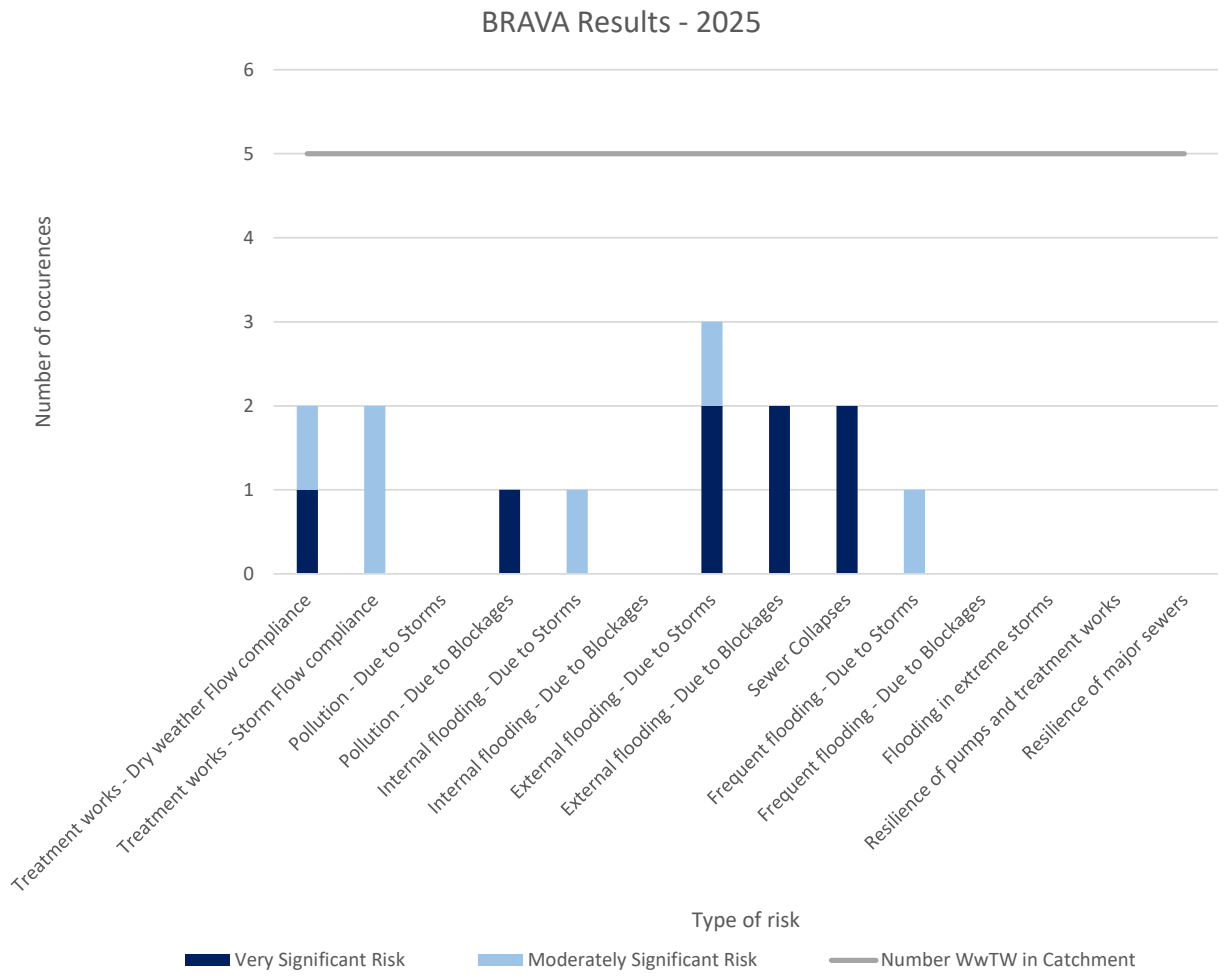


Figure 4 - BRAVA 2025 Summary

In 2025 there are no significant risks in this catchment. The risks that do exist are a result of storm conditions that could cause flooding, pollution and blockages. The WwTW is also at risk of being under capacity.

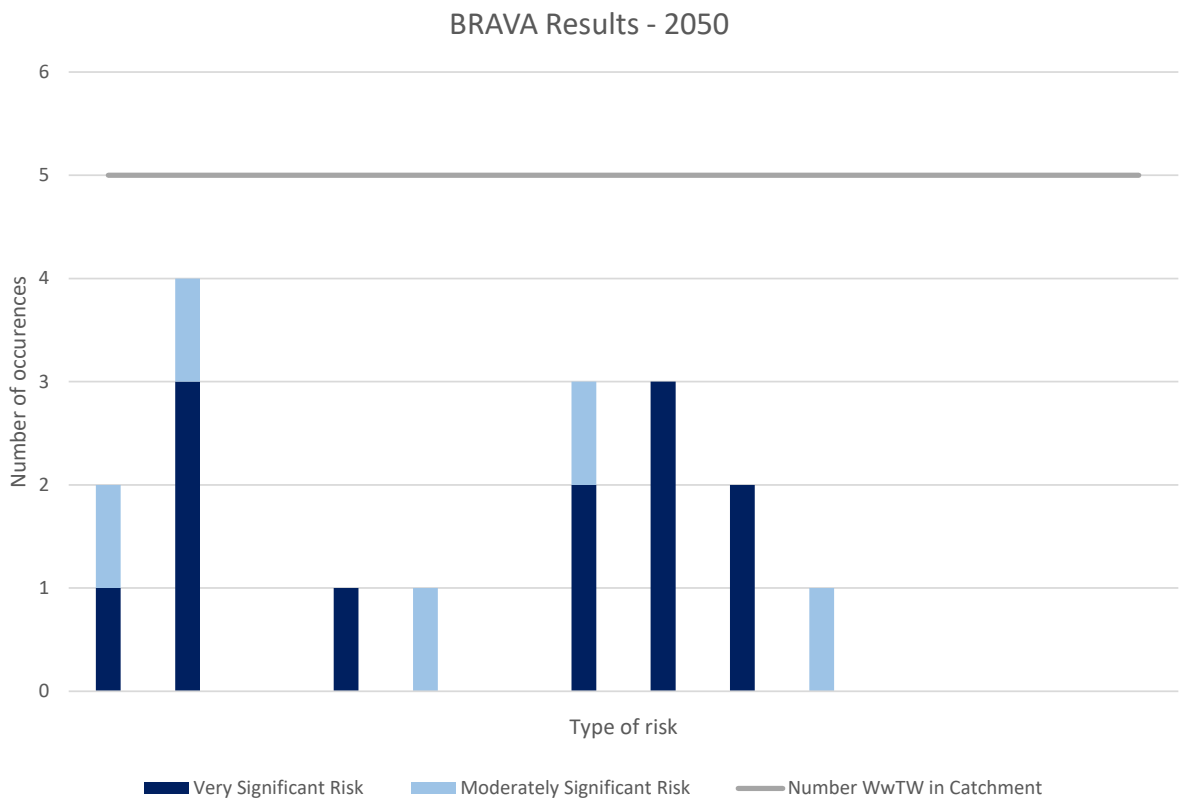


Figure 5 - BRAVA 2050 Summary

In 2050 the risks associated to storm conditions increase. This risk of flooding, pollution and the treatments works not operaing within compliance also increases.

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.

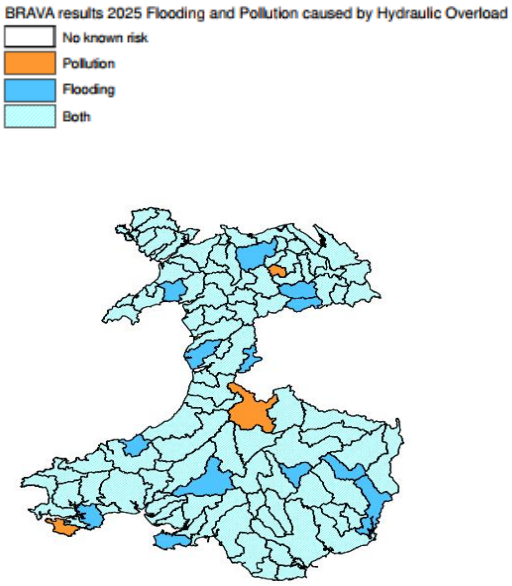


Figure 6 - Associated Strategic Planning Areas priority (2025)

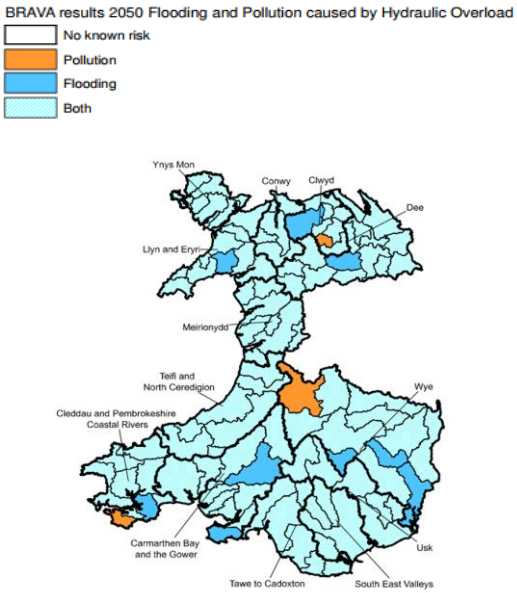


Figure 7 - Associated Strategic Planning Areas

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. Eastern Cleddau - conf with Syfynwy to tidal limit 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 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
Eastern Cleddau - conf with Syfynwy to tidal limit	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.

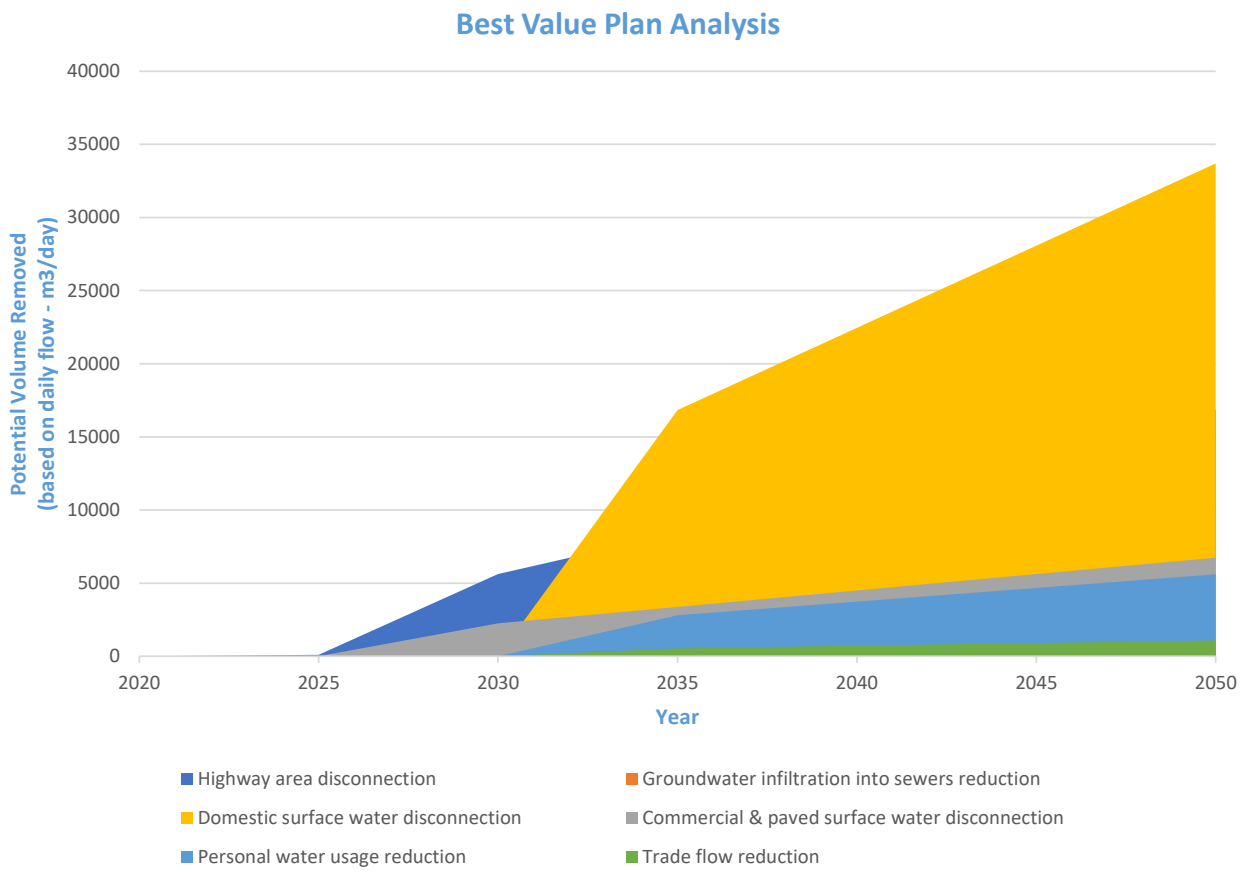


Figure 8 - Best Value Plan Analysis

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 probability of occurring once every 30 years. Table 5 illustrates the cost of potential mitigation measures to mitigate varying flood risk types.

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

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain Existing Performance*	-	£10,000,000.00	£15,000,000.00
40 spills in a Typical Year	£9,000,000.00	£9,000,000.00	£9,000,000.00
20 spills in a Typical Year	£11,000,000.00	£10,000,000.00	£11,000,000.00
10 spills in a Typical Year	£12,000,000.00	£13,000,000.00	£13,000,000.00
0 spills in a Typical Year	£21,000,000.00	£22,000,000.00	£23,000,000.00
Equivalent No. Olympic Swimming Pools in 10 spills scenario	109.00	121.00	128.00

* 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	£6,000,000	£7,000,000	£10,000,000
No flooding	-	£2,000,000	£6,000,000
Total	£7,000,000.00	£10,000,000	£17,000,000

Table 5 - Summary of Flooding option investments

Table 4 and 5 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 two. 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

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

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

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

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

Table 6 - Summary of schemes per WwTW within the Tactical Planning catchment first cycle prior to HRA/ SEA

L4 Catchments	No. Schemes
NARBERTH WEST	0
LLYS-Y-FRAN DAM	0
ROSEBUSH (DYFED)	0
MAENCLOCHOG	0
CLYNDERWEN	0

DWMP Tactial Planning Catchment Summary

Ford's Lake - HW to tidal limit, Wiseman's Bridge

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 Ford's Lake - HW to tidal limit, Wiseman's Bridge planning catchment lies within the Cleddau and Pembrokeshire Coastal Rivers river basin catchment, (see Figure 1 below), it consists of 5 wastewater catchments (see Figure 2 below). There is a combined population of 2402, this is set to decrease to 2293 by 2050, a change of -5%. There is a total sewer length of 14km, with a foul sewer length of 13km, a surface water length of 0km and a combined sewer length of 0km. There are 5 Wastewater Treatment Works (WwTW), 5 Sewerage Pumping Stations (SPSs), and 4 Combined Storm Overflows (CSOs) across this tactical planning unit.

Ford's Lake - HW to tidal limit, Wiseman's Bridge is a catchment situated in the south of Pembrokeshire. The catchment is relatively small and much of the catchment borders the Bristol Channel to the south. Within the southwestern part of the catchment is the Pembrokeshire Coast National Park. The catchment stretches from Templeton in the northwest to near Pendine in the southeast. A number of settlements are present within the catchment including Ludchurch and part of Saundersfoot. There are 3 relatively short main rivers within the catchment that each run into the Bristol Channel; Ford's Lake, Amroth and Trelissey.

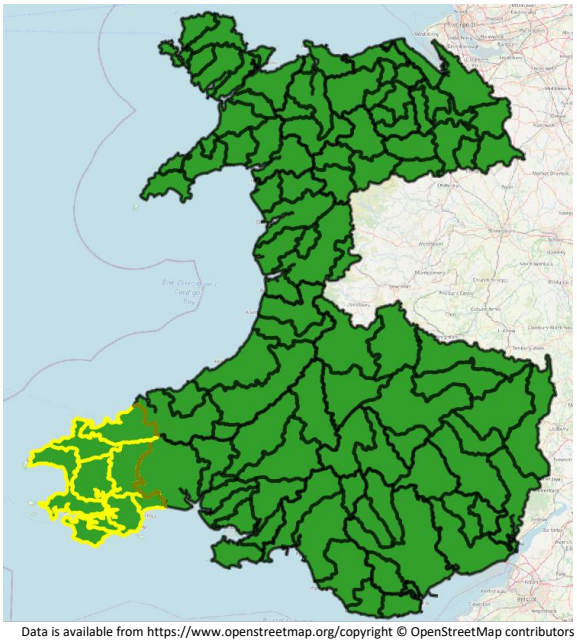


Figure 1 - River basin location detailing the associated tactial planning catchments

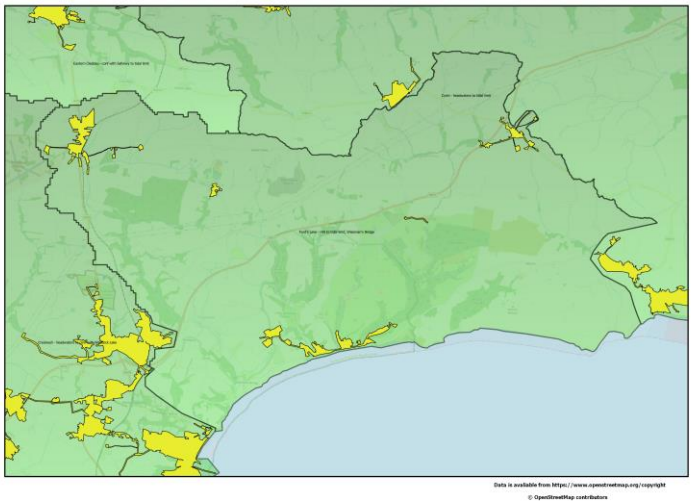


Figure 2- Tactical planning catchment

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 alighn 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.

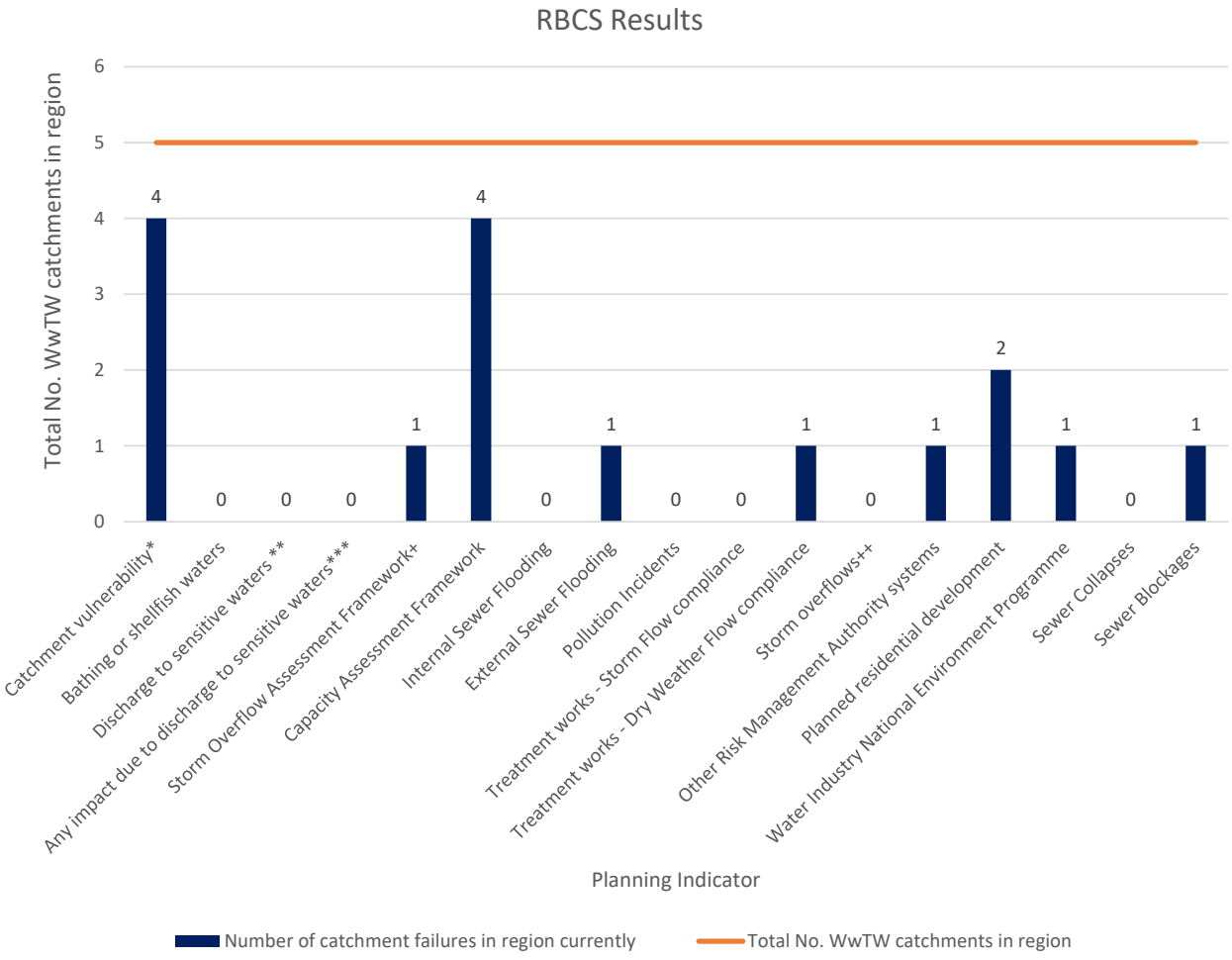
Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

Climate change is predicted to increase the intensity of storms by around 15% 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 Cleddau and Pembrokeshire Coastal Rivers region is set to decrease to 2300 by 2050, a change of -5% based on our future projections. However there are major developments in localised areas that will contribute to future pressures on the network, including South of Boars Head junction, Templeton with 22 units.

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.

The RBCS has highlighted that 4 out of the 5 L4 catchments within this L3 are likely to be vulnerable to sewer flooding due to an extreme storm event. Capacity Assessment Framework risks were also flagged as significant within this catchment.



*To sewer flooding due to extreme wet weather events.
**Sensitve waters are considered as Bathing Water and Shellfish Water.
**Catagorised as a "planned" scheduled action within the Natural Resources Wales Action Database or considered as "Remedy" on Natural England Designated Sites system.
***Catagorised 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.

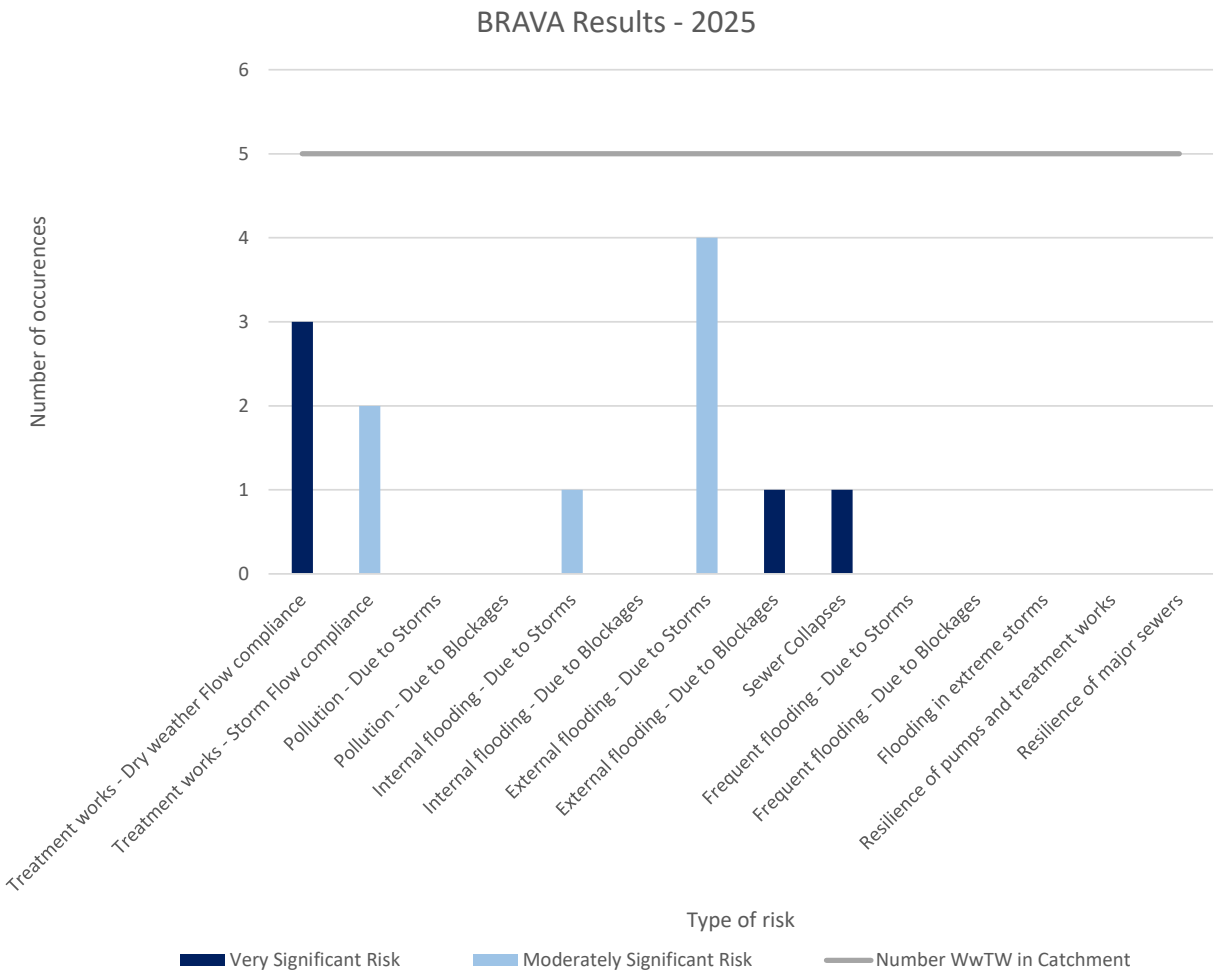


Figure 4 - BRAVA 2025 Summary

In 2025 it is predicted that 8 types of risk will contribute to the overall risk. Of these, treatment work compliance during dry weather flows and external flooding due to blockages are predicted to be the most significant.

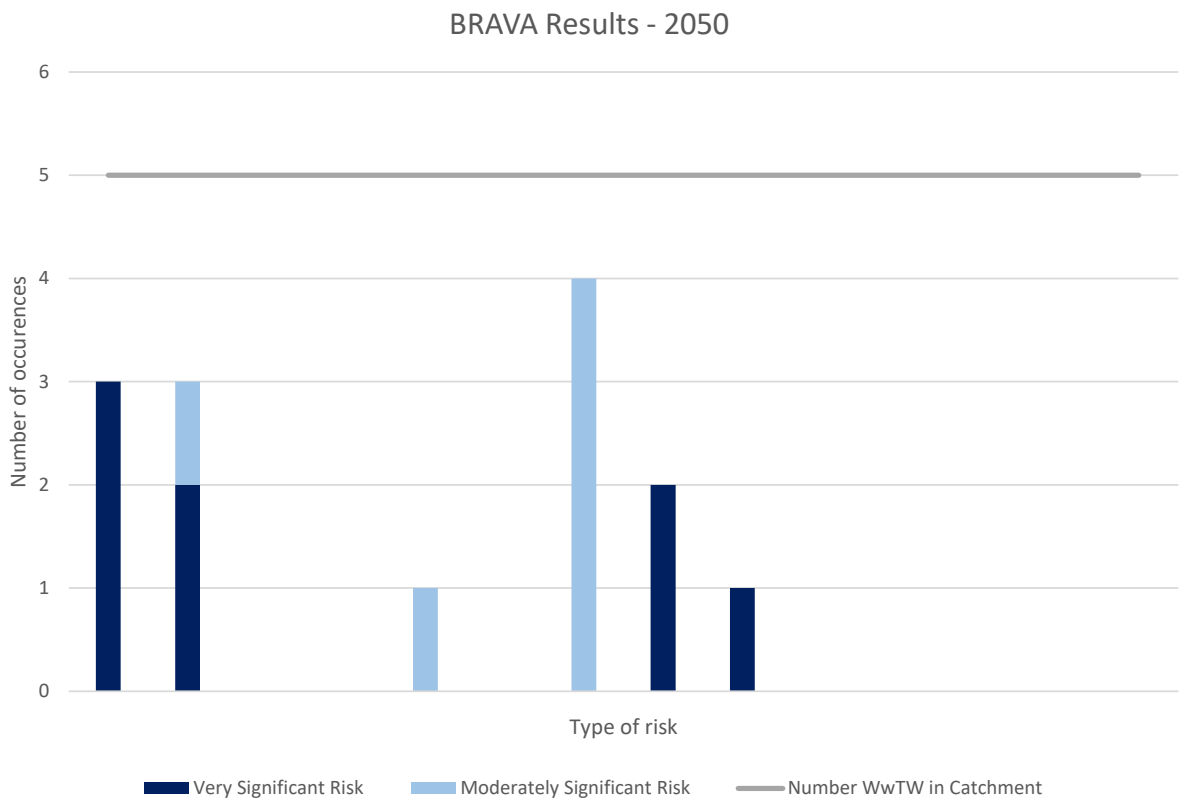


Figure 5 - BRAVA 2050 Summary

In 2050 it is predicted that treatment work compliance during dry weather flow will be the most significant contributor to overall risk within the catchment. Treatment work compliance during storm events is also expected to be a significant contributor to overall risk, as well as 5 other types of risk.

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.

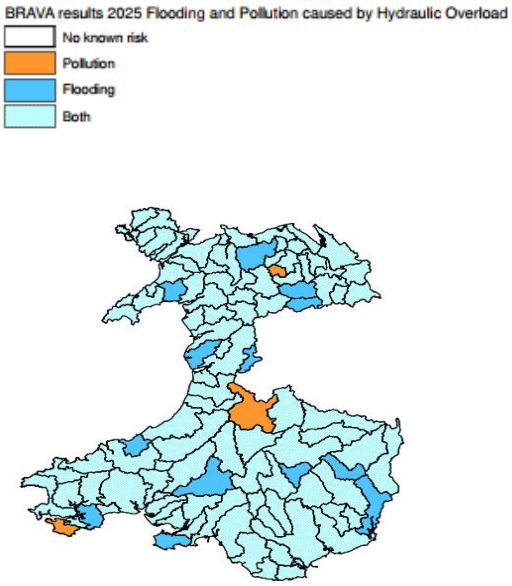


Figure 6 - Associated Strategic Planning Areas priority (2025)

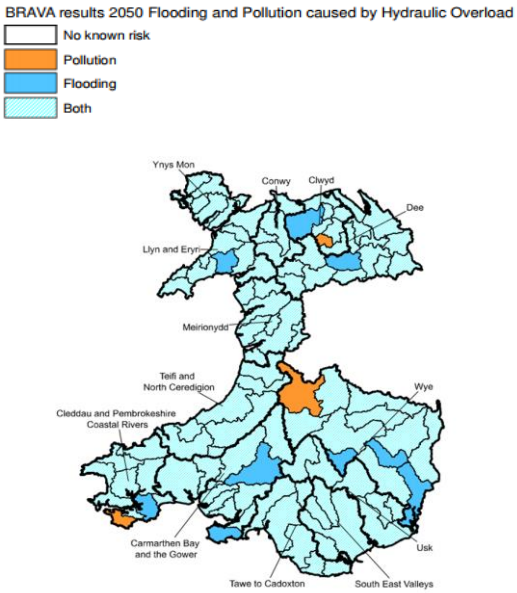


Figure 7 - Associated Strategic Planning Areas

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. Ford's Lake - HW to tidal limit, Wiseman's Bridge has a water quality priority status for 2050 of 2 which indicates targeted investment to mitigate and focus during AMP10.

4.0 Supply Demand

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

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

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

Table 2 shows the supply-demand assessment for this region. Where a region may not have adequate capacity under a given scenario, it is flagged 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
Ford's Lake - HW to tidal limit, Wiseman's Bridge	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.

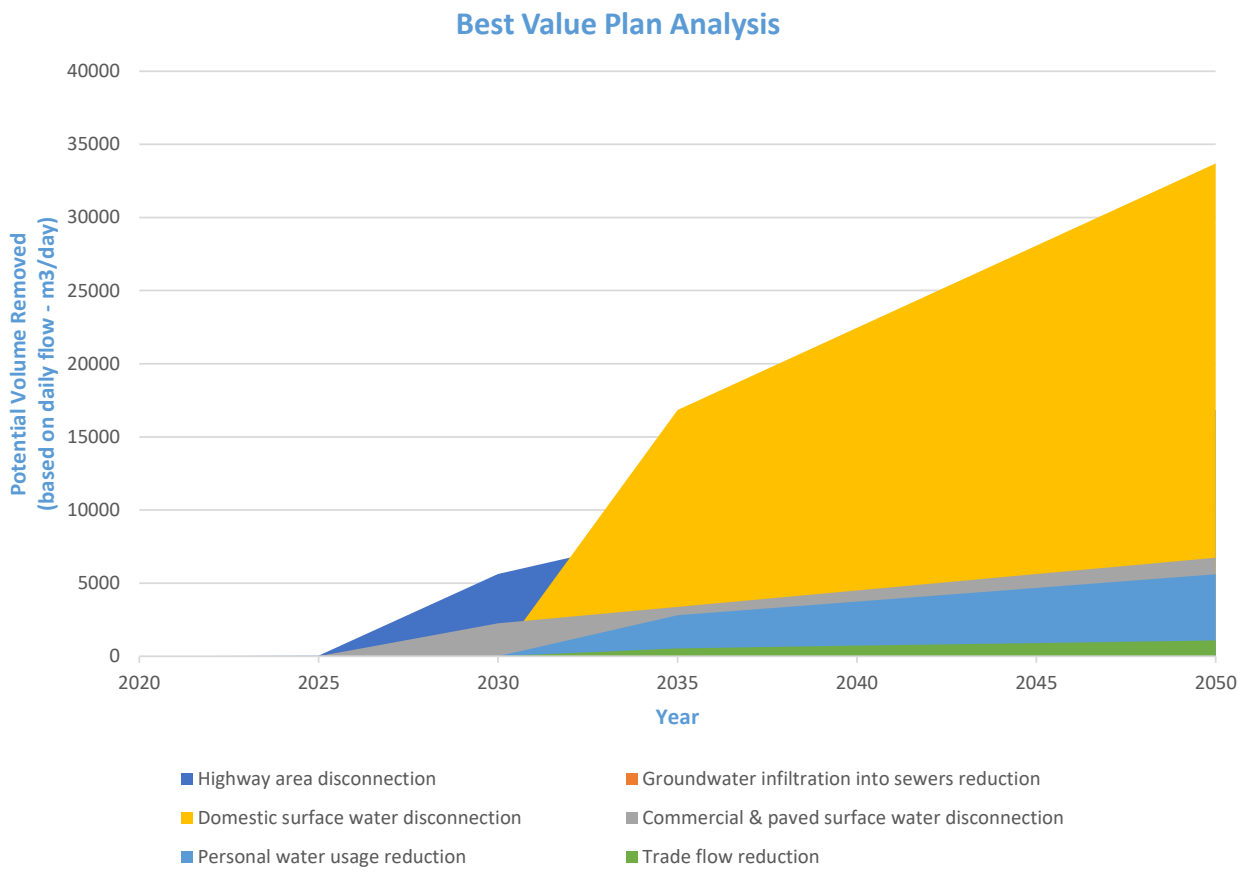


Figure 8 - Best Value Plan Analysis

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 probability of occurring once every 30 years. Table 5 illustrates the cost of potential mitigation measures to mitigate varying flood risk types.

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

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain Existing Performance*	-	£10,000,000.00	£15,000,000.00
40 spills in a Typical Year	£1,000,000.00	£1,000,000.00	£1,000,000.00
20 spills in a Typical Year	£3,000,000.00	£3,000,000.00	£3,000,000.00
10 spills in a Typical Year	£4,000,000.00	£4,000,000.00	£4,000,000.00
0 spills in a Typical Year	£11,000,000.00	£11,000,000.00	£11,000,000.00
Equivalent No. Olympic Swimming Pools in 10 spills scenario	26.00	28.00	31.00

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

Table 4 - Summary of Combined Sewer Overflow option investments

Choice of Scenario	Current Scenario (£)	2050 Scenario (£)	2050 Resilience Scenario (£) 1 in 50 yr (Storm Dennis)
Internal escapes	£0	£0	£0
External escapes in gardens	£0	£0	£0
Escapes in highways	£0	£0	£0
No flooding	-	£3,000,000	£9,000,000
Total	£0.00	£3,000,000	£9,000,000

Table 5 - Summary of Flooding option investments

Table 4 and 5 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 two. 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

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

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

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

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

Table 6 - Summary of schemes per WwTW within the Tactical Planning catchment first cycle prior to HRA/ SEA

L4 Catchments	No. Schemes
CRUNWERE	0
LUDCHURCH	0
TEMPLETON (S OF NARBERTH)	0
RED ROSES	0
AMROTH	0

DWMP Tactial Planning Catchment Summary

Gwaun - headwaters to tidal limit

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 Gwaun - headwaters to tidal limit planning catchment lies within the Cleddau and Pembrokeshire Coastal Rivers river basin catchment, (see Figure 1 below), it consists of 10 wastewater catchments (see Figure 2 below). There is a combined population of 11763, this is set to decrease to 10073 by 2050, a change of -14%. There is a total sewer length of 81km, with a foul sewer length of 40km, a surface water length of 1km and a combined sewer length of 36km. There are 10 Wastewater Treatment Works (WwTW), 19 Sewerage Pumping Stations (SPSs), and 20 Combined Storm Overflows (CSOs) across this tactical planning unit.

The catchment of Gwaun - headwaters to tidal limit is situated on the northern coast of Pembrokeshire, with most of the catchment falling within the Pembrokeshire Coast National Park. It stretches from Fishguard in the west, to Blaenfoss in the east and to Moylgrove in the north. Large parts of the catchment can be characterised as steep and rural, with numerous villages throughout the catchment. Within the catchments are the rivers Gwaun and Nevern, from source to mouth.

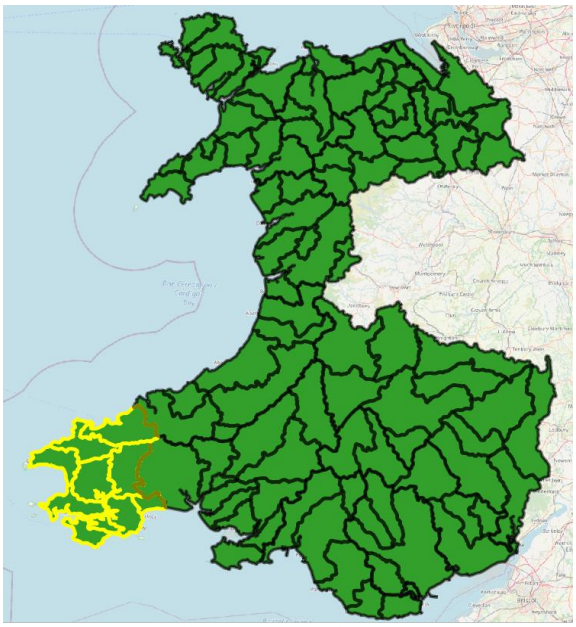


Figure 1 - River basin location detailing the associated tactial planning catchments

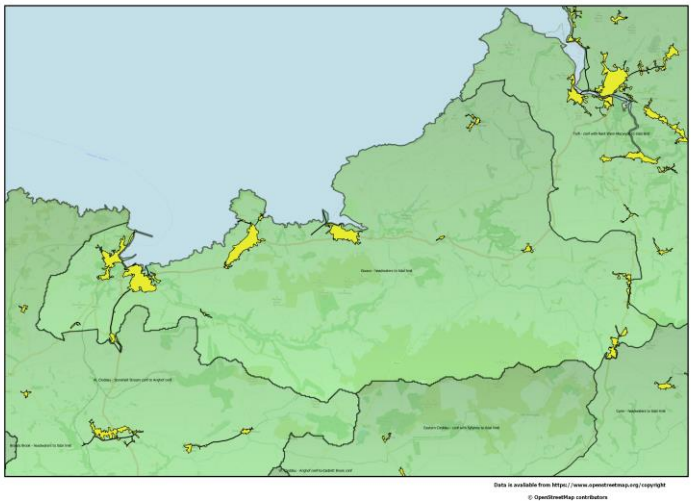


Figure 2- Tactical planning catchment

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 alighn 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.

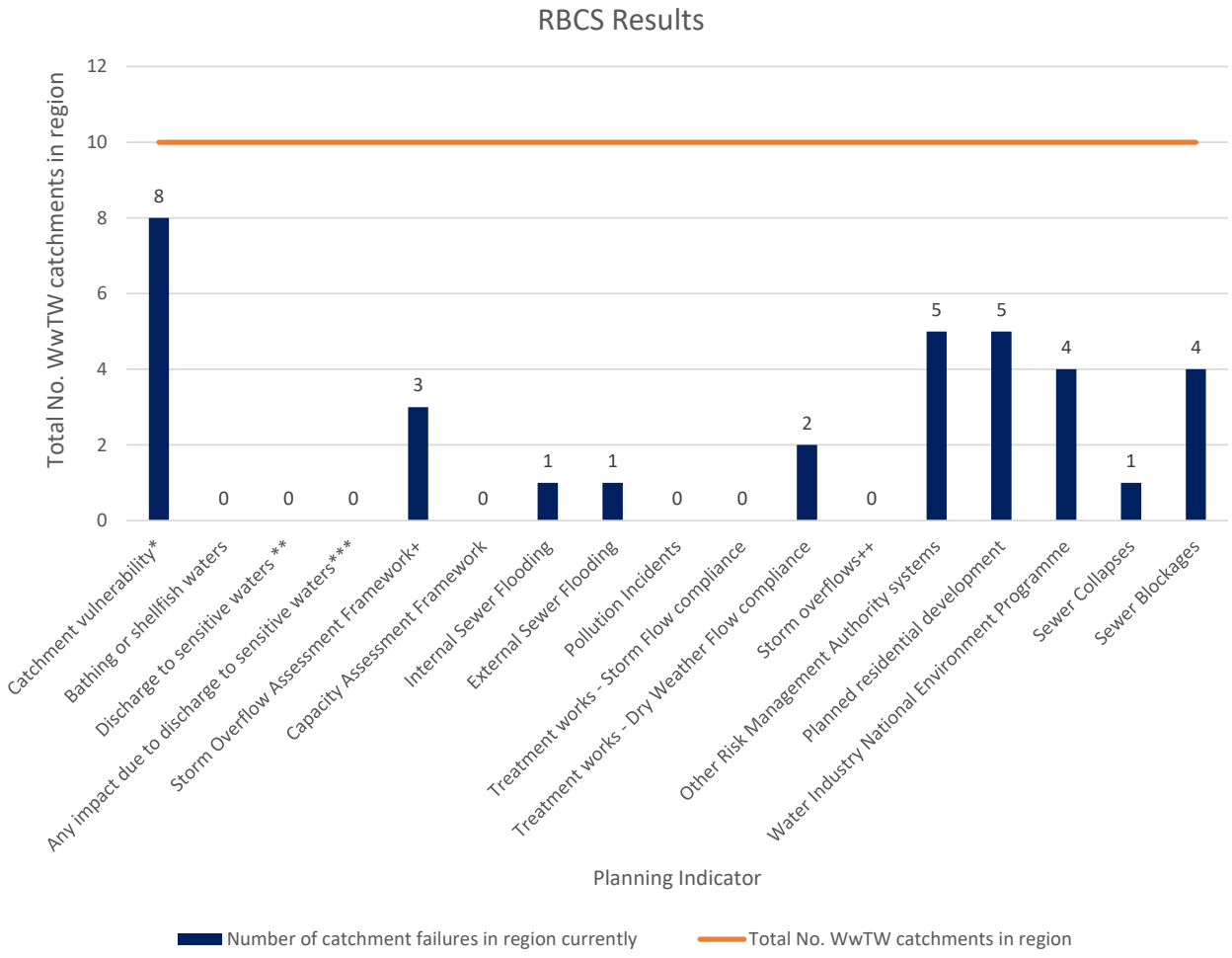
Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

Climate change is predicted to increase the intensity of storms by around 15% 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 Cleddau and Pembrokeshire Coastal Rivers region is set to decrease to 10100 by 2050, a change of -14% based on our future projections. However there are major developments in localised areas that will contribute to future pressures on the network, including Maesgwynne Farm, Fishguard with 399 units and in Crymych with 60 units.

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.

The RBCS has highlighted that 8 out of the 10 L4 catchments within this L3 are likely to be vulnerable to sewer flooding due to an extreme storm event. Planned residential development and flooding that falls under the scope of other risk management authorities were also flagged as risks within the catchment.



*To sewer flooding due to extreme wet weather events.
**Sensitve waters are considered as Bathing Water and Shellfish Water.
**Catagorised as a "planned" scheduled action within the Natural Resources Wales Action Database or considered as "Remedy" on Natural England Designated Sites system.
***Catagorised 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.

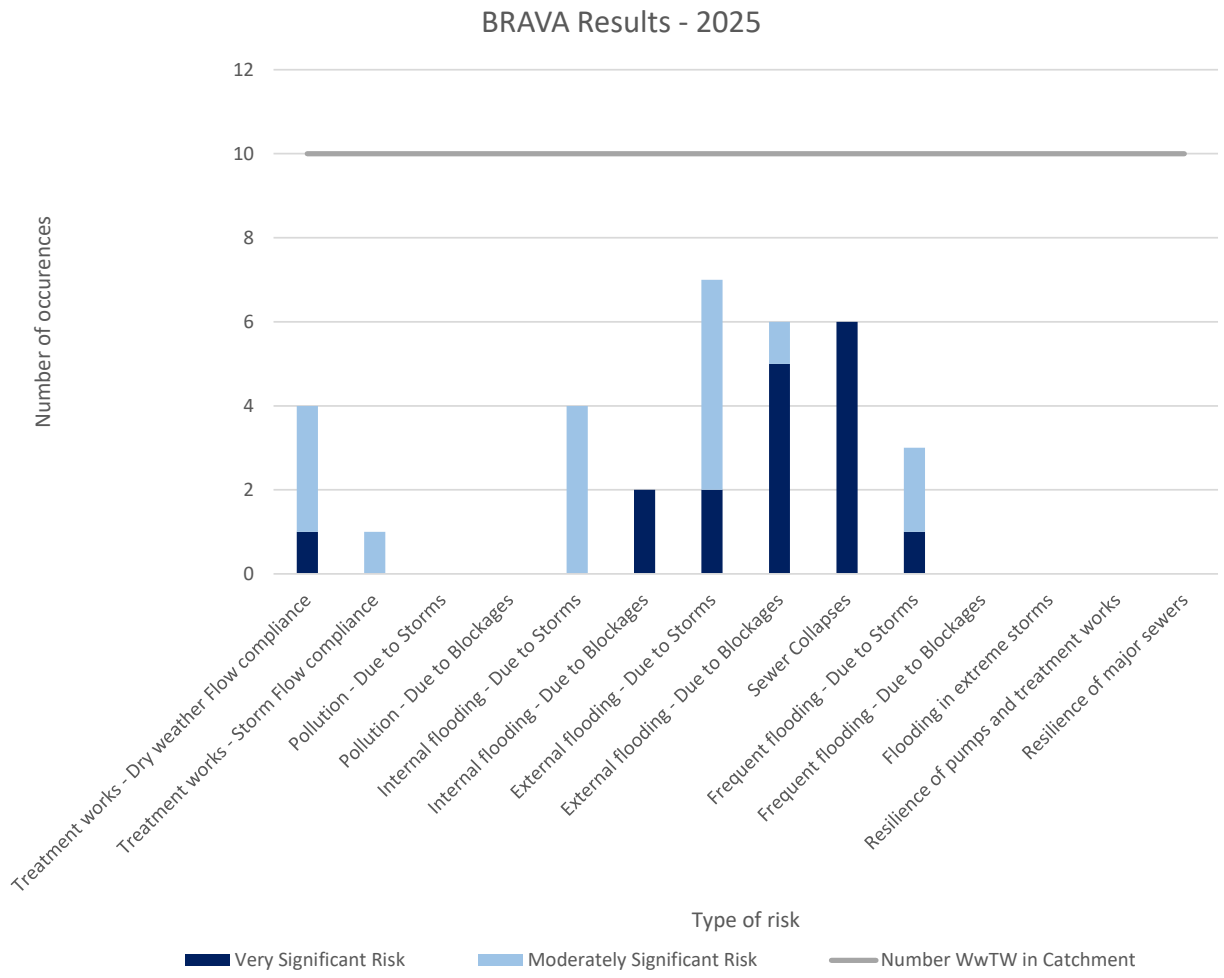


Figure 4 - BRAVA 2025 Summary

In 2025 it is expected that external flooding and pollution due to storm events are likely to be the greatest contributors to overall risk within the catchment.

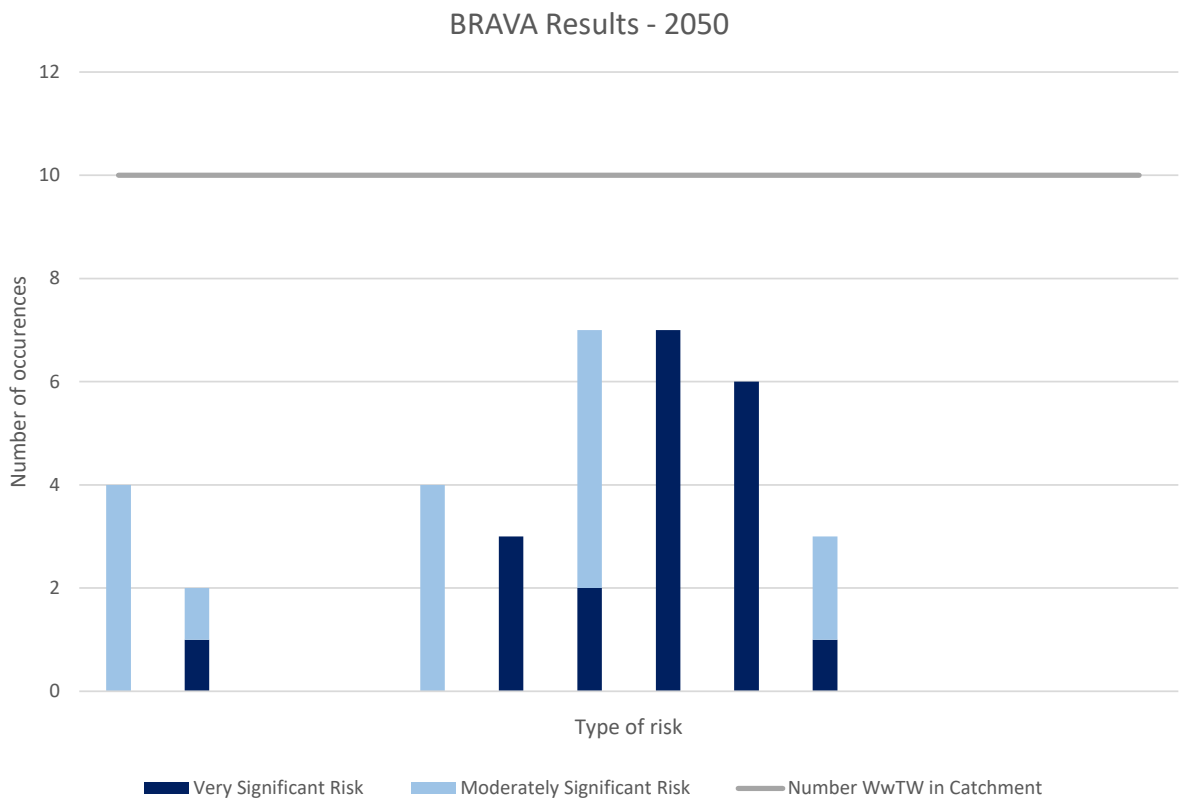


Figure 5 - BRAVA 2050 Summary

In 2050 it is expected that internal flooding due to blockages and sewer collapse are likely to be the largest contributors to overall risk within the 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.

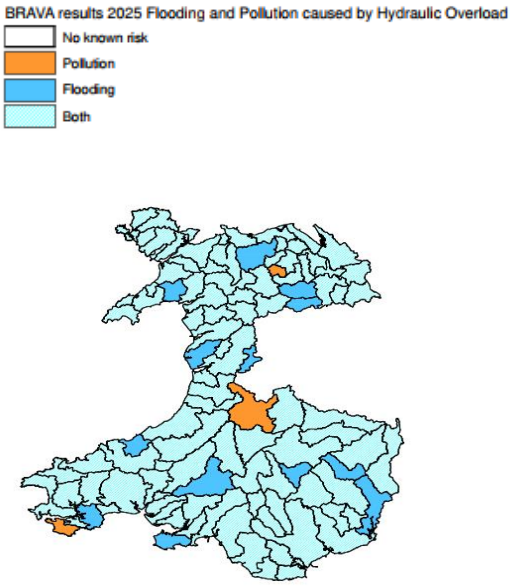


Figure 6 - Associated Strategic Planning Areas priority (2025)

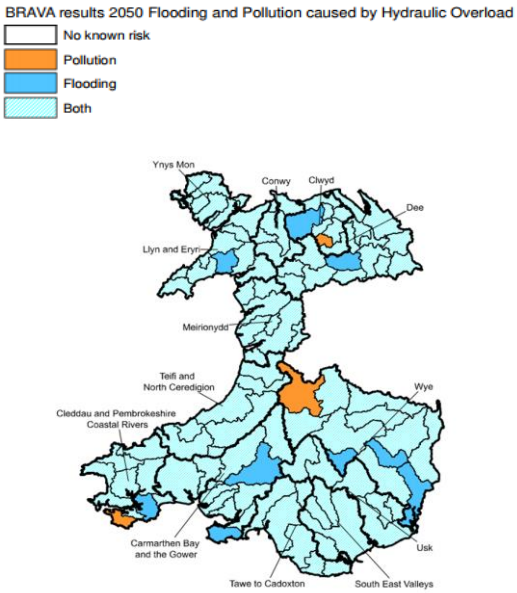


Figure 7 - Associated Strategic Planning Areas

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. Gwaun - headwaters to tidal limit 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 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
Gwaun - headwaters to tidal limit	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.

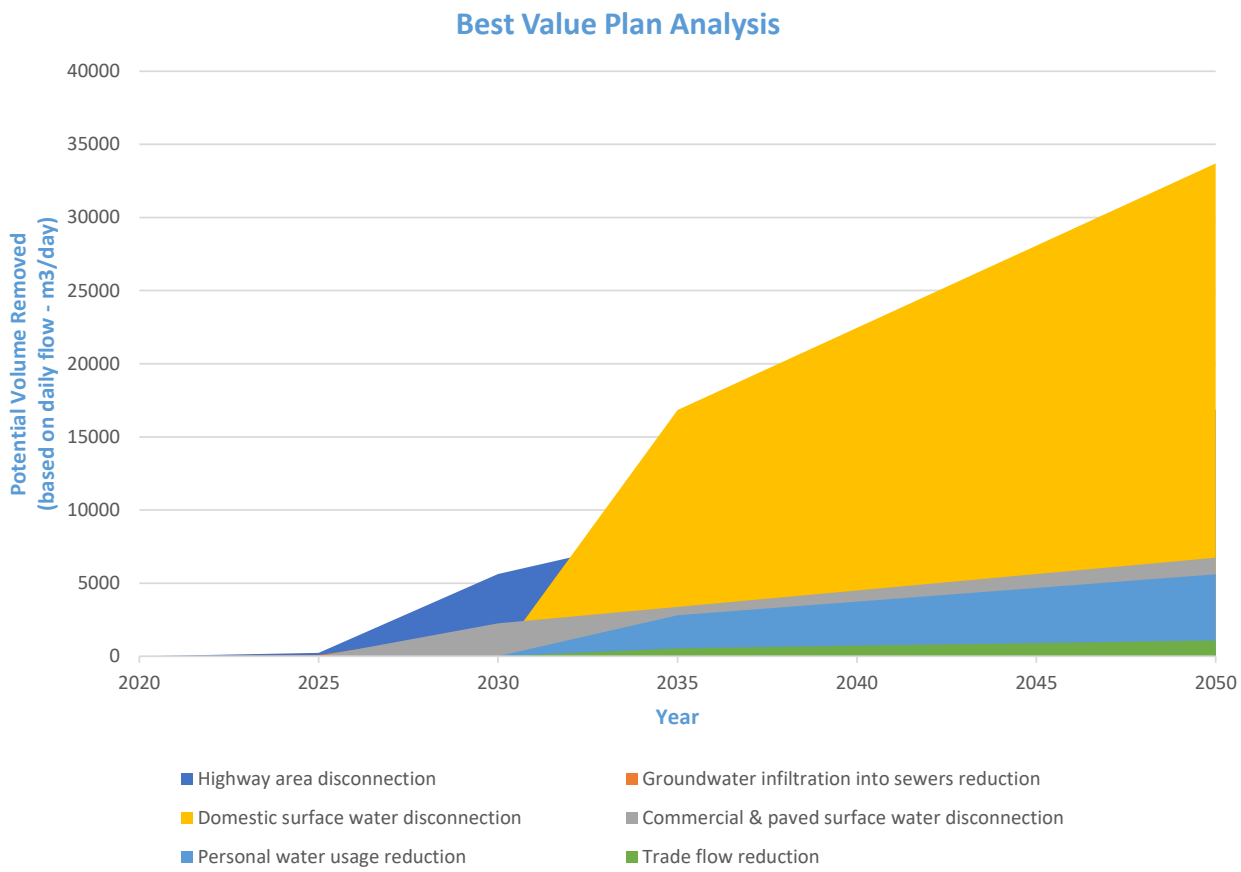


Figure 8 - Best Value Plan Analysis

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 probability of occurring once every 30 years. Table 5 illustrates the cost of potential mitigation measures to mitigate varying flood risk types.

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

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain Existing Performance*	-	£21,000,000.00	£30,000,000.00
40 spills in a Typical Year	£8,000,000.00	£7,000,000.00	£6,000,000.00
20 spills in a Typical Year	£18,000,000.00	£17,000,000.00	£18,000,000.00
10 spills in a Typical Year	£24,000,000.00	£25,000,000.00	£25,000,000.00
0 spills in a Typical Year	£46,000,000.00	£47,000,000.00	£50,000,000.00
Equivalent No. Olympic Swimming Pools in 10 spills scenario	40.00	74.00	79.00

* 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	£5,000,000	£6,000,000	£6,000,000
Escapes in highways	£7,000,000	£8,000,000	£11,000,000
No flooding	-	£3,000,000	£8,000,000
Total	£13,000,000.00	£18,000,000	£26,000,000

Table 5 - Summary of Flooding option investments

Table 4 and 5 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 two. 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

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

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

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

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

Table 6 - Summary of schemes per WwTW within the Tactical Planning catchment first cycle prior to HRA/ SEA

L4 Catchments	No. Schemes
CRYMMYCH	0
FISHGUARD	0
EGLWYSWRW	0
PANTEG (NR FISHGUARD)	0
FELINDRE FARCHOG STW	0
BLAENFFOS	0
LLANYCHAER	0
MOYLGROVE (NR CARDIGAN)	0
DINAS CROSS (NR FISHGUARD)	0
NEWPORT (DYFED)	0

DWMP Tactial Planning Catchment Summary

Huberston Pill - headwaters to tidal limit

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 Huberston Pill - headwaters to tidal limit planning catchment lies within the Cleddau and Pembrokeshire Coastal Rivers river basin catchment, (see Figure 1 below), it consists of 12 wastewater catchments (see Figure 2 below). There is a combined population of 26335, this is set to decrease to 23819 by 2050, a change of -10%. There is a total sewer length of 152km, with a foul sewer length of 88km, a surface water length of 1km and a combined sewer length of 54km. There are 12 Wastewater Treatment Works (WwTW), 43 Sewerage Pumping Stations (SPSs), and 30 Combined Storm Overflows (CSOs) across this tactical planning unit.

The catchment of Huberston Pill - headwaters to tidal limit is situated in the southwest of Wales, with the western half of the catchment falling within a section of the Pembrokeshire Coast National Park. The catchment stretches from Wooltak Bay in the west to Llangwm in the east. There are a number of settlements throughout the catchment such as Marloes, Milford Haven and Neyland. The West Cleddau river borders to catchment to the east.

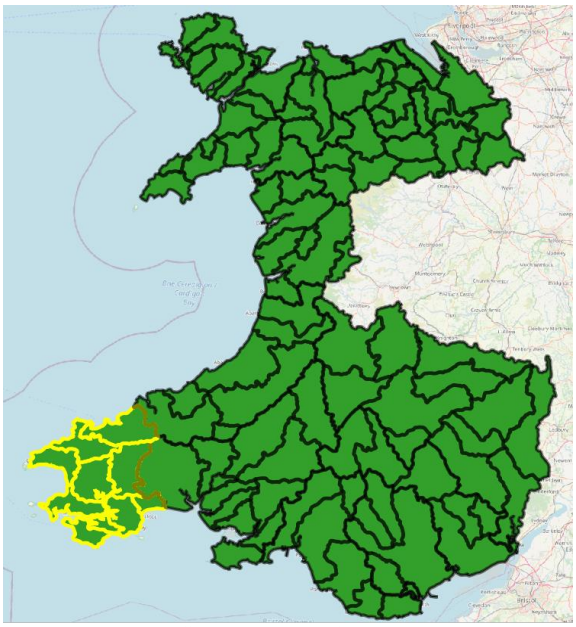


Figure 1 - River basin location detailing the associated tactial planning catchments

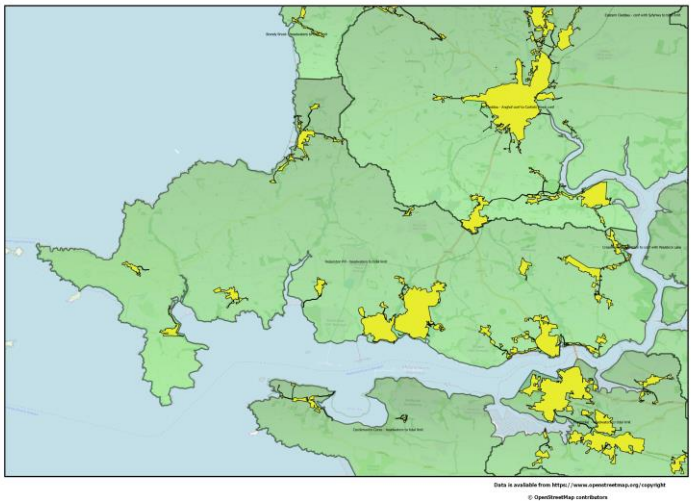


Figure 2- Tactical planning catchment

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 alighn 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.

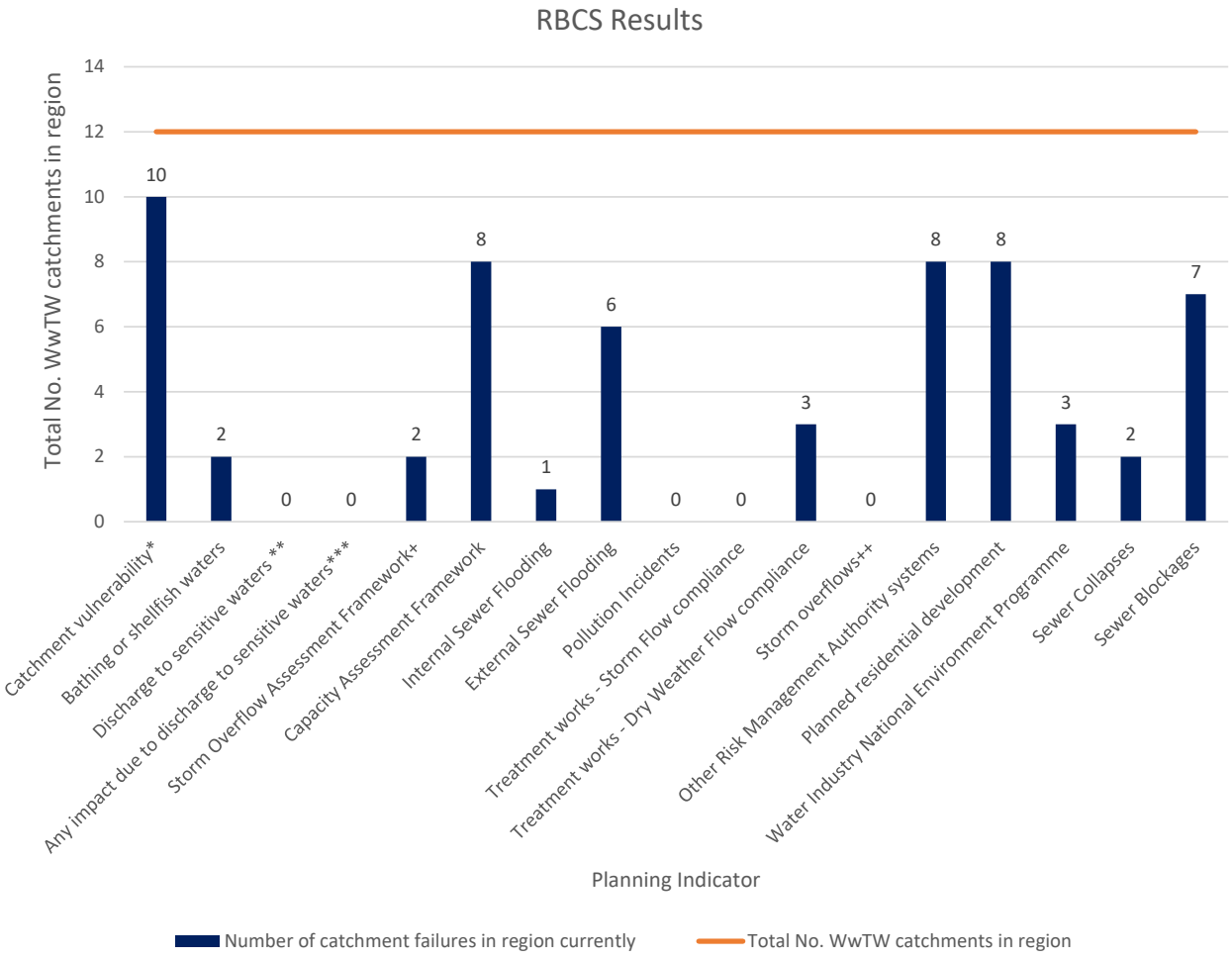
Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

Climate change is predicted to increase the intensity of storms by around 15% 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 Cleddau and Pembrokeshire Coastal Rivers region is set to decrease to 23800 by 2050, a change of -10% based on our future projections. However there are major developments in localised areas that will contribute to future pressures on the network, including Steynton Thornton Road, Milford Haven with 224 units and Dale Road, Milford Haven with 168 units.

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.

The RBCS has highlighted that 10 out of the 12 L4 catchments within this L3 are likely to be at risk of sewer flooding due to extreme storm events. Capacity Assessment Framework risks, flooding under the scope of other risk management authorities and planned residential development were also flagged as areas of potential risk within the catchment.



*To sewer flooding due to extreme wet weather events.
**Sensitve waters are considered as Bathing Water and Shellfish Water.
**Catagorised as a "planned" scheduled action within the Natural Resources Wales Action Database or considered as "Remedy" on Natural England Designated Sites system.
***Catagorised 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.

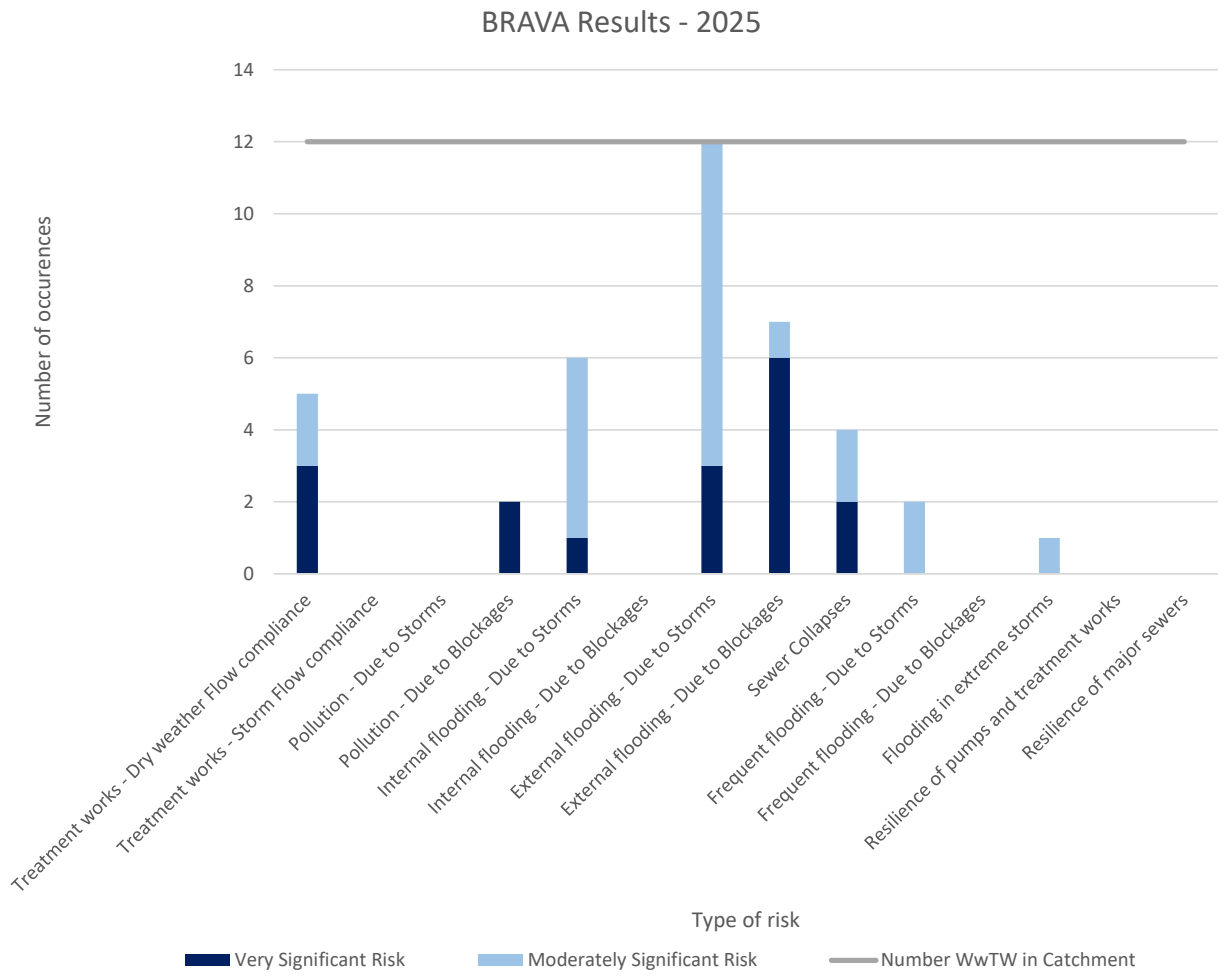


Figure 4 - BRAVA 2025 Summary

In 2025 it is predicted that external flooding due to storm events will be the most significant risk within the catchment. In total 9 types of risk are predicted to be present throughout the catchment

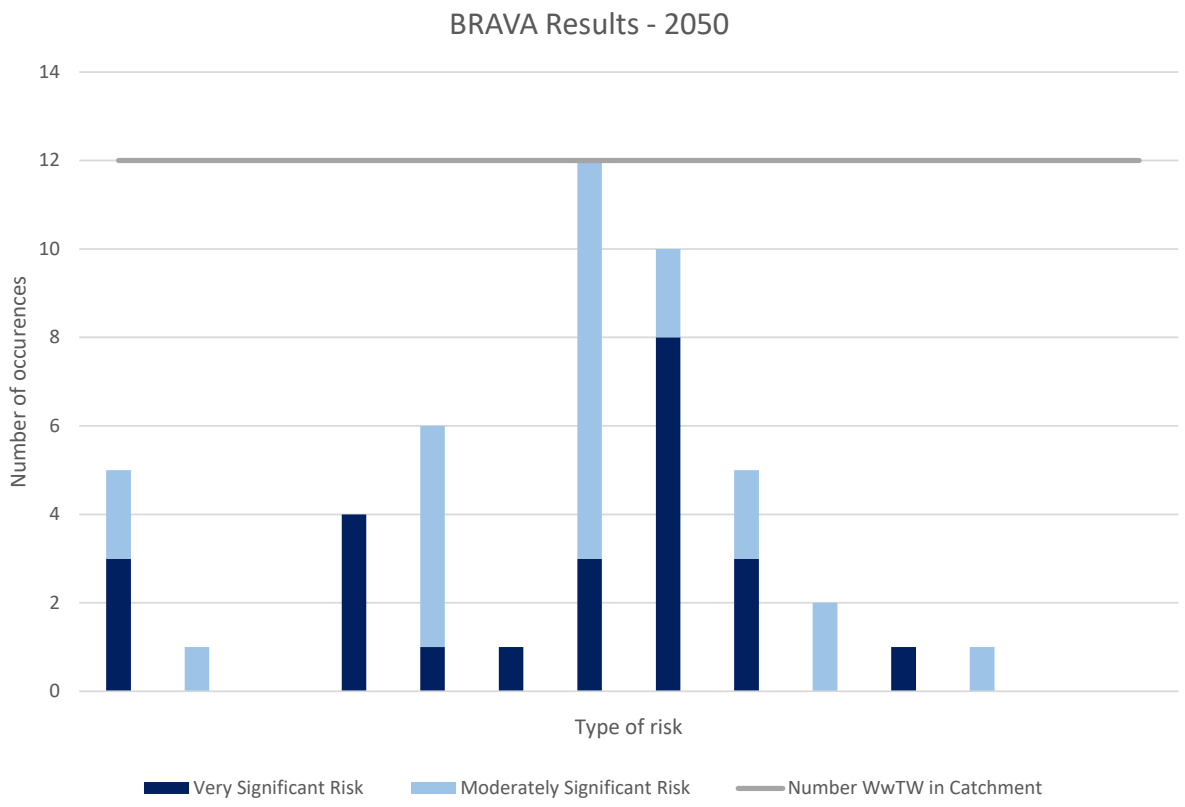


Figure 5 - BRAVA 2050 Summary

in 2050 it is predicted that treatment work compliance during both dry weather and storm flows will be a significant risk within the catchment, along with sewer collapse and internal flooding due to blockages.

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

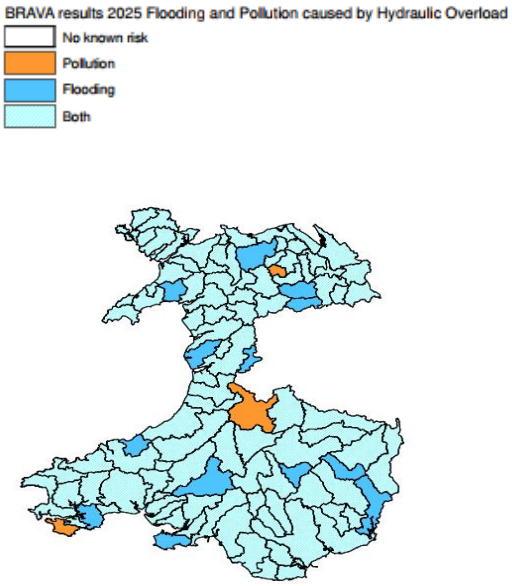


Figure 6 - Associated Strategic Planning Areas priority (2025)

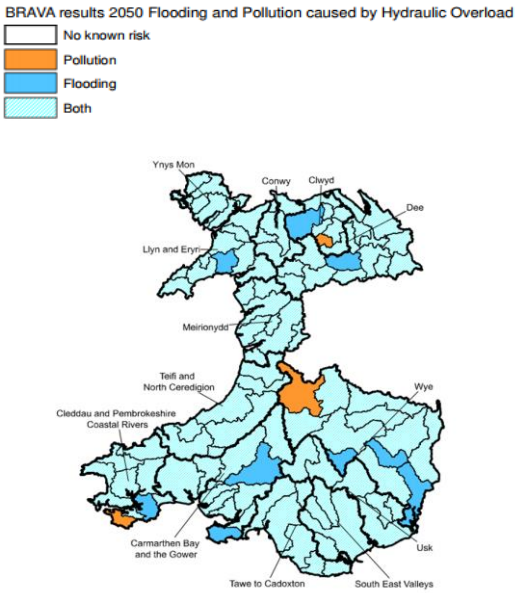


Figure 7 - Associated Strategic Planning Areas

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. Huberston Pill - headwaters to tidal limit has a water quality priority status for 2050 of 2 which indicates targeted investment to mitigate and focus during AMP10.

4.0 Supply Demand

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

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

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

Table 2 shows the supply-demand assessment for this region. Where a region may not have adequate capacity under a given scenario, it is flagged 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
Huberston Pill - headwaters to tidal limit	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.

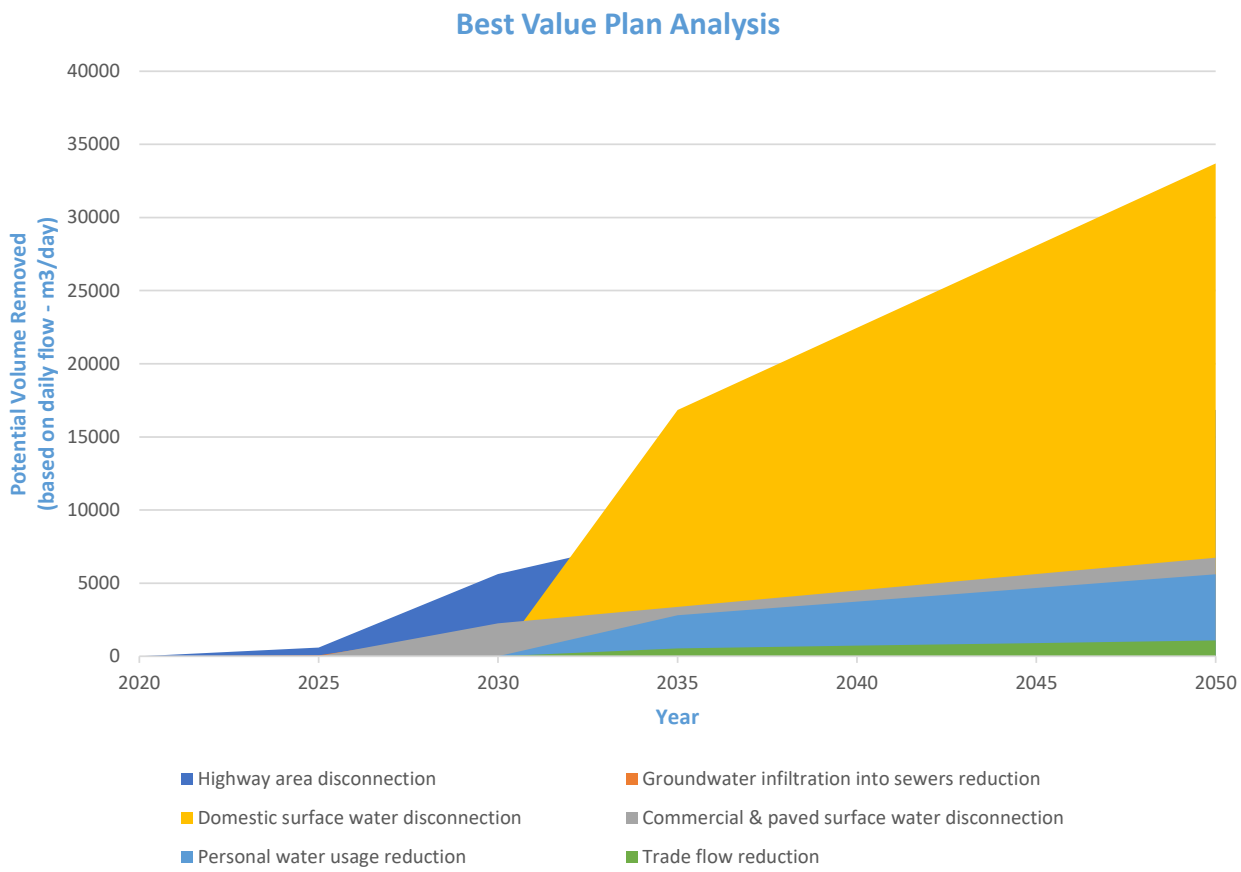


Figure 8 - Best Value Plan Analysis

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 probability of occurring once every 30 years. Table 5 illustrates the cost of potential mitigation measures to mitigate varying flood risk types.

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

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain Existing Performance*	-	£41,000,000.00	£62,000,000.00
40 spills in a Typical Year	£11,000,000.00	£11,000,000.00	£11,000,000.00
20 spills in a Typical Year	£16,000,000.00	£15,000,000.00	£18,000,000.00
10 spills in a Typical Year	£18,000,000.00	£18,000,000.00	£23,000,000.00
0 spills in a Typical Year	£73,000,000.00	£75,000,000.00	£80,000,000.00
Equivalent No. Olympic Swimming Pools in 10 spills scenario	103.00	115.00	125.00

* 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	£6,000,000
External escapes in gardens	£2,000,000	£3,000,000	£4,000,000
Escapes in highways	£16,000,000	£19,000,000	£25,000,000
No flooding	-	£3,000,000	£8,000,000
Total	£22,000,000.00	£30,000,000	£43,000,000

Table 5 - Summary of Flooding option investments

Table 4 and 5 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 two. 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

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

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

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

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

Table 6 - Summary of schemes per WwTW within the Tactical Planning catchment first cycle prior to HRA/ SEA

L4 Catchments	No. Schemes
MILFORD HAVEN	0
ST ISHMAELS	0
WATERSTON	0
TIERS CROSS	0
DALE	0
HERBRANDSTON	0
MARLOES	0
ROSEMARKET (NR MILFORD HAVEN)	0
BURTON FERRY (NR NEYLAND)	0
WALTON WEST (NR BROAD HAVEN)	0
LLANGWM (MILFORD HAVEN) STW	0
NEYLAND STW	0

DWMP Tactial Planning Catchment Summary

Pembroke - headwaters to tidal limit

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 Pembroke - headwaters to tidal limit planning catchment lies within the Cleddau and Pembrokeshire Coastal Rivers river basin catchment, (see Figure 1 below), it consists of 4 wastewater catchments (see Figure 2 below). There is a combined population of 22756, this is set to decrease to 17698 by 2050, a change of -22%. There is a total sewer length of 100km, with a foul sewer length of 23km, a surface water length of 3km and a combined sewer length of 72km. There are 4 Wastewater Treatment Works (WwTW), 26 Sewerage Pumping Stations (SPSs), and 19 Combined Storm Overflows (CSOs) across this tactical planning unit.

The Pembroke catchment stretches from the Pembrokeshire Coastal National Park covering the small towns of Hodgeston and Lamphey, West into to more urban and more densely populated regions of Pembroke and the Pembroke Dock. There is one watercourse in this catchment which runs West from Lamphey, through Pembroke and meeting the estuary of the West Cleaddau River.

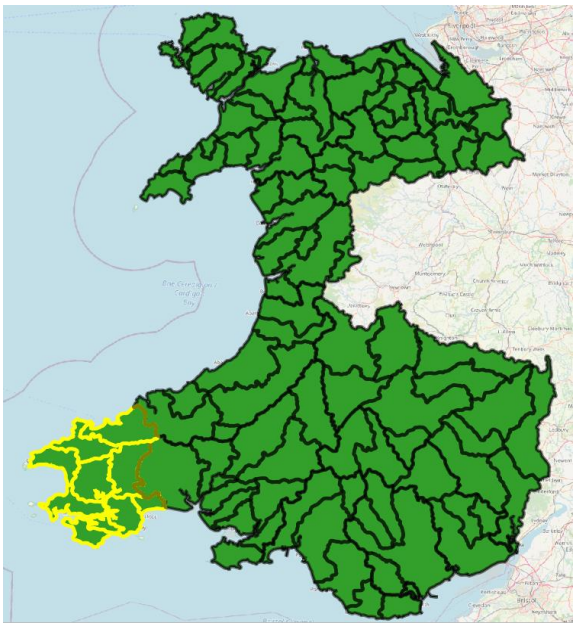


Figure 1 - River basin location detailing the associated tactial planning catchments

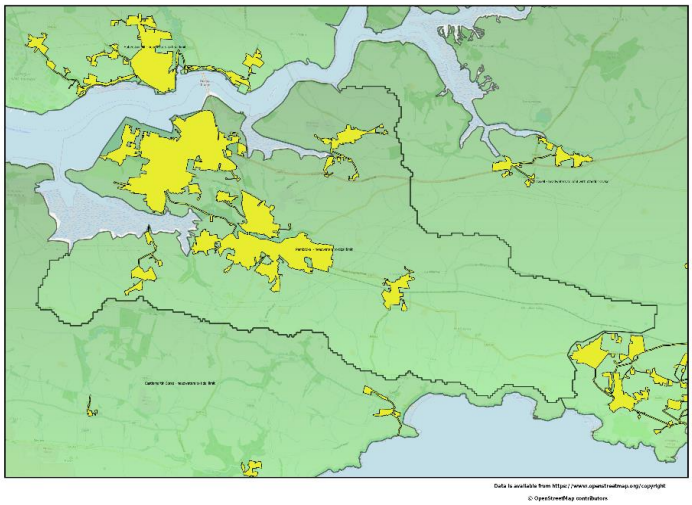


Figure 2- Tactical planning catchment

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 alighn 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.

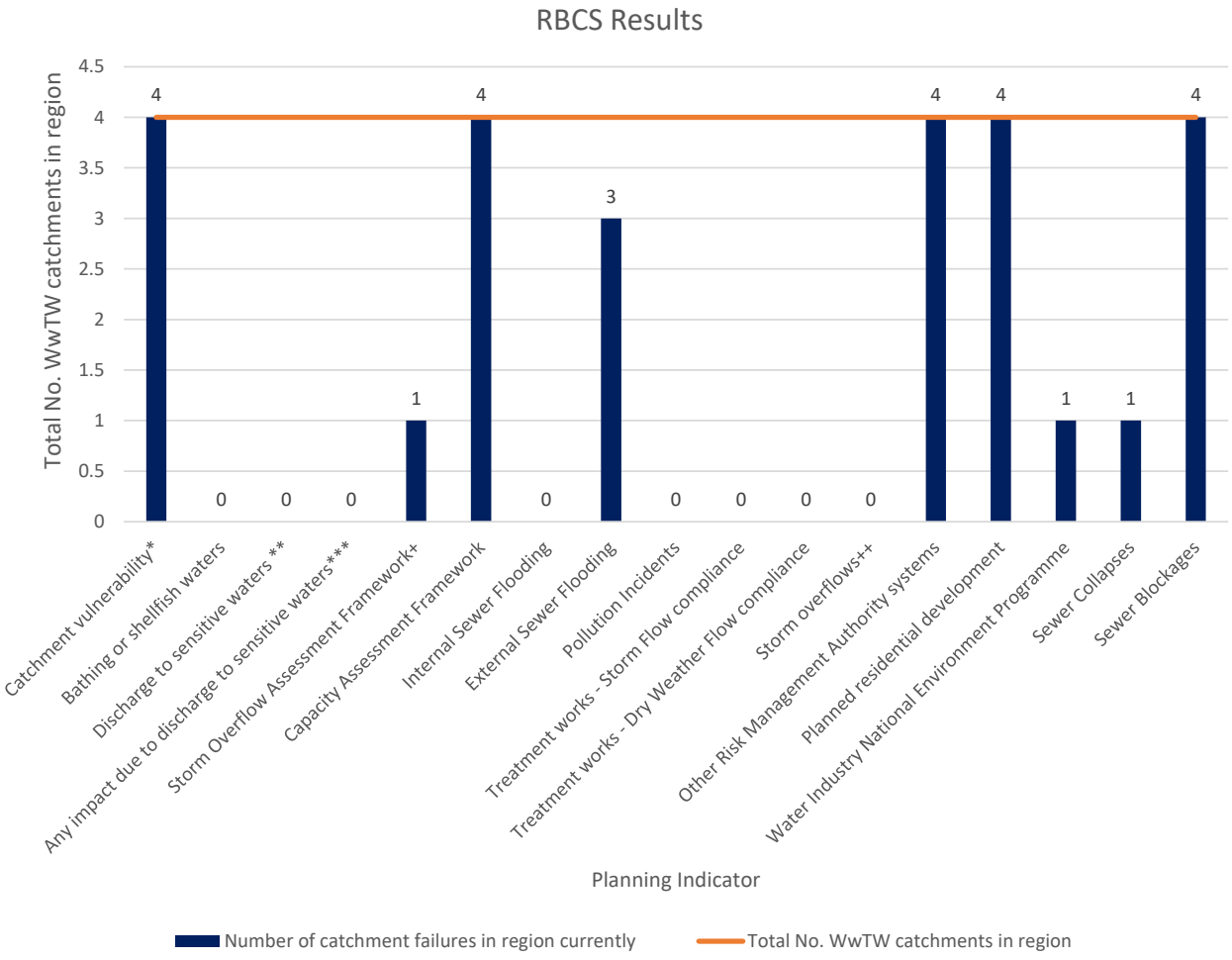
Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

Climate change is predicted to increase the intensity of storms by around 15% 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 Cleddau and Pembrokeshire Coastal Rivers region is set to decrease to 17700 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 north and west of Railway Tunnel, Pembroke with 150 units.

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.

No RBCS available showing on the table. check data



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+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.

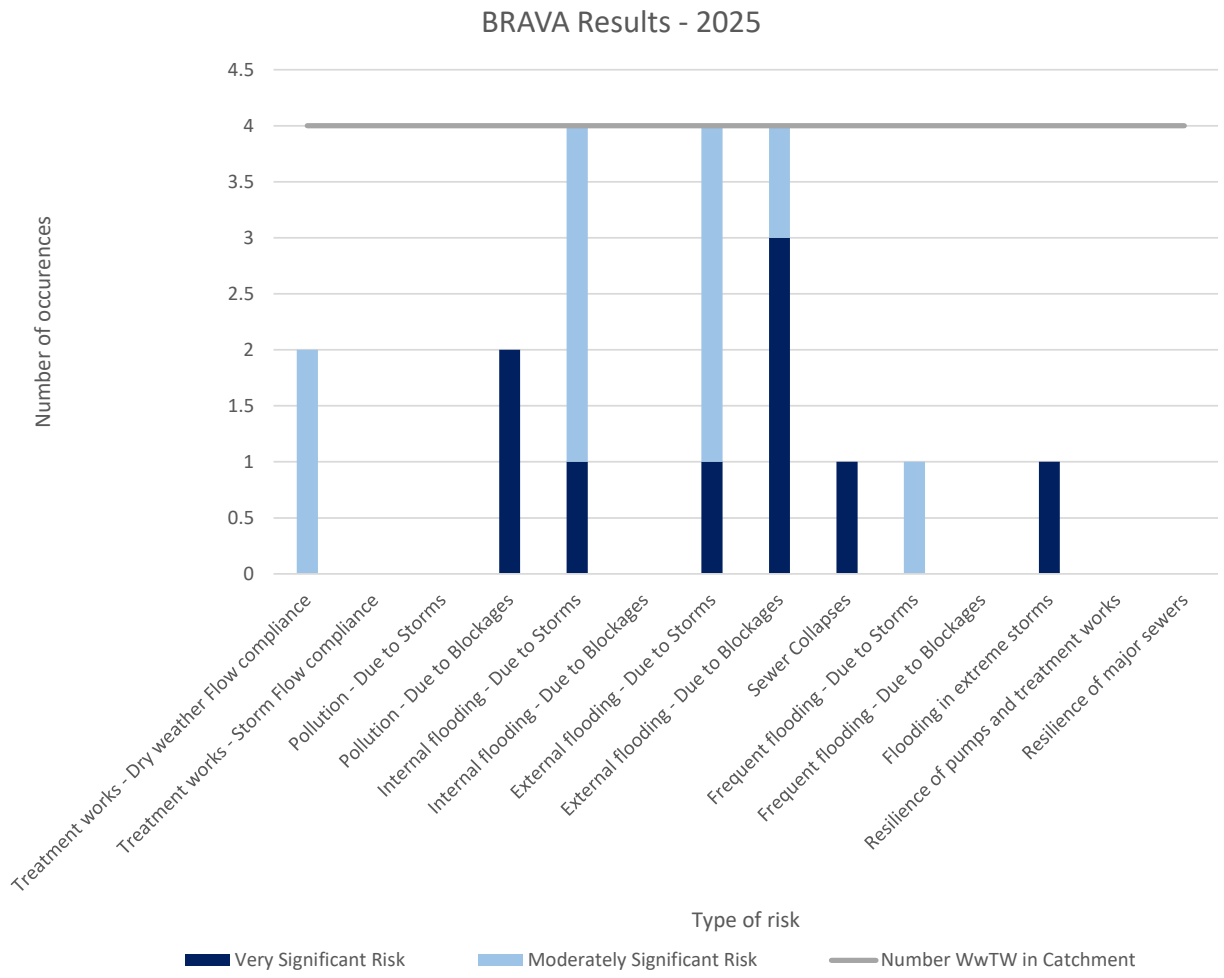


Figure 4 - BRAVA 2025 Summary

In 2025 the biggest risk in this catchment is the compliance of the WwTW in dry weather conditions.

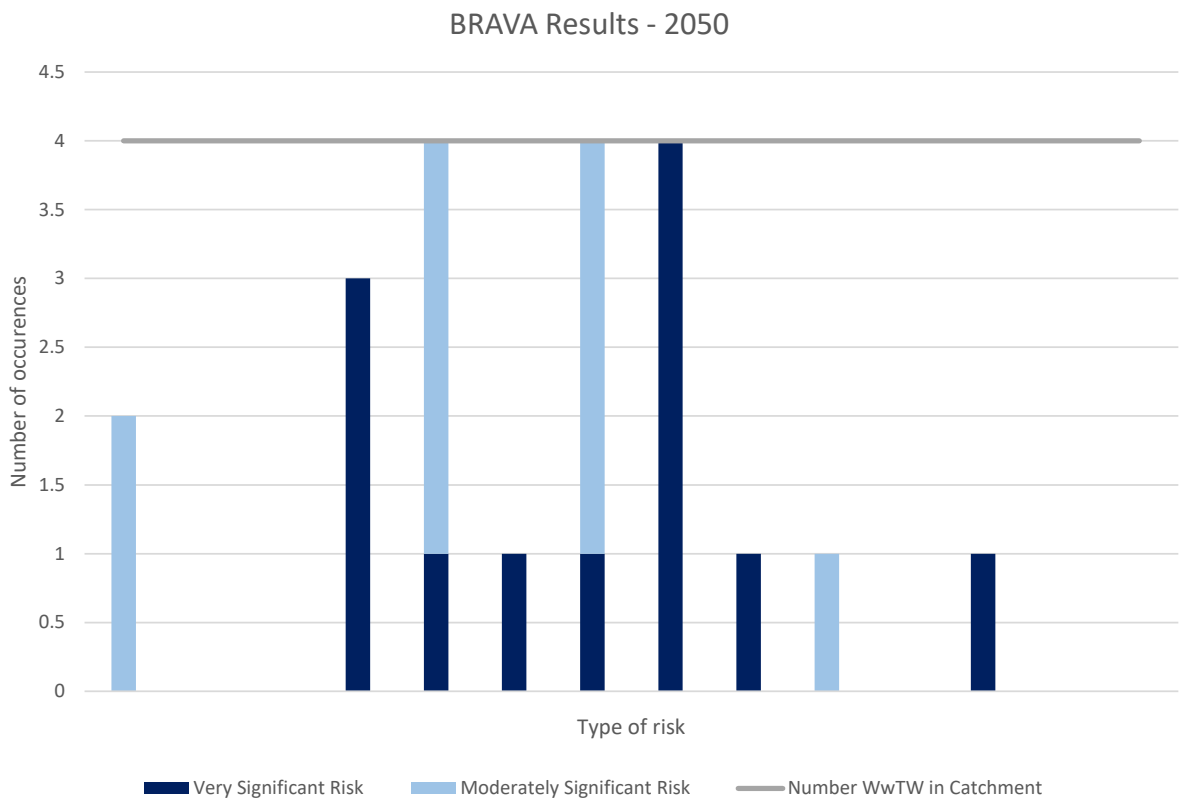


Figure 5 - BRAVA 2050 Summary

In 2050 the risks remain the similar. However, the risk of pollution during storm events is predicted to increase.

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.

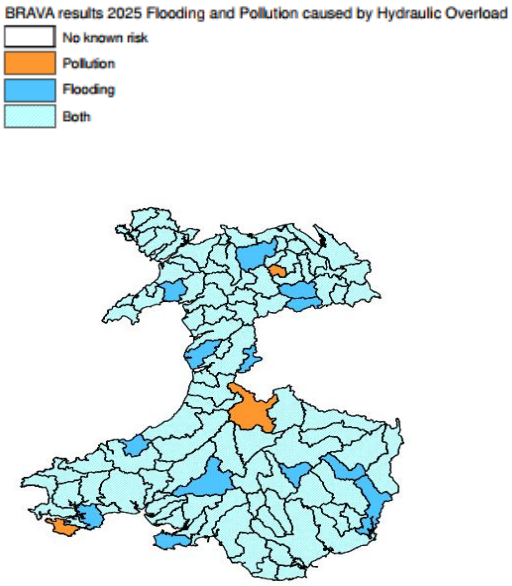


Figure 6 - Associated Strategic Planning Areas priority (2025)

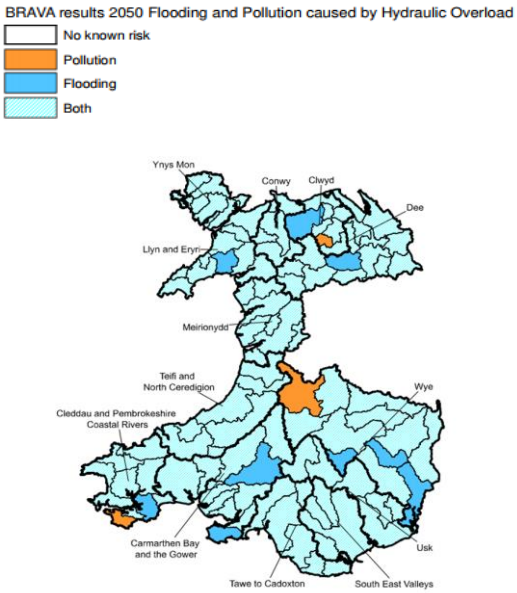


Figure 7 - Associated Strategic Planning Areas

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. Pembroke - headwaters to tidal limit 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 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
Pembroke - headwaters to tidal limit	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.

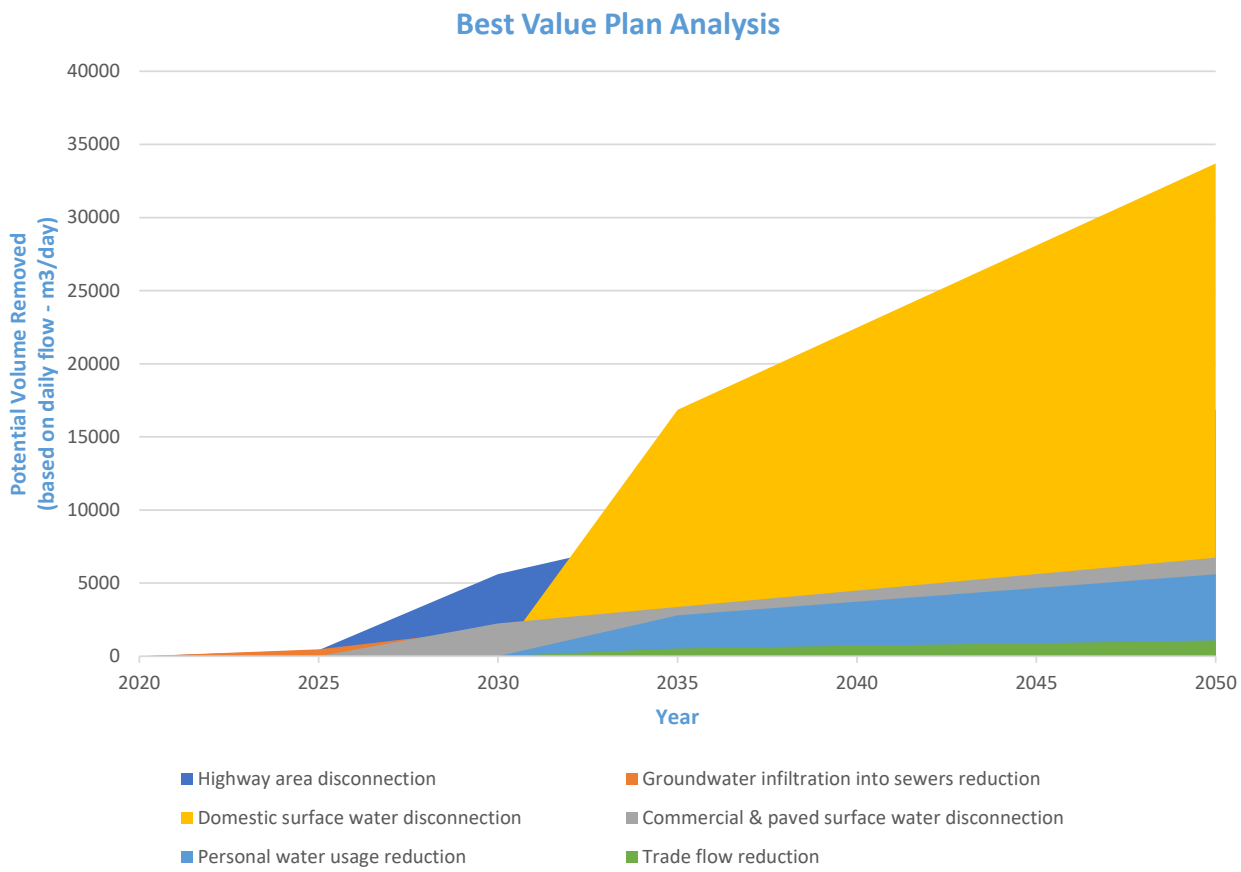


Figure 8 - Best Value Plan Analysis

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 probability of occurring once every 30 years. Table 5 illustrates the cost of potential mitigation measures to mitigate varying flood risk types.

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

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain Existing Performance*	-	£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	£0	£0	£0
External escapes in gardens	£1,000,000	£1,000,000	£1,000,000
Escapes in highways	£6,000,000	£8,000,000	£9,000,000
No flooding	-	£0	£0
Total	£7,000,000.00	£9,000,000	£10,000,000

Table 5 - Summary of Flooding option investments

Table 4 and 5 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 two. 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

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

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

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

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

Table 6 - Summary of schemes per WwTW within the Tactical Planning catchment first cycle prior to HRA/ SEA

L4 Catchments	No. Schemes
LAMPHEY STW	0
HUNDLETON	0
COSHESTON STW	0
PEMBROKE DOCK	0

DWMP Tactial Planning Catchment Summary

W. Cleddau - Anghof conf to Cartlett Brook conf

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 W. Cleddau - Anghof conf to Cartlett Brook conf planning catchment lies within the Cleddau and Pembrokeshire Coastal Rivers river basin catchment, (see Figure 1 below), it consists of 11 wastewater catchments (see Figure 2 below). There is a combined population of 26830, this is set to decrease to 19167 by 2050, a change of -29%. There is a total sewer length of 153km, with a foul sewer length of 114km, a surface water length of 7km and a combined sewer length of 30km. There are 11 Wastewater Treatment Works (WwTW), 26 Sewerage Pumping Stations (SPSs), and 22 Combined Storm Overflows (CSOs) across this tactical planning unit.

The W.Cleddau - Anghof conf to Cartlett Brook conf is situated within mid Pembrokeshire. The Pembrokeshire Coast National park borders the catchment to the west and covers the southeastern part of the catchment. The Catchment runs from from Wolf's Castle in the north to Johnston in the south, Keeston in the west to Clarbeston Road in the east. The catchment is relatively urbanised with numerous towns and villages, with the largest being the town of Haverfordwest in the centre of the catchment. The West Cleddau river runs throughout the catchment, meeting the East Cleddau river in the south of the catchment.

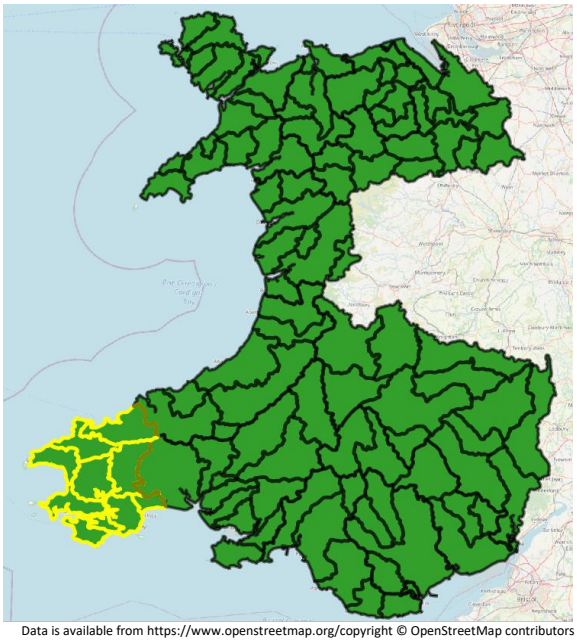


Figure 1 - River basin location detailing the associated tactial planning catchments

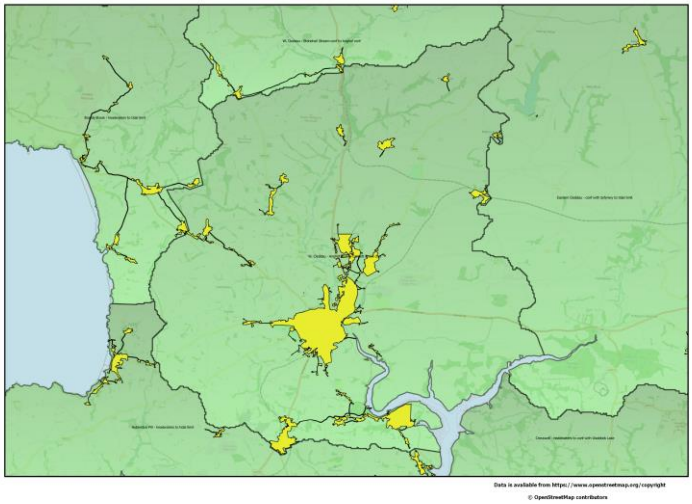


Figure 2- Tactical planning catchment

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 alighn 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.

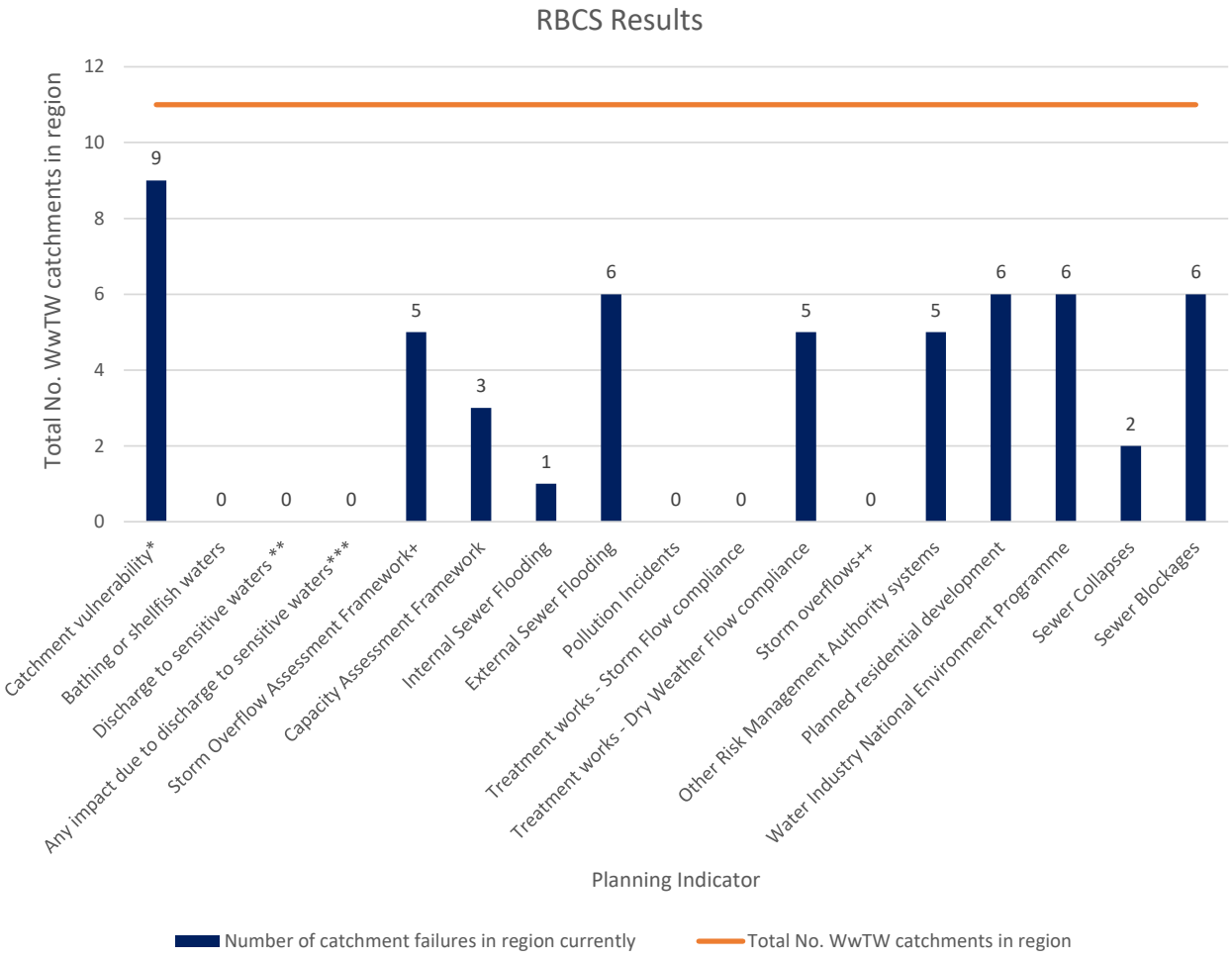
Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

Climate change is predicted to increase the intensity of storms by around 15% 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 Cleddau and Pembrokeshire Coastal Rivers region is set to decrease to 19200 by 2050, a change of -29% based on our future projections. However there are major developments in localised areas that will contribute to future pressures on the network, including Slade Lane South and Slade Lane North, Haverford West with 512 and 459 units respectively.

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.

According to the RBCS 9 of the 11 L4 catchments within this L3 were indentified as being potentially vulnerable to sewer flooding due to extreme storm events. Sewer blockages, planned residential developments, external sewer flooding and issues related to the Water Industry National Environment Programme were also identified as areas of potentially significant risk within the catchment.



*To sewer flooding due to extreme wet weather events.
**Sensitve waters are considered as Bathing Water and Shellfish Water.
**Catagorised as a "planned" scheduled action within the Natural Resources Wales Action Database or considered as "Remedy" on Natural England Designated Sites system.
***Catagorised 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.

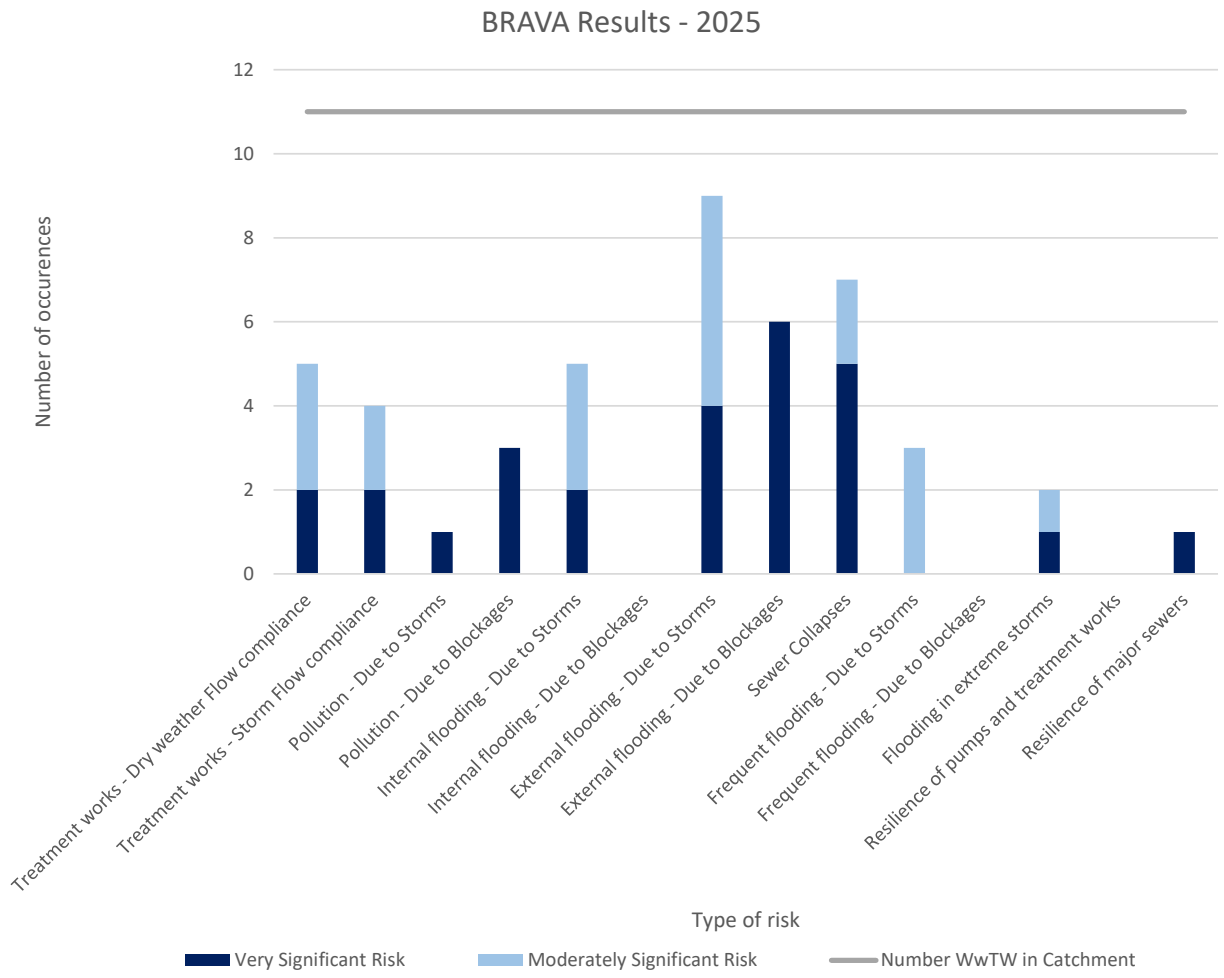


Figure 4 - BRAVA 2025 Summary

In 2025 it is predicted that the overall risk for the catchment will be relatively small. Treatment work compliance during dry weather flow is predicted to be the only source of risk.

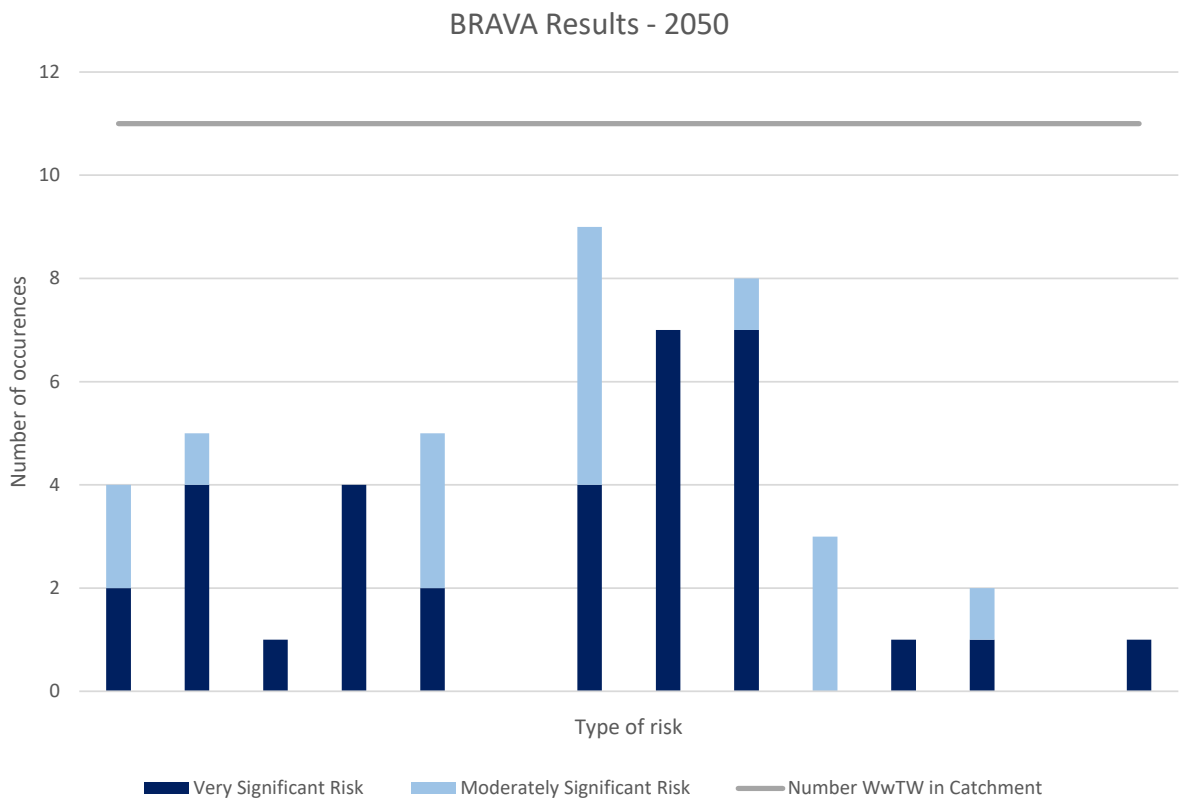


Figure 5 - BRAVA 2050 Summary

In 2050 it is predicted that 5 types of risk will be of a roughly similar level. These are treatment work compliance during dry flows and storm events, sewer collapse, internal flooding due to blockages and pollution due to storm events.

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.

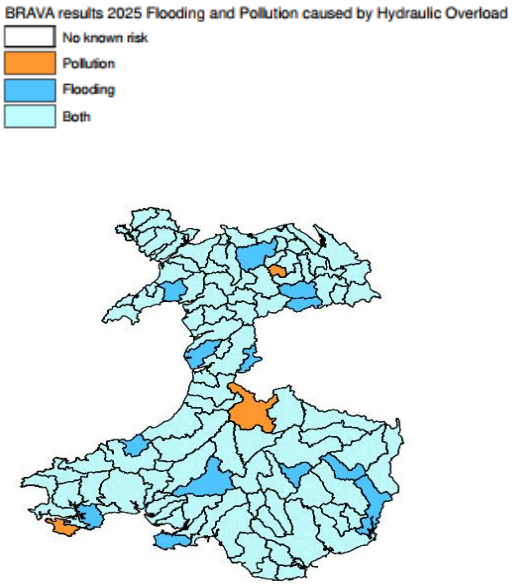


Figure 6 - Associated Strategic Planning Areas priority (2025)

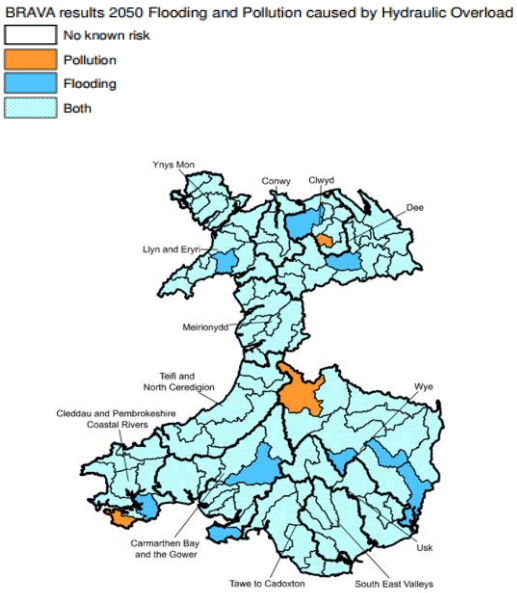


Figure 7 - Associated Strategic Planning Areas

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. W. Cleddau - Anghof conf to Cartlett Brook conf has a water quality priority status for 2050 of 2 which indicates targeted investment to mitigate and focus during AMP10.

4.0 Supply Demand

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

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

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

Table 2 shows the supply-demand assessment for this region. Where a region may not have adequate capacity under a given scenario, it is flagged 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
W. Cleddau - Anghof conf to Cartlett Brook conf	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.

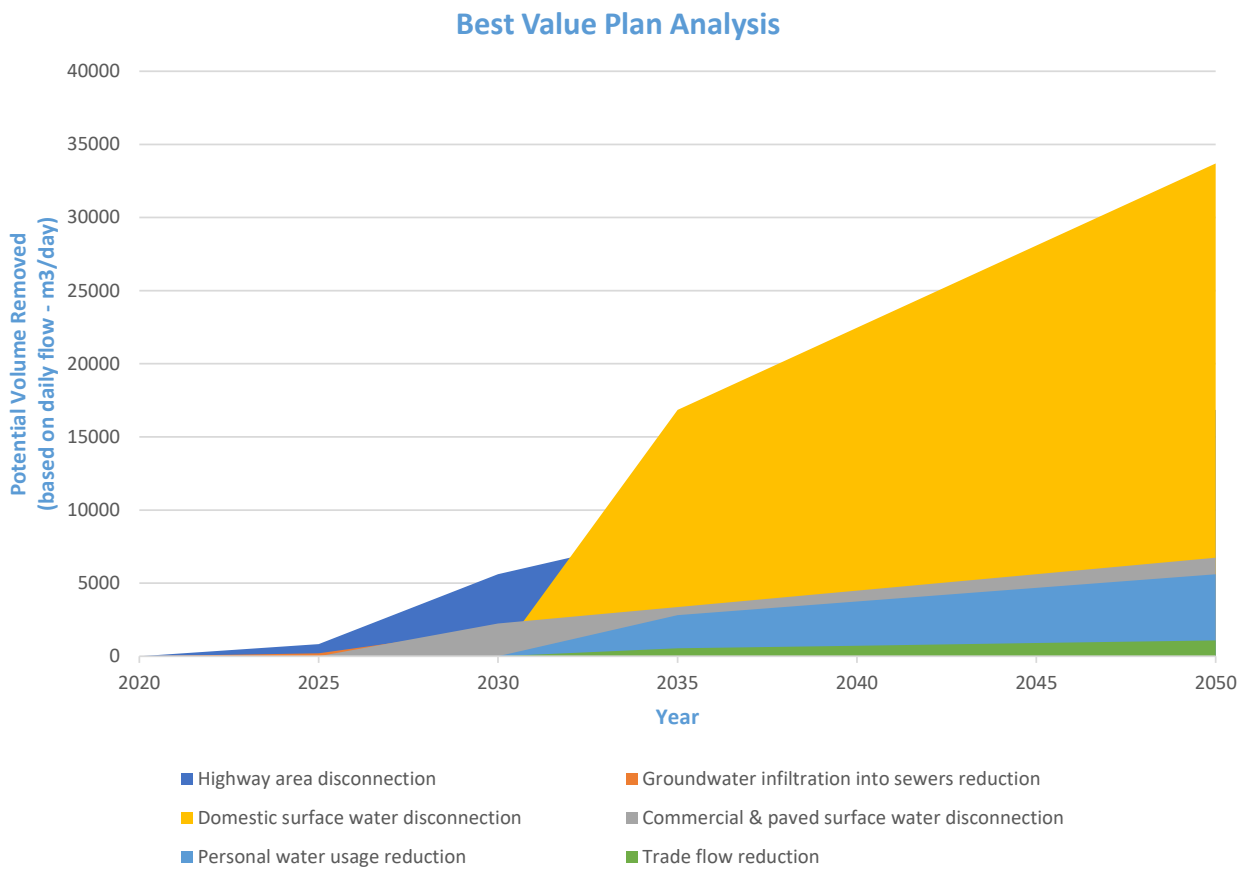


Figure 8 - Best Value Plan Analysis

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 probability of occurring once every 30 years. Table 5 illustrates the cost of potential mitigation measures to mitigate varying flood risk types.

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

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain Existing Performance*	-	£18,000,000.00	£23,000,000.00
40 spills in a Typical Year	£25,000,000.00	£25,000,000.00	£26,000,000.00
20 spills in a Typical Year	£31,000,000.00	£31,000,000.00	£31,000,000.00
10 spills in a Typical Year	£36,000,000.00	£36,000,000.00	£37,000,000.00
0 spills in a Typical Year	£62,000,000.00	£63,000,000.00	£67,000,000.00
Equivalent No. Olympic Swimming Pools in 10 spills scenario	1146.00	1148.00	1135.00

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

Table 4 - Summary of Combined Sewer Overflow option investments

Choice of Scenario	Current Scenario (£)	2050 Scenario (£)	2050 Resilience Scenario (£) 1 in 50 yr (Storm Dennis)
Internal escapes	£13,000,000	£15,000,000	£16,000,000
External escapes in gardens	£2,000,000	£3,000,000	£4,000,000
Escapes in highways	£13,000,000	£16,000,000	£21,000,000
No flooding	-	£4,000,000	£11,000,000
Total	£28,000,000.00	£38,000,000	£52,000,000

Table 5 - Summary of Flooding option investments

Table 4 and 5 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 two. 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

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

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

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

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

Table 6 - Summary of schemes per WwTW within the Tactical Planning catchment first cycle prior to HRA/ SEA

L4 Catchments	No. Schemes
JOHNSTON (S OF HAVERFORDWEST)	0
CLARBESTON ROAD NO 1	0
CAMROSE	0
SPITTAL	0
UZMASTON STW	0
TREFFGARNE	0
WALTON EAST (NE OF HAVERFORDWEST)	0
AMBLESTON	0
HOOK	0
KEESTON (NW OF HAVERFORDWEST)	0
MERLINS BRIDGE	0

DWMP Tactial Planning Catchment Summary

W. Cleddau - Stonehall Stream conf to Anghof conf

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 W. Cleddau - Stonehall Stream conf to Anghof conf planning catchment lies within the Cleddau and Pembrokeshire Coastal Rivers river basin catchment, (see Figure 1 below), it consists of 9 wastewater catchments (see Figure 2 below). There is a combined population of 3226, this is set to decrease to 3037 by 2050, a change of -6%. There is a total sewer length of 39km, with a foul sewer length of 36km, a surface water length of 0km and a combined sewer length of 2km. There are 9 Wastewater Treatment Works (WwTW), 10 Sewerage Pumping Stations (SPSs), and 11 Combined Storm Overflows (CSOs) across this tactical planning unit.

The catchment of W.Cleddau - Stonehall Stream conf to Anghof conf is situated in the southwest of Wales, with parts of the catchment falling within the Pembrokeshire Coast National Park. The catchment stretches from Abereiddy Bay in the west to Casmael in the east. The catchment is mostly rural and coastal numerous villages throughout such as Letterston and Little Newcastle. The source and confluence of the rivers Cleddau and W.Cleddau are within this catchment.

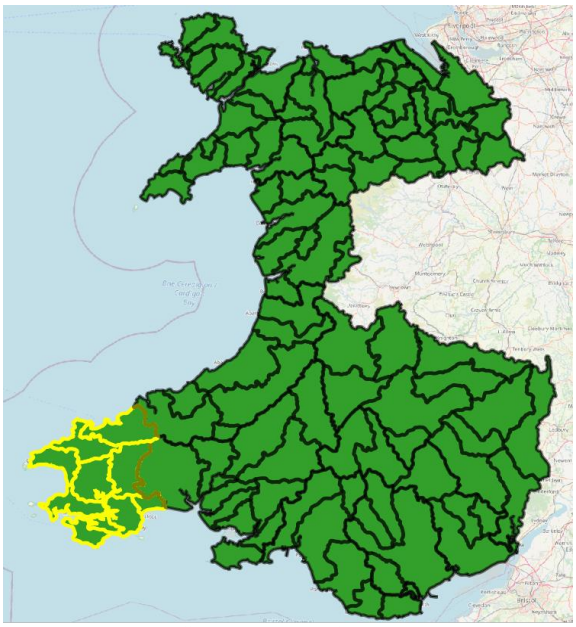


Figure 1 - River basin location detailing the associated tactial planning catchments

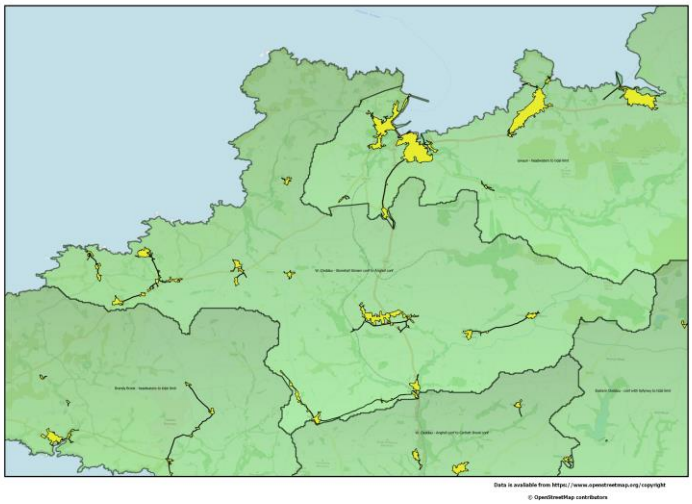


Figure 2- Tactical planning catchment

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 alighn 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.

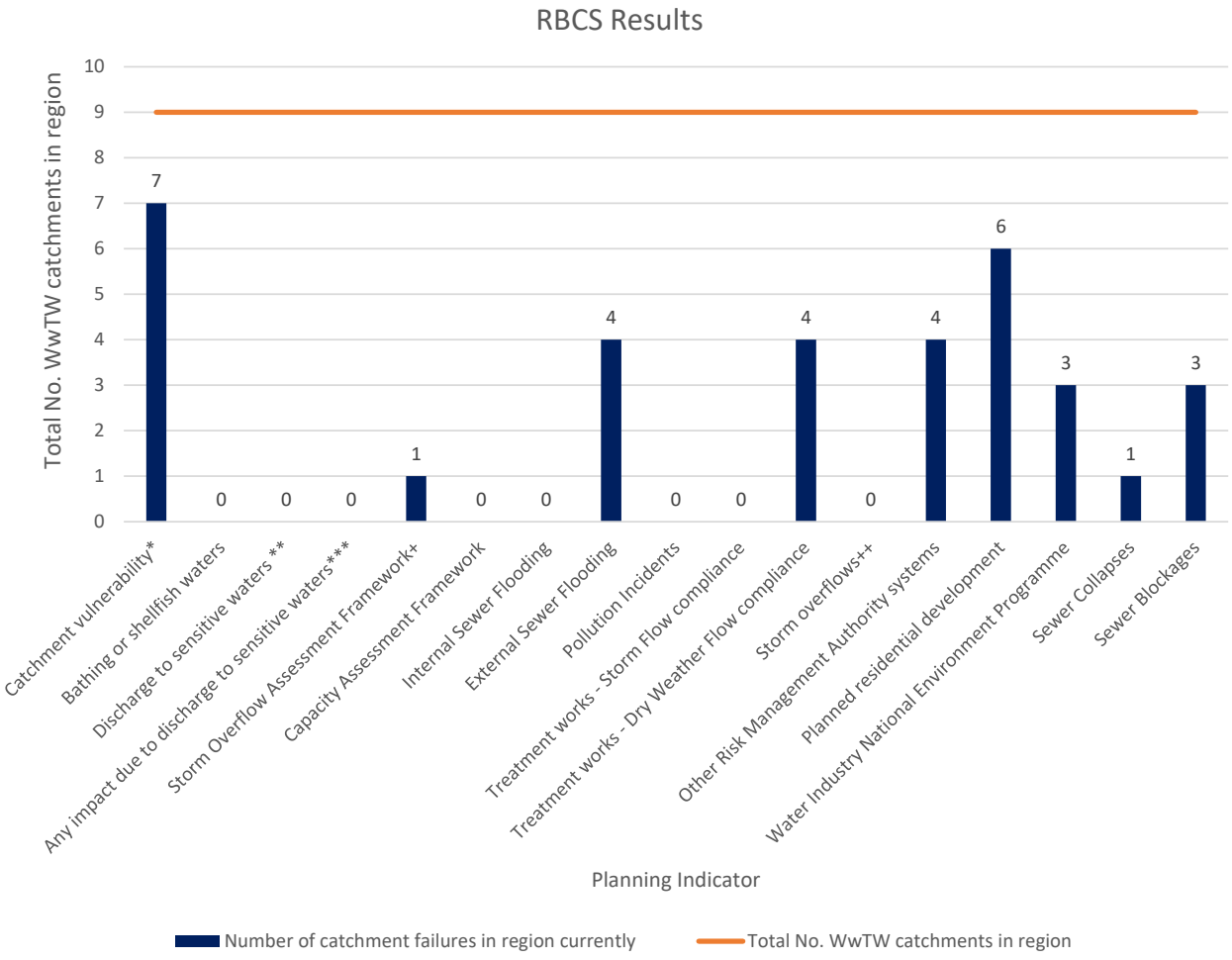
Urban creep is the term used to explain loss of green spaces, for example when new driveways or house extensions are built. It often leads to more rainwater entering sewers. Our forecasts suggest that urban creep will add up to 0.63 metres squared of impermeable ground per house per year.

Climate change is predicted to increase the intensity of storms by around 15% 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 Cleddau and Pembrokeshire Coastal Rivers region is set to decrease to 3000 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 Court Meadow, Letterston with 91 units.

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.

According to the RBCS 7 of the 9 L4 catchments within this L3 have been identified as being vulnerable to sewer flooding due to extreme storm events. Planned residential developments within the catchment has also been identified as a source of risk.



*To sewer flooding due to extreme wet weather events.
**Sensitve waters are considered as Bathing Water and Shellfish Water.
**Catagorised as a "planned" scheduled action within the Natural Resources Wales Action Database or considered as "Remedy" on Natural England Designated Sites system.
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+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.

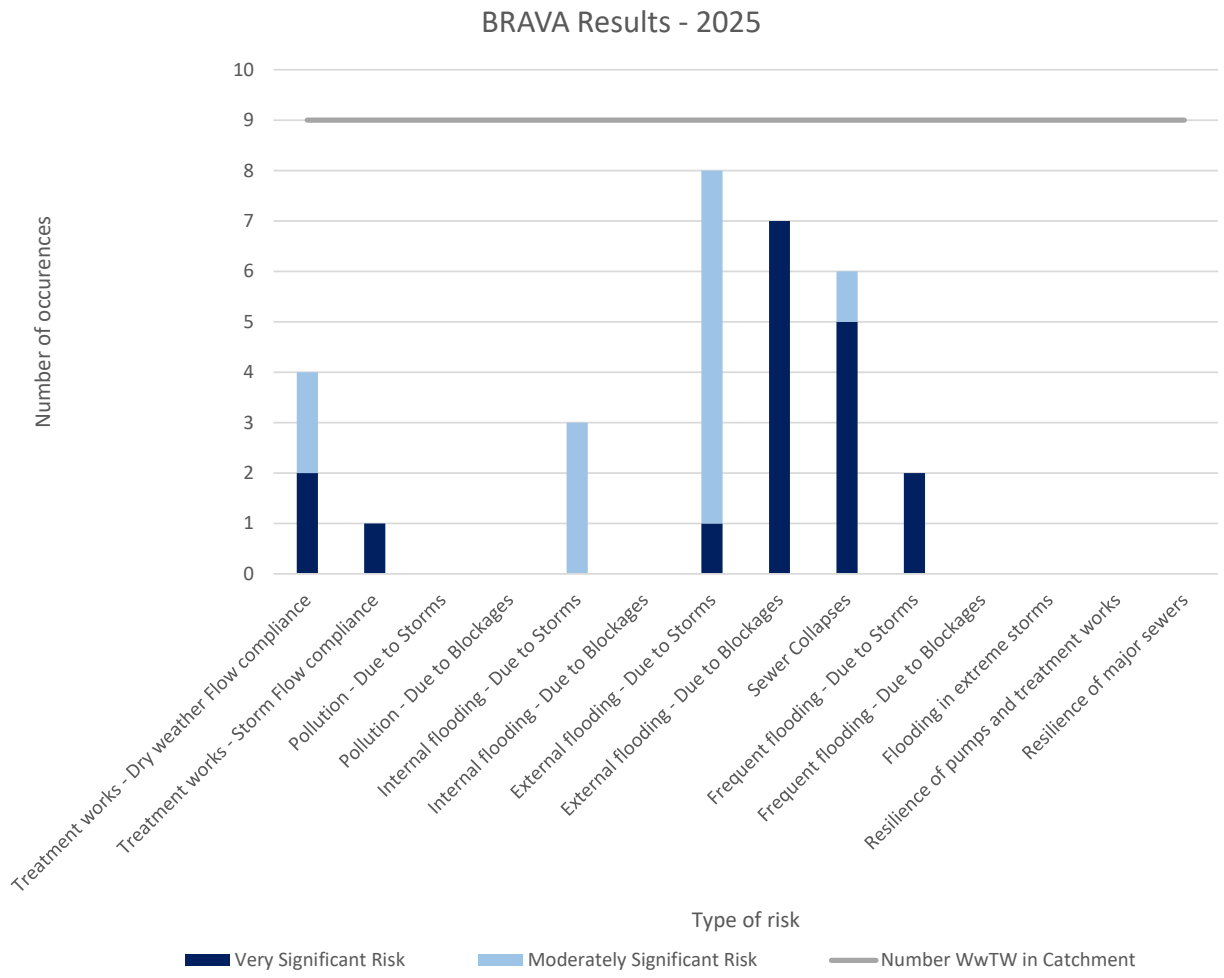

Figure 4 - BRAVA 2025 Summary

In 2025 external flooding due to storm events is expected to be the most significant source of risk within the catchment, followed by the risk of treatment work non-compliance due to storm events. In total, it is expected that 8 sources of risk will contribute to overall risk wiithin the catchment.

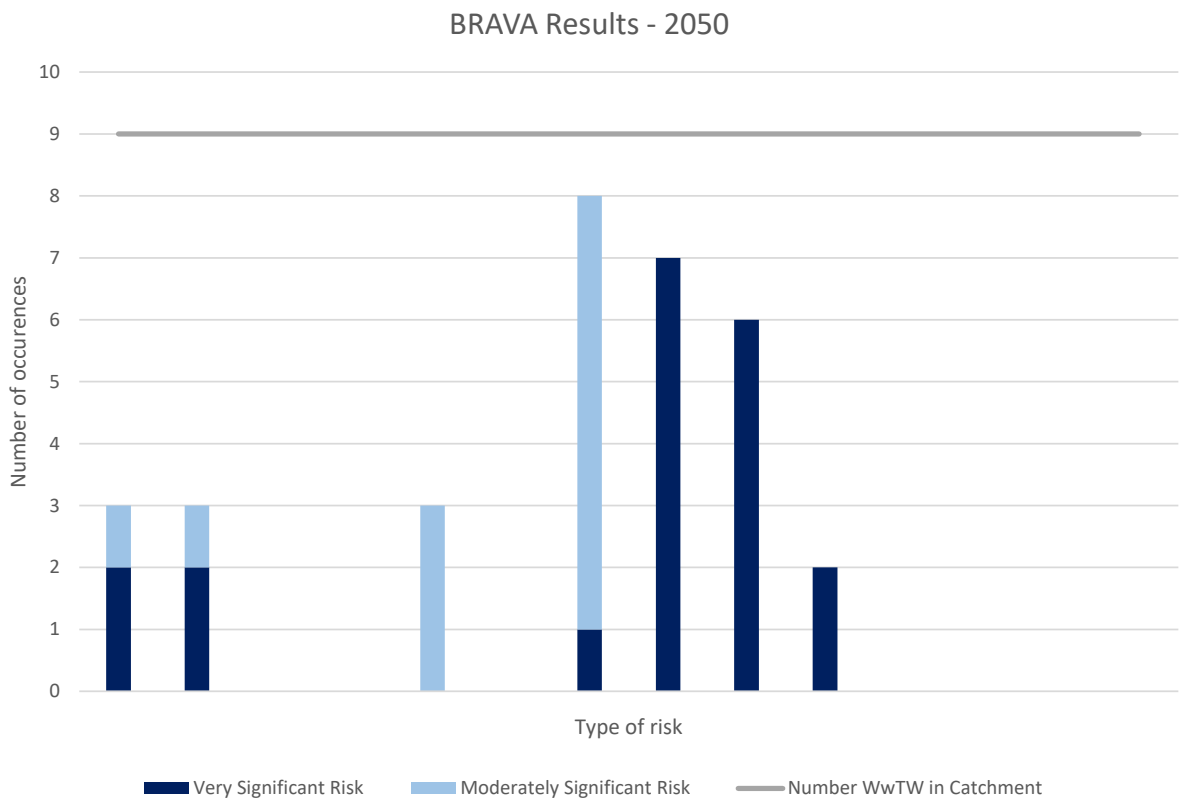

Figure 5 - BRAVA 2050 Summary

In 2050 it is expected that internal flooding due to blockages will be the most significant source of risk within the catchment, followed by the risk of treatment work non-compliance due to storms. In total it is expected that 6 sources of risk will contribute to overall risk within the 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.

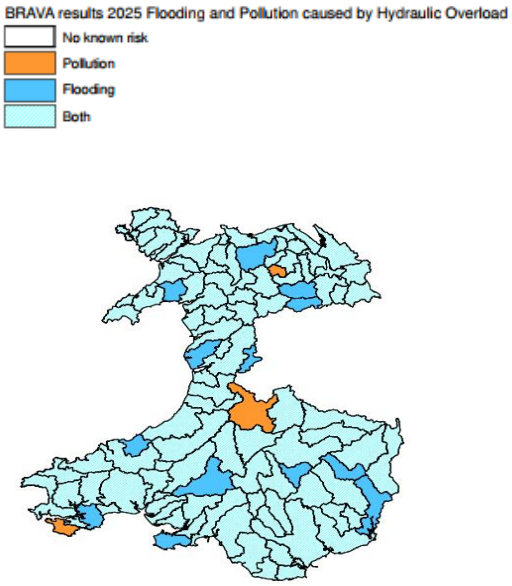

Figure 6 - Associated Strategic Planning Areas priority (2025)

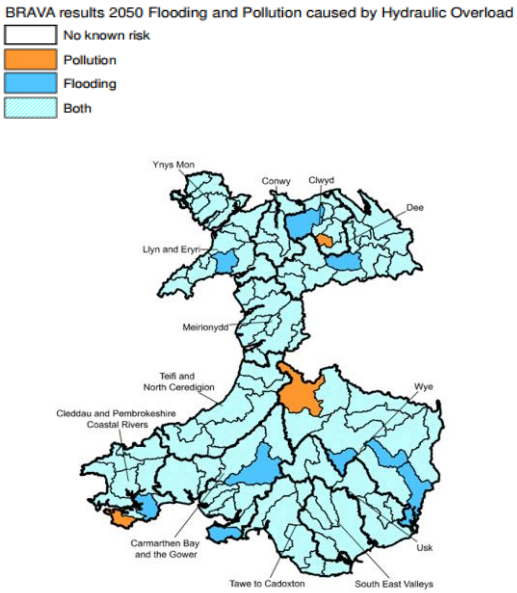

Figure 7 - Associated Strategic Planning Areas

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. W. Cleddau - Stonehall Stream conf to Anghof conf 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 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
W. Cleddau - Stonehall Stream conf to Anghof conf	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.

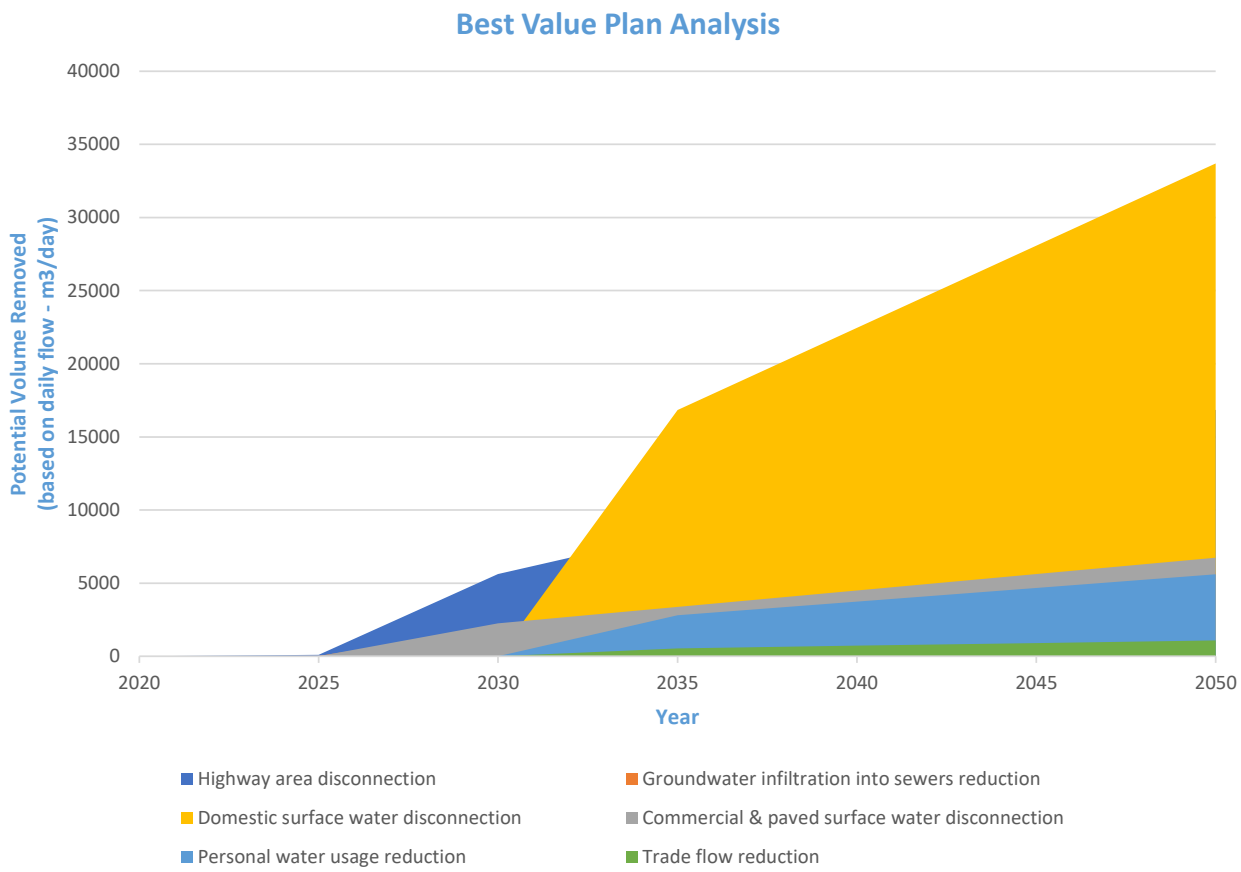

Figure 8 - Best Value Plan Analysis

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 probability of occurring once every 30 years. Table 5 illustrates the cost of potential mitigation measures to mitigate varying flood risk types.

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

Choice of Scenario	Current Scenario (£)	2030 Scenario (£)	2050 Scenario (£)
Maintain Existing Performance*	-	£21,000,000.00	£29,000,000.00
40 spills in a Typical Year	£6,000,000.00	£6,000,000.00	£6,000,000.00
20 spills in a Typical Year	£7,000,000.00	£7,000,000.00	£7,000,000.00
10 spills in a Typical Year	£12,000,000.00	£12,000,000.00	£12,000,000.00
0 spills in a Typical Year	£28,000,000.00	£29,000,000.00	£29,000,000.00
Equivalent No. Olympic Swimming Pools in 10 spills scenario	80.00	111.00	118.00

* 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	£2,000,000	£2,000,000	£3,000,000
Escapes in highways	£4,000,000	£4,000,000	£5,000,000
No flooding	-	£4,000,000	£11,000,000
Total	£6,000,000.00	£10,000,000	£19,000,000

Table 5 - Summary of Flooding option investments

Table 4 and 5 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 two. 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

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

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

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

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

Table 6 - Summary of schemes per WwTW within the Tactical Planning catchment first cycle prior to HRA/ SEA

L4 Catchments	No. Schemes
LETTERSTON WEST	0
CROES-GOCH	0
PUNCHESTON	0
ST NICHOLAS (DYFED)	0
CASTLE MORRIS	0
PORTHGAIN	0
TREFIN	0
MATHRY	0
WOLF'S CASTLE STW	0